June 15, 1937. W. NOBLE 2,083,736

BLASTING CARTRIDGE

Filed April 27, 1935

Fig. 1.

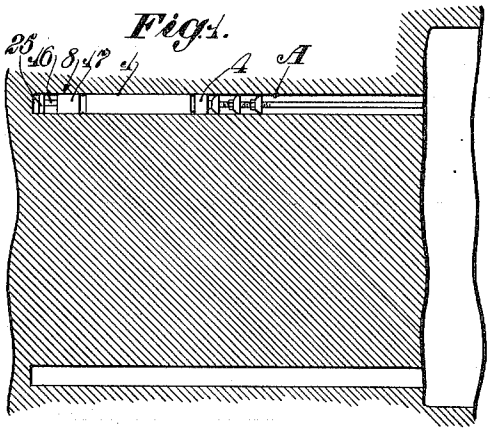


Fig. 5.

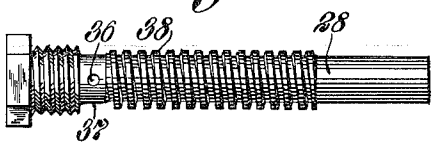


Fig. 2.

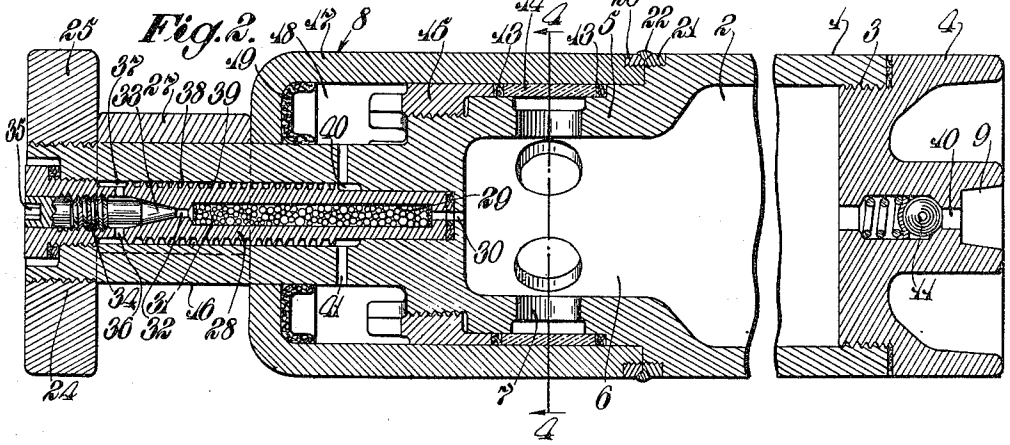


Fig. 3.

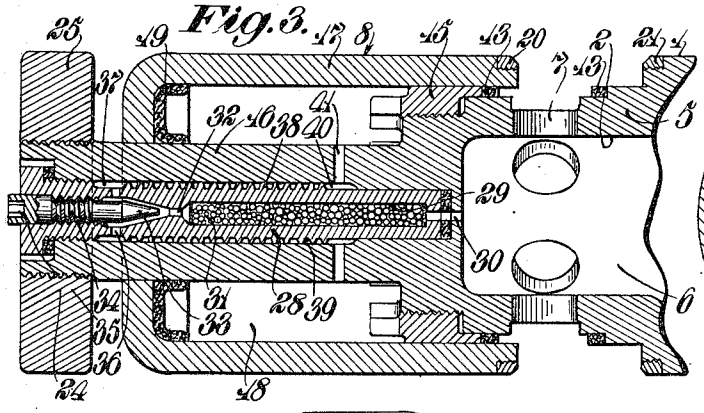


Fig. 4.

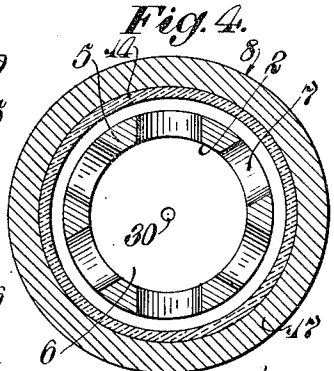
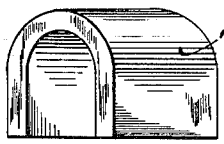


Fig. 6.



