ing idle, aerating, etc. I approve of the idea of the deep tank and baffle plates; the soda business, also, if it is a genuine substitute for air, and can be efficiently applied at a small cost. I cannot approve the use of any precipitant, though manganese is one of the best precipitants that can be used, because the latest scientific experiments have proved that microbes and bacteria can totally destroy every impurity contained in sewage when properly aerated and housed in filters composed of powdered charcoal made from town refuse or small pea coal, and in a lesser degree by sand, small clinkers, stone and coke.

SOME MODERN FORMS OF MILLING MACHINERY.*

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The time has happily gone by when directors of mining companies order a mill "ready made" like a suit of clothes, and it is not unusual to have a mill designed to fit the ore it is to treat, as carefully as the development aims to explore the lead. The machinery, whose description follows, is a case where designing to meet specific conditions has been carried somewhat further than is customary. The problem was to plan a custom plant to handle the gold ores of the Lake of the Woods, many of which are low in grade, but contain streaks of high values. The absence of copper or lead in addition to the low tenor, put smelting out of the question. A site was selected at Keewatin, having ample water power with the lake for a mill pond. The ore is brought in from the mines to the plant in barges carrying thirty tons. It was decided to build the mill, to unload this ore, crush it, and sample into storage, then run over amalgamated plates and vanners; all the ore handling to be automatic. It will be seen in the following description that nothing radical was introduced, and that the principal features worth noting were improvements in the detail of existing methods.

The ore is unloaded from the barges by means of a Locke-Miller cableway of four hundred and fifty feet span. This hoists the ore in skips to an elevation of seventy feet and carries it across the main line of the Canadian Pacific Railway into the sampler building. The skip is automatically dumped into a two hundred ton bin, by means of a spring hook. The bottom of this bin is shaped like the letter W, having a gate at each point, so that each side may be used as an independent bin. Both discharge into a crusher feed hopper in the form of an iron cone, thirty inches in diameter at the bottom, placed with the open end thirty inches from the crusher feed floor. The gates being open the ore forms a cone on the floor around the bottom of the hopper, and automatically works down as it is fed into the crusher.

This crusher is of the "Invincible" type. Tension strains are carried by wrought iron, and all compression strains by cast metal. The movement of the jaw is parallel, the top and bottom moving equal distances; and not, as in the Blake, where the bottom moves more than the top; or, as in the Dodge type of crusher, where the top has the greater throw. The usual arrangement is reversed and the outside jaw made movable, with the result that the common massive frame is done away with. This brings the weight of a ten-inch by eighteen-inch machine, which is the size used in this plant, down to nine thousand pounds, while the customary weight of the cast-iron framd machine of the Dodge or Blake type is from twelve thouse and pounds to eighteen thousand pounds. Each portion of the jaw moves over an elliptical path, the long axis of which is so inclined that during the moment of crushing the hanging jaw plate moves directly towards the stationary plate, and only at the end of the stroke moves down and back to feed the material through. The result is a minimum amount of cut ng of the plates by the ore, there being no sliding movement at the time of greatest pressure. The tension strains are taken by four wrought rods, which run through the frame of the machine to the rear and end in nuts. By tightening independently the rods holding the top and bottom of the hanging jaw, the inclination of the moving plate with reference to the fixed one can be altered. It is profitable to have the opening of the crusher as large as possible, that sledging may be avoided, while the angle between the jaws must be so sharp that the rock will not jump up when the jaws come together. These independent adjustments allow the angle between the jaws to be the largest practicable for any particular ore, and once placed, does not change during the operation of the crusher. In the design of this machine the parts which require attention have been concentrated at the back, so that the jaw end can be built into the feed floor, placing the jaw opening where most accessible, and at the same time bringing together within easy reach and out of the dirt and dust from the ore all oil cups and adjustments requiring attention. The inertia effects in this machine were planned to make it as free as possible from longitudinal shake, and in this plant, where it is set twenty feet or more from the ground, produce little or no vibration of the building.

The ore from this crusher is carried by bucket elevator to a screen, which deserves especial notice, its use removing the list of troubles attendant on handling crushed quartz dry through a revolving trommel. It is an ordinary gravel screen, set up at an angle of forty-five degrees, and furnished with a cover. But it is this cover that makes the difference, as it prevents the ore from taking long jumps, and thus permits the use of a screen of almost double the mesh of the product desired. That is, to get half inch mesh ore use a one inch screen, the ore particle striking the screen at so small an angl as not to fall through if more than two-thirds the size of the opening. Particles of ore which get wedged in an ordinary screen do not get into the openings of this screen at all, but jump down over it to be further crushed. The screen surface used in this plant is five feet long and ten inches wide, and readily handles six tons of ore per hour.

What fails to pass the screen goes to a pair of rolls, in which the best results of the experience of a number of mining machinery designers have been utilized. These rolls having shells thirty-six inches in diameter and ten inch face, weigh twenty-six thousand pounds, and when taking rock from a three inch screen and crushing to half inch mesh, run smoothly without jar. The frame is cast in one piece, extended below to form a hopper. The moving roll is of the sliding yoke type. The bearings are nine inches in diameter by twenty inches long, and are patterned after the journals of a railroad axle, which seems to be the best type for heavy service under repeated strain. They have a solid shell and are babbited on the side supporting the strain. The other half is chambered out to form a recess to hold waste, soaked with oil. In addition, back of the babbit is cored out a water jacket, which, in the event of heating, can be connected by hose with the water supply, and the operation of the rolls continued. The shell on the outside is but partially formed in the shape of a ball and socket box. It allows the box to adjust itself to any horizontal angularity of the shaft, such as is produced when one side of the roll is fed an the other side is empty, but prevents the

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