Feb. 3, 1942. G. SCHAAF 2,272,132

VALVE

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FIG. 1.

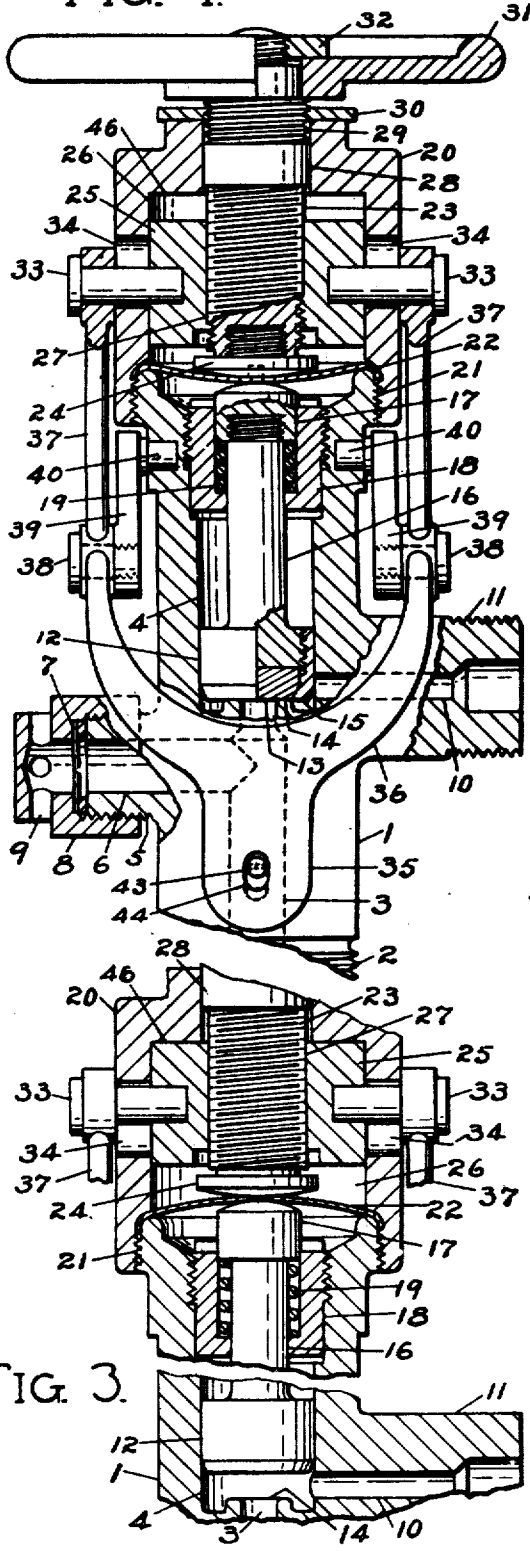


FIG. 2.

