June 15, 1937. A. D. FERGUSON 2,083,699

BLASTING CARTRIDGE

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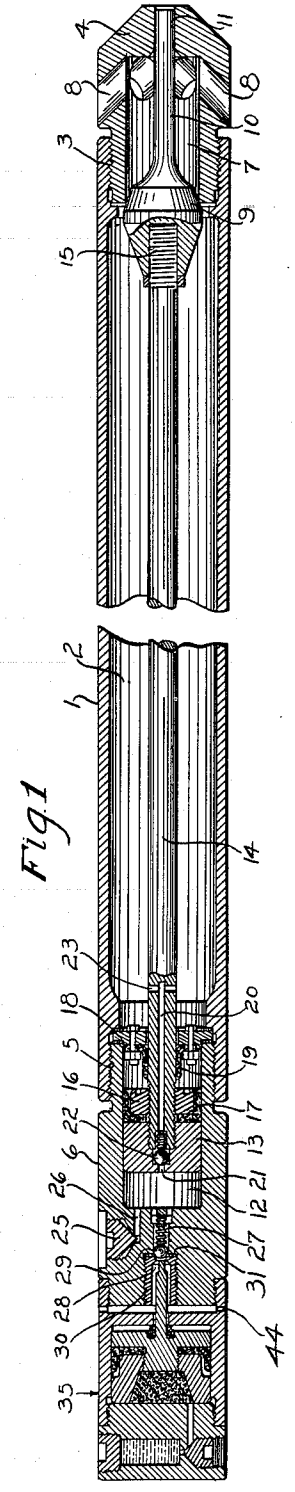


Fig. 1

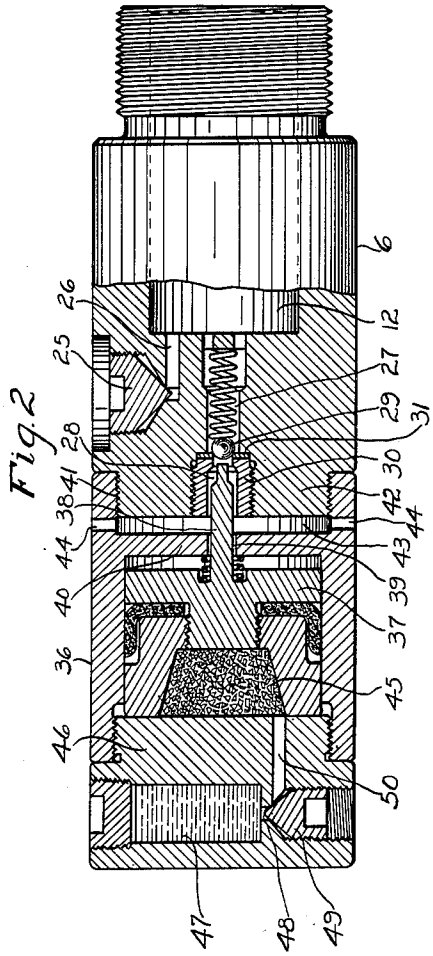


Fig. 2

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BLASTING CARTRIDGE

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20 Claims. (Cl. 102—6)

This invention relates to blasting cartridges, and more particularly to a blasting cartridge of the self-contained, pre-charged type especially designed for use with a highly compressed gas as a blasting medium.

An object of this invention is to provide an improved blasting cartridge of the self-contained, pre-charged type. Another object is to provide an improved release means or so-called "firing gun" for releasing the blasting charge from the pressure chamber. A further object is to provide an improved blasting cartridge of the type which is pre-charged with high pressure gas in adequate volume and at a proper pressure for the particular character of the work, and which has embodied therein improved release means in the form of a "firing gun" for effecting sudden liberation of the blasting charge when the cartridge is properly positioned with respect to the work, release of the blasting charge occurring after a definite time interval subsequent to such positioning of the cartridge. Yet another object is to provide an improved self-contained, pre-charged blasting cartridge which may be transported from place to place without possible danger of a premature discharge, and which, when positioned in blasting relation with respect to the work, may be rendered active to discharge after the lapse of a definite interval of time, thereby enabling the operator to reach a place of safety prior to the release of the blast. A further object is to provide an improved pre-charged blasting cartridge having embodied therein an improved pressure release means or "firing gun" whereby the blasting charge may be discharged, after positioning of the cartridge with respect to the work, entirely by self-contained means without any extraneous connections, thereby rendering the cartridge entirely self-contained. A still further object is to provide an improved pressure release means or "firing gun" adapted to be attached to the cartridge for developing a gaseous pressure sufficient to effect release of the blasting charge, such release taking place after a definite time interval and subsequent to the positioning of the cartridge with respect to the work. A still further object is to provide an improved pressure release means or "firing gun" wherein calcium carbide and water, or elements having similar characteristics, are employed for creating a gaseous pressure sufficient to effect release of the blasting charge. These and other objects will, however, hereinafter more fully appear.

