Compressed Air Traction Plant, Red Point nine, Placer County, Cal.

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The Red Point mine is a gold placer situate in Placer county, Cal, on what is locally known as the Forest Hill Divide, 15 miles toward the summit of the Sierra Nevada mountains from the town of Forest Hill. It adjoins the Hidden Treasure mine and, like it, is exploited as a drift mine. Both are sections of Neocene river channels which were obliterated as such by filling to depths of a thousand feet or more by volcanics. Subsequent erosion of new stream channels, replacing those buried, has cut the country surface in deep canyon lines across and alongside of the old channel beds until the latter were left part of existing mountain summits. The method of drift mining developed from the physical position of the gold-bearing placer in the heart of the mountain consists in driving tunnels through the solid rock rims of the side of the mountain, so that they enter the unconsolidated gold-bearing gravel beds of the old channel beneath the covering of volcanics. The tunnel then furnishes a gravity drainage outlet for large flows of underground water, collected in and following the old stream beds, and the gold-bearing gravel is attacked and removed much in the manner of the mining of coal. It is the winning of a horizontal lying deposit of ore as contrasted with the winning of a proximately vertical-lying deposit.

Mine Buildings and Plant at Tunnel Entrance, Red Point Mine, Placer County, Cal.

The Red Point mine is notable from the mode in which its discovery was made. Unlike most of the California placers, the locus of which was discovered in the early mining days, even if not then mined, the existence of this particular gold-bearing placer is a comparatively recent development. J. B. Hobson, at that time (1885) of Placer county, but now manager of the Cariboo Con. Hy. mine, at Bullion, B. C, deductively from the geology becoming satisfied that the gold-bearing old river channel traversed the ground, now the Red Point, located and bought the area and interested French capital in its exploration. Ross E. Browne, M. E., of San Francisco, then made an elaborate survey of the ground and adjoining mines that were being operated and made a proximate location of the line and elevation of the old buried channel, and what is now known as the Red Point tunnel was projected and run to develop the channel. The method of location employed—a practical application of topographic and geological surveys—was novel then. Very little of that class of work had been done then, and none on so large a scale, or for the development of a channel that was buried throughout its whole extent for many miles and only doubtfully identified in the underground workings several miles apart. The tunnel projected by Mr. Browne proved successful, striking only 15 feet below the bed of the channel at 2000 feet, the projected distance having been 2400 feet. The close determination of the actual geological facts in advance, deductively in this instance, was a brilliant demonstration of a theory applied. Descriptions in detail of this work appear in the "VIII Annual Report of the State

Mineralogist of California, page 749, and following, and in Volume LXVIII of this journal, pages 151, 165, 181.

The Red Point mine has been operated continuously since 1887 and has been continuously a profit earning mine. The main tunnel, following the turns of the old channel, has been extended until the face of the working is now about 17,500 feet from the entrance to the tunnel, nearly 3} miles. In this dis, with up-hill gradients varying from 1% to 3%, the total rise is 240 feet. The fast-increasing distance of haulage some years since compelled a change from the use of horses. The loaded cars run out of the mine by gravity under the brake, but the inhaulage with the grade and distance to be overcome was the difficulty. The installation made and now in operation was designed by H. C. Behr, mechanical engineer, then of San Francisco, but now of Cape Town, South Africa.

The choice lying between electric traction and compressed air, the economic conditions made the decision in favor of the latter. The workings in the channel were more or less uneven in height, dependent on the full depth of the gravel, which was all mined out. The roof consists of a hard, compact volcanic cement. For mining the gravel it was not necessary to remove this or the bedrock on which the gravel rests. The latter is cut down in the tunnel to provide a more even track floor, a better water drain channel and to give sufficient height for traction. The roof of cement is, however, kept unbroken. The illustration on this page shows the relation described, the tunnel track cut in the bedrock, the breast in the gravel on the unbroken bedrock, and the solid rock roof, which, unbroken, only requires posts to hold it.

Compressed Air Locomotive, Red Point Mine, Placer County, Cal.

The installation of electric traction would have required a very large expense in cutting the roof, and extra expense in wiring the trolley, owing to turns and irregularities of the tunnel. There is practically no tunnel timbering to which the trolley insulators could be attached. Since the compressed air installation for traction was made in the Red Point mine, an electric traction installation has been made in the Hidden Treasure mine, adjoining. This is described in Vol. LXXIX, page 604, of this journal. In this installation the difference of initial cost was in favor of the electric installation. The tunnel is everywhere timbered and did not require any additional cost of cutting to provide for putting in trolley wires. In both cases the operating prime mover was the water flowing out through the mine openings. The two different systems of traction installed in the two adjoining and similar mines, each in its particular place the most economic for that place, shows how impossible it is for broad generalizations to be made as to comparative economy between electric and compressed air systems of traction. Each mine is a problem by itself, demanding economic solution, not from generalizations from practice County, Cal. elsewhere, but from the special conditions as they are found to be in the particular mine. In the Red Point mine the mine waters are the prime mover for power for all purposes for which power is used. The water is first caught up and turned into a pipe well up toward the inner face of the upstream workings. This pipe delivers the water under the head of the tunnel fall to a 36-

inch Pelton wheel, located in the tunnel about } mile from the entrance. This water drives a No. 4 Baker blower, giving its positive pressure as an addition to the air pressure in an 11-inch pipe from a blower outside of the tunnel. From this Pelton wheel the water flows through the tunnel to the entrance, where it is divided. The total quantity of flow is 70 cubic feet a minute. Of this, about 30 cubic feet is conducted to the storage tank, to be used for washing the gravel. Forty cubic feet is turned into a pipe leading down the mountain slope and is used under 103 feet head on a 36-inch Pelton wheel, driving a No. H Baker blower. These two blowers and the single 11-inch pipe line, conducting the air to the workings in the face, ventilate the mine.

After use driving the blower the water passes through a head box into another pressure pipe line. Under several hundred feet pressure the water operates a 5-foot Pelton wheel, driving a three-phase Simmons air compressor, which compresses 120 cubic feet of free air per minute to 800 pounds to the square inch pressure. Prom the receiver a strong 2-inch pipe conducts the air 3500 feet to the tunnel entrance and 11,500 feet farther into the tunnel. In addition to providing several convenient charging stations, the long pipe acts as a receiver, giving added storage capacity.

A six-ton air locomotive, with a storage capacity of 60 cubic feet of compressed air, takes the air from the charging stations at 700 pounds pressure. The illustration on the front page shows the locomotive. Prom the large receiver on the locomotive the air passes through a Foster reducing valve and is reducted to 200 pounds pressure. It is then reheated to 300° P. and, passing into cylinders, is used in all respects as if it were steam.

The locomotive takes sixteen to eighteen cars into the mine at a trip, at a speed of 9 miles an hour. The engine is charged before starting into the tunnel and takes a second charge in the tunnel. A single charging will run it up the tunnel grade with the train of empties for 2 miles. Coming out, the down grade of the track takes the loaded train out of the tunnel by gravity. The track consists of thirty pound rail and ties are placed 1 foot apart.

Three Miles Underground, Red Point Mine, Placer County, Cal.

The mine employs sixty-five men. The output of gold has been quite uniform through the entire period of operation. Variations in width of the channel and quantity of gravel have been found to be compensated to some extent by opposite changes in the quantity of gold content. With the adjoining Hidden Treasure mine the Red Point mine is a typical drift mine, representing in its operation all the perfection and detail and economy of cost that experience in this kind of mining has suggested.

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Note: The pictured Locomotive can be seen at the Foresthill Museum, near the Memorial Hall.