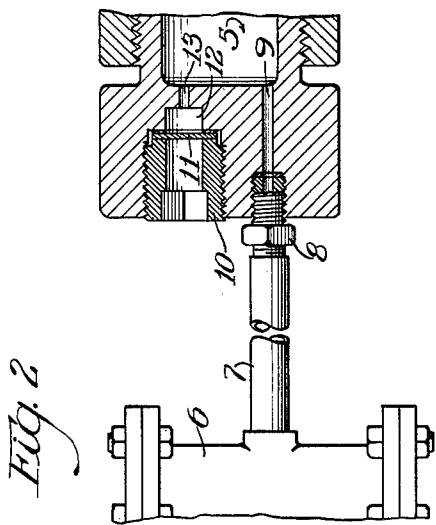
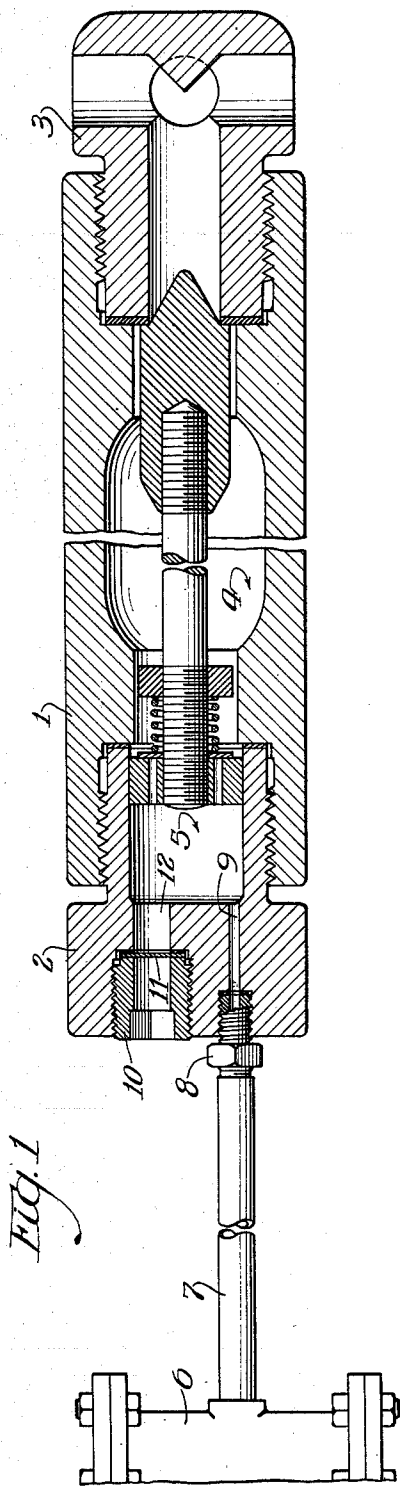


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A. HARRIS
BLASTING DEVICE

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BLASTING DEVICE

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This invention relates to a type of blasting cartridge as illustrated in the pending application of Frank H. Armstrong, Serial No. 673,385 filed May 29, 1933.

5 The object of the invention is to provide an improved means for effecting the discharge of a cartridge of this type. Another object is to provide improved means for automatically effecting discharge of the blasting charge from the cartridge when a predetermined blasting pressure is attained within the cartridge. Yet another object is to provide an improved rupturable pressure release means adapted to rupture upon the attainment of a predetermined pressure within the cartridge for effecting automatic release of the blasting charge. These and other objects will, however, hereinafter more fully appear.

Referring to the drawing,

20 Figure 1 is a view in longitudinal section through a cartridge of the type indicated and embodying the principles of the present invention.

25 Figure 2 is a sectional detailed view illustrating a slight modification of the device shown in Figure 1.

The cartridge consists essentially of a tubular body 1, a terminal cap 2 and a discharge cap 3. The interior of the cartridge provides a chamber 4 designed to receive a substantial volume of potential energy, preferably in the form of high pressure air or other gas. Disposed axially within the cartridge is a differential valve mechanism consisting of a valve head designed to have sealing engagement with the end of discharge cap 3 for closing the discharge orifice therein. On the opposite end of the rod which carries the valve head there is provided a plunger slidably fitting the bore 5 formed in the terminal cap 2. This plunger is provided with a plurality of ports extending entirely therethrough, which ports are normally closed by a spring compressed disc check valve as shown.

45 The charging passage 9 indicates with the chamber 5 and with piping or tubing 7 extending to a source of high pressure air 6 which may take the form of a compressor or of a high pressure air or gas receiver. A suitable fitting 8 is provided for coupling pipe 7 to the terminal cap 2. Thus, high pressure air or other gas may be introduced into the chamber 5 resulting in the opening of the disc check valve and in the passage of the air through the several ports formed in the plunger and thence into the main charge 55 receiving chamber 4. The initial effect of the

introduction of high pressure air into the chamber 5 is to force the valve firmly against its seat on the discharge cap by reason of the action of such pressure upon the area presented by the plunger. It will be observed in this connection 5 that the area of the plunger which is exposed to pressure from the chamber 4 is less than that exposed to pressure from chamber 5 by an amount equal to the cross sectional area of the rod on which the plunger and valve are mounted. 10 Hence, there is normally a differential tending to maintain the valve in closed position.

In order to effect the discharge of a cartridge of this type it is merely necessary to effect a rapid decrease in pressure within the chamber 15 5, thus resulting in a reverse differential pressure condition wherein the pressure exerted on the plunger from chamber 4 exceeds that exerted thereon from chamber 5, with a consequent axial movement of the entire differential valve mechanism. According to the present invention, this drop in pressure within chamber 5 is effected automatically upon the attainment of a predetermined pressure in that chamber. To this end, there is provided in the terminal cap 2 a 25 relatively large bore 12 which is normally closed or sealed by a disc 11 held firmly in place by a nut 10. It has been found in practice, however, that by appropriate selection as to material and thickness, the disc 11 can be relied upon to fail 30 at any desired predetermined pressure. A very thin disc made of mild steel has been found most suitable for this purpose, although fibre or other materials may be effectively used.

Assuming that the particular work to be performed will require a charge of air or other gas at approximately 6500 pounds pressure, a disc 11 designed to fail or shear out at this pressure is selected and securely positioned in the terminal cap 2. When this has been done, high pressure 40 air may be allowed to pass from the receiver or compressor 6 through the pipe 7 into chamber 5 of the cartridge, which results, as described above, in the immediate closing of the differential valve. The continued flow of high pressure air 45 into the chamber 5 will in a very short space of time result in the attainment of a pressure value of the desired 6500 pounds, at which point the disc 11 will shear out, thus providing a rapid escape for the high pressure air contained in the chamber 5 and resulting in a correspondingly rapid drop in pressure in this chamber. It will be understood, of course, that immediately upon failure of the disc 11 the operator at the compressor or air receiver should close the valve, thus dis- 55

continuing the flow of air from the source to the cartridge. Any conventional form of valve may be used for this purpose either at the receiver or in the pipe line adjacent to the receiver.

5 The sudden drop in pressure in chamber 5 results, as indicated above, in a differential pressure condition wherein the pressure exerted upon the plunger from chamber 4 so far exceeds that exerted upon the opposite face of the plunger
10 from chamber 5 that the differential valve mechanism immediately moves to open position and by reason of the rapidity of the escape of high pressure air from the chamber 5 and of the drop in pressure therein, the differential valve mechanism will remain in open position until the entire
15 charge has been exhausted from chamber 4 through the discharge cap.

A slight modification is represented in Figure 2 which consists essentially in restricting the
20 rate of flow of air from chamber 5 after the disc 11 has been sheared. This is accomplished by providing a small passage 13 communicating with the larger bore 12 which the disc 11 is designed to seal. By thus restricting the rate of flow of
25 air from the chamber 5 the differential valve mechanism is caused to alternately open and close in rapid succession several times in effecting the discharge of the high pressure air contained in the main chamber 4. This alternate
30 opening and closing action results from the fact that the initial opening of the differential valve causes an instantaneous pressure drop in the main chamber 4 to a value below that which has been attained in the chamber 5 due to the restricted flow from the latter chamber. Hence,
35 the pressure in chamber 5 again preponderates and results in the closing of the differential valve. However, the continued flow from chamber 5 through the restricted passage 13 again results
40 in a drop in pressure below that existing in chamber 4, thus resulting in a second opening of the differential valve. This action is repeated until the entire charge contained in chamber 4 has been exhausted. It may be well to mention
45 in this connection that the disc check valve prevents the flow of high pressure air from the chamber 4 into chamber 5, thus preventing an equalization of pressure in the two chambers in this manner.

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

1. A material breaking apparatus comprising a cartridge adapted to receive a charge of high
60 pressure air or gas and embodying a discharge orifice through which such charge may be released, a differential valve mechanism normally sealing said orifice when pressure exists within the cartridge, and means for effecting the opening
65 of said differential valve mechanism automatically upon the attainment of a predetermined pressure within the cartridge.