In the accompanying drawing there is shown, for purposes of illustration, one form which the invention may assume in practice.

In this drawing,—

Fig. 1 is a view in longitudinal section showing the illustrative form of the improved blasting cartridge.

Fig. 2 is an enlarged sectional view of the improved pressure release means or "firing gun".

In this illustrative embodiment of the invention, the improved charge release means or "firing gun" is shown associated with a blasting cartridge of the pre-charged type designed for use with a high pressure gas, such as highly compressed air, as a blasting medium. The particular blasting cartridge with which the improved discharge release means is associated may be of the same general type as that disclosed in a copending application of one Frank H. Armstrong, Serial No. 718,175, filed March 30, 1934 (see Fig. 12), and is of the type designed to be charged at some central charging point and then transported in a pre-charged condition to the point of use.

The particular cartridge disclosed comprises an elongated cylindrical shell or container 1 having a chamber 2 for receiving a charge of high pressure gas. Threaded at 3 within the inner end of the container is a discharge cap 4, while threaded at 5 within the outer end of the container is a control cap 6. Formed in the discharge cap is an axial discharge orifice 7 communicating externally through a series of radial discharge ports 8. Seating on the inner end wall of the discharge orifice 7 is a conical discharge control valve 9 having an axial guide extension 10 which, with a bore 11 formed in the discharge cap, serves to center and guide the valve 9 with respect to its seat. Contained in the bore of a control chamber 12 formed in the control cap 6 is a plunger 13 having a valve rod 14 arranged axially within the pressure chamber and secured at 15 at its inner end to the control valve 9. Secured against the inner side of the plunger body by a keeper 16 threaded on the valve rod is a cup leather 17 for preventing leakage of high pressure gas from the inner side of the control chamber past the plunger to the control chamber at the outer side of the plunger. Secured to the container by the control cap 6 is a metallic plate 18 supporting a hat leather 19 tightly engaging the exterior peripheral surface of the valve rod and acting as a check valve to permit flow of high pressure gas from the pressure chamber to the inner side of the control chamber while preventing gas flow from the control chamber in the opposite direction. The valve rod 14 is axially

bored at 20, and this bore communicates, through a passage 21 in the plunger controlled by a spring-pressed check valve 22, with the control chamber 12 at the outer side of the plunger, and through radial ports 23 with the pressure chamber 2.

The control cap 6 embodies a charging valve 25 for controlling a passage 26 communicating with the control chamber 12. The charging pressure flows past the valve 25 through the passage 26 to the control chamber 12, the pressure acting on the outer pressure area of the plunger 13 to hold the valve 9 firmly against its seat. The charging pressure also flows through passage 21, past the ball check valve 22, through the bore 20 in the valve rod, and radial ports 23, to the pressure chamber 2; and when a predetermined blasting pressure is attained within the chamber 2, the charging valve 25 is closed in a suitable manner. By means of the charging valve 25 a charge of high pressure gas may be introduced into the container chamber 2 at some central charging point, and the cartridge may be then transported as a self-contained pre-charged unit to the point of use. An axial passage 27 communicates with the control chamber 12 through an axial vent passage 28 controlled by a spring-pressed check valve 29, the passage 28 being formed in a plug 30 threaded within the control cap, and the ball valve seating on a metal washer 31 held in position by this plug. The ball check valve 29 normally cuts off communication of the axial passage 27 with the vent passage 28.

