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BLASTING ASSEMBLY

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1 Claim. (Cl. 102—5)

This invention relates to a method of blasting in which the explosive charge in the bore hole is more effectively tamped, and more particularly to an improved composition of tamping material for increasing the effectiveness of the explosive.

In the blasting of rock, coal and other material, it is customary to load a suitable charge of the explosive into the bore hole and then tamp or stem the charge by an inert non-explosive material. The primary object of the stemming material is to bring about increased confinement for the blasting charge so that its explosive effect is increased. This increased confinement is particularly desirable in the case of explosives of relatively low velocity. The use of stemming materials has the additional advantage, when used in coal mines where inflammable gases are present, of increasing the safety of the blasting operation and decreasing the possibility of ignition of the mine gases.

The materials used heretofore for stemming purposes have ordinarily comprised solid inert materials such as clay, stone dust and the like, which tend to absorb heat and thereby cool the gaseous decomposition products of the explosive, as well as to prevent the direct expulsion from the mouth of the bore hole of solid products which might be sufficiently hot to bring about dangerous ignitions of the mine gases. Such stemming materials had a preventive safety effect only, however, and in no way altered the explosive effect other than by lessening its dissipation.

An object of my invention is an improved method of tamping blasting charges in bore holes. An additional object is such a method in which the tamping material is of such nature as to increase the effectiveness of the explosive at the time of detonation. A further object is a stemming material which improves the safety properties of explosives, when fired in the presence of inflammable gases. A still further object is a method of tamping explosive charges which permits the safe and ready removal of the explosive charge in case of a misfire.

I have found that the foregoing objects are accomplished by the use, as a tamping material, of a solid agent which is wholly or partly converted or decomposed into gases or vapors, at the time of explosion, by the heat developed by the explosive charge. More particularly I have found that the foregoing objects are accomplished by the use, as tamping, of an incombustible solid material capable of thermal decomposition or conversion with absorption of heat into products completely or partly gaseous, these products containing at least a substantial proportion of carbon dioxide and no carbon monoxide. At least a substantial proportion of this solid agent is converted into gaseous material by the heat developed from the explosive at the time of explosion. While various such materials are available for employment, I find the ammonium carbonates particularly desirable for such use, since these compounds become entirely decomposed to gaseous products. As such ammonium salts I may use ammonium carbonate, ammonium carbamate, or ammonium sesqui-carbonate, but preferably ammonium bicarbonate is used. A particularly desirable material for such use also is solid carbon dioxide, since this material becomes gasefied yielding carbon dioxide as sole product on heating.

Instead of the ammonium salts mentioned in the foregoing, I may use mixtures of sodium bicarbonate or potassium bicarbonate with a suitable ammonium salt, for example the carbonate, chloride, sulphate or phosphate. From this combination of salts no objectionable acid fumes would be produced such as might result from a decomposition of the ammonium salts alone with the exception of the carbonates. Alkali or alkali-earth normal carbonates, calcium carbonate for example, may also be utilized with one or more of the above ammonium salts, but these are less effective for my purpose than the alkali bicarbonates.

In carrying out my invention, the above materials may be used in the form of cylinders or plugs of any suitable diameter, but preferably the same as that of the explosive charge or that of the bore hole. These materials may, however, be charged into the bore hole as loose powder and rammed in, in the manner of the usual stemming of clay or dust. If desired, the cylinders may be wrapped or filled into paper shells or rupturable cases of other material. Solid carbon dioxide may be readily formed into cylinders by compressing the crushed material in a mold. It will be understood that a hole or passage may also be formed in such cylinder by employing a suitable mold so as to allow free passage for the fuse from the explosive. If desired, a part of the stemming material may be loaded into the bore hole before insertion of the explosive charge and the remainder loaded after the explosive. Preferably additional stemming material of clay, stone dust, or the like will be used in the outer portion of the bore hole.

When solid carbon dioxide is used as stemming material according to my invention, a small

amount or plug preferably consisting of one of the other stemming materials described will be used adjacent to the explosive, in order to separate the solid carbon dioxide from the explosive. Otherwise the extremely low temperature of the solid carbon dioxide might cause the explosive to freeze and become insensitive to detonation, particularly in case the explosive composition included nitroglycerin or other such liquid explosive.

An example of the increase in explosive effect which may result from the use of tamping materials, according to my invention, is shown by the fact that, when 4 ounces of gelignite containing 60% of nitroglycerin were shot in a ballistic pendulum, using 7 ounces of solid carbon dioxide as stemming separated from the explosive by a ¼" layer of ammonium bicarbonate and 2 pounds of china clay as additional stemming material, an increased strength of 16% was obtained over that given by the same amount of explosive fired with the use of clay stemming alone.

The use of stemming materials of the nature described in the foregoing brings about many advantages in blasting operations. The development of a supplementary volume of gas from the stemming material at the time of the explosion serves to modify the explosive effect and to distribute the force over a greater length of the bore hole than is the case with an explosive tamped in the usual manner. The shattering effect of the explosive on the material blasted is thereby reduced so that a smaller proportion of fine dust is obtained than would be the case otherwise. Moreover, the gases developed by the stemming material augment those from the explosive itself, and thus add to the efficiency of the explosive.

When used in coal mining for example, my new method of blasting tends to make it possible to produce a larger proportion of lump coal. Such a result is very much to be desired and previous attempts to bring this about have made use of various methods, for example, the method known as "cushion" blasting, in which air spaces are left between the individual cartridges and the bore hole. The same advantage has been sought in the use of extremely low density explosives, whereby a given weight of explosive is distributed over a greater length of bore hole.

My invention is particularly applicable for use in coal mines containing inflammable gases, or where there is danger of the occurrence of such gases. Using stemming material such as has been described, the gas developed from the stemming will tend to suppress any flame that would otherwise be formed. This increased safety will be obtained without the loss of efficiency such as would result from the inclusion of the gas-producing material as a safety ingredient in the explosive itself.

An additional advantage of the stemming material described in the foregoing, when such material comprises solid carbon dioxide, comes from the fact that, in case of misfire, no difficulty or danger is met in removing the explosive from the bore hole, since the stemming material will become dissipated by evaporation, leaving the explosive charge available for examination and removal.

My new stemming material may be used in conjunction with any of the explosives employed for blasting operations, for example black blasting powder, nitroglycerin and other dynamites of all types, both the non-gelatinous and the gelatinous explosives.

I am aware of the fact that solid carbon dioxide has been used heretofore in blasting cartridges. In such use, however, carbon dioxide was employed as the main explosive charge, the explosive effect coming from the conversion of the material suddenly from solid to gaseous form by means of a heated cartridge contained within the solid carbon dioxide. In such use the carbon dioxide was employed within a metal cylinder having a rupturable portion to allow the building up of the pressure from the carbon dioxide. This required a bore hole of a diameter appreciably greater than that of the blasting explosive used. My invention, therefore, shows considerable economy in drilling costs as compared with the methods in which bore holes appreciably greater in diameter are required. I am aware also of the fact that various materials such as ammonium carbonate have been used as safety ingredients in blasting explosives. Such applications however are entirely different in purpose from the object of the present invention.

I have described my invention in considerable detail in the foregoing. It will be apparent, however, that many variations from the exact procedure described may be made, without departing from the spirit of the invention. I intend, therefore, to be limited only as indicated in the following patent claim.

I claim:

A blasting assembly, comprising a blasting charge loaded into a bore hole, and a tamping charge consisting of solid carbon dioxide.

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