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UNITED STATES PATENT OFFICE

2,083,736

BLASTING CARTRIDGE

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Application April 27, 1935, Serial No. 18,636

24 Claims. (Cl. 102—6)

This invention relates to blasting cartridges, and more particularly to improvements in 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 for liberating the blasting charge from the cartridge. A further object is to provide an improved blasting cartridge having improved release means for effecting sudden liberation of the blasting charge when the cartridge is properly positioned in blasting relation 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 of the type known as an "air shell" which may be transported from place to place without possible danger of a premature discharge and which, prior to positioning thereof with respect to the work, may be rendered active so that subsequent to the positioning thereof with respect to the work and after the lapse of a definite interval of time, the same may be discharged, a sufficient interval of time elapsing after the positioning of the cartridge to enable 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 improved pressure release means whereby the blasting charge may be discharged after positioning of the cartridge with respect to the work entirely by means embodied in the cartridge without any extraneous connections, thereby rendering the cartridge entirely self-contained. A still further object is to provide an improved pressure release means arranged at the inner discharge end of the cartridge and having embodied therein delayed action release means operated by the pressure in the cartridge for releasing the blasting charge subsequent to the positioning of the cartridge with respect to the work and after a definite lapse of time. A still further object is to provide in a release means of the above character an improved positive lock and seal for preventing premature discharge of the release means during the charging process and transport of the cartridge from place to place. 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 diagrammatic view showing the cartridge in blasting position in a blast hole drilled in a mine wall.

Fig. 2 is a view in longitudinal section of the illustrative embodiment of the improved blasting cartridge, showing the release parts in their locked and sealed position.

Fig. 3 is a fragmentary view similar to Fig. 2 showing the release parts in their released position with the lock removed and the seal broken.

Fig. 4 is a cross sectional view taken on line 4—4 of Fig. 2.

Fig. 5 is a detail view showing the pressure retarding element.

Fig. 6 is a perspective view showing the release means lock.

In this illustrative embodiment of the invention, the improved charge release or "firing" means is shown associated with a blasting cartridge of the self-contained, pre-charged type designed for use with a high pressure gas, such as highly compressed air, as a blasting medium. The particular blasting cartridge shown is of the type known as an "air shell", and is herein 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 metallic shell or container 1 having a chamber 2 for receiving a charge of high pressure gas. Threaded at 3 within the outer end of the container is a charging cap 4, while preferably formed integral with the inner portion of the container is a discharge head 5. Formed in the discharge cap is an axial discharge orifice 6 communicating externally of the container through a series of radial discharge ports 7. During charging of the container and during transport of the cartridge to its point of use the discharge ports 7 are maintained closed by the improved discharge release means generally designated 8. The charging cap 4 is provided with a charging socket 9 for receiving the charging nozzle of a suitable charging apparatus. The charging pressure flows from the charging socket through a passage 10 past a ball check valve 11 to the chamber 2, the pressure in the container holding the ball check valve closed after the container has been pre-charged to a predetermined blasting pressure.

Now referring to the improved pressure release means 8, it will be noted that arranged between

sealing rings 13, 13 on the exterior of the discharge cap 5 is a frangible sleeve 14 herein preferably composed of glass for maintaining the discharge ports 7 closed, the sleeve 14 being retained in place between the sealing rings by a cap 15 threaded on the exterior of the discharge cap. As shown in Fig. 2, the discharge cap 5 is provided with an inwardly projecting cylindrical reduced portion or tubular stem 16 having mounted thereon a slidable head or shield 17 housing the entire discharge end of the control cap and having a chamber 18 sealed against leakage past the stem 16 by a cup packing 19 engaging the exterior periphery of the stem 16. The inner end of the discharge cap forms a stationary piston fitting the bore of the chamber 18 and the shield 17 constitutes a sliding cylinder with which the stationary piston cooperates. Threaded on the outer end of the shield 17 is a bronze sealing ring 20 which cooperates with a similar bronze ring 21 threaded on the exterior of the container, and when the shield 17 is in its outermost closed position the rings 20, 21 engage one another and a ring of solder 22 permanently seals the joint between the rings. Threaded at 24 on the inner extremity of the stem-like prolongation 16 is an abutment collar 25, and interposed between this abutment collar and the inner end of the shield 17 is a U-shaped locking member 27 having its side arms straddling the stem 16. The member 27 holds the shield in its closed position and forms a positive lock for the release means during the charging process and transport of the cartridge from place to place.