Associated with the blasting cartridge above described, is the improved pressure release device or "firing gun", generally designated 35, for effecting discharge of the cartridge which has been previously pre-charged. This may be attached to the blasting cartridge continuously, or placed thereon when the cartridge is properly positioned with respect to the work. The charge comprises a pressure actuated element for opening the vent controlling valve previously described and means for generating, by the reaction which takes place upon the access to each other of previously segregated substances, a pressure sufficient to cause said pressure actuated element to open said vent controlling valve, and there is provision for effecting an adequate delay, between the initiation of such reaction and the opening of the vent valve, to enable any necessary activity of the shot firer and his escape to a point of safety. Herein the charge release device shown at 35 consists of a casing 36 having a bore in which is positioned a packed plunger 37 having a stem 38 projecting inwardly through an opening 39 in a partition 40. This casing 36 is threadedly connected at 41 to a threaded projection 42 integral with the control cap 6 of the cartridge, and when the casing is threaded on this projection, there is provided a chamber 43 between the partition 40 and the outer surface of the projection 42, and this chamber is vented to atmosphere through radial vent ports 44. The stem 38 projects within the bore in the plug 30 in axial alinement with the ball check valve 29. Formed in the plunger 37 is a chamber 45, while formed in a cap 46 threaded within the outer end of the casing 36 is a chamber 47. A passage 48 controlled by a valve 49 communicates with a passage 50, and these passages 48 and 50 connect the chamber 47 with the plunger chamber 45 when the valve 49 is open. The chambers 45 and 47 are adapted to contain substances, the former preferably a solid in suitably divided form and the latter preferably a liquid, which when in contact with each other give rise to the production of pressure, as by generating a gas. Herein the chamber 45 may desirably contain some calcium carbide, while the chamber 47 is adapted to contain water. It will be evident, however, that the chambers 47 and 45 may contain any suitable forms of chemicals which, when brought into intimate contact, will effect the generation of a gas. If desired a screw may be placed across the inner face of the cap 46 more readily to retain the granulated carbide. Passage 50 may be restricted to preclude access of the water to the carbide at a rate which would effect too rapid generation of the gas pressure.

In using a cartridge of the type illustrated, the same may be brought to or even actually positioned within a blast hole in the material to be broken. The valve 49 is then adjusted to permit a flow of water from the chamber 47 through the passages 48 and 50, to the carbide chamber 45, and the cartridge is then shoved completely into the blast hole in blasting position with respect to the work. The shot firer then retires to a safe distance. After a definite lapse of time, which may be obviously varied in different ways, as by varying the rate of water flow, the quantity and character of the carbide employed in the chamber 45, etc., a gaseous pressure is built up in the casing bore at the outer side of the plunger 37 sufficient to move the plunger 37 inwardly and cause the stem 38 to unseat the ball check valve 29. The unseating of this valve causes the control chamber 12 at the outer side of the plunger 13 to be vented to atmosphere through passage 27, vent passage 28, chamber 43, and vent ports 44. The pressure in the control chamber 12 at the inner side of the plunger 13 then acts on the plunger to move the latter outwardly against the reduced cumulative opposing pressures, and as a result, the valve 9 is unseated to release suddenly the blasting charge through discharge orifice 7 and discharge ports 8. After the blasting operation, the charge release means is detached from the cartridge, cleaned and re-loaded. These and other uses and advantages of the improved blasting cartridge will be clearly apparent to those skilled in the art.

If desired, one release means may be used for several cartridges successively, or each cartridge may be supplied with a release means which will be again placed in firing order when the cartridge is re-charged. If a single release means is used with several cartridges, the former will be put on each cartridge only as the same is about to be used, with assurance against premature explosion. If desired, supply of water to chamber 47 may be delayed until nearly time to effect discharges, for further safety.

While there is described in this application one form which the invention may assume in practice, it will be understood that this form is shown for purposes of illustration, and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. In a pre-charged blasting cartridge, a container for receiving a charge of high pressure gas, discharge means for the blasting charge, and self-contained means embodied in the cartridge adapted to be rendered active to effect release of the discharge means after the lapse of a definite time interval and subsequent to the po-

sitioning of the cartridge with respect to the work, said release means including a casing attachable to the cartridge container and having a chamber containing calcium carbide and sealed from the interior of said container, a chamber containing water, and valve means for allowing flow of water from said water chamber to said carbide chamber.