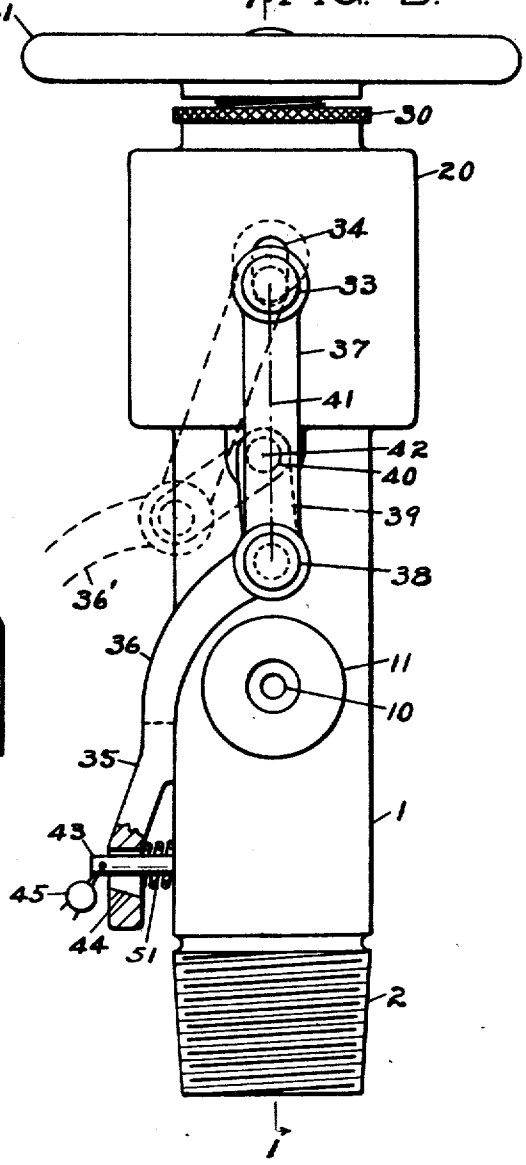


FIG. 3.

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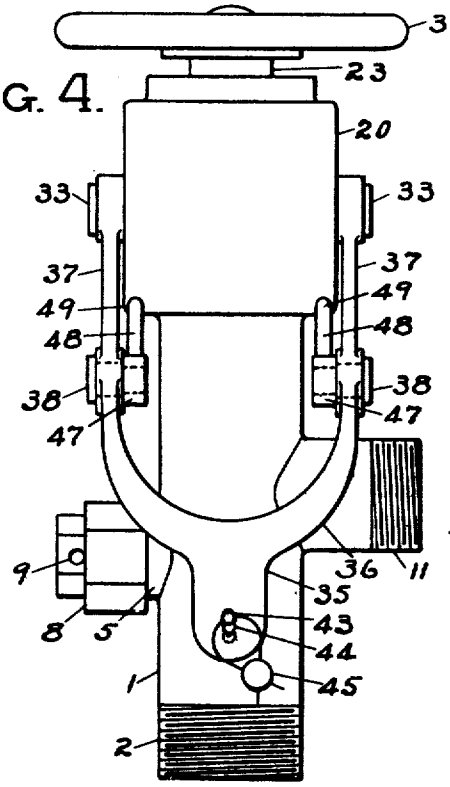
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VALVE

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FIG. 4.



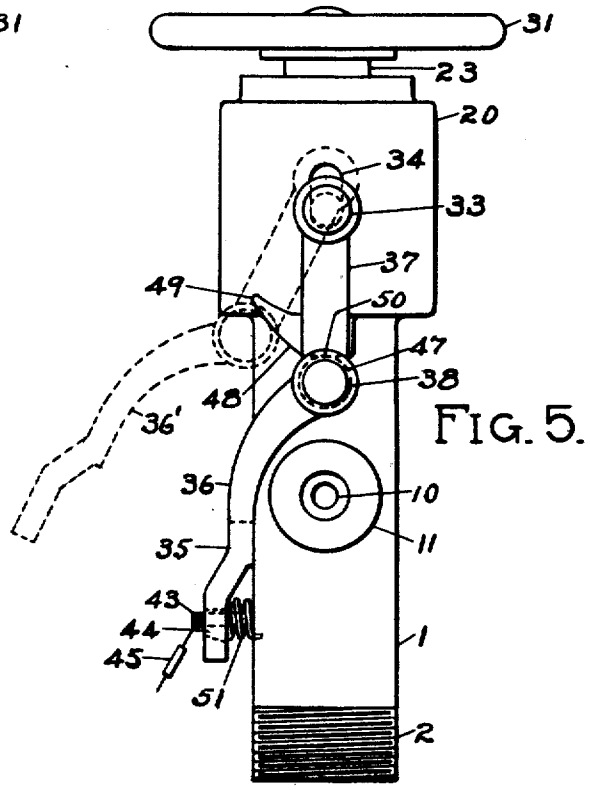
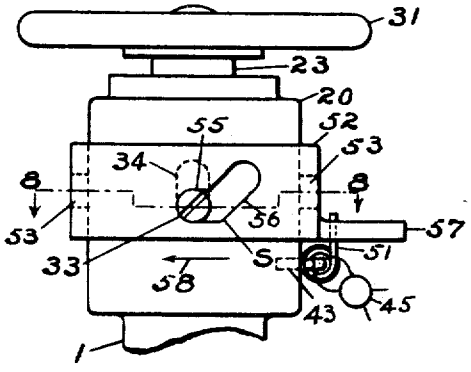


FIG. 5.

