July 3, 1962 E. C. FILSTRUP 3,041,969

GAS PRESSURE DEVICES

Filed April 27, 1959

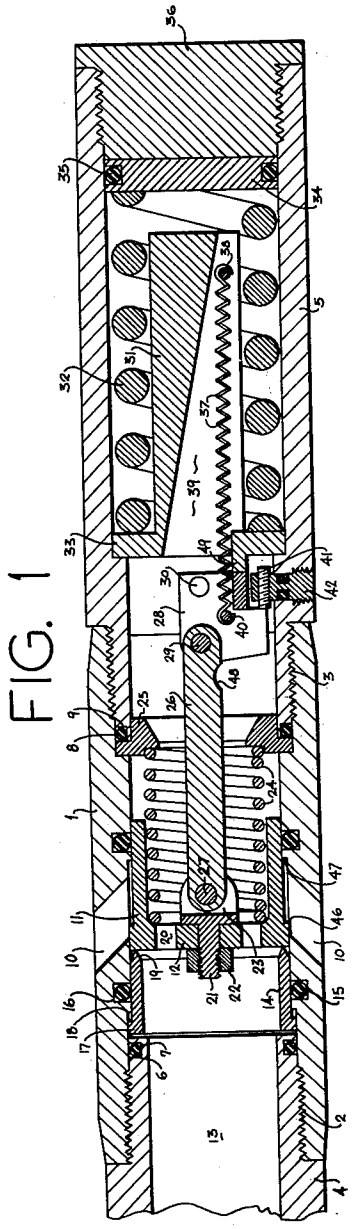


FIG. 1

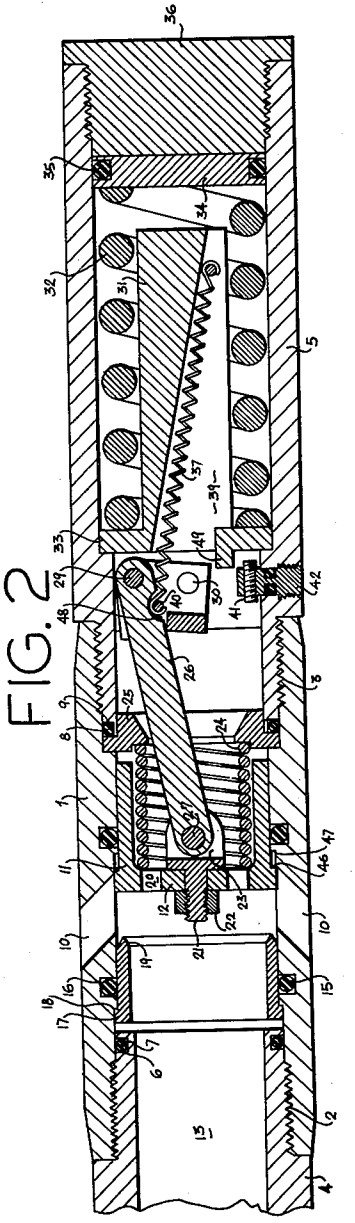


FIG. 2

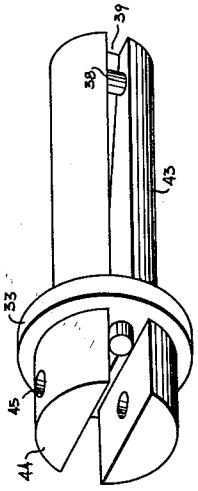


FIG. 3

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3,041,969

Patented July 3, 1962

3,041,969

GAS PRESSURE DEVICES

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Filed Apr. 27, 1959, Ser. No. 809,276

5 Claims. (Cl. 102—25)

This invention relates to gas pressure devices, and more particularly to a novel self-contained and indestructible release mechanism for gas pressure devices utilized in blasting operations.

In general, the instant device is of that type provided with a chamber into which a gas, such as air, is introduced while the chamber is positioned in a mine bore juxtaposed to an under-cut formed in the coal or other ore to be mined. The source of gas pressure, such as a gas pump, may be located remotely at a safe position spaced from the blasting chamber and is connected to the chamber by a suitable gas-conducting conduit. The chamber has outlet ports which are controlled by a valve to close the chamber while gas is being introduced into the same. The valve is held in a closed position by a member of a strength which will permit it to withstand a predetermined pressure. When the gas pressure within the chamber builds up to a value exceeding the pressure which the valve stop member will sustain, the member will cease to exert any restraining action, thereby releasing the valve which moves in response to pressure acting thereon to a position at which the discharge outlets are opened. The opening action occurs in a very short interval of time so that there is a sudden release of the gas confined in the chamber, which release is in the nature of a blast that is effective to break down the coal, ore or other material around the bore in which the chamber is located.

