Catalogue No. 4.

# Union Iron Works.

# ...THE UNION...

IMPROVED

# ORE CONCENTRATOR.



OFFICE, – – – 222 MARKET STREET,

MAIN WORKS, – – – – POTRERO,

CITY WORKS, – 225 AND 227 FIRST STREET,

CABLE ADDRESS, "UNION,"

P. O. BOX 2128,

SAN FRANCISCO, CAL.

H. S. CROCKER COMPANY, PRINTERS, S. F.

# NOTICE.

THIS MACHINE is the result of twenty years practical experience in concentrating machinery, and the valuable features embodied therein are covered by

**U. S. Letters Patent No. 313,481 March 10, 1885,**
**U. S. Letters Patent No. 556,089 March 10, 1896,**
**and patents pending.**

Infringements will be prosecuted to the full extent of the law.



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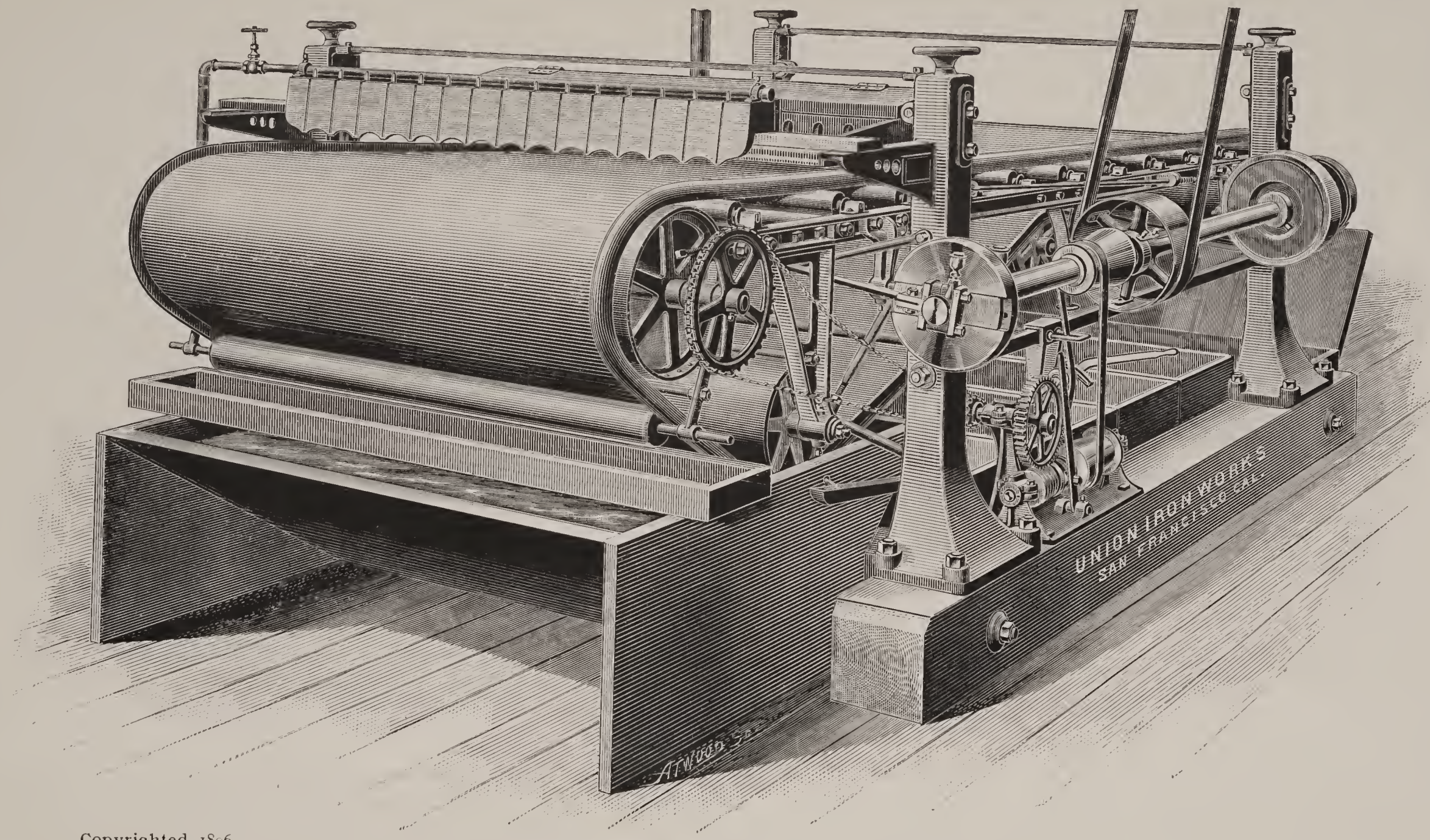





# UNION ORE CONCENTRATOR

WITH SULPHURET DISCHARGE.

[PATENTED]

# Union Ore Concentrator.

On the opposite page we illustrate a Union Ore Concentrator, set up in complete running order. The type of machine here shown is so well and generally known that a lengthy description is not necessary.

The machine consists of an inclined shaking frame or table, suspended by hangers or links from the four iron posts or columns shown. A side shake or lateral motion is imparted to the frame by means of steel connecting rods, attached to adjustable cranks, keyed to main driving shaft.

Upon the shaking frame is mounted or stretched an endless rubber belt, with raised or flanged edges, forming the bed or plane upon which the dressing of the ore is effected.

This belt or bed is caused to travel continuously up hill by rotating the head roll or drum, the power for which is transmitted by means of a link-chain belt and sprocket wheels, driven from the worm and gear shown.

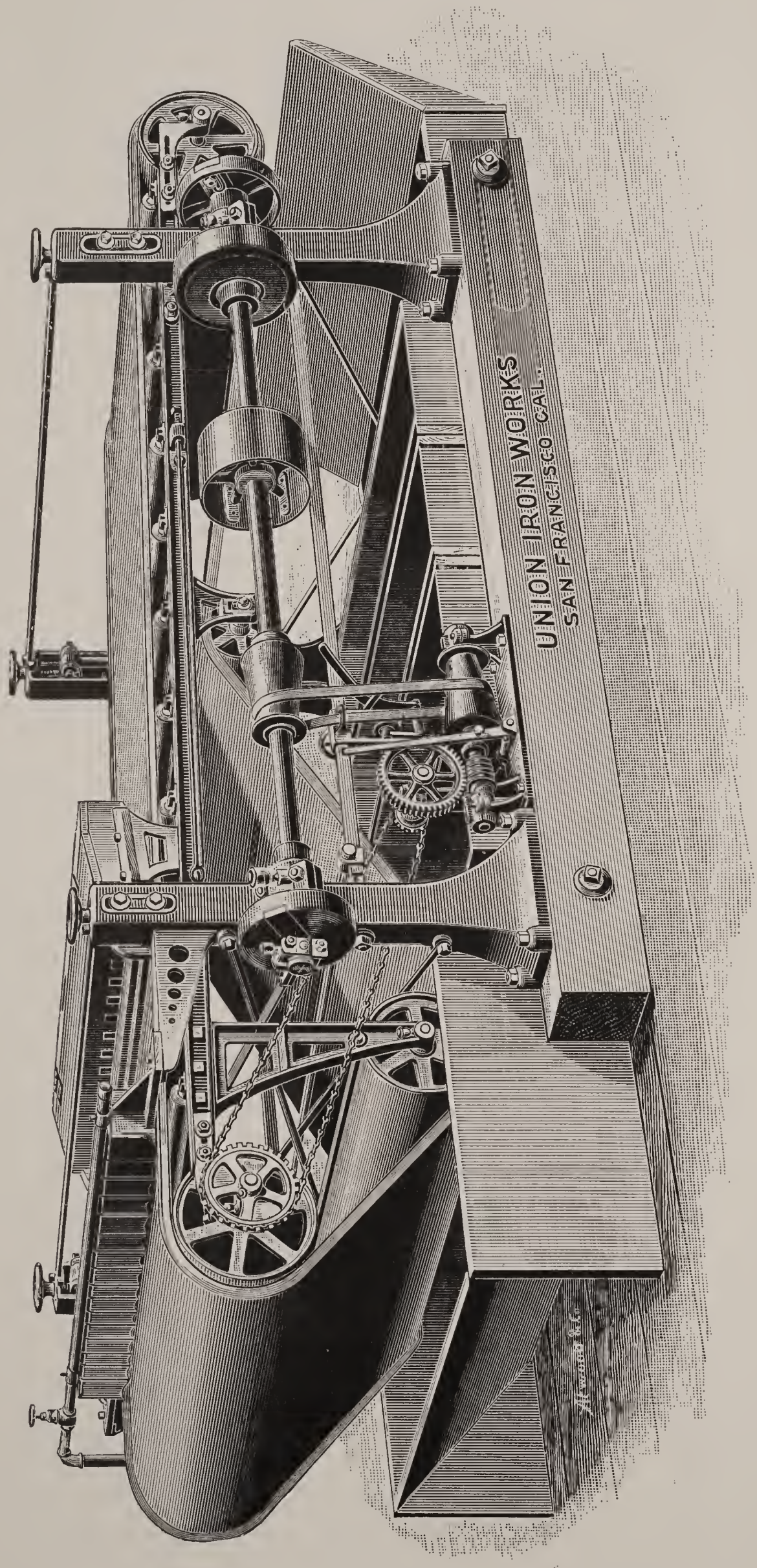
The travel of the belt is under full control, and can be regulated to any speed required.

The operation of the machine is as follows: The pulp or crushed ore from the battery is conveyed to the distributor located on top of the shaking frame above the belt. This distributor spreads the pulp evenly over the surface of the bed or belt, which is moving continuously up hill or toward the head of the machine.