FIG. 6.



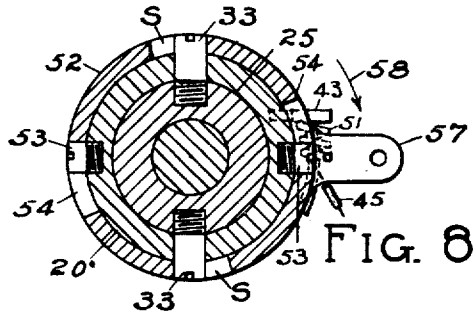
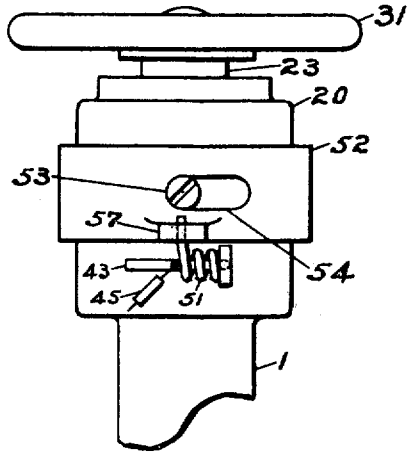


FIG. 8.

FIG. 7.



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VALVE

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FIG. 9.

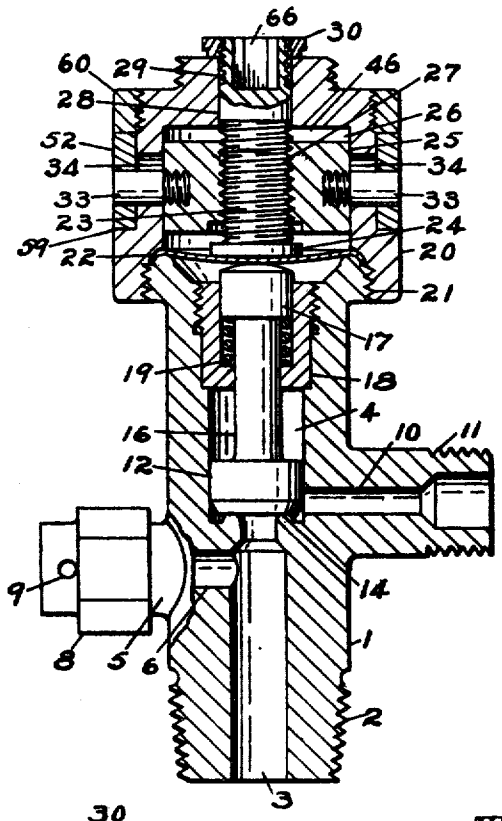
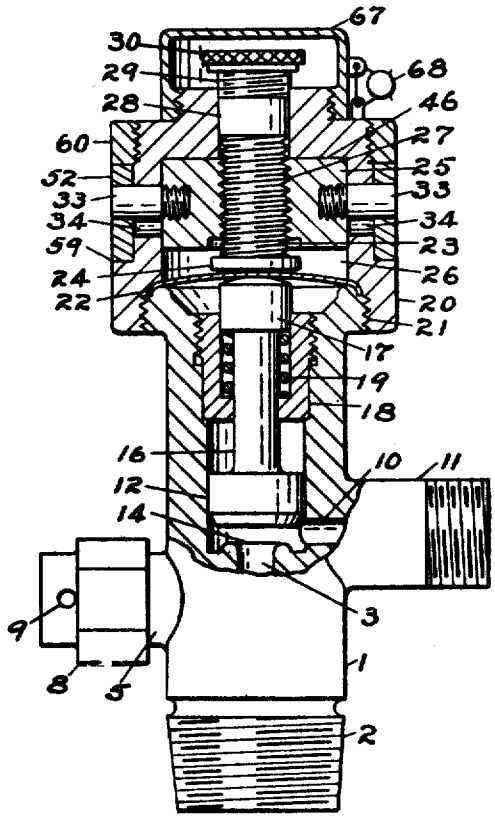


FIG. 10.



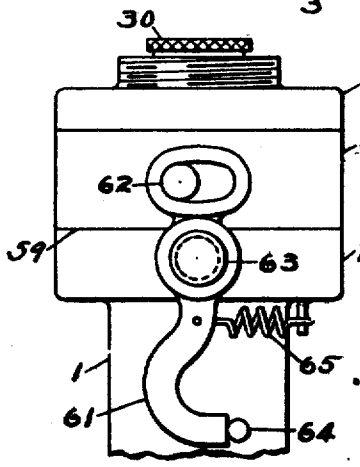


FIG. 11.

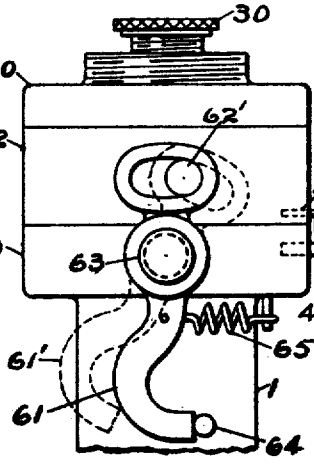
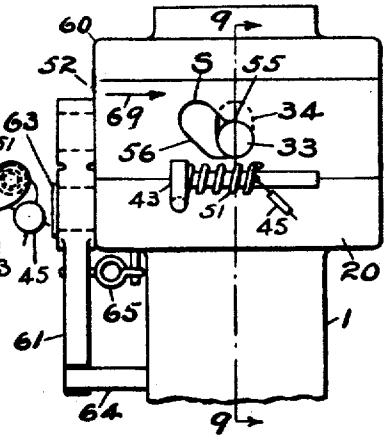


FIG. 12.

FIG. 13.



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2,272,132

UNITED STATES PATENT OFFICE

2,272,132

VALVE

George Schaaf, Buffalo, N. Y.

Application July 1, 1940, Serial No. 343,381

10 Claims. (Cl. 251—26)

This invention relates in general to valves and to a type of valve for controlling the passage to a container for carbon dioxide or other medium which is held in said container under considerable pressure, and especially to the class known as packless valves.

Where carbon dioxide is employed for fire extinguishing purposes the fluid is maintained under high pressure in a container, and at ordinary temperatures the carbon dioxide is in liquid form. On account of the high pressure under which the carbon dioxide is maintained special forms of valve construction have been devised for controlling the discharge from the container. To prevent leakage a preferred type is the so-called packless valve in which a diaphragm is employed to close off the valve from its operating mechanism. In order to have the contents of the container instantly available it is desirable to have a quick opening valve and one which will be fully opened by the valve spring and fluid pressure when once released. Also that means be provided to close the valve against the fluid pressure when once opened, as in the case of a large container when partly discharged, and to prevent such closing until the entire tank contents is discharged, as in the case of a small tank.

One of the objects of this invention is to provide a valve of the packless type which can be fully opened instantly, either manually or automatically, for the release of the contents of the container to which it is attached.

Another object is to provide a valve of the above general type which may be closed after a portion of the contents of the container have been discharged.

Another object is to provide means to lock the valve in a closed position.

Another object is to provide means to prevent manual operation of the valve during discharge.

With the foregoing and other objects in view which will appear as the description proceeds, the invention consists in certain features of novelty in the construction, combination and arrangement of parts by which the said objects are attained, the invention being more particularly pointed out in the claims.

In the accompanying drawings:

Figure 1 is a front elevation, mostly in section on line 1—1 of Figure 2, of a valve structure embodying my invention and showing the valve in a closed position.

Fig. 2 is a side elevation of my device showing the outside valve operating mechanism in a closed position as in Fig. 1.

Fig. 3 is a sectional view of a portion of the device as in Fig. 1 but with the valve in an open position.

Fig. 4 is a front elevation of my device with a modified operating handle in a closed position.

Fig. 5 is a side elevation as in Fig. 4 with the handle in full for the closed position and dotted to show the open position.

