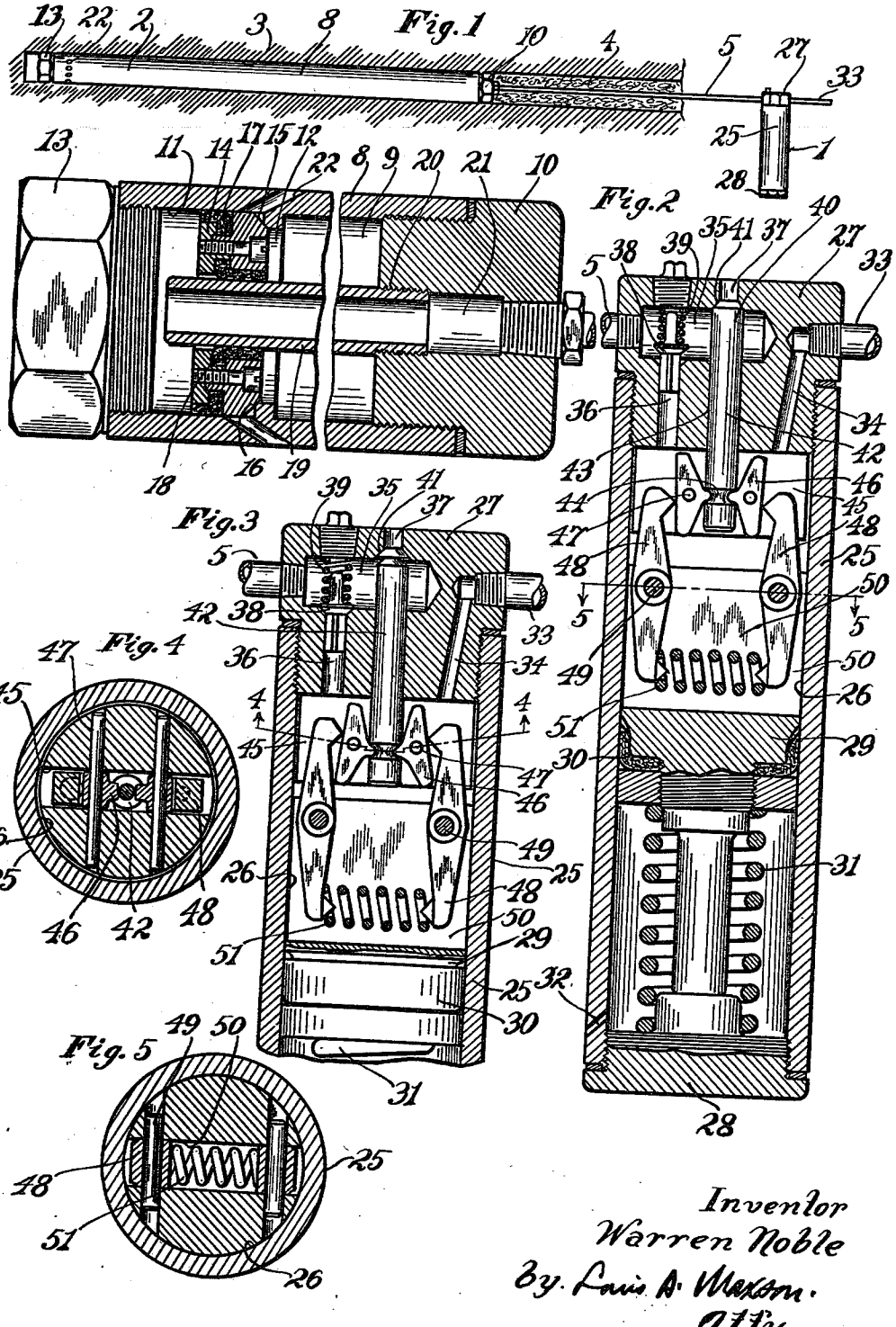
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AIR SHOOTING APPARATUS

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AIR-SHOOTING APPARATUS

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24 Claims. (Cl. 102—5)

This invention relates to blasting cartridges and more particularly to improvements in the pressure release control means for a blasting cartridge of the type wherein high pressure gas is employed as a blasting medium.

An object of this invention is to provide an improved pressure release control means for a blasting cartridge. Another object is to provide an improved control means for a blasting cartridge of the type wherein a highly compressed gas is employed as a blasting medium, so that when it is desired to effect release of the blasting charge the same may be readily and quickly effected. A further object is to provide an improved control means for the valve mechanism of a blasting cartridge of the above character whereby when it is desired to effect a blasting function, the valve mechanism may be quickly opened to effect release of the blasting pressure. Yet another object is to provide an improved automatic vent means for a blasting cartridge of the high pressure gas type whereby venting is effected in an improved manner thereby to effect quick operation of the blasting pressure release means of the blasting cartridge. These and other objects and advantages of the invention 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 somewhat diagrammatic view showing the association of the improved control means with respect to the blasting cartridge.