The side shake or lateral motion given the bed causes the sulphurets and valuable metallic portions of the ore to settle and lay upon the surface of the belt, and, as they pass up hill or toward the head of the machine, they come under the water box, delivering clear water in fine streams upon the belt; and, as the pulp passes through these streams, the worthless or lighter portion of the ore is "winnowed" out or washed from the valuable portions, and passes down the belt into the tailing sluice.

The valuable portions of the ore, which still adhere to the belt, pass on over the head roll until they come in contact with the small wooden automatic discharge roller shown. Here the moisture, still clinging to the belt, forms a water cushion, which causes the concentrates to leave the belt and deposit themselves in the small box resting upon the water tank, into which the belt is depressed for the purpose of washing off any fine sulphurets that may have escaped the automatic discharge.

When the small box is filled with sulphurets, it is removed and another substituted, thus making the process of concentration continuous and automatic.




# UNION ORE CONCENTRATOR

WITHOUT SULPHURET DISCHARGE.

[PATENTED]

# Union Ore Concentrator.

No process connected with the reduction and treatment of ores commands as much attention as that of concentration. As is well known the ores in many of our most prominent mines carry their value largely in the sulphurets, and when large quantities of ores are being milled close and economical concentration is a matter of the greatest importance, and the production of a simple and efficient automatic concentrating machine, capable of being adapted to the varying conditions and character of ores, has cost many thousands of dollars in experiments, extending over a wide field of practice.

The Union Ore Concentrator, which we illustrate herewith, is the latest and most improved machine of this class now made. In it are embodied all that twenty years of practical experience with concentrating machinery has demonstrated as valuable, and we believe we are justified in offering it to the mining public as the best concentrator now made.

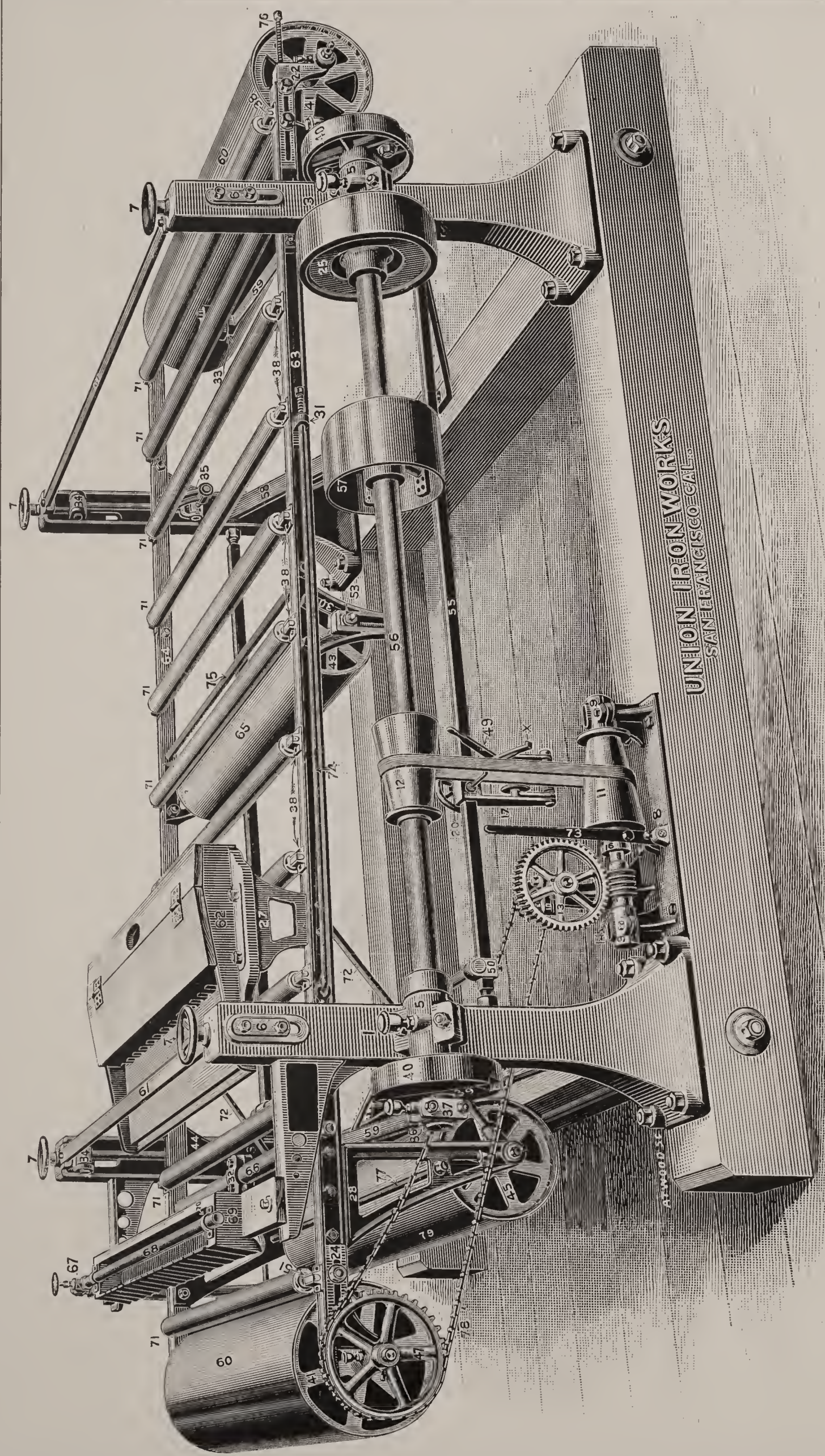
No radical innovations have been introduced into this machine. It is of the well-known Vanner type, with an endless traveling rubber belt, having a side shake or lateral motion. It possesses, however, means of adjustment that render the machine capable of being adapted to any character or condition of ores, a feature fully appreciated by those familiar with machines of this class. It is simple, durable and efficient, constructed entirely of iron and brass, and is complete and ready for erection as it leaves our works.

On the following pages will be found a more complete and detailed description of this machine.

Respectfully,

UNION IRON WORKS,

San Francisco, Cal.




UNION ORE CONCENTRATOR (Without Belt).

[PATENTED]

# Union Ore Concentrator Construction.

The engraving on the opposite page illustrates the Union Ore Concentrator without the belt. The engraving is so complete in detail that it is unnecessary to describe more than special points of construction.

Fig. 1 shows one of the iron posts or columns in section, illustrating the method of hanging or supporting the shaking frame or table. To the sliding block, located in top of column, the shaking frame is pivoted by means of link, 34. By raising or lowering this block, the inclination or level of the table can be changed. This adjustment is made by loosening the clamp, 6, and turning the screw, 7. This valuable feature is possessed by no other machine of this class.

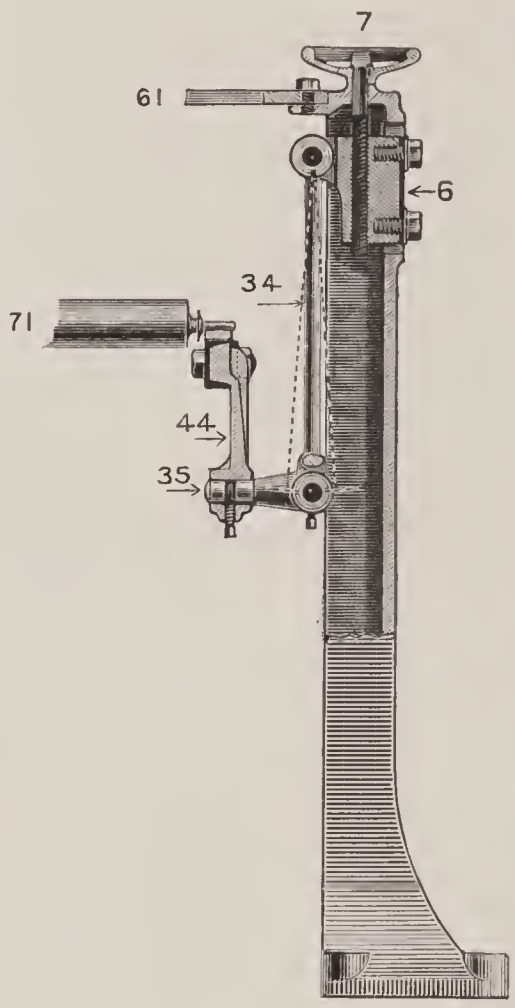



Fig. 1.

Fig. 2 illustrates the method of supporting and carrying the main rolls. The hanger, 22, is securely bolted to the channel iron, 63, forming the sides of the shaking frame. This hanger is provided with slots, which admit of the rolls being screwed forward, thus taking up the stretch of belt when required. The rolls are journaled in brass bushing, 82, fitted with set screw to take up all lost motion, thus preventing undue vibration. All journals of the machine are constructed in this manner, admitting of their being replaced, when worn, at small expense.

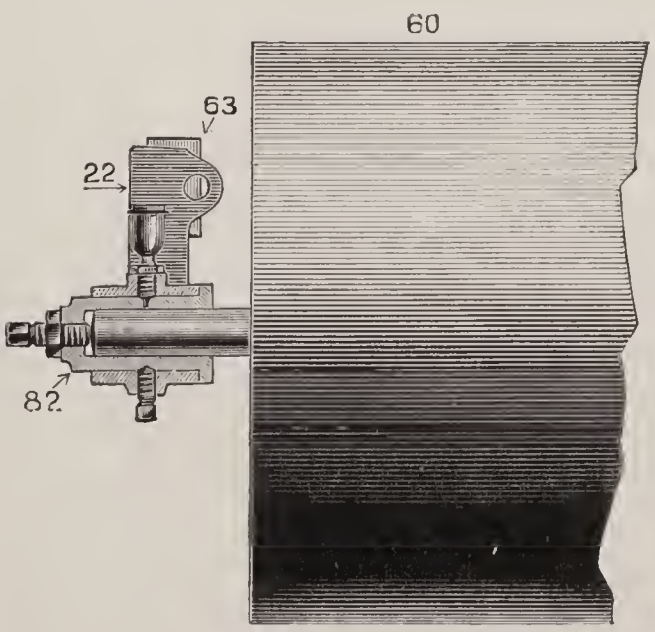



Fig. 2.

# Union Ore Concentrator Construction.

(*Continued.*)

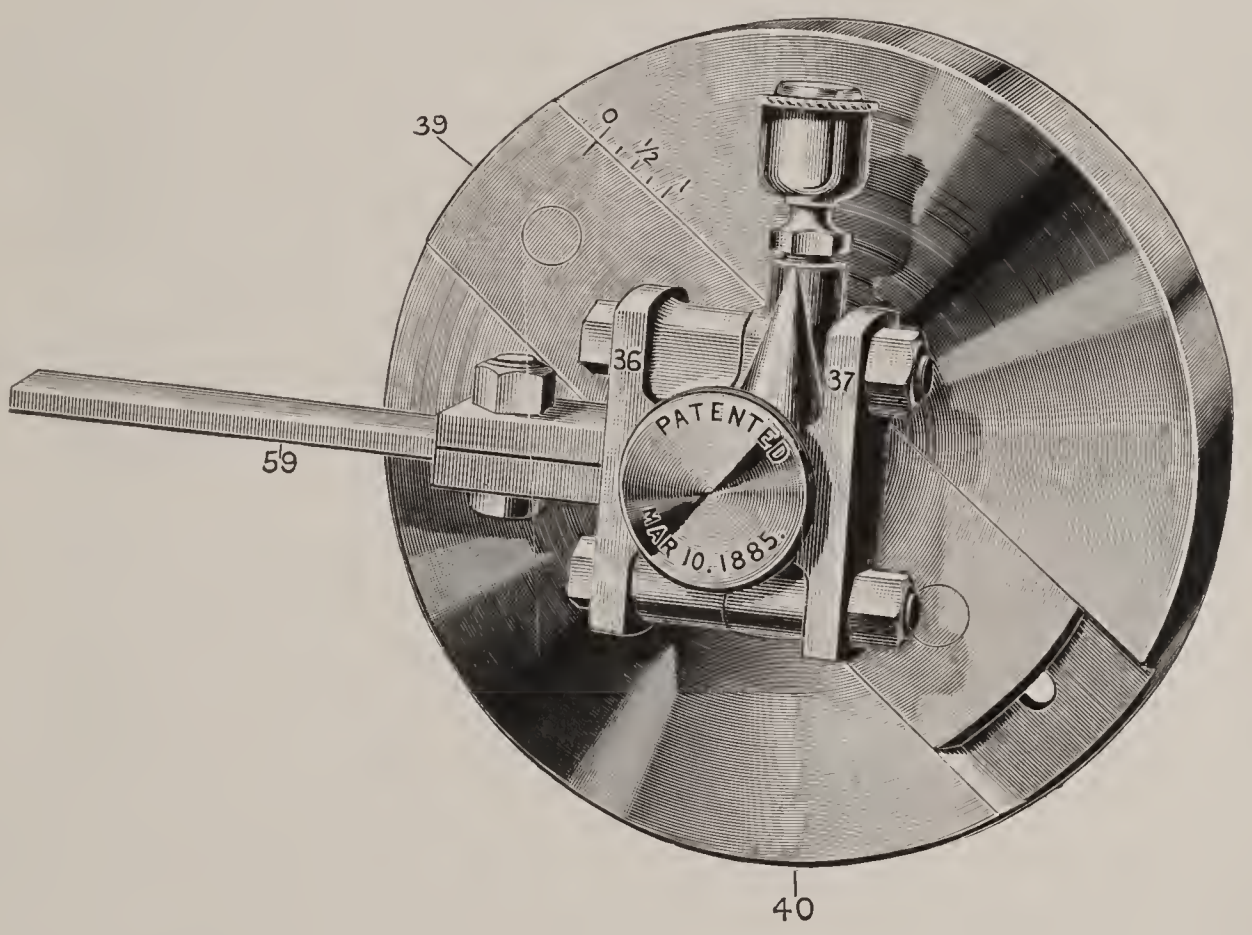



Fig. 3.

Fig. 3 illustrates the adjustable crank, which imparts motion to the shaking frame or table. The disc, 40, is keyed to the driving shaft, in the face of which is a slot. In this slot the sliding crank pin, 39, is secured, by means of two bolts or studs, passing throughout the disk. By moving this sliding crank pin in or out from the center, the shaking frame can be given any throw or travel desired. This adjustment in combination with that shown in Fig. 1 renders it possible to adapt the machine to any class or grade of ore required, which is not possible in other machines of this class.

# Union Ore Concentrator Construction.

*(Continued.)*

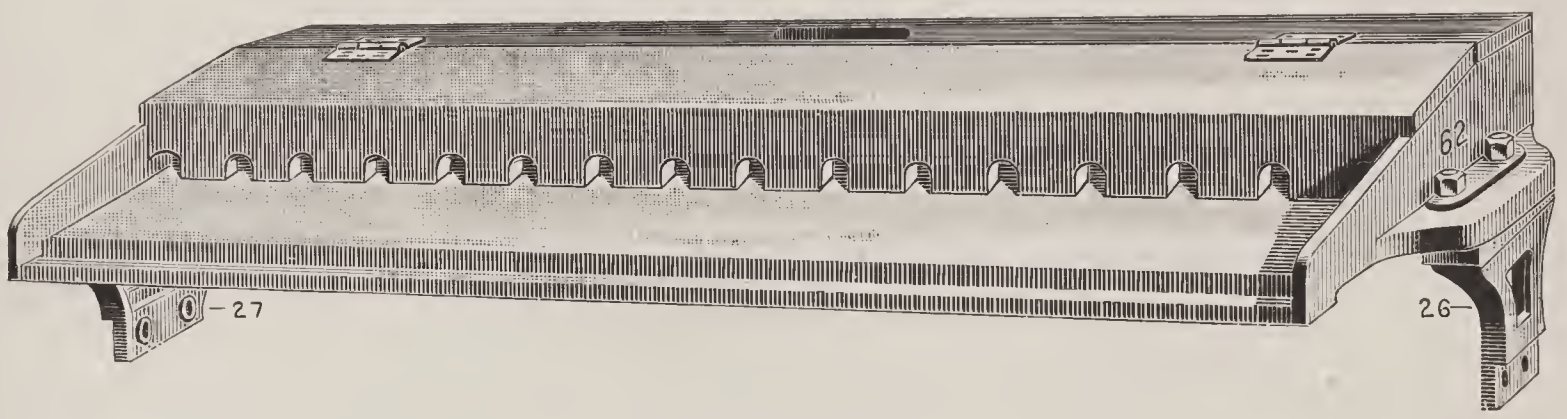



Fig. 4.

Figs. 4 and 5 illustrate the pulp distributor, which is carried by the shaking frame and is located under the head of the machine above the belt; into this distributor the crushed ore is introduced by means of a pipe or sluice and evenly spread or distributed over the belt or bed of the machine.

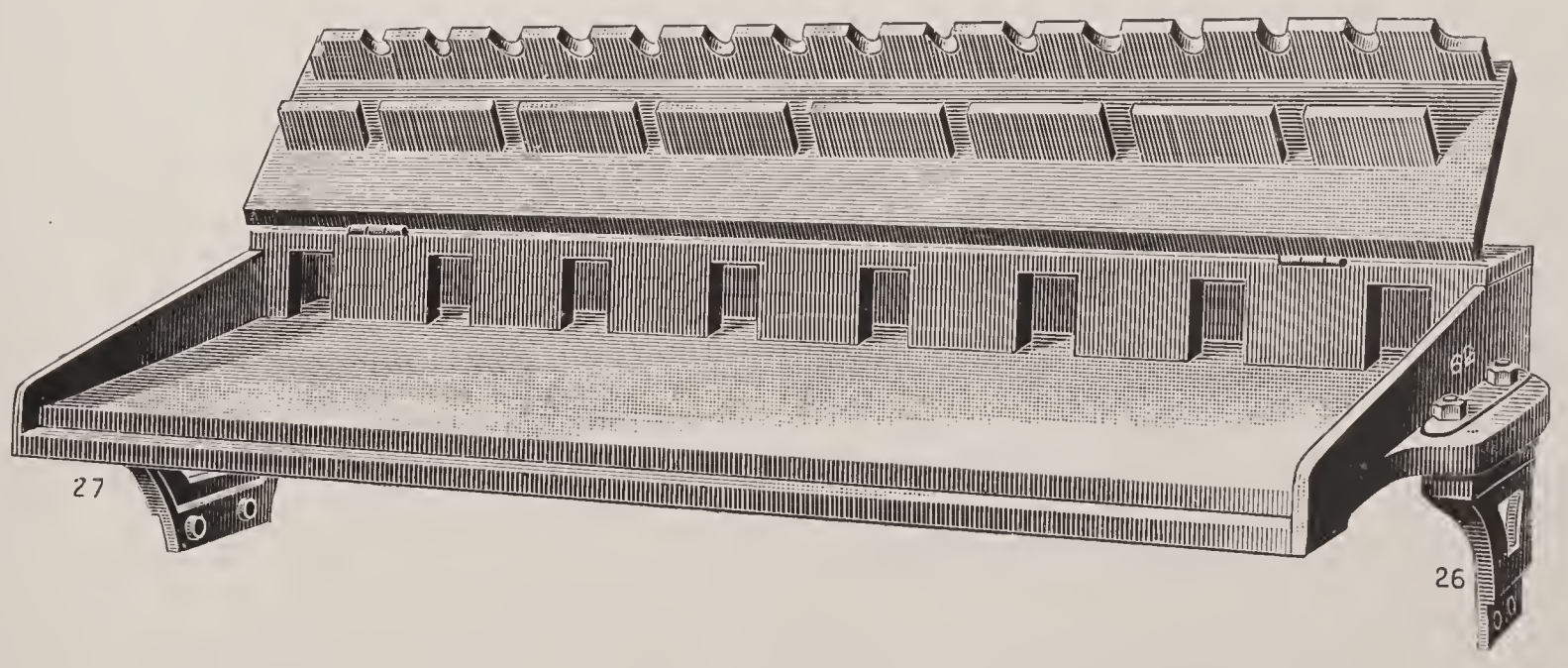
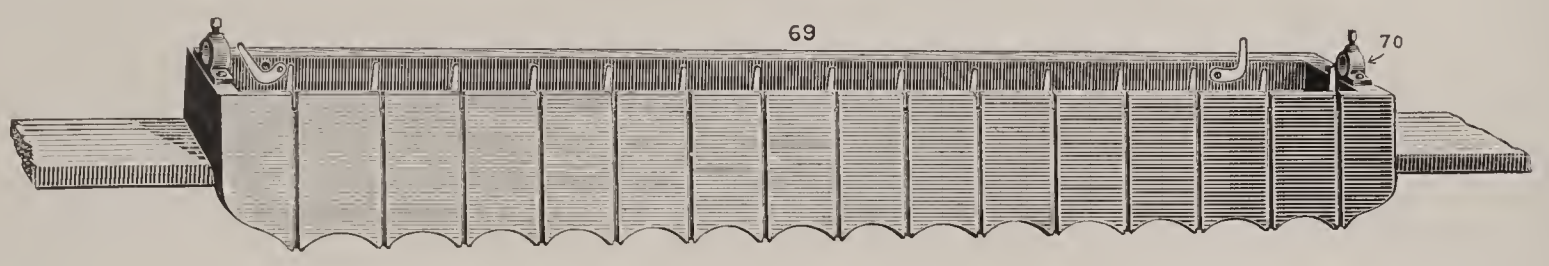