Figs. 6 and 7 are front and side elevation of the upper portions of a valve structure embodying another modification for the valve control.

Fig. 8 is a section on line 8—8 of Fig. 6.

Fig. 9 is a front elevation, mostly in section or line 9—9 of Fig. 13, of a valve structure as in Fig 1 but with a modified valve control from that o. Figs. 6, 7 and 8, and showing the valve in a closed position.

Fig. 10 is a view as in Fig. 9 but with the valve in an open position and showing a cover for the operating stem.

Fig. 11 is an outside front elevation of the upper portion as in Fig. 9.

Fig. 12 is an outside front elevation of the upper portion as in Fig. 10 but without cover.

Fig. 13 is a side elevation of Fig. 11.

Referring to Figs. 1, 2 and 3, the lower end of body 1 is threaded at 2 for connection to a container and has an axial inlet passage 3 extending up into a valve chamber 4. A laterally extending boss 5 having a passage 6 communicating with passage 3, provides means for accommodating a safety disk 7 which is held in place by a threaded cap 8.

Any abnormal pressure developed in the tank will rupture the disk 7 and allow the fluid to escape through passages 9 in the cap 8 in the usual manner.

Communicating with the valve chamber 4 is a discharge passage 10 in another laterally extending boss 11 which can be threaded as shown, or otherwise arranged for connecting to the other parts of a fire extinguishing apparatus.

The opening and closing of passage 3 is controlled by a valve 12 which has a suitable sealing insert 13 on its lower end to cooperate with the annular valve seat 14. Insert 13 is fastened to valve 12 by means of the threaded thimble 15. Valve 12 has a stem 16 on the upper end of which is fastened a nut 17 by means of threads. The upper end of chamber 4 is closed by a threaded plug 18 with a stepped central bore. The lower and smaller part of said bore forms a guide for the valve stem 16 while the upper and larger part

of said bore forms a guide for said nut 17 and a pocket below said nut for a compression valve spring 19 around the valve stem 16. Acting against the lower shoulder of nut 17 the spring 19 operates to raise valve 12 from its seat 14 as will later appear.

A bonnet 20 is threaded at 21 to cover and form a connection with the upper end of body 1 and to inclose and confine a suitable metal diaphragm 22, the rim of which seals the joint between said bonnet and body and the center of which rests on the top of nut 17. Centrally in line with nut 17 and contacting with the top center of diaphragm 22 is head 24 of the screw 23, said screw 23 being carried in a crosshead 25 which has sliding contact within the cylindrical chamber 26 of the bonnet 20. Screw 23 is threaded at 27 through the crosshead 25 and has a cylindrical portion 28 which is adapted to slide in, and be guided by, the top wall of bonnet 20.

Above the cylindrical portion 28 of screw 23 is a thread 29 to engage the nut 30 for locking the screw 23 from turning when the crosshead 25 is held at the lower end of its travel by the toggle joints to be described, and the valve 12 is closed on its seat 14. 31 is a hand wheel fastened to screw 23 by a nut 32 for operating said screw.

Fastened into opposite sides of the crosshead 25 are two pins 33, 33 which are adapted to extend through and slide in vertical slots 34, 34 in the bonnet 20. 35 is the handle of a Y-shaped lever 36 having two arms 37, 37. Each arm 37 is pivoted at its end to a pin 33 and intermediate of its length is pivoted to a pin 38 on one end of a link 39. The opposite end of link 39 is pivoted to the body 1 by the pivot 40, and said link 39 and arm 37 form a toggle joint to hold crosshead 25 at the bottom of its travel as shown in Fig. 1. When said crosshead 25 is at the bottom of its travel as in Fig. 1 the handle 35 of lever 36 rests against the body 1 as in Fig. 2 and is held there by reason of the line 41 between the centers of pins 33 and 38 having crossed the center 42 of pivot 40. Pin 43 extends through a slot 44 in handle 35 (Fig. 2) to provide means for a seal 45. The seal element here identified by 45 consists of a wire passed through a hole in the end of pin 43, the ends of said wire being clamped in a piece of lead in the usual manner. The breaking of this seal occurs when the wire is broken or heated sufficiently to melt it.

