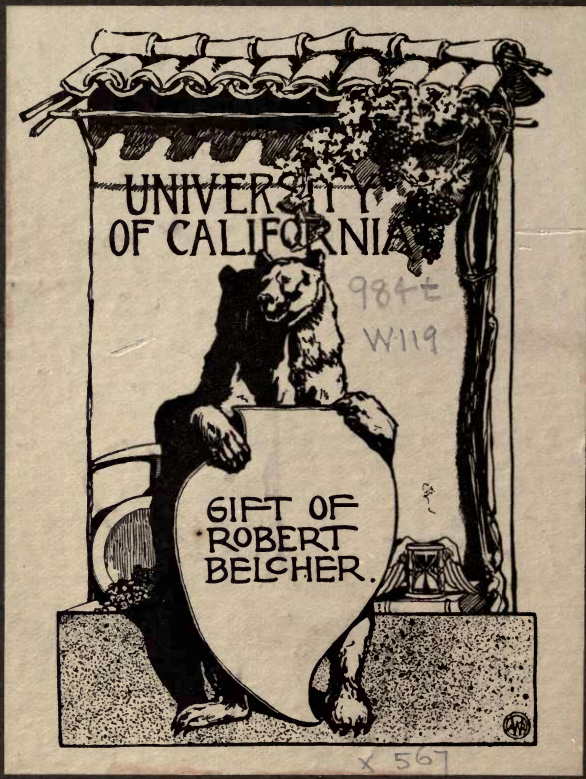


A COMPENDIUM OF

GOLD METALLURGY

AND

Digest of U. S. Mining Laws, Water Rights and Desert Land Laws

E. M. AND M. L. WADE, B. Sc.
Los Angeles, Cal.

"For the Land's Sake"

NOTICE

WADE & WADE, Assayers and Analytical Chemists, will REMOVE January 1, to 318 E. First St., into their own new building, with improved facilities.

AGRICULTURAL CHEMICAL WORKS,

901-907 Macy St., Los Angeles, Cal.

MANUFACTURERS OF

FERTILIZERS

For Oranges, Lemons, Peaches, Prunes, Apricots, Berries, Grapes, Pears, Walnuts, Beets, Olives, Vegetables, Lawns and Flowers.

.....DEALERS IN.....

Ground Bone, Sulphate of Iron, Potash Salts, Land Plaster, Phosphates Tankage, Nitrates, Guanos.

Send for Descriptive Catalogue

Los Angeles and Pasadena Electric Cars Pass our Office and Factory.

Selby Smelting ...AND... Lead Co.

Refiners of Gold and Silver Bars, Gold Dust, etc.

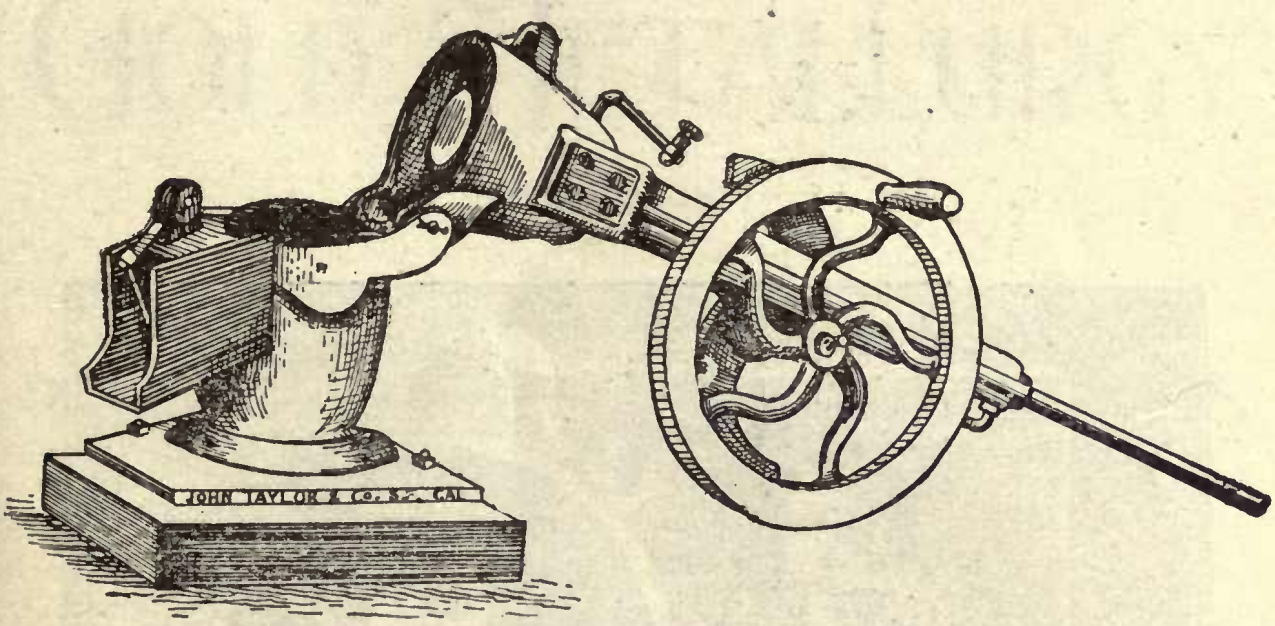
Buyers of . . .

Gold, Silver, Lead and Copper Ores, Gold Concentrates, Lead Bullion, Cyanide Products, etc.

ORE AND BULLION ASSAYERS

Works at Vallejo Junction, Cal.
Office, 416 Montgomery Street,
SAN FRANCISCO, CAL.

PORTABLE
ONE-STAMP MILL



Patented

The above cut represents our Portable One-Stamp Mill opened for cleaning, or to take apart for transportation.

This mill can be run by hand or belted for power. Will crush one-half ton of average ore per day of ten hours.

Total weight of mill			.....	405 lbs.
"	"	" upper half	.....	205 "
"	"	" lower "	.....	200 "

Price $100.00

Write for special illustrated circular to the undersigned

IMPORTERS AND DEALERS IN

Assayers' Materials,

Laboratory, Mine and Mill Supplies,

Chemicals, Acids, Etc.

JOHN TAYLOR & CO.,

63 First Street, - - - San Francisco, Cal.


E.M. WADE
M.L. WADE
Schumacher
AMER ENG CO. LA.

A COMPENDIUM

OF

GOLD METALLURGY

(ORES)

AND

DIGEST OF U. S. MINING LAWS, WATER RIGHTS, DESERT LAND LAW, ETC.

SECOND EDITION—REVISED

PRICE, $1.00

BY

E. M. AND M. L. WADE, B. Sc.

MEMBERS OF THE

AMERICAN CHEMICAL SOCIETY,

SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

AND

CHEMISTS OF THE AGRICULTURAL EXPERIMENT AND CHEMICAL SECTION.

LATE CHEMISTS AT THE CHINO AND LOS ALAMITOS

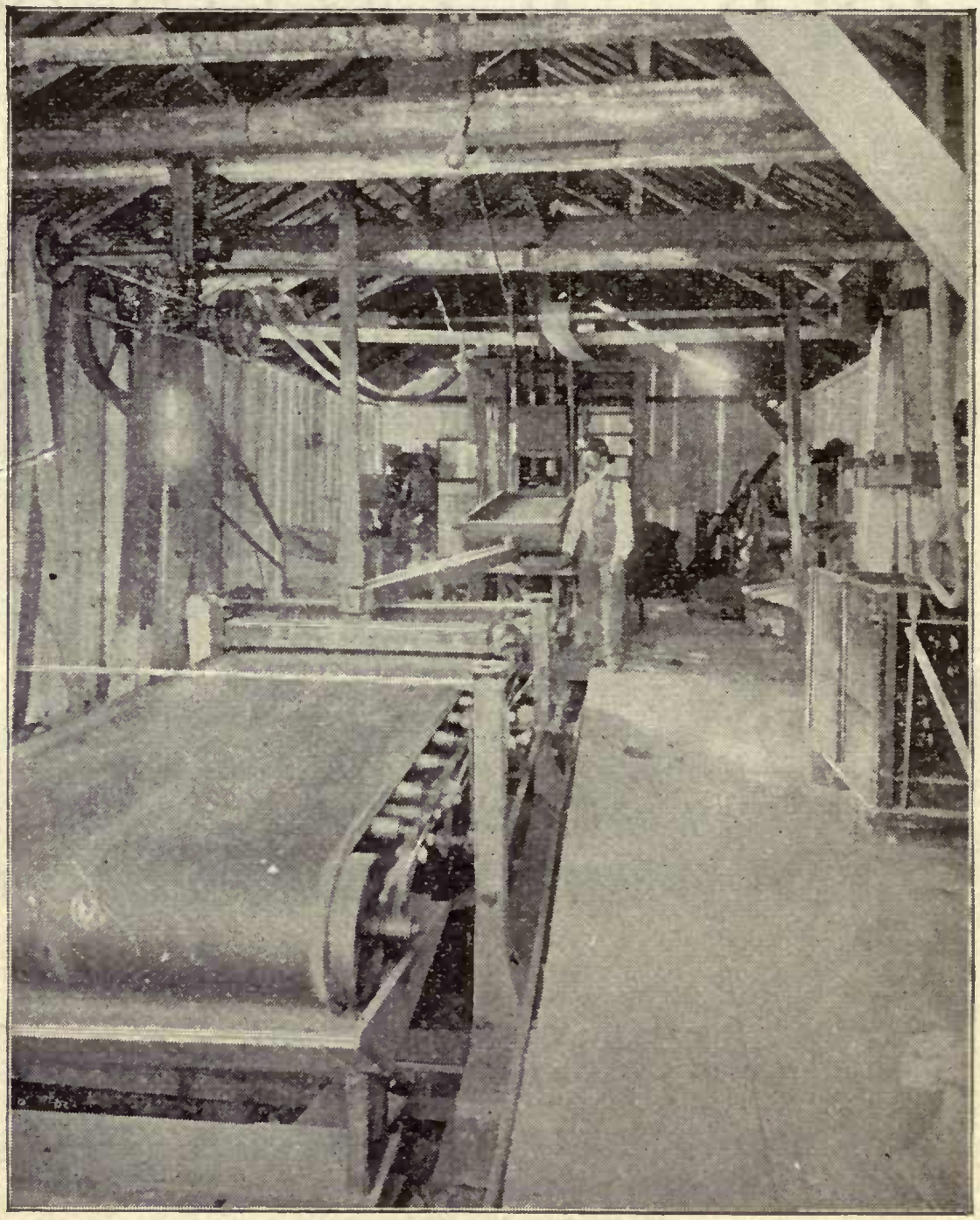
BEET SUGAR FACTORIES.

JANUARY, 1901

WADE & WADE,

Analytical Chemists and Assayers

115½ North Main Street, Los Angeles, Cal.



Our Milling, Concentration and Cyanide Plant, for Testing and Sampling Ores, Tailings, &c., in ton lots, more or less.

CONTENTS

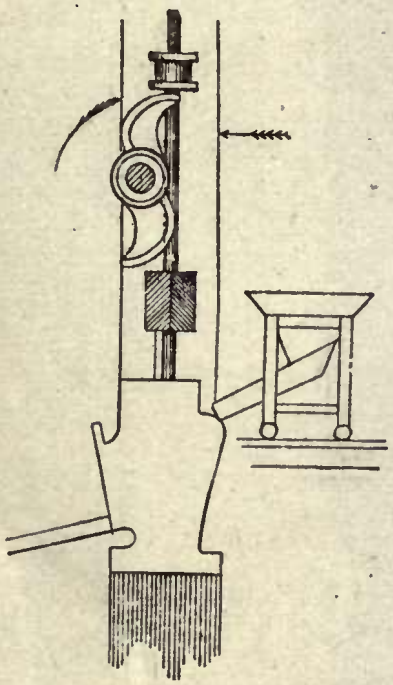
ESTABLISHED 1887. TELEPHONE GREEN 1704

WADE & WADE,

Assayers and Analytical Chemists

115½ N. Main St., Los Angeles, Cal.

Oldest Firm and Most Complete Establishment in the Southwest.



WHAT WE DO.

Assaying and Analysis of—

Gold, silver, copper, lead, iron, zinc, chromium, mercury, and other metallic ores; **fertilizers, mineral waters, petroleum, oils,** dairy products, bitumens, coal, limestones, clays, borates, sulphur, acids, alkalies, **nitrogen, potash, phosphoric acid,** urine, citrus fruits, poisons, tannin, wines, liquors, and industrial products generally.

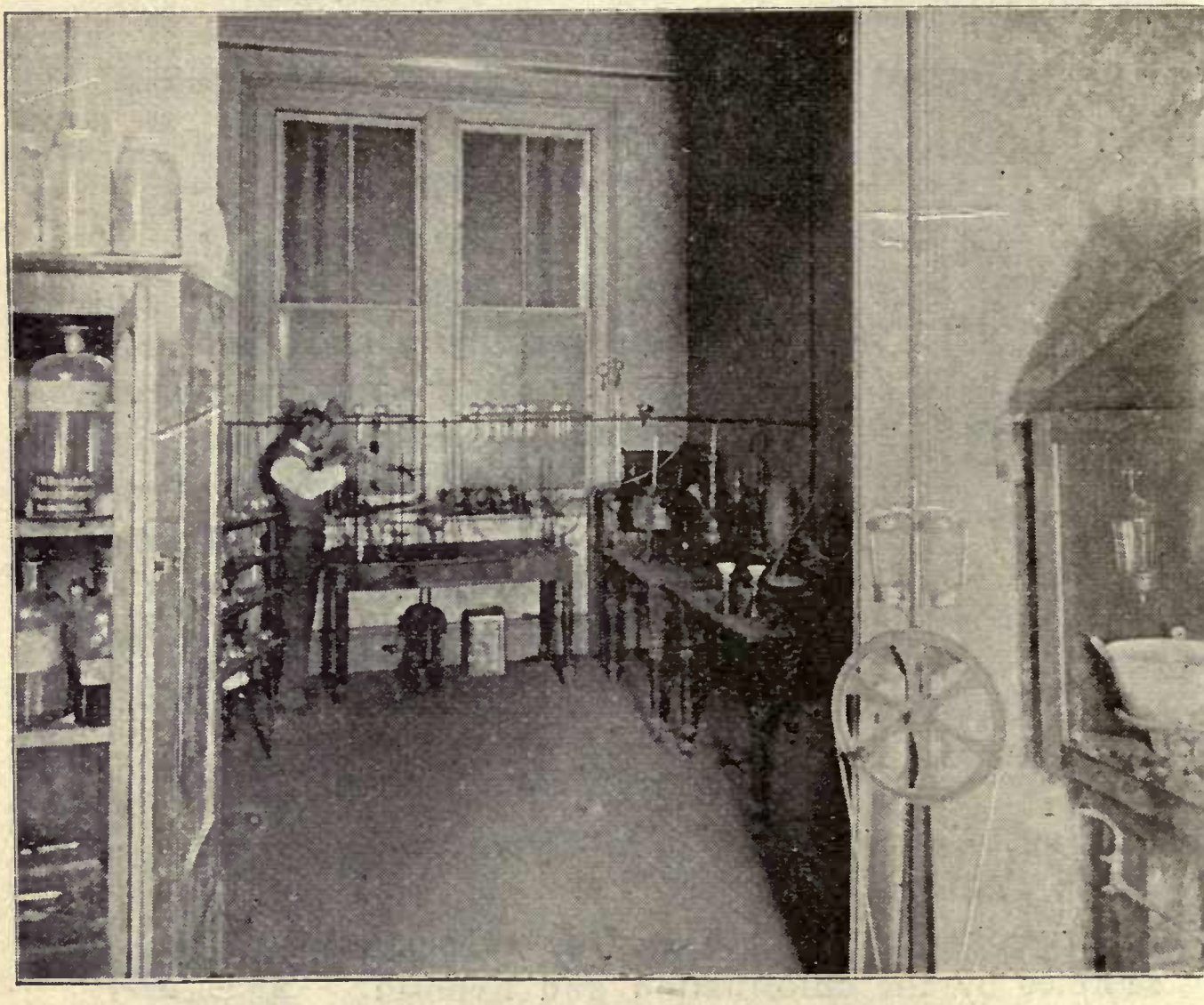
WORKING TESTS.

Milling, Concentration and Cyanide TESTS of Ores and Tailings—

in large or small lots. Also tests of small samples by the chlorination and hyposulphite processes.

We Call Your Attention—

to our complete milling, concentration and cyanide plant, the object of which is to make practical working tests of ores for their adaptability to treatment.



Chemical Laboratory

Analysis of Ores, Water, Fertilizers, Oils, and Natural Products generally.

The plant consists of a stamp mill, a Frue-Vanner concentrator, an automatic ore feeder, a Dodge ore breaker, a set of pulverizing rolls, and cyaniding vats, pumps, etc.

LARGE SAMPLES.

Only place in Southern California where large lots of ore can be crushed and sampled accurately for assaying or anaylsis. All crushing done by machinery and electric power in ton lots, more or less.

UMPIRE AND CHECK ASSAYS.

We make a specialty of umpire and check assaying. Our work has been checked up repeatedly by the smelting companies, the U. S. Mint, and the most reputable commercial assayers and chemists in the United States, and always found substantially correct. But we do not claim to be infallible or not liable to mistakes, and are always glad to repeat our work under reasonable circumstances, without extra charges. (See Appendix IV—Umpire Assaying.)

ASSISTANTS.

None but experienced and trustworthy assistants are employed by us. Personal attention to all custom work.

SCIENTIFIC AND TECHNICAL LIBRARY.

Our library of scientific and technical works and journals, devoted to mining, metallurgy, mineralogy, chemistry, and cognate subjects, is unique for its variety and select quality; all of which visitors are welcome to consult.

Chemical Laboratory

Analysis of Limestones, Clays, Borates, Oils, Bitumens, Sugar Beets etc.

MINERAL AND ORE COLLECTION.

This consists of a great variety of specimens of rare and economic minerals and ores collected from all over the United States, and foreign lands, which we are always pleased to exhibit.

SPECTROSCOPE AND POLARISCOPE.

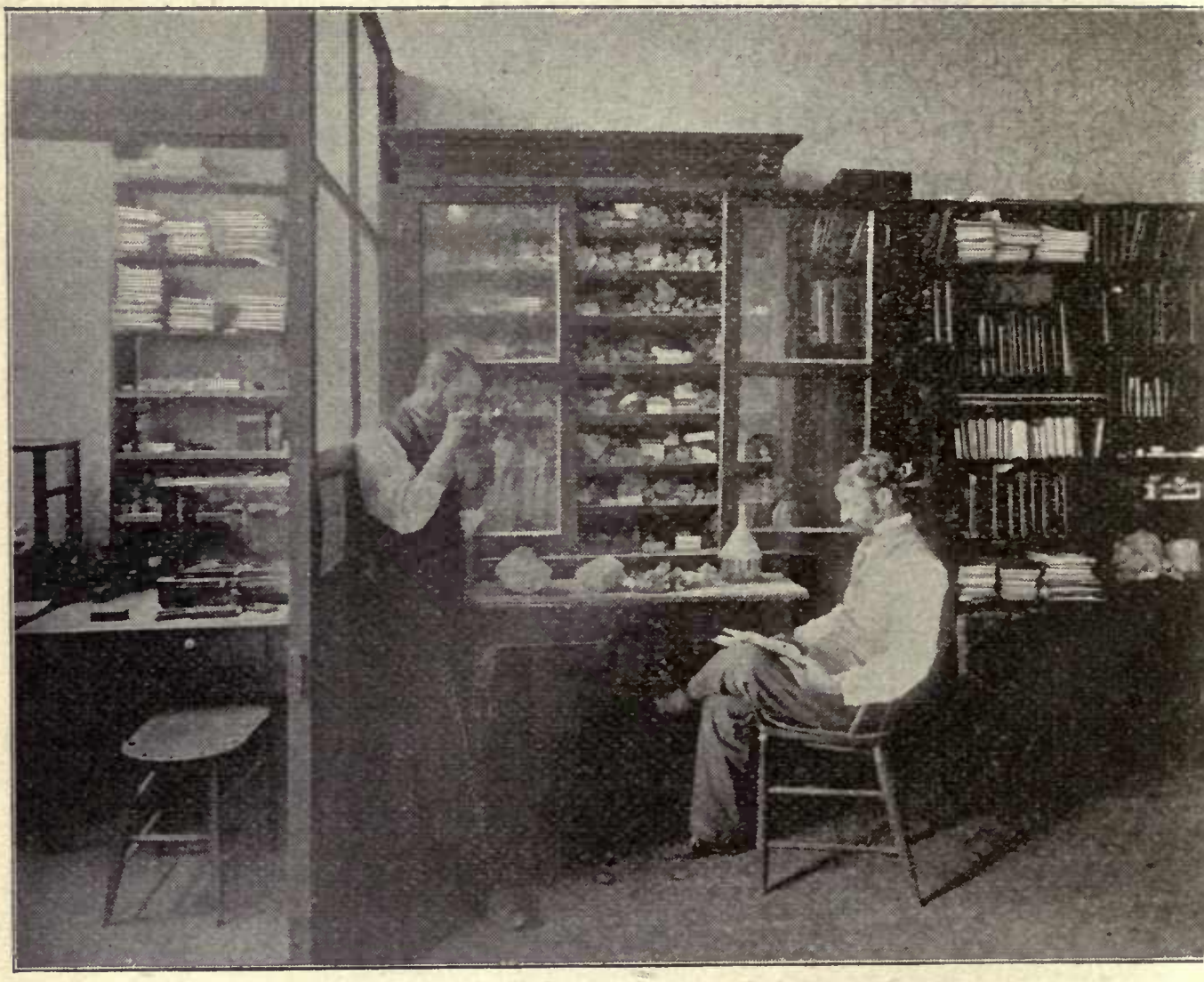
Two important and useful adjuncts to our apparatus, are, a direct vision spectroscope (valuable among other things as a means of testing lithium in water, etc., and other rare metals,) and a magnificent polariscope, such as is used in testing sugar beets and saccharine products generally.

MINE EXAMINATION AND SURVEYING.

This department is conducted by Messrs. John Goldsworthy and Harry V. Wheeler, civil and mining engineers and experts, who have had long experience on the Pacific Coast, in Mexico and elsewhere. Will make thorough and practical examination and survey of mines or mineral deposits, with plats or any other graphical information desired. Any business in this line will be carefully and promptly attended to.

MINING LAW DEPARTMENT.

In connection with our establishment we have also a mining-law department, which is carefully looked after by Messrs. Geo. W. King and Willoughby Cole, Attorneys-at-Law. These gentlemen have had extensive practice in mining law, and will conscientiously attend to any mining cases presented to them, in the State, Territorial or Federal Courts.



Assay Office. Library and Weighing Room

115½ N. Main St., Los Angeles, Cal.

MINING BLANKS.

Location notices and other blanks furnished on application.

ASSAYING OUTFITS—MINING MACHINERY.

Either first-class or second-hand, handled on commission. We are always glad to assist or advise in their purchase or sale. For assaying outfits and second-hand mining machinery we have frequent calls.

MINES.

Parties desiring to purchase or sell mines or mineral deposits, or have them examined, surveyed, platted, etc., will also do well to consult with us.

STANDARD METHODS.

We have no secret processes or nostrums, but employ the standard methods used and proven by experience throughout the world.

WADE & WADE,

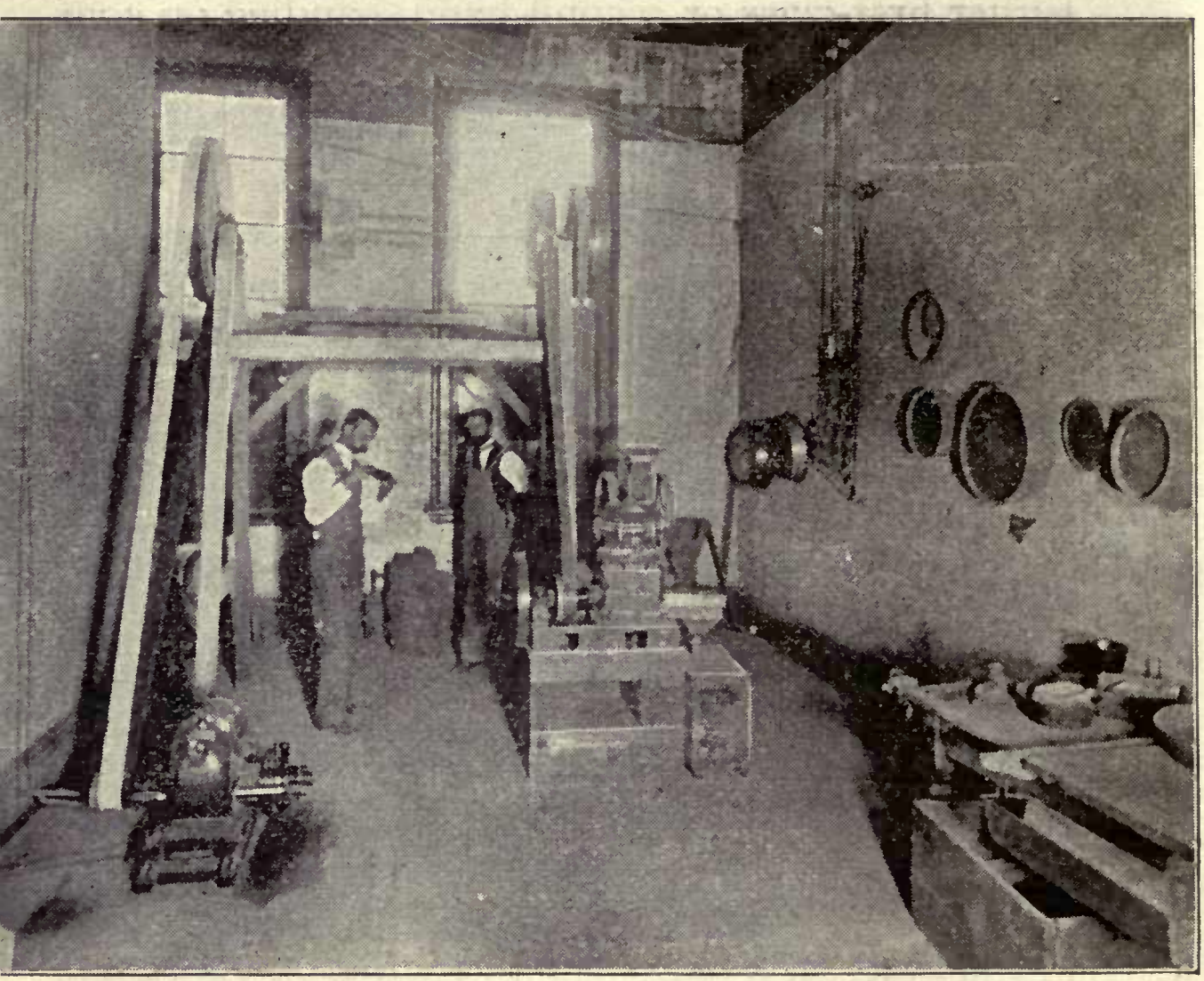
115½ N. Main St., Los Angeles, Cal.

Graduates of the University of Georgia, and of the Columbian University, Corcoran Sc. Department, Washington, D. C.

Long experience in the West.

REFERENCES.

Farmers & Merchants Bank, L. A.
First National Bank, L. A.
L. A. National Bank.
F. W. Braun & Co., wholesale druggists, L. A.
Los Angeles Business College, L. A.
Jno. Taylor & Co., dealers in mining and assay supplies, S. F., and our advertisers, et al.



Assay Office—Crushing Machinery and Electric Motor

Large Samples Sampled and Assayed.
115½ N. Main St., Los Angeles, Cal.

PREFACE TO FIRST EDITION.

We offer this little volume to the mining public; especially to those, unhappily too numerous, who possess little or no knowledge of metallurgy. To such we believe it will be of value. It is not intended as a text-book, or for the making of experts, but to give a general idea of the scope and application of metallurgical processes used in extracting gold from its ores. Hence, we omit largely the technical details—which may be found in numerous technical works and journals—giving chiefly an outline of the common commercial processes and the principles involved.

In this connection we are reminded of a "mining" man who inquired of us about the cost of a cyanide plant. Upon being asked if he had had any cyanide tests of his ore, he replied, "No," but that he knew it would work, because it was from a "cyanide country," (meaning syenitic granite!).

It being beyond the purview of this work, as set forth above, we omit any lengthy homilies on mineralogy, geology, etc., but add in appendices much information in regard to amalgams, amalgamation tests, prospecting, weights and measures, water rights, measurement of water, assaying and mining law.

THE AUTHORS.

Assay Furnaces

Petroleum Oils Analyzed

PREFACE TO SECOND EDITION.

The great appreciation and continued demand induce us to issue a new and revised edition of this work. We have endeavored and believe we have made the subject-matter standard and up to date. Many new ideas and processes are floating around, but their practicability or commercial success being not evident, we forbear the mention of them. Also processes mentioned in the former edition, which have proved a failure or had only a limited success have been eliminated. We do not endorse or advocate any particular process or machinery, though it may be mentioned in this work, unless it is within our own experience. The title has been slightly enlarged from that of the former edition, in order to emphasize the value and importance of the Chapter on Mining Laws, etc., which has been thoroughly revised by Mr. Geo. W. Knox, Mining and Corporation Attorney, of Los Angeles, to whom we extend our thanks.

THE AUTHORS.

THE OLDEST AND THE BEST

LOS ANGELES
Business College
AND
School of Assaying

212 West Third Street
Currier Block

Offers superior advantages to young people desiring to fit themselves for useful positions in life. Thorough courses in Bookkeeping, Shorthand, Tpyewriting and ASSAYING. Write for catalogue or call on the LOS ANGELES BUSINESS COLLEGE, 212 W. Third St., Los Angeles, Cal.

The Young Man's Opportunity

NO profession offers greater opportunity to make an independent fortune, or to utilize the talents, and sharpen the mind, than those of Mining and Metallurgy. They require a knowledge of more of the Chemical and Physical Sciences and Arts than almost any other profession. The foundation and *open sesame* of these is Practical Assaying and Chemical Analysis. In order to give the young man an opportunity of starting in these professions, we offer a practical course of ASSAYING, which is conducted by Prof. E. M. Wade, of the well known and reputable firm of Wade & Wade.

Los Angeles Business College

A. Leschen & Sons Rope Co.

Sole Manufacturers

PATENT FLATTENED STRAND

Tough, Strong,

HERCULES WIRE ROPE

Safe, Durable.

