W. H. TIBBALS.

FIRE EXTINGUISHER.

APPLICATION FILED NOV. 26, 1915.

1,274,957. Patented Aug. 6, 1918.

FIG. 2.

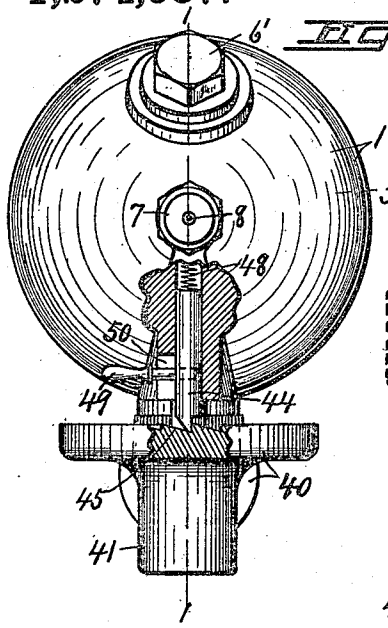


FIG. 1.

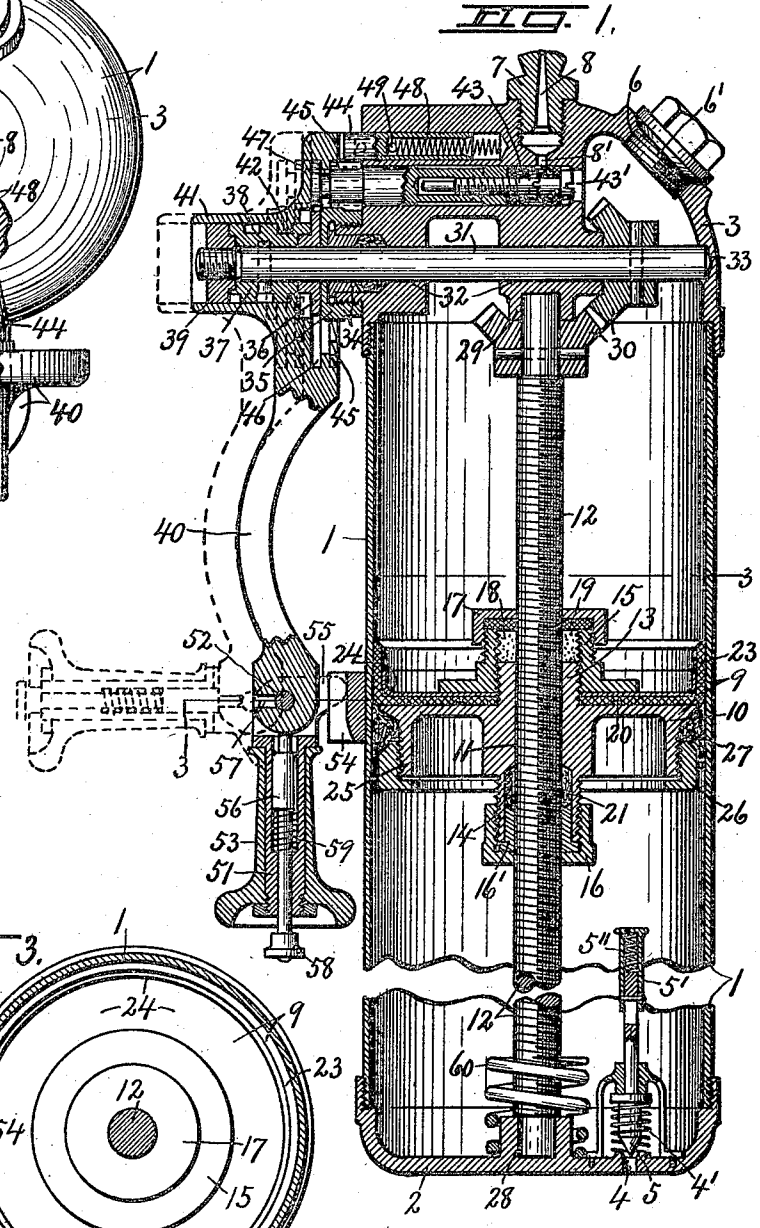
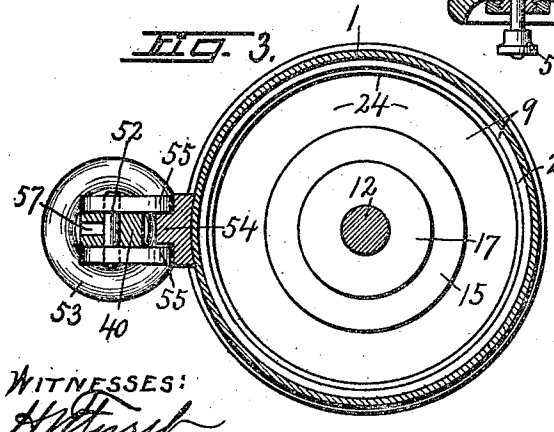


