

Reinforcement Methods — Angle Bracing.—If, after the square sets are properly erected in place, the members manifest an inclination to swing out of the right-angled positions they originally occupied to each other, this tendency may be arrested and prevented by a system of angle bracing. This consists of placing diagonal braces made of round or square timber on the sill floor and against the foot of the posts and leaning the heads so they will fit snugly against the top of the posts underneath the caps or girts, as the case may be, of the next adjacent set. The head of this diagonal brace should lean in the direction from which the pressure comes. This method is illustrated in Figure 8.

Cribbing.—When the square sets manifest a stronger tendency to swing than in the case above referred to, the collapse threatened may be prevented by crib work. This consists of crossing alternate layers of round or square timbers of any convenient size between the posts of the sets until the space between the sill and cap is filled, as shown in Figure 9. This crib work may extend from wall to wall through two or more rows of sets if required, and the spaces between the sets thus cribbed may be filled with waste rock, but this is called "filling," and will be referred to under that heading below.

Bulkheading.—This method of reinforcement consists of placing timbers closely together in much the same way as the crib work above referred to, and wedging them tightly between cap and sill.

Filling.—This method consists of filling the spaces between the members of the square set with any material such as waste rock, earth or sand. When the filling is done it is retained within proper bounds and the necessary passageways are kept open through the timbers by building crib work around them as described.

Waste rock for "filling" purposes is generally secured from the development or dead work that is being prosecuted in other sections of the mine, but where a large quantity is required it is often found necessary to mine it specially for that purpose, or drawn from the waste dumps on the surface. About eight cubic yards of material is required to fill the vacant space of the frame of a square set, and the cost of such filling will be the cost of obtaining and placing such material, together with the crib work required to retain it within proper bounds.

General Remarks.—The square set system of timbering is used successfully and exclusively in all mines where large deposits of metalliferous ores occur.

Where favourable conditions, such as railway transportation and a moderate supply of timber, exist, it is comparatively cheap. If care is taken in the construction of this system in the mine, it ensures that all the ore existing may be extracted without injury to the workmen or the mine. Round logs or sawed timbers of any dimension, ranging from eight inches upward, may be used, but the sizes are governed by the economic conditions and the mining requirements.

In the mines of Rossland the round logs or timbers used for the square sets cost \$1.20 for each log 16.5 feet in length f. o. b. the framing shed at the mine. These logs are cut in the State of Washington and delivered over the Spokane Falls & Northern Railway on flat cars, over distances ranging from 45 to 75 miles, each flat car being loaded on an average with

sixty logs. The unloading at the framing shed is done in a few minutes by cutting off the retaining standards on the flat cars and allowing the logs to roll off on the storage platform.

Of course, where waggon transportation is required from the railway terminus the expense will be correspondingly increased.

In every mining camp there will be more or less variation in the method of framing and in the cost of the square sets in place, also the tonnage of ore to be extracted from the space occupied by each square set.

Where the dip of the vein is at a flat angle, or the walls are bad, shorter posts than those described herein will probably be more advantageous; the more vertical the dip of the ore deposit the longer the posts may be, and vice versa.

Where sawed lumber is comparatively cheap, 3-inch plank is preferable to lagging poles for floors, on account of the greater floors it offers for shovelling, and the fact that it may be removed and reused.

THE INFLUENCE OF GOVERNMENT ON MINING.*

(By Edmund B. Kirby.)

IN most mining districts of the world the difficulties which we as engineers have to confront are mainly business-technical problems. Methods and economies in mining, transportation, milling and smelting, studied both from the scientific and business side, absorb our attention.

In few cases do questions of State economics force themselves upon us, because mining is almost everywhere a favoured industry, treated by governments with fostering care, and considered worthy of every sacrifice and every encouragement by the State. It is rightly recognized as the mother of industries, focusing the attention of the entire world upon each newly-discovered area. Upon this all the resources of civilization in men, money and skill are poured out. Around it agriculture, stock-raising, and lumbering spring up; railroads appear without the aid of land grants and subsidies; manufactures and towns follow, and a commonwealth is established.

Now, the British Columbia mining industry is unique in the world, not only in its entire lack of State recognition and fostering, but in the fact that difficulties imposed by State economics overshadow in importance all the ordinary technical and business problems with which mining men have to deal. It affords to-day a curious and interesting illustration of the injury wrought by unwise government, and also of the reaction of repressed mining upon commerce and other industries. These effects are emphasized by contrast with the present prosperous condition of the other Provinces of the Dominion, and also of the United States.

It is clearly recognized by the Canadian Mining Institute that British Columbia contains one of the largest and most promising mineral areas of the Dominion. But in considering the welfare of its leading industry of what use is it to concentrate attention on the fine points of machinery, mining

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