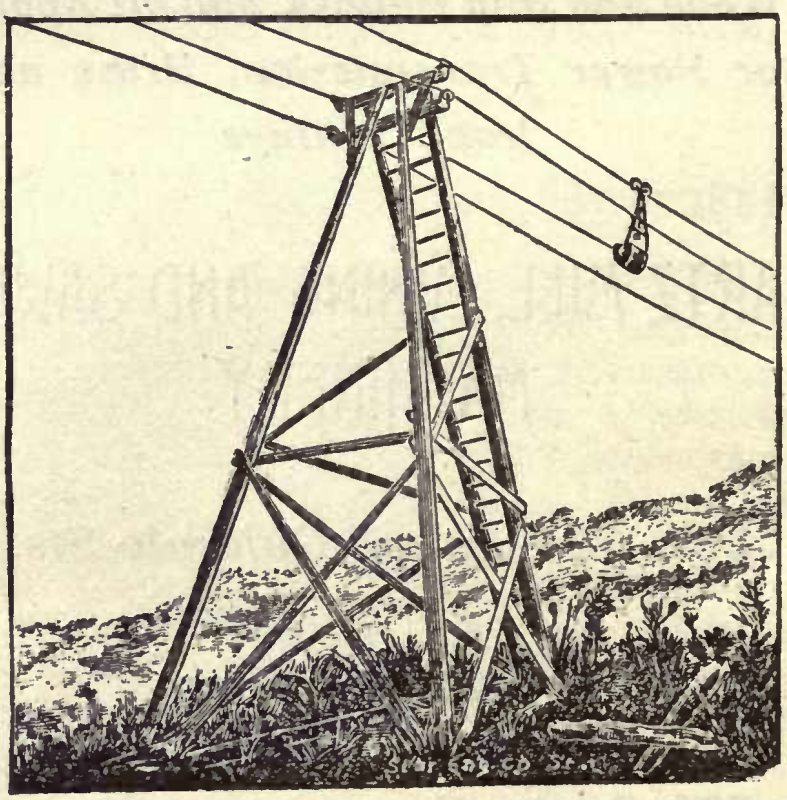
(TRADE MARK REGISTERED)

This is not a new brand of Rope. It has been on the Market for years.

....ALSO....

Leschen Co.'s Pat Aerial Wire Rope Tramway

For transportation of ore, dirt, timber. Loads and unloads automatically. Operated by one man.



929-922 North First St., - - - - ST. LOUIS, MO.

47-49 South Canal St , CHICAGO, ILL

CHAPTER I

IMPORTANT PROPERTIES OF GOLD, MERCURY, SULPHURETS, TELLURIDES, QUARTZ AND SILICATES.

GOLD.

Is a yellow metal, with metallic lustre; malleable; ductile; sectile. Specific gravity about 19.3 when pure; in nature (native) from 14.5 to 17.5, averaging about 17 in California; hardness, 2.5 to 3. Fuses at about 1915 deg. F. Soluble in nitro-muriatic acid (aq. reg.,) and in solutions of chlorine, bromine, iodine, and alkaline cyanides. Native gold is always alloyed with silver and copper; sometimes with iron, lead and other metals—platinum, iridium, et al. In regard to its distribution in ores, veins, etc., see Appendix III.

MERCURY, OR QUICKSILVER.

Is a white lustrous metal; opaque; liquid; boils at about 680 deg. F.; distills and condenses similarly to water. Specific gravity, about 13.6. Forms amalgams, (no doubt more or less weak chemical

compounds,) which are white, pasty or somewhat hard at common temperatures, with gold, silver, copper, sodium, and a few other metals. This property is utilized in the "free milling" process. (See Chapter III.)

The common ore of mercury is cinnabar, the sulphide; a heavy, carmine red mineral; specific gravity 8.9; hardness, 2 to 2.5; lustre adamantine to earthy. Occurs native also.

SULPHURETS OR SULPHIDES.

Are chemical compounds of sulphur and the metals. In color, from white to black, usually of metallic lustre; brittle or sectile. Specific gravity, from about 4. to 6.5, and hardness, 2. to 7. Separated from ores, when conaining gold, silver, copper, lead or other values, by means of concentrating machines, as concentrates. See Chapter V., on "Concentration."

Iron and copper "pyrites" are the most commonly occurring sulphurets in ores; frequently auriferous, and very often barren. Their color ranges from brass-yellow to bronze, and sometimes whitish when arsenical pyrites are present. Copper pyrites have usually more of a golden color, and are frequently iridescent from oxidation. Hardness, 2.5 to 3. Iron pyrites have more of a brassy color; usually crystalline; hardness, 6. to 6.5; brittle. Atmospheric agencies change them to oxides—noticed in the often prevalent shades of brown, red and yellow colors in surface ores.

Pyrites are sometimes utilized in the manufacture of sulphuric acid. See tests for sulphur in Appendix I.

TELLURIDES.

Are chemical compounds of tellurium (an element very similar to sulphur in many respects, but also having metallic properties,) and gold, silver, lead, bismuth and some other metals. They usually carry considerable gold and silver; are associated with, and often like sulphurets. Color, from silver white to bronze yellow; metallic lustre. Such ores are usually roasted, and either chlorinated or cyandied. Oxidized tellurium ores occur also. (See tests, Appendix I.)

QUARTZ AND SILICATES.

Quartz is essentially silica (the oxide of the metallic element, silicon.) In color, it ranges from white to black, and is transparent, translucent, opaque, crystalline or amorphous; massive; granular, etc.; specific gravity, 2.5 to 2.8; hardness, 7. It is very hard, scratching glass easily; infusible alone; not attacked by the common mineral acids; is etched by hydrofluoric acid, and forms a glass when melted with soda and other metallic oxides. It is a large constituent of most mineral veins and country rocks, either free or combined as silicates with the metallic oxides (soda, potash, lime, iron and alumina, principally.)

MINERALS MISTAKEN FOR GOLD.

Yellow quartz and mica, and pyrites, iron sulphurets ("fool's gold,") are the most common.

Mica is cleavable, fissile. Pyrites are brittle, acted upon by nitric acid, giving off reddish brown vapors, and easily fusible, emitting sulphurous fumes. The knife-point applied to the mineral will often suffice to determine the presence or absence of gold, which is not brittle, and appears the same from all points of view, while pyrites glitter usually and change appearances when turned in the light. "All is not gold that glitters"—and in fact, native gold very seldom glitters.

NOTE.

"Specific gravity" is the ratio of the weight of a body to that of an equal volume of some standard substance—water in the case of solids and liquids.

"Hardness" is that quality of a mineral the degree of which is determined by its power to scratch or be scratched by other minerals, as arranged by an arbitrary scale. The scale of hardness in general use is: 1, talc 2, gypsum; 3, calcite; 4, fluorite; 5, apatite; 6, feldspar; 7, quartz; 8, topaz; 9, sapphire; 10, diamond.

CHAPTER II

OUTLINE OF PROCESSES AND OPERATIONS.

Three properties of gold are utilized in its extraction, viz., forming an amalgam or an alloy; dissolving in chemical solutions; and its specific gravity.

The methods or processes are:

1. Mechanical, including *milling* and *concentration.*

2. Chemical, including *cyaniding* and *chlorination,* with various modifications and *smelting,* applicable more especially to silver, lead and copper ores, and for gold incidentally.

Crushing and pulverizing are nearly always necessary; and also sometimes sizing (separating the pulverized ore into different grades of fineness,) and other mechanical operations; or roasting, (to rid of sulphur, zinc, arsenic, etc.,) and drying, as a preliminary preparation.

In regard to their free-milling qualities, ores may be divided technically into:

1. FREE MILLING, OR MILLING—
the gold of which is practically all capable of amalgamation by ordinary "milling." (See Chapter IV.)

2. REFRACTORY—

That is, the gold being incapable of amalgamation ordinarily, on account of some prohibiting physical or chemical condition, as for instance, it is so fine that it floats; is coated with sulphur, arsenic or iron; intimately associated with sulphurets; chemically combined with tellurium (tellurides) or other elements; or, on account of the physical nature of the ore (talcose, clayey,) too much sulphurets, or heavy metallic oxides. The gold of this class may sometimes be largely amalgamated by means of intimate grinding with mercury.

An ore is nowadays rarely fully free-milling, the gold being generally both free and refractory. The extent to which it belongs to the one or the other decides largely what methods should be adopted in treatment.

This should be decided generally by means of careful working tests.

A combination of processes is often necessary for success.

Concentration may follow milling, or milling be preceded or followed by cyaniding, etc. Concentrates are either smelted, cyanided, chlorinated or roasted and amalgamated by grinding in pans.

The tailings from free-milling ores usually carry sufficient values to pay for cyaniding.

Ores of less than $3.00 per ton value are being worked at a profit, by milling and concentration. Likewise, gold tailings of less than $1.00, and ore of less than $4.00 per ton value, by cyaniding.

In Colorado, a high-grade concentrate is obtained after chlorination.

A system of treatment sometimes suitable to mixed gold and silver ores, is to wet-crush, amalgamate on plates, concentrate and treat the tailings by pan amalgamation.

Local conditions, transportation, fuel, water, labor, etc., requiring the attention of an expert, must be considered in regard to selecting the method of treatment.

CAUSES OF FAILURE—

Two general causes of failure in mining operations prevail, viz., incompetent management and insufficient development of the mine before erecting machinery, or so that the general character of the ore and its extent, on which the methods of treatment and the magnitude of the plant depend largely, may be determined. Free-milling ores often change to sulphurets and become refractory below the water level; and it may happen that the ore becomes too wet for dry crushing, thus necessitating the putting in of drying or calcining machinery.

A vein does not always grow richer as it goes down. Experience in a particular locality is usually the only guide as to that. A practically inexhaustible low-grade ore may be, and is, in fact, being worked in places, by means of very large machinery.

Failure is also not infrequently due to experimenting with untried machinery, or to the lack of sufficient capital.

P. & B. PAINT

..FOR..

MINES, CHLORINATION WORKS,
SMELTERS AND REFINERIES

THE CYANIDE PROCESS

P. & B. ROOFINGS put up in rolls to lay 200 square feet with paint and nails. Absolutely acid, and alkali proof.

PARAFFINE PAINT COMPANY

SOLE MANUFACTURERS

116 Battery St., San Francisco, Cal.
312-314 W. Fifth St., Los Angeles, Cal.

Haas, Baruch & Co.

LOS ANGELES, CAL.

WHOLESALE

Grocers
And Wholesale
Druggists

Headquarters for . . . **ROESSLER-HASSLACHER**

CYANIDE

Guaranteed to be 98 to 99 per cent. Chemically Pure

. . . CORRESPONDENCE SOLICITED.

CHAPTER III

CRUSHING AND PULVERIZING—MACHINERY EMPLOYED.

The degree of fineness necessary for proper treatment of an ore depends on its chemical and physical nature and the methods of treatment. Generally, hard, compact ores require fine pulverizing; and porous ores, or those with much sulphurets or coarse gold, require only coarse crushing. Fine pulverizing is often more necessary in milling than in cyaniding or chlorination.

The operation of crushing or pulverizing generally consists of the following:

1. COARSE CRUSHING—

or breaking, by means of breakers, followed by

2. FINE PULVERIZING—

by means of rolls, stamps, ball pulverizers, etc.

3. SCREENING—

This is done in connection with fine pulverizing, in order to regulate the size of the ore particles.

Before being broken, fine ore is usually separated from the coarser lumps, which go to the breaker, by dumping onto a grizzly—a row of inclined iron

bars set the width of the breaker jaws from each other.

Breakers are represented commonly by two types, viz.:

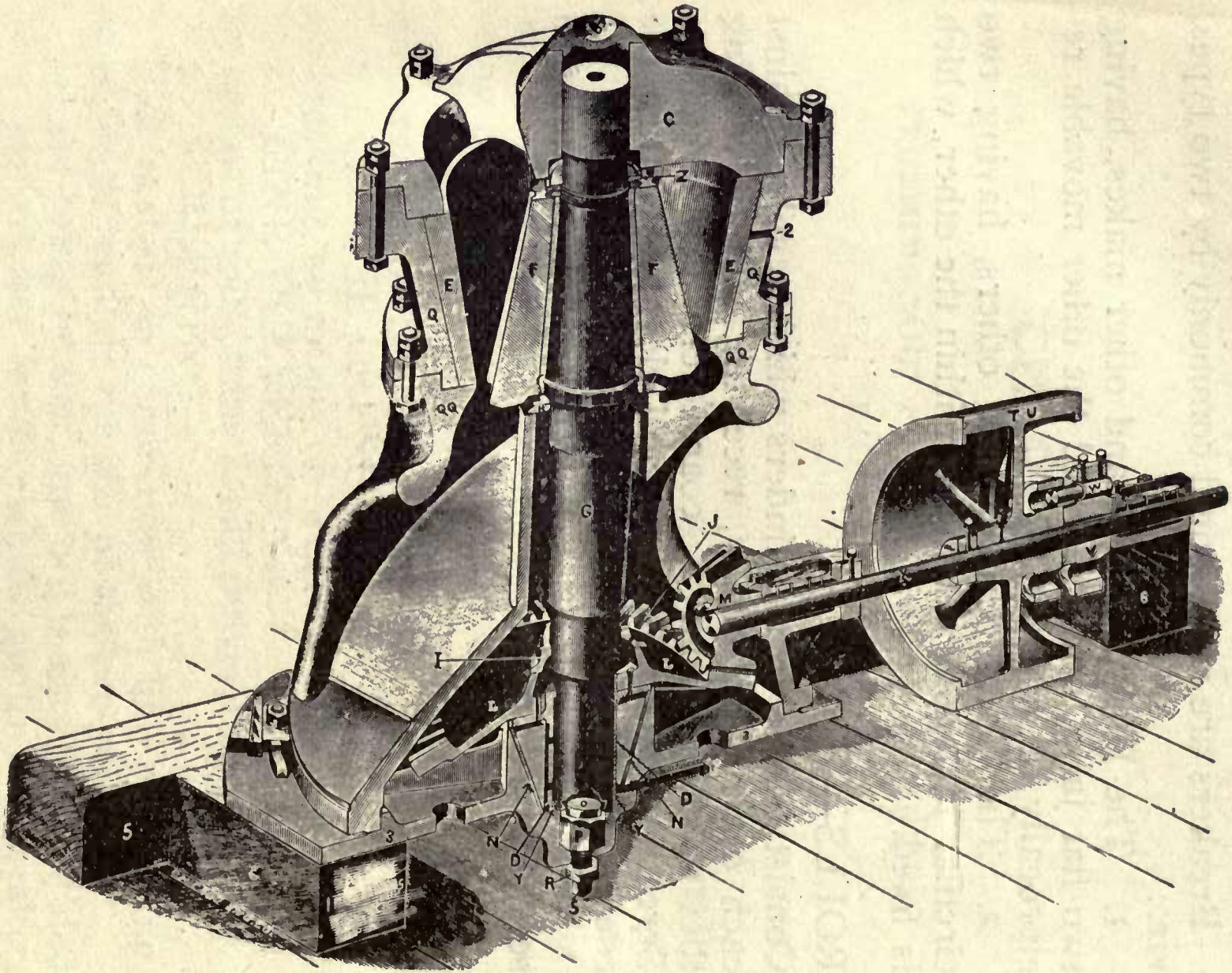
1. The Dodge, Blake, and other makes, having two flat jaws, one fixed and the other movable reciprocally on a pivot.

2. The Gates, Comet, and others, having two circular jaws, one revolving within the other, which is fixed.

ROLLS—

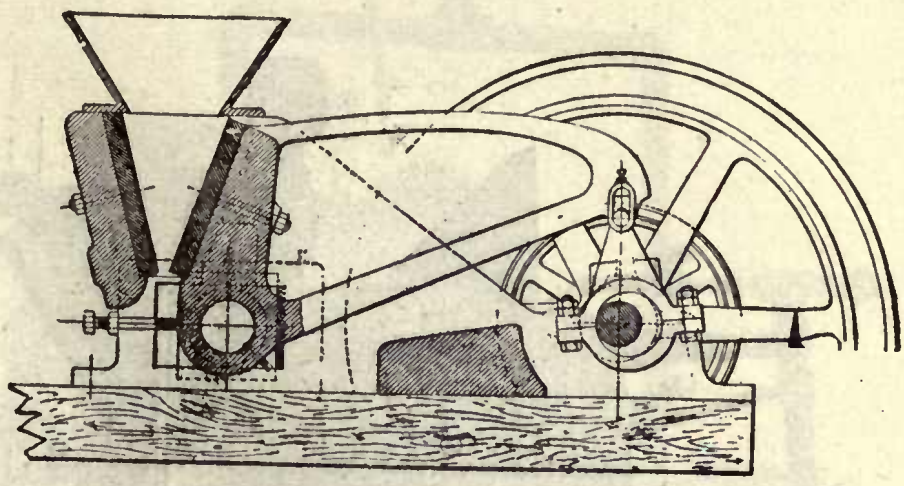
Consist of two iron cylinders which revolve against each other horizontally, receiving and pulverizing the product from a coarse crushing machine. Screens separate the fine, and elevators return the coarser material.

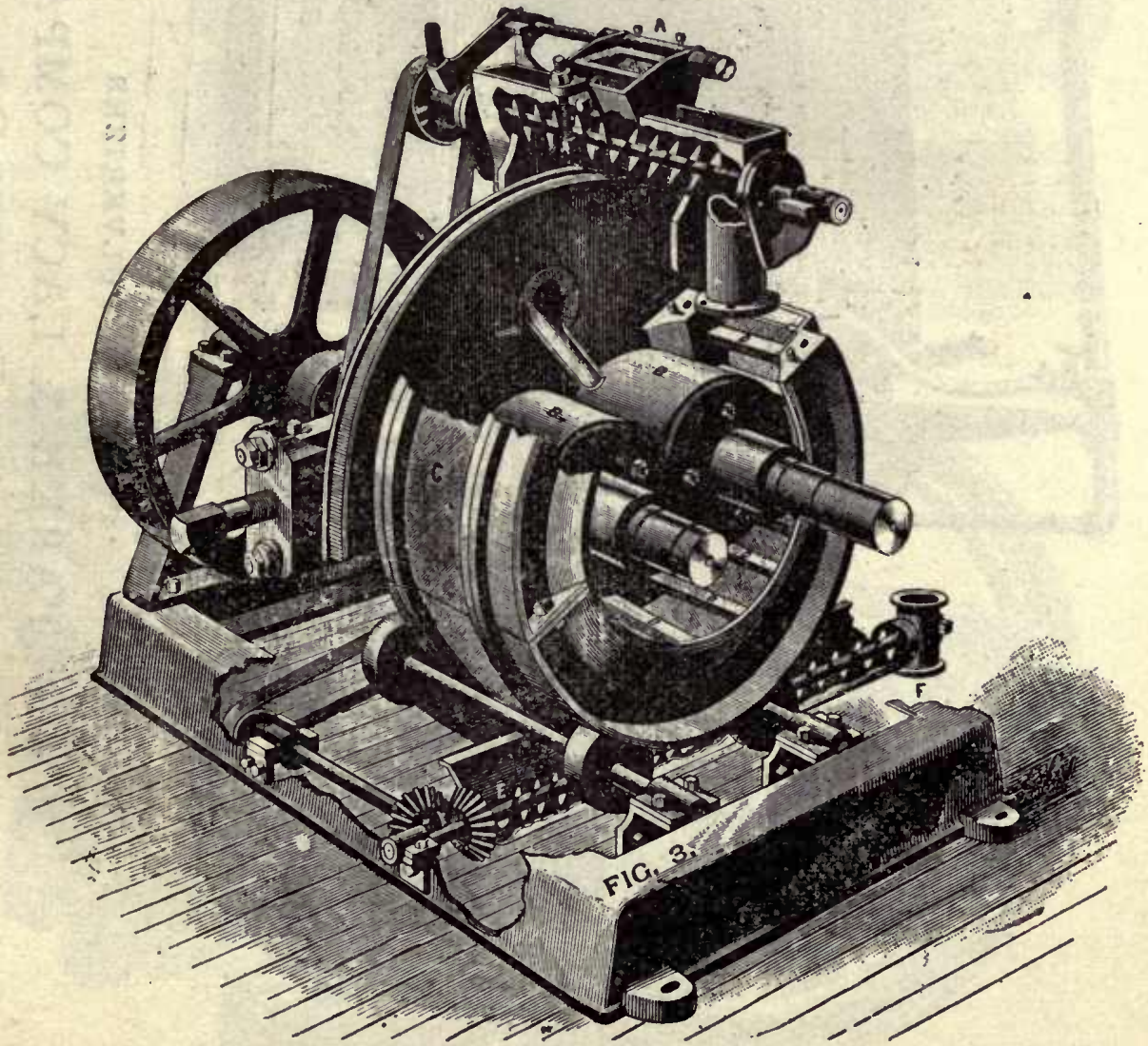
Rolls are used for dry pulverizing, generally in sets of two or more.



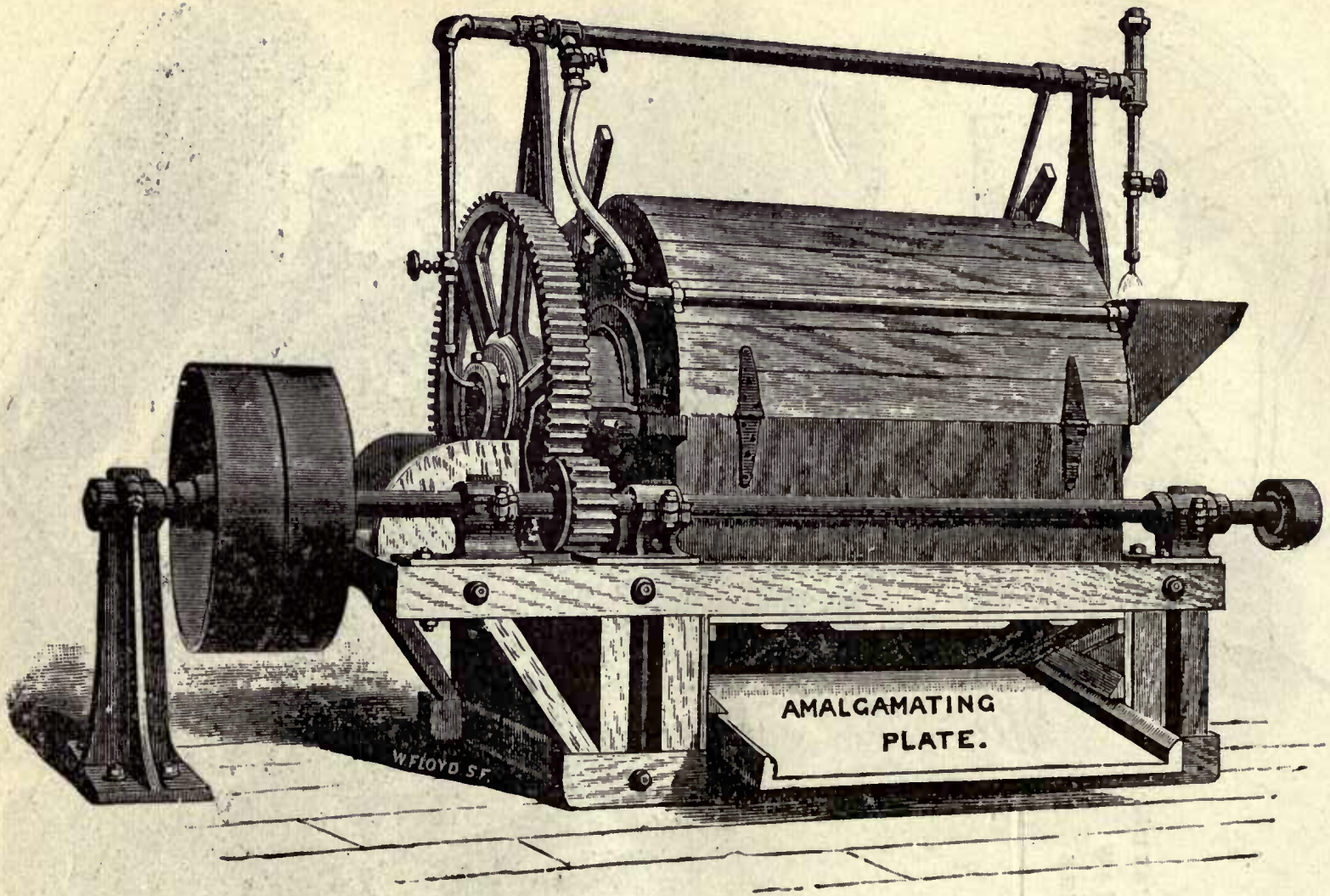
CROSS SECTION OF CIRCULAR JAW CRUSHER

RECIPROCATING
FLAT JAW
CRUSHER





PULVERIZING ROLLS



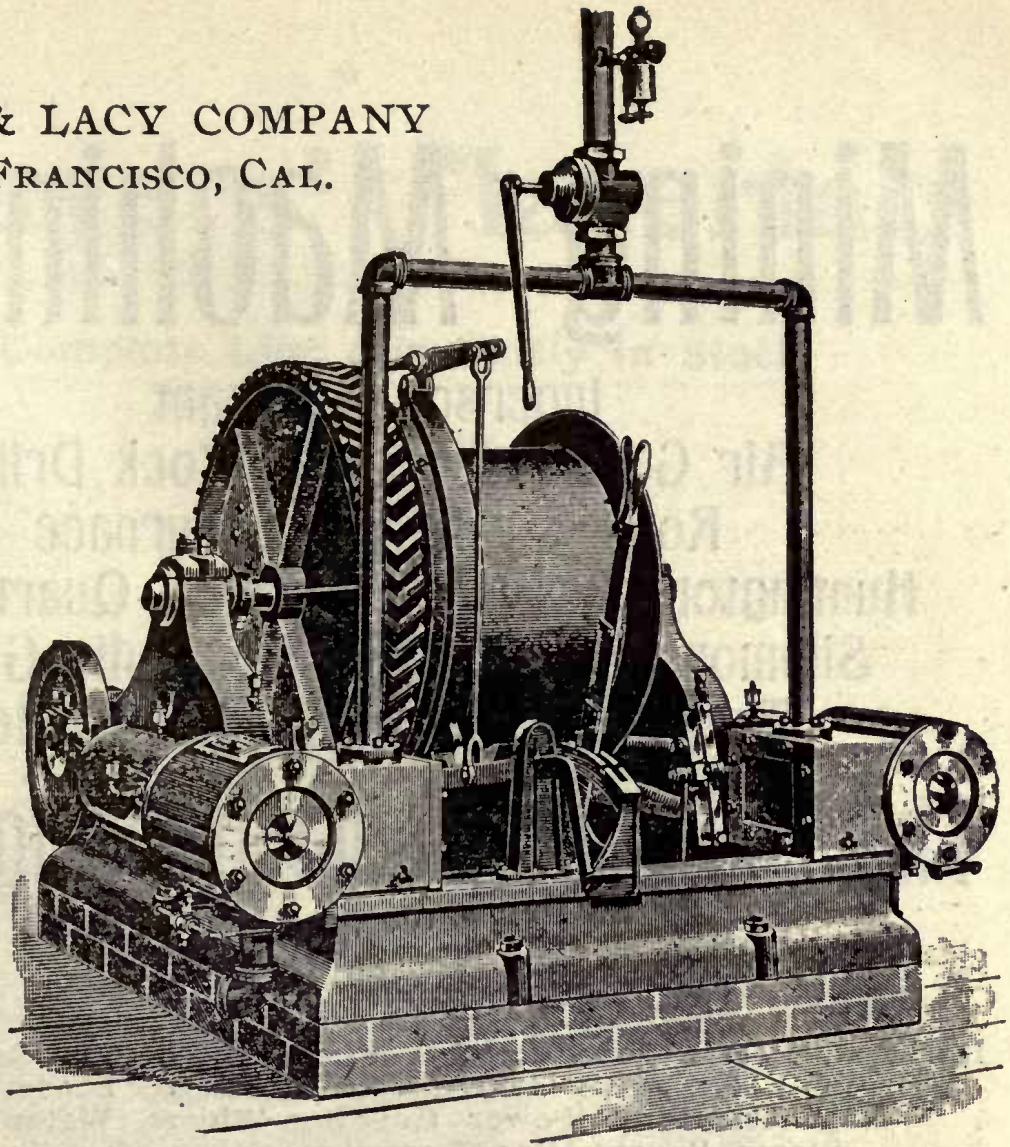
DODGE PULVERIZER

PARKE & LACY COMPANY,

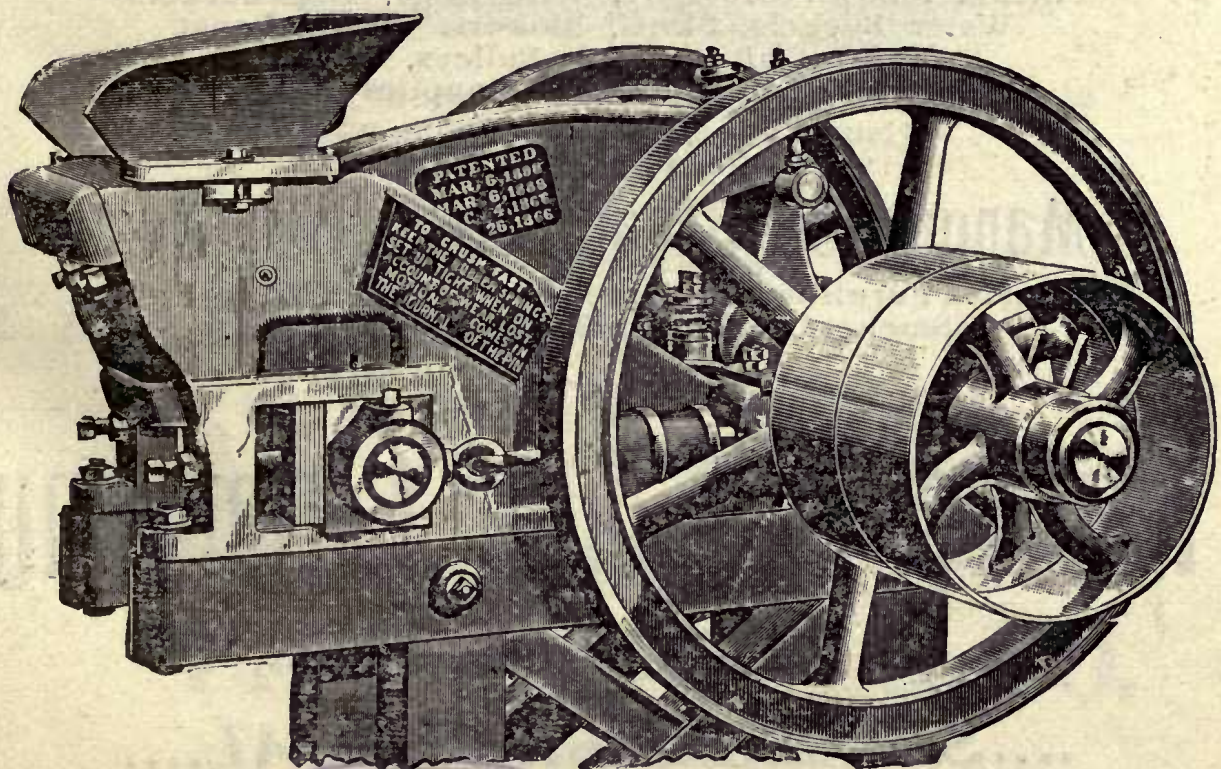
SAN FRANCISCO, CAL.

PARKE & LACY COMPANY

SAN FRANCISCO, CAL.



GEARED HOIST



DODGE BREAKER.

Mining Machinery

Ingersoll-Sargeant
Air Compressors and Rock Drills
Ropp Straight Line Furnace
Huntington Centrifugal Roller Quartz Mill
Simmons Ball-Bearing Hydraulic Giants
The James Automatic Ore Feeder

The Bartlett Concentrating Table

WE CARRY IN STOCK:

Horizontal, Vertical and Portable engines and Boilers, Rock Breakers, Cornish Rolls, Pulverizers. Concentrators, Ore Feeders, Hoisting Engines, Horse Power Hoisting Whims, Water Wheels, Steam Pumps, Ore Cars, Wire Rope, Ore Buckets Water Buckets, Skips, Blowers. and Exhaust Fans, Shafting and Pulleys, Belting Oils and Mine Supplies

SOLE AGENTS FOR

Manganese Steel Shoes and Dies

Estimates Furnished for Complete Plans for hoisting works, Smelters, Concentrating and Stamp Mills.

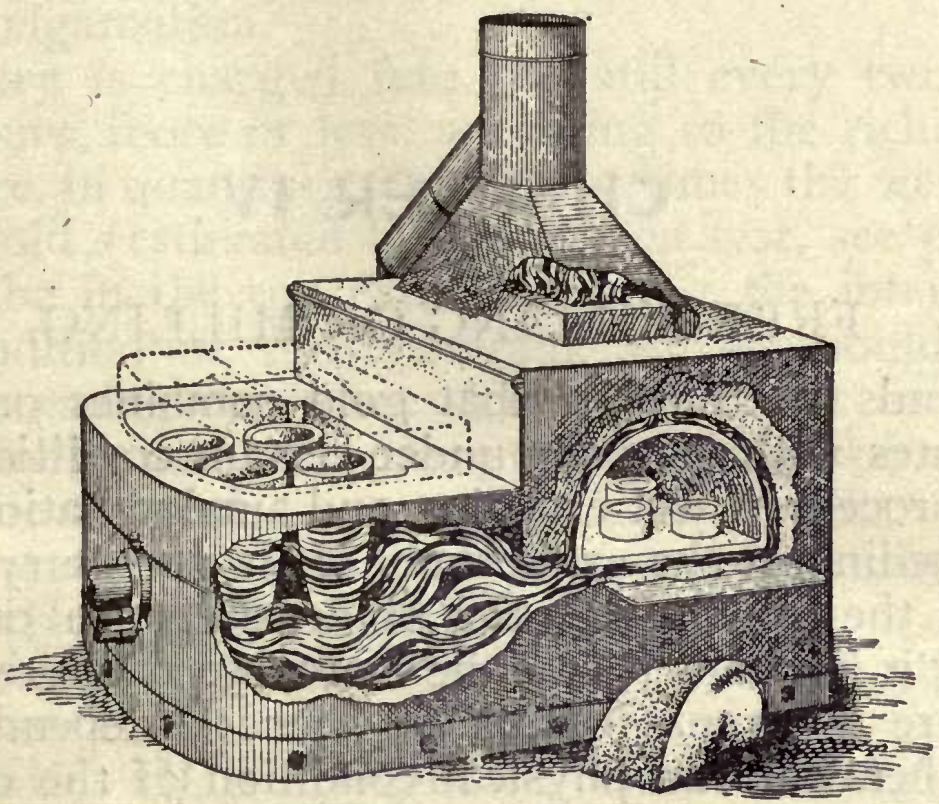
Parke & Lacy Company

21 and 23 Fremont Street.

....SAN FRANCISCO, CAL....

Assayers' Materials

A Complete Line Constantly in Stock



This Illustration shows Cary Combination Furnace No. 30
Melting and Cupelling Simultaneously
with one Burner.

MANUFACTURERS OF

L. & C. and Cary Furnaces
and Calkins Cupel Machines
Crushers, Pulverizers, etc.

New Illustrated Catalogue upon Application

F. W. BRAUN & CO.

Los Angeles, Cal.

CHAPTER IV

FREE-MILLING OR MILLING.

Depends on the fact that gold combines or amalgamates with mercury under certain conditions. It is a process of wet crushing and amalgamation, both proceeding at the same time. It is necessary to liberate the gold by means of crushing, in order to bring it in contact with the mercury. Different ores require different degrees of fineness, depending on the chemical and physical condition of the ore and its gold contents. The pulverizing or crushing is done in a "quartz mill," which is generally given the function of amalgamation also. The mercury is utilized as a thin coating on inclined copper plates, placed outside and inside, and as loose mercury inside the mill. The ore, after passing through a breaker, if necessary, is fed to the mill, crushed and washed out through a discharge screen, with a continuous flow of water, over the outside plates, and off as tailings. The gold settles down on the mercury, and assumulates as amalgam, which is periodically cleaned up, retorted, melted, and cast into a bar of bullion. The gold is caught mostly inside the mill, and at the upper end of the outside plate.

Inside amalgamation is not always permissible or advisable, especially with highly sulphuretted or base ores, which foul or "sicken" the mercury and prevent amalgamation.

Mercury is charged into the mill every two or three hours, more or less, according to the richness of the ore, in quantities about three times the weight of the gold (estimated by hornspoon test, see page 78), to be in the ore crushed during the interval. The condition of the amalgam, which should be pasty, retaining the impression of the finger nail, is a good indication as to the proper amount of mercury to be charged.

Mills are of two general types, represented by

1. THE STAMP MILL—

acting with percussion, similar to the blow of a hammer on an anvil.

2. THE HUNTINGTON, BRYAN, LANE SLOW SPEED,

and others, called in common, roller quartz mills.

THE STAMP MILL.

Is considered par excellence the machine for milling, being most generally in use. Its main parts are:

1. THE MORTAR—

A rectangular cast-iron box, with slots, usually on one side only, for holding the frame of a discharge screen. The mortar is set firmly on and bolted to a wood or board mortar block, set firmly in the ground.

2. THE STAMPS—

Usually in sets or "batteries" of five, and the dies, one to each stamp, on which the crushing is done. Two and three-stamp mills are made with single, double or triple discharge.

3. THE LIFTING MECHANISM—

A horizontal shaft on which are keyed double-armed cams, one for each stamp, and a driving pulley. The cam, in its upward movement, gives a vertical lift and revolving motion to the stamp by striking underneath a collar or tappet keyed on a central stamp stem.

THE STAMP—

Consists of a long stem fitting into a socket of a cylindrical head or boss, and a movable shoe (the wearing part) held by means of a shank and wooden wedges driven tightly into a lower socket of the head. The stamp stems are supported vertically by guides, and reversible when broken. The die is round, with square base, and sets best on a bed of tailings on the bottom of the mortar. Shoes and dies are made of the hardest cast iron or forged steel.

SCREENS—

Under fixed conditions, regulate the rate of discharge and size of ore particles. They are made usually of slotted, sometimes round-punched, Russian iron, plain or burred; and sometimes of brass or steel wire, etc., and designated by the number of the needle fitting for punched or slotted, and by the number of meshes per linear inch for wire screens.

COMPARISON OF SIZES.

No. of Needle.	*Corresponding Mesh.*	*Width of Slot (Inches).*	*Weight per Sq. ft. (lbs.)*
5	20	0 029	1 15
6	25	0 027	1 08
7	30	0 024	0 987
8	35	0 022	0 918
9	40	0 020	0 827
10	50	0 018	0 735
11	55	0 016	0 666
12	60	0 015	0 660

Nos. 6 to 9, slotted, and Nos. 30 to 40 wire screens are most in use. For low-grade ores No. 11 slotted is considerably used. Screens last from two to five weeks, more or less, according to the nature of the ore, and other conditions. Chock blocks are sometimes placed underneath the screens to keep constant height of discharge, as the dies wear down.

PLATES—

are usually electroplated with silver, about 1 oz. per sq. ft., the advantage being that they work better from the start and are kept clean more easily. Outside plates are usually in one continuous plane, but sometimes stepped; width the same as the mortar, and length about 10 ft., varying up to about 20 feet. The inclination is, say, from ½ to 2½ inches per foot, (the latter prevailing largely,) according to the nature of the ore. Inside plates are placed usually

at the base of the screen, inclined about 40 deg., and sometimes in the rear of the stamps.

Various amalgam traps, fine gold savers, sluice boxes, and blankets are sometimes placed below the plates to advantage.

Copper plates absorb gold and become valuable in time.

THE CLEANUP—

This is done generally once or twice a month by rubbing up the plates and cleaning out the battery. All ore, particles of iron, etc., are separated from the liquid amalgam, which is then squeezed through a cloth or buckskin, and retorted. The skimmings, rich in amalgam, are treated in a grinding pan or clean-up barrel with addition of more mercury. The strained mercury retains some gold. Outside plates are cleaned up once a day or oftener.

RETORTING AND MELTING—

Retorting is a process of distillation used to separate and recover the mercury from the amalgam, or to purify mercury. It is done in cup-shaped or cylindrical cast-iron retorts, into which the amalgam is placed, and closed with a cover luted on with clay or other substances. An iron condensing pipe, with a jacket, or wrapped with sacks or cloth, leads from the cover, and is kept cool with water to condense the mercury. It is best to line the interior of the retort with chalk paste or equal parts of clay and graphite, which is allowed to dry. Paper or cloth is sometimes placed on the bottom to prevent sticking.

Do not dip the condenser in water—dangerous. Loosely fit on the end a piece of canvas rolled cylindrically, and allow the end to dip in the water. The charge should not occupy more than about two-thirds the capacity of the retort, and it is best to cover with a loosely fitting asbestos board. A gentle heat is started and increased to near redness until the mercury is all over in the receiver (filled with water,) and then to redness for a few minutes. The gold, left in a porous or spongy mass, is melted with fluxes in plumbago crucibles, and cast into a bar.

FINENESS OF BULLION—

The gold obtained nearly always contains silver, copper and some other base metals, making more or less "base bullion." The fineness is determined by assay, and is stated in parts per 1000; thus, gold "850 fine" means 850 parts by weight in 1000 parts of bullion. 1000 fine is absolutely pure gold.

DRESSING OF PLATES—

Mercury is sprinkled on and rubbed with a brush once every day or oftener, as is necessary, and a weak solution of potassium cyanide applied to clean the plates and remove spots of verdigris. Also lye, sulphuric acid, salamoniac, ammonia, and various secret nostrums are used for cleaning plates. Sodium amalgam is sometimes added to the mercury to liven it up or cure "sickening." The silvering, when worn off in spots, may be replaced by rubbing on silver amalgam.

ASSAYS—

Of head, battery and tailing samples should be made daily. The ore (head) is sampled usually by catching a shovelful under the feeder every half hour or so; and the tailings, by taking a bucketful not to overflowing, periodically, and allowing to settle and the water carefully poured off. Automatic samplers for tailings are coming into use. See page 40.

CONDITIONS OF GOOD AMALGAMATION.

The grade of the plates; amount of water, fineness of crushing, and feed must be carefully regulated, grease kept out of the mill, and the mercury pure. The pulp should flow down the plates in successive waves. Grease may be neutralized by means of alkali.

The general rule is: Fine crushing of compact ores, or those containing chiefly fine gold; and coarse crushing for those carrying much coarse auriferous sulphurets or coarse gold; and a good coating of amalgam on the plates. The plates should not be cleaned up too close. The loss of quicksilver should not exceed one-sixth (1-6) oz. per ton of free-milling ore, and more for base ores.

Sulphurets may best be removed by concentration sometimes, before running over plates.

In regard to the temperature of the battery waters, there has been much discussion, and the general consensus seems to be that it should be not below 40 or 50 deg. F.—heated up if necessary to 70 or 80 deg. F.

DROPPING OF STAMPS, HEIGHT OF DROP, DUTY, Etc.—

The height of drop varies largely, from about "4 to 10" inches, averaging about "6 to 7" inches—"4½ to 5" inches is recommended by good authorities. The rate of drop ranges from about 80 to 100 per minute, averaging about 90 drops per minute. The Colorado practice is, on highly sulphuretted ores, light stamp, high drop, low speed, etc. The tendency is toward high speed, short drop, and heavier stamps. The weight of stamps vary from about 600 to 1300 pounds, averaging about 850 pounds. The height of discharge—i. e., distance from bottom of screen to top of die—and quantity of water also regulate the size of crushing and the output. The order of drop varies, some being better than others. 1, 5, 2, 4, 3 is recommended as good.

The duty of stamps varies considerably, according to weight, the height of drop, speed, size of screen, nature of the ore, height of discharge, width of mortar, etc., being sometimes four tons or more per stamp in 24 hours.

WATER REQUIRED—

Water is supplied from pipes placed into the rear of the battery and sometimes in front over the plates. From 100 to 120 cubic feet per ton of ore is usually required, but the quantity varies greatly. A miner's inch per 24 hours (about 9 gallons per minute) is generally reckoned for five stamps, and from one-fourth to one-third miner's inch for the average concentrator vanner.

POWER REQUIRED.

For each 850-lb. stamp, dropping 6 inches 95 times per minute.....1 33 H.P.
For each 750-lb. stamp, dropping 6 inches 95 times per minute.....1 18 H.P.
For each 650-lb. stamp, dropping 6 inches 95 times per minute.....1 00 H.P.
For an 8x10-inch Blake pattern rock breaker .....9 00 H.P.
For a Frue or Triumph vanner, with 250 revolutions per minute.....0 50 H.P.
For a 4-foot clean-up pan, making 30 revolutions .....1 50 H.P.
For an amalgamating barrel, making 30 revolutions .....2 50 H.P.
For a mechanical batea, making 30 revolutions .....1 00 H.P.

—PRESTON.

It is calculated that each 1350-lb. stamp dropping 100 times per minute will require 2¾ H.P.; each 900-lb. stamp, at the same drop rate, 2 H.P., and each 750-lb. stamp 1½ H.P. Boiler feed for each H.P. per hour will average five gallons water; each stamp per hour will require from 60 to 75 gallons; each concentrator per hour 250 gallons.—Mng. & Sc. Press.

ROLLER QUARTZ MILLS

Operate with rollers or heavy wheels moving on a circular track or die inside a circular mortar, around the periphery of which discharge screens are placed. The crushing force is due to either cen-

trifugal action or to the weight of the roller, or to both.

The general principles of amalgamation are also applicable to these mills. The advantages claimed for this type of mill are lightness, cheapness, easiness of transportation, and special adaptability to milling soft or easily crushed ores—and some of them even to working hard quartz.

STEAM STAMP MILLS.

In this kind of a mill the lifting power is applied directly by means of a vertical steam cylinder, in which the stamp stem acts similar to a piston rod.

THE ARRASTRA—PAN AMALGAMATION.

The arrastra is a primitive machine (now superseded largely by the stamp and other mills), built in the ground, and consisting of a circular vat of flat stones, around the bottom of which heavy flat stones are dragged by means of a vertical shaft and horizontal tongue, to which mule or other power is applied. It is for small mines, or in opening new mines, where it is not advisable to put in expensive machinery. One of the most efficient and inexpensive devices. The ore is fed under the drag-stones with water and mercury, and when sufficiently ground to a pulp and the mercury mixed well, the mass is diluted and washed out through plug-holes over riffles. The amalgam is then cleaned up and retorted. Water or animal power may be applied.

From this machine originated the amalgamating pan, consisting of a cast-iron vat with revolving

mullers, which grind up and mix the ore with mercury and chemicals. It is used sometimes in treating gold ores, concentrates, tailings and battery sands, but more generally applied to working silver ores.

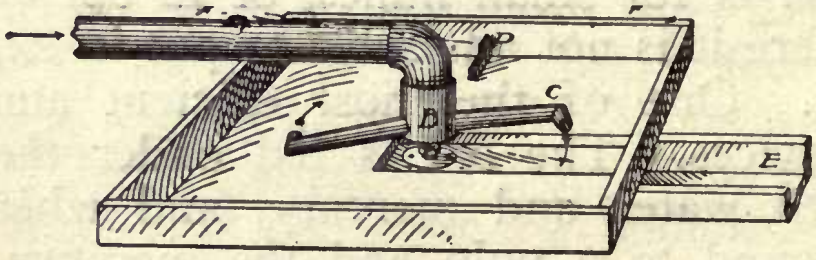
AUTOMATIC FEEDERS.

Have the advantage of more regular feeding, a greater output, and the saving of wear and tear of mill. Two makes are, among others, in general use, viz., the Challenge, suited to wet or dry, and the Tulloch, best to dry ores.

A collar on one of the stamp stems strikes against a level extending underneath from the feeder and operates by scraping or shaking out the ore.

AUTOMATIC SAMPLING

THE correct sampling of tailings is of great importance. For this purpose the AUTOMATIC SAMPLER devised by Wade & Wade, and illustrated in accompanying figure, is used after the plates and concentrator of their milling and concentration plant.



Automatic Sampler

The pulp flows through the pipe A and the hollow drum and arms B C, which the pressure at termiuals C revolves on a vertical spindle with ball bearing. As the terminals pass. over the slot D in the tray F, a small portion of pulp falls through at regular intervals into a receptacle below, the maiu flow of pulp passing off down the launder E.

MILLING AND CONCENTRATION TESTS.

These tests are much more valuable than are mere assays, in that large quantities of ore may be treated; a more certain valuation of a lode or vein, and also an indication as to the best methods of working the ore thereof, are obtained.

The improvement of processes and machinery renders it more possible to work profitably large bodies of very low grade ores, in which a very small margin represents the difference between profit and loss. It taxes the powers and skill of the assayer to get a sufficiently accurate valuation of such ores, requiring quite a number of assays, and the most delicate assay balances and manipulation. Hence, it becomes necessary for low grade, and advisable even for high grade ores, which may contain very coarse gold that renders accurate sampling difficult or impossible, to resort to the larger working tests.

In order to give a conception of the scope and work necessary in making such tests, we append copy of an actual report. If copper, lead or other metallic values are present, it becomes necessary to assay the ore, concentrates and tailings for them also. (See appendix I for small amalgam tests.)

E. M. WADE TELEPHONE GREEN 1704 M. L. WADE

WADE & WADE

ANALYTICAL CHEMISTS AND ASSAYERS

115½ N. Main Street.

LOS ANGELES, CAL., Jan. 2, 1901.

Report of working tests for

The Big Bug G. M. & M Co.

Amount of ore tested, 5 tons.

Gold valued @ $20.67 per oz.
Silver " @ 60 per oz.
Lead " @ ..... per lb.
Copper " @ ..... per lb.

WORKING TEST

MILL TEST—Per Ton of 2000 Pounds

	GOLD		Per Cent of Head	SILVER		Per Cent of Head	GOLD & SILVER	
	OZ.	VALUE		OZ.	VALUE		VALUE	Per Ct.
1. Battery (head) assay	0.725	$15 00	100 00	2.50	$1 50	100.00	$16 50	100.00
2. Tailings from plates, assay	0.170	3 50	23 33	2.34	1 40	93.33	4 90	29.70
3. Milled by difference (1–2)	0.555	11 50	76 67	0.16	10	6.67	11 58	70.30
4. **Cleanup, actual amalgam**	0.532	11 00	73 33	0.12	07	4.66	11 07	66.70
5. Left on plates, or unaccounted for.....	.023	50	3 34	0.04	03	83.33	51	3.60

BULLION — Assay and Value of.

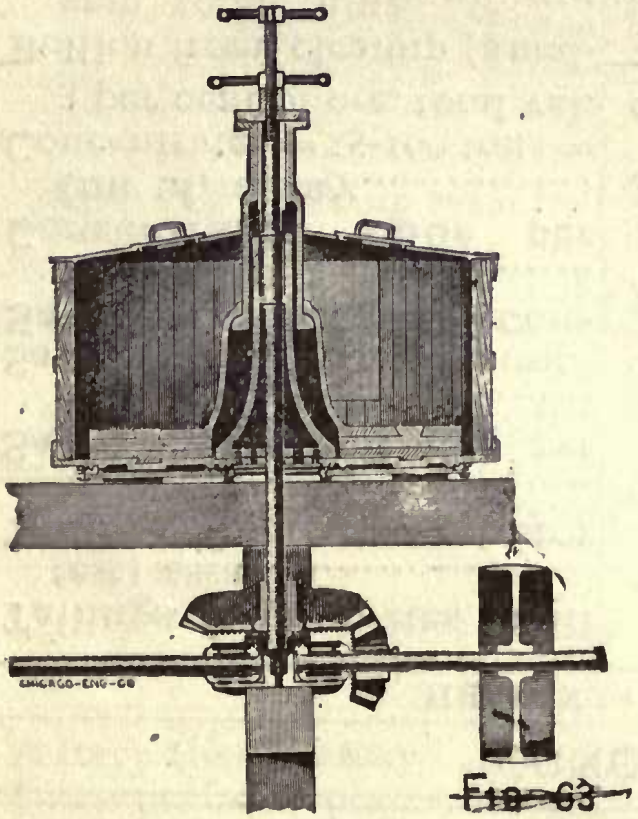
Weight in Ounces	GOLD Value	GOLD Fineness	SILVER Value	SILVER Fineness	TOTAL
3 80	$55 00	700	$0 35	153	$55 35

CONCENTRATION TEST

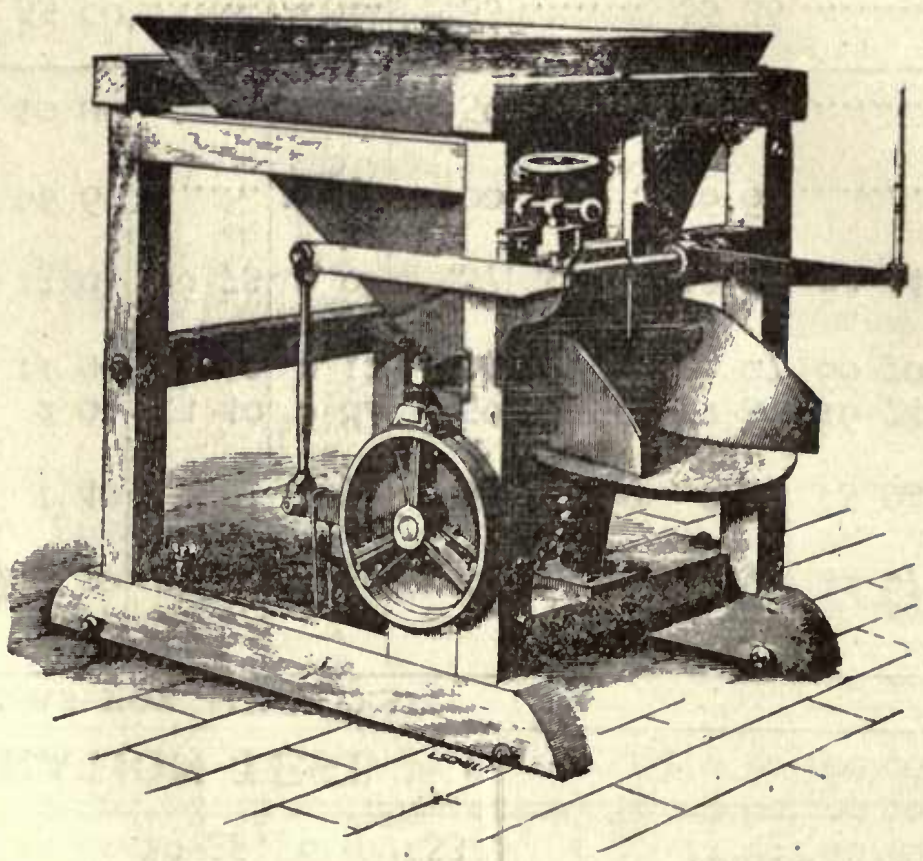
HEADINGS SAME AS FOR MILL TEST.

1. Tailings from plates (mill test) assay	0 17	$ 3 50	23 33	2 34	$1 40	93 33	$ 4 90	32 67
2. Tailings from concentrator assay	0 072	1 49	9 93	1 50	90	60 00	2 39	15 93
3. Saved by concentration per ton (1-2)	0 098	2 01	13 40	0 84	50	33 33	2 51	16 74
4. Saved by milling (cleanup)	0 532	11 00	73 33	0 12	07	4 66	11 07	66 70
5. Saved by milling and concentration 3+4	0 630	13 01	86 73	0 96	57	37 99	13 58	83 44
6. Concentrates, value per ton of, assay	3 225	66 67	.....	16 67	10 00	.....	76 67	.....
7. Concentrates = 15-100 tons = 3 per cent of ore, total val.	0 484	10 00	.....	4 17	2 50	.....	12 50	.....
8. Bullion from cleanup (amalgam) total value	.....	55 00	.....	.....	35	.....	55 35	.....
9. Total value of bullion and concentrates (7+8)	.....	65 00	.....	.....	2 85	.....	67 85	.....

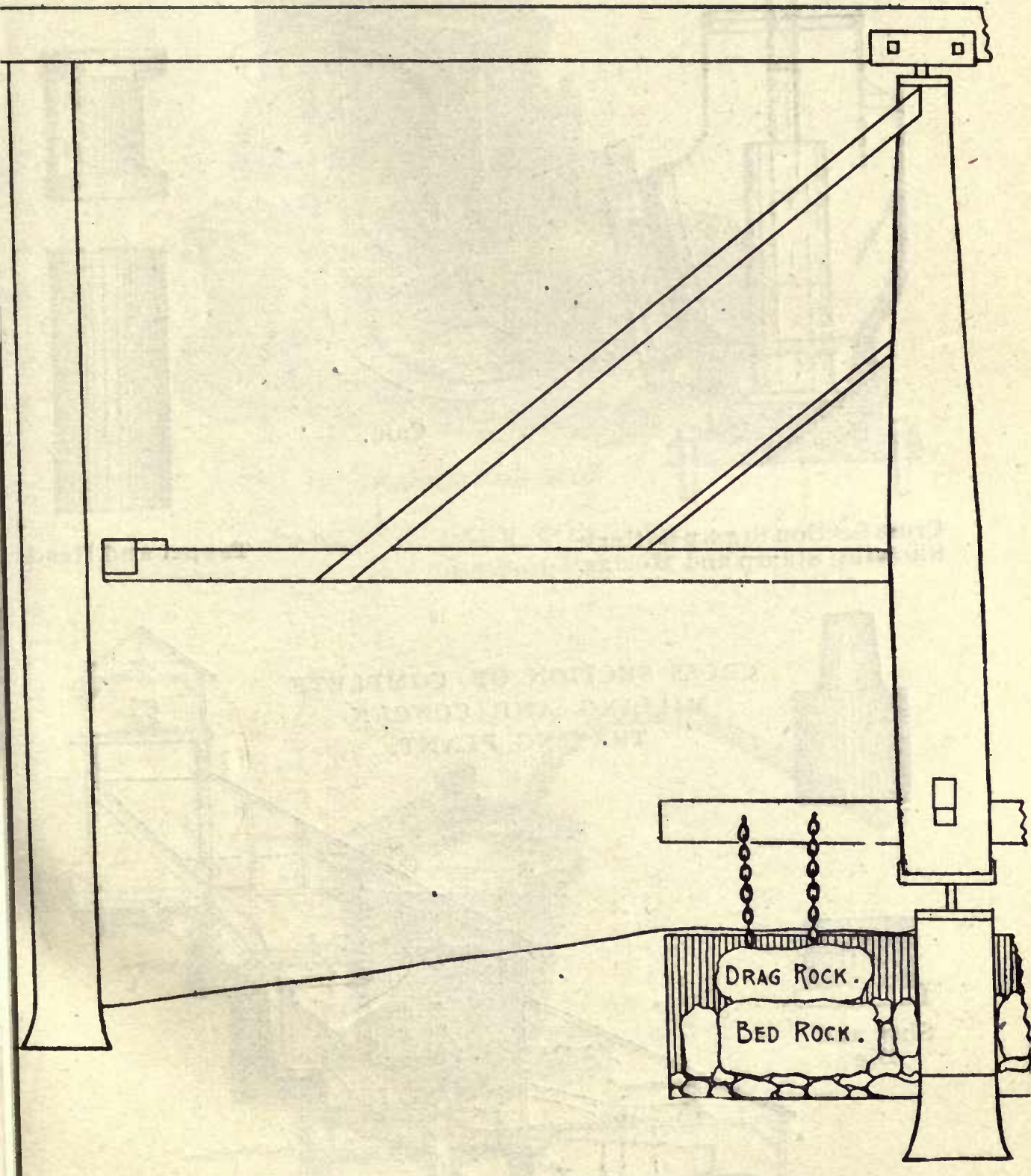
(Signed) WADE & WADE.



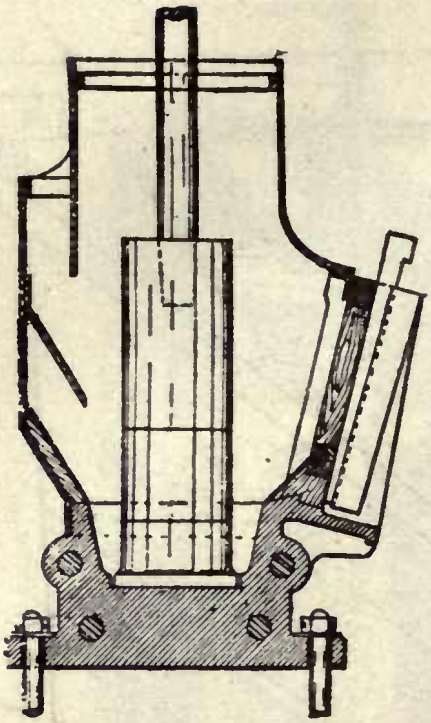
AMALGAMATING PAN,
CROSS-SECTION.



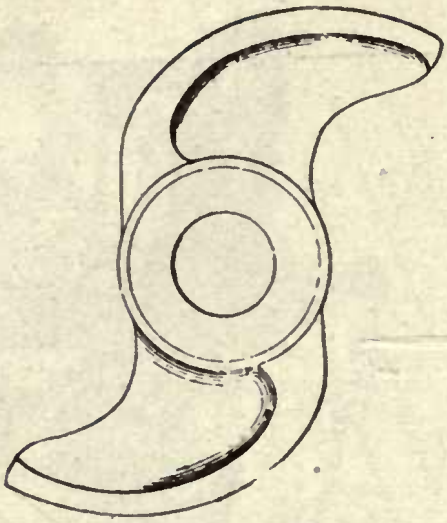
AUTOMATIC ORE FEEDER.



Half Vertical Cross Section of an Arrastra.



Cross Section Stamp Battery, Showing Stamp and Mortar.