The method which has been most extensively adopted for effecting the desired control in the commercial use of gas pressure as a blasting medium consists of providing the indestructible cartridges or shells with rupturable wall portions. Specifically, the rupturable wall portion takes the form of a disc which is associated with a discharge cap in such a manner that the central portion will be sheared from the remainder of the disc when a predetermined blasting pressure is obtained.

Several disadvantages are inherent to cartridges in which rupturable discs are used. A supply of expendable discs must always be kept on hand to insure uninterrupted operation. In addition, considerable time is required to put this type of shell into condition for refiring. Also, since the discharge pressure is dependent upon the strength of the rupturable member, this pressure will vary widely unless rigid controls are maintained in the manufacture of the members to be ruptured. The development of an indestructible mechanism which would permit an accurate control of the discharge pressure of blasting charges would eliminate the cost of providing a new disc for each charge placed within the cartridge, the need for disturbing the cartridge assembly to effect substitution of a new disc, the danger of the blown out portion of the disc flying into the mine proper, and a need for separation of the disc portion from the blasted ore.

Another method to effect the control of the blasting pressure makes provisions for trigger mechanism actuated from a source exterior to the cartridge requiring some means of connection, and involves possible premature firing. Still another method for control of the release mechanism of the blast cartridges involves the use of multi-chamber blasting shells and an elaborate network of passageways and pistons to effectuate the

release of a valve mechanism. This latter method necessitates multi-movable parts which have the disadvantage of depending for their operation on the relative motion of preceding mechanisms.

Accordingly, it is the object of this invention to provide an improved blasting cartridge which eliminates the disadvantages of the prior art.

It is also an object of this invention to provide a novel indestructible discharge mechanism for blasting cartridges.

Another object of this invention is to provide an improved blasting cartridge for use in coal mines, and the like, wherein the cartridge is operated by a novel self-contained trigger mechanism.

A further object of this invention is to provide a novel non-destructive trigger mechanism which is contained in a blasting cartridge, and which is actuated in response to a predetermined pressure.

Other objects and advantages will become apparent from the following description and drawings in which:

FIGURE 1 is a longitudinal sectional view of a blasting cartridge head in closed position embodying a preferred example of the present invention;

FIGURE 2 is a longitudinal sectional view of the cartridge head of FIGURE 1 in open position; and

FIGURE 3 is a perspective view of the spring cage utilized in the cartridge of FIGURES 1 and 2.

As illustrated in FIGURE 1, the cartridge is provided with a tubular head 1 which is internally threaded at either end as indicated at 2 and 3 for connection to the main cartridge body 4 (partially shown) and end cap 5. The seal between the tubular head and cartridge body is completed by O-ring 6 in annular groove 7 of the cartridge body. In like manner, the seal between the end cap and the head is completed by O-ring 8 in annular groove 9 of the end cap. The tubular head is provided with lateral ports 10 which are normally closed by skirt 11 of sleeve valve 12. The main chamber 13 of the cartridge is sealed by the sleeve valve 12 together with follower sleeve 14. Any leakage between the follower sleeve and the valve head is prevented by resilient sealing means 15 in internal annular groove 16 of the tubular head. The forward movement of the follower sleeve is restricted by the enlarged base portion 17 thereof contacting shoulder 18 on the internal surface of the tubular head. Although that portion of the follower sleeve 14 in contact with the sleeve valve 12 is preferably a knife edge as shown at 19, it can be flat or of any desired configuration. Sleeve valve 12 is provided with one or more openings 20 so that upon charging the main chamber 13, the pressure is equalized on either side of the valve. However, since the effective area of the follower sleeve and sleeve valve exposed to the pressure in the main chamber is greater than the effective area on the reverse side of the sleeve valve, this valve is normally urged into an open position as the cartridge is charged. Also, the effective area of the valve remote from the main chamber is slightly greater than the effective area of the valve in the main chamber. This slight difference in effective diameters on either side of the valve overcomes any tendency of the follower sleeve and valve to cling together at discharge pressures.