FIG. 3.



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FIRE-EXTINGUISHER.

1,274,957. Specification of Letters Patent. Patented Aug. 6, 1918.

Application filed November 26, 1915. Serial No. 63,505.

To all whom it may concern:

Be it known that I, WALTER H. TIBBALS, a citizen of the United States of America, and resident of Onondaga, in the county of Onondaga, in the State of New York, have invented new and useful Improvements in Fire-Extinguishers, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

This invention relates to certain improvements in portable fire extinguishers involving the use of a cylindrical container and a mechanically operated piston movable therein for forcibly expelling the fire extinguishing fluid.

The primary object is to provide simple, practical and efficient means whereby a continuous stream of the fluid may be accurately directed upon the fire where most effective.

Another object is to construct the piston operating mechanism in such manner that a stream of substantially the same size and force may be maintained throughout the period of operation until practically all of the fluid within the container is expelled, irrespective of the speed of operation of the piston-actuating means.

Another object is to provide means for automatically locking the piston in its adjusted position and to utilize such piston for holding the liquid in advance thereof in the outlet end of the cylinder when the outlet is closed and to prevent the back flow of the liquid into the opposite end of such cylinder, whereby the piston is always in position for the instantaneous discharge of the liquid.

A still further object is to enable the valve for the outlet to be opened and closed automatically by the operation of a part of the piston-operating means.

Another object is to provide automatic means for preventing the operation of the piston-operating mechanism in a reverse direction from that required to expel the liquid, and at the same time to enable one of the members of the automatic lock to be released at will when it is desired to return the piston to its starting position, as for example when the cylinder is filled to its capacity with the fire extinguishing fluid.

Other objects and uses relating to specific parts of the apparatus will be brought out in the following description.

In the drawings—

Figure 1 is a central vertical sectional view of a portable fire extinguisher embodying the various features of my invention showing the piston as locked in an intermediate position, and the valve for the outlet closed, the dotted lines indicating the position the hand-crank assumes when about to operate the piston for expelling the fluid from the cylinder.

Fig. 2 is a top plan partly in section of the same device.

Fig. 3 is a horizontal sectional view taken in the plane of line 3—3, Fig. 1.

As illustrated, this apparatus comprises a cylinder —1— of such size as to be conveniently carried in the hand of the operator and provided with opposite end heads —2— and —3— forming air and liquid-tight joints with the main body, the head —2— being provided with a relatively small vent opening —4— controlled by a suitable valve —5— hereinafter described.

The head —3— is located at the discharge end of the cylinder and is provided with an inlet —6— for filling and a discharge nozzle —7— having a relatively small outlet —8— through which the fire extinguishing fluid is adapted to be discharged, said nozzle being preferably detachable and screw threaded for engagement in a corresponding opening in the head —3—.

The main body of the cylinder —1— between the end heads —2— and —3— is of uniform interior diameter throughout its length and is preferably milled to form a smooth bore in which is closely fitted a movable piston —9— having a main supporting body —10— of metal provided with a threaded central opening —11— for receiving an operating screw —12—, whereby the piston may be moved lengthwise of the cylinder in either direction by rotating the screw first in one direction and then in the opposite direction.

The hub of the main body —10— of the piston is provided with reduced externally threaded extensions —13— and —14— engaged, respectively, by an internally threaded collar —15— and a cap —16—, the upper end of the collar —15— being threaded externally for receiving a screw cap —17—.