Fig. 2 is an enlarged longitudinal sectional view taken through the illustrative form of the improved pressure release means and the associated blasting cartridge.

Fig. 3 is a fragmentary view of the control means shown in Fig. 2, showing the valve means in its pressure releasing position.

Fig. 4 is a cross sectional view taken on line 4—4 of Fig. 3.

Fig. 5 is a cross sectional view taken on line 5—5 of Fig. 2.

In this illustrative embodiment of the invention the improved pressure release control means, generally designated 1, is shown associated with a blasting cartridge generally designated 2, the latter, in Fig. 1, being shown in position in a blast hole 3, and held therein by usual tamping 4. This blasting cartridge is herein of the type wherein a high pressure gas is used as a blasting medium, and in this instance is similar in design to that disclosed in my copending application Ser. No. 730,828 filed June 15, 1934. As above mentioned this cartridge is receivable in the blast hole 3 in the coal face and high pressure gas, herein air under high pressure, is conducted thereto through a short tube or "pig tail" connection 5. The blast hole is tamped at 4 at the outer end of the cartridge so that when the blasting pressure is released at the inner end of the cartridge the latter will tend to stay in the hole, thereby to enable the compressed gas to act expansively on the rear of the mine wall to break down the latter. The blasting cartridge 2 comprises a cylindrical metallic casing or shell 8, having a chamber 9 for receiving a charge of gas compressed to a high pressure. The chamber 2 at the outer end of the shell is closed by a head 10 threaded within the outer end of the shell. As shown, formed in the inner end portion of the shell is a bore 11 alined with a pressure chamber 9 and communicable therewith through a large axial opening 12. The outer end of this bore 11 is closed by a cap 13 threaded within the inner end of the shell. Slidably mounted within the bore 11 is a piston 14, having formed thereon an end seating valve 15 adapted to engage a conical valve seat 16 surrounding the opening 12 to cut off communication between the bore 11 and the pressure chamber 9. This piston carries an outer cup packing 17, tightly engaging the walls of the bore 11 to prevent leakage of pressure from the bore 11 past the piston 14. Also carried by this piston is an inner cup packing 18 tightly engaging the exterior periphery of a tube 19. This tube is herein secured at 20 within the rear head 10 and extends centrally through the pressure chamber 9 and through the piston 14 into the bore 11, the interior of this tube communicating with the bore 11 at the inner side of the piston 14. Compressed gas is adapted to be conducted through this tube 19 through a passage 21 communicating with the short tube or "pig tail" connection 5. In this instance connecting the bore 11 with the exterior of the shell is a series of outwardly inclined pressure releasing passages 22. When compressed gas is supplied to the tube 19 from the connection 5 the compressed gas flows into the bore 11 at the inner side of the piston and through the piston past the cup packing 18 to the pressure chamber 9. When a predetermined blasting pressure is attained within the chamber 9, the supply of compressed gas through the connection 5 is cut off, and thereafter this connection is suitably vented to atmosphere so that the pressure in the tube 19 and within the bore 11 at the inner side of the piston is substantially reduced. Pressure

from the chamber 9 is prevented from leaking past the piston by the cup packing 18, and the relatively high pressure in the chamber 9 overcomes the reduced pressure in the bore 11, thereby causing the piston 14 to move suddenly inwardly and as a result unseat the valve 15 to release the blasting charge from the chamber 9 through the axial opening 12, past the valve and through the pressure release passages 22.

Now referring to the improved pressure release control means for effecting rapid venting of the cartridge, it will be noted that in Figs. 2 and 3 there is shown a cylindrical casing 25 having a bore 26 closed at its upper end by a head 27 and at its lower end by a head 28. Reciprocable in the bore 26 is a piston 29 carrying a cup packing 30 to prevent leakage of compressed gas from above the piston to below the same. Interposed between the lower side of the piston and the lower head 28 is a coil spring 31 which normally urges the piston 29 to its uppermost position. The bore 26 at the lower side of the piston is vented to atmosphere through a small vent passage 32. Connected to the upper head 27 is a pipe connection 33 leading to any suitable source of compressed gas supply, and this connection communicates through a passage 34 with the bore 26 at the upper side of the piston 29. In this illustrative construction, the upper head 27 is formed with a chamber 35 with which the short tube or "pig tail" 5 communicates, and this chamber is connected by a passage 36 with the bore 26 at the upper side of the piston 29. Also communicating with the chamber 35 is a vent passage 37 which may be larger in cross section than the cross sectional area of the supply line of the smallest portion of the latter as desired. Flow of compressed gas from the bore 26 through the passage 36 to the chamber 35 is controlled by a check valve 38 normally maintained in its seated position by a coil spring 39. Flow of gas from the chamber 35 to the vent passage 37 is controlled by an end seating valve 40 engageable with a conical seat 41 surrounding the vent passage 37. The valve 40 is herein in the form of plunger 42 guided in a bore 43 formed centrally in the head 27, and the inner end of this plunger projects inwardly within the bore 26 and is exteriorly grooved at 44. The head 27 is transversely slotted at 45, and swingably mounted in this slot are levers 46 herein in the form of trigger release means for the valve 40 and having projections engaging the groove 44. These levers 46 are pivotally mounted on pins 47 carried by the head 27, and engageable with these levers are actuating levers 48, 48 suitably mounted on pins 49 carried by the piston 29, these levers being pivotally mounted in a transverse slot 50 formed in the piston. The lower ends of these levers 48, 48 are constantly urged away from each other by a coil spring 51 interposed therebetween, thereby to maintain the upper ends of these levers in operative engagement with the trigger levers 46.

In the operation of the improved pressure release control means it will be noted that when high pressure gas is supplied through the pipe connection 33 and passage 34 to the bore 26 at the upper side of the piston 29, the latter is moved downwardly against the tension of the spring 31 and, the levers 48 being movable therewith, causes the upper ends of the latter to move below a transverse plane including the centers of the pivot pins 47, and as a result the trigger levers 46 are quickly swung about their pivots with a snap action to move the valve 40 tightly against its seat 41. The compressed gas in the bore 26 flows through passage 36, unseating the check valve 38, and flows through the short tube or "pig tail" 5 to the blasting cartridge shell. When the desired blasting pressure is attained within the blasting cartridge shell the supply of compressed gas to the pipe connection 33 is cut off and the latter is vented to atmosphere and as a result the pressure in the bore 26 at the upper end of the piston 29 is substantially reduced, the coil spring 31 then quickly moving the piston 29 into its uppermost position, thereby moving the upper ends of the snap action levers 46 to the opposite side of the transverse plane including the centers of the pins 47, and as a result the trigger levers 46 are quickly swung about their pivots to move the plunger 42 downward, thereby to unseat the valve 40 and to open the chamber 35 to atmosphere through the vent passage 37. When the parts are thus positioned the cartridge is vented to atmosphere through the "pig tail" connection 5, chamber 35 and vent passage 37, thereby to effect operation of the valve mechanism of the cartridge to release the blasting charge.

As a result of this invention it will be noted that an improved pressure release control means is provided for a blasting cartridge of the type wherein high pressure gas is employed as a blasting medium, so that when a blasting function is desired the cartridge may be quickly vented to atmosphere to effect sudden release of the blasting charge control means. It will further be noted that an improved vent control means is provided for controlling the valve mechanism of a blasting cartridge of the compressed gas type whereby the blasting charge may be quickly released to effect actuation of the pressure release mechanism. Obviously a spring 31 may be provided of such strength that valve 40 will be opened much sooner than valve 15 would move to open position, i. e. upon a smaller pressure drop, and a much faster rate of venting of chamber 11 can be secured, even aside from the quicker valve action. These and other uses and advantages of the improved pressure release control means will be clearly apparent to those skilled in the art.

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 material breaking apparatus a casing having a storage chamber and a control chamber to be charged with a gaseous medium stored at high pressure, means in the casing to suddenly release the charge to a point of use by the venting of the control chamber, and a pressure control device for effecting quick venting of such control chamber comprising a vent valve and snap action means for quickly opening said vent valve having pressure responsive controlling means.

2. In a material breaking apparatus a casing having a storage chamber and a control chamber to be charged with a gaseous medium stored at high pressure, means in the casing to suddenly release the charge to a point of use by the venting of the control chamber, and a pressure control device for effecting quick venting of such

control chamber comprising a vent valve and pressure actuated means for quickly opening said valve comprising a cylinder having a bore, a piston reciprocable in said bore and a snap action, valve-actuating means operated by said piston.

3. In a material breaking apparatus a casing having a storage chamber and a control chamber to be charged with a gaseous medium stored at high pressure, means in the casing to suddenly release the charge to a point of use by the venting of the control chamber, and a pressure control device for effecting quick venting of such control chamber comprising a vent valve and pressure actuated means for effecting sharp opposite movements of said valve.

