caps. Like the members of the sill floor, these members may be duplicated to any extent required by the size of the excavation to be timbered.

The posts as framed are 8 feet 2 inches over all; the caps are 5 feet 4 inches, and the girts or braces are 5 feet; the butt caps, like the butt spreaders, of the sill floor are cut in varying lengths to suit such spaces as may exist.

The details of framing the logs into members of the square set are plainly shown in figures on plate 1, and need no further description. The philosophy of this method of framing the timbers is that the cap pieces of the various sets form continuous stringers of timber running horizontally from wall to wall of the vein, no matter what this distance may be. Such stringers offer the end grain or greatest strength of the timbers to the walls, from which the greatest strains are generated.

The posts and girts rigidly support the stringers thus formed of the several cap pieces in true horizontal position, bearing on the joints from right-angled directions, while the cap pieces and the girts support the posts in true vertical position.

The whole framework forms a strong rigid structure capable of indefinite extension upwards and longitudinally as stoping proceeds, allowing at the same time for any expansion and contraction in width to suit such irregular widths of the vein as may occur.

Besides the function of the various members of the square set system to support each other in the manner described, that of the cap pieces is to receive directly to sustain the strains coming from the walls of the exhausted deposit, while that of the posts is to support the vertical weight coming from the undercut ore deposit and the broken ore lying on the floors, but strains coming from any direction are distributed over all the members of the set.

The system possesses, to a considerable degree, the qualities of a truss, and makes it possible to extract all the ore of any deposit and effectually secure the enclosing walls from caving in. When the framework comprising the sets is erected, a floor, consisting of 3-inch plank, is spiked down on the caps of each floor set. These are the working floors on which the miners operate the machine drills, in the method shown on Fig. 5. When the ore is dislodged from the vein by blasting, it falls on these floors, where the waste or second-class ore may be sorted out from the shipping ore. The shipping ore is shovelled into chutes, which are built of 4-inch plank spiked to the timber framework and carried upwards with the square sets, as shown in the plate. The second-class ore, or waste sorted out, may be stored temporarily or permanently in the framework of the timbering, from whence it may be drawn off at any time through chutes, should removal elsewhere be desired.

Figs. 4 and 5 are ideal cross and longitudinal sections illustrating the method of timbering and the work of stoping as it is caried on between the levels. Fig. 4 is a cross-section through the line A-B on Fig. 5, which in turn represents the longitudinal section through the line C-D on Fig. 4. On Fig. 4, the original position of the level drive in the vein is assumed as shown at the point X. This drive, as already stated, furnishes the point from which the excavation of the vein matter for the sill floor is commenced.

The step method of excavating the ore is shown on Fig. 5, where stoping is proceeding in double-headed steps, each step excavating the ore from wall to wall and having a vertical height of 9 feet in the clear, which allows the erection of one floor of timber sets, which in turn provides the scaffolding from which the miners may attack the ore above.

In stoping out the ore on any level, the ordinary method is to keep the sill floor at least 30 feet in advance of the first floor, and it about 30 feet in advance of the second, and so on, as is shown in Fig. 5. One machine drill, or generally two, in case the vein is wide, are assigned to the work of the two opposite headings of any floor, going in opposite directions, working on each heading alternately. When one face is drilled and blasted, the machine drills are changed to the opposite face, and the shovellers pass the broken rock into the chutes, or sort it, if sorting is required. When the ore broken is thus removed from the face, the timber gang erects another unit of timber there, and the stope is again in readiness for the machine drills, which have by this time finished drilling on the opposite face.

Generally, the step method of stoping proceeds in opposite directions from a raise, run through the ore body between the levels, as shown in Fig. 4. The framed timbers are delivered in the stope by dropping them down through this raise or hoisting them from the level. Sometimes the framed ends of the timbers are injured by dropping them through the raise, but as a rule, no material injury is done to them, while the time gained by this method is a very important factor in cheapening the cost of timbering compared with hoisting piece by piece from the sill floors underneath.

Per Tonnage Cost of Square Set Timbering.—After the sill floor is laid and the framework started, a square set, which is made up of one post, one cap and the brace, consumes 18½ running feet of logs.

The logs, peeled and seasoned, cut measuring 16 feet 6 inches, cost $1.20 each delivered f. o. b. the cars at the works, or about 8 cents per running foot. Therefore, the 18 feet 6 inches required for the set would cost $1.48, or say, $1.50 unloaded, in the framing shed, provided the logs are not cut to waste in framing, which may be avoided with a little care and foresight.

The cost of framing the pieces comprising the set would be about $0.55 per set, when framed by hand labour, carpenters being paid $3.50 per day of nine hours.

Cost Data Per Square Set, Hand Framed.—Material.—A log measuring 16 feet 6 inches, costing $1.20, cuts into two posts, or three caps, or three braces; therefore:

Material in one post costs	$0 65
Material in one cap costs	43
Material in one brace costs	40
Total cost of material in one set is, say	$1 50
Labour.—One carpenter frames per day:—	
About 21 posts, costing each	$0 167
About 21 caps, costing each	167
About 16 braces, costing each	219
Total cost of framing	$0 553
Total cost of labour and material in set	$2 053