The top 46 of chamber 26 forms a stop for the crosshead 25 when said crosshead is at the top of its travel as in Fig. 3 and handle 36 is then in a dotted position 36' shown in Fig. 2.

The operation of the valve is as follows: A container or cylinder (not shown) is loaded with CO_2 and the valve body 1 screwed into said container. Lever 36 is closed against body 1 as in Figs. 1 and 2 which brings crosshead 25 to the bottom of its travel as in Fig. 1. Screw 23 is now turned by the hand wheel 31 to thread said screw 23 down through crosshead 25 to flex diaphragm 22 downward against valve nut 17 and close valve 12 on its seat 14 and compress valve spring 19.

Nut 30 is now screwed down on to bonnet 20 to put a pressure on threads 27 in crosshead 25 to lock screw 23 from turning. Passage 3, which communicates with the container, is now closed and the melting of the CO_2 at normal temperatures raises the pressure in said container to say 700 or 800 pounds per square inch. Under conditions which abnormally raise this pressure to an unsafe point the safety disk 7 will be ruptured to allow the fluid in the container to escape through passages 3, 6 and 9. To open the valve 12 the lever 36 is pulled away from body 1 to break the seal 45 and as soon as the locking effect of the toggle joint is released by the line 41 crossing center 42 the valve spring 19, assisted by the container pressure, forces valve 12 to a full open position as in Fig. 3 and lever 36 then assumes dotted position 36' as in Fig. 2. Passages 3 and 10 are thus fully opened immediately (Fig. 3) allowing the fluid to flow freely from the container.

In case it is desired to stop the fluid flow and preserve an unused portion in the container the hand wheel 31 is operated to thread screw 23 through crosshead 25 while said crosshead is in its upper position as in Fig. 3, thus flexing diaphragm 22 and closing valve 12 on seat 14 against the tank and valve spring pressures to the position shown in Fig. 1.

The internal parts of the valve structure shown in Figs. 4 and 5 are the same as in Figs. 1, 2 and 3 but the lever 36 is controlled in a different manner from that in Figs. 1 and 2, i. e., the lever pin 38 on each lever arm 37 is provided with a roller 47 which is adapted to follow the contour 48 of lug 49 during the movement of the lever 36 to dotted position 36'. The lug 49 on bonnet 20 has a lower surface 50 for holding lever 36 in a closed position by means of roller 47 and locking crosshead 25 in its lower position (Fig. 1).

A spring 51 surrounding pin 43 and fastened into body 1 is held in a compressed position by lever 36 in its closed position and locked by the seal 45. The spring 51 provides an automatic means for operating the lever 36 by forcing said lever away from its locked position against body 1 when a fire breaks the seal 45 by raising the temperature to its melting point. The valve 12 is then opened by its spring 19 as before explained in reference to Figs. 1, 2 and 3.

A modified method of locking and releasing the crosshead 25 of Fig. 1 is shown in Figs. 6, 7 and 8 and consists of a sleeve 52 mounted on bonnet 20 and having a limited rotating movement thereon. Sleeve 52 is guided and limited in its rotating movement by two oppositely disposed pins 53, 53 threaded into bonnet 20 and extending through horizontal slots 54, 54 in said sleeves. On the quarters between screws 53, 53 are two crosshead pins 33, 33 which extend through the vertical slots 34, 34 in bonnet 20 and the compound slots S in sleeve 52. The compound slots S in sleeve 52 have two component parts, a horizontal part 55 for locking the crosshead 25 in its lowest position and a diagonal part 56 in which said pins 33, 33 travel when sleeve 52 is partly rotated by means of its handle 57.

In the position shown in Figs. 6, 7 and 8 the crosshead 25 is locked in its lowest position as in Fig. 1 by the pins 33, 33 in horizontal slots 55, 55. Rotating sleeve 52 in the direction of arrow 58 by means of handle 57 unlocks said pins 33, 33 and allows them to rise in diagonal slots 56, 56 in sleeve 52 and in vertical slots 34, 34 in bonnet 20 when the crosshead 25 moves from its lower position as in Fig. 1 to its upper position as in Fig. 3 under action of valve spring 19 in opening valve 12.

The main parts of the valve structure shown in Figs. 9 to 13 are similar to those shown in Figs. 1 to 3 but with an operating sleeve as in Figs. 6 to 8 and the above description applies to said Figs. 9 to 13. The latter however has some

modifications which are more suitable when applied to a small hand fire extinguisher. These modifications include a finger trigger for opening the valve and a cover to inclose the crosshead screw and without hand wheel so the valve cannot be closed until the container is entirely discharged. As, for instance, a ten ounce container is so small, and it can only be effective when starting full, the container should be entirely discharged, necessitating refilling, when once the valve is opened for use.

In Figs. 9 to 13, the sleeve 52 is mounted on bonnet 20 to be guided between a shoulder 59 and a bonnet nut 60 and is adapted to be partiallly rotated by trigger 61 acting on a pin 62 which is fastened to said sleeve. Trigger 61 is pivoted to bonnet 20 by a pin 63 and held in its operative position against a stop 64 by a spring 65 as in Fig. 11. Figs. 9, 11 and 13 show the position of sleeve 52 when the crosshead 25 is in its lowest position to close valve 12 as in Fig. 9 and locked in this position by the crosshead pins 33, bearing against the horizontal slots 55 as in Fig. 13. When trigger 61 is moved by the finger from its position in Fig. 11 to the dotted position 61' in Fig. 12, the sleeve pin 62 moves to position 62' (Fig. 12) and in so doing moves sleeve 52 in the direction of arrow 69 (Fig. 13) to unlock pins 33 from the horizontal slots 55 and allow said pins 33 to rise in diagonal slots 56 of sleeve 52 and in the vertical slots 34 of bonnet 20. The crosshead 25 then moves from its lower position in Fig. 9 to its upper position in Fig. 10 under action of valve spring 19 in opening valve 12. Releasing trigger 61' it returns to its normal stop position 61 in Fig. 12.

Crosshead screw 23 in Figs. 9 and 10 is provided with a socket opening 66 for a socket wrench in place of a hand wheel and the end of screw 23 is covered by a cap 67 and a seal 68 to prevent tampering with and closing valve 12 from its position in Fig. 10, by manipulating screw 23, before the container contents is completely discharged which takes only a matter of seconds. The screw 23 is locked from turning by nut 30 when the valve is seated to prevent leakage or turning except as intended. It will be understood that any elements can be used without reference to sizes mentioned.

In Figs. 6, 7, 8, 12 and 13 one end of pin 43 is fastened into bonnet 20 and has a suitable shape as shown for holding coil spring 51. One end of spring 51 is fixed to sleeve 52 and held in a compressed position on pin 43 by seal 45 when the valve 12 is closed. Seal 45 is broken to release valve 12 and this can be done manually, or when suitably mounted for fire protection, the spring and seal furnish automatic means for releasing said valve when a fire breaks the seal as before explained.

I am aware of the valves of Forbes, No. 1,890,505, Dec. 13, 1932, for replacing a diaphragm; of Minor, Re. 19,087, Feb. 20, 1934, for resiliently locking a valve; and of Phillips, No. 1,996,489, for releasing contents of pressure containers; and the present invention is to provide improved and practical means for a quick opening valve.

Having thus described my invention, I claim:

1. In a device of the character described, comprising a valve body having a discharge passage, a valve seat within a valve chamber, a valve in said chamber for said valve seat and having a stem, a spring to raise said valve from its seat, a diaphragm in contact with said valve stem, a bonnet sealing said diaphragm in said body and having a chamber, a reciprocating crosshead guided in said bonnet chamber, an operating stem movable in line with said valve stem to close said valve on its seat and located on the opposite side of said diaphragm from said valve stem, said operating stem carried by said crosshead, means fastened into said crosshead and extending through said bonnet to travel with and hold said crosshead in a fixed position when said operating stem is holding said valve closed on its seat, means to lock said crosshead in said fixed position and means to lock said operating stem.

2. In a device of the character described, the combination as in claim 1 and means to automatically release said crosshead locking means to open said valve.