The release means 8 is operable by the pressure in the container chamber and has embodied therein improved means for delaying or retarding the flow of high pressure gas from the chamber 2 to the chamber 18 comprising a flow delay member 28 of tubular form having an axial chamber 29 connected by a passage 30 to the pressure chamber 2. The chamber 29 is preferably filled with a porous substance 31, preferably composed of granules of carbon or similar substances, for delaying or retarding flow through the chamber 29 and through which the high pressure gas slowly percolates to a passage 32 controlled by a valve 33. This valve is of the needle type and has its stem threaded at 34 within the inner extremity of the member 28 and provided with a socket 35 for the reception of a suitable turning instrument. This needle valve controls the flow of fluid through the passage 32 and radial ports 36 to an annular groove 37 encircling the member 28. Formed externally on the member 28 are threads 38 which form an elongated helical passage 39 of restricted dimensions through which the gas must slowly flow from the groove 37 to a chamber 40, the latter being connected through radial ports 41 in the stem 16 to the chamber 18. As above mentioned, the improved cartridge is of the self-contained, pre-charged type adapted to be charged at some central charging point and then transported in a precharged condition to the point of use. During the charging process and transport of the cartridge from place to place the U-shaped locking member 27 maintains the pressure release shield 17 in its closed position, thereby to prevent premature discharge of the blasting pressure. Prior to the insertion of the cartridge into the blast hole indicated at A in Fig. 1, the "shot firer" releases the U-shaped lock 27 from between the abutment collar 25 and the shield 17, and, by the use of a suitable turning instrument receivable in the socket 35, turns the needle valve into its open position. The "shot firer" then shoves the cartridge into the drill hole in the manner shown in Fig. 1 and retreats to a place of safety. High pressure gas then flows from the pressure chamber 2 through passage 30 slowly past the granular substance in the chamber 29, through passage 32 past the needle valve, through radial ports 36 to the grooves 37 and thence through the elongated, restricted helical passage 39 along the flow delay member 28 to chamber 40 and through ports 41 to the pressure chamber 18. The pressure in the chamber 18 acts on the inner pressure area of the release shield cylinder 17 and when a predetermined pressure is built up within the chamber 18, and after a definite lapse of time subsequent to the positioning of the cartridge in the drill hole, the solder ring 22 is broken, permitting the shield to move suddenly inwardly from the position shown in Fig. 2 to its wide open position shown in Fig. 3. When the shield assumes its wide open position, the pressure of the blasting charge in the container 2 acts on the frangible ring 14, causing the latter to break and permitting the sudden liberation of the blasting charge through the discharge orifice 6 and discharge ports 7.

As a result of this invention, it will be noted that an improved air shell of the self-contained, pre-charged type is provided designed to use with highly compressed air as a blasting medium and having improved pressure release means actuated by the pressure in the cartridge for releasing the blasting charge after a definite lapse of time subsequent to the positioning of the cartridge with respect to the work. It will further be noted that by locating the release means adjacent the discharge means at the inner end of the cartridge, the release and discharge means are rendered comparatively simple in design and direct in action, and further by the provision of the improved delay action means whereby the flow of actuating pressure from the cartridge to the pressure release element is substantially delayed, possibility of the discharge of the blasting pressure prior to the proper positioning of the cartridge in the drill hole is reduced to a minimum, the "shot firer" having ample time to retreat to a point of safety. These and other uses and advantages of the improved blasting cartridge will be clearly apparent to those skilled in the art.

The dimension of the helical passage along member 28 may in practice be made much smaller than it has been shown, for clarity, in the drawing; and further delay may be effected by having thread 38 engage an internal thread on part 16, if desired, so that a very restricted passage will be provided.

While there is in this application specifically described one form which the 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.

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 at the inner end of the container, fluid pressure operated means at the inner end of the container and associated with said discharge means adapted to be actuated to effect release of the discharge

means, and means operable after the lapse of a definite time interval from the time it is rendered active to feed fluid pressure to the fluid pressure means.

2. In a pre-charged blasting cartridge, a container for receiving a blasting charge, discharge means for the blasting charge at the inner end of the cartridge, and self-contained means embodied in the cartridge at the inner end of the latter and operated by the pressure in the latter to effect automatic release of said discharge means and after a time interval subsequent to when the same has been rendered active said self-contained means including means for delaying the action of its operating pressure.

3. In a pre-charged blasting cartridge, a container for receiving a charge of high pressure gas, a pressure rupturable discharge means for the blasting charge at the inner end of the cartridge, and self-contained means embodied in the inner end of the cartridge and adapted to be rendered active to effect release of the discharge means after the lapse of a definite time interval, said self-contained means including a discharge means sustaining element displaceable by the pressure within the cartridge to permit rupture of the discharge means.

4. 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 inner end of the cartridge and operative after being rendered active to effect automatic release of said discharge means, said release means being operated by the pressure in the container and having embodied therein flow delay means for impeding the flow of pressure from the container to effect release.

5. In a pre-charged blasting cartridge, a container for receiving a blasting charge, releasing means for the blasting charge, a shield for holding closed said releasing means, and releasable means for locking said shield in position.

6. In a pre-charged blasting cartridge, a container for receiving a blasting charge, releasing means for the blasting charge, a shield for maintaining said releasing means closed, and means for moving said shield into its released position by the pressure in the container.

