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BLASTING METHOD AND APPARATUS

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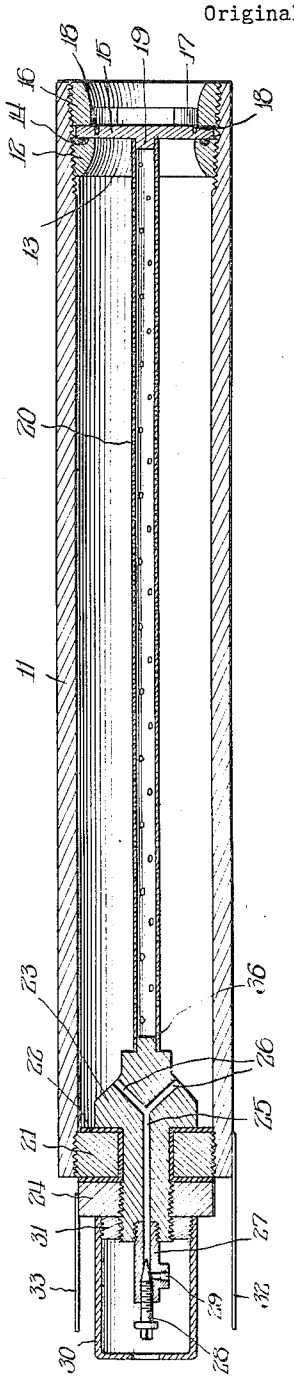


Fig. 1

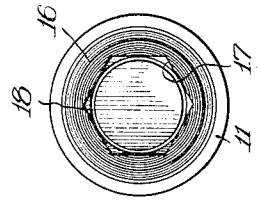


Fig. 2

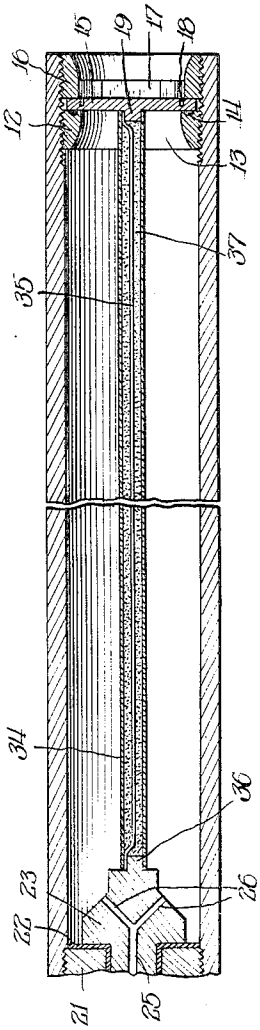


Fig. 3

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BLASTING METHOD AND APPARATUS.

Application filed February 11, 1925, Serial No. 8,328. Renewed December 19, 1925.

This invention relates to a new and improved blasting method and to an apparatus adapted for carrying out the method.

In mine operation by blasting with the use of explosives as now commonly carried out, it is necessary to clear the mine of the operating personnel before setting off the blast. This is due to the danger to personnel from fumes and gases evolved by the blast and also to the danger of ignition of mine gases or powdered coal by the highly heated blast gases. These requirements prevent more than one blast in each head or room for each shift and consequently, slowing up production.

According to our present invention, we blast by means of apparatus giving off no dangerous gases and without the development of dangerous temperatures. The present invention is in the nature of a modification and improvement of our prior application, Serial No. 710,724, filed May 3, 1924. In that application, we have disclosed the rupture of a closed container by the gasification of a non-gaseous material by the means of heat.

According to the present invention, we provide heat producing means located within the container and adapted to not only produce heat but to violently agitate the carbon dioxide and thus facilitate the transfer of the heat.

It is an object of the present invention to provide a new and improved means and method for blasting without the generation of dangerous heat or gases.

It is a further object to provide a means and method of this character adapted for use by simple apparatus and which may be utilized without danger to mine personnel.

It is also an object to provide a means and method whereby the blasting force is supplied by the sudden gasification and liberation of a gas held in liquid form in a closed container.

It is an additional object to provide means wherein the heat necessary for gasification is supplied internally of the container together with violent agitation of the material.