2. A material breaking device comprising a cartridge having a discharge orifice, a differential
70 valve for sealing said orifice, a control chamber for governing operation of said differential valve and a pressure responsive element for venting said chamber to the atmosphere.

3. A material breaking device comprising a
75 cartridge having a charge receiving chamber and

a discharge orifice, a differential valve mechanism for sealing said orifice when pressure in excess of atmospheric exists in the cartridge, said cartridge embodying a control chamber, the pressure wherein governs the action of said differential valve, there being a passage extending from
5 said control chamber to the exterior of said cartridge for venting the chamber to the atmosphere and an element rupturable at a predetermined pressure for normally sealing said passage.
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4. A blasting cartridge comprising a casing having a chamber for receiving a charge of high pressure air or gas, release means for said charge constructed and arranged to be normally held in charge retaining position by pressure fluid, and
15 means automatically operative to effect opening of said release means upon the attainment of a predetermined pressure within the cartridge.

5. A blasting cartridge comprising a casing having a chamber for receiving a charge of high pressure air or gas, release means for said charge movable into said chamber to effect charge release, and means automatically operative to effect opening of said release means upon the attainment
20 of a predetermined pressure within the cartridge.
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6. A blasting cartridge comprising a casing having a chamber for receiving a charge of high pressure air or gas, release means for said charge movable into and normally held in charge retaining position by pressure fluid in the chamber, and means automatically operative to effect opening of said release means upon the attainment
30 of a predetermined pressure within the cartridge.
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7. A blasting cartridge comprising a casing having a chamber for receiving a charge of high pressure air or gas, release means for said charge constructed and arranged to be held in charge retaining position and to be moved into charge releasing position by fluid pressure, and fluid pressure responsive means, for effecting automatic opening of said release means when a predetermined blasting pressure is attained within the
40 cartridge.
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8. A blasting cartridge comprising a casing having a chamber for receiving a charge of high pressure air or gas, release means for said charge, and pressure responsive means including a plunger rigidly connected to said release means for effecting automatic opening of said release means when a predetermined blasting pressure is attained within the cartridge.
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9. A blasting cartridge comprising a casing having a chamber for receiving a charge of high pressure air or gas, release means for said charge comprising a discharge control valve, fluid pressure responsive means constructed and arranged for effecting automatic opening of said discharge control valve when a predetermined blasting
55 pressure is attained within the cartridge and for pressing the latter closed during building up of the blasting pressure within the cartridge, and additional fluid pressure responsive means for causing the first mentioned pressure means to
60 automatically open said valve when said blasting pressure is attained.
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10. A blasting cartridge comprising a casing having a chamber for receiving a charge of high pressure air or gas, release means for said charge comprising a discharge control valve, and pressure responsive means for effecting automatic opening of said discharge control valve when a predetermined blasting pressure is attained within the cartridge and including a pressure-fluid-
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actuated piston rigidly connected to said valve for holding the latter closed during building up of the blasting pressure within the cartridge and for automatically opening said valve when said blasting pressure is attained.

11. A blasting cartridge comprising a casing having a chamber for receiving a charge of high pressure air or gas, release means for said charge, and means automatically operative to effect opening of said release means upon the attainment of a predetermined blasting pressure within the cartridge including a releasable valve means adapted to release automatically upon the attainment of said predetermined blasting pressure to cause said release means to release the charge.

12. In a blasting cartridge comprising a casing having a chamber for receiving a charge of high pressure air or gas, release valve means for said charge, and means automatically operative to effect opening of said release valve means upon the attainment of a predetermined blasting pressure within the cartridge including a releasable venting means adapted to release automatically upon the attainment of said predetermined blasting pressure.

13. A blasting cartridge comprising a casing having a chamber for receiving a charge of high pressure air or gas, release means for said charge, and means automatically operative to effect opening of said release means upon the attainment of a predetermined blasting pressure within the cartridge and including frangible valve means adapted to rupture to effect opening of said release means upon the attainment of said predetermined blasting pressure.

14. A blasting cartridge comprising a casing having a chamber for receiving a charge of high pressure air or gas, and a control chamber, releasable valve means for discharging the blasting charge from said charge receiving chamber, a piston in said control chamber for controlling said valve means, means for supplying pressure fluid to said control chamber, valve controlled passages in said piston for supplying pressure fluid from said control chamber to said blasting charge receiving chamber, and means automatically operative to effect venting of said control chamber upon attainment of a predetermined blasting pressure within the charge receiving chamber, said passages in said piston being automatically closed when said control member is vented and the pressure in said charge receiving chamber effecting movement of said piston in said control chamber to release said valve means when said control chamber is vented.

15. A blasting cartridge comprising a casing having a chamber for receiving a charge of high pressure air or gas and a control chamber, valve means for releasing the blasting charge from said charge receiving chamber, a piston in said control chamber for controlling said valve means, and means for automatically venting said control chamber to effect movement of said piston to release said valve means when a predetermined blasting pressure is attained within said charge receiving chamber.

16. A blasting cartridge comprising a casing having a chamber for receiving an energy storing charge, and means for automatically effecting release of the charge from said chamber when a predetermined blasting pressure is attained within said chamber and including a pressure controlled discharge control valve movable in a seating direction outwardly of said chamber.

17. A material breaking apparatus comprising a cartridge providing a charge receiving chamber having concurrently movable opposite end walls, means for introducing a charge of gaseous medium into said chamber between said walls, and means for effecting movement of said walls automatically upon attainment of a predetermined charge pressure to effect charge release.

18. A material breaking device comprising a cartridge having a discharge orifice, release means for said orifice including a valve opening oppositely of the direction of discharge through said orifice, and means automatically operative to effect opening of said release means upon the attainment of a predetermined pressure within the cartridge.

19. A blasting cartridge comprising a casing having a chamber for receiving an energy storing charge and a fluid control chamber, charged simultaneously with and to the same pressure as said first chamber and means for automatically effecting release of the energy storing charge when a predetermined fluid pressure is attained within said control chamber.

20. A blasting cartridge comprising a casing having a chamber for receiving an energy storing charge and a control chamber having communication with said energy storing charge only during charging of the cartridge, and means for automatically effecting release of the energy storing charge when a predetermined pressure is attained within said control chamber.

21. In a blasting cartridge, a casing constructed to confine fluid medium at a blasting pressure, and releasing mechanism for the casing comprising two blasting medium discharging devices both of which are subjected to the same fluid pressure while the casing is charged and adapted to operate to release the medium when one of the devices is subjected to a blasting pressure during charging, and means for causing the operation of said one device to effect operation of the other device.

22. In a blasting cartridge, a casing constructed to confine fluid medium at a blasting pressure, and releasing mechanism for the casing comprising two fluid pressure responsive blasting medium discharging devices independently mounted in the casing, and means for causing the operation of one of said devices to be dependent upon the prior operation of the other device.

23. In a blasting cartridge, a casing constructed to confine fluid medium at a blasting pressure, and releasing mechanism for the casing comprising two blasting medium discharging devices adapted to operate to release the medium, one of said devices being operated by said medium at a blasting pressure, and means for operating the other of said devices when differential fluid pressures above atmospheric pressure are applied to the same as a result of the operation of said one device.

24. In a blasting cartridge, a casing constructed to confine fluid medium at a blasting pressure, and releasing mechanism for the casing comprising two cooperatively associated blasting medium discharging devices adapted to operate to release the medium, one of said devices being a fluid pressure responsive venting device automatically operable when a predetermined pressure is attained within the casing.

25. In a blasting cartridge, a casing constructed to confine fluid medium at a blasting pressure and having two blasting medium discharge openings, and a separate fluid pressure respon-

sive device for discharging the blasting medium through each of said openings, one of said devices being destructible and the other indestructible.

26. In a blasting cartridge, a casing having a
5 chamber for receiving a charge of blasting pressure, a valve for releasing the pressure from said chamber, a piston secured to said valve and controlled by the pressure in said chamber for actuating said valve, and valve means carried by said
10 piston in radially spaced relation to the axis thereof for controlling the supply of pressure fluid to said pressure chamber.

27. A blasting cartridge comprising a substantially cylindrical container adapted to receive a
15 high pressure charge and having a discharge opening adjacent one end thereof, valve means

closing said opening, releasable means adjacent the other end of said container for holding said valve means in said opening, and means operable automatically in response to the attainment of a predetermined blasting pressure in said container for effecting release of said releasable means. 5

28. In a blasting cartridge, a casing constructed to confine fluid medium at a blasting pressure and having two blasting medium discharge openings located at or adjacent the opposite ends thereof, and a separate fluid pressure responsive device for discharging the blasting medium through each of said openings. 10

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