Fig. 5.

# Union Ore Concentrator Construction.

*(Continued.)*



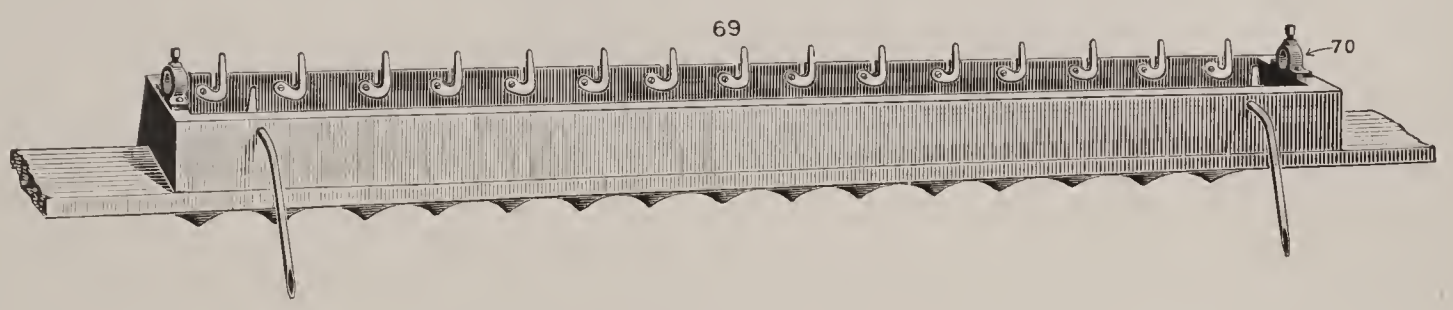




Fig. 6.

Fig. 6 illustrates the front and rear of the water box or water distributor, which is located at the head of the machine, supported on brackets forming part of the head columns. This distributor delivers clear water upon the belt in fine streams, usually about three inches apart. The construction of this enables the water to be delivered on the belt at any point and in such quantities as desired, a feature fully appreciated by those familiar with the process and operation of these machines.

# Union Ore Concentrator Construction.

(*Continued.*)

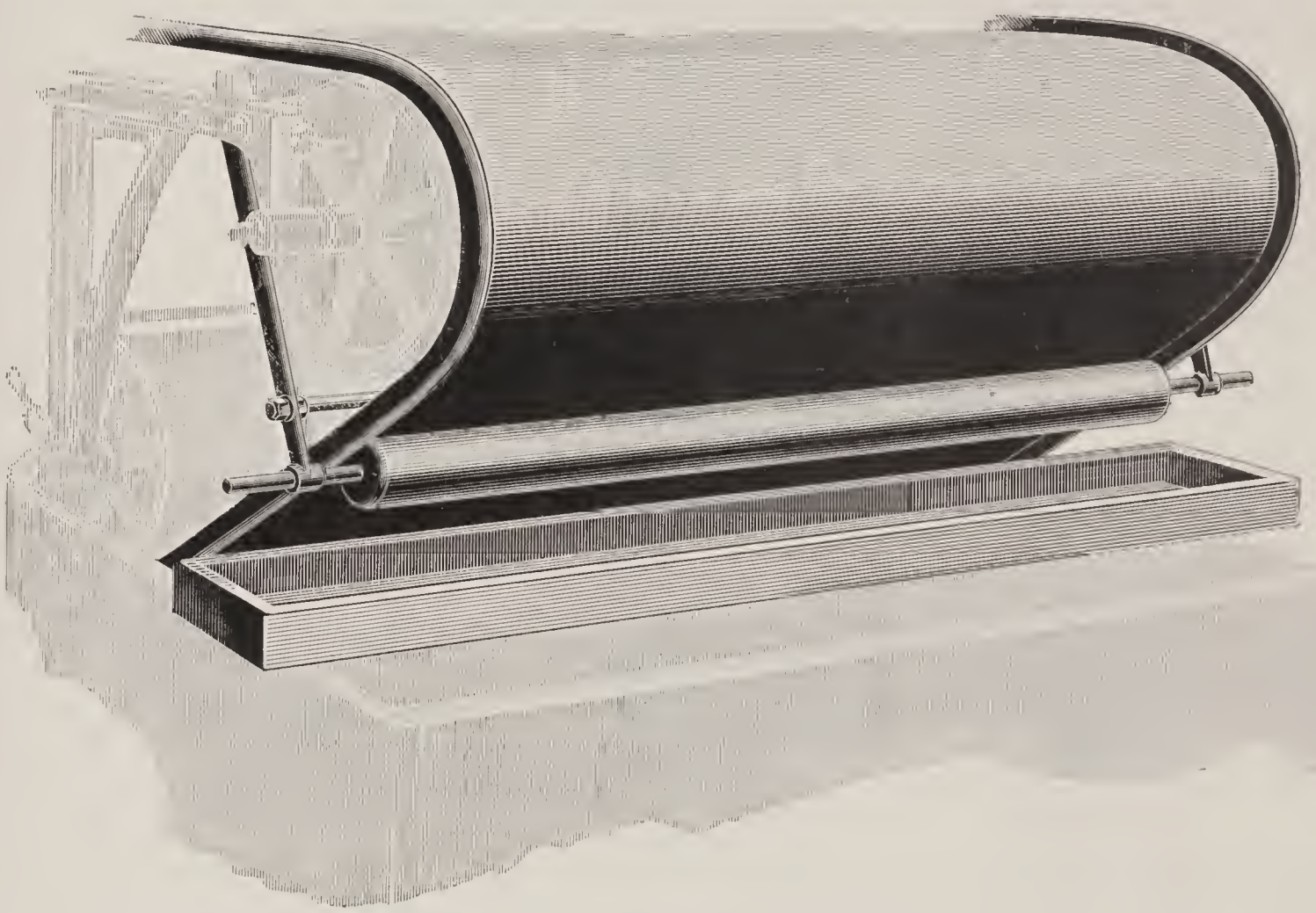




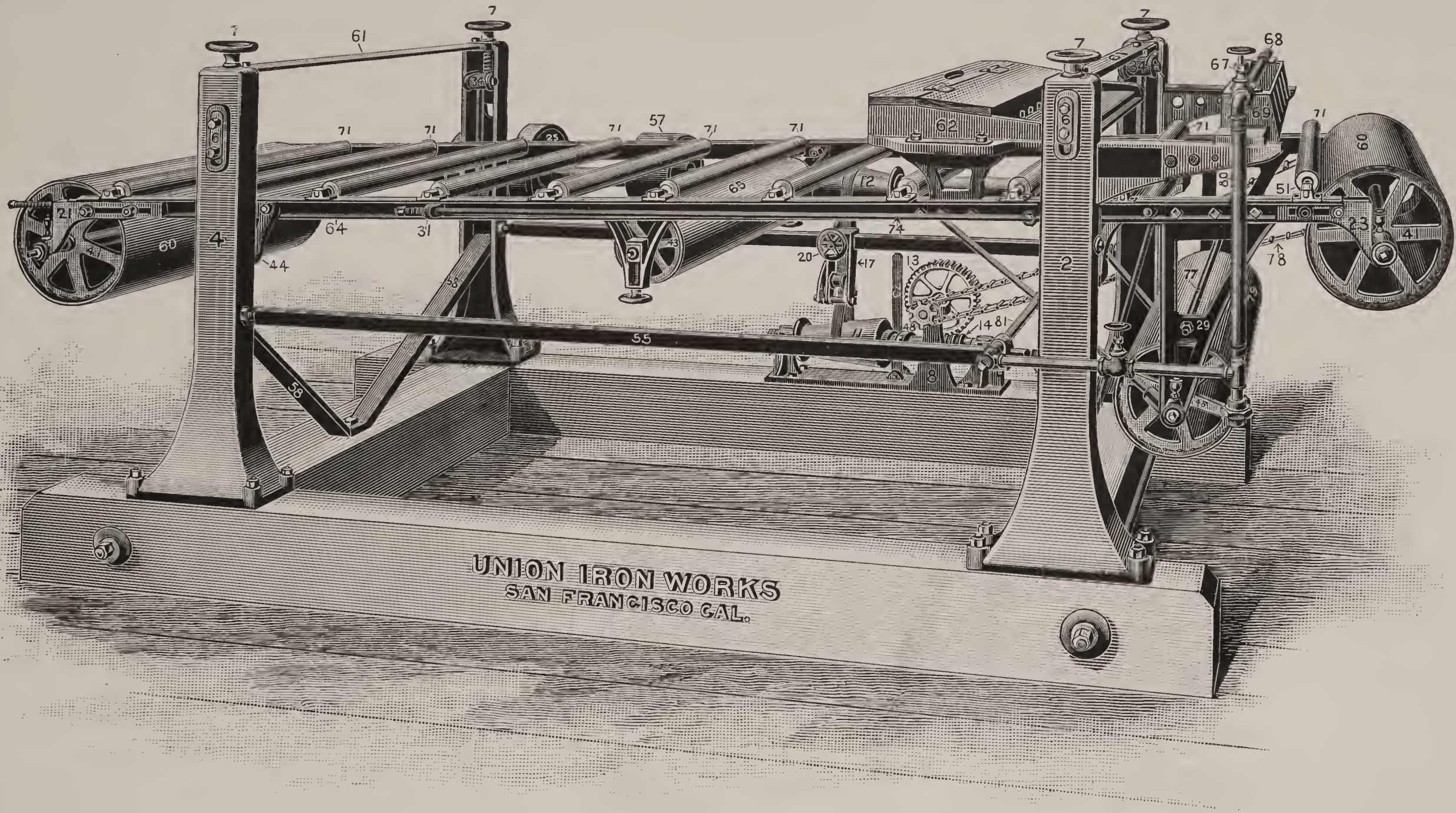
Fig. 7.