4. In a material breaking apparatus a casing having a storage chamber and a control chamber to be charged with a gaseous medium stored at high pressure, means in the casing to suddenly release the charge to a point of use by the venting of the control chamber, and a pressure control device for effecting quick venting of such control chamber comprising a vent valve and pressure actuated means for sharply opening and closing said valve comprising a piston-actuated, snap action, valve actuating means operated to close said valve by the charge of gaseous medium on its way to the casing.

5. In a material breaking apparatus a casing having a storage chamber and a control chamber to be charged with a gaseous medium stored at high pressure, means in the casing to suddenly release the charge to a point of use by the venting of the control chamber, and a pressure control device for effecting quick venting of such control chamber comprising a vent valve and pressure actuated means for sharply opening and closing said valve comprising a pressure chamber, a piston reciprocable in said chamber and a snap action valve actuating means operated by said piston.

6. In a material breaking apparatus in which a charge of gaseous medium is stored at high pressure in a casing and is released suddenly to a point of use by the venting of a control chamber which is filled with high pressure gaseous medium while the casing is charged, a pressure control device for effecting quick venting of such control chamber comprising a vent valve and pressure actuated means for quickly opening or closing said valve comprising a pressure chamber, a piston reciprocable in said chamber, and a snap action valve actuating means operated by said piston, said snap action means comprising levers pivotally mounted on said piston.

7. In a material breaking apparatus in which a charge of gaseous medium is stored at high pressure in a casing and is released suddenly to a point of use by the venting of a control chamber which is filled with high pressure gaseous medium while the casing is charged, a pressure control device for effecting quick venting of such control chamber comprising a vent valve and pressure actuated means for quickly opening or closing said valve comprising a pressure chamber, a piston reciprocable in said chamber, and a snap action valve actuating means operated by said piston, said snap action means comprising levers pivotally mounted on said piston and snap action levers actuated by said piston levers.

8. In a material breaking apparatus in which a charge of gaseous medium is stored at high pressure in a casing and is released suddenly to a point of use by the venting of a control chamber which is filled with high pressure gaseous medium while the casing is charged, a pressure control device for effecting quick venting of such control chamber comprising a vent valve and means for quickly opening said valve comprising a cylinder having a bore, a piston reciprocable in said bore, means for supplying compressed gas to said bore at one side of said piston, a check valve for controlling flow of gas from said bore to the cartridge, and snap-action controlled means actuated by said piston for venting the chamber to effect charge release.

9. In a material breaking apparatus in which a charge of gaseous medium is stored at high pressure in a casing and is released suddenly to a point of use by the venting of a control chamber which is filled with high pressure gaseous medium while the casing is charged, a pressure control device for effecting quick venting of such control chamber comprising a vent valve and means embodying a snap-action for quickly opening said valve comprising a cylinder having a bore, a piston reciprocable in said bore, means for supplying compressed gas to said bore at one side of said piston, a check valve for controlling the flow of gas from said bore to the cartridge, and means actuated by said piston for venting the chamber to effect charge release, said check valve closing automatically when said vent valve is opened.

10. In a material breaking apparatus a casing having a storage chamber and a control chamber to be charged with a gaseous medium stored at high pressure, means in the casing to suddenly release the charge to a point of use by the venting of the control chamber, and a pressure control device for effecting quick venting of such control chamber comprising a vent valve and pressure responsive trigger mechanism for actuating said valve.

11. In a material breaking apparatus a casing having a storage chamber and a control chamber to be charged with a gaseous medium stored at high pressure, means in the casing to suddenly release the charge to a point of use by the venting of the control chamber, and a pressure control device for effecting quick venting of such control chamber comprising a vent valve and pressure responsive trigger mechanism for actuating said valve effective to cause sharp closing movement of said valve when gas is supplied to charge the casing.

12. In a material breaking apparatus a casing having a storage chamber and a control chamber to be charged with a gaseous medium stored at high pressure, means in the casing to suddenly release the charge to a point of use by the venting of the control chamber, and a pressure control device for effecting quick venting of such control chamber comprising a vent valve and quick acting pressure control means embodying a snap-action for actuating said valve, said means acting to close quickly said valve when compressed gas is supplied to the cartridge, and to open quickly said valve when the supply of compressed gas to the cartridge is cut off and the cartridge is vented.

13. The combination with a cartridge having provision for storing a charge of gas under a high pressure, a supply line therefor, and means for releasing the charge to a point of use upon a reduction of pressure in the supply line, of means between the ends of said supply line for providing a vent orifice larger than the minimum cross sectional area of the supply line, upon pressure reduction in said supply line.