The collar —15— extends upwardly some distance above the corresponding end of the

hub of the main body or piston head —10— to form a chamber —18— for receiving and retaining a lubricant or absorbent therefor which is held in place by a packing ring —19— interposed between the upper end of the collar —15— and cap —17— for lubricating the threaded connections between screw —12— and piston head —10—.

The threaded extension —14— on the lower end of the piston head —10— is bored out to a diameter slightly larger than that of the screw —12— passing therethrough for receiving a follower —16'—, and also forming a pocket —21— adapted to contain a lubricant or absorbent therefor for additionally lubricating the threaded connections between the screw and piston.

The cap —16— and its follower —16'— closely fit upon the periphery of the screw —12— and together with the threaded extension —14— engaged thereby constitute a gland which not only holds the lubricant packing —21— from escape, but also prevents leakage of the fire extinguishing fluid through the piston along the screw.

For a similar purpose, the screw cap —17— and packing ring —19— fit closely against the periphery of the screw, the packing —19— being actually threaded internally to engage the threads of said screw and thereby additionally prevent the escape of the lubricant from the pocket —18—, and to also additionally prevent the passage of the fire extinguishing fluid through the piston along the screw.

The diameter of the piston head —10— is only slightly less than that of the interior of the cylinder, the upper face thereof outside of the extension —13— being substantially flat, except for a small annular rib 20 for receiving and supporting a cup-shaped packing —23— of leather or equivalent flexible material and a cup-shaped expander —24— of metal resting upon the upper face of the leather packing —23— and having its marginal flange spring-tensioned against the corresponding marginal flange of the packing —23— to hold the latter in close contact with the inner walls of the cylinder, thereby producing a substantially liquid-tight joint, the open sides of both of the packing members —23— and —24— facing the outlet end of the extinguisher so that as the liquid is compressed by the upward movement of the piston, it tends to further expand the peripheral walls of the packing —23— against the adjacent sides of the cylinder.

These packing rings —23— and —24— are firmly secured to the piston head by screwing the collar —15— tightly upon the adjacent threaded extension —13—. As the collar —15— is tightened, the annular rib —20— on the upper flat face of the piston head —10— is embedded in the adjacent portion of the packing ring —23— to additionally hold the latter against radial displacement.

The piston head —10— is also provided with a depending annular flange —25— surrounding the central hub of considerable diameter, but of less diameter than the interior diameter of the cylinder, and threaded externally for receiving an internally threaded ring or collar —26— which, together with the superposed portion of the piston head, are beveled transversely to form an annular chamber in which is placed a lubricant packing —27— to additionally prevent the discharge of the fire-extinguishing fluid around the piston from the upper end to the lower end thereof.

These lubricant packings between the piston and cylinder and also between the piston and screw are particularly important in fire extinguishers of this type, in that it is necessary not only to lubricate the joints, but also to exclude the fire extinguishing fluid from the portion at the lower end of the piston.

The screw —12— extends lengthwise of the cylinder and co-axial therewith between the end heads —2— and —3—, and its opposite ends are stepped in suitable bearings —28— and —29— therein for rotary movement, the upper end of the screw being connected by beveled gears —30— to one end of a diametrically extending cross shaft —31— which is journaled in suitable bearings —32— forming a part of the head —3—.

The inner end of the cross shaft —31— is also stepped in a suitable bearing —33— in one side of the head —3—, while its opposite end extends outwardly to the exterior of the head through a gland —34— having a screw cap —35—, the outer end face of which is substantially flat for engagement by a wear-plate or disk —36— which is adapted to turn the shaft —31—.

A nut or collar —37— is keyed to the shaft —31— by a pin —38— between the wear-plate —36— and a lock nut —39— to turn with said shaft, the lock nut being secured to the outer threaded end of the cross shaft, as shown in Fig. 1.

A hand lever or crank arm —40— is provided with a hollow hub —41— journaled upon the periphery of the externally threaded nut or collar —37— to turn about the axis of the cross shaft —31—, and is provided with an internal thread —42— engaging the external threads of the nut or collar —37—, but of relatively less number of turns than those on the nut or collar so as to permit the lever and its hub to move axially a limited distance as it is rotated in one direction from and to its normally locked position, the wear-plate —36— and lock nut —39— constituting abutments or limiting stops engaged by said internal thread and determining the amount of axial movement of the lever, it being understood that when

the internal thread engages the wear-plate or nut, the cross shaft —31— and screw —12— will be operated by the further turning movement of the lever for moving the piston axially.