Fig. 7 illustrates our automatic sulphuret discharge roll. The engraving clearly shows the method of attaching this roll to the machine.

This roll, which is made of wood, and about three inches in diameter, is placed between the head and depression roll, against the traveling belt.

The moisture on the belt forms a water cushion or pocket which causes the sulphurets or concentrates to leave the belt when coming in contact with the roll, and are discharged into the small box shown in practically a dry condition.

This is a great convenience in large mills, as it saves much labor in removing the concentrates as compared with the ordinary method.






UNION ORE CONCENTRATOR (Without Belt).

[PATENTED]

# General Remarks.

SPEED.—The main driving shaft of the Union Concentrator should make 180 revolutions per minute, and the throw or side shake should be from 7/8 of an inch to 1 1/8 inches, depending upon the character of the ore.

The speed at which the belt should travel depends entirely upon the character of the ore, varying from 30 inches to 6 feet per minute.

Regularity of speed is of the greatest importance for close and efficient work. The necessity for this is obvious, considering that the machine is automatic in its operation.

Regularity in speed, regularity in the delivery of material upon the belt, and regularity in the supply of clear water, are conditions that must be observed and maintained to insure perfect work.

WATER.—The material should be delivered upon the belt with as little water as required to keep the bed in good condition and spread the pulp evenly over the surface.

The amount of clear water required for each machine depends somewhat upon the character of the ore, but may be stated as from six to ten gallons per minute, about equal to ½ miners' inch.

CAPACITY.—This depends upon the character of material to be treated. Under ordinary conditions each machine will handle eight tons of material per day.

ERECTION AND RUNNING.—No rules can be laid down for erection. The engravings presented show clearly how the machine is put together, as each piece is numbered, and any intelligent mechanic can erect one in a few hours' time; as to running the machine, a few days' experience will enable any one familiar with machinery of this class to make the adjustments necessary to work any ore that can be concentrated.

IN GENERAL.—The motion, grade of the machine, quantity of water required, and speed of belt travel, must be regulated and adjusted to meet the conditions required by each individual class of ore, and, when these have once been determined, no trouble will be experienced, as the machine will work continuously and uniformly as long as conditions are unchanged.

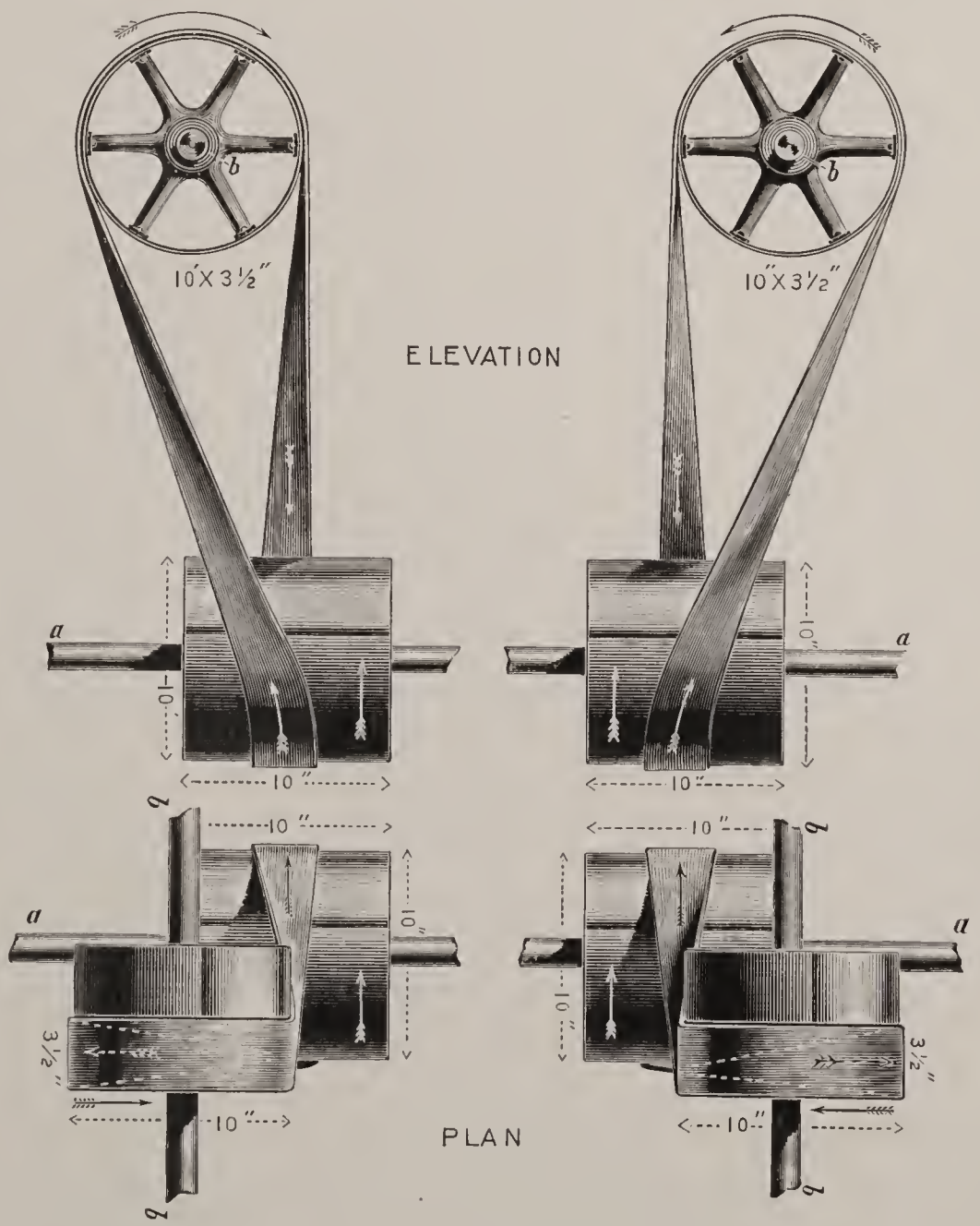
In conclusion, it is not out of place to mention, however well built a machine may be, it requires some attention. Keep all lost motion out of the machine, avoiding knocks and jars. Keep the machine clean; splashing of sand and dirty water over the sides of the belt should not be permitted. The metal work should be kept bright and clean.

There is no reason why a Union Concentrator should not be kept as clean and in as good condition as a high-grade engine. It is safe to say that a dirty, ill-kept machine will not do efficient work.

# Setting of Counter Shaft.

The counter shafting to drive the Union Concentrators is usually placed in line or parallel with the main line shaft of the mill. This arrangement, therefore, places the counter shaft at right angles to the crank shaft and pulley of the concentrator, and necessitates the use of a quarter twist belt.

The proper setting of these pulleys, to insure the perfect running of a quarter twist belt, is a matter of importance, and often puzzles even good mechanics ; and, for the benefit of those who are not perfectly familiar with the setting, we illustrate herewith the manner in which these pulleys are set with reference to each other, a a being crank shaft of concentrator, b b counter shaft above.



# Union Ore Concentrator.

## CAPACITY, WEIGHT AND PRICE.

### CAPACITY.

As before stated, the capacity of the Union Ore Concentrator depends upon the character of the ore being worked; it will handle about eight tons per twenty-four hours, and, in some instances, when the ore is not very heavy in sulphurets and their value not high, one concentrator will handle the pulp from five stamps; but where the ore is heavy in sulphurets and their value high two concentrators should be employed for each five stamps.