14. The combination with a cartridge having provision for storing a charge of gas under a high pressure, a supply line therefor, and means for releasing the charge to a point of use upon a reduction of pressure in the supply line, of means between the ends of said supply line and adjacent to but spaced from said cartridge for venting the latter upon pressure reduction in said supply line.

15. In a material-breaking apparatus a casing having a storage chamber and a control chamber to be charged with a gaseous medium is stored at high pressure, means in the casing to suddenly release the charge to a point of use by the venting of the control chamber, and means for effecting quick venting of such control chamber including a venting valve, a pressure responsive element and operative connections between said valve and element providing for different rates of movement between them.

16. In a material-breaking apparatus a casing having a storage chamber and a control chamber to be charged with a gaseous medium stored at high pressure, means in the casing to suddenly release the charge to a point of use by the venting of the control chamber, a conduit alternatively pressure-filled and vented to atmosphere, and a control apparatus connecting said conduit with said control chamber and providing a chamber-venting device, a pressure responsive element oppositely movable upon rise and fall of conduit pressure, and means operative while said pressure responsive element is moving at a slow rate for effecting a rapid opening movement of said venting device.

17. In a material-breaking apparatus a casing having a storage chamber and a control chamber to be charged with a gaseous medium stored at high pressure, means in the casing to suddenly release the charge to a point of use by the venting of the control chamber, a conduit alternatively pressure filled and vented to atmosphere, and a control apparatus connecting said conduit with said control chamber and providing a chamber-venting device, a pressure responsive element oppositely movable upon rise and fall of conduit pressure, and means operative while said pressure responsive element is moving at a slow rate for effecting a rapid closing movement of said venting device.

18. In combination, a casing providing a storage space for a charge of gaseous medium at high pressure and a control space, a charge release valve for said storage space having controlling means governed by pressure conditions in said control space and held closed when high pressure prevails in said space and opened and held open during charge release upon rapid venting of said control space, and means for governing pressure conditions in said control space including means providing a chamber adjacent said casing and in continuous communication with the control space of the latter and having a plurality of stationary valve seats, a conduit selectively connectable to a source of supply or to exhaust communicating with one of said seats, a check valve on said seat preventing back flow through said conduit, the other seat communicating with exhaust and having a valve cooperating therewith, and controlling means for said last mentioned valve responsive to pressure conditions in said conduit and operative with a snap action.

19. In a material breaking apparatus, a control device for effecting quick venting of a high pressure gaseous blasting medium supply line comprising a vent valve, and pressure actuated means for quickly opening or closing said valve comprising a pressure chamber, a piston reciprocable in said chamber, and a snap-action valve actuating means operated by said piston, said snap-action means comprising levers pivotally mounted on said piston.

20. In a material breaking apparatus, a control device for effecting quick venting of a high pressure gaseous blasting medium supply line comprising a vent valve, and pressure actuated means for quickly opening or closing said valve comprising a pressure chamber, a piston reciprocable in said chamber, and a snap-action valve actuating means operated by said piston, said snap-action means comprising levers pivotally mounted on said piston and additional levers actuated by said piston levers.

21. In a material breaking apparatus, a control device for effecting quick venting of a high pressure gaseous blasting medium supply line comprising a vent valve, and means for quickly opening said valve comprising a cylinder having a bore, a piston reciprocable in said bore, means for supplying compressed gas to said bore at one side of said piston, a check valve for controlling flow of gas from said bore, and snap-action controlled means actuated by said piston for venting the chamber.

22. In a material breaking apparatus, a control device for effecting quick venting of a high pressure gaseous blasting medium supply line comprising a vent valve, and means embodying a snap-action for quickly opening said valve comprising a cylinder having a bore, a piston reciprocable in said bore, means for supplying compressed gas to said bore at one side of said piston, a check valve for controlling the flow of gas from said bore, and means actuated by said piston for venting the chamber, said check valve closing automatically when said vent valve is opened.

23. In a material breaking apparatus, a control device for effecting quick venting of a high pressure gaseous blasting medium supply line comprising a vent valve, a pair of levers for effecting a snap-action opening or closing of said valve when said levers are moved bodily longitudinally of each other, and pressure responsive means for effecting said longitudinal movement.

24. In a material breaking apparatus, a control device for effecting quick venting of a high pressure gaseous blasting medium supply line comprising a vent valve, a pair of levers for effecting a snap-action opening or closing of said valve when said levers are moved longitudinally of each other, and a pressure responsive piston operatively connected to one of said levers for effecting said longitudinal movement.

WARREN NOBLE.