2. In a pre-charged blasting cartridge, a container for receiving a blasting charge, discharge means for the blasting charge, and self-contained means embodied in the cartridge and operative after being rendered active to effect automatic release of said discharge means, said release means including a casing attachable to the cartridge container and having a chamber containing calcium carbide and sealed from the interior of said container, a chamber containing water, and valve means for allowing flow of water from said water chamber to said carbide chamber.

3. In a pre-charged blasting cartridge, a container for receiving a blasting charge, discharge means for the blasting charge, and self-contained means embodied in the cartridge and operative after being rendered active to effect automatic release of said discharge means and after a time interval subsequent to when the same has been rendered active, said release means including a casing attachable to the cartridge container and having a chamber containing calcium carbide and sealed from the interior of said container, a chamber containing water, and valve means for allowing flow of water from said water chamber to said carbide chamber.

4. In a pre-charged blasting cartridge, a container for receiving a charge of high pressure gas, discharge means for the blasting charge, and self-contained means embodied in the cartridge adapted to be rendered active to effect release of the discharge means after the lapse of a definite time interval and subsequent to the positioning of the cartridge with respect to the work, said release means including a casing attachable to the cartridge container and having a chamber containing calcium carbide, a chamber containing water, valve means for allowing flow of water from said water chamber to said carbide chamber, and a pressure release plunger in said release means chamber, the water upon intimate contact with the calcium carbide creating a gaseous pressure which acts on said release plunger to effect blasting charge release.

5. In a pre-charged blasting cartridge, a container for receiving a blasting charge, discharge means for the blasting charge, and self-contained means embodied in the cartridge and operative after being rendered active to effect automatic release of said discharge means, said release means including a casing attachable to the cartridge container and having a chamber containing calcium carbide, a chamber containing water, valve means for allowing flow of water from said water chamber to said carbide chamber, and a pressure release plunger in said release means chamber, the water upon intimate contact with the calcium carbide creating a gaseous pressure which acts on said release plunger to effect blasting charge release.

6. In a pre-charged blasting cartridge, a container for receiving a blasting charge, discharge means for the blasting charge, and self-contained means embodied in the cartridge and operative after being rendered active to effect automatic release of said discharge means and after a time interval subsequent to when the same has been rendered active, said release means including a casing attachable to the cartridge container and having a chamber containing calcium carbide, a chamber containing water, valve means for allowing flow of water from said water chamber to said carbide chamber, and a pressure release plunger in said release means chamber, the water upon intimate contact with the calcium carbide creating a gaseous pressure which acts on said release plunger to effect blasting charge release.

7. A blasting cartridge comprising a container for receiving a blasting charge and having a discharge opening, valve means for closing said opening, releasable means for holding said valve means in said opening, and means independent of the blasting charge operative after the lapse of an appreciable time interval subsequent to being rendered active for effecting release of said releasable means.

8. A blasting cartridge comprising a container for receiving a blasting charge and having a discharge opening, valve means for closing said opening, fluid pressure operated means for holding said valve means in said opening, fluid pressure control means operative to release the pressure from said holding means to effect opening of said valve, and means operative after the lapse of a definite time interval subsequent to being rendered active for operating said control means.

9. A blasting cartridge comprising a container for receiving a blasting charge and having a discharge opening, valve means for closing said opening, fluid pressure operated means for holding said valve means in said opening, means for venting said fluid pressure operated holding means to effect release of said valve means, and wholly self-contained means operative subsequent to positioning the cartridge with respect to the work and without the exercise of extraneous influence thereon for effecting operation of said venting means.

10. In a pre-charged blasting cartridge, a container for receiving a fluid charge at blasting pressure, charge releasing means for the container, and self-contained fluid pressure operated means embodied in the cartridge for causing operation of said charge releasing means, said fluid operated means including a manually set control, and means for causing an appreciable time lag between the setting of said control and the operation of said charge releasing means.

