

June 15, 1937.

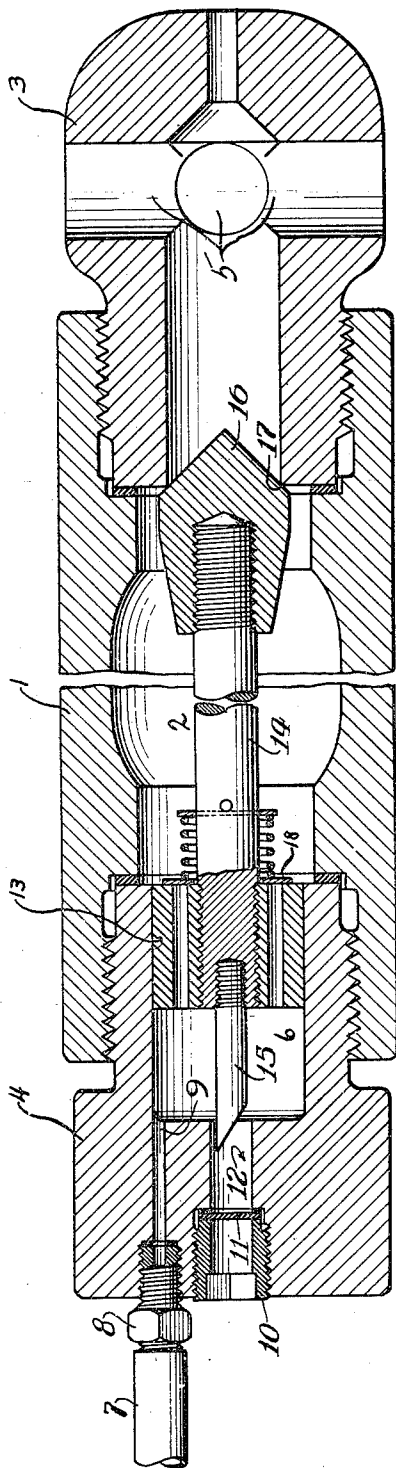
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2,083,707

BLASTING CARTRIDGE

Original Filed Aug. 5, 1933

Fig. 1



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UNITED STATES PATENT OFFICE

2,083,707

BLASTING CARTRIDGE

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Application August 5, 1933, Serial No. 683,739
Renewed November 26, 1934

18 Claims. (Cl. 102-6)

This invention relates to an improvement in blasting cartridges particularly to that type in which a charge of high pressure air or other gas may be introduced in work performing condition and may be subsequently released or discharged from the cartridge at will.

The object of the invention is to provide an improved mechanism within a cartridge of this type adapted to receive a charge of potential energy and to effect the discharge thereof at any desired time and particularly in relation to any desired attained value of a charge of potential energy.

Other objects and advantages of the invention will appear in connection with the following detailed description.

Referring to the drawing, the single figure is a view in longitudinal section through a blasting cartridge embodying by way of illustration the principles of the present invention.

The body of the cartridge 1 is provided with a charge receiving chamber 2 which may be of any desired volumetric capacity. The ends of this body are internally threaded as shown for the reception of the correspondingly threaded ends of discharge and terminal caps 3 and 4 respectively. The discharge cap 3 is provided with a plurality of discharge orifices 5 through which a charge of potential energy contained within the main chamber 2 of the cartridge may escape into the material to be broken down by the cartridge.

Terminal cap 4 is provided with a cylindrical chamber 6 into which high pressure air or other forms of potential energy may be introduced through a suitable supply pipe 7, fitting 8 and supply passage 9. In this connection it will be observed that there is provided in terminal cap 4 an axial bore 12 which communicates with the chamber 6 but which is effectively sealed from the atmosphere by means of a suitable metal or fibre disc 11 and a sealing nut 10, the latter having threaded connections with terminal cap 4.

A plunger 13 is slidably disposed within the cylindrical bore 6 of the terminal cap and this plunger is carried by one end of a valve rod 14 which extends throughout the length of the main chamber 2 of the cartridge and carries at its opposite end a valve member 16 designed to have sealing engagement as indicated at 17 with the inner end of discharge cap 3. The end of rod 14 on which plunger 13 is mounted also carries a chisel 15 the end of which extends slightly into axial bore 12 when valve 16 is in sealing engagement with the end of the discharge cap. The purpose of this chisel is to puncture the disc 11

under appropriate conditions, thus venting the chamber 6 to the atmosphere. A check valve 18 on the valve rod 14 is provided to cooperate with a series of charging passages formed in the plunger 13, the operation of which will be more particularly described hereinafter.

For the purposes of explanation we may assume that the cartridge as above described has been positioned in a suitable drill hole formed in the face of coal to be broken down and that it is ready to perform its intended work. The supply pipe 7 having been connected to the cartridge in the manner indicated on the drawing may be extended back to a remote point and there connected to a suitable source of high pressure air or other form of potential energy. It should be mentioned in this connection that such source of potential energy may be in the form of a generator such as an air compressor or in the form of a receiver containing a considerable quantity of such potential energy. Having connected the supply pipe 7 to a source of potential energy and opened a suitable valve permitting such potential energy to flow from the source to the cartridge, the following results occur. For convenience we will assume that the form of potential energy is compressed air of a pressure ranging from 5,000 to 10,000 pounds per square inch. The flow of high pressure air into the chamber 6 results first in immediately moving the plunger 13 and valve rod 14 attached thereto in a direction to bring the valve 16 into firm sealing engagement with the ends of the discharge cap 3 as indicated at 17. This action is followed immediately by the building up of pressure within chamber 6 sufficiently to overcome the spring pressed check valve 18 thereby permitting a flow of high pressure air from the chamber 6 into the main chamber 2 of the cartridge. There will, of course, be a slight differential between the pressures existing in chambers 2 and 6, that in chamber 6 prepondering slightly during the entire charging operation. When the pressure in chamber 2 has reached a desired value, which may be readily determined by a suitable pressure gauge located in the supply line 7 adjacent to the source of supply, the control valve positioned at the source of supply may be cut off to discontinue the flow of high pressure air into chamber 6. When the flow of air into chamber 6 has been stopped the check valve 18 will immediately close thereby preventing the passage of air from chamber 6 to chamber 2 and vice versa.

Under these conditions valve 16 will be maintained in firm sealing engagement with the end

of the discharge cap by reason of the fact that the cross sectional area of plunger 13 which is exposed to the pressure existing in chamber 6 is substantially greater than the cross sectional area of plunger 13 which is exposed to the pressure existing in chamber 2.

In order to effect the discharge of the cartridge which has been charged as described above it is merely necessary to relieve the pressure existing in chamber 6 thereby bringing about a reversal of the differential pressure conditions as described above. In other words with the pressure in chamber 6 substantially or entirely relieved the pressure existing in chamber 2 acting upon the face of plunger 13 which is exposed to such pressure will result in an immediate axial movement of the plunger and valve rod in a direction away from the discharge cap. The pressure in chamber 6 may be conveniently relieved by merely opening a suitable valve at or adjacent the source of supply and serving to vent the supply pipe 7 to the atmosphere. This will result in an immediate drop in pressure within the chamber 6 which will cause actuation of the plunger and valve mechanisms as described above. In order to secure complete and rapid depletion of the pressure in chamber 6 advantage is taken of the initial movement of plunger 13 and its associated valve rod to shear out the disc 11 by means of the chisel 15. Thus immediately upon the venting of pipe 7 to the atmosphere the pressure of chamber 6 will drop sufficiently to cause a rapid axial movement of plunger 13 and the valve rod and by reason of the fact that this movement is actuated by a very considerable pressure differential as between chambers 2 and 6 there is ample force to bring about the rupturing of disc 11 by means of the chisel 15 carried by the valve rod. The rupturing of disc 11 serves to greatly accelerate the escape of air from chamber 6.

Experience has developed the fact that the pressure in chamber 6 must be dissipated very rapidly in order to prevent alternate opening and closing of the valve 16 which, of course, under certain conditions may be undesirable. Thus if the escape of pressure from chamber 6 is relatively slow the initial movement of plunger 13 which, of course, is inevitable by reason of a positive differential in pressures, may be reversed due to a more rapid drop in pressure within chamber 2 resulting from the escape of large volumes of high pressure air from that chamber through the discharge cap. However, by means of the auxiliary venting arrangement shown and described there is accomplished a positive opening of the discharge valve and the ability to retain this valve in open position until the entire charge contained in chamber 2 has been exhausted. While I have in this application specifically described one form which my invention may assume in practice, it will be understood that this form of the same 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.

I claim:

1. A material breaking device of the character described comprising a cartridge embodying a charge receiving chamber having a discharge orifice, a differential valve mechanism designed to control said discharge orifice, a control pocket for governing the action of said differential valve mechanism, means for venting said control pocket to the atmosphere, and means consequent upon

movement of the differential valve mechanism for accelerating the venting of said control pocket.

2. A material breaking device comprising a cartridge having a discharge orifice, a differential valve controlling said orifice, a control chamber governing the action of said differential valve, means for initiating the opening movement of said differential valve and means consequent upon such movement for venting said control chamber to the atmosphere.

3. In a blasting cartridge, a container having a charge receiving chamber and a discharge orifice, means for controlling said discharge orifice, to preclude or effect charge release, means for governing the action of said control means providing control thereof independent of the existence of any particular blasting pressure in said chamber, means for initiating the operation of said control means to effect opening movement of the latter, and means consequent upon such movement for accelerating actuation of said governing means quickly to open widely said control means.

4. In a blasting cartridge, a container having a charge receiving chamber and a discharge opening through which the charge may be released, a differential valve responsive solely to charge pressure conditions within said container for controlling said discharge opening, means for effecting initiation of opening movement of said differential valve, and means automatically operative upon initiation of opening movement of said valve for effecting rapid movement of said valve into its wide open position.

5. In a blasting cartridge, a container having a charge receiving chamber and a discharge opening through which the charge may be released, a differential valve responsive solely to charge pressure conditions within said container for controlling said discharge opening, means controllable from a remote point for providing charge pressure conditions effecting initiation of opening movement of said differential valve, and means automatically operative upon initiation of opening movement of said valve for providing different charge pressure conditions effecting rapid movement of said valve into its wide open position.

6. In a blasting cartridge, a container having a charge receiving chamber, a discharge orifice, a valve adapted to seal said orifice, fluid actuated means governing the position of said valve, and means automatically operative upon initiation of opening movement of said valve for causing said fluid actuated means suddenly to open widely said valve.

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 comprising a discharge control valve, pressure responsive means for effecting opening of said discharge control valve when a predetermined blasting pressure is attained within the cartridge and including a pressure actuated piston connected to said valve for holding the latter closed during building up of the blasting pressure within the cartridge and for opening said valve when said blasting pressure is attained, and means controlled by movement of said piston and rendered active upon initiation of movement of said valve toward its open position for accelerating movement of said piston suddenly to move said valve into its wide open position.

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,

means operative to effect opening of said release means upon the attainment of a predetermined blasting pressure within the cartridge, and means including frangible valve means adapted to rupture upon initiation of movement of said latter means for accelerating movement of said last mentioned means toward its wide open position.

9. 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 charge receiving chamber, means 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 chamber 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, and valve means automatically opened upon the initiation of opening movement of said first mentioned valve means for further and more freely venting said control chamber to effect acceleration of movement of said control piston to move suddenly said first mentioned valve means into a wide open position.

10. A blasting cartridge comprising a casing having a chamber for receiving a blasting charge, 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, means for 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, and means for automatically further and more freely venting said control chamber upon the initiation of opening movement of said valve means to accelerate opening movement of said valve means.

11. In a blasting cartridge, a container adapted to receive a blasting charge and having a discharge orifice through which said charge may be released, a differential valve mechanism subject to a preponderance of fluid pressure in a closing direction when seated normally sealing said orifice when pressure exists within the cartridge, means for effecting the opening of said differential valve mechanism when a predetermined pressure within the cartridge is attained, and associated means automatically operative to accelerate opening movement of said valve.

12. A blasting cartridge, a container having a charge receiving chamber and a discharge orifice, a differential valve for sealing said orifice, a control chamber for governing operation of said differential valve, means for venting said chamber to the atmosphere for initiating opening movement of said valve, and means automatically operative upon initiation of opening movement of said valve for further and more freely venting said chamber to accelerate opening movement of said valve.

13. In a blasting cartridge, a container having a charge receiving chamber and a discharge orifice, a differential valve mechanism for sealing said orifice when pressure in excess of atmos-

pheric exists in the cartridge, said cartridge embodying a control chamber, the pressure wherein governs the action of said differential valve mechanism, there being a passage extending from said control chamber to the exterior of said cartridge for venting the chamber to the atmosphere, means for venting said chamber to atmosphere to effect initiation of opening movement of said valve mechanism, and an element rupturable upon the initiation of opening movement of said valve mechanism for further and more freely venting said chamber to accelerate opening movement of said valve mechanism.

14. A blasting cartridge comprising a casing having a chamber for receiving a blasting charge 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, means for venting said control chamber to effect movement of said piston to initiate opening movement of said valve means, and means automatically operative upon initiation of opening movement of said valve means for further and more freely venting said control chamber to accelerate opening movement of said valve means, said latter means including a frangible element adapted to be broken to vent the control chamber, and an element actuated by said piston for breaking said frangible element.

15. A blasting cartridge comprising a casing having a chamber for receiving a blasting charge and a discharge orifice, a valve for closing said orifice, controlling means for said valve governable to effect exertion of a valve closing and holding pressure on said valve or to effect relief of said pressure to effect valve opening upon attainment of any one of a wide range of blasting pressures in said chamber, and means operative automatically upon predetermined opening movement of said valve to effect complete relief of said holding pressure.

16. A blasting cartridge comprising a casing having a chamber for receiving a blasting charge and a discharge orifice, a valve for closing said orifice, a charging line for said chamber, controlling means for said valve governable upon supply of charging pressure through said charging line to close and maintain closed said valve and operative on a predetermined reduction of pressure in said charging line to effect valve opening, and means operative automatically upon such predetermined reduction in pressure in said charging line to provide an accelerated reduction in such pressure.

17. In a material breaking device, the combination of a container adapted to be charged with high pressure gas at a material breaking pressure and having an outlet therefor, differential valve mechanism controlling said outlet for releasing the charge of material breaking pressure into the material to be broken, a control pocket for governing said differential valve mechanism, and means for reducing pressure in said pocket to cause initial opening movement of said differential valve mechanism, said container having an exhaust port normally sealed from said pocket but communicable therewith consequent upon opening movement of said valve mechanism.

18. In a material breaking apparatus, the combination with a blasting cartridge having a casing in which a charge of gaseous medium is stored at high pressure and embodying means for releasing suddenly the charge including a valve, and controlling means for said valve including a

control chamber which is filled with high pressure gaseous medium while the casing is charged and adapted to be vented to effect opening of said valve, pressure responsive means for actuating the valve
5 located in the control chamber, and means for

effecting quick venting of such control chamber comprising a vent valve, and means for opening said vent valve actuated by the pressure responsive means.

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