Other and further objects will appear as the description proceeds.

We have illustrated a preferred embodiment of our invention in the accompanying drawings in which—

Figure 1 is a longitudinal section to one form of cartridge;

Figure 2 is a view of the cartridge as seen from the right of Figure 1, and—

Figure 3 is a fragmentary view similar to Figure 1 but showing a modified form of construction.

The cartridge comprises the cylindrical outer casing 11, into the right end of which is secured the ring 12. This ring has been shown as threaded into the casing 11, but it may be brazed or welded or otherwise permanently secured in place. The face 13 of the ring is rounded off to minimize the resistance offered to the passage of gases outwardly through the ring. The outer axial face of the ring is recessed to receive the packing 14. The outer ring 16 which is threaded into the casing 11, as best shown in Figure 2, is provided with the hexagonal opening 17 by means of which it may be secured tightly in position by the use of a wrench.

The disk 15 is held against the packing 14 by the ring 16 and is provided with the circular groove 18, which may be any desired depth. The thickness of the material left at the base of the groove 18 will determine the force required to rupture the disk on the line of the groove and consequently blow out the central part of the disk. The inner face of the disk is provided with a stud 19 and adapted to support the tubular member 20.

The ring 21 is screwed into the opposite end of the casing 11. This ring carries the insulating packing member 22 and supports the plug 23, which extends through the ring. The outer end of the plug 23 is threaded and receives the ring 24 which bears against the outer face of the packing 22 and retains the plug in place. The plug 23 is provided with the axial passage 25 communicating through passages 26 with the interior of the casing.

The needle valve 27 is threaded into the outer end of the plug and receives the needle valve member 28. The housing is provided with the threaded opening 29

adapted to be connected to a source of fluid supply. The valve is protected by a housing member 30 secured to the outer portion of plug 23 by means of disk 31.

The electrical conductor 32 is secured to the casing 11 and the conductor 33 is secured to the ring 24. It will be noted that the plug and the associated rings and valve housing are insulated from the housing.

The member 20 is formed of conducting material and consequently, current will pass through conductor 33 to the plug and thence through member 20 to disk 19 and to the housing 11. From the housing 11 it flows through conductor 32 back to the source of current supply.

In the form of construction shown in Figure 3 all of the elements are the same as described with the exception of the member 20. For the member 20 is substituted a tubular member 34 formed of non-conducting fluid-proof material. Enclosed within this member is the electrical conductor 35, the ends of which make electrical contact with the nipple 36 on the plug 23 and also with the stud 19 on the disk 15. The tubular member 34 is filled around the conductor 35 with combustible material 37 adapted for combustion attended by large heat liberation. This material may be ordinary black powder.

In the use of either form of construction shown, after the parts have been put in place, a source of fluid under pressure is connected to the opening 29 in the needle valve. The valve is opened and fluid is introduced into the casing up to the desired pressure. The valve is then closed and the source of supply disconnected. The housing member 30 is then screwed in place to protect the valve against accidental injury or opening.

It will be understood that the disk 15 fitted into the cartridge will be adapted to rupture at the desired blasting pressure. The liquid introduced into the cartridge will be brought to a pressure sufficiently less than the rupturing pressure of the disk, so as to render the cartridge entirely safe for handling. The conductors 32 and 33 are connected to a suitable source of electric current, the switch controlling which, however, is held open. The cartridge is then introduced into the drill hole and is tamped in place in the same manner as a charge of dynamite.

In the form of construction shown in Figure 1, it will be necessary to supply a relatively large amount of electricity. It is desired to supply sufficient current so as to cause the member 20 to blow out, or to be substantially instantaneously fused and atomized by the current. This vaporized or gasified metal passing into the liquid in all directions very quickly heats the whole body of liquid and raises it to such temperature as to raise its pressure above that required for rupturing the disk 15. The disk blows out and releases the imprisoned liquid which has been gasified by the heat and which has a blasting effect in the drill hole.

