Motive Power at Mines.

The principal motive powers now employed in mine operations are either steam, water, or some form of gas or other type of explosive engine. By means of these, power is generated and applied in other ways —by ropes, by compressed air, or by electricity. When deciding upon what means shall be adopted to supply power to a mine, the problem should always be solved by selecting that which will afford the best economic results. In many situations no one of these several methods will supply every requirement. Either of them will operate a mill or a hoist, but there are generally pumping problems and traction problems to be worked out. Underground haulage is an important matter with all large mines. For this purpose, men as trammers, horses, rope-haulage, electric, steam, and compressed air motors are employed. The question which each manager is required to decide is, which system will give the most satisfactory and economical results. If the mine workings are large and well ventilated, and fuel is cheap, the ordinary type of mine steam locomotive would operate satisfactorily, no doubt. If the amount of material to be handled does not appear to justify a motor of any kind, horses or mules may be what is required.

As between compressed air and electric motors, the choice must be determined by the first cost of installation, the situation and the convenience of either system. On the Forest Hill divide, in Placer county, Cal., are two noted drift mines, the Hidden Treasure and the Red Point. These mines are situated similarly in many respects, the former being opened from the south side of the ridge and the latter from the north side. The haulage in the Hidden Treasure mines is accomplished by electric motors, and has proven eminently satisfactory. In the Red Point a compressed air motor was in use and was found equally satisfactory. The advantage in point of installation probably lies with the Red Point, as the plant was less expensive than that of the Hidden Treasure—due largely to the incidental relative situation. The water from the tunnels of the Hidden Treasure Co. is conveyed in pipe lines to a reservoir about 3 miles distant, where it is employed to develop power under 850 feet head. The water wheel is attached to a dynamo, and the electric current operates the motor cars and lights the mine workings and buildings.

At the Red Point mine the water flowing from the mine drives ventilating fans, and is again used at a lower elevation to drive an impulse wheel which supplies power to run a large air compressor of special design. This air is charged into the receiver of the motor which hauls the empty cars into the mine. The loaded cars run out on the grade in trains, being controlled by brakes, the motor not being required for the purpose of hauling out, though attached to the train. The system worked satisfactorily, and was similar to compressed air haulage elsewhere. The Red Point mine is at present being operated only in a small way, by leasers.

The two instances above cited are typical, and the situation at the two properties, though not very unlike, seems to have been met in each instance by the adoption of the method best suited to each case. There are many good things that may be said of the use of electricity or compressed air in and about mines without disparagement to the other. Both are good, and it is merely a matter of decision which to employ under conditions as they exist.

At the Homestake mines in South Dakota, compressed air haulage is in use both underground and on the surface. In former years steam locomotives were used to haul cars from the large open cuts to the mills, a portion of the route traveled being underground. The compressed air motors were introduced on account of ventilation.

In the Cripple Creek district of Colorado many of the larger mines are equipped with electric motors, and these are found to give inexpensive and satisfactory service.

In mine pumping operations the Cornish pump, at one time the most extensively used device for unwatering mines, has largely been displaced by direct acting steam or electric pumps, though in certain districts the Cornish pump still continues in favor. Where this is the case the plants are in position and have been there for years. They have been found efficient and satisfactory. The amount of water is not greatly variable in these mines, and never exceeds the capacity of the pumping plant, therefore there is no marked incentive to change to any other system. In cases where constantly increasing amounts of water are met with as the development of the mine becomes daily more extensive, some more expansive and readily applied system of pumping must be installed. To meet these requirements, the compact steam or electrically driven pumps are utilized, and both are satisfactory. In some districts bailing has almost wholly superseded pumping operations in mines, and some engineers do not hesitate to express the opinion that when properly equipped a mine may handle its water more cheaply by bailing than by any system of pumping.

Hoisting is one of the most important of all mine engineering problems. Here are found a greater range of power appliances than in any other department in mining. Hoisting is successfully accomplished by geared, friction and direct acting steam engines; by the same methods of application employing water power; by the use of compressed air—usually with electrically driven compressors — the initial power generally being water; and by electricity direct. Gas, gasoline and heat engines are also used largely in some districts where water and fuel are expensive.

Compressed air hoisting plants must necessarily be less efficient than where the power is applied direct from the motor, whether a water wheel, a steam engine or an electric motor, but this loss of efficiency is in some measure compensated for by the greater expansibility of the compressed air system. Should anything occur to interrupt the initial power, there is usually sufficient air in the receivers to enable the engineer to haul a cage or skip in transit to the surface. The electric motor, though having a higher efficiency than the compressed air plant, must stop immediately the current is interrupted. Still the electric hoists are growing in favor, and seem well adapted to certain districts and conditions. Many improvements in electrical hoisting machinery may be anticipated. With most managers it is not so much the question of water, steam, electric or other power, as which will be the most satisfactory and economical at any particular place. With this question in mind a consulting engineer may advise a water plant for some portions of California, a steam plant for the Black Hills, a gas engine plant for Arizona and electricity for Colorado, depending upon the mine's environment and the cost of power.

Mining and Scientific Press, V. 91, 11/4/1905, p. 304