3. In a valve device of the type in which the valve is inclosed in the valve body by a sealing diaphragm, comprising a valve body having a valve chamber with inlet and discharge passages and a valve seat, a valve to cooperate with said valve seat, a stem for said valve, a valve spring to raise said valve from its seat, a bonnet having a chamber, a diaphragm clamped at its rim between said body and bonnet to seal the joint therebetween, a stem operating in line with said valve stem, a reciprocating crosshead in said bonnet and threaded to carry said operating stem, horizontally disposed pins connected to said crosshead through said bonnet to slide in slots in said bonnet, means to move said crosshead by said pins, means to lock said moving means and spring means to release said moving means.

4. A valve device as in claim 3 and a seal to hold said spring means in an operative position.

5. A valve device of the type in which the valve is inclosed in the valve body by a sealing diaphragm with valve operating mechanism outside of said diaphragm, comprising a valve body having a valve chamber with inlet and discharge passages and a valve seat, a valve in said chamber, a stem for said valve, means to guide said valve stem, a valve spring, a bonnet having a chamber, a diaphragm clamped at its rim between said body and bonnet to seal the joint therebetween, valve operating means, said operating means consisting of a crosshead to reciprocate in said bonnet chamber, an operating stem threaded through said crosshead to flex said diaphragm and slide through the top of said bonnet, pins fastened into said crosshead and extending through slots in said bonnet to move said crosshead in line with said valve stem, a sleeve having a rotative moment about said bonnet and operatively connected to said crosshead pins by compound slots, said compound slots having a diagonal part and a substantially horizontal part, said horizontal slot part serving to lock said crosshead in its lowest position by means of said pins.

6. A valve device as in claim 5 and a cover to prevent operation of said operating stem when said valve is open for discharge.

7. In a valve device of the type in which the valve is inclosed in the valve body by a sealing diaphragm with valve operating mechanism outside of said diaphragm, comprising a valve body having a valve chamber, a valve having a stem, a spring for opening said valve, a diaphragm for sealing said valve and stem in said body, a bonnet having a chamber, a diaphragm clamped between said body and bonnet, valve operating means, said operating means including a reciprocating crosshead, an operating stem carried by said

crosshead, pins fastened into said crosshead and extending through vertical slots in said bonnet to move said crosshead in line with said valve stem, a sleeve on said bonnet and having a rotative movement, said sleeve having diagonal slots for moving said crosshead by means of said pins, away from and toward said valve by its rotative movement and locking said crosshead in its lowest position to hold said valve on its seat.

8. In a valve device of the diaphragm sealing type with valve operating mechanism outside of said diaphragm, comprising a valve body, a valve in said body, a diaphragm to seal said valve in said body, a bonnet on said body, valve operating means outside of said diaphragm, said valve operating means consisting of a crosshead, an operating stem threaded through said crosshead for flexing said diaphragm, pins to move said crosshead from without said bonnet, a sleeve mounted on said bonnet for rotative movement, diagonal slots in said sleeve for operating said crosshead toward and away from said valve by said sleeve rotative movement, said slots having a substantially horizontal part for locking said crosshead and operating stem to hold said valve on its seat in a closed position and pivoted lever means to rotate said sleeve to unlock said crosshead and release said valve.

9. In a valve device of the diaphragm sealing type, said device including a valve body, a valve in said body, resilient means for opening said valve, a diaphragm to seal said valve in said body, a bonnet on said body, a crosshead to reciprocate in said bonnet, an operating stem adjustable through said crosshead to close said valve by flexing said diaphragm, pins in said crosshead extending through vertical slots in said bonnet, a rotative sleeve mounted on said body, diagonal slots in said sleeve for reciprocating said crosshead, said slots having a substantially horizontal part for locking said crosshead pins to hold said valve in a closed position, a lever pivoted to said bonnet and having a slotted end for rotating said sleeve to release said crosshead pins from locked position and a spring to return said lever to its operative position.

10. A valve device as in claim 9 and spring means connected to said bonnet and to said sleeve and a seal to hold said spring in a compressed position, said spring means operating said sleeve to release said pins from locked position independently of said lever.

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