A bolt 21 and lock nut 22 serve to secure a clevis 23 to the sleeve valve. Helical spring 24 is positioned within the annular skirt of the sleeve valve and spring support ring 25. Clevis 23 is hingedly secured to connecting link 26 and pin 27. The opposite end of the connecting link 26 is hingedly connected to pivot link 28 by pin 29. Pivot link 28 is freely rotatable about shaft 30 mounted in spring cage 31. The relationship between the pivot link and the spring cage will be fully described hereinafter with particular reference to FIGURE 3 of the drawing. It will be noted that pin 29 is below the line between shaft 30 and

pin 27. Thus, any movement of the sleeve valve 12 urges the pivot link 28 in a counterclockwise direction. Pin 29 can also be on, or even slightly above, the line between pin 27 and shaft 30. When so positioned, the pivot link 28 is forced straight back. Any tendency of the pivot link to prematurely rotate clockwise is overcome by friction in the linkages. While pin 27 and shaft 30 are shown in central locations, either or both of them can be located off-center to accentuate the cam action of the linkage. Spring cage 31 is maintained in position by helical spring 32 acting against shoulder 33 of the spring cage and shim 34, which is provided with a resilient sealing means 35 to seal the screw threaded joint between end cap 5 and end plug 36.

A tension spring 37 extending between pin 38 in slot 39 of the spring cage and pin 40 on pivot link 28 also tend to impart a counterclockwise movement of the pivot link. Boss 49 arrests the counterclockwise movement of the pivot link. Adjustable stop 41, which initiates clockwise movement of the pivot link is mounted on fixture 42.

The manner of mounting pivot link 28 in cylindrical spring cage 31 is best illustrated in FIGURE 3 of the drawing. The main body 43 of the spring cage is provided with a longitudinal slot 39 through its length to accommodate spring 37. The upper slotted portion 44 of the spring cage is provided with a hole 45 to accommodate shaft 30 on which the pivot link is mounted.

In operation, compressed gas is introduced into chamber 13 by conventional means (not shown). The gas passes through openings 20 in sleeve valve 12, equalizing the pressure on either side of the valve. The valve is then urged away from ports 10. This movement is initially arrested by helical spring 24 and by the cooperation of connecting link 26 and pivot link 28. Pressure on the sleeve valve tends to force pivot link 28 counterclockwise about shaft 30. Such counterclockwise movement of the pivot link continues until it contacts boss 49. With pin 29 below or slightly above the axis defined by pin 27 and shaft 30, the assembly is locked. Thus, as pressure is increased in the main chamber 13, the sleeve valve 12, connecting link 26, pivot link 28 and spring cage 31 are forced against helical spring 32. This sliding motion, which is very small, continues until adjustable stop 41 contacts the pivot link. Then adjustable stop 41 exerts a progressively increasing clockwise force moment on pivot link 28. This causes pin 29 to gradually come into line or move out of line with the axis of shaft 30 and pin 27 and the pin is gradually elevated above this axis. The pressure then exerted on the sleeve valve also imparts a clockwise force moment to pivot link 28. Thus, the clockwise leverage about shaft 30 builds up with increasing rapidity and causes the pivot link to snap clockwise practically instantaneously. When the linkage is thus unlocked, connecting link 26 augments rather than prevents movement of the sleeve valve and the sleeve valve slides rapidly toward the end plug. In this manner, ports 10 are abruptly opened and a very efficient discharge of the compressed gas in chamber 13 is effected.

Upon discharge, the various components of the cartridge head assume the positions shown in FIGURE 2 of the drawing. When the sleeve valve slides forward exposing the ports, it will be noted that helical spring 24 is compressed and also that tension spring 37 is fully extended. As the sleeve valve opens, the extended portion 46 thereof approaches shoulder 47 of the tubular head. Also, due to the restriction of vents 20, air is trapped on the right side of valve 12 and is compressed. This prevents destructive impact upon discharge. After the compressed gas is discharged through ports 10, springs 24, 32 and 27 cooperate to return the sleeve valve and pivot link to their normally closed position. In this way, the cartridge is rendered completely automatic.

