

shield fixed in the bonnet. The main gauze cylinder is provided with a gauze cap. The bonnet is locked by a sliding bar, which cannot be withdrawn until the oil-vessel is removed. In a gas-mixture the gas burns in the gauze cylinder only between the top of the brass tube and the lower edge of the gauze cap. The lamp seems very safe in all currents in which it was tested (up to 3,200ft. per minute for eight seconds), but its security would probably be lessened considerably if the bonnet and the flange on the shield ceased to be concentric, and if any perforations were made in this flange. In air moving with any velocity up to 3,500ft. per minute the flame burns very steadily when the lamp is either erect or inclined. The flame is scarcely affected by violent oscillations of the lamp, or by rapid motion up and down in a vertical direction, and it is not extinguished by inclining the lamp until the latter is nearly horizontal.

The Mueseler lamp (see D, Appendix I.) is, in Belgium, constituted the legal lamp for fiery mines, and exact forms and dimensions are prescribed, from which only the smallest divergence is allowed. As will be seen by the diagram, this lamp consists of a Clanny lamp, into which an interior chimney is introduced. The air which goes to feed the flame passes through the lower part of the gauze cap and then downwards through the horizontal gauze ring which supports the chimney. The products of combustion ascend under ordinary circumstances by the chimney; but when the lamp is so much inclined that the stream of heated air rising from the flame strikes upon the gauze diaphragm instead of going up the chimney, the action of the lamp is reversed, and it feeds down the chimney: the entering air, being highly charged with carbonic acid, at once extinguishes the flame; hence very great care is required in using this type of lamp. If, while the current is partially reversed, the lamp becomes surrounded by an explosive mixture, the gas-mixture outside the chimney becomes ignited, and if the current-velocity be above 400ft. per minute the lamp behaves like a Davy, and an explosion will certainly follow.

With the Belgian lamp, with a flame of normal size, and exposed in a vertical position to a horizontal current of any velocity, the Commissioners did not produce this result, but with a very small flame, such as is used for looking for gas, there is a danger of this accident.

In Great Britain the Mueseler lamp has been altered by varying the dimensions, and particularly in removing the orifice of the chimney further from the flame. By this means the danger of accidental extinction is reduced, but the safety of the lamp is much diminished; and even with the prescribed dimensions the Belgian lamp is not safe when it receives the current obliquely and is partially shielded from its action. A number of experiments with deflected currents proved this fact very clearly. By the addition of a bonnet to protect the gauze the Mueseler lamp is rendered very safe; but care must be taken to leave no gap between the bottom of the bonnet and the flange on which it ought to rest. Mr. A. H. Stokes, F.G.S., Her Majesty's Inspector of Mines, has added a shut-off apparatus, whereby the outlet of the lamp may be closed, and the flame extinguished.

Morgan's lamp, which is of the bonneted Mueseler type, is also stated to be very safe, with the serious defect, however, of great weight and somewhat complicated construction. Since the report was published this lamp is said to have been very much improved.

In the following table the main facts in reference to these lamps are collected:—

Lamp.					Weight with- out Oil.	Illuminating Power in Standard Candles.	Current Velocity of Explosive Mixture dur- ing Trial.	Duration of Trial in Ex- plosive Mixture.
					Lb.			Min. sec.
Marsaut, 3 gauzes	...	...	...	...	*2.75	0.4 to 0.5	3,100	2 0
" 2 "	...	...	...	...	"	0.6 to 0.7	2,000	1 0
" 2 "	...	...	...	...	"	"	800	15 0
" 2 "	...	...	...	...	"	"	2,650	5 0
Mueseler, with bonnet	...	...	...	...	"	0.3 to 0.4	2,850	†
" "	...	...	...	...	"	"	2,650	1 0
Gray	...	...	...	...	"	"	3,100	1 0
"	...	...	...	...	"	"	2,857	1 40
Evan Thomas, No. 7	...	...	...	...	3.25	0.4 to 0.5	3,200	7 40

After giving these details of the various lamps, the Commissioners go on to make sundry suggestions for modification and improvements; and, after pointing out that the ultimate sources of danger with all these lamps is the breakage of the glass, they suggest that both the Marsaut and the bonneted Mueseler would be safer if there were no apertures in the bonnet for the admission of air except the holes in the horizontal flange which forms its base; also, that the holes in the top of the bonnet for the escape of the products of combustion should be completely above the top of the outer gauze. It is also suggested, with regard to the bonneted Mueseler, that the metal rim at the bottom of the gauze cap in lamps of Belgian manufacture, or the vertical ring on the lamp-frame which takes the place of this rim in most lamps of English construction, should be somewhat deeper than is usually the case. The object of this is to cause the intake air, after entering through the holes in the flange supporting the bonnet, to rise vertically as much as possible before passing through the gauze cap.

An improvement might be made in the Mueseler lamp by introducing, above the glass, and below the horizontal gauze diaphragm, a ring of thin metal with a short vertical tube projecting

\* The weight of these lamps is practically the same: different specimens of the same lamp vary by less than 2oz.  
† In an explosive current with this high velocity the gas sometimes continues to burn under the glass ring, but in general it is extinguished in a few seconds.