

hand-drill. Around near the boilers are benches and books for the miners' use, warmed in winter by the exhaust steam. At a very large tunnel-working in Colorado, often to be referred to, and in which the writer worked, the cost of such an engine-house thus supplied was \$8,700, while another \$1,000 was spent on two other buildings, a well equipped blacksmith-shop and a timber-shed on either side of the track near the tunnel, which was double-tracked and driven 6,000 feet at a cost of \$125,000; with such an equipment, the first 3,940 feet taking exactly two years to accomplish, being delayed by hundreds of feet of tremendously difficult and dangerous ground.

If two drills are being used a third should be kept in the shop, also a good supply of track-iron, piping, sharp drills, etc., trying to anticipate always any wants that otherwise might delay work. If good water-power is available, excellent machines are now made, by the using of which power the cost of this kind of work can be greatly reduced.

As to houses and eating-quarters for the men, I think company money should not be spent on these, as good men can nearly always be got who are willing to work and also to build their own houses or shanties. Even the manager or superintendent should be content with humble quarters if in a new region, until the mine warrants more expense.

Ventilation.—When the tunnel is run a short distance some means of conveying fresh air to the face must be provided:—(1) By hand-blower set up at entry and pipes 4 to 5 inches diameter; (2) by a tight wooden box, 1 foot square, running into the face and having its outer end running up the hill to create a draught; (3) by some regular form of blower or exhaust fan, as the Root or Baker, driven by water or a small steam-engine, using piping 8 to 12 inches diameter, spiral-welded and tight joints; (4) by discharging compressed air at intervals as found so successful in the large Patrolino tunnel, Italy, 3,600 metres long; (5) or, by perhaps the best and cheapest method of all, *i. e.*, using pipes 8 to 14 inches diameter, with tight joints, running nearly to the face, introduce in the pipe near the tunnel-mouth a Koerting exhaust (made in Philadelphia, which is about 3 feet long and the same diameter as the pipe. To this conduct through a $\frac{1}{2}$ inch pipe live steam of 60 to 80 lbs. pressure, or as usually used, compressed air, which is allowed to blow off in the exhaust in a direction towards the mouth, a vacuum tends to form quickly behind the jet and at once a strong current of air begins