THINGS TO KNOW ABOUT PERMISSIBLE EXPLOSIVES

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From September 2, 1908, to June 1, 1911, during which time the gallery for testing explosives has been in operation in Pittsburg, Pa., one hundred and forty-five (145) explosives have been submitted for official tests, eighty-four (84) of which have been passed for use in coal mines under certain provisions. The remainder have either failed to pass the tests or have been withdrawn by the manufacturers when introducing new and improved explosives.

During the year 1909, 8,598,027 pounds of permissible explosives were used in the United States. In the mines of Great Britain there were used, during the same year, 8,502,232 pounds of permitted explosives. For the year 1910 the use of permissible explosives has shown a marked increase in the coal mines of this country. The returns received from the manufacturers indicate that the quantity used during the year 1910 will reach 12,000,000 pounds.

The underlying reasons why one explosive passes and another fails when tested in the presence of gas and dust have been investigated at the testing station. The results of researches made, especially on explosives which failed to pass tests, have been reported to the manufacturers and in nearly all cases resulting in the manufacturers so changing and perfecting their explosives that later when new explosives were submitted they have successfully passed all requirements of the bureau. The results of tests indicate that every explosive if fired in very large quantities will cause ignition of gas and coal dust mixtures. An arbitrary charge; namely, 1½ pounds, has been established as the amount of explosives to be used in making tests, and all explosives, in order to be placed on the permissible list, must pass the gas and dust tests with this charge of explosive. A charge of 1½ pounds per drill hole should never be exceeded in practice. In good mining practice it need not exceed one pound and, accordingly, a greater factor of safety obtains. Explosives of many different compositions are now on the permissible list but all have been formulated with a view to producing explosives which on detonation give a relatively low flame temperature of short duration. It has been found that in order to ignite inflamable gas and coal dust mixtures a certain temperature, acting through a certain length of time, is required. It has also been determined that the temperature on detonation of all explosives exceeds the ignition temperature of inflamable gas and dust mixtures, but fortunately the flame of the permissible explosives is of such short duration when properly detonated that the requisite time necessary for igniting the inflamable mixtures does not obtain. It is evident that any factor that increases the duration of the flame temperature of a permissible explosive, such as the use of a weak detonator or the use of any explosive not in accordance with the provisions prescribed by the Bureau of Mines, will increase the danger in their use.

Encourage Experiments.

The energy developed by the detonation of permissible explosives, like other high explosives, depends on the change of the small solid particles and liquids of the explosive into large volums of gases and the rate of detonation or the rapidity with which these gases are formed. To meet the varying coal mining conditions in this country the manufacturers have formulated explosives in rates of detonation from 1,447 to 4,439 meters (4,746 to 14,560 ft.) per second. It is evident that for certain work where a shattering effect is desired in driving through or bushing rock, or producing coal for coking purposes the explosive reaction should be rapid, and permissible explosives should be selected from the list having a high rate of detonation. In a similar manner a suitable permissible explosive for use in soft friable coal and especially so when lump or steam coal is desired, should be selected which develops its gases at a slow rate in order that the pressure developed will be more prolonged.

I have been informed that the coal operators of West Virginia are overwhelmed with agents of permissible explosives with their various claims of efficiency. To establish their claims it means that their demonstrators must conduct a series of experiments over a considerable period of time in the mines. This procedure should not be discouraged for the reason that the manufacturers are constantly improving their explosives and in many cases permissible explosives which are more suitable to the work have been selected as a result of such tests. However, much of this unnecessary work could be eliminated by careful consideration of the physical characteristics of each explosive before making tests. The chemical composition would be of little value to the operator and it is not proposed to publish such information. In several instances in mining bituminous coal it has been found that permissible explosives containing only 20 per cent. of nitroglycerine have given better results and produced better coal than those made under a similar formula containing 25 per cent. of nitroglycerine. The physical tests of explosives, such as in the gallery, rate of detonation, strengths of explosives as determined bp lead blocks, gauges, ballistic pendulum, height and duration of flame, will be published as Bulletin No. 15 by the Bureau of Mines during the present month. The information will be of value to both the manufacturers and users of explosives.

Points in Hole Charging.

Suppose, for instance, an operator has tried several permissible explosives in a certain mine where the coal is soft and friable and has selected one as the most suitable for the work in question. From this bulletin he will note that the rate of detonation of this explosive is 2,000 meters per second. Now suppose the operator receives a request to try out a new explosive. He should first ascertain the physical characteristics of the new explosive. If he learns that the new explosive has a rate of detonation of 4,000 meters per second it would be obvious that this explosive would be too quick of action and not suitable for this particular coal. It is true a powder man skilled in the use of a quick explosive might possibly in a limited series of tests, through special skill, demonstrate the new explosive to be more economical and at the same time equally efficient as a slower permissible explosive but it should not be expected that the average miner would obtain the same results.

By carefully considering the location of the drill holes and using special conditions in loading and tamping to reduce the pressure developed, a permissible explosive of a high rate of detonation could be successfully used in nearly all coal mines. It is well known that the pressure developed by the detonation of explosives in a closed space is directly proportional to the charging density; that is to say, a 1¾-