

more uniformly distributed under the stamps. Thus, the Homestake mortar feed-opening is 24in. long and 4½in. wide, while that of the Caledonia, occupying the entire length of the mortar, is 52in. long and only 3in. wide.

"The two ore-feeders used in the district are the Hendy Challenge and the Tulloch Automatic. Each has a well-earned name, the Challenge being, perhaps, the most desirable for wet ores. Both right-and left-hand feeders are used, the bumper-rod standing between stamps 1 and 2 or 4 and 5. The Challenge feeders introduced with the twenty new stamps of the Caledonia mill are central feeders, the bumper-rod being placed next to the central stamp. The rod is guided from the cam-floor, to which a piece of board, with a suitable hole for the rod to pass through, is fastened. The comparative advantages of the two feeders may be summed up by stating that, while the sheet-iron plate below the hopper of the Tulloch wears out quickly—with Homestake ore in two years—it is cheap, and can be patched or renewed by any blacksmith; whilst the circular cast-iron carrier-table of the Challenge lasts seven years with the same ore; but it is costly, and, if anything is out of order with the gearing, it requires a shop and a machinist.

"*Battery-foundations, Frames, and Guides.*—The essential importance of a good foundation is well known. In preparing it a rectangular pit, from 11ft. to 14ft. deep, is first dug to receive the mortar-block. It is made sufficiently long and wide—4ft. by 6ft. 6in.—to leave a space of about 24in. all around the block. The bottom is then carefully levelled, and some sand tamped down. On this are laid two layers of 2in. plank, spiked crosswise to each other, and then the planks which form the mortar-block. The latter used to be placed directly on the bottom of the pit, the uneven tops being sawn off afterwards. Now care is taken that this 4in. wooden floor shall be accurately horizontal, and that the distance between it and the bottom of the mortar shall have the length of the mortar-block. The top of the block is only planed off, which saves time. By use of this flooring the time required for replacing a mortar-block is reduced from six or seven days to five days. The mortar-block consists of planks 11ft. to 14ft. long, according to the depth of the pit, or varying breadth, and not more than 2in. or 3in. thick, as it is difficult to find wood of greater thickness which is sound throughout. They are spiked together, and are fastened above and below, bolted to each other by transverse rods, the upper binders—8in. by 12in.—being even with the top of the mortar-block, and the lower binders—12in. by 12in.—about 3ft. lower down. The space around the mortar-block is then carefully filled and tamped with rock and tailings up to the level of the mudsills, which are about 4ft. below the bottom of the mortar. When the top of the mortar-block has been planed off and levelled a sheet of rubber-cloth ¼in. in thickness is placed over it, and the mortar put in place. Through the four holes on each side pass eight bolts, from 3ft. to 4ft. 6in. long, and from 1½in. to 1¾in. diameter, with which the mortar is fastened to the block.

"In placing the planks forming the mortar-block, and in adjusting the bolts that hold down the mortar, a decided improvement has been made at the Homestake mills. The planks, which always stand on end, were formerly spiked so that the width was parallel to the short side of the mortar. The holes for the eight bolts were then bored into the mortar-block from above. At a suitable distance below recesses were chopped out to receive the nuts which screw the lower ends of the bolts. Now the planks are so placed that their width is parallel to the long side of the mortar. The bolts have only at the upper end a thread, and end in a loop at the bottom. Through these loops and through the mortar-block pass horizontally 2in. iron rods. The planks on the two sides of the block, where the bolts pass down, are cut out to receive them. The advantages of this arrangement are apparent. In addition to the mortar being more securely and evenly tied to the block, it is easier to renew the mortar-block if necessary. The pit need only be dug in front of the mortar, and, when the front binders have been removed, it is easy to tear out the planks one after another with pick and adze. In putting in the new block, the two outside rows of planks, with places cut to receive the bolts, are kept ready, so that only four horizontal 2½in. holes for the rods need be bored when the planks have been spiked together. With the old method two trenches had to be dug instead of one if a mortar-block was to be exchanged. Then the planks had to be chopped out in pieces, until room enough had been made for them to be torn off.

"*Battery-frames.*—These are generally 12in. by 24in. in size, with recesses for the boxes of the cam-shaft. They are placed on the short sides of the mortar, and are independent of the mortar-block standing on cross-sills—which are placed on the top of and at right angles to the mud-sills—and tied by the upper and lower guide timbers, and at the foot by two longitudinal beams bolted to them and let into the cross-sills. The frames are braced either from the back or the front of the battery, according to the way in which the power is transmitted to the cam-shaft. In the Homestake, Highland, Golden Star, and Father de Smet mills, where the line-shafts are at the back of the battery, the frames are braced by posts, generally placed on an incline between the frame and the cross-sill, leaving the entire front of the battery unobstructed. In the Golden Star and Caledonia mills the cam-shafts receive their motion from line-shafts placed on the cam-floor, and the frames are braced against the cross-beams, to which the boxes of the line-shafts are bolted.

"*Guides.*—The stamps are held upright by two guides, fastened to the guide-timbers, which tie the battery-frames. The upper guides are above the tappets or discs, the lower one between the cam-shaft and top of mortar. At the Homestake mill the centre of the lower guides is 17½in. above the top of the mortar, and the cam-shaft, revolving between the two set of guides, is 3ft. 10½in. below the centre of the upper, and 4ft. above the centre of the lower, making the total distance between the two sets 7ft. 10½in. At the Caledonia mill the distance from the top of the mortar to the centre of lower guides is 16½in., from these to centre of cam-shaft 3ft. 4½in., and from this to centre of upper guides 4ft., 2½in., making a total of 7ft. 6¾in. Each set of guides consist of two pieces of 4in. pine plank, 16in. deep, having semicircular grooves, through which the stems of the stamps pass. Between the two posts of the guides, when new, are inserted small pieces of wood to keep them slightly apart. When the grooves are somewhat worn these slats are removed, and the guides brought nearer each other. Later on the faces are planed off to diminish the size of the grooves, so that the stamps may not be held too loosely. Each set of guides is secured