

introduction into the colony, and some are at present unemployed. Full particulars of the bores put down by each drill, the locality in which it was employed, and the strata pierced in every case, will be found in Appendix A.

Size of Bits.

The size of the diamond bit used with the underground-drills is $1\frac{1}{4}$ in. Each bit usually contains twelve diamonds, six on the crown, with three on the inside and three on the outside clearances. Boart diamonds are considered best for the clearances, and carbon for the crown. In boring from the surface, bits of 5 in. diameter are first used, and as the bore becomes deeper it is often lined with thin iron tubes to prevent the sides falling in, and continued with bits of smaller diameter. A bore started with a 5-inch bit may be continued with bits decreasing in size to 4 in., 3 in., and 2 in., owing to the necessity that frequently exists of introducing sets of tubing at different depths. The number of diamonds inserted in each of these last-mentioned bits is, as a rule, twenty, sixteen, twelve, and twelve respectively.

Work done by Bits.

Several of the bits used have bored over 500 ft. in depth, and one, employed in coal-boring at Colac, bored as much as 1,450 ft. with the loss of only two or three diamonds; while others have been destroyed after boring only a few feet. Much depends on the nature of the strata pierced, the quality of the diamonds, and the mode of setting them in the bits; and a good deal depends also on the skill and care of the operator in charge of the machine.

Diamonds.

With regard to diamonds used in boring, it may be mentioned that those which experience has shown to be most useful are, for underground-drills, Brazilian boarts as nearly globular in shape as possible, and Brazilian carbons as nearly cubical in shape and as smooth and free from sharp angles as they can be obtained. The carbons should weigh from $\frac{1}{4}$ to 2 carats each, and should, when fractured, show a clear steel-grey colour, with very fine grain, and great hardness. For surface-drills the diamonds may be as large as 5 carats each for the 5-inch bits, down to 1 carat each for the 2-inch bits. Cape boarts, which are not one-fourth the price of Brazilian stones, have been tried by this department as an experiment; but, although they have answered fairly well in boring through mesozoic rocks (sandstones and shales) in search of coal, it is found that they are quite unfit for penetrating dense basalt in search of alluvial leads, or hard, broken schistose rocks in search of quartz-reefs.

Sites for Boring.

In selecting sites to put down bores the advantage of being adjacent to a good water supply should be borne in mind, as work cannot be done satisfactorily with less than from 500 to 1,200 gallons of water per day.

Cost of Boring.

When the drills were first introduced into this colony the prices of diamonds for drilling purposes were very much lower than at present, and of course the cost per foot of boring was comparatively less than it is now. Brazilian boarts were then obtainable at about £1 10s. per carat, and carbons as low as 17s. 6d.; but the prices at present ruling are about £4 4s. and £3 respectively, and diamonds (especially the best Brazilian boarts, known as ballas) are not always readily obtainable at even those rates. The estimated cost of boring per foot when drilling operations were first commenced was 7s. 6d. in sandstone, 8s. 6d. in basalt, and 12s. 6d. in metamorphic schist; but at the present time the cost is about 10s., 14s., and 18s. for the same descriptions of rock respectively down to depths of about 500 ft.; and these rates would be exceeded at greater depths. The estimates mentioned include wages and the cost of diamonds, fuel, and water, also repairs to machinery; but not the cost of superintendence and of the clerical work connected with the management of the drills. The average number of diamonds lost and fractured per 100 feet of boring has been 2.89. The fractured diamonds are, as a rule, unsuitable for resetting, and they are sold as "splints" at about 12s. per carat.

Repairs.

The repairs and renewals required for the drills are executed under annual contracts. A copy of the contract at present in force (Appendix D) is attached to this memorandum. The cost of repairs and renewals (exclusive of diamonds) is estimated at £20 per month per drill, assuming the drill to be fully employed three shifts of eight hours each per day.

Conditions on which Drills are lent.

Prior to the 1st August last the companies using the drills were charged £10 per week for the wear and tear of machinery and loss of diamonds, and in addition they had to pay the wages of the men engaged by the department to work the machines. This was done under regulations, a copy of which will be found in Appendix B. With the view, however, of bringing the machines within the reach of poor and struggling companies and of parties of miners who might desire to prospect remote and untried localities, fresh regulations were framed. Under these latter (Appendix C) the drills are now lent to mining companies and individuals free of charge, and diamonds are supplied at current rates, half the working expenses being also borne by the Department of Mines in the case of companies searching for gold, and two-thirds of the expenses in the case of companies searching for coal. Mining companies are now also allowed to select their own men for working the drills (except the foremen), and to pay what wages they may determine upon, provided that the rates do not exceed those usually paid by the Government. The only condition imposed is, as mentioned hereunder, that the drills shall be kept in repair and be returned to the department in good order when boring operations are completed. In addition to the drills lent to mining companies, it has recently been decided to employ one drill in prospecting in each of the mining districts solely at the expense of the Government. A list of the sites already recommended for boring by the Geological Surveyor of the department is given in Appendix F.