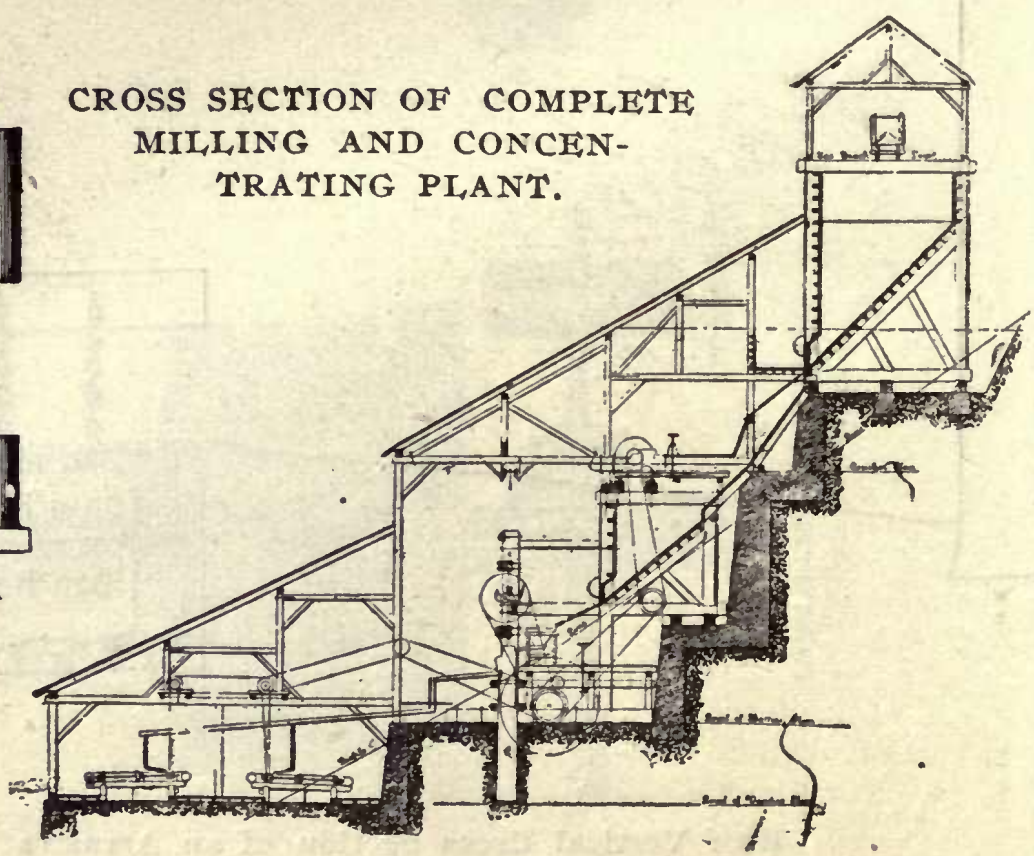


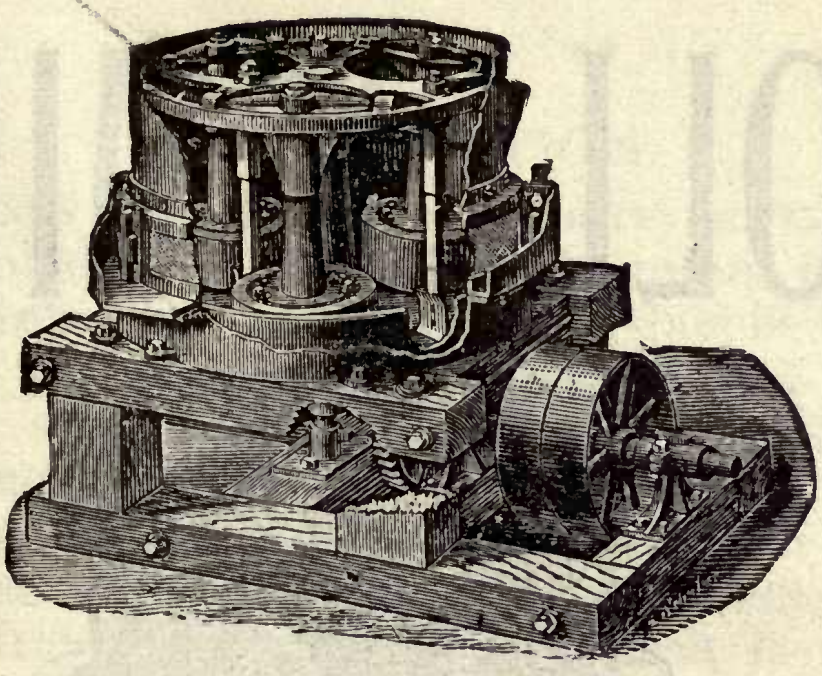
Cam.

Tappet and Head

Shoe and Die

CROSS SECTION OF COMPLETE MILLING AND CONCENTRATING PLANT.





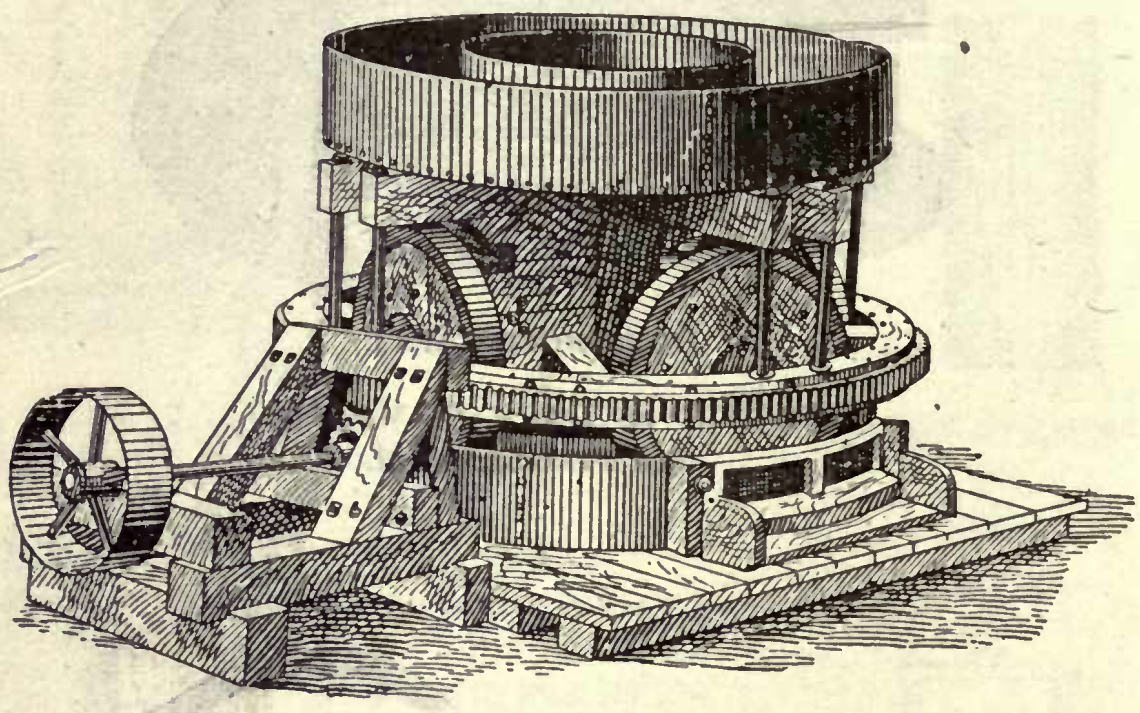
HUNTINGTON MILL.

PARKE & LACY COMPANY,
San Francisco, Cal.

AMALGAM RETORT

LANE SLOW SPEED

ROLLER MILL



Slow speed gives perfect amalgamation. Extra good mill for saving fine, flour or rusty gold. Cheapest mill on market. Capacity 15 to 25 tons per day according to speed and double that of stamps of equal cost. *Send for Catalogue.*

Thomson & Boyle Co.

1101 to 1111 North Main St. Los Angeles, Cal.

CHAPTER V

CONCENTRATION.

Is a process of separating the heavy metallic sulphurets, oxides, etc., from ores, by means of water and concentrating machinery, and is applied generally after wet crushing and amalgamation, when a profitable saving of gold, silver, copper, lead, or other element of value may be thereby effected.

The type of concentrator, or "vanner," in general use consists of an endless rubber belt mounted on a shaking frame with rollers. The belt is inclined lengthwise at a suitable angle, revolves toward the higher end, and is given a shaking motion, either sideways, endways, or a combination of the two. Near the head is a water pipe and stationary distributor box placed crosswise, from which water is admitted onto the belt in jets. Lower down is a pulp distributor which moves with the shaking frame and belt. The pulp and water, as they come from the mill, are distributed over the belt. The shaking motion settles the heavy concentrates, which cling to the surface of the belt and are carried over the head and washed into a box of water below. The water jets are adjusted so as to keep the lighter gangue matter of the ore moving downward towards the foot and off, without losing any more than possible of the concentrates.

Even after concentration the tailings may still contain considerable value capable of being saved by cyaniding or other processes, and the concentrates may be either poor or rich.

The quantity of water, the speed and incline of belt, and the thickness of pulp have all to be carefully regulated to suit the ore.

Of the standard belt machines the Frue, Triumph, and Woodbury are in general use. They differ in the kind and speed of shake, style of belt, or the general arrangement of the parts, but are similar in general plan and mode of working.

Concentrators are built on other principles (centrifugal force, bumping, shaking, etc. Of the shaking type of machine may be mentioned the Wilfley and the New Standard, which consist of a large shaking platform covered with lineoleum and traversed lengthwise with small wood slats decreasing in length and thickness from head to tail. As the ore pulp and water are fed at the upper part of the machine, the concentrates gravitate to a defined channel at the lower end, while the lighter gangue matter passes off above. These machines have come into extensive use and proved very efficient.

THE BARTLETT TABLE—

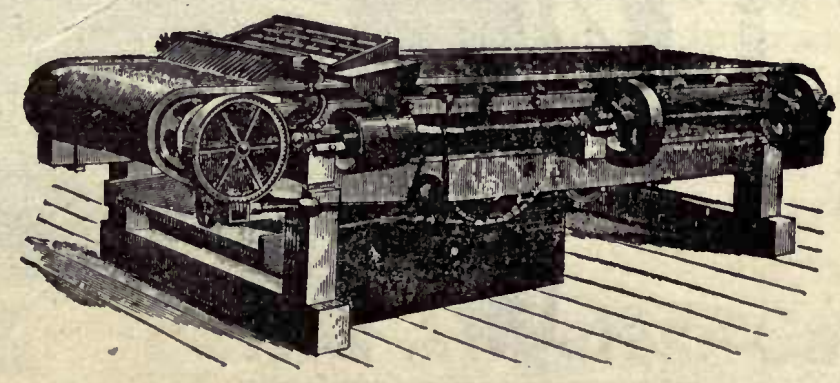
Is somewhat differently constructed from the Wilfley, the table being divided into three descending shelves, having right-angled triangular grooves gradually diminishing in area toward the discharge end. Each shelf has a separate water supply. All tailings and middlings which pass the first shelf return to the end of the second and third, and thus travel over a great distance. As the ore travels the first shelf it is subjected to a very light flow of water, thus preventing the fine stuff from being

washed over. Having removed the fine ore, more water can be applied to the succeeding shelves. This table will take single screened ore from 8-mesh down, and do nearly as good work as it will with sized ore, the loss from slimes being very small. This also separates the different minerals perfectly, and will save the fine stuff down to 200-mesh size. The Bartlett table will do better work direct from the screens and without the intermediate use of jigs and other concentrating devices.

"The three-shelf system permits great nicety of operation and practically fulfills the operation of sizing and separation of all the minerals in the ore, one from the other."

Dry concentrators employing air blasts or currents, are not yet a general success.

It generally requires two 4-foot, or one 6-foot vanner (the two sizes usually made,) to five stamps, and about one-fourth to one-third miner's inch (200 to 300 gallons per hour) for each vanner—or 2 to 4 cubic feet per minute in the pulp, and half as much in the jets (Louis.) The capacity of a 4-foot Frue is about 6 tons, and of the 6-foot up to 12 tons of ore in 24 hours.

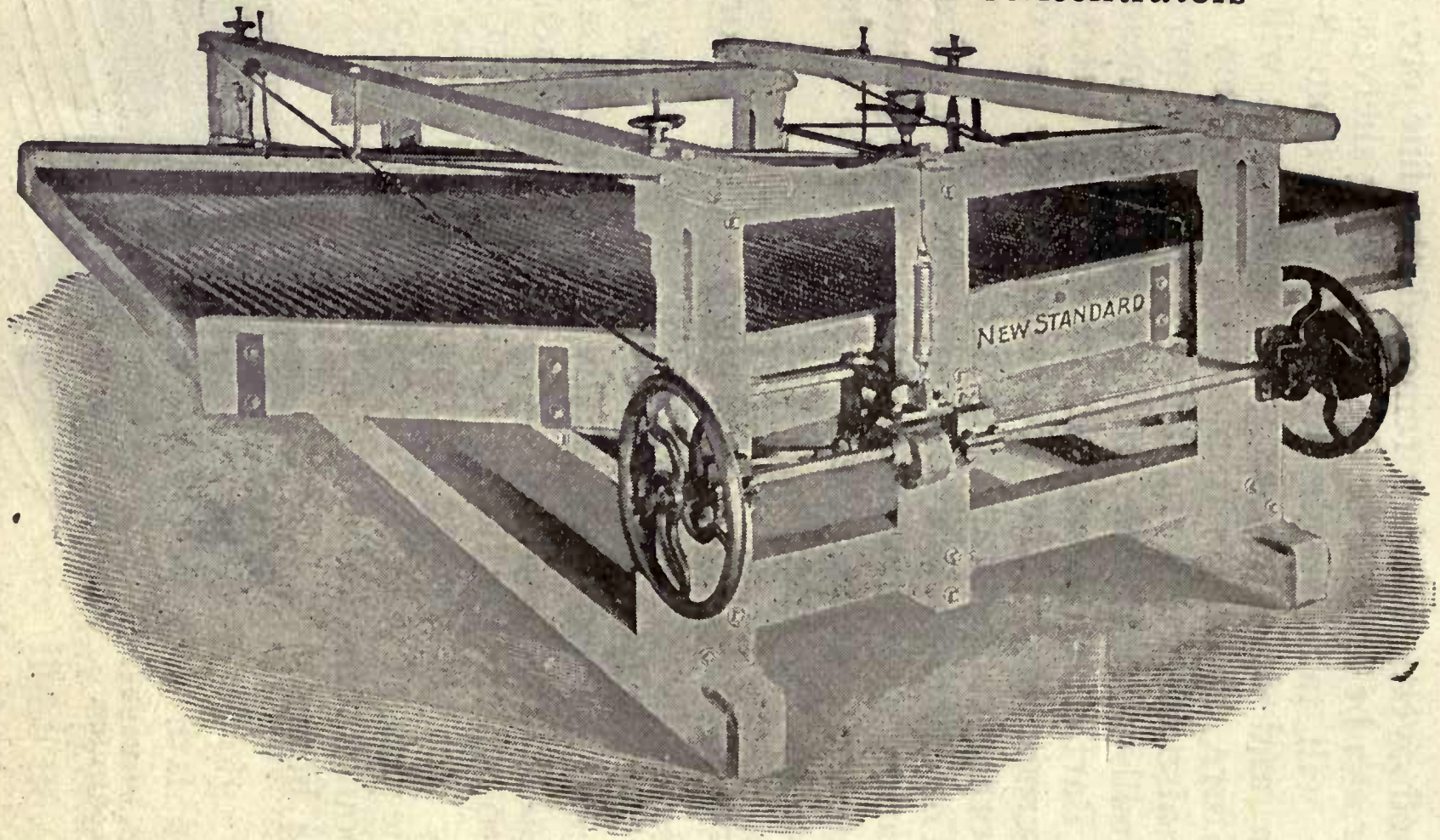


Belt or "Vanner" Concentrator.

NEW STANDARD CONCENTRATOR CO.,

INCORPORATED

Manufacturers of New Standard Ore Concentrators



Main Office and Factory, 602-4-6 N. Main St., Tel. Main 1391. Up-town Office, 321 to 324 Potomac Block, Tel. Main 347. Los Angeles, Cal.

H. V. WHEELER JOHN GOLDSWORTHY

Goldsworthy & Wheeler

Civil, Mining and Hydraulic Engineers

DEPUTY UNITED STATES MINERAL SURVEYORS

... AND

MINING EXPERTS

ALL persons contemplating either buying or selling mines would do well to consult us. Agents for a large body of oil land in Ventura and Los Angeles counties. Surveys for mining patents and underground work a specialty.

Give us a call

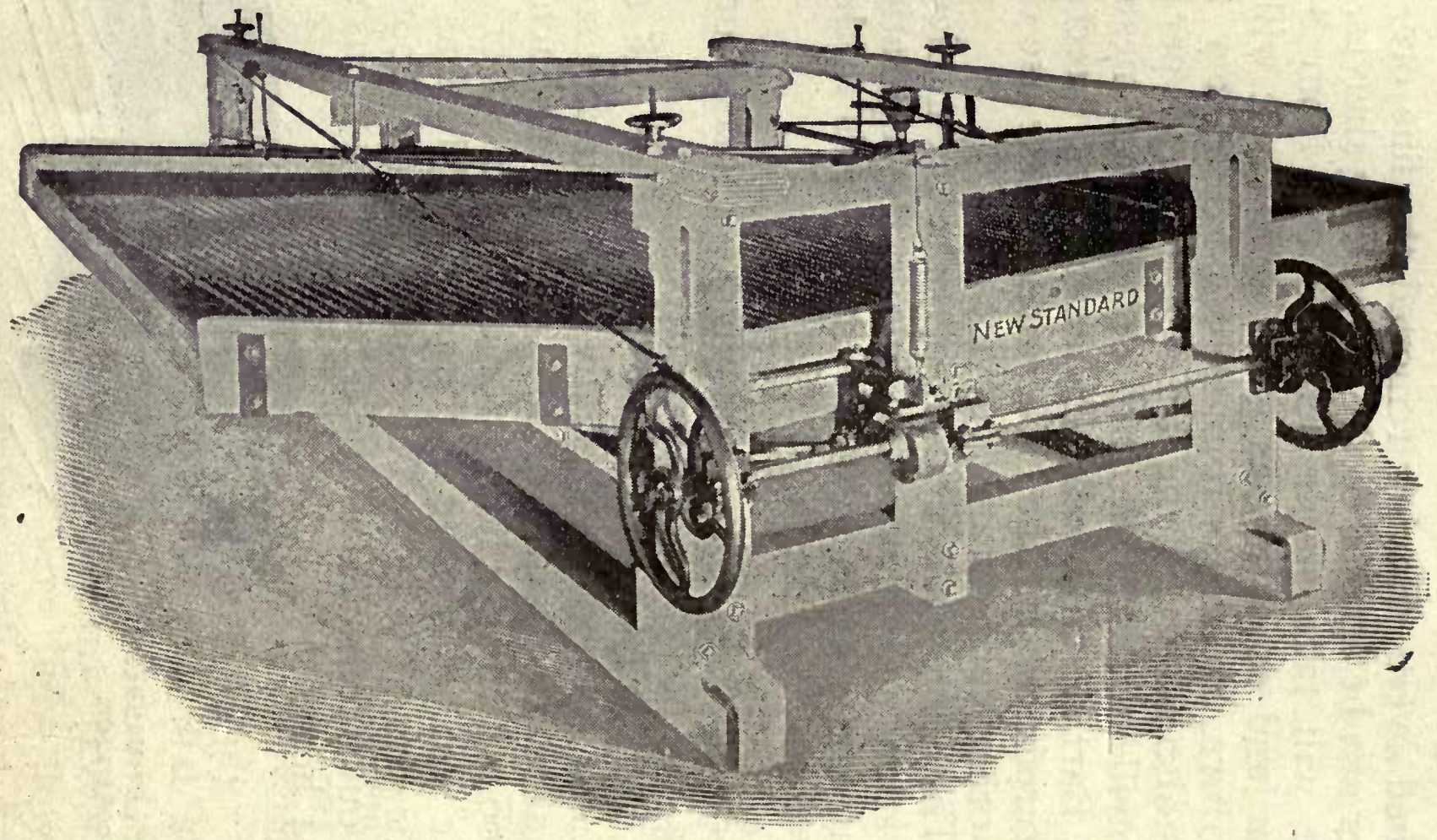
ROOMS 6 and 7
128 N. MAIN St.

Los Angeles, Cal.

NEW STANDARD CONCENTRATOR CO.,

INCORPORATED

Manufacturers of New Standard Ore Concentrators



Main Office and Factory, 602-4-6 N. Main St., Tel. Main 1391. Up-town Office, 321 to 324 Potomac Block, Tel. Main 347. Los Angeles, Cal.

H. V. WHEELER JOHN GOLDSWORTHY

Goldsworthy & Wheeler

Civil, Mining and Hydraulic Engineers

DEPUTY UNITED STATES
MINERAL SURVEYORS
. . . AND
MINING EXPERTS

ALL persons contemplating either buying or selling mines would do well to consult us. Agents for a large body of oil land in Ventura and Los Angeles counties. Surveys for mining patents and underground work a specialty.

Give us a call

ROOMS 6 and 7
128 N. MAIN St.

Los Angeles, Cal.

Electro-Geodetic Mining Company

518-519-520 Stimson Building

LOS ANGELES, - - - CALIFORNIA

We have the Most Wonderful Electrical Invention of the Age. ABSOLUTELY LOCATES QUARTZ AND PLACER DEPOSITS, Fullest Scientific Investigation invited.

CHAPTER VI

THE CYANIDE PROCESS.

Depends on the solubility of gold in weak alkaline cyanide solutions, and its recovery from solution by means of precipitants—zinc, electricity, etc. "Weak cyanide solutions have a selective action on gold in preference to the base metals." The commercial "98 per cent." salt of potassium cyanide is generally used. It is white, very poisonous, and quite soluble in water. Price, in large lots, about 30 to 31 cents per pound.

OXYGEN AND OXIDIZERS—

The presence of oxygen or other agent which liberates nascent cyanogen in solution is recognized as also necessary to effect the solution of gold. Oxygen derived from the air is always present in the cyanide solutions, generally in sufficient quantity. Authorities claim that about a 25-100 per cent cyanide solution contains the maximum of oxygen capable of solution. The addition of chemical oxidizers—sodium peroxide, potassium permanganate, etc.,—have been tried, but with little or no generally-recognized benefit, though claimed so in some instances.

APPLICABILITY—

The process, with its various modifications, is applicable to ores and tailings (wet or dry crushed) concentrates and slimes, which we shall call in common, *material.* The gold must generally be very fine, coarse gold dissolving quite slowly. Gold telluride dissolves with great difficulty.

More or less silver and base metals are extracted at the same time, and some silver ores are well adapted to the process, but the expense of treatment is generally too great.

The adaptability of any particular material should be determined by practical Working Tests.

INTERFERING SUBSTANCES—

Are: Copper (which is often difficult or impossible to treat); antimony, arsenic, and other soluble metallic sulphides; free sulphuric acid; iron salts resulting from the oxidation of pyrites; salts of magnesia, organic matter, manganese, and other substances. The effect of these is chiefly to consume cyanide, or to consume the oxygen in solution, making the process expensive or difficult. Organic matter re-precipitates the gold in the leaching vats and probably absorbs oxygen. Copper, besides consuming cyanide, precipitates on the zinc (MacArthur Forrest process) more or less retarding the precipitation of the gold, especially with weak solutions. The addition of more cyanide to the solution before it reaches the zinc is a proposed remedy; also a thin coating of metallic lead produced by dipping the zinc in a 1-per-cent or 2-per-cent solution of lead acetate

(sugar of lead). In this latter case the gold is said to be precipitated more completely. It is proposed to overcome soluble sulphur by means of a lead salt, or oxidizers.

Wood absorbs gold, and therefore wood chips should be kept out of the solution and wooden vats should be painted with paraffine, asphalt, or other suitable paint. P. & B. Paint, manufactured by the Paraffine Paint Co., is excellent and has largely superseded all other paints. This absorption has been shown to be not very serious. Free acid, iron and magnesia salts are generally neutralized with an alkali (quick lime or soda); or, if soluble, washed out with water. Consumption of cyanide by zinc is generally insignificant.

MECHANICAL DIFFICULTIES—

Excessive fineness, or slimy (talcose, clayey), condition of the material; or heavy compactness (concentrates, etc.), retard or prohibit percolation. Slimes, in wet crushing, are usually separated by running the pulp through pointed V-shaped boxes, or into vats, arranged so that the slimes overflow, while the coarser sands settle to the bottom or pass off into another vat. Slimes often retain considerable value, but are usually, owing to the difficulty or expense of treatment, allowed to go to waste. Their treatment in Africa is by means of agitation in circular vats with stirrers, and settling and siphoning or decanting of the solutions. Slow percolation is sometimes to advantage hastened by means of vacuum apparatus—usually a receiving barrel

with a solution gauge, and an air-pump. Calcining or roasting to drive off water is sometimes advantageous, rendering the ore more porous and leachable.

PRECIPITATION OF GOLD FROM CYANIDE SOLUTIONS—

The method by means of zinc shavings is explained under the MacArthur-Forrest process. Precipitation by means of zinc dust is now in practical operation. The Siemens-Halske method of precipitation by means of electrolysis, using iron anodes and lead cathodes, upon the latter of which the metals are precipitated and cupelled, has been generally abandoned in America in favor of zinc. The use of charcoal has had a limited employment. There are also electrolytic processes employing agitation in vats with copper bottoms covered with a coating of quicksilver. A stirrer is connected with one pole of an electric machine and the bottom with the other pole. While being agitated with cyanide or other chemical solutions, an electric current is passed, the metals being deposited on the mercury, and finally cleaned up as amalgam.

COMPLETE PRECIPITANTS OF GOLD FROM CYANIDE SOLUTIONS—

Silver nitrate; corrosive sublimate (best hot) when no excess of free cyanide salt; copper sulphide (freshly precipitated best) in acidified solutions; all cuprous salts; cupric sulphate mixed with sodium chloride and their solution saturated with sulphur-

ous oxide. (Free hydrocyanic acid should be removed by aeration. Christy.)

PARTIAL PRECIPITANTS—

Nitrates of lead and mercury; copper sulphide, in neutral or alkaline solutions; acid salts in ores.

The usual Methods of Application of the Process are:

1. Percolation in vats with filter bottoms made of wooden slats covered with canvass (usually No. 8 ducking) and burlap, cocoa matting, etc.; or sometimes consisting of a filter-bed of coarse gravel, filled in with successive layers of finer gravel and finally sand on top, without a covering of cloth.

2. Agitation in revolving barrels, or vats having mechanical stirrers, or by means of air under pressure in hermetically sealed vats.

THE MAC ARTHUR-FORREST PROCESS

Is the most commonly applicable, and of which there are various modifications:

Percolation is commonly employed. The pulverized material is charged into "leaching" vats and cyanide solutions, followed by wash water, run onto its surface and soaked through until the gold, as far as practicable, is dissolved and washed out. Time required varies much—from two or three days for tailings, up to several weeks for slimy or other slow-percolating material.

The gold solution passes out through a pipe leading from the bottom of the vat into extractor or

precipitating boxes containing zinc shavings, and then into sump tanks below. The gold is precipitated on the zinc as a brownish black powder or slime, accumulating in the bottom of the box.

Old zinc may be made more active by dipping in a weak sulphuric acid solution, and the addition of acid to the head of the precipitation box has been recommended.

The zinc is gradually consumed, about 2-10 (two-tenths) to 6-10 (six-tenths) lb. per ton of material, and is replenished when necessary. It is turned on a lathe from round discs of metal, should be very thin, presenting a large surface to the solutions, and not over a few hours old.

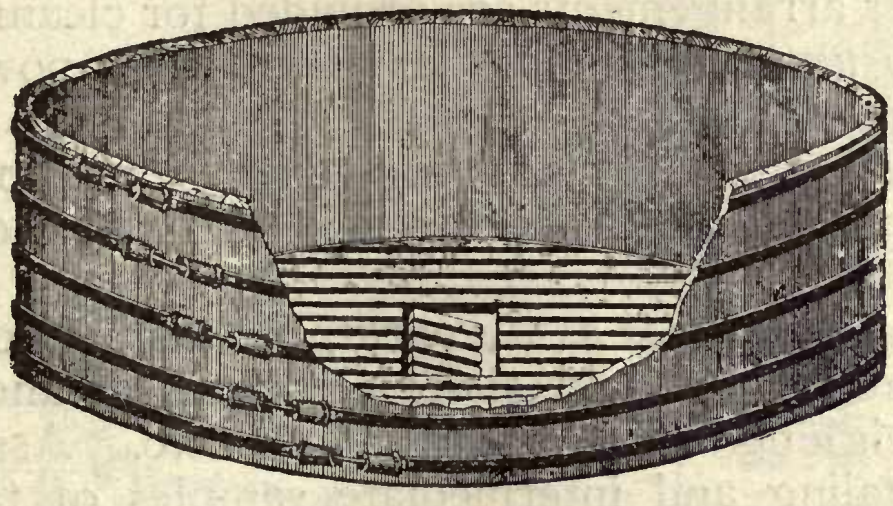
A PERCOLATION PLANT—

consists essentially of

1. *Leaching vats*—with filter bottoms and outlet pipes. Their number may be a few or many, depending on the capacity of each. Usually as many are employed as days required to fill, leach and discharge one vat, the capacity—depth and width—being determined by the nature of the material and the depth of percolation. For ores the depth is usually 3 to 5 feet, and for tailings as much as 14 feet. Some ores can be leached much deeper than 5 feet. Pipes, hose or wooden launders (troughs) are provided to turn the solutions in any desired direction.

In calculating size of vats, 100 lbs. per cubic foot of pulverized silicious ore, or tailings, free from

much of heavy metallic constituents, is considered about an average weight. (See appendix II.)



Leaching Vats, showing Filter Bottom Slats.

2. *Sump or solution vats*—one for each separate solution employed. They are usually made deeper and narrower, but about the same capacity as the leaching vats. Their size may be proportioned to the quantity of solution held by each, the wash water being the smallest.

Vats are made of either wood or iron, and round, but sometimes rectangular. The redwood tanks made by the Pacific Tank Co., with groove in the upper rim and drip-cup to keep constantly wet, gives good satisfaction in dry climates.

3. *Zinc extractor boxes*—There are generally two—one for each cyanide solution employed—strong and weak—and sometimes more. Usually made of wood, and varying in size from 12 to 20 feet long, 2 to 3 feet high, and 1 1-2 to 2 feet wide, more or less. They are divided into compartments by means of partitions and baffle boards, which force the solutions down and up through the zinc. Wire

screens, suspended a few inches above the bottom, support the zinc. Plug holes in the bottom or side, or other arrangements are provided for cleaning out.

4. *Pumps and pipes or hose,* with power for pumping solutions.

5. *Furnaces for roasting,* drying, melting, etc., or small wooden vats for acid treatment of gold slimes.