In the form of construction shown in Figure 3, only a small amount of current is necessary. The conductor 35 need merely be heated to such a temperature as to cause the detonation of the black powder or other explosive 37. The explosion of this powder raises the temperature of the surrounding liquid sufficiently to gasify it and cause the rupture of the disk 15 and the consequent desired blasting action.

The liquid which is preferably used is carbon dioxide. This liquid when gasified will form so small a portion of the air in the mine as to have no harmful effects. The sudden expansion of the gas will have a refrigerating action and consequently, there will be no dangerous heat evolved from the blasting action. With the form of construction involving the use of black powder, it will be possible to use such a small portion of powder as to have no appreciable defect upon the air. The heat from the powder will be dissipated through a large volume of carbon dioxide gas evolved upon the blasting rupture of the container. Consequently, either method of gasifying the carbon dioxide may be used without danger to persons in the mine. It will simply be necessary for the personnel to move far enough away from the working face to be out of danger from flying fragments.

After the blast, the cylinders may be recovered and the only parts destroyed will be the member 20, or its equivalent in the form of Figure 3, and the disk 15. The outer ring 16 may be removed and a new member 20 and disk 15 inserted. The casing may then be filled with liquid as before and used again. The cost of operation is therefore kept very low since the parts to be replaced are relatively inexpensive and the carbon dioxide may be cheaply secured. While we have mentioned carbon dioxide as a suitable substance to be used, it will be understood that we may employ other material in the non-gaseous state, such as air, nitrogen, etc.

While we have illustrated certain preferred forms by way of example, it is to be understood that we contemplate such changes and modifications as come within the spirit and scope of the appended claims.

We claim:

1. The method of blasting which comprises confining in a closed container a compressible fluid not a liquid under atmospheric temperatures and pressures, and applying to said fluid a gasifying heat by means of the vaporization of an electrical

conductor in the container, the gasification producing a pressure sufficient to rupture a wall of the container.

2. The method of blasting which comprises confining carbon dioxide in the non-gaseous state in a closed container, and applying to said carbon dioxide a gasifying heat by means of the vaporization of an electrical conductor in the container, the gasification producing a pressure sufficient to rupture a wall of the container.

3. The method of blasting which comprises confining in a closed container a compressible fluid not a liquid under atmospheric temperatures and pressures, and applying to said fluid a gasifying heat by means of the vaporization of an electrical conductor and the detonation of an explosive in the container, the gasification producing a pressure sufficient to rupture a wall of the container.

4. The method of blasting which comprises confining carbon dioxide in a closed container, and applying to said carbon dioxide a gasifying heat by means of the fusion of an electrical conductor and the combustion of material accompanied by large heat liberation in the container, the gasification producing a pressure sufficient to rupture a wall of the container.

5. The blasting cartridge comprising a casing, means whereby a fluid under pressure may be introduced into the casing, a fusible electrical conductor in the casing and electrical connections for the conductor extending exteriorly of the casing.

6. A blasting cartridge comprising a casing, a removable and replaceable wall section in the casing, said section being rupturable at less pressure than the remainder of the casing, means whereby a fluid under pressure may be introduced into the casing, a fusible electrical conductor in the casing, and electrical connections for the conductor extending exteriorly of the casing.

7. A blasting cartridge comprising a casing, means whereby a fluid under pressure may be introduced into the casing, a vaporizable electrical conductor extending lengthwise of the casing and having one end secured to the casing and the other end secured to a plug insulated from the casing and extending through a wall thereof.

8. A blasting cartridge comprising a casing, means whereby a fluid under pressure may be introduced into the casing, a fusible electrical conductor in the casing, a body of material located adjacent the fusible conductor, said material being ignitable by heat and adapted for combustion attended by large heat liberation, and electrical connections for the conductor extending exteriorly of the casing.

9. A blasting cartridge comprising a casing, means whereby a fluid under pressure may be introduced into the casing, an inner casing extending longitudinally of the casing, a material in said inner casing, said material being ignitible by heat and adapted for combustion attended by large heat liberation, a fusible electrical conductor extending into the inner casing and having one end secured to the outer casing and the other end secured to a plug insulated from the outer casing and extending through a wall thereof.

Signed at Harrisburg, Illinois, this 7th day of February, 1925.

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