HYDRAULIC MINING WITH CENTRIFUGAL PUMPS.

BY ENOS BROWN.

The first attempt ever made in the State of Oregon to exploit an extensive gold placer deposit by artificial power has been recently given a successful trial at Grant's Pass, a city in the southern part of the State just north of the California line. The employment of "giants" in hydraulic mining was first introduced in California, and by this means enormous quantities of gold, in the aggregate, have been saved from deposits where values were too low to justify mining by any other process.

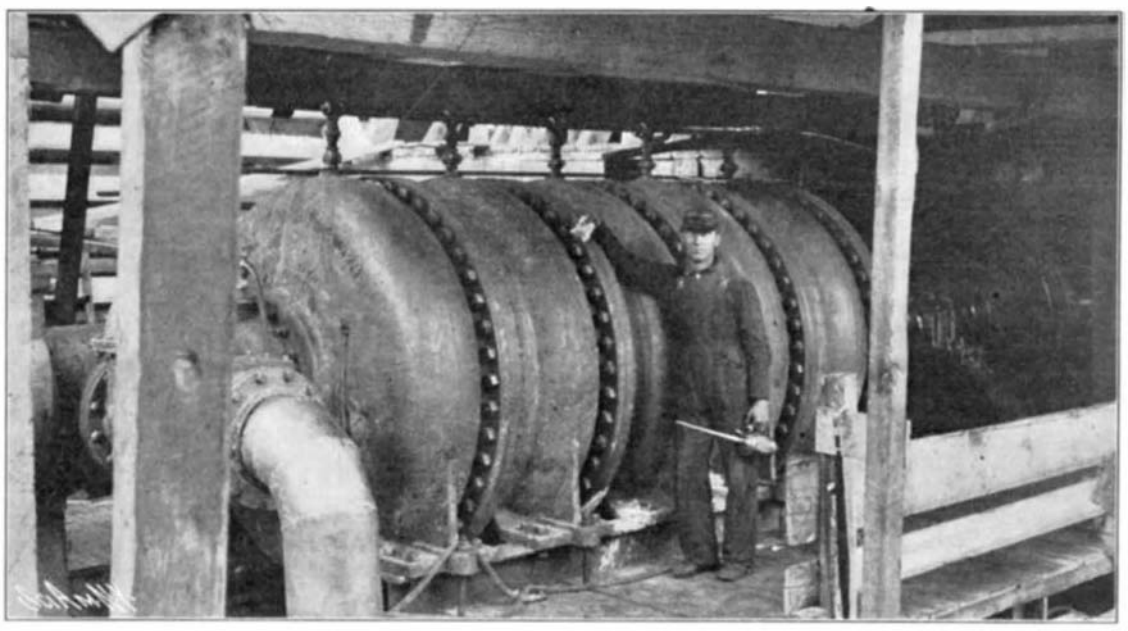
In the vicinity of Grant's Pass there are thousands of acres of rich placers which have never been worked extensively, owing to their high elevation above the surrounding country and the difficulty of installing a water supply, the hydraulic method being the only one by which the deposits could be profitably worked.

Rogue River is a stream which rises in the high Sierras and is fed from inexhaustible banks of snow. It is at all seasons of the year of large volume; but its bed lies at a depth of 430 feet below the placer deposits referred to. Surveys have been made from time to time, with the object of damming the river in higher altitudes and conveying water to the desired point through pipes and by gravity; but although such a scheme would be practicable, the expense would be very large and hardly justified by anticipated results, especially when the engineering obstacles that had to be surmounted were considered. It would be necessary to travel far to find so large an extent of country, as irregular in its contour, or rough in character, as this portion of the State of Oregon. The first expense of a pipe line, therefore, together with the inaccessibility of the region and the probability of accidents, rendered its construction exceedingly difficult. The alternative, if gravity could not be employed in developing the placers, was in utilizing the power at hand in Rogue River, which never flows less than 144,000 miner's inches and has close at hand an easily developed fall of 20½ feet.