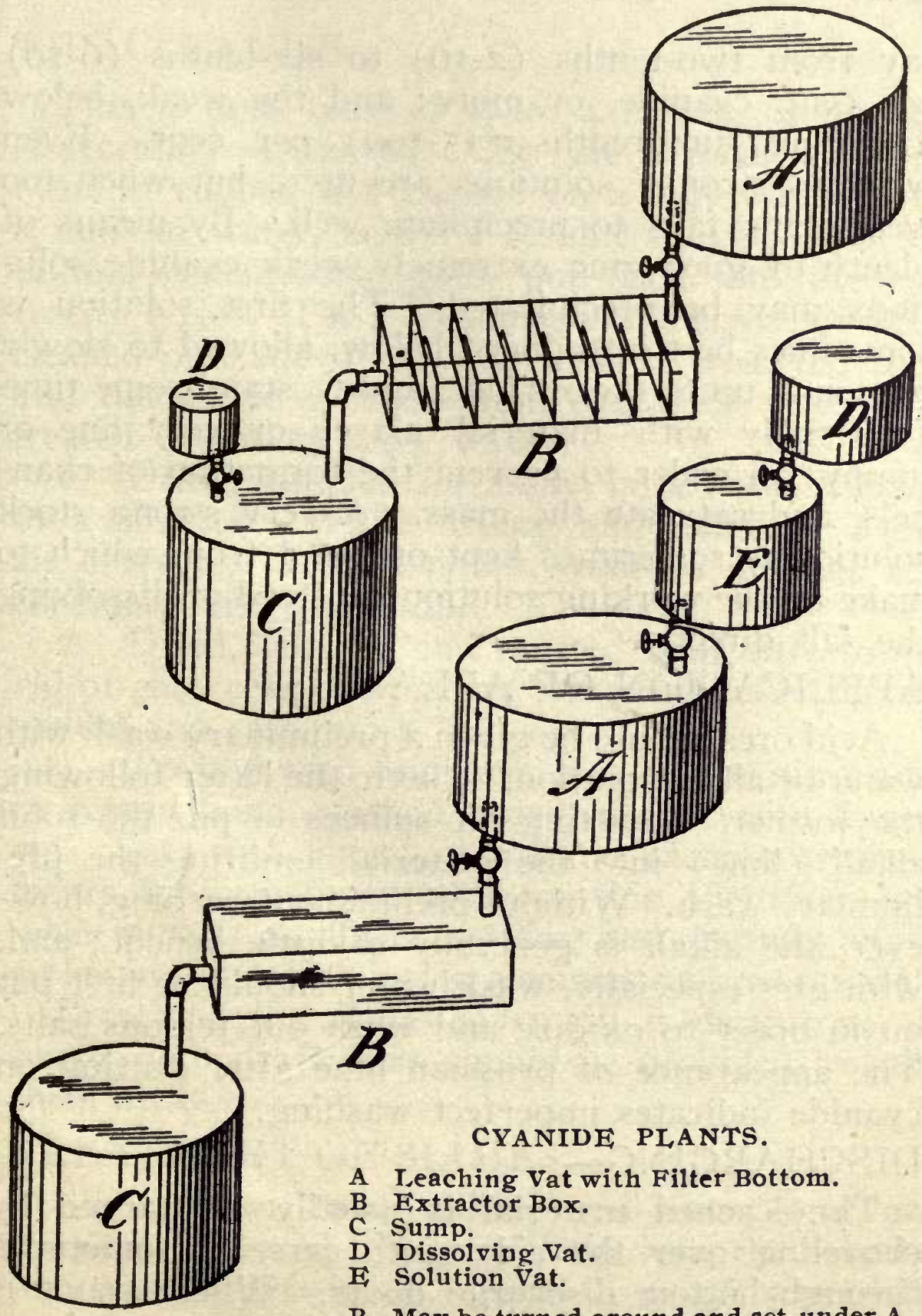
6. *A first-class assay outfit,* for testing solutions and material for gold, silver and cyanide; and scales for weighing out cyanide, alkali, etc. Assays of head, taling and intermediate samples of the material and solutions, should be made regularly. The tests for strength of cyanide is made usually by means of a standard silver nitrate solution sometimes more conveniently by means of starch and iodine, or corrosive sublimate.

7. *A competent cyanider and assayer,* best with a good knowledge of chemistry. Though apparently simple in execution, management by an experienced chemist is nearly always indispensable to success.

Two simple arrangements of a percolation plant are shown on the following page.

WORKING SOLUTIONS, STRENGTH, ETC.—

Two, and sometimes more, cyanide solutions are employed, designated strong and weak, the weak following the strong, and that followed by weaker solution of water. Sometimes the weak precedes the strong solution. The weak solutions are derived from the consumed stronger solution, which ranges,



CYANIDE PLANTS.

A Leaching Vat with Filter Bottom.
B Extractor Box.
C Sump.
D Dissolving Vat.
E Solution Vat.

B May be turned around and set under A.

say from two-tenths (2-10) to six-tenths (6-10) per cent. cyanide, or more; and the weak, below fifteen-one-hundredths (15-100) per cent. Even weaker "strong" solutions are used, but when too weak, zinc fails to precipitate well. By means of plenty of good zinc extremely weak cyanide solutions may be precipitated. The first solution is sometimes best introduced below, allowed to slowly percolate up to the surface, and to stand some time (especially with material clayey or very fine or lumpy) in order to prevent the formation of channels, and saturate the mass. A very strong stock solution is sometimes kept on hand from which to make up the working solutions, instead of dissolving the salt directly.

APPLICATION OF ALKALIES—

Acid ores should be given a preliminary wash with water or alkali solution, or both, the latter following the former. Sometimes it suffices to put the solid alkali (lime) into the material, omitting the preliminary wash. Without preliminary washing, however, the alkali is generally of little benefit; and, with ores especially, wash water should be first put on in order to oxidize and wash out ferrous salts. The appearance of prussian blue after putting on cyanide indicates imperfect washing.

DISCHARGING—

The leached material is usually discharged by shoveling over the sides into cars, or sometimes through bottom discharge doors. Where water is plentiful, sluicing out is practiced to advantage.

THE CLEANUP—

This is done once or twice a month, or oftener if necessary or desired. The zinc is washed free of cyanide, rubbed and washed on a wire screen over a tank of water, and the residue of zinc, still retaining considerable gold, put back into the extractor boxes. The gold slimes in the boxes are then cleaned out, added to those washed from the zinc, and the whole is freed from excess of water and treated in one of three ways:

1. Dried, sampled for assay, boxed and shipped to a smelter. While drying and handling avoid air currents. This is now a common practice and considered more economic.

2. Dried, calcined and roasted with nitre to get rid of zinc, etc., or litharge, borax and other fluxes, melted and cast into a bar; or

3. Treated with sulphuric, muriatic or nitric acid to remove zinc, washed, dried, melted with fluxes, etc. Vats with filter bottoms and vacuum arrangements are sometimes used for this operation, but, when time is no object, settling and decantation, or siphoning and draining in a canvas sack works well.

Breathing the fumes given off is dangerous, so hoods with draft flues should be provided to take them away.

TREATMENT OF SLIMES—

Slimes from stamp milling and slimey ores, are sometimes treated by agitation in vats, the solution and wash waters being separated, either by settling and decantation or by means of filter presses. The

separation is sometimes found to be more effective if lime is mixed in with the pulp to coagulate. Agitation by means of centrifugal pumps, adding lime while in action has also been successful.

DEGREE OF PULVERIZING NECESSARY FOR ECONOMIC TREATMENT—

This varies greatly, from that of very fine dust to that of walnuts. Usually No. 30 mesh gives good results. The rule is, fine pulverizing for hard, compact, and coarse crushing for soft or porous ores. The "size of pulverizing," or the number of screen, means nothing in themselves, unless other conditions and the relative size of the various particles of the material are considered.

Rolls, or ball pulverizers are generally used for the dry pulverizing.

LABORATORY TESTS—

For adaptability to treatment. This is no simple assay, as many think, but generally should consist of the most, if not all, of the following tests, viz., for

1. Acidity of the material and effect of alkali in reducing consumption of cyanide.
2. Strength of cyanide best suited, and consumption of same.
3. Time required.
4. Size of crushing suitable.
5. Depth of percolation permissible.
6. Assays of head, tailing and intermediate samples of pulp and solutions, taken daily or oftener,

for gold, sometimes for silver also, and for cyanide strength.

7. A chemical analysis, either partial or complete, of the ore or working solution, may be necessary or advisable. Also of the water used.

8. Zinc or electric precipitation of the gold might also be necessary or advisable, as a confirmatory test.

Several days or a week or more may be required for a proper performance of the tests.

WATER REQUIRED—

For plain cyaniding, the water consumed per day is about that held in the pulp after draining, plus evaporation and wastage. The quantity of water retained in the pulp depends on the nature and fineness of the material. Tailings free of slimes will hold about 12 per cent. of its weight, and very clayey material up to 20 or 25 per cent. or more. A 20-ton plant for silicious ore holding, say 15 per cent. moisture, would consume 3 tons of water per day (7-100 miners inches) besides wastage and evaporation. The quantity required for cyaniding is generally much less than for milling.

CYANIDE POISONING—REMEDIES FOR.

Accidents are very rare, considering the poisonous nature of cyanide. Some persons are more susceptible to its effects, especially externally, than others. A coating of kerosene oil on the hands (Scheidel,) or a pair of rubber gloves will protect

the hands. There should be good ventilation about the mill.

For internal poisoning: Bathe the patient in hot water and apply cold water to head and back. Administer internally emetics, and freshly precipitated carbonate of iron (a mixture of sodium carbonate and iron sulphate—green vitriol dissolved in water.) These two chemicals should be kept on hand.

For effects of inhaling hydro-cyanic acid gas, inhale ammonia, chlorine gas or ether, rubbing with camphor. Alcohol is recommended.

Nitrate of cobalt is reported to be a good antidote, also injection of a 2 per cent solution of hydrogen peroxide subcutaneously, with a Pravarz syringe. The liquid should be kept in small glass-stoppered bottle, in the dark.

For analytical methods, see Appendix I.

Lacy Manufacturing Co.

MANUFACTURERS OF

STEEL

Water Pipe

WELL CASING, CYANIDE TANKS, OIL TANKS

GENERAL SHEET IRON WORK,

IRRIGATION SUPPLIES

Dealers In Cast Iron Pipe

OFFICE: 334 N. MAIN.

WORKS: COR. NEW MAIN AND DATE STS.

TELEPHONE: NO. 196.

Los Angeles, Cal.

CHAPTER VII

CHLORINATION.

HYPO SULPHITE, AND RUSSELL PROCESSES—ROASTING.

CHLORINATION—

Is applied to roasted refractory ores and concentrates chiefly. In Cripple Creek, on telluride ores; in Northern California, on concentrates; and elsewhere. The roasted material is charged with chlorine gas, which changes the gold into soluble chloride. This is washed out with water and the gold precipitated with sulphuretted hydrogen gas or sulphate of iron (green vitriol.)

Two methods of application are in practical use, viz.:

1. MODERN BARREL CHLORINATION—

employing agitation. The roasted material is charged into lead-lined iron barrels containing perforated sheet-lead and asbestos filters, and water sufficient to make a liquid pulp, a weighed quantity of chloride of lime (bleaching powder,) and sulphuric acid are added. The barrel is closed and revolved. The acid liberates chlorine gas, which combines with

and forms the chloride of gold, and likewise of some of the base metals. After about one to four hours the solution is filtered and washed out, with the aid of air or water pressure, into a lead-lined vat, where it is precipitated as gold sulphide by passing in sulphuretted hydrogen gas. The gold sulphide is collected in a filter press, dried, roasted, melted and cast into a bar.

2. PLATTNER PROCESS—

employing percolation. The material, roasted with salt, is charged into a leaching vat, closed tightly, and chlorine gas passed into it through the filter bottom. The gas is generated from a mixture of salt, sulphuric acid and manganese ore in an outside generating lead vessel, connected by a lead pipe to the bottom of the filter vat. After some hours, the chloride of gold is washed out and the solution treated with sulphate of iron solution. The metallic gold, with some copper, etc., is collected and finally cast into a bar. Copper is next precipitated by sodium sulphide or scrap iron.

Chloride of silver is then leached out of the material with a solution of hyposulphite of soda, and precipitated by sodium sulphide.

Omitting the treatment with chlorine gas, this constitutes the essentials of the hyposulphite process, which is applied chiefly to silver ores; and the addition of sulphate of copper to the "hypo solution," which gives it a greater solvent power in some instances, constitutes the Russell process.

Processes substituting bromine, a mixture of sul-

phuric acid, salt and potassium permanganate, et al., have also been introduced—and there are more to hear from.

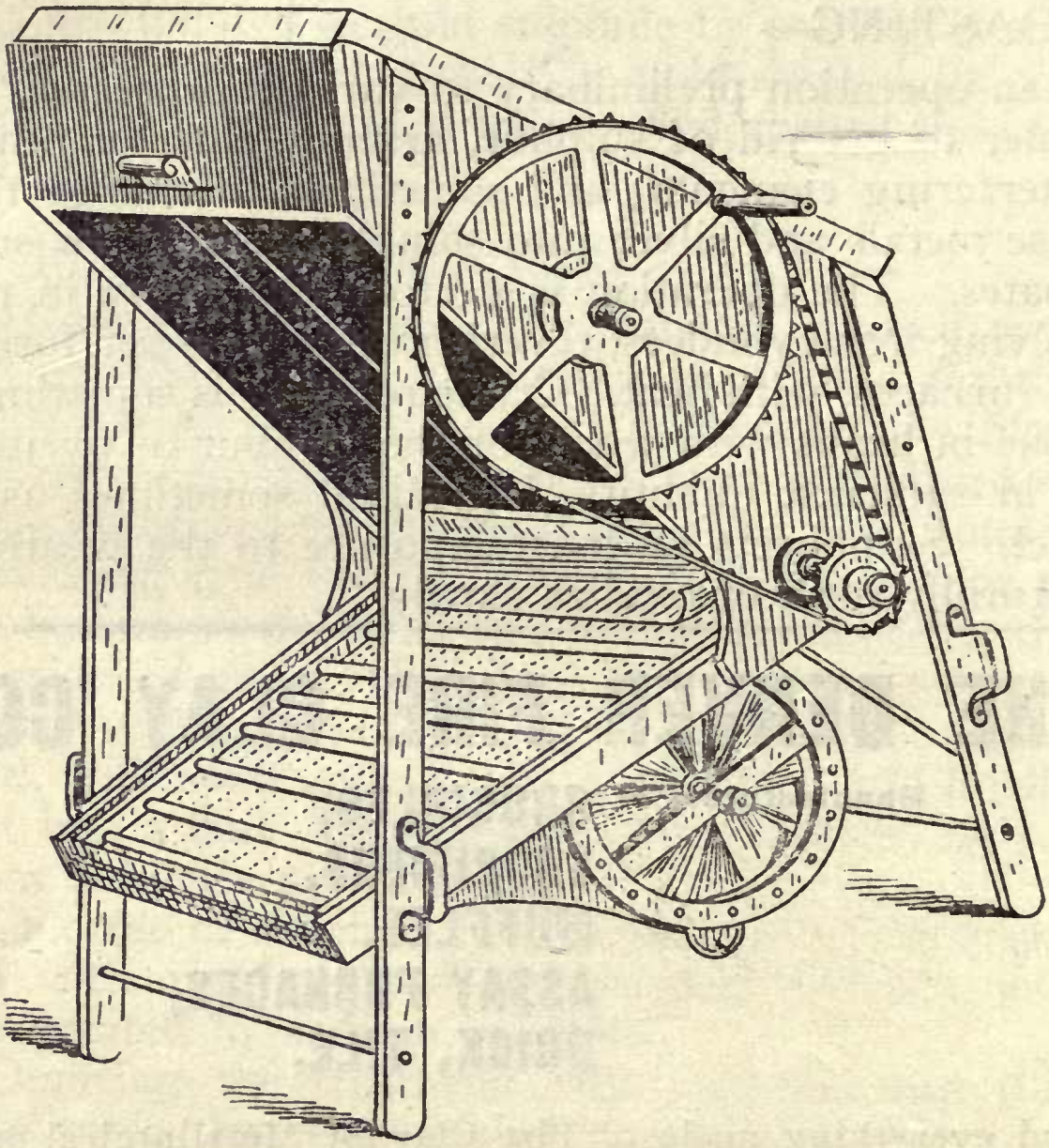
ROASTING—

is an operation preliminary to various processes, in order to get rid of sulphur, arsenic, zinc, or other interfering elements; and sometimes to change the base metals and silver into soluble chlorides or sulphates. The operation is performed usually in revolving iron cylinders, reverberatory, or other forms of furnaces, with heat. Crude roasting is sometimes done in heaps with wood, or the sulphur of pyrites, if in sufficient quantity, is utilized sometimes as a fuel. Sulphurets by long exposure to the weather naturally roast or oxidize slowly.

A. G. GODFREY,

Manufacturer of

DRY WASHERS



I manufacture bellows as well as fan machines. If I have not got what you want, will make to your order

206 S. Los Angeles St., - Los Angeles Cal.

CHAPTER VIII

SMELTING.

Is the most generally applicable of all processes; but the cost of treatment and transportation are so great (smelters being usually located at some central point to do custom work,) that only high-grade ores, especially those carrying silver, lead or copper, and not amenable to economic treatment by any other process, are usually smelted. It is a melting operation by fire, usually in water-jacketed blast furnaces, in which the ores, mixed with fluxes, (iron, manganese, lime, etc.,) are melted down to a fluid glass or slag, and the precious metals, alloyed with lead, copper, or a matte consisting of the sulphides, arsenides, etc., of these and other metals, settle down to the bottom and finally obtained as base bullion. The lead, copper, etc., are separated from the precious metals by further oxidizing and smelting operations.

Ores are sometimes self-fluxing; i. e., contain the elements of opposite chemical nature (silica on the one hand, and the metallic oxides on the other—acid and base,) in the proper ratio to combine chemically, with the aid of heat, and form a fluid glass

or slag. At custom smelters the chemically opposite kinds of ores are analyzed and mixed with each other in the proper proportions for fluxing.

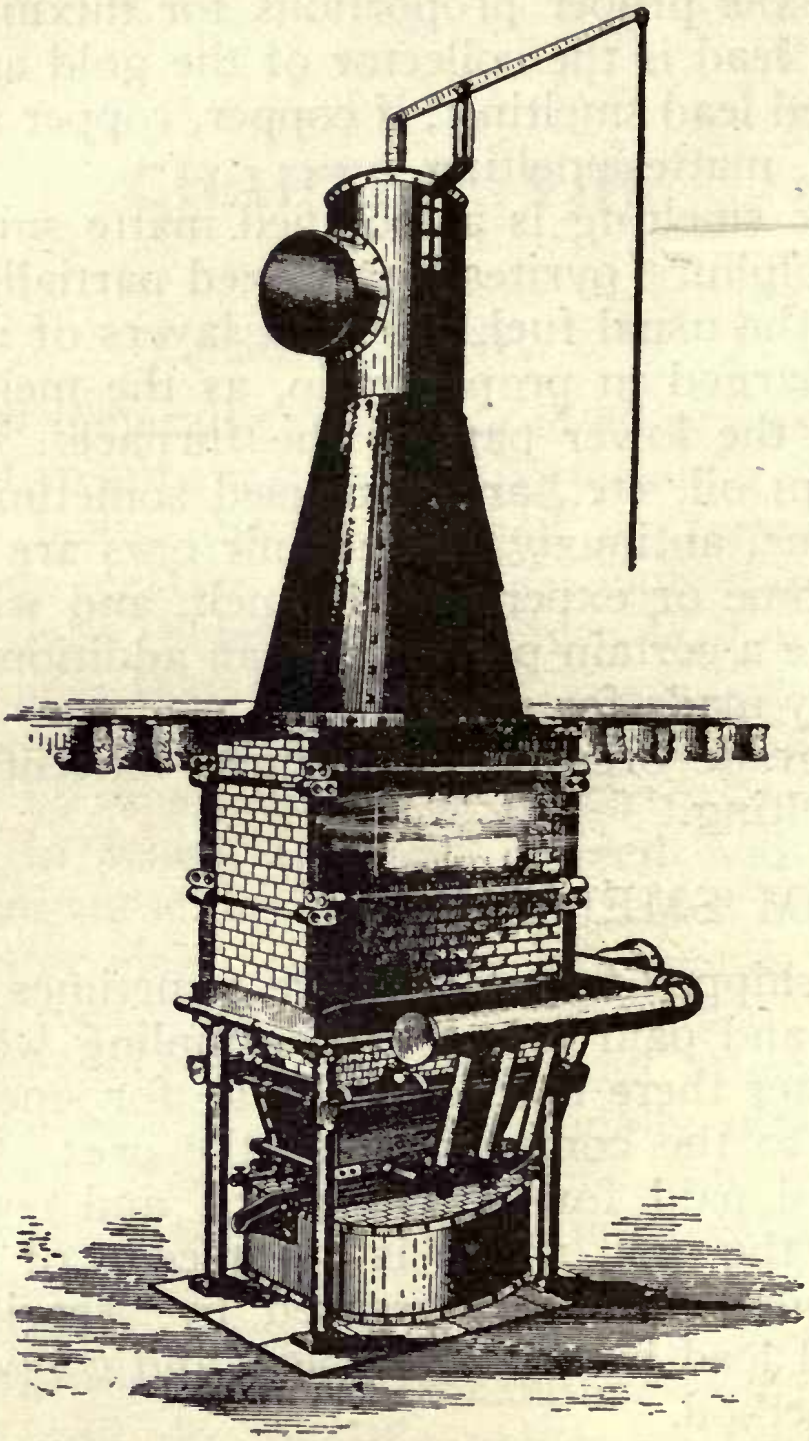
When lead is the collector of the gold and silver, it is called lead smelting; if copper, copper smelting; if matte, matte smelting.

Pyritic smelting is a modified matte smelting, in which sulphur (pyrites) is utilized partially as fuel. Coke is the usual fuel, alternate layers of it and ore being charged in proper ratio, as the melting proceeds in the lower part of the furnace. Charcoal, petroleum oil, etc., are also used sometimes. Silicious, zinc, antimony and arsenic ores are the most troublesome or expensive to smelt, and when present above a certain percentage, an additional charge is usually made for smelting.

Low-grade ores are sometimes concentrated before smelting.

CUSTOM SMELTING—

Ores shipped to smelters are sometimes sampled, assayed and paid for at local sampling works. At the smelter there is a fixed charge for smelting, according to the composition of the ore: Gold and silver are paid for by the ounce, and copper and lead, by the unit, which is 1 per cent. of a ton, or 20 pounds. Silver is assayed by "scorification"; gold and lead by the "crucible," and copper by the "wet" method.



A Modern Smelter.

APPENDIX I

ANALYTICAL METHODS.

Tests for Alkaline or Soluble Sulphides in Cyanide Solutions.—1. To five or ten cc. solution add *dilute* cp. nitric acid, drop by drop, stirring after each drop; a milky appearance indicates sulphides. The alkilinity of solution must be neutralized to get reaction.

2. To solution add a little ammonia and a small grain, or a few drops of the solution, of sodium—or potassium, nitro-prusside and stir. A purple or pink coloration of the solution indicates sulphides. To make the nitro-prusside, dissolve pot. or sodium ferrocyanide in water, add strong nitric acid in excess, and evaporate solution to dryness on water bath. We have made the salt by allowing to exaporate in hot sun.

TESTS FOR COPPER IN ORES.

Boil well with strong nitric acid, add ammonia in excess and filter off or settle precipitate of iron or other hydroxids. Blue solution indicates copper. Nickel gives a similar color.

TESTS FOR ANTIMONY.

1. To a few grams ore add about 20 cc. aq. req. (1 HN O3 to 2HCl), stir well for about 15 minutes with glass rod, let settle, decant and dilute liquid gradually. If antimony is present a milky precipitation is produced. Bismuth acts likewise.

2. Wade & Wade's method for antimony sulphides. Boil a little of the pulverized mineral with strong caustic potash or soda solution. Let settle, decant and add gradually dilute sulphuric or muriatic acid in slight excess. A characteristic orange precipitate will be produced if antimony sulphide (stibnite) is present.

TESTS FOR ACIDITY IN ORES OR TAILINGS.

1. Shake up about ten minutes 100 grams with 100 cc. standard caustic potash, soda or lime, solution, in corked flask. Filter through dry filter and titrate 25 cc. or other aliquot portion with standard acid (sulphuric or muriatic), using phenolphthalein as indicator. Calculate in terms of soda or lime, as desired. Loss in strength gives the acidity. 1 cc. alkaline solution equals one gram ore. Any moisture in sample must be determined and allowed for in separate sample.

To make standard alkali, dissolve 10 grams caustic soda or potash in 1 L. water and standardize against standard acid (2½ grams sulphuric per L.), using phenolphthalein as indicator.

To make standard lime, dissolve by shaking well, 5 grams burnt lime in 1 L. distilled water containing about 100 grams cane sugar, and standardize as above. The actual amount of caustic (Ca.O) in lime may be thus de-

termined by titrating against an acid solution of known strength.

2. To 100 grams ore or tailings, diluted with water to make quite fluid, stir in solid pulverized lime or soda, in small weighed doses, testing occasionally with red litimus paper until alkaline reaction is produced. We find this method slow and tedious, and not giving the full amount of "acidity," and method (1) more satisfactory for lime.

TEST FOR FREE POTASSIUM CYANIDE IN SOLUTION.

Standard Silver Solution. Dissolve 13.05 grams pure silver nitrate crystals in 1 L. water, 1 cc. equals 1-10 per cent K. Cy, or 2.0 lb. per ton, when 10 cc. of solution is tested.

Test: Titrate 10 cc. solution, diluted to 50 cc., in glass beaker, under which a piece of black glazed paper is placed, with silver solution, until permanent opalesence is produced. To working solutions a small grain or a few drops of solution of potassium iodide should be added before titrating.

Of very weak cyanide solutions more than 10 cc. should be taken.

ASSAY OF CYANIDE SOLUTIONS FOR GOLD.

Methods, by evaporation and *fire assay.*

(a) Evaporate one assay ton in tray of sheet lead to dryness, fold into button form and scorify, or melt down in crucible with soda and borax, and cupel. The solution may be measured in cc.'s, and when gold is very small, more may be taken.

(b) Cupel lead after evaporation. This is sufficient to determine relative value of solution, and degree of extraction of metals from solutions. A little silver may to advantage be added to the solutions if only gold is desired, or it is very small.

(c) Evaporate solution in iron or porcelain dish with litharge, scrape out and assay.

PROF. CHRISTY'S METHOD OF PRECIPITATING GOLD.

From cyanide solution. Make slightly acid with sulphuric acid, or sulphurous gas, add cupric sulphate solution saturated with SO_2, until excess of copper is shown by means of potassium ferrocyanide solution by adding a drop of two to upper layer of two thicknesses of filter paper, then applying ferrocyanide solution to lower layer of paper.

Let stand 12 hours, filter and test filtrate with more copper solution for further precipitation, and stand another 12 hours. Filter, wash and assay precipitate.

TESTS FOR TELLURIUM AND SULPHUR.

1. Kustel's method: Place a little of the finely-pulverized ore in a porcelain dish with a little mercury and water, and then add a little sodium amalgam. Tellurium will produce a violet color, and sulphur blacken a silver coin dipped into the water. Iron sulphide may mask the violet color; if so, pour off the water, put on more and then again, a little amalgam.

2. Oxidize a little of the pulverized ore on a piece of white porcelain with a blowpipe; cool and add a drop or

two of strong sulphuric acid. A deep violet will be produced by tellurium.

Sometimes 1 and 2 fails, while it is our experience the following test will show a mere trace:

3. Boil a little of the powdered ore in a porcelain dish or beaker with a little muriatic acid and a few drops of nitric acid, until excess of nitric acid is off. Dilute with a little water, and filter. The solution will likely be colored red or yellow with iron. Now add to the filtered solution (filtrate) in a beaker or test tube, stannous chloride (made by dissolving metallic tin in muriatic hydrochloric acid), until the iron color is gone, and a little in excess. A black or dark brown precipitate (cloudiness) will be produced by tellurium. Mercury acts similarly.

(Reprinted from the Journal of the American Chemical Society, Vol. XXII, No. 9. September, 1900.)

WADE & WADE'S QUALITATIVE TESTS FOR BORACIC ACID.

It seems not to have occurred to authorities on the subject to test the effect of the alcoholic vapors of boracic acid on tumeric paper. We find that if the test is applied in the following manner the presence of boracic acid in minerals is rendered more certain and delicate:

Use a test tube about 2.5 cm. in diameter and 20 cm. long. Put into the tube about 0.1 gram of the substance, 0.5 cc. hydrochloric acid, and 10 cc. wood alcohol. Boil vigorously down to small bulk, agitating the lower end of the tube in flame of burner, and holding the moistened end of a piece of turmeric paper just outside the mouth, so as

to catch the vapors. Boracic acid will finally color the turmeric a characteristic red. Now, if the turmeric is placed vertically on the side of a beaker so as to dip into a little distilled water to which a few drops of ammonia have been added, a pinkish to deep purple or blue will be produced, in marked contrast to the red produced by the ammonia on the end of the paper unaffected by the vapors.

CHLORINATION ASSAY FOR GOLD.

Mix one pound of ore (pulverized to 40 mesh) with sufficient warm water to make fluid, in glass stoppered bottle. Then add about 10 grains of sulphuric acid (66 deg. B.), and in small batches at a time (about 1 gram), bleaching powder (chloride of lime), agitating for some time after each addition, until the emission of chlorine gas remains permanent after about eight hours. Filter, wash free from chlorine, and assay solution and pulp. Sulphurets should be roasted, leaving not more than 3 per cent. of sulphur. Ores require in practice from 10 to 60 pounds of bleaching powder and 15 to 70 pounds of sulphuric acid.

HOW TO SOFTEN COPPER PLATES.

Mix and moisten equal parts of copper sulphate, quicklime and salammoniac; spread on plates, let stand 30 or 40 minutes, rub down with a cloth and dry the plates. Rub on a strong solution of potassium cyanide, and then mercury.

HOW TO AMALGAMATE RAW COPPER PLATES.

Dissolve 1 oz. of mercury in 4 oz. strong nitric acid diluted with a little water. Add half pint more of water

and rub solution over the plates previously brightened by rubbing with sand or tailings, and lye or potassium cyanide and water. More mercury may then be rubbed on.

SODIUM AMALGAM—

How to make: Add about 3 per cent. of dry chips of metallic sodium to some mercury in an iron or porcelain dish, and heat gently, pushing down the sodium with an iron or glass rod, if necessary. Cool the amalgam, break into lumps and preserve in a well-stoppered bottle.

SILVER AMALGAM—

How to make: Dissolve pure silver in just sufficient dilute (1 to 3) nitric acid with aid of heat; cool, dissolve crystals of silver nitrate in water and pour in sufficient mercury to reduce and amalgamate the silver. Wash and strain the amalgam to remove surplus mercury.

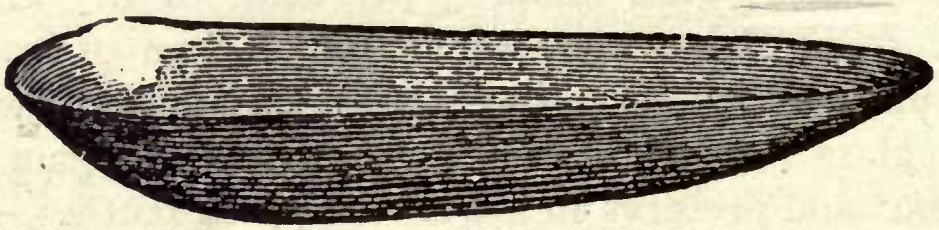
HOW TO PURIFY MERCURY.