The purpose of this axial movement of the lever —40— relatively to the shaft —31— is to automatically open and close a valve —43— controlling the outlet —8—, and also to free the lever from engagement with a stop pawl —44— which, in the initial movement of the lever, is adapted to engage ratchet teeth —45— on the inner end of the hub of the lever —40— to prevent rotation of said lever in one direction, and permit its rotation in the opposite direction, as will be hereinafter more fully described.

The inner end of the hub of the lever —40— is enlarged and provided with an internal annular groove —46— for receiving an annular flange or shoulder —47— on the outer end of the valve —43—, whereby when the lever is in its normal innermost position, as shown by full lines in Fig. 1, the valve will be closed across the outlet port, as —8′—, of the valve chamber, but when the lever is forced outwardly to the position shown by dotted lines, Fig. 1, by the rotation of the lever —40— relatively to the shaft, the valve —43— will be automatically opened to establish communication between the interior of the cylinder and outlet —8—, the inner end of the valve chamber communicating with the interior of the cylinder through a port —43′—.

The valve —43— is located in a valve chamber in the upper head —3— of the cylinder parallel with the cross shaft —31— and is movable axially thereof, such movement corresponding to the movement of the lever, as determined by the limiting stops —36— and —39— co-acting with the internal thread or hub of the lever.

The pawl —44— is also slidable in a transverse opening in the head —3— just above the valve —43— and is normally forced outwardly into engagement with the ratchet teeth —45— of the lever —40— by a coil spring —48—.

Secured to the pawl is a pin or handle —49— extending radially through an elongated slot —50— in the adjacent side of the head —3— of the cylinder, the ends of the slot constituting limiting stops coöperating with the pin to limit the inward and outward movement of the pawl, and permit said pawl to be forced inwardly by hand out of engagement of the ratchet teeth of said lever when it is desired to operate said lever in a reverse direction therewith required to move the piston upwardly for expelling the fire extinguishing fluid.

The lever —40— is provided with a relatively movable section or extension —51— pivoted thereto at —52— so as to swing toward and from the outer face of the adjacent portion of the cylinder from a normal position substantially parallel with the cylinder, as shown by full lines, to a position substantially at right angles thereto, as shown by dotted lines, and upon this extension is mounted a rotary handle —53— by which the lever may be turned without excessive friction upon the hand.

Secured to the periphery of the cylinder at the side adjacent the lever is a lug —54— constituting a limiting stop, the opposite faces of which are adapted to be engaged by inwardly projecting lugs or ears —55— on the adjacent portion of the movable section —51— of the lever substantially radial to the pivot —52— and of sufficient radial length so that when engaged with the base of the lug —54—, the lever —40— will be placed under slight spring tension to hold the movable extension —51— in its normal locked position.

Suitable means is also provided for locking the extension —15— in its operative position for turning the lever, said means consisting, in this instance, of a bolt —56— slidable in a lengthwise opening in the extension —51— and having its inner end reduced and adapted to engage in a socket or recess —57— in the adjacent end of the lever —40— radial to the pivot —52—, and its outer end provided with a hand-piece —58— by which it may be withdrawn from its locking position against the action of a retracting spring —59—.

The locking lugs or ears —55— are disposed at substantially right angles to the axis of the movable extension —51— of the lever —40—, but the portion of the extension at the side of the pivot —52— opposite the handle —53— is of less radial length than the radial distance between the pivot and outer edge of the lug —54— so that when the extension —51— is shifted from its normal position to the position shown by dotted lines, the lugs —55— will be entirely disengaged from the lug —54—, thus permitting the lever to be rotated about the axis of the cross shaft —31—.

The cylinder —1— is adapted to contain a predetermined quantity of the fire extinguishing fluid which is introduced therein through the inlet —6— while the piston is in its extreme downward position, after which the inlet is closed by a plug —6′—.

It, therefore, follows that the entire amount of fluid will be held between the piston and upper head —3— of the cylinder and that the portion of the cylinder below the piston forms an air space which communicates with the atmosphere through the vent opening —4—.

The valