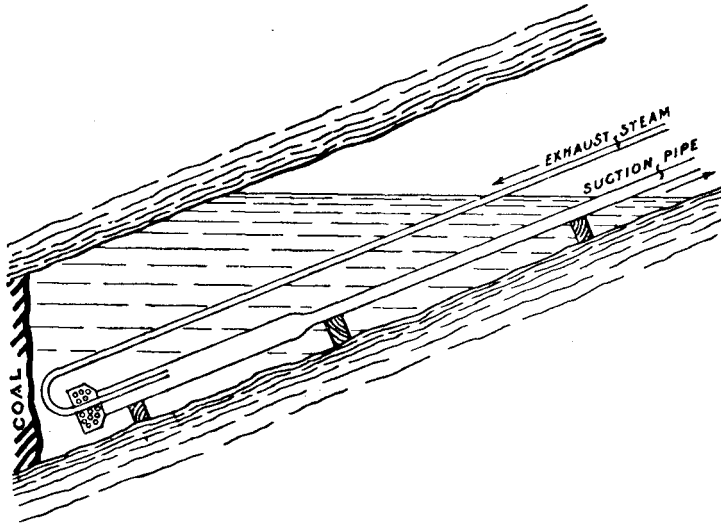


than the pipes above. The exhaust-steam pipe is carried down alongside the suction-pipe and turned into it at the lower end as shown in the sketch. Near the pump a plug tap or cock is placed



on the exhaust-pipe, but between this tap and the pump a short branch-pipe (of the same diameter as the exhaust-pipe) must be connected and fitted with a similar tap. These two taps should be connected to one lever so that the operation of opening one closes the other. Before starting the pump to work, the tap on the main exhaust-pipe must be closed, and that on the branch-pipe opened. On the pump being started this allows the exhaust to discharge into the surrounding atmosphere, but it is desirable to continue the branch-pipe a few feet past the tap and lead the exhaust into a small tank of water. (In the case of small pumps an oil-drum is ample.) When it is ascertained that the pump has got fairly to work on the water, the lever connecting the taps is pushed gently over, and the exhaust steam then passes down the main pipe and into the suction. It is to be remembered that the taps must be reversed by the connecting-lever a few seconds before the steam is shut off from the pump to avoid flooding the cylinders, and also that where leather pump-buckets are used care should be taken not to let the pump get on air before altering the direction of the exhaust steam, otherwise the heat will damage the leathers.

Actual experiments have demonstrated that an increase of  $12\frac{1}{2}$  per cent. in the working speed and capacity has been attained by the use of this simple condenser. The method has its limits, but is eminently suited to pumps designed for comparatively low heads.

#### COAL-CUTTING BY MACHINERY.

For some years past coal-cutting machinery has been in use at the collieries of the Westport Coal Company (Limited), the type generally used being that known as the "Yoch," a percussive machine mounted on wheels. All classes of coal-cutting machines have their various spheres of usefulness, and so far no one machine can be said to meet the various demands or suit the requirements of the diversified conditions of mining. Both the disc and cutter-bar (rotary) machines are adapted for longwall working (a method little practised in New Zealand), and the percussive type for working in bords at collieries worked on the bord-and-pillar system. A want for a light and handy machine which can be set up quickly, moved about the workings with ease, suited to the driving of narrow places in coal, and which will not smash up an undue proportion of coal into slack has long been felt.

A machine known as the "Champion" Coal-cutter has been introduced into the colony within the last year, and appears to fill the conditions just named admirably. Briefly, it may be described as a rock-drill with a swivelling attachment, and will be readily understood from the illustrations. It will hole or undermine the coal for a depth of 7 ft., and only takes out a cut  $3\frac{1}{2}$  in. in height. Holing may also be done in any band of dirt or inferior coal which may occur in the seam being worked. In many places this is a distinct advantage, but a very strong point in favour of the machine is that it will "nick" or "shear" the sides of the working-place as well as do the holing, the breadth of the coal taken out in a "nicking" cut being only  $3\frac{1}{4}$  in. The machine can be worked at any angle and in any part of the seam. It can be used for drilling the holes necessary for shot-firing, and also for wedging if required. Compressed air is used for driving, and the amount of air used is not large, the branch supply-pipe being only about  $\frac{3}{4}$  in. diameter.

In actual work at English collieries the new machine has proved of great value in opening new headings in coal, the experiences of eminent mining engineers going to show that the work is performed at from twice to four times the speed of hand-labour (according to local conditions) and at considerably less cost.\*

#### EXAMINATION FOR MINE-MANAGERS' CERTIFICATES.

The papers used at the examination held during the first week of February, 1904, are appended.

\* Further reference to the working of this machine at Westport is made in the article on "Coal-cutting by Machinery," by Mr. J. Dixon, M.E. (See Appendix.)