This is best done by retorting, with covering of lime or charcoal, and keeping distillate under dilute nitric acid. Draw off a portion when needed, and add a small quantity of sodium amalgam. Sufficient is added when the mercury just begins to amalgamate the bright edge of a nail. Distillation with a covering of iron filings will separate arsenic or sulphur. A shaking of small quantities of mercury with crushed loaf sugar and straining will suffice sometimes, especially for separating mechanical impurities. Pure mercury rolls in round globules; if impure, it trails behind as it rolls on a surface. (See Note, p. 80.)

HORNING AND PANNING.

Are small concentration tests by hand, to detect or estimate free gold, sulphurets (concentrates), mercury or amalgam in an ore or tailings.

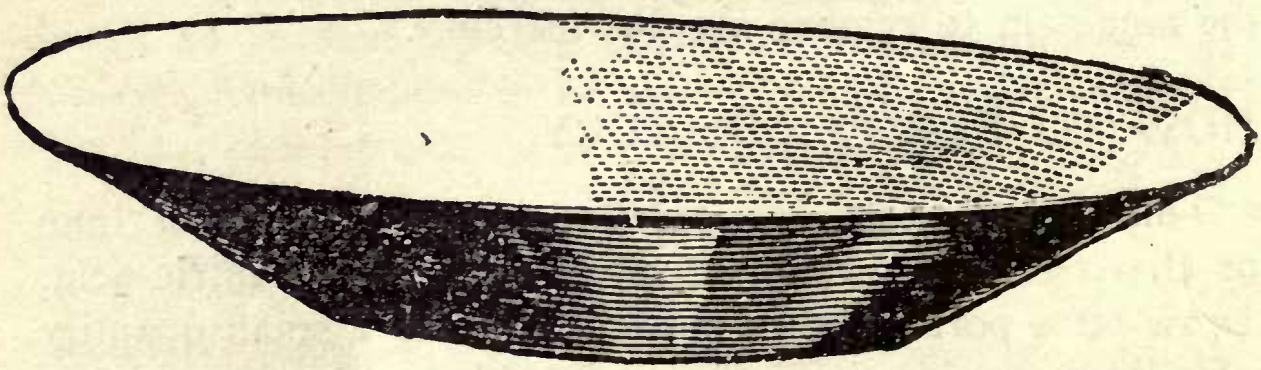
The hornspoon is a semi-oval bowl made of horn, Russia iron or gutta percha. The gold pan, made of iron,



Horn Spoon.

is circular with sloping sides and slightly convex bottom. The bottom is sometimes of copper, which may be amalgamated with mercury and utilized for free-gold tests.

The operation is performed by putting in some of the pulverized material and washing out the lighter gangue



Miner's Gold Pan.

matter. A dexterous shaking of the horn or pan in the surface of a vessel of water settles the heavy metallic particles to the bottom so that the lighter quartz, silicates, etc., may be washed off from the surface.

The batea, also used for the same purposes, is a shallow, cone-shaped disk of wood or metal.

LABORATORY "MILL TESTS."

It is usually not the case that small laboratory amalgamation tests will agree with the results of a regular mill run; and even this latter will often vary according to the experience of the mill man, manner of working, and other conditions. Valuable information may, however, be obtained by means of carefully conducted laboratory tests. Three methods follow:

1. Grind up, in a wedgewood mortar, a few ounces of the pulverized material (weighed out), with the addition of sufficient water to make a stiff paste, about 1-3 oz. of mercury and a little sodium amalgam or solid potassium cyanide. Thoroughly incorporate the mercury throughout the pulp, and horn or pan out carefully, repeating once or twice, to obtain all the amalgam. Retort and weigh the gold. (See note, p. 80.)

To obtain fine gold, the bullion should be alloyed with pure silver (about 2 1-2 parts), and parted with nitric acid. The mercury used in making mill test may be first weighed, and any loss determined by weighing again afterward, considering the last mercury to contain the same ratio of gold as that of the amalgam recovered. Hot water assists sometimes. This method usually extracts more gold than would be obtained in a mill—all that is capable of amalgamation under the most favorable circumstances.

2. Shake the pulverized ore, etc., in a bottle instead of grinding; wash down and retort as before. This ought to give nearer to the actual results of a mill run.

3. Pan down carefully, and repeatedly, if necessary, with mercury, or in a pan with amalgamated bottom. The re-

sults are usually low, on account of some of the gold floating off.

Sulphurets may be tested after roasting.

N. B.—The mercury should be free of gold. Commercial mercury usually contains a little gold, and at mills sometimes considerable amalgam is left in it, to the benefit of someone else. The neglect of this has been the cause of serious mistakes, for which the assayer is often blamed when his assays do not agree with the tests.

The presence of gold may be easily detected, estimated and allowed for by dissolving a weighed quantity of the mercury in nitric acid. This method may also be used on small quantities of amalgam instead of retorting.

Cyanide Plants

Made of steel or galvanized iron. Low price plants a specialty. Fifteen of our plants in operation in California, Arizona, Nevada and Mexico.

Water Pipe, Tanks, Ore Cars, Ore Buckets, Etc.

Send for Catalogue

Thomson & Boyle Co.

1101 to 1111 N. Main St.

Tel. Main 157 LOS ANGELES, CAL.

NORTHERN CONSOLIDATED OIL AND MINING CO. NO. 2.

General Offices, 246, 248 Wilcox Bldg. Los Angeles, Cal.
Par Value of Stock $1.00 per Share,
Present selling Price 10c. CHAS. V. HALL, President.

This oil company is now producing oil from its own wells in the Los Angeles field sufficient to pay a large rate of dividend upon its outstanding stock, which has thus far been at the rate of five per cent per month upon the price for which the shares are selling, and which, it is expected will continue to pay dividends at from three to five per cent. per month upon the money invested in its stocks. In addition to the productive wells owned by the company, it also has several thousands acres of oil land in various portions of California that it holds under favorable leases or fee, upon which development work will be prosecuted with the funds realized from the sale of stock, thus making provisions for a large increase in the amount of oil produced.

The conservative policy thus far pursued by this company and the fact of the judicious investment of the funds thus far realized from the sale of stock, give promise that in the future, as its revenues increase, it will be able to maintain a very high dividend upon its shares.

It offers one of the safest and most promising opportunities for the investment of capital to be found anywhere.

For further particulars write for the company's illustrated booklet, which will be mailed to any address on application to the president, at 248 Wilcox Block, Los Angeles, Cal.

APPENDIX II

WEIGHTS AND MEASURES.

I.

METRIC SYSTEM AND EQUIVALENTS.

The Metric is the only rational and scientific system of weights and measures ever devised by man. It is based on decimals, and one denomination is readily convertible into another. The unit of weight is the gram. The A. T. is the unit of assay weights used for weighing out ore pulp.

LENGTH—

The unit of length is the meter, equals 39.37 inches, equals 1.09361 yards, equals 100 centimetres.

SQUARE—

The unit of land measure is the hectare, equals 2.471 A. 1 acre equals .4047 hectares. Smaller measurements are stated commonly as square meters, square centimeters, etc.

The higher denominations of weights, measures, etc., are designated by the Greek numeral prefixes, deka (10); hekta (1000), etc., and the lower ones by the Latin pre-

fixes, milli (1000dth), centi, (100dth), and so on: thus, e. g., the kilogram, equals 1000 grams; the milligram, 1-1000dth of a gram; the deciliter, 1-10 of a liter; the centiliter equals 1-100dth of a liter.

TABLES.

WEIGHTS

One	Grains	Grams	Assay T'n	Oz. Av.	Oz. Troy
Gram	15.43236			0.03527	0.03215
Kilogram		1000.000	34.287		
Assay Ton	450.100	29.166		1.0290	0.9377
Pound, Av	7000.000	453.600	15 560	16.0000	14.582
Pound, Troy	5760.000	373.245	12.797	13.1657	12.000
Ounce, Av	437.500	28.350	0.972		0.91146
Ounce, Troy	480.00	31.104	1.0664	1.0970	
Milligram		0.0010			

1 grain=64.87 milligrams.
1 kilogram=1000 grams=2.205 pounds Av.
1 pound Av =0.82286 pound Troy.
1 short ton=2000 lb. Av.=32.08 cubic feet water=240.1 U. S. gallons.

VOLUMES

One cubic centimetre=15.43236 grains water at 4 deg. Centigrades= 1 gram.
" cubic centimetre (technical)=1 gram water at 60 deg. Farenheit.
" litre=1000.00 C. C.=.26418 U. S. gallons=61.0237 cubic inches.
" cubic inch=16.386 C. C.
" U. S. gallon = .8331 Imperial gallon = 3.7852 litres = 8.33 pounds Av. water=58.318 grains=231.000 cubic inches.
" Imperial gallon=70.000 grains=1.2003 U. S. gallons.
" cubic foot=7.48 U. S gallon=28.315 lttres=62.34 pounds Av.water
" California Miner's inch= about 9 U S. gallons
" fluid ounce=29.57 C. C.
" Quart=946 360 C. C.

LENGTH

One yard=.914402 metre.
One foot=30.480 centimetres.
One inch=2.54010 centimetres.
One mile=1760 yards=1.60935 kilometres.

SQUARE SURFACE

One square inch=6.452 square centimeters.
One square foot=9.290 square decimeters.
One square yard=.836 square metre.

CIRCULAR VOLUMES AND WEIGHTS OF WATER

DIAMETER	DEPTH 1 FOOT			DEPTH 1 INCH		
Feet	U. S. Gal.	Cu. Ft.	Tons Water	U. S. Gal.	Cu. Ft.	Tons Water
5.....	146.83	19.63	.612	12.48	1.640	.051
10.....	587.49	78.54	2.450	48.96	6.545	.204
12.....	845.91	113.09	3.527	70.49	9.424	.279
14.....	1151.40	153.93	4.800	95.96	12.827	.400
15.....	1321.79	176.71	5.509	110.14	14.725	.459
20.....	2349.84	314.15	9.793	195.82	26.179	.816
30.....	5287.24	706.85	22.034	440.57	58.900	1.837

THERMOMETERS—Centigrade or Celcius. freezing point 0; Farenheit, freezing point 32 degrees, boiling point of water, 212 degrees. Temperature Celcius multiplied by 9 divided by 5 plus 32 equals temperature F. Temperature F, less 32 and remainder multiplied by 5 divided by 9 equals temperature Celcius.

II.

WEIGHTS OF QUARTZ.

Ores and rocks vary in their specific weights according to their quality, or the quantity of metallic sulphides, oxides, etc., they contain. The more there is of these present the heavier is the rock.

1 ton of quartz in place equals 12 to 13 cu. ft.

1 cu. ft. quartz in place equals 154 to 167 lbs.

The following are actual determinations:

1 cu. ft. of quartz passed through a No. 30 screen, weighed 99 pounds.

1 cu. ft. of quartz passed through a No. 60 screen, weighed 98 pounds.

1 cu. ft. of quartz passed through a No. 100 screen, weighed 94 pounds.

1 ton of quartz, No. 30 mesh, equals 20.2 cu. ft.

1 ton of quartz, No. 60 mesh, equals 20.4 cu. ft.

1 ton of quartz, No. 100 mesh, equals 21.2 cu. ft.

The specific weights depend also on the amount of shaking and packing. Our experience with a very clayey ore, pulverized to a No. 30 mesh, has been that it continued to pack, as a result of the jarring of the crushing machinery, for about ten days, its leaching (cyanide solution) getting slower and slower every day. The material varied, when measured at different times, from 87 to 103 pounds per cubic foot.

III.

WATER MEASUREMENT—THE MINER'S INCH.

In California the miner's inch is the flow of about 8.796 gallons of water per minute. Fifty miner's inches are eqivalent to one cubic foot per second. The most common measurement is under a mean pressure of four inches, through an aperture 2 inches high and 2 inches above the bottom of box, the plank being 1¼ inches thick, and the height of water above the aperture 3 inches, giving a mean pressure of 4 inches. Each square inch of the aperture represents one miner's inch, or about 1.2 cubic feet flow per minute. The method is illustrated in accompanying figure.

"Where water-power is to be used, the first and most important step is to determine the flow, as well as the head and fall which can be secured. Upon these depend the

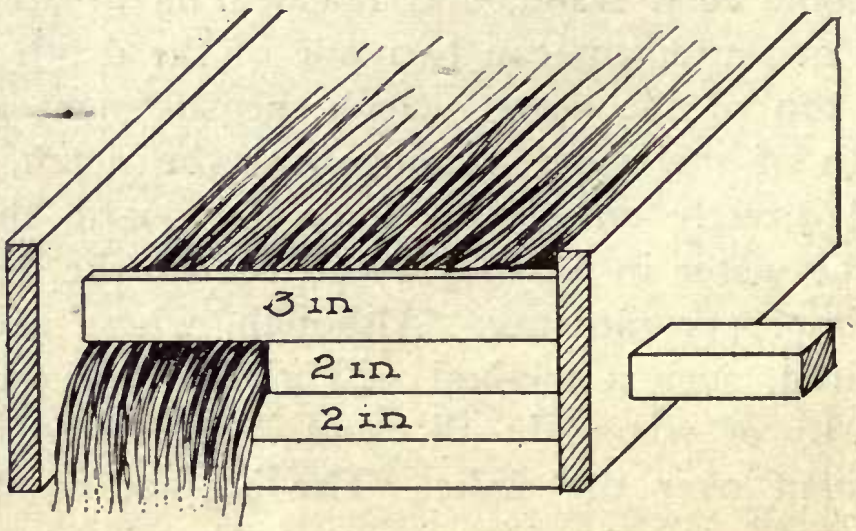
power that can be expected; and the neglect of proper measurements causes much disappointment and trouble. It is not uncommon to find plants erected which the water power proved in the long way inadequate to drive.

Where it is desired to measure the flow of a small stream with a fair degree of accuracy, a good plan is to make a weir across it with an opening or notch for the water to pass. The weir can be made of planks. When it is convenient to use a single board, select one that is long enough to reach across the stream, resting in the bank at each end. Cut a notch in the board sufficient in depth to pass all the water to be measured, and not more than two-thirds of the width of the stream in length. The bottom of the notch in the board should be beveled on the down-stream side; the ends of the notch should also be beveled on the same side, and within 1-8 in. of the upper side of the board, leaving the edge almost sharp. A stake in the bottom of the stream several feet above the board or dam should be driven down to the level of the notch in the board, this level being easily found as the water is beginning to spill over the board. After the water has come to a stand, and reached its greatest depth, a careful measurement can be made of the depth of water over the top of the stake. Such measurement gives the true depth of the water passing over the notch, since, if measured directly on the notch or the board, the curvature of the water in passing would reduce the depth, giving the improper measure. Although, where accuracy is not required, such a method will give a fair estimate of the quantity of water; in all cases it is best to make the measurement over the stake. The surface of the water

below the board should not be nearer the notch than 10 in., that the flow of water over the notch may not be impeded. Neither should the nature of the channel above the board be such as to force or hurry the water to the board, but it should be of ample width and depth to allow the water to approach the notch and board steadily and quietly. If the water passes the channel rapidly it will be forced over the notch, and a larger quantity will pass than if allowed to spill from a large body moving slowly.

When the depth of water over the stake is known, the quantity of water passing can be easily calculated. If we take H as the weight of the water level over the weir, or stake, in inches, and Q as the quantity in cubic feet per minute for each inch length of weir, when contraction of area is reckoned at 62 per cent. of full area, we have the simple formula: Q equals 0.4 multiplied by H square H.

In some of the catalogues issued by Fraser & Chalmers—in which this simple plan of measuring water is suggested—tables will be found, from which the value of Q can be ascertained at once, without the trouble of working it out by the formula."—*N. Y. E. and M. J.*, Nov. 4, 1899.



The M. and E. Co.,

Los Angeles, Cal.

General Machinery,

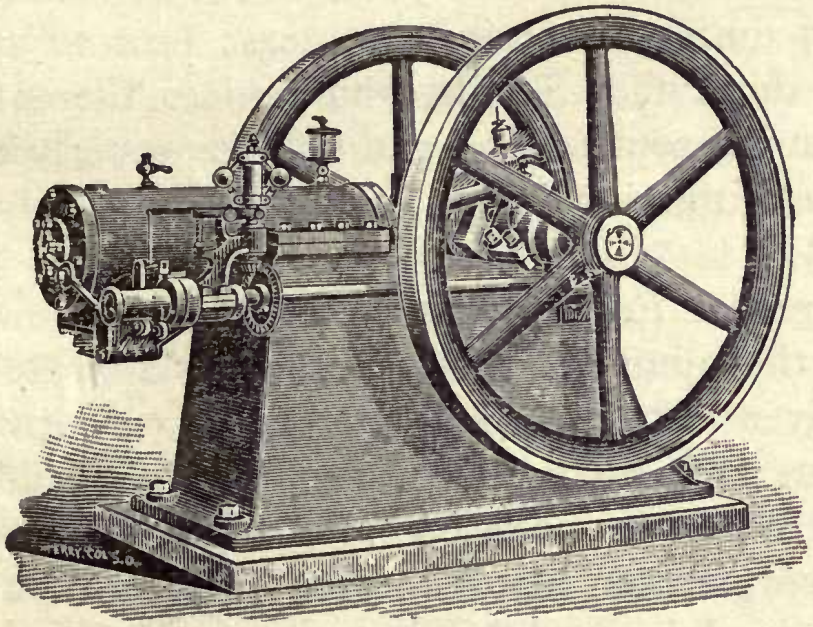
Engineering Supplies,

Mining Machinery and Supplies,

Electrical Apparatus and Supplies,

GASOLINE HOISTS

Only up-to-date Gasoline Hoist on the market. See it! Send for circulars



STEAM Hoists, Boilers, Engines, Pumps, Stamp Mills, Ore Cars, Ore Buckets, Mine Rails.

M. and E. GASOLINE and DISTILLATE ENGINE

Write for Circulars and prices to

The Machinery and Electrical Co.

351-353 North Main St.,

LOS ANGELES, - - CALIFORNIA

GEO. W. KING. WILLOUGHBY COLE

KING and COLE,

Attorneys-at-Law

MINING AND CORPORATION LAW

Office with Wade & Wade,

115½ N. NAIN ST., - - LOS ANGELES, CAL.

Practice in all the Courts, and give Special Attention to Mining and Corporation Laws.

Mining Location Notices drawn, and advice how to properly mark off boundaries of claim on the ground; advice on rights and duties of mining partners; how to appropriate water on the Public Lands, and notices thereof properly drawn; mining contests in Land Offices properly conducted, and mining litigation in all the courts, carefully attended to.

Incorporation Papers drawn, and advice how to open and keep the minutes of Directors and Stockholders; assistance given in opening and conducting corporation books of account, and instructions how to issue and transfer stock and make out monthly and annual accounts. Experts in corporation book-keeping provided on request; and general advice and legal services on all questions of corporation law.

Note—George W. Knox, attorney for a number of successful Los Angeles oil corporations, and editor of the Digest of Mining Laws herein, will act as special counsel in mining and corporation law, with above attorneys, and will also continue to edit answers to questions submitted to this office.

APPENDIX III

PROSPECTING.

"Gold is where you find it," and it is found very widely distributed in a great variety of rocks and minerals, although in the early days of mining it was thought to exist only in "quartz," excepting placers. It is found sometimes in the great country formations, granite, sandstones, volcanic rocks, etc. (though relatively only in very small quantities or traces, as a rule); in mineral veins, or deposits; in limestone, iron ore, clays, talc, sulphurets, tellurides and a large number of other minerals.

Mineralized veins and deposits are, however, its natural habitat, and where it should be generally searched for. These *lode* formations are the result of the filling in with minerals matters of gashes, fissures and chambers, occurring usually in the geologically older country rock formations, such as granite, slate, porphyry and quartzite.

In searching for gold, other than placer, the more recent formations, sedimentary rocks, and unaltered shales, etc., may be ignored as a rule.

Native gold is present in ores either as fine dust (the usual condition), generally invisible even through a glass, coarse grains, or as nuggets; and usually distributed very

irregularly throughout the vein or in the ore. Sometimes it is only in seams.

Of a piece of ore broken into two parts, one part may contain little or no gold, while the other is rich. This accounts for an occasional discrepancy in assays of the same rock, for which the assayer is often to blame. Gold-bearing ores are usually, unless metallic gold is visible in it, undistinguishable in appearance from barren rocks. Decomposed country or wall rock frequently looks similar to auriferous vein matter, and apparently is as likely to carry gold. Long experience will, however, enable one to safely guess the presence of gold in a particular specimen sometimes, but it is not generally safe to pass an opinion. The most successful prospector is one who tests everything in sight—such is the proverbial "greenhorn."

PROSPECTING OUTFIT FOR GOLD.

1. A miner's hornspoon, or a gold pan.
2. An iron mortar and pestle for pulverizing rock. A No. 40 wire sieve might be useful also.
3. Strong nitric acid, 1 or 2 pounds.
4. Mercury, a few pounds, and a little sodium amalgam and potassium cyanide.
5. A small dish or bucket of water for horning or panning in.
6. A small iron pan or a piece of sheet metal, for roasting.
6. A small porcelain tub, with watch glass or other suitable cover, for retorting in. Miners sometimes tie up the amalgam in a rag and roast in the ashes.
8. An alcohol lamp and alcohol for heating.

9. A blowpipe, and sticks of willow charcoal; a little borax, soda, etc.

10. A wedgewood mortar and pestle, or a stoppered bottle, for mixing the ore and mercury.

11. A pick and hammer; and, if quantitative results are desired:

12. Pulp and assay balances. Cheap scales may be used, provided sufficient pulp is treated to overcome the effect of their lack of delicacy. Of low-grade ores, it is very necessary to treat considerable pulp to get a weighable quantity of the gold. (See appendix I for methods of testing.)

E. GERSON,

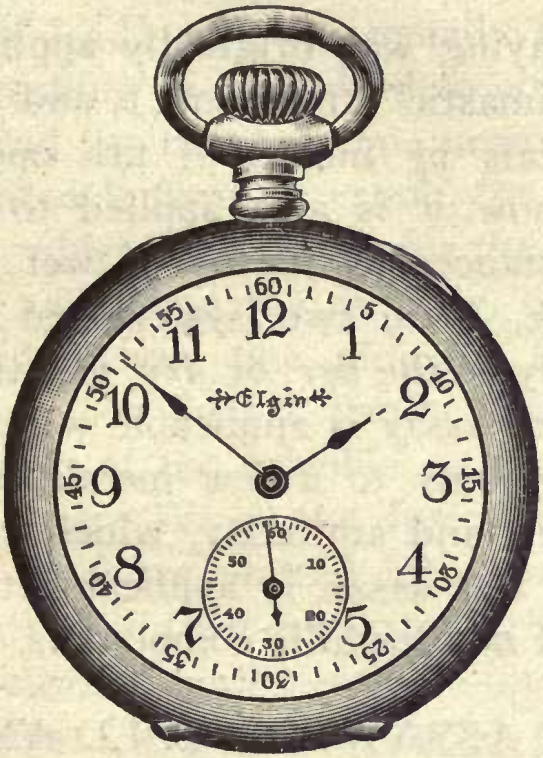
118 N. Spring St., **Tel. Brown 12** **Los Angeles, Cal.**

WATCHMAKER AND MANUFACTURING

JEWELER

DEALER IN

Diamonds,
Watches,
Jewelry,
Silverware,
Optical Goods



Manufacturing of all kinds of

JEWELRY

Engraving,
Enameling,
Die and Seal Cutting

Repairing and Adjusting Fine Watches A Specialty

We have the largest jewelry factory in the city All orders promptly attended to. **We pay the highest cash price for gold and silver.**

A cordial invitation is extended to the public.

APPENDIX IV

ASSAYING AND SAMPLING.

The term assaying was originally applied to the art of "testing" ("docimastic" treatment,) and determining the quantity of metals by means of fire operations, in clay crucibles; but now it is also applied to the quantitative analysis of substances by means of wet reagents, (acids, etc.) There are, then, two systems of assaying, designated respectively as the *fire,* or *dry,* and the *wet* or *humid,* method. The dry assay is applicable with reasonable commercial accuracy only to a few metals, viz., gold, silver, lead, tin, mercury and antimony, which are usually tested that way. The wet assay is applicable to all the metals and metallic and non-metallic compounds.

DRY OR FIRE ASSAY FOR GOLD AND SILVER—

There are two methods of fire assaying, viz., by crucible and scorification.

CRUCIBLE METHOD—

This operation is one of smelting, and the same principles govern as are employed in the smelting of ores, the chief difference in fluxing being that—as the object in assaying is not to extract the value of the ore for itself, *per se*—more expensive, but more convenient fluxes are employed,

viz., borax and silica or glass, (acid fluxes) and soda, potash, litharge, lime and niter (basic fluxes.) The general rule of fluxing is, for an acid ore, (one in which silica predominates,) use a basic flux; and for a basic ore (one in which iron, copper or other metallic compounds are in excess,) use an acid flux. The relative proportion of each constituent of the ore must be taken into consideration in mixing up. The basic fluxes have usually two functions, viz., slagging and oxidizing or desulphurizing. Litharge (yellow oxide of lead) is given usually another function, viz., that of furnishing metallic lead to collect the precious metals. This lead is reduced by means of a reducing agent, either charcoal, flour or argol, (or sulphur, if present in the ore,) which is mixed with the finely pulverized ore and fluxes; and when the mixture, or "charge," is in a state of liquid fusion, fine globules float around and gather up the precious metals, finally settling down as an alloy to the bottom of the crucible (a clay pot,) in which the melting is done. When the fusion is completed, the liquid slag and lead are poured into moulds and cooled. The metallic button is then separated from the hard slag, hammered and cleaned, and cupelled—an oxidizing operation in small cups ("cupels") made of ground bone ash. The lead button is put into a cupel previously heated up in a muffle, melted and slowly oxidized (burnt,) part of it volatilizing and the larger part forming litharge, which is absorbed by the cupel. The gold and silver (which are obtained together,) are left in the cupel, from which they are taken out, cleaned, weighed and parted with nitric acid, which dissolves out the silver, leaving the gold. The gold is washed, dried, etc., and weighed. This weight, when taken from the original weight, gives the amount of

silver by difference. About 2½ parts of silver to one of gold must be present to make a perfect parting, so any deficiency is made up by alloying the button with more silver.

This method is applied chiefly for assaying gold. A preliminary roasting is sometimes necessary. Silver is usually assayed by scorification, which is oxidizing in effect, while the crucible method is reducing.

SCORIFICATION METHOD—

This is performed by melting the finely-pulverized ore with granulated test lead and a little borax, (and sometimes other fluxes) in a small shallow clay dish or "scorifier." The lead oxidizes, forming litharge, which fluxes off the gangue matters of the ore. The rest of the operation is the same as for the crucible assay. One important difference between the two is, that usually only 1-10 or 2-10 A. T. of the ore can be tested by scorification (several of them having to be carried on at once.) while 1 A. T. or more may be tested in the crucible. The assay ton weight, which is in general use, for weighing pulp, is in the same ratio to a milligram (metric weights) as a ton of 2000 lb. Av. is to an ounce Troy, viz: In a ton of 2000 lbs. Av. there are 29,166 oz. Troy, and in 1 A. T., 29,166 milligrams. Hence, if one assay ton of ore, 29.166 grams, yields one milligram of gold, the result is, one oz. Troy of gold per ton. This system of weights (A. T.) simplifies calculation.

CHECK ASSAYS—

A check, or control assay, is one made on a sample of ore for sale, and is usually a check on another assayer.

A number of duplicates, and sometimes a repetition, are necessary. Great accuracy is required.

UMPIRE ASSAYS—

are for the purpose of settling the differences between other assayers; and are usually final. Great skill must be exercised, as much depends on it, and quite a number of duplicates made.

Silver is usually estimated by scorification, and gold by the crucible method, though the latter is applicable largely to the assaying of silver when very little or no base metals are present.

CAUSES OF ERROR IN ASSAYING—

1. Improper sampling. (See appendix III, "Prospecting" in respect to the distribution of gold.)
2. The use of old crucibles in which rich assays have been made.
3. Insufficient cleaning of bucking board or crushing machinery after rich ore has been pulverized, or from other outside sources.
4. When coarse gold is present, it is liable, if not carefully examined, to be left in the sieve used in preparing sample.
5. Improper fluxing, personal equasions of the assayer, and other causes.

TELLURIDES—ASSAY OF—

Much fear has been expressed that tellurides cannot be assayed properly by the fire methods. This is groundless, however, provided a proper fluxink and heat are employed. Mr. Van F. Furman, a most reputable metallurgist, and chief chemist of the Denver branch mint, says (Mng. &

Sc. Press), that he "doubts if any greater degree of accuracy is attained in the valuation of commercial products than that which is the result of the present Colorado practice for the assay and valuation of ores." He gives a number of comparison tests on high grade tellurides by means of scorification and crucible assay, and chemical analysis by an eminent eastern chemist; the results of which our own investigations also confirm. The general practice in Colorado is to flux with litharge and niter in crucible, scorification proving unreliable.

WET OR HUMID ASSAYING—

Two general methods are commonly employed in wet assaying, viz., volumetric and gravimetric.

1. Volumetric—

This has largely superseded the gravimetric method, being more convenient and rapid. A solution of a chemical standardized against a definite quantity of the pure element or substance sought, is run into a definite change in color, a white or colored precipitate, or other recognizable phenomena, is produced at the end point. The quantity of the standard solution required measures the quantity of metal or other substance sought. E. g., the volumetric method for copper.: The pulverized and weighed ore is put into acid solution, ammonia added in excess, the solution filtered, if necessary, and the deep purple or violate color produced by the ammonia and copper, just destroyed by running in a standard solution of potassium cyanide. A faint violet indicates the end. The solution is measured from a burette—a long glass tube graduated into cubic centimeters.

2. Gravimetric—

Consists in separating the metal or substance either in the metallic or elemental condition; or in combination with other elements as a definite chemical compound, in which the ratio or percentage of the substance sought is known, washing, drying, etc., and finally weighing the precipitates. E. g., copper is sometimes separated from acid solution by means of zinc, electricity, or other reagent, and finally weighed as metal. Silver (or chlorine) is sometimes precipitated as the chloride of silver (silver, 75.27 per cent.; chlorine, 24.73 per cent.) and the precipitate separated by means of filteration, washed, dried, ignited, and finally weighed in a small crucible. The percentage of silver or chlorine is found by means of the above ratio

Sometimes colorimetric estimation is employed, as may be done with very weak copper solutions, the colored solution being compared with a standard color.

SAMPLING.

The sampling of a mine or vein is one of great practical importance, and too often done improperly. To be correctly done, take large samples across the face of the vein or lode, drifts, etc., including therein also the more or less worthless vein matter (which has to be mined and milled along with the ore,) at sufficient intervals along the "ledge," in order to get a fair average sample. The "wall rocks" should also be sampled to see if they contain any values; and separately, also, each different kind of ore or rock, advisedly, sampled and tested. These samples, which should be as large as possible, may be shipped to a mill or metallurgical works where they may be each separately properly sampled and assayed or given an actual working

test; or broken up, mixed and sampled by a system of "quartering" repeatedly, (or taking alternate shovelfuls) until a convenient sample, a few pounds or more, representing the whole, is obtained. Don't grind the ore to dust, or send to the assayer too small samples. Finely pulverized ore is apt, if not properly enclosed in package, to lose some of the gold by concentration and shaking out at some corner or crack.