To construct a dam and install the necessary turbines was an easy proposition as well as a comparatively inexpensive one. The main, and in fact the only, difficulty to overcome, lay in finding a pump of adequate strength and capacity to withstand the great pressure to which it was to be subjected in raising a quantity of water of not less than 9,000 gallons per minute to a height of 430 feet. The work demanded was continuous. Like the flow of the river, the pump was required to run day and night from one year's end to the other. The design and construction of the pumps was undertaken successfully by the Byron Jackson Machine Company, of San Francisco. Confident of the result they assumed all risk and responsibility and have just completed the installation of one of their five-step centrifugals with very successful results. The first unit has been in continuous operation for over three months.

The power generated by the Rogue River is capable of driving four units of four turbines each. One unit has been installed. The turbines are of the ordinary vertical-draft tube type of standard pattern. The heavy gearings are seated on I-beams on the pump deck. The turbines convey their power by transmission gear to a line shaft tapering from 7 to 6 inches, directly connected to the pump by flexible couplings. Each unit of four turbines will operate one pump. The pump of the Byron Jackson Machine Company is an 18-inch five-step centrifugal, weighing over forty tons, resting on heavy steel I-beams and securely anchored to a concrete foundation, 4 feet in depth. The main pipe-line from the pump is 1,500 feet in length by 22 inches in diameter, attaining a vertical height of 150 feet in that distance. Distribution to the giants is made at the point of greatest elevation. The pump is guaranteed to supply three giants through a 3-inch nozzle at 360 revolutions. So far but two giants are in operation, the pressure on the pump at this duty not exceeding 160 pounds. With the centrifugal a steady head is maintained at the nozzles by direct connection with the main line from the pump. The total volume of water pumped in 24 hours is 13,000,000 gallons and this amount has been continuous from the time when the power was first applied.

"Giant" in Operation, Throwing Stream 250 Feet.



A Five-Step Series Centrifugal Pump.

The Pipe Line from the Pumps to the "Giants."

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For the benefit of engineers a technical description of this pump is annexed.

The water enters in the suction elbow on the shaft side of the pump case. At that end the pressure is only that which can be created by vacuum; and for practical purposes this amounts never to more than twenty inches.

The pump is so constructed that none of the stuffing boxes in any part of it is subjected to the discharge pressure due to 430 feet head. It may be well realized by engineers and mechanics that it is difficult to make a tight joint under such heavy hydraulic pressure. The water enters the center of the first runner and is discharged from the ports of the same at a tangent and its energy is converted into pressure head in the whirlpool space. Properly curved water vanes are inserted between the first and second runners, guiding the water in a continuous stream without eddies to the center of the next runner, and the operation is continued until the final fifth step is reached, so that each runner takes care of one-fifth the total head for which the pump is pumping, and it is shown by gages placed on the different chambers that the pressure increases in an exact geometrical progression.

This particular pump was built with the view of limiting the speed to 360 revolutions in order to prevent a too great velocity of the bevel gears, which drive the same, there being mounted four sets of bevel gears, one for each of the vertical turbines which supply the power for the pump.

If the arrangement had been designed so that the pump could have been directly connected to horizontal turbines, and if a speed considerably in excess of that under which the pump is operating had been obtained, it would have been easily possible to produce the necessary head of 430 feet with three or even two steps instead of five. The pump was tested under 250 pounds working pressure equal to a static head of 577 feet.

In view of the heavy column of water resting on this pump, the perfection with which the balancing of this pump against end thrust has been secured is certainly remarkable. Owing to the automatic water balance with which it is furnished the pump seems to run perfectly free. Such a result could never be accomplished by means of a metal, or even a ball step bearing.

The success of the plant described is complete. It is intended to increase the output by installing three additional units of turbines and centrifugal pumps by which a surplus for irrigation, light, and power will be generated and distributed to the surrounding country. The monthly running expense, including all labor connected with running of pump, giants, sluicing, etc., is about $1,500.

Owing to structural instability it has been decided to rebuild the "Auld Brig of Ayr," immortalized by the poet Burns. The characteristics of the bridge, which dates from the end of the fifteenth century, are to be preserved. The stones are to be carefully removed and numbered. The foundations will then be strengthened, and the stones reassembled in their former positions. The work of restoration is to be carried out by Sir John Arrol, the well-known bridge builder, to whom the work is intrusted.