

cent. below the explosive line, at which point there is sufficient expansive effect of the combined gases in the test cylinder to propel the piston valve against the gong J, causing an audible and unmistakable sound, which occurs always at a certain definite fraction of the percentage of the gas tested, and which point is made a standard for comparison for all other percentages of the same gas.

If it is desired to test the gas taken from a mine for fire damp, a supply of the mixture existing in the mine is secured by pumping it into a rubber bag by means of an ordinary small diaphragm pump and brass tube fitting the mouth of the bag. As soon as the bag is filled it is corked and taken to the testing machine on the surface, and a cork with a tube and ordinary stop cock replaces the first cork. This is then connected by rubber tube to the disc valve L. The gas cylinder B is set at the point marked 6 per cent. on the beams for the first test of gas of unknown quality. The crank handle N is operated by hand, giving two or three strokes of the pumping cylinders, the combined action of which forces 6 cubic inches of gas from the rubber bag with 94 cub. in. of atmospheric air through the mixer, to the tester. If the lowest point of ignition is sufficient to cause the gong to ring, by the expulsion of the piston valve, it would determine the presence of pure light carbureted hydrogen gas of rich quality. When tests of air containing low percentages of fire damp are required, any ignitable gas is first taken in a rubber bag, and its lowest point of ignition, when mixed with air is determined. The clamp D on the beam G is moved to the point at which the small cylinder B was located when the lowest point of ignition was determined, or 6 per cent. and clamped. The cylinder B is then shifted to a point marked one per cent. less than the point marked by the clamp or 5 per cent. At this point the instrument can be operated without any possible sound from the gong, because the quantity of gas is decreased. If, when the air from the mine is forced through the machine and mixed with the standard gas taken, the gong rings, it is known that there is more than one per cent. of explosive gas in the mine air, so a smaller proportion of the standard gas must be taken, by moving the cylinder B back to  $4\frac{1}{2}$  per cent. and again operating it. If the gong rings from a faint blow of the piston valve, it is known that the test is nearly completed, and the line of demarkation