ENCYCLOPEDIA OF

MEXICAN MINING LAW

The ENGINEERING AND MINING JOURNAL of New York says: [July 28th, 1900.]

This very useful book includes a digest of the Mexican mining code, including all supplementary laws and decrees. It gives also the laws relating to taxation and exportation of the precious metals. The author is a mining engineer of long experience in Mexico, and is thoroughly acquainted with his subject. The book is conveniently arranged, each point being treated separately and the various subjects arranged alphabetically so that it is possible to find the information needed on any special topic with very little labor. A convenient addition is a glossary of Mexican mining terms, which will be of much assistance to the reader. The book is a very serviceable and timely one.

Special chapters on: Buying a Mexican Mine. Cost of a Mining Concession. Obtaining a Mining Concession. Water Rights. Prospecting Permits.

..BY..

Richard E. Chism, Ph. D.

Consulting and Reporting Mining Engineer.

[Graduate of the Mexican School of Mines, etc.]

Apartade Postal 2085, Mexico, D. F.

NO Mail Orders filled unless accompanied by cash, Mexico City exchange or P. O. order.

For Sale at all Book Stores.

Price $2.00 U. S. Coin.

APPENDIX V

DIGEST OF U. S. MINING LAWS—WATER RIGHTS—CALIFORNIA—ARIZONA—DESERT LAND LAWS.

1. FEDERAL LAWS.

The federal laws govern, and take precedence when in conflict with state or local laws. They provide (Sec. 2324 U. S. Revd. Stat.) that the miners of each mining district may make regulations not in conflict with the federal, state or territorial laws.

KINDS OF LOCATIONS, AND WHO MAY LOCATE.

The Revised Statutes (Sections 2318 to 2352, inclusive) provide for three kinds of mining locations, 1st, lode or vein; 2d, tunnel; 3d, placer. The mineral deposits in the surveyed and unsurveyed lands of the United States are only open to location and purchase by citizens of the United States, and those who have declared their intentions to become such. (Rev. Stat. 2318.) This excludes Chinese, Japanese and all other foreigners, until they become naturalized (as provided above).

Mining locations may be made either by single individuals or associations of such persons as copartnerships, or by corporations. (Rev. Stat. 2321.) *No location of a mining claim can be made* until the discovery of the vein or lode within the limits of the claims located. (Rev. Stat. 2320.)

MARKING BOUNDARIES—RECORDING OF NOTICES.

The markings of boundaries must be such that they may be distinctly traced. (Rev. Stat. 2324), and the description of vein or lode claims, when upon surveyed lands, shall designate the location of the claim with reference to the lines of the public surveys, but need not conform therewith. (Rev. Stat. 2327.)

All records of claims located must contain the names of the locators, the date of the location, and such a description, by reference to some natural object or permanent monument, as will identify the claim. (Rev. Stat. 2324.) The adjoining or the relative positions of the nearest claims, if any, should be stated, and a post or monument of stones erected at each corner of the surface ground, and at the point of discovery or discovery shaft, also fix a post, stake or board, upon which should be designated the name of the lode, the name or names of the locators, the number of feet claimed, and in which direction from the point of discovery. It is essential that the location notice filed for record, in addition to the foregoing description, should state whether the entire claim of 1500 feet is taken on one side of the point of discovery, or if partly upon one and partly upon

the other side thereof, and in the latter case, how many feet are claimed upon each side of such discovery point. Prior to locating, unless the vein can be traced on the surface, the locator should sink a discovery shaft, or run a tunnel or drift, to a sufficient depth therein, to discover and develop a mineral bearing vein, lode or crevice, and should determine, if possible, the general course of such vein in either direction from the point of discovery, by which direction he will be governed in marking the boundaries of the claim. The location notice should give the course and distance as nearly as possible from the discovery shaft on the claim to some permanent, well-known points or objects, such, for instance, as stone monuments, blazed trees, the confluence of streams, points of intersection of well-known gulches, ravines or roads, prominent buttes, hills, etc., which may be in the vicinity, and which shall serve to perpetuate and fix the locus of the claim and render it susceptible of identification from the description thereof given in the record of locations in the district, and should be duly recorded. Within a reasonable time, say twenty days, after marking boundaries, or after such times as is allowed by the local laws, notice thereof, or a copy of the location notice should be filed for record with the proper recorder of the mining district, or if there be no such district, then with the county recorder, who will issue to the locator the usual certificate of location, and return the original notice, after making record of same, with an endorsement thereon of the date of filing for record, and book in which recorded. But the return of the notice is apt to be overlooked by the recorder, unless he is requested to do so.

LODE CLAIMS

Are limited to 1500 feet along the vein and 300 feet on each side of the center thereof. Not more than 300 feet may be taken one one side of the center of the vein. The end lines must be parallel and should be crosswise of the vein.

TUNNEL CLAIMS.

A tunnel location entitles the locator to all veins previously unknown within 3000 feet from the face of the tunnel and on the line thereof.

The statute does not expressly state that the miner who may wish to run a tunnel to explore for a vein, shall make a location claim, as in case of a lode or vein. Section 2323 provides when a tunnel is run for the development of a vein or lode, or for the discovery of mines, that the diggers of such tunnel shall have the right of possession of all veins or lodes within 3000 feet from the face of such tunnel, on the line thereof, not previously known to exist, discovered in such tunnel, to the same extent as if discovered from the surface; and locations on the line of such tunnel or veins, or lodes not appearing on the surface, made by other parties after the commencement of the tunnel and while the same is being prosecuted with reasonable diligence, shall be invalid; but failure to prosecute the work on the tunnel for six months shall be considered as an abandonment of the right to all undiscovered veins in the line of such tunnel.

The Land Office at Washington has, however, considered that in order to avail oneself of this provision of the law, the owners of the tunnel will be required, at

the time they enter cover, to give proper notice of their tunnel location by erecting a substantial post, board or monument, at the face or point of commencement thereof, upon which should be posted a good and sufficient notice, giving the names of the parties or company claiming the tunnel right, the actual or proposed course or direction of the tunnel, the height and width thereof, and the course and distance from such face or point of commencement, to some permanent and well-known objects in the vicinity, by which to fix and determine the *locus* in manner applicable to locations of veins or lodes, and at the time of posting such notice they shall, in order that miners or prospectors may be enabled to determine whether or not they are within the lines of the tunnel, establish the boundary lines thereof, by stakes or monuments placed along such lines, at proper intervals, to the terminus of the 3000 feet from the face or point of commencement of the tunnel; and the lines so marked, will define and govern as to the specific boundaries within which prospecting for lodes not previously known to exist is prohibited, while work on the tunnel is being prosecuted with reasonable diligence.

At the time of posting notice and marking out the lines of the tunnel as aforesaid, a full and correct copy of such notice of location, defining the tunnel claim, must be filed for record with the mining recorder of the district, or with the county recorder, if there be no such mining district, to which notice must be attached the surveyor's statement, or declaration of the owners, claimants, or projectors of such tunnel, setting forth the facts
9 in the case; stating the amount expended by them-

selves and their predecessors in interest in prosecuting work thereon; the extent of the work performed, and that it is bona fide their intention to prosecute work on the tunnel so located and described, with reasonable diligence, for the development of a vein or lode, or for the discovery of mines, or both, as the case may be. This notice of location must be duly recorded, and with the said sworn statement attached, kept on the recorder's files for future reference.

In order to prevent parties from monopolizing the lands lying in front of their tunnels, to the detriment of the mining interests, and to the exclusion of bona fide prospectors, or miners, the government will hold tunnel claimants to a strict compliance with the statute, and to a reasonable diligence on their part in prosecuting the work. Negligence or want of due diligence will be construed as working a forfeiture of the right to all undiscovered veins in the line of such tunnel.

PLACER CLAIMS.

Placers are limited to 20 acres; but two persons uniting in one location may locate 40 acres, three persons 60 acres, and so on until a claim of 160 acres may be located by not fewer than eight persons.

Claims usually called "placers," *including all forms of deposit,* excepting veins of quartz or other rock in place, are subject to entry and patent, under like circumstances and conditions, and upon similar proceedings as are provided for vein or lode claims; but where the lands have been previously surveyed by the United States, entry in its exterior limits shall conform to the legal subdivisions of the public lands. (Sec. 2329 R. S.)

Legal subdivisions of forty acres may be subdivided into ten-acre tracts, and two or more persons, or associations of persons, having contiguous claims of any size, although such claims may be less than ten acres each, may make joint entry thereof, but no location of a placer claim * * * shall exceed 160 acres for any one person, or association of persons, which location shall conform to the United States surveys; but no such claim shall defeat or impair any bona fide pre-emption or homestead claim upon agricultural lands, or authorize the sale of the improvements of any bona fide settler to any purchaser. (Sec. 2330, R. S.)

When a placer claim shall also include a vein or lode within its boundaries, the location notice should state that the claim also includes such vein or lode * * * but where the existence of a vein or lode in a placer claim is not known, the claim will cover all valuable mineral and other deposits within the boundaries thereof. (Sec. 2333 R. S.)

Where placer claims are upon surveyed lands, and conform to legal subdivisions, no further survey or plat shall be required * * and all mining claims * * shall conform as near as practicable with the United States system of public land surveys, and the rectangular subdivisions of such surveys, *and no location shall include more than twenty acres,* for each individual claimant; but where placer claims cannot be conformed to legal subdivisions, survey and plat shall be made as on unsurveyed lands; and where by the segregation of mineral lands in any legal subdivision, a quantity of agricultural land less than forty acres remain, such frac-

tional portion of agricultural land may be entered by any party qualified by law for homestead or pre-emption purposes. (Sec. 2331 R. S.)

The regulations heretofore given as to the marking of locations on the ground, and placing the same on record, must be observed in the case of placer locations so far as the same are applicable, but when these claims are upon surveyed public lands, the locations must conform as nearly as possible to the legal subdivisions of the survey.

ANNUAL WORK.

By federal statute not less than $100 worth of work shall be performed or improvements made on each claim annually. This applies to both lode and placer claims. The period within which this work must be done or improvements made begins on January 1st, succeeding the date of location. If done or made before that period it will not apply as annual work. Annual assessment must be done, not to keep alive a title, but to prevent it from lapsing. If a claim is located on the 1st of January, the assessment work need not be done for nearly two years. If no one else asserts a claim to the property, a locator need not do any work at all upon his claim. The work need not be done on the claim if done for the benefit thereof. Such work may consist of trails, roads, draining, flumes, cabins, watchmen and the like. In case of a group of contiguous claims, the work required for all may be done on one, if such work, so expended, tends to develop the whole group. In estimating the value of such work only the market price of labor will control.

PRIORITY—INTERSECTING VEINS.

Where two or more veins intersect or cross each other, priority of title shall govern, and such prior location shall be entitled to all ore or mineral contained within the space of intersection; but the subsequent location shall have the right of way through the space of intersection, for the purpose of the convenient working of the mine. And where two or more veins unite, the oldest or prior location, shall take the vein below the point of union, including all the space of intersection.

FIVE ACRES FOR MILL SITES.

Where non-mineral land, not contiguous to the lode, is used by the claimant for mining or milling purposes, such surface ground may be included in an application for patent for such lode, and it may be patented therewith, subject to the same requirements as to survey and notice as applies to lodes, but no larger quantity of land shall be included than five acres. The owner of a quartz mill or reduction works, not owning a mine in connection therewith, may also receive a patent for his mill site under this section. (See 2337 Rev St.) It is important to note that the mill site must not be located on land of a mineral character.

THE APEX RULE.

The locator, so long as he complies with the laws and local regulations, shall have the exclusive right of possession of all the surface included within the lines of the location, and of all veins, lodes and ledges throughout their entire depth, the top or apex of which lies inside of such surface lines extended downward vertically, although such vein, lodes or ledges may so far depart from

a perpendicular in their course downward, as to extend outside the vertical side lines of such surface locations. But their right of possession to such outside parts of such veins or ledges, shall be confined to such portions thereof, as lie between vertical planes drawn downward through the end lines of their locations, so continued in their own direction that such planes will intersect such exterior parts of such veins or ledges; but the locator is prohibited from entering upon the surface of such adjoining claims when owned by another. (Sec. 2322 Rev. St.)

LIABILITY OF CO-OWNER TO CONTRIBUTE.

Upon failure of any one of several co-owners to contribute his proportion of the expense in locating the claim, and in doing the annual labor required, the co-owners who have performed the labor or made the improvements, may at the expiration of the year, give such delinquent a written notice, or notice by publication in the newspaper published nearest the claim, for at least once a week for ninety days, and if at expiration of such time, such delinquent should fail to pay his proportion of such expenses, his interest in the claim shall then become the property of the co-owners who have made the required expenditures. (Sec. 2324 Rev. St.)

THE U. S. PATENT.

As the application for a patent will require an appearance in the Land Office, and as the details of the work required will necessitate the employment of an attorney for that purpose, it is not deemed of importance to here insert the requirements of the law on this point. It is also often the case that contests arise in the Land Office upon

such applications; such contests also will require an attorney. The mining locator will in both such events, require more detailed instruction than he will find in the statute. For these reasons Sections 2325, and 2326 and 2333 of the Revised Statutes are passed without further notice.

Five hundred dollars' worth of labor must be expended or improvements made upon each claim to be patented. Lode claims must be paid for at the rate of five dollars per acre.

Placer claims at the rate of two dollars and fifty cents per acre.

The expenses of survey, publication and land office fees must be paid by the applicant.

Claims are not often patented, continuous possession and development being a sufficient guarantee of title.

COST OF RECORDING.

The usual charges by County Recorders are: (1) for single lode on placer claim, 90 cents. (2) for placer claims, eight names, $1.40.

District Recorders charge arbitrarily from $1.00 up to $5.00 for recording single claim.

SURVEYS.

When a survey is necessary, the costs of same must be paid by the claimant. Full information on this subject, together with names of competent surveyors, will be given by the Land Office of the district. (Sec. 2334 Rev. St.)

ACQUIRING WATER RIGHTS ON U. S. LANDS.

Whereever by priority of possession, rights to the use of water for mining or other useful purposes have vested and

accrued, and the same are recognized by local customs or laws, the owners thereof shall be protected in the same, and the right of way for ditches and canals for such purposes is hereby granted over the lands of the public domain, but for all injuries caused by the construction of such water conduits to any settler on the public domain, the party so committing such injury or damage, shall be liable to the party so injured. (R. S., sec. 2339.)

The state law of California provides for and prescribes a method of appropriating water for mining and other useful purposes upon the public domain. (Sec. 1410-1422 Civil Code.) And prescribes the method therefor as follows: Water when flowing in a stream,or down a canon or ravine, may be appropriated for a useful or beneficial purpose, and when the appropriator ceases to use it for such purpose the right is lost. The appropriator must post a written notice in a conspicuous place at the point of proposed diversion from the stream, stating therein that he claims the water so flowing, to the extent of the number of inches specified, under a four-inch pressure, the purposes for which he claims it, and the place of its intended use, and the means by which he intends to divert it, and the size of the flume, ditch, or pipe in which he intends to divert it.

A copy of this notice must be recorded in the county recorder's office of the county within ten days after it is posted.

Within sixty days after posting the notice, the appropriator must commence the excavation or construction of the works in which he intends to divert the water, and must prosecute the work diligently and uninterruptedly to completion, unless temporarily interrupted by snows or

rain. If, however, the California Debris Commission shall recommend the erection of a dam at or near the proposed point of diversion, then the claimant shall have sixty days after the dam is finished, in which to begin the excavation or construction of the works in which he intends to divert the water.

By compliance with these rules, the claimant's rights to the use of the water relates back to the time the notice was posted.

The claimant may change the place of, or point of diversion on the stream, if others are not injured thereby, and he may extend his ditch, flume or pipe for making the diversion, to places beyond that where the first use was made. Water already appropriated by another, *and being used by him,* cannot be taken away, nor can the quantity he has been using be diminished. But when the appropriator *ceases to use it, he loses the right to it.*

In all cases the first appropriator has the prior right to the water of the stream, but only such quantity of water as he has actually appropriated, and by his flume, ditch or pipe has conducted to the place of use by him.

II.

THE CALIFORNIA MINING LAWS.

The act of 1897 prescribing the manner of locating mining claims upon the public domain of the United States, and requiring location notices to be filed with the county recorders, and requiring the performance of fifty dollars worth of work in developing the claim within sixty days from the date of discovery, was duly repealed by act

passed at the special session of 1900, and is therefore no longer law. It is error, however, to claim that there is no other state law to be observed. The law of 1891 has not been repealed. That law provides for filing in the county recorder's office by the mining locator, within thirty days after the time allowed by law in which to do the annual work upon the mining claim shall have expired, an affidavit, particularly describing the labor performed and improvements made, and the value thereof, which affidavit shall be prima facie evidence of the facts therein stated; and in case of failure so to do, the claim or mine shall be open to relocation in the same manner as if no location of the same had ever been made.

This applies to the work required under the United States laws, and is a rule of evidence to show and preserve the proof of the performance of the whole work required to be done, as well as to give notice of what claims are not open to relocation. The act of 1897 is commonly supposed to have repealed this law of 1891, but such act does not repeal the law of 1891, either by express reference or by implication, for the two acts were in no wise conflicting; nor did they legislate upon the same subject.

The law of 1891 further provides that *if prior to a relocation by a stranger,* work shall have been resumed and continued with reasonable diligence until the required amount of labor has been performed, and the required statement of accounts and affidavit has been filed with the county recorder, then the claim or mine shall not be open to relocation. Provision is also made that if one co-owner fails to contribute his proportion of the expense

required by the act, the other co-owners may give notice to said co-owner personally, or by publication, to make payment of the amount due from him, and on failure so to repay said expenditure, his interest in the claim shall become the property of those who made such expenditure.

Said act further provides for the benefit of tunnel runners, where the tunnel is run for purpose of developing a lode or vein, that the money expended in running such tunnels shall be taken as expended on said claims, provided such surface claim shall be distinctly marked on the ground as provided by law.

Said act further makes all mining claims subject to a reservation of a right of way over or through the claim and over or through all ditches, roads, canals, cuts, tunnels and other easements, for public use for the purpose of working other mines, provided that any damage thereby occasioned shall be duly assessed and paid for as in case of land taken for public use under the right of eminent domain.

SALE OF SCHOOL LANDS.

The act of the legislature of March 28, 1874, amended April 6, 1880, regulating the purchase from the state of any sixteenth or thirty-sixth section of land (school sections) that has been designated by the United States survey as of a mineral character, or which is so in fact, has been repealed by the law of April 1, 1897, and provision was made by said repealing act that such mineral lands should thereafter be disposed of under the United States laws. In a case recently decided by the Superior Court of San Francisco, arising under this latter law, the court held that the law, in providing for the sale of such mineral

lands under the laws of the Federal government, was unconstitutional. The question will probably go to the United States Courts to decide. In the meantime persons desiring to take up any such lands had better confer with the State Attorney General, and Surveyor General as to the method of procedure recommended to be followed by the state authorities.

FOREST RESERVES.

Mineral lands in the forest reserves are subject to location and entry under the general mining laws.

The statutes say: "Any mineral lands in any forest reservation which have been or which may be shown to be such, and subject to entry under the existing mining laws of the United States, and the rules and regulations applying thereto, shall continue to be subject to such location and entry."

TIMBER RIGHTS.

The owner of a mining claim has the right to the timber thereon. A tunnel owner has a right to timber growing on a tunnel site, so long as he complies with the law in running his tunnel. No timber less than eight inches in diameter may be cut.

If a mill site is timbered, the lawful claimant may cut and remove the timber thereon for the purpose of constructing a mill, reduction works, tramways, or other accessory required in the development of his mining interests.

The cutting or removing of timber from mineral lands is permitted for the following purposes, viz., mining, agriculture, and domestic purposes; but not for exportation

from the state or territory where cut; also, the cutting and removing of timber from non-mineral public lands is only allowed when the material is used in the actual development or improvement of the mine or farm of the particular person for whom the cutting or removing is done.

ARIZONA.

The Arizona statute on the subject of locating claims provides that a discovery shaft at least ten feet deep from its lowest rim (or, an open cut or tunnel equal in amount of work to such shaft) showing mineral in place is required as a preliminary to a valid location; that substantial posts or stone monuments of a specified size shall be placed at each corner of the claim and center of the side and end lines. The shaft (or tunnel) must be excavated within 90 days from the date of discovery.

III.

ANSWERS TO QUESTIONS ON MINING LAWS SUBMITTED TO OUR LAW EDITOR.

I.

Can a woman, or a minor child, take up a mining claim?

Yes. The law provides that all mineral deposits * * * are open to exploration and purchase * * * by citizens of the United States, etc. Article XIV of the U. S. Constitution defines who are such citizens, i. e., "all persons born or naturalized in the United States and subject to the jurisdiction thereof are citizens of the United States, and of the state wherein they reside." This ena-

bles women, married and unmarried, minor children, and all others who are citizens of the United States to locate such claims. The courts have further so decided they have such rights. (72 Cal. 530.)

II.

Can a person make a location and file a claim by an agent, the principal not being upon the ground?

The courts hold that where there is no local or state law otherwise providing, a person can take up a mining claim through an agent, either previously authorized to do so, or subsequently ratified. (18 Cal. 588.) But some *mining districts,* in order to avoid fraudulent holdings, or improper monopoly, adopt local regulations, requiring that such agency must be exhibited, by also filing with the notice of the claim, a power of attorney from the absent principal, authorizing the agent so to act.

The safer plan is, however, to obtain a power of attorney from the principal, giving the agent the power to locate such claims. Yet the courts have held that subsequent ratification of the agent's act legalizes the claim. As a minor may take up a claim in person, so he may, contrary to the usual rule, act through an agent, the same as an adult.

III.

Is it necessary *to record* a mining notice?

In the absence of any local regulation or provision of the state law, it is not necessary (72 Cal. 533); but careful miners do so record such notices in the County Recorder's office, where there is no district recorder, and always where there is such a district recorder, so record it

with him. It gives notice to others, and often prevents jumping the claim.

IV.

Is a mining claim void if it includes more land than the statute provides for?

It is only void as to the excess. The quantity of land allowed by statute is protected by the claim. (72 Cal. 528.)

V.

When a person locates a claim for himself and several others, under a mining custom so allowing it, and posts up his notice on the claim with his own name, and the names of such others whom he chooses to associate with him appended thereto, some of whom have no knowledge of the location, can he afterwards tear down the notice and post up another, omitting some of such names and inserting others?

No. Those persons named in the first notice have become tenants in common with each other, and none of them can be subsequently divested of their interests, unless it is done with their knowledge and consent. (18 Cal. 583; 26 Cal. 534.)

VI.

Is *written authority* required from the principal in order to authorize an agent to take up a mining claim for the principal?

No. The statute of frauds requiring an instrument in writing to create an interest in land, does not apply to the taking up of mining claims. A mere verbal authority to one man to take up a claim for another is sufficient. The

location of such claim does not divest government of its title; it only gives a right of entry under it. (18 Cal. 583.)

VII.

Can the locator correct errors in a location notice, by posting and recording an amended notice?

Yes, provided his amended notice does not omit any of the parties named in the original location notice. Such original claimants may not be thus amended out of any vested rights. (72 Cal. 528.) Mining notices are liberally construed, however (83 Cal. 187).

VIII.

Will work done outside of the claim, but with the intent to improve the claim, be included as work done on the claim?

If the work thus done has direct relation to the claim, and be in a reasonable proximity to it, and for the benefit of it, it will be so counted. (12 Cal. 427.)

IX.

Can a stranger make a second location upon a claim already located by prior locator, in the absence of first locator, or when he is in possession?

When the first locator has had continuous possession of his claim, and has performed upon it annually the amount of work required by law, and his claim is otherwise valid, the claim is not open to re-location. (78 Cal. 544.) Only when a mining claim has been abandoned, is the ground open to location by any other qualified person (83 Cal. 187). But if the first locator fails to perform the amount of work required by law, the claim is then

subject to relocation, *and a peaceful entry* in good faith, may be made for that purpose, although the claim is occupied by the first locator. The right of the first locator to go ahead and perform the required amount of work after such failure, and retain the benefit of his location, is dependent upon the performance of the labor before the re-location. (65 Cal. 555.) If a mining district regulation provides that upon a failure to work and notice a claim, as required by the mining laws of the district, the claim shall be considered abandoned, then a failure to comply with such laws, is an abandonment of the claim, and it is then open to location as vacant ground. (46 Cal. 34.) But while possession alone, is not good as against one who has complied with the mining laws, it is good as against mere intruders who have not so complied. (73 Cal. 543.)

X.

When a mining location has become subject to relocation by the *laches,* or by the abandonment of the first locator, must he make a re-location, as in the first instance, in order to continue to hold the claim?

It is not necessary; resumption of work upon the claim is sufficient, provided no valid re-location by any other locator has intervened. But the courts will not uphold an attempt to assert a continuous right, by a pretense of work done, where the quantity of work done is in fact a mere pretense and sham (62 Cal. 163); and where the original locator resumes possession after such lapse, and commences to do the work required, a stranger cannot subsequently acquire any rights by going upon the claim, taking possession, and posting notices and doing work thereon. (75 Cal. 287.)

XI.

What constitutes *possession* of a mining claim?

Actual occupation of it, or appropriation of it in some mode which the law sanctions. When the *boundaries are distinctly marked* on the ground, the possession of the whole claim is embraced, though actual occupancy of only a part of it may be had, or the work may be only on a small part of it. But these boundaries must be indicated by such distinct physical marks or monuments as will fairly advertise to all concerned, just where, and what it is, and its full extent. If the boundaries are not so marked, then a stranger may enter and locate any part of the land not then in actual occupation of and being worked by the first locator. (30 Cal. 349.)

XII.

Where it is difficult to describe the starting point of a claim, in the notice to be posted, may the notice locate this point with reference to some other claim or mine?

The courts have held that such a reference is admissible, but the claimant may be obliged, in case of contest, to prove that such other claim or mine is a *well known* natural object or permanent monument. (83 Cal. 191.)

XIII.

May the owner of adjoining claims held in common, do the annual assessment work required for both claims, upon one of them?

Where the work done is clearly for the benefit of both claims, as in sinking a shaft on one claim, or be at a distance away, such as turning a stream of water for working the claims, or building a flume to carry it to the claims,

or building a road to reach them so they can be worked, such labor on one claim, or off it, will be considered as work done on all, or for the benefit of all. (83 Cal. 165.)

XIV.

In case a question arises as to whether the land on which a mining claim is located is, or is not, subject to homestead, what is the rule?

If the land is known to contain precious metals, but in quantities so small as not to justify the attempt to extract them, they are not properly mineral lands, and even if they might be mined at a very small profit, but are clearly of more value for agriculture than for mining, they are agricultural rather than mining lands, and as such may not be held under mining laws (81 Cal. 50.) But no land known at the time of sale by the government, to contain valuable mineral, can be obtained under the homestead laws of the United States. If the land *at the time of sale by the government was not known* to contain valuable mineral deposits, then the purchaser may not, after the patent has been issued, be disturbed by mining locators, in the case of discovery of such mineral, years after the patent has been granted. (81 Cal. 52.) This rule, however, has not been followed in the case of railroad grant lands, because in these cases the grant from Congress expressly reserved all mineral lands to the government, and such lands may be shown to be mineral in character, and open to mining location. (75 Cal. 194.)

XV.

When a location notice for a tunnel site has been made, but no vein has been discovered in the tunnel, may

a locator who subsequently locates a claim on the surface, hold such claim as against the tunnel locator, when the latter, after the surface location is made, discovers a vein that crosses into the lines of the surface claim?

No. The discovery of mineral in the tunnel, is like a discovery on the surface; until a vein is discovered in the tunnel there is no vein to locate, and no tunnel claim can be made until such vein is discovered, and the time to determine where and how the tunnel claim shall be located, arises only upon the discovery of such vein. When the vein is discovered in the tunnel, then the right to the vein *relates back to and dates from the location of the tunnel site;* the right of locating *the claim to the vein* arises upon its discovery in the tunnel, and it may be exercised by locating that claim the full length of 1500 feet on either side of the tunnel, or in such proportion thereof on either side of the tunnel, as the locator may desire. Such a discovery of mineral by the tunnel locator, is therefore superior to that of the surface locator, and cuts off his rights, even though patent has been obtained by him before the discovery of the vein in the tunnel. It is important to note that the tunnel locator need not indicate the particular 1500 feet of his claim when he locates the tunnel site. If he fails to do so, the line of the tunnel is not to be taken as dividing the extent of the vein and thus limiting him to 750 feet on either side of the tunnel; his right extends to the full 1500 feet on either side of the tunnel, if he so desires. (Sup. Court. U. S., August, 1897.)

XVI.

If the tunnel locator fails to mark on the ground his point of discovery, and boundaries on the tract claimed, does it destroy his right to veins he may discover in his tunnel?

No. If he has posted the proper notice at the mouth of the tunnel, and filed it in the office required by state, or mining districts, his failure to mark on the surface of the ground his point of discovery, and the boundaries of tract claimed, does not invalidate his tunnel location. (Sup. Court U. S., August, 1897.)

XVII.

Is it necessary in case of placer claims, to mark the boundaries on the ground, when the land has been surveyed, and the claim is for the whole of a legal subdivision of a section?

Yes, the law requires that the location must be distinctly marked on the ground, so that its boundaries can be distinctly traced, and a failure so to do, invalidates the claim. The law also provides that where such lands have been surveyed by the United States, the entry in *its exterior limits, shall conform* to the legal subdivision of the public lands. This provision only describes the places where claimant *shall run his lines,* but does not dispense with the other requirements *as to how those lines shall be marked, or evidenced on the ground.* (78 Cal. 595.) It is the only safe way, therefore, to distinctly mark the boundaries on the ground by proper monuments or posts, and also describe those boundaries in the notice posted, as well as to connect with, and make it conform to the surveys.

XVIII.

In case of placer claims, can the claim be legally taken before the discovery of valuable mineral in the land?

The Supreme Court of California, in one case, held that it might (73 Cal. 116); but such view has not been approved by other courts. Judge Ross of the United States Court recently held in what is called the "Scrippers' case," that there could be no valid placer petroleum mining location not based upon *an actual discovery* of oil within the boundaries of the claim, and that until such actual discovery of oil, the land was vacant and open to settlement; and the land was hence open to Scrippers under the Forest Lieu Land act. Therefore, no subsequent discovery of mineral (petroleum oil is so classed as among the mineral deposits) upon such land, could impair the title of the Scripper, nor alter the legal character of the land, which was fixed by known conditions at the date of the scripping.

XIX.

Oil Scripping.—Where mining locations have been made on land supposed to contain petroleum deposits, but which are as yet undiscovered, and such claimants are in possession of the claim and working the same for the discovery of such mineral deposit, may the owners of forest reserve scrip subsequently locate said scrip upon vacant government land which includes the mining claim so taken up, and hold said mining claim against the mining locator?