11. In a pre-charged blasting cartridge, a container for receiving a charge of high pressure gas, discharge means for the blasting charge comprising a charge releasing member and control means operated by an unbalanced pressure condition within the container for actuating said releasing member, and wholly self-contained means embodied in the cartridge adapted to cause operation of the control means, said self-contained means comprising mechanism for developing a motivating force during the lapse of a definite time interval after being set in motion, and means operated by said force for causing the control means to be subjected to said unbalanced pressure condition.

12. In a pre-charged blasting cartridge, a container for receiving a high pressure gaseous blasting charge, discharge means for the blasting charge comprising release means, means for operating the release means when subjected to an unbalanced pressure condition within the container, and control means for effecting said un-

balanced pressure condition, and self-contained means embodied in the cartridge for actuating said control means to bring about release of the charge and including means for rendering said self-contained means active.

13. In a pre-charged blasting cartridge, a container for receiving a high pressure gaseous blasting charge, discharge means for the blasting charge comprising release means, means for operating the release means when subjected to an unbalanced pressure condition within the container, and control means for effecting said unbalanced pressure condition, and self-contained means embodied in the cartridge for actuating said control means to bring about release of the charge and including an actuator for the control means, means for operating the actuator by a gaseous pressure developed by the chemical reaction of gas-producing materials, and means for maintaining said chemical reaction gas separate from the blasting charge.

14. In a pre-charged blasting cartridge, a container for receiving a high pressure gaseous blasting charge, discharge means for the blasting charge comprising release means, means for operating the release means when subjected to an unbalanced pressure condition within the container, and control means for effecting said unbalanced pressure condition, and self-contained means embodied in the cartridge for actuating said control means to bring about release of the charge after the lapse of a definite time interval subsequent to when the same has been renderd active and including an actuator for the control means, means for operating the actuator by a gaseous pressure developed by the chemical reaction of gas-producing materials, and means for maintaining said chemical reaction gas separate from the blasting charge.

15. In combination, a blasting cartridge containing a charge of high pressure gas, and charge release means for said cartridge comprising a valve movable to open position by the pressure of the charge, and a self-contained device having means for attaching the same to said cartridge in the charged condition of the latter and being operable to effect actuation of the charge release means, said self-contained device comprising mechanism for rendering the same active after the lapse of a time interval subsequent to when the device is set for operation.

16. In combination, a blasting cartridge containing a charge of high pressure gas, and charge release mechanism for said cartridge comprising a valve having means for normally holding it closed and movable to open position by the pressure of the charge when freed from said holding means, and a self-contained device having means for attaching the same to said cartridge and being operable to bring about opening movement of said valve by withdrawing its holding means, said device including means for setting the same in motion prior to operatively positioning the cartridge relative to the material to be broken down.

17. In combination, a blasting cartridge, and charge release means for said cartridge including a fluid pressure operated valve, a device positioned within the cartridge and movable to control the operating fluid pressure for said valve to effect opening movement of the valve, and fluid pressure operated means for effecting control movement of said device insertable with said cartridge into a blast hole, said last mentioned means including self-contained mechanism for creating its own operating fluid pressure.

18. A blasting cartridge comprising a container for receiving a blasting charge and having a discharge opening, valve means for closing said opening, releasable means for holding said valve means in said opening, and wholly self-contained means embodied in said cartridge and operable subsequent to positioning of the cartridge with respect to the work for effecting release of said releasable means, said self-contained means comprising a fluid pressure operated device for effecting release of the releasable means, and means for creating a fluid pressure for operating said device.

19. Means for actuating the differential fluid pressure control mechanism for the releasing means of a fluid charged blasting cartridge comprising a valve for controlling a vent opening which forms a part of said control mechanism, means for holding said valve against its seat, and slow-acting means operating with a definite time lag for displacing said valve against the action of said holding means to uncover said vent opening.

20. Means for actuating the differential fluid pressure control mechanism for the release means of a fluid charged blasting cartridge comprising a valve for controlling a vent opening which forms a part of said control mechanism, means for holding said valve against its seat, slow-acting means operating with a definite time lag for displacing said valve against the action of said holding means to uncover said vent opening, and a control for starting operation of said slow-acting means.

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