### WEIGHT.

The Union Ore Concentrator, complete, boxed and ready for shipment, weighs

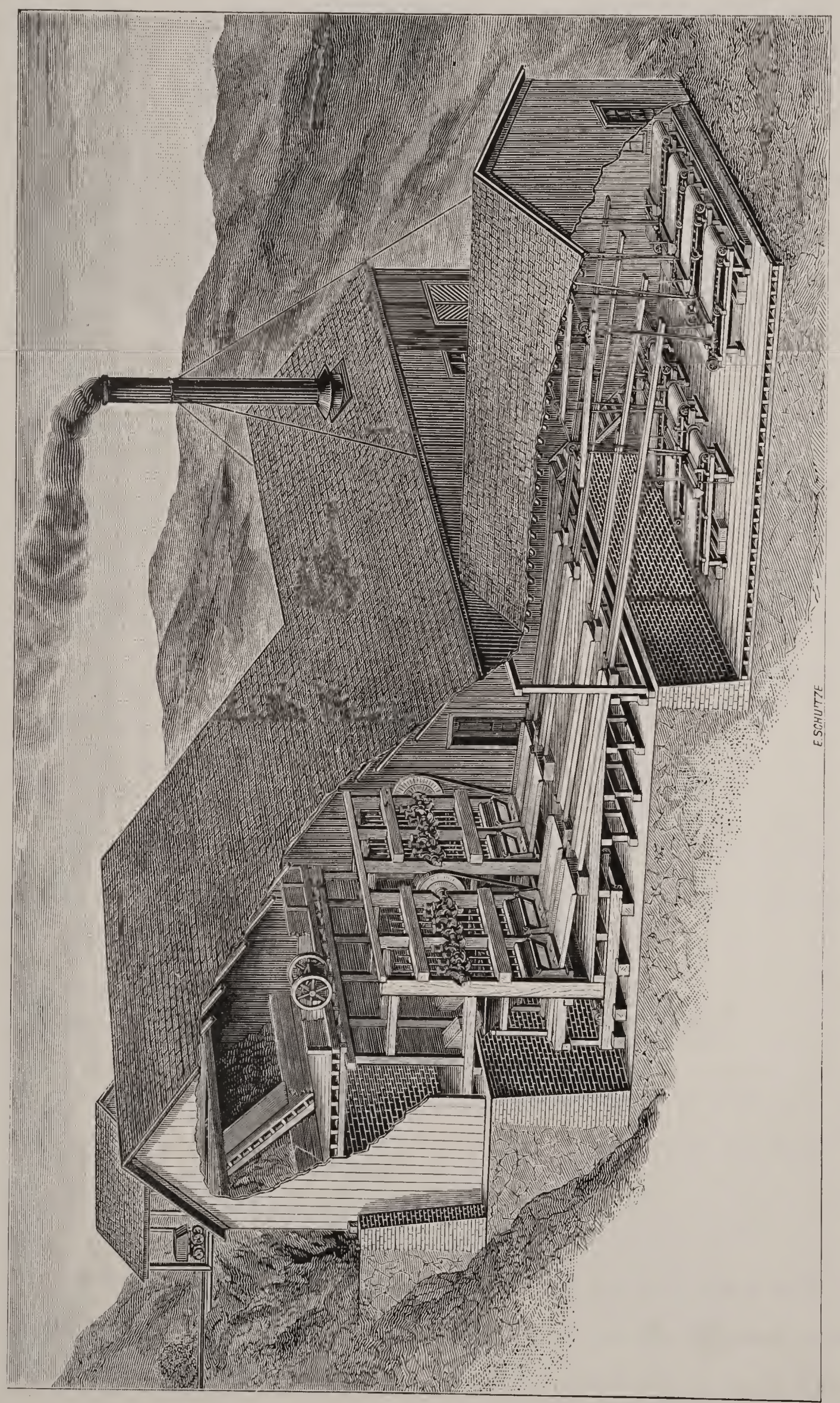
**2,500 POUNDS.**

### PRICE.

The price of the Union Ore Concentrator, boxed and placed free on board cars or steamer at San Francisco, is

**$400 EACH.**

This price does not include overhead shafting, belting, head sulphuret box, or settling boxes under machine. If desired, we will furnish these at cost prices.




Twenty-stamp Gold Mill with Union Concentrators.

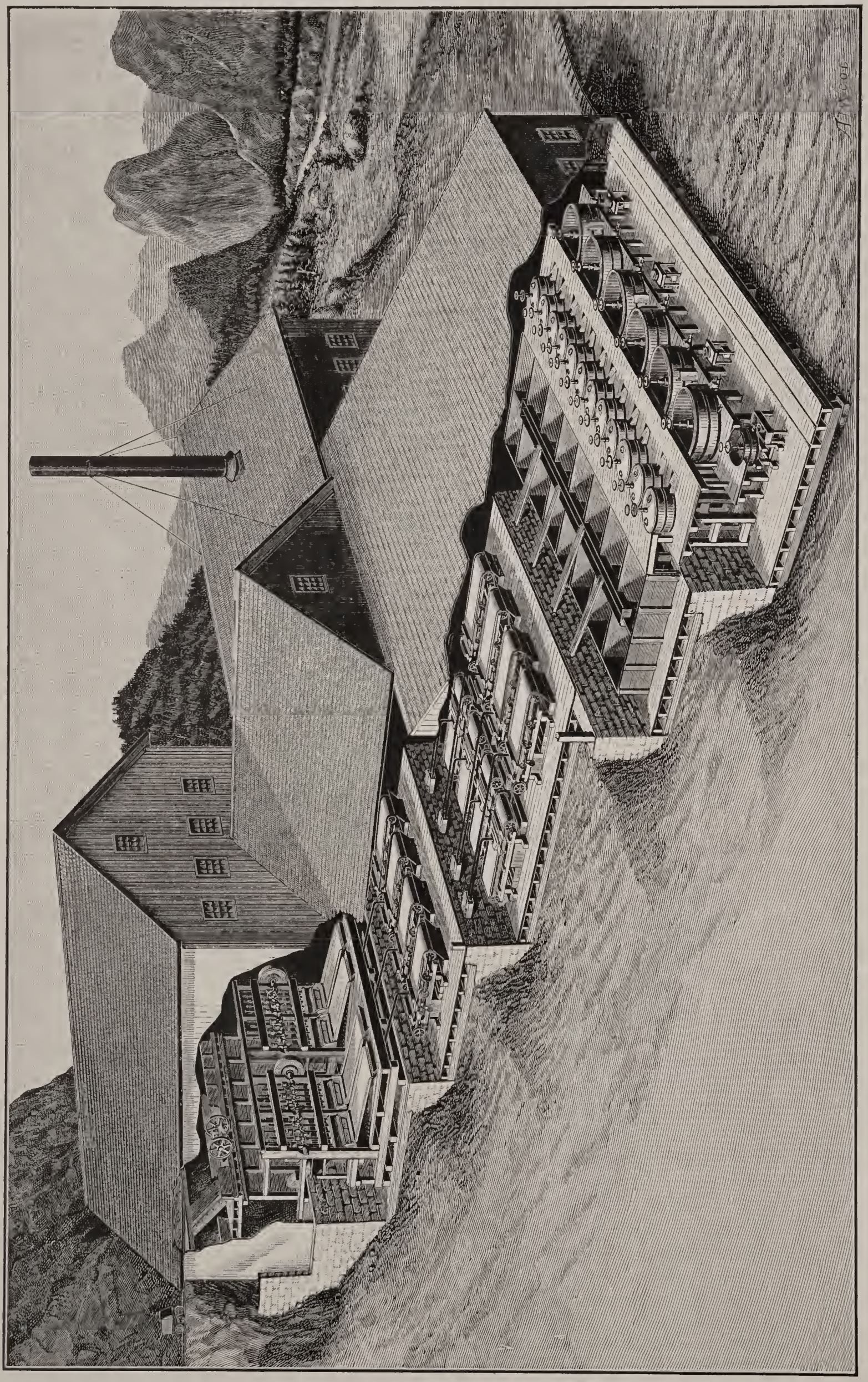
# Gold Mill.

The illustration on the opposite page gives an interior view of a Twenty-stamp Gold Mill of the usual design employed throughout California for working gold ores.

The ore is first passed through the rock breaker or crusher (located at top of mill) into the ore bins, from whence it passes automatically into the self-feeders, which deliver it, as required, into the mortars of the stamp battery. Here it is crushed wet and discharged through the battery screens (usually about 40 mesh), upon silver-plated copper plates, which extract the free gold contained in the ore. The pulp or crushed ore, after passing these plates, is run onto the Union Concentrators, which eliminate or concentrate the sulphurets or other valuable portions of the ore which will not amalgamate on the copper plates referred to.

These sulphurets after being concentrated are dried and roasted, and the gold contained in them is usually extracted by the chlorination process, described elsewhere.

Plans, specifications and prices given upon application.



Twenty-stamp Mill, Combination Process, with Union Concentrators.

# Combination Process.

The illustration on the opposite page gives an interior view of a Twenty-stamp Combination Mill equipped with Union Concentrators.

The "Combination Process" is the method of treating gold and silver bearing ores by the application of the concentration and amalgamation processes combined, and is especially adapted to ores that are not "free milling."

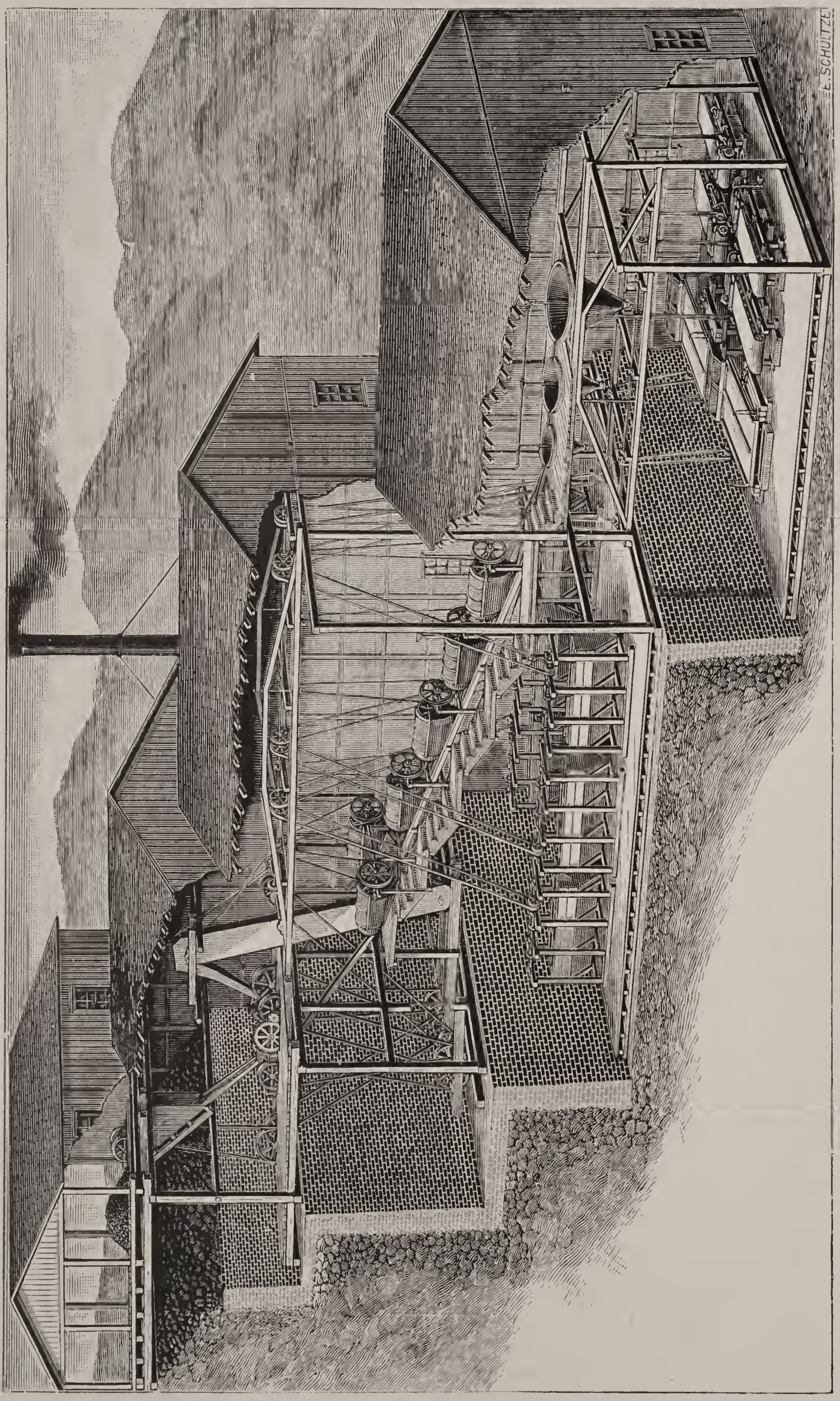
It is not an experimental nor new process, but simply a combination of well-known and successful methods in daily operation throughout the mining sections of the country.

The mill, which we illustrate herewith, is designed to treat refractory ores, carrying gold and silver associated with the baser metals, such as iron and copper pyrites, lead, zinc, antimony, etc.

The ore is first passed through the rock breaker or crusher, into the ore bins, from whence it passes automatically into the self-feeders, which deliver it as required into the mortars of the battery. Here it is crushed wet, and discharged through the battery screens upon silver-plated copper plates, which extract the free gold contained in the ore. From these plates it passes on to the first set of Union Concentrators, where the heavier base metals are eliminated. The tailings from these machines then pass on to the second set of Union Concentrators, where the final concentration takes place, eliminating the zinc, antimony, etc. The tailings from these last set of machines, containing the sulphides, chlorides and fine gold, which cannot be concentrated, pass into the settling tanks, where, after the surplus water is drawn from the pulp, it is shoveled into the pans, amalgamated, discharged into the settlers, and the amalgam strained, retorted and melted in the usual manner.

The concentrates obtained can be disposed of as may be best suited to the commercial conditions governing each particular case.

This process is being adapted by many of the largest mines; and, for such ores as we have described, the "Combination Process" is not only the cheapest, but the most practical method of reduction that can be employed under any and all conditions.




Coarse Concentrating Mill with Rollers, Jigs and Union Concentrators.

# Coarse Concentrating Mill

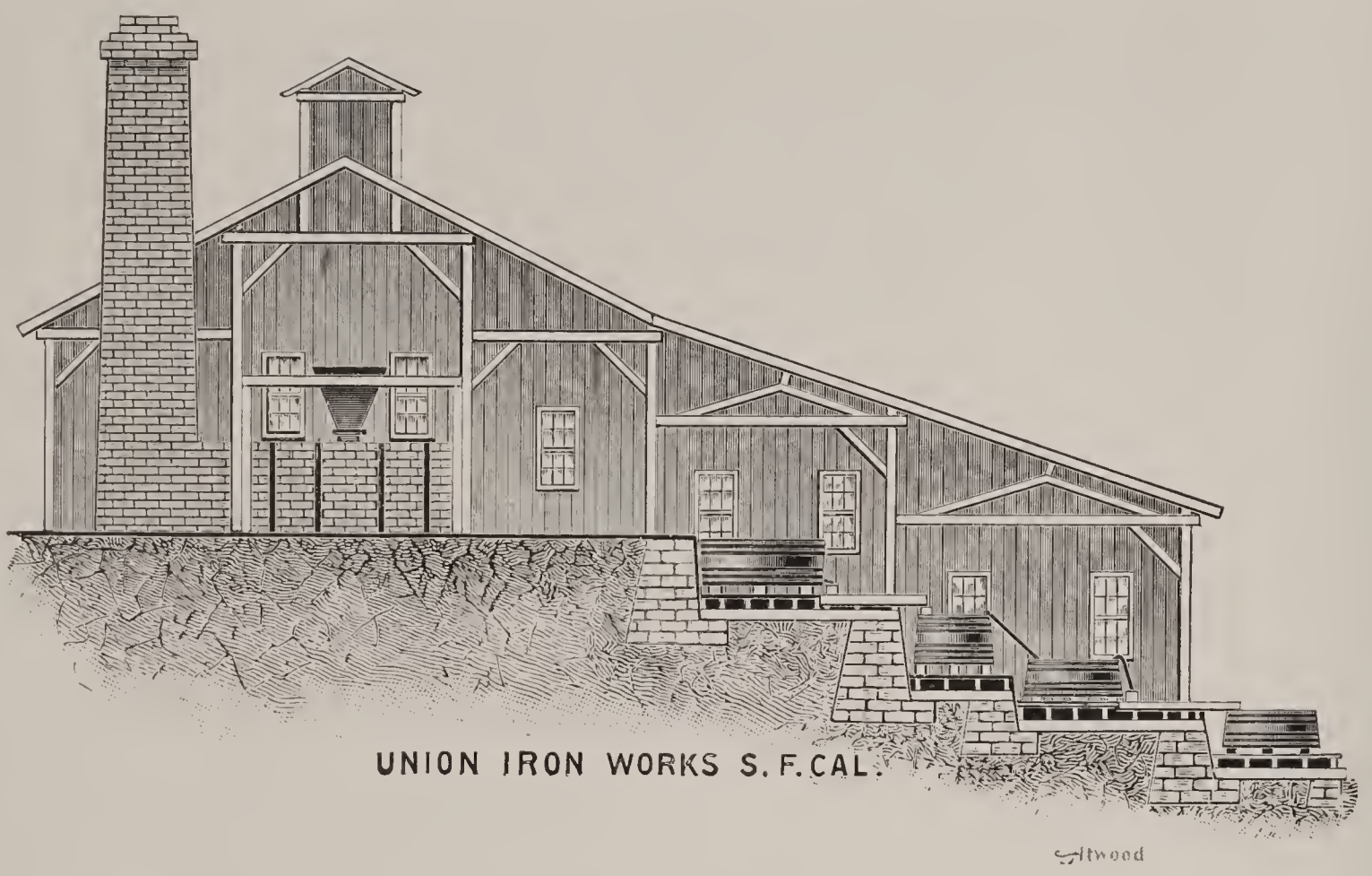
WITH ROLLERS, JIGS AND UNION CONCENTRATORS.

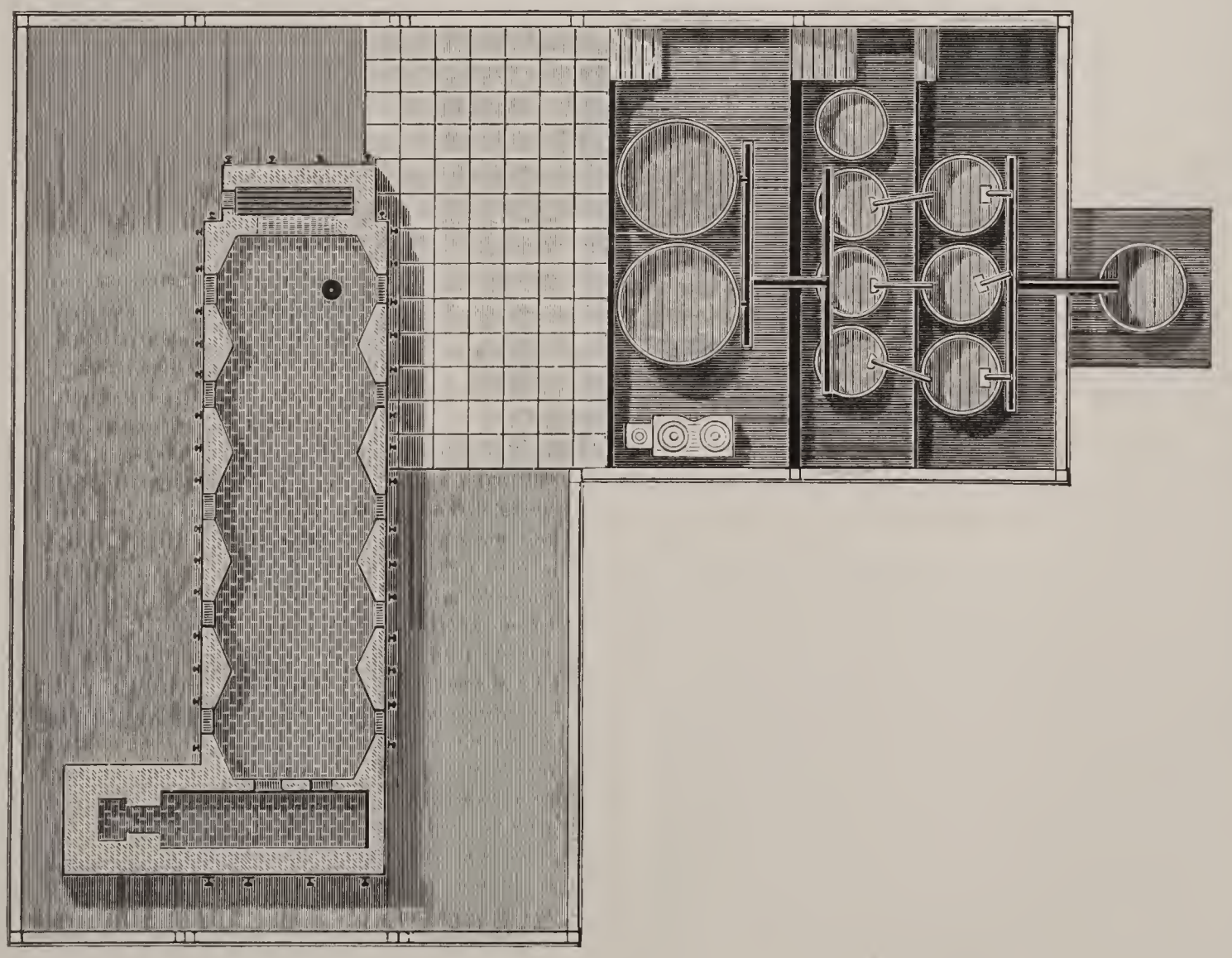
The illustration on the opposite page shows an interior view of a Coarse Concentrating Mill of the usual design, used principally for lead and copper ores.

The ore as it comes from the mine is first passed through the rock breaker or crusher (located on the upper floor of the mill), then through coarse rolls, from whence it passes into a trommel. The ore too coarse to pass through is returned by a bucket elevator to a set of finishing rolls, is further crushed and returned to trommel No. 1, the ore that passes through goes to trommel No. 2, and that portion too coarse goes to jig No. 1, and so on until it has passed through the entire series. The pulp that passes through the last in the series of sizers consists of very fine sands and slimes, which flow into inverted pyramidal boxes called "Spitzkasten," where the sands and heavier particles settle to the bottom and the slimes or lighter material flow off with the current.

The pulp (or slimes) is now passed over the Union Concentrators, percussion tables, etc., the larger particles (specifically lighter), being acted upon more readily by the flowing water, are carried down the belt and pass away as tailings, while the smaller particles (specifically heavier) cling to the belt and are saved as concentrates.

Plans, specifications and estimates given upon application.



CHLORINATION WORKS.

# Treatment of Concentrates.

The gold ores of California usually carry from one to two per cent of sulphurets, which are eliminated from the ore after passing through the batteries. These concentrates range in value from $40 to $200 per ton, chiefly in gold, though in many instances they contain from $12 to $20 in silver and from one to five per cent of copper.

The method usually employed for their treatment is that of chlorination (Plattner process) (see illustration on opposite page). This consists in roasting the concentrates in an ordinary reverberatory furnace to expel the sulphur, arsenic and other volatile, deleterious substances. Salt is added as the roast nears completion, and when a "dead roast" has been obtained (which is of the utmost importance) the ore is drawn from the furnace and spread upon the cooling floor; when cold, about six per cent of moisure is added; it is then screened into the leaching tanks, care being taken to have it lie as loosely as possible to facilitate the penetration of the chlorine gas, the screen used being usually ⅜″ to ½″ mesh. The tanks are filled to within about three inches of the top and chlorine gas (generated in lead holders) is introduced into the bottom of the tank, and remains on until ammonia held above the ore gives off fumes of ammonia chloride. This usually takes about four hours. When this point is reached covers are put on the tanks and luted with dough or any other suitable substance and the gas shut off. The tank is then allowed to stand for two days, during which time the gold contained in the ore has been converted into a terchloride of gold. The covers are then removed, water introduced and the terchloride of gold washed or leached out.

This "liquor" or lixivium is run into precipitating tanks, where by the use of a solution of sulphate of iron the gold is precipitated, falling to the bottom of the tank, forming a dark paste. The liquor is then siphoned off, the gold collected, washed with water until all the acid and iron salts are removed; it is then dried, melted and cast into bars, the average fineness being from 998 to 999½.

When the concentrates carry silver the roasting with salt has converted it into a chloride; this is leached out after the gold has been extracted, by using a solution of hyposulphide of soda. The lixivium from this leach is run into separate tanks, where the silver is precipitated by the addition of a solution of polysulphide of sodium or calcium. The precipitate is in the form of a sulphide of silver which is collected upon filters, washed, dried, and then reduced to a metallic state.

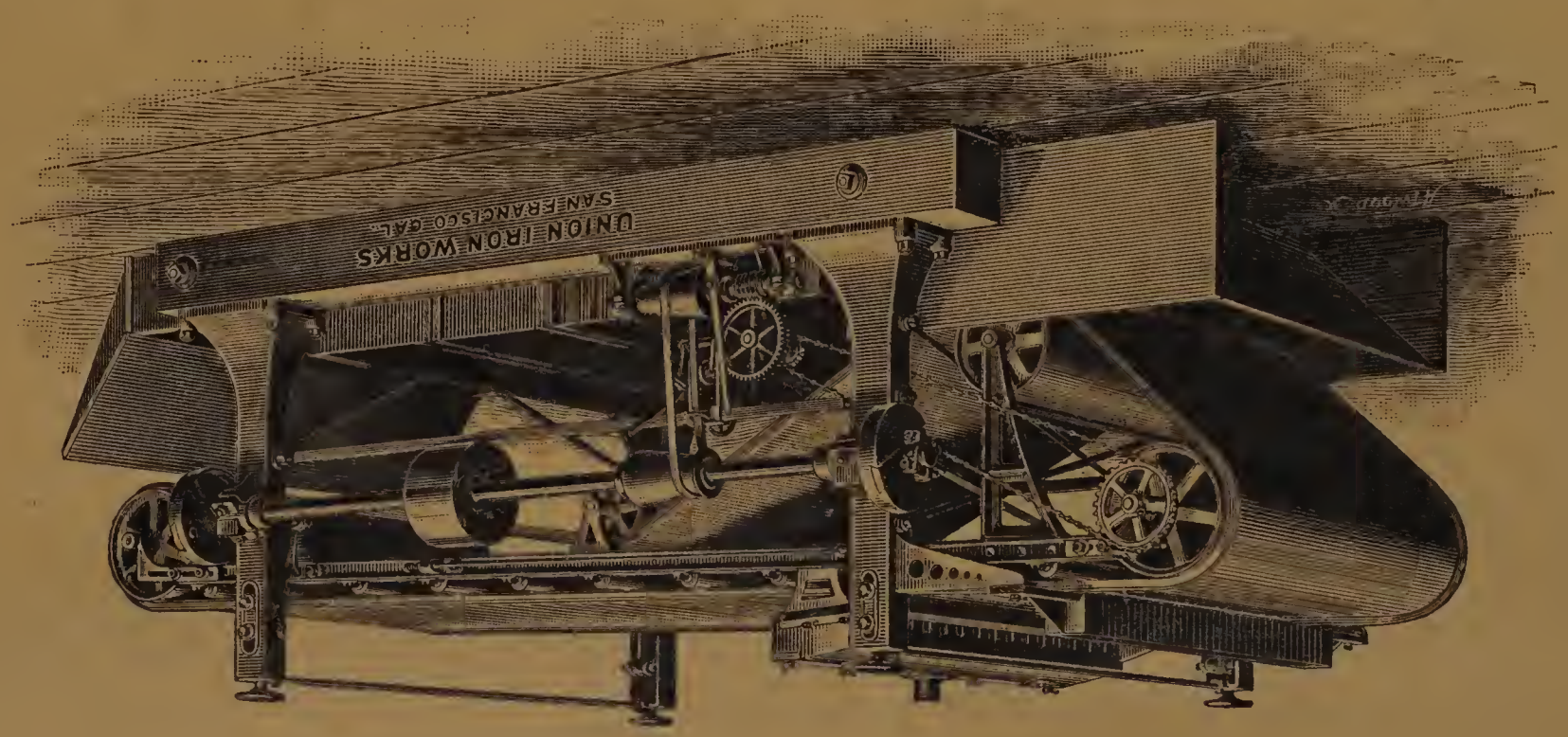
When the concentrates contain copper sulphides they are converted by roasting into sulphates and are leached out with the gold, and remain in the "liquor" after the gold has been precipitated; if the amount of copper carried in this liquor is sufficient to justify its being saved, the liquor, when siphoned from the gold precipitating tank, is run into another tank containing scrap iron, which precipitates the copper into a metallic form known as "cement copper."

By the process described above from 92 to 96 per cent of the assay value of the concentrates is obtained, the cost varying from $10 to $15 per ton of concentrates treated, depending upon local conditions as to labor and fuel.

The Plattner process, while slow in operation, meets with general favor—no moving machinery is required, there is nothing to break down and but little to wear out. A set of vats once installed will last indefinitely if properly taken care of and painted with coal-tar and asphaltum, from time to time. The furnace is simple in construction and easy of operation.

We have a variety of patterns for generators and furnaces of different sizes and capacities, also build machinery for the Barrel process.

Plans, specifications and estimates furnished on application.


UNION IRON WORKS
SAN FRANCISCO CAL.