

The Commissioners conclude their remarks on this subject by the following recommendations :—

- (1.) That all work involving blasting in mines should be intrusted only to experienced workmen.
- (2.) That, in order to lessen the risk from blown-out shots, particular care should be taken that each shot should be assisted by under-cutting and nicking, or shearing whenever it is practicable.
- (3.) That the tamping, stemming, or ramming should consist of very damp or non-inflammable material.
- (4.) That, where strong tamping is needed, the compression of air at the bottom of the hole should be avoided by pushing in the first part of the tamping in small portions.
- (5.) That, where safety-lamps are used and powder is employed, the shots should be fired only by specially-appointed shot-men, who, before firing the shots, shall satisfy themselves that the foregoing instructions are observed, and shall also satisfy themselves, by carefully examining all accessible contiguous places within a radius of 20yd. of the shots to be fired, that firedamp does not exist to a dangerous extent.

8. SAFETY-LAMPS.

The next subject treated of in the report is safety-lamps ; and into this branch the Commissioners have made very detailed and elaborate inquiries.

In commencing, the report points out that the two causes, explosions of gas and falls of roof and sides, cause 60 per cent. of the deaths in Great Britain, and that these two causes are intimately connected.

In order to satisfy the requirements of safety, it is necessary not only that a lamp should be what is called a "safety-lamp"—namely, one which will not, under any probable circumstances, ignite an inflammable mixture of firedamp and air even when passing at a high velocity—but that it shall give a sufficiently brilliant light to enable workmen to guard against falls of coal and stone from the roof and sides. It is also necessary that the lamp should be so simple in construction as to be easily examined, and should not be liable to extinction when handled with ordinary care. Another matter deserving consideration is the relative facility afforded for observing the presence in the air of abnormal quantities of firedamp.

It is hardly necessary here to do more than mention lamps which furnish an excellent light, while entirely independent of the surrounding medium. Of this character are the various electric lights which will be mentioned later, and the lamp invented by Mr. Fleuss, in which the source of light is a cylinder of lime maintained in an incandescent state by a spirit-flame fed by a stream of oxygen derived from a reservoir containing that gas under considerable pressure. Though exceedingly useful as a means of exploring after explosions, and in places where the atmosphere of a mine does not consist of air sufficiently pure to support combustion, lamps of this description are, fortunately, not at present required in this colony. The class of lamps which merits consideration is that in which the light is fed by air from the mine.

Sir Humphrey Davy discovered that under certain conditions wire-gauze is able to distribute by conduction the heat which it receives, and to subsequently emit it by radiation, so that it will remain, even when in contact with inflamed gas, at a temperature inferior to that required to bring about the combination of firedamp and oxygen in a mixture of the gases which is passing through the gauze. Upon this discovery rest the many hundreds of so-called safety-lamps which have been brought forward; but even Davy acknowledged that this gauze, when constructed upon correct principles, could be trusted to prevent explosion only when the velocity of the air-current did not exceed a certain limit. Beyond this limit the flame may pass the gauze.

At the time of Davy's invention air-currents in mines seldom exceeded a velocity of 5ft. per second, and under such circumstances the lamps of Davy, Clanny, and Stephenson were all safe. But at present in Great Britain velocities of even 30ft. to 35ft. per second are met with, and in this colony, though the velocities are usually low, 26ft. per second has been registered, and there are special circumstances in which a much higher velocity might occur; so that the employment of any but the approved kinds of lamps is inadvisable.

It is thus seen that the more efficient becomes the ventilation of mines the greater becomes the danger from imperfect lamps, and the more care is necessary to prevent explosions of fire damp. The labours of the Commission have conclusively proved that the Davy, Stephenson, and Clanny lamps are absolutely unsafe under certain conditions.

There are two methods of behaviour for lamps when in explosive gas, either of which may be safe. The first, in which the light goes out, is obviously so; the second, in which the gas burns inside the gauze, may or may not be dangerous. If the ignited gas be shielded from the mechanical action of the current, and if the lamp be surrounded by glass, and the ignited gas be sufficiently distant from the glass to prevent the latter from becoming cracked by the heat, a considerable step towards safety is gained. In the Clanny and Mueseler lamps the light is surrounded by a glass cylinder, which may become cracked so as to allow the ignited gas inside to communicate with the external atmosphere. Injury to the glass may obviously arise from various causes, such as a blow, careless use by which the flame of the lamp is allowed to impinge on the glass, or by the impact of cold water on the heated glass.

Another point requiring attention is the difficulty of maintaining at all temperatures sufficiently tight joints where the glass and metal parts meet. If too tightly connected the expansion of the glass by heat causes its fracture; if too loosely, an opening of a dangerous size may be left. "Washers" of indiarubber and leather have been usually employed, but they are liable either to perish, or shift in position if strongly heated. The report most strongly urges the use of asbestos millboard washers, and great care in examining the surface of the glass.