The pressure at which the cartridge is discharged, in accordance with this invention, can be readily adjusted. This firing pressure increases as the strength of springs 24, 32 and 37 is increased. Also, as the adjustable stop 41 is positioned closer to the end plug 36, the firing pressure increases. It will be noted that the tension on spring 32 can also be adjusted by putting additional shims between the end plug and the spring or by turning the end plug further into the end cap.

Although the invention has been described in great particularity with reference to a specific embodiment and details, various modifications will readily suggest themselves to those skilled in the art and are encompassed within the invention.

The present application is a continuation-in-part of the application of Edward C. Filstrup, Serial No. 748,729, filed July 15, 1958, now Patent No. 3,022,730.

What is claimed is.

1. A blasting device comprising a substantially tubular body having a wall, a lateral outlet in the wall, means for introducing gas under pressure into the body, a sleeve valve slidable within the body in response to gas pressure therein and normally positioned to span and seal said outlet, the valve having a greater effective cross-sectional area at one end than at the other end whereby the valve is urged to open position by increasing gas pressure in the body, a pivot link having a pivot point resiliently mounted for longitudinal movement within the body, rigid connecting means hingedly connected to the sleeve valve and to the pivot link, stationary means to restrain counterclockwise rotation of the pivot link and to normally maintain the pivot link in a stable condition, and resilient means urging the pivot link toward the sleeve valve.

2. A blasting device comprising a substantially tubular body having a wall, a lateral outlet through the wall, means for introducing gas under pressure into the body, a sleeve valve slidable within the body in response to gas pressure therein and normally positioned to span and seal said outlet, the valve having a greater effective cross-sectional area at one end than at the other end whereby the valve is urged to open position by pressure in the body, a pivot link resiliently mounted for longitudinal movement within the body, a rigid connecting link hingedly connected to the sleeve valve and to the pivot link, the pivot link normally being in a stable condition and stationary means within the body to upset the pivot link.

3. A blasting device comprising a substantially tubular body having a side wall, a lateral outlet in the wall, means for introducing gas under pressure into one end of the body, an end cap closing the opposite end of the body, a sleeve valve slidable within the body in response to increasing gas pressure within the body, said valve normally positioned to span and seal said outlet, the valve having a greater effective cross-sectional area at one end than at the other end, a pivot link positioned in the body between the sleeve valve and the end cap, the pivot link having a pivot point resiliently mounted for longitudinal movement within the body, rigid means connecting the sleeve valve and the pivot link, one end of the rigid means being hingedly attached to the sleeve valve and the other end being hingedly attached to the pivot link, the pivot link being normally in a stable condition, the sleeve valve being urged toward the end cap as gas pressure within the body increases, and stationary means within the cartridge to upset the stable condition of the pivot link upon movement of the sleeve valve toward the end cap.

4. A blasting device comprising a substantially tubular body having a side wall, a lateral outlet in the wall, means for introducing gas under pressure into one end of the body, the opposite end of the body being closed by an end cap, a pressure responsive sleeve valve slidable within the body in response to gas pressure therein and normally positioned to span and seal said outlet, the valve having a greater effective cross-sectional area at one end than at the other end, said sleeve valve having an opening therein for permitting gas to pass through the sleeve valve, resilient means positioned within the body adjacent the end cap, a fixture within the body urged away from the end cap by said resilient means, a pivot link mounted on

the fixture and normally being in a stable condition, rigid means connecting the pivot link and the sleeve valve, one end of the rigid connecting means being hingedly attached to the sleeve valve and the other end of the rigid connecting means being hingedly attached to the pivot link, and stationary means in association with the wall of the tubular body adapted to upset the stable condition of the pivot link upon axial movement of the sleeve valve toward the end cap.

5. A blasting device comprising a substantially tubular cartridge body having a side wall, a lateral outlet through the wall, means for introducing gas under pressure into one end of the body, a pressure responsive sleeve valve slidable longitudinally within the body in response to gas pressure therein and normally positioned to span and seal

said outlet, the valve having a greater effective cross-sectional area at one end than at the other end, the valve being urged to a position away from the outlet by gas pressure within the tubular body, a resiliently mounted pivot linkage hingedly connected to the sleeve valve and preventing movement of the sleeve valve away from the lateral outlet when the linkage is in a stable condition.

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