This question involves the claims recently made by the owners of such scrip to take up supposedly valuable petroleum government lands in Kern county, California, upon the ground that they had a right to float said scrip

upon any vacant government lands open to settlers, and that as they floated the scrip upon the land before the discovery of any valuable mineral in the land, their right of location under the scrip would attach and hold the land over any subsequent discovery of mineral thereon by the mining locator. A contest arose in the Land Office on the facts as to whether the land was vacant and open to settlement. The local land office took evidence as to the character and condition of the land, under these two conflicting claims, and the matter of determining the questions involved, coming on to be considered by the Commissioner of the General Land Office at Washington, on the facts as shown by affidavits filed by both claimants, that officer held, on December 18, 1900, that the facts showed that the land was held in good faith by the mineral claimants was conclusive. That good faith was not the case of the agricultural claimant, who evasively and fraudulently sought to acquire mineral lands under agricultural laws, the lands being admittedly mineral and not agricultural, and, therefore, not open to settlement as agricultural lands; that the forest lien land law of 1897 was not intended to be an instrument for the usurpation of property rights already belonging to others. Nor does it contemplate the seizure of private property held under statutory rights; nor can the lieu land selector lay claim to the land on the ground that the Land Office records do not show that any mining location claim existed against the land, and that the land was therefore vacant and open to settlement; that where a mining locator has made a mining location upon public land in conformity with law, and the local regulations of miners, he has a qualified title to the land, which may be

bought and sold as other property; that as he is not required by law to apply for a patent or pay for the use of the land, he is not required to notify the Land Office of his claim in order to give him a vested right to the land; and that the fact that these conditions are not of record in the Land Office did not affect the mining claimant's rights, as the agricultural claimant, is charged with the notice of mining locations; that by virtue of his mining location on the land, the mining claimant has thereby segregated it from the public domain, and has acquired an exclusive right, possession, and enjoyment of all the surface included within the lines of his claim; that the law devolves it upon the Land Department to determine whether a mining claim contains valuable minerals, and the local officers should have required the scrip claimant to give the mineral claimant notice of his proposed filing; and lastly, that the mineral claimant was on the land in personal occupancy, and under the color of right, and should have been allowed by the local land officers the opportunity to show that the land possessed mineral qualities, which on being made evident, his rights under his mineral claim would relate back to the date of his location of the claim.

It is important to bear in mind that the scrip claimant under the law of June 4, 1897, is only allowed to float his scrip upon vacant land open to settlement, and the Land Office is given by that law the jurisdiction to determine whether the land is so vacant or open to settlement. While therefore this decision is adverse to the attempt to locate lieu land scrip upon mineral lands, it does not in any way vary the general rule that mineral must be first discovered on the land to validate a mining claim. It, of course, re-

sults that the claimant must first sink his oil well and discover oil in paying quantities before he is entitled to locate his claim. But the bill prepared by the General Land Office and now pending in Congress, if passed, at the present session, will permit the mining claimant to mark out the boundaries of his claim on the ground, and then give him three months in which to begin work, and when oil is discovered, the claimant's rights relate back to the time he marked his boundaries on the ground.

XX.

Can an oil placer claim be taken before discovery of mineral?

Judge Ross recently held, in the case of the Nevada Sierra Oil Company vs. The Home Oil Company (98 Fed. Rep. 673), that while the law required the discovery of mineral on the claim before location, and oil seepages on the surface were no indication of the existence of oil in the land underneath, yet as between conflicting claimants, all of whom are mineral locators, the law should receive a liberal construction, and so as to protect bona fide locators, who really made a discovery of mineral; and so, if a locator *actually finds petroleum upon the land, or upon the ground, and so situated as to constitute a part of it, it is a sufficient discovery* within the meaning of the statute to justify a location under the law, without waiting to ascertain by exploration whether the ground contains the mineral *in sufficient quantities to pay.* This is a modification of the rule which has heretofore been adopted that the mineral discovered should be on the land *in sufficient quantities to pay,* and the court extends the principle to lode claims as well as placer oil claims.

XXI.

When a placer oil mining claimant is in prior possession under his mining claim, has the scripper the right to come upon the land and forcibly attempt to take the possession away from the prior claimant, and to exclude him therefrom?

The courts have held that if a man has a right to enter upon public lands to explore for mines, then he may make a location; but if he has not that right of entry in the first place, then his entry amounts to nothing (40 Fed Rep. 618); and if the patent has not passed, the miner has a right to enter upon public land for the purpose of mining (15 Cal. 100), and he may enter upon public lands, even when occupied by settlers for grazing or agricultural purposes, when the land is actually mineral (22 Cal. 453); but a person in actual possession of a mining claim may not be invaded by another on the pretext that the former has neglected to perform the requisite amount of work, or has failed in some other respect to comply with the law (38 Cal. 367); mining claims are not open to relocation until the rights of a former locator have come to an end. A relocator cannot avail himself of mineral in the public lands which another has discovered, until the discoverer has in law abandoned his claim and left the property open for another to take up; hence, a relocation on lands actually covered at the time by another valid and subsisting location, is void absolutely (73 Cal. 24); a party in the prior possession of a mining claim is entitled to the possession as against a mere intruder, even without compliance with the mining law on his part; but such possession is not good

as against one who has complied with the mining laws (73 Cal. 543); a person cannot enter upon the mining claim in the possession of another, except under claim or color of right, peaceably, and in good faith, and believing himself to be rightfully entitled to enter upon the claim; he cannot enter forcibly, and by committing a breach of the peace, or for the purpose of obtaining title or color of right; he must have it before he enters (55 Cal. 147).

Such is the rule applying to trespassing upon the mining claim of one rightfully in possession of lode and placer claims generally; but touching the right of scrippers to enter upon a locator of an oil claim, Judge Ross has in a recent decision by him, stated: "It is, to say the least, doubtful if persons authorized to select vacant land only, are authorized to select lands *in the actual bona fide occupancy of others,* under the settlement laws or under a mining location, even though in the case of the latter the location be invalid by reason of the absence of a valid discovery of mineral; but they are certainly not authorized to affect such selection by any sort of fraud or circumlocation;" and in another case, also recently decided by the same judge, the court says (98 Fed. Rep. 673): "It is true that upon mineral land of the United States upon which there is no valid existing location, any competent locator may enter, even if it is in the actual possession of another, *provided he can do so peaceably and in good faith,* in order to initiate a location for himself; but no right upon any government land, whether mineral or agricultural, *which is in the actual possession of another,* can be initiated by a forcible, fraudulent, surreptitious or clandestine entry thereon."

The courts will, therefore, enjoin by injunction, any forcible entry or trespass upon the possession of the claimant of such oil placer claims, and oblige the scripper to follow the course pointed out by the United States Land Department, in proving his right to select such land as vacant and open to settlement.

It has been advised by government officials that as soon as a second, or lieu land filing, or agricultural filing, is made by scrip or otherwise, covering the same land as is occupied by the oil claimant, that the mineral oil locator immediately file with the local Land Office, affidavits showing that the claim is more valuable for mineral than for agricultural purposes, and also evidence going to show the fraudulent filing upon the claim by those other than the mineral claimant, and giving the description of the claim by township, range and division of the section whereon the claim is located, and in such case the Land Office will see that the rights of all parties will be thoroughly investigated and protected.

The Supreme Court of the United States (See 160 U. S. Rep. 303) held that two locations made by the same person upon the same lode, upon the same day, was valid; and the attempted location thereof by other persons on the supposition that the locator could make but one valid claim, was a nullity. This settles the right of the locator to follow up the lode, and take as many successive locations of 1500 feet each as he deems necessary to cover the entire mineral deposit he may find in the ledge he uncovers. It also establishes the miner's right to take as many successive placer oil locations, of twenty acres each, as he may deem advisable, to cover the field of deposit.

XXII.

Does the taking and operation of oil claims on the public lands of the United States come under what is called the placer mining law?

Yes; oil is classed as a mineral deposit, and all rights to mine for petroleum are identical with rights to mine for placer deposits of gold, and are governed by the general mining laws regulating all placer deposits.

XXIII.

Can a mining claim be taken up upon ocean beach lands under United States mining laws?

No. The courts hold that the title to the bed of the ocean is in the state, which represents the sovereign power (52 Cal. 397). In a recent case decided by the Superior Court of Santa Barbara county, the court held that land situated below ordinary high water mark, in the absence of sovereign grant from the state, were not subject to private ownership. The title belonged to the state, subject to the right in the United States Government to regulate commerce and navigation, and without a grant from the state, there can be no exclusive right of possession in any one in or to tide lands. Therefore, possession of any part of such lands must be presumed to be a common possession to all the people of the state, in the absence of any grant or license from the state and general government. In this case the court refused to restrain by injunction the Ocean Beach miners from sinking an oil well below high water, as petitioned for by the owners of the abutting land, who claimed that their lands were being drained of their oil deposits. While this decides one point

in ocean beach mining, another point is yet to be decided, viz: Can such abutting landowner restrain the erection of derricks, wharves and other erections, in front of his property, when built on tide land below high water mark? The court has held that such owner cannot maintain ejectment to remove a wharf extending below low water mark into the ocean (52 Cal. 398), and it would seem from this decision that the abutting landowner cannot interfere with any obstructions below such water line.

It results, therefore, that, as the state by virtue of its sovereignty, controls the tide lands, that the United States mining laws are inoperative thereon, and that no mineral rights to the oil therein can be acquired under the mining laws of the United States; that all such claims are null and void; and that the only legal method of acquiring a right to sink and operate oil wells thereon, is, firstly, by license from the state to extract the oil from the state lands; and, secondly, by permit or license from the United States Government to erect a wharf, or other structure, and sink wells under the navigable waters of the ocean. This latter is necessary because the United States Government has control of the navigable waters of the United States, and no obstruction to navigation may be first erected without such permit. The application, therefore, is made to the Secretary of War, who refers the same to the chief of the Engineer Corps, by whom it is referred to the local officer of said corps in Los Angeles, Captain J. J. Meyler, office in the Byrne Block, for his recommendation and approval. This is seldom refused. The permit from the state is not always sought, but is necessary in order to obtain an undisputed

right to extract the oil from the ocean bed. Such lands are not included in the class that the state is permitted to sell (Secs. 3440 and 3443 Pol. Code, and notes thereto in Deering's Codes); so ownership thereof cannot be had. As the law is indefinite as to the officer who possesses the power to issue such state permit, the enquirer is referred for further information on this point to the State Surveyor General and the State Attorney General.

XXIV.

Is there any advantage to the stockholders of a mining corporation which proposes to do business in California, to incorporate under the laws of Arizona?

None whatever. Such corporations have been formed on the supposition that the stockholders would escape the liability for the debts of the corporation that is imposed upon California corporations. But this is a mistake. No foreign corporation can do business in this state on more favorable conditons than the local corporations (Constitution Cal. Art. 12, Sec. 15), and the stockholders of all corporations foreign and domestic, are liable in the same manner for the debts of the corporation (Art. 12, Sec. 3 of same). It ought to be regarded as an evidence of intent to swindle on the part of any incorporators who organize a foreign corporation and officer it from, and with the purpose of doing its business in, this state. Have no dealings with such a corporation, should be the motto of every mining man.

XXV.

Where a claim is held by several parties jointly, can one of such persons sell and convey away the rights of his copartners without their joining in the sale; and in

case of a sale of a mining interest, must it be in writing?

No, one joint owner of a mine cannot convey the interest of another, without a power of attorney so to do (Sec. 2519 Civil Code of Cal.); and when one partner so conveys his interest in the mine, he ceases to be a partner, without dissolving the copartnership, while the new purchaser becomes a member of the copartnership in turn, by reason of such purchase (Sec. 2516 C. C.) Yes, a transfer of an interest in a mine must be in writing, under Sec. 1091 of the C. C., as held by the court in 51 Cal. 260. The transfer should also be acknowledged before a notary public or other officer so authorized.

XXVI.

Has one the right to enter upon and locate a mining claim upon lands included in the limits of what are commonly called Mexican grant lands?

No; the minerals in such lands never were granted by the Mexican Government in making grants of lands; they therefore passed over from the Mexican Government to the United States at the time of the passing of such lands to the United States. When the United States, however, by its patent conveyed these lands, in pursuance of decree of the court confirming such Mexican grants, the patent conveyed the entire title of the government to these lands, and everything contained upon or in such lands, unless the patent expressly reserved the minerals. The patents, however, made no such reservation of such minerals to the government, and hence the government after the issuance of the patent had no longer any control over such minerals. Whenever the government has claimed the min-

erals, it has been as part of the lands in which they were contained, and whenever the government has reserved the minerals from sale or other dispositon, it has only been by reserving the lands themselves. It follows, therefore, that such minerals found on Mexican grant lands is the absolute property of the owners of such lands, and no intruder may acquire any right to locate a mining claim thereon, or extract mineral therefrom, except upon license from the owner in fee thereof (17 Cal. 223-226).

XXVII.

Can claim be located on railroad grant land?

In case reported in 154 U. S. Rep. 288 (1894), the Supreme Court of the United States decided that grants of lands to railroads uniformly excluded the mineral contained therein, except iron and coal; that it was the intention of Congress to exclude from these grants actual mineral lands, whether known or unknown, and not merely such as were known at the time to be mineral; that in no instance has such a grant been held to pass the minerals, and that no act of Congress should be construed to give them any; that in all cases they shall be and are reserved exclusively to the United States, unless otherwise specially provided in the act or acts making the grant (which was not the case in any of the Pacific Railroad grants).

This decision applies to all cases where the lands have not been patented, for after the patent has passed, the government has parted with all its right, title and interest in the lands, the same as a private owner. Under this decision it was held that the Secretary of the Interior might determine whether the lands selected by the railroad company under its grant were or were not mineral in char-

acter, and upon his so certifying that they were not mineral, the patent issued; that after the patent issued, the land as ithout his jurisdiction, and no furwther hearing upon the character of the land could be had.

Pursuant to said decision, the Secretary of the Interior adopted rules for determining whether the lands so selected and listed by the railroad company are mineral or otherwise, and for opening such lists to the public for inspection, and for receiving protests or contests from mining locators, and for granting hearings thereon, whether the land is more valuable for mineral than for agricultural purposes.

After such investigation and on being satisfied that the lands so selected and listed by the railroad company are not mineral in character, the Secretary of the Interior causes the patent to be issued to the railroad company, and then the railroad's title to the land, and also to all the mineral it may be afterwards found to contain, is confirmed. Where the patent has been issued to the railroad company, such lands are no longer open to location by the mineral claimants, nor to contest in the court, and the only way title to such minerals can be acquired, is by purchase of such lands from the railroad company direct.

IV.

THE DESERT LAND LAW.

DESERT LANDS.

All lands, exclusive of timber lands, and mineral lands, which will not, without artificial irrigation, produce some agricultural crops, shall be deemed desert lands.

NOT DESERT LANDS.

Lands bordering upon streams, lakes, or other natural bodies of water, or through or upon which there is any river, stream, arroyo, lake, pond, body of water, or living spring, are not subject to entry under the desert land law until the clearest proof of their desert character is furnished.

Lands that produce native grasses sufficient in quantity, if unfed by grazing animals, to make an ordinary crop of hay in usual seasons, are not desert lands.

Lands which produce an agricultural crop of any kind in amount to make the cultivation reasonably remunerative are not desert.

Lands containing sufficient moisture to produce a natural growth of trees are not to be classed as desert lands.

FILING A MAP.

The party making entry is required at the time of filing the declaration to file also a map of the land, which shall exhibit a plan showing the mode of contemplated irrigation, and which plan shall be sufficient to thoroughly irrigate and reclaim said land and prepare it to raise ordinary agricultural crops, and shall also show the source of the water to be used for irrigation and reclamation.

AN IRRIGATION COMPANY.

Provision is made that persons may associate together in the construction of canals and ditches for irrigating and reclaiming tracts entered or proposed to be entered by them, and they may file a joint map or maps showing their plan of internal improvements.

NECESSARY EXPENDITURES.

It is required that the entryman shall expend for the purpose of the statute, at least $3 per acre—$1 per acre during each year for three years—and shall file proof thereof during each year such proofs to consist of his affidavit, corroborated by the affidavits of two or more witnesses, showing that the full sum of $1 per acre has been expended during such year and the manner in which expended, and at the expiration of the third year a map or plan showing the character and extent of improvements; that failure to file the required proof during any year shall cause the land to revert to the United States, the money paid to be forfeited, and the entry to be cancelled.

RESIDENTS OF THIS STATE.

The right to make desert-land entry is restricted to resident citizens of the State or Territory in which the land sought is located, whose citizenship and residence must be duly shown.

LIMITED TO 320 ACRES.

No person could be permitted to enter more than 320 acres in the aggregate under all the land laws, which is construed not to include the amount of mineral lands entered in the prescribed maximum. Parties initiating claims are required to make affidavit to show observance of such inhibition.

No person is entitled to hold under assignment or otherwise, prior to the patent, more than 32 acres entered as desert land.

FILINGS MAY BE ASSIGNED.

Assignees must properly prove their assignments by filing in the local office an affidavit and a certified copy

of the instrument under which they claim, and must make affidavit of the amount of land held.

Under the act of March 3, 1877, it is held that desert land entries were not assignable, and that the transfer of such entries, whether by deed, contract or agreemnt, vitiated the entry. This is changed by the seventh section of the Act of March 3, 1877, as amended by the Act of March 3, 1891, which recognizes assignments after entry and before patent; but an entry made in the interest or for the benefit of any other person, firm or corporation, or with the intent that the title shall be conveyed to any other person, firm or corporation, is illegal.

PRICE OF LAND.

It is now held that the price of lands sought to be entered is to be $1.25 per acre, without r l to the situation of such land in relation to railroad nts.

NECESSARY DECLARATION.

A party desiring to avail himself of the privileges of the desert-land act must file with the register and receiver of the proper district land office a declaration, under oath, showing that the applicant is a citizen of the United States, or has declared his intention to become such, and a resident of the State or Territory in which the land sought is located. It must also be set up that the applicant has not previously exercised the right of entry under the provisions of this act, and that he intends to reclaim the tract of land applied for by conducting water thereon within four years from date of his declaration. The declaration must also contain a description of the land applied for. by legal subdivision.

PERSONAL KNOWLEDGE OF LAND.

Attention is called to the terms of this declaration which are such as require a personal knowledge by the entrymen of the lands intended to be entered. The required affidavit cannot be made by an agent nor upon information and belief, and the register and receiver must reject all applications in which it does not appear that the entryman made the averments contained in the sworn declaration upon his own knowledge derived from a personal examination of the lands. The blanks in the declaration must be filled in with a full statement of the facts of his acquaintance with the land and how he knows its character as alleged. Said declaration must be corroborated by the affidavits of two reputable witnesses who are acquainted with the land and with the applicant, and who must clearly state their acquaintance with the premises, and the facts as to the condition and situation of the lands upon which they base their judgment.

RESIDENCE AND POSTOFFICE ADDRESS.

Applicants and witnesses must in all cases state their places of actual residence, their business or occupations, and their postoffice addresses. It is not sufficient to name the county and State or Territory where a party lives, but the town or city must be named, and if a residence in a city the street and number must be given.

WATER FOR ENTIRE TRACT.

Persons making desert-land entries must acquire a clear right to the use of sufficient water for the purpose of irrigating the whole of the land, and of keeping it permanently irrigated. A person who makes a desert-land entry

before he has secured a water right does so at his own risk; and as one entry exhausts his right of entry, and such right cannot be restored or again exercised because of failure to obtain water to irrigate the land selected by him.

(Note—It will thus be seen that a person who files on 320 acres of land and only secures a water right for a portion of the tract cannot prove up on any of it, and must lose the whole in consequence thereof.

MAY PROVE UP.

At any time after filing the declaration and within the period of four years thereafter, upon making satisfactory proof of the reclamation and cultivation of the land according to the legal requirements, and that he or she is a citizen of the United States, and upon payment in full therefor, a patent shall issue for the land to the applicant or his assigns.

SOURCE OF WATER SUPPLY.

The source and volume of the water supply, how acquired, and how maintained, the carrying capacity of the ditches, and the number and length of all ditches on each legal subdivision of the land, must be specifically shown. Applicants and witnesses must each state in full what has been done in the matter of reclamation and improvement, and by whom, and must each answer fully and of his own personal knowledge the questions propounded in the final proof depositions. They must state specifically whether they at any time saw the land effectually irrigated, for without knowledge thus derived, the fact of reclamation remains a matter of conjecture.

ENTIRE TRACT TO BE IRRIGATED.

The whole tract and each legal subdivision if surveyed, for which proof is offered, must be actually irrigated. If there are some high points or uneven surfaces which are practically not susceptible of irrigation, the nature, extent and area of such spots must be fully stated. In this connection, the right to the water used, the quantity of it, the manner of its distribution, and the permanence of the supply are all to be taken into consideration.

NOTICE OF FINAL PROOF.

Before final proof shall hereafter be submitted by any person claiming to enter lands under the desert-land act, such person will be required to file a notice of intention to make such proof, which shall be published in the same manner as required in homestead and pre-emption cases.

MAY BE CONTESTED.

Contests may be instituted against desert-land entries for illegality or fraud in the inception of the entry, or failure to comply with the law after entry, or for any sufficient cause affecting the legality or validity of the claim. In case of successful contests, the entry shall be cancelled and the lands and money paid therefor shall be forfeited to the United States, and contestants will be allowed a preference right of entry for thirty days after notice of the cancellation of the contested entry, in the same manner as in homestead and pre-emption cases, and the register will give the same notice and be entitled to the same fee for notice as in other cases.

Fairbanks, Morse & Co.

Gasoline and Distillate Engines,

Combined Gasoline Engines and Gasoline Hoists,

Combined Gasoline Engines and Compressors,

Combined Gasoline Engines and Pumpers,

Pumping Machinery of all descriptions.

Fairbanks' Standard Scales

Mining Machinery, Ore Cars, Ore Buckets, Wire Rope, Etc.

136 and 138 South Los Angeles Street,

LOS ANGELES, CAL.

California Agency for

DENT'S Celebrated

DOG REMEDIES

Send for Free Book on Dogs.....

GUNS, RIFLES

and

REVOLVERS

of all Descriptions

FINE GUNSMITHING OUR SPECIALTY

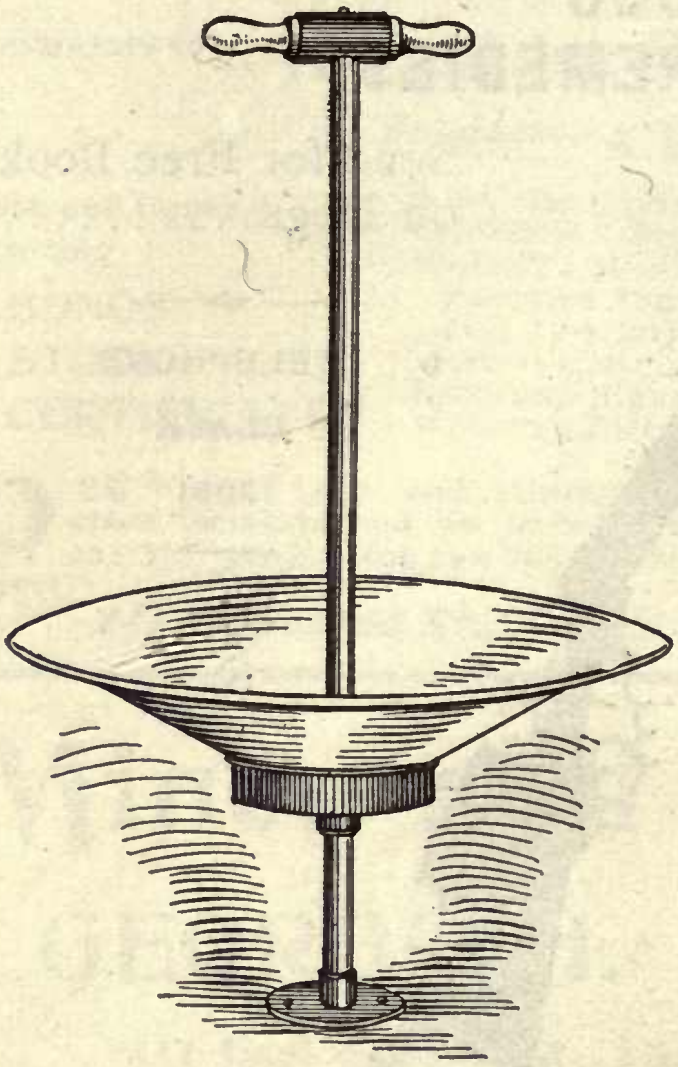
TELEPHONE BLACK 3031

Southern California Arms Co.

JOS. SINGER, Prop.

113 West First Street, - - Los Angeles, Cal.

Little Alaska Gold Washer



The "Little Alaska" is without a rival as a gold washer. Its small size (weight 7½ lbs), durability and efficiency, make it the ideal gold washer for the miner and prospector. It is made of heavy Iron and galvanized pipe, and has a cast iron cup at the bottom, into which the gold is precipitated by gravity and centrifugal motion. The method of working is, to place the basin of the washer about two inches below the surface of the water in a tub, tank, or bed of a stream. The dirt is shoveled directly into the basin without screening, then the upright handle of the machine is given a few turns back and forth to precipitate the gold. A long turn in one direction instantly causes the refuse or tailings to leave the basin. The operator works in an upright position without wetting his hands.

It will extract and save all the gold from pure black sand. It handles about thirty times as much material as the rocker or pan, and requires less than one fiftieth of the water.

LITTLE ALASKA GOLD WASHER Co.

(Incorporated)

Office 3rd Floor Cal. Bank Bldg., Los Angeles, Cal.

Pacific Coast Underwriting Comp'y

INCORPORATED

Main Offices, 507-508-509 Parrot Building,
SAN FRANCISCO

BRANCH OFFICES,

334 Wilcox Building, Tel. Black 1492, Los Angeles.
Seattle, Washington, L. C. Dillman.
134 Van Buren St., Chicago, R. Ruxton.
London, England, Chas. F. Pierce.

Companies incorporated, bonds furnished to guarantee oil, mining and manufacturing stocks. Oil lands; mining properties for sale.

H. T. HAZARD G. E. HARPHAM

PATENT ATTORNEYS

And Solicitors of Patents,
Trademarks and Copyrights

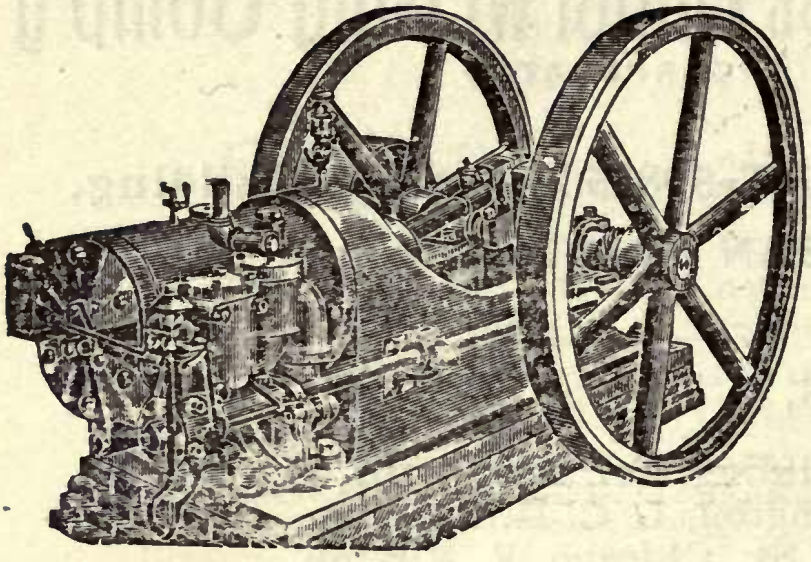
Oldest American and Foreign Patent Agency in Southern California

HAZARD & HARPHAM

Los Angeles, Cal.

7 Downey Block **Telephone James 2761**

Established in 1878 by Hazard. Associated Agents throughout the world. Most complete Patent Library on the Coast, outside of San Francisco. No charge to consult our library. A patent to be valuable, must stand the test of litigation, and should be prepared by attorneys familiar with the practice and rulings of the Courts on Patents. We have had more than 25 years practice in patent and other litigation.



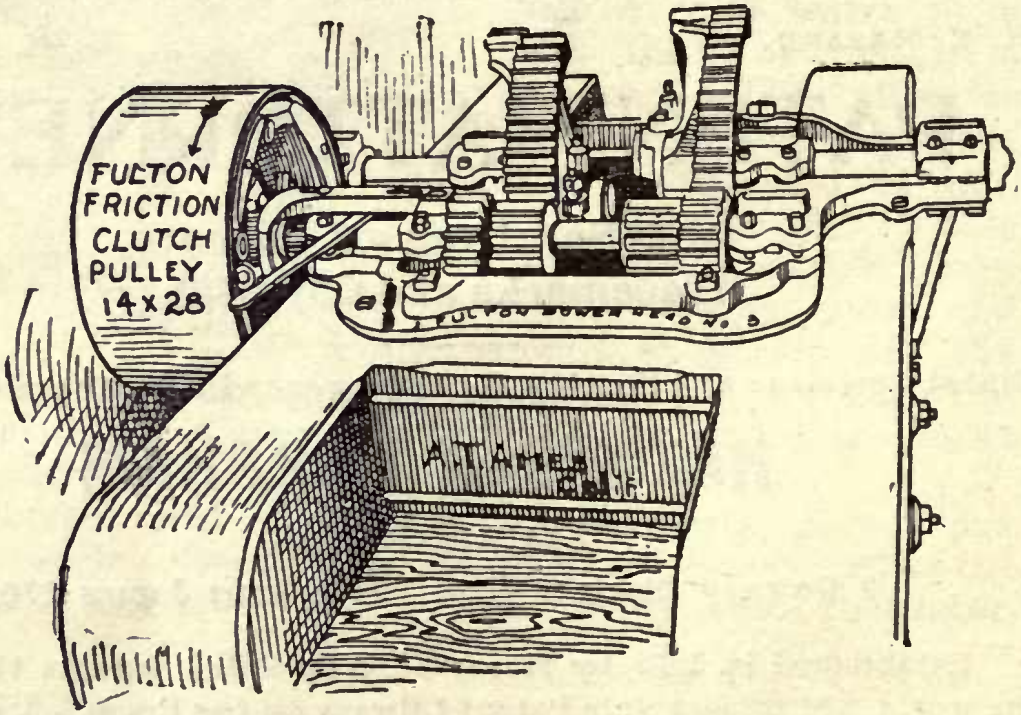
Lambert

Gasoline and Distillate Geared.... Hoisting Engine..

S. J. SMITH,

228 and 230 E. 4th St.
Los Angeles, Cal.

Catalogues for the asking
They will interest you



Ames' Deep Lift Pumps

CHAS. WELLBORN

ATTORNEY-AT-LAW

ROOMS 424, 425 AND 426
DOUGLAS BLOCK

LOS ANGELES. CAL.

WILL PRACTICE IN ALL THE COURTS

☞ Careful Attention to Mining Cases and General Law Practice.

NOTICE

We are pleased to recommend the firms &c. dealing in Mining Machinery, Supplies &c. who have honored us with their advertisements, as strictly first-class; and request that any one dealing with them through the instrumentality of this work would mention the fact.

Price of this Paper Bound Edition, 75c.

WADE & WADE.