7. In a pre-charged blasting cartridge, a container for receiving a blasting charge, discharge means for the blasting charge, a shield for maintaining said discharge means closed, means for moving said shield into its released position by the pressure in the container, and delay means embodied in the cartridge for impeding the flow of pressure from the container to said shield.

8. In a pre-charged blasting cartridge, a container for receiving a charge of high pressure gas, discharge means for the blasting charge, a frangible ring for maintaining said discharge means closed, a shield surrounding said ring for supporting the latter, and means for locking said shield in position, said locking means when released permitting movement of said shield into its released position so that said frangible ring is broken by the pressure in the container, thereby suddenly to release said discharge means.

9. 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 comprising a shield for shrouding the entire discharge end of the cartridge.

10. 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 comprising a shield for shrouding the entire discharge end of the cartridge, said shield being released by the pressure in the container, and associated delay means for impeding the flow of pressure from said container to said shield whereby movement of the shield into its released position is substantially delayed.

11. 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 being operated by the pressure in the container and having embodied therein delay means in the form of an elongated restricted passageway through which pressure must flow to act on said release means.

12. 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 being operated by the pressure in the container and having embodied therein delay means in the form of an elongated restricted passageway through which pressure must flow to act on said release means, said delay means also including a granular substance through which the pressure must slowly flow to said passageway.

13. In a blasting cartridge, a container for receiving a blasting charge, release means for the blasting charge, and a shield for maintaining said release means in charge confining condition and displaceable to permit said means to release the charge.

14. In a blasting cartridge, a container for receiving a blasting charge, release means for the blasting charge, a shield for maintaining said release means in charge confining condition and displaceable to permit said means to release the charge, and means operated by the pressure of the charge for displacing said shield.

15. In a blasting cartridge, a container for receiving a blasting charge, release means for the blasting charge, a shield for maintaining said release means in charge confining condition and displaceable to permit said means to release the charge, means operated by the pressure of the charge for displacing said shield, and removable locking means for preventing accidental displacement of the shield during charging and transporting of the cartridge.

16. In a blasting cartridge, a container for receiving a blasting charge, release means for the blasting charge, a shield for maintaining said release means in charge confining condition and displaceable to permit said means to release the charge, means operated by the pressure of the charge for displacing said shield, said last mentioned means including mechanism for controlling communication with the charge in the cartridge.

17. In a blasting cartridge, a container for re-

ceiving a blasting charge and having a plurality of radial discharge ports, rupturable release means for encircling and closing said ports, and axially displaceable reinforcing means for the release means for controlling the rupturing operation of said release means.

18. In a blasting cartridge, a container for receiving a blasting charge having a plurality of radial discharge ports, rupturable release means for encircling and closing said ports, and displaceable reinforcing means for the release means operable by the pressure of the charge for controlling the rupturing operation of said release means.

19. In a blasting cartridge, a container for receiving a blasting charge and having a plurality of discharge ports, common release means for directly closing all of said ports, blasting charge operated means for controlling operation of said release means, and delay means for impeding the action of the blasting charge on the charge operated means.

20. In a blasting cartridge, a container for receiving a blasting charge, an annular rupturable charge releasing means for the container, and annular means for enclosing and reinforcing said release means.

21. In a blasting cartridge, a container for receiving a blasting charge, charge release means for the container, means for enclosing and reinforcing said release means, and means including an expansible fluid chamber for displacing said enclosing and reinforcing means.

22. In a blasting cartridge, a container for receiving a blasting charge, rupturable charge release means for the container, means for enclosing and reinforcing said release means, and including an expansible fluid chamber means for displacing said enclosing and reinforcing means.

23. In a blasting cartridge, a container having a chamber for receiving a blasting charge and a radial discharge opening for the chamber, destructible means located entirely exteriorly of said chamber and encircling and sealing said opening for effecting release of the said charge, and means for controlling operation of said destructible means located entirely exteriorly of the chamber.

24. In a blasting cartridge, a container having a chamber for receiving a blasting charge and a radial discharge orifice for the chamber, destructible means located entirely exteriorly of said chamber and encircling said orifice for effecting release of said charge, and displaceable means located exteriorly of and encircling said destructible means for controlling operation of the latter means.

WARREN NOBLE.

CERTIFICATE OF CORRECTION.

Patent No. 2,083,736. June 15, 1937.

WARREN NOBLE.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, first column, line 28, for "elapsing" read lapsing; page 4, second column, line 9, claim 22, strike out the word "means" and insert the same after "and" second occurrence, line 8, same claim; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 25th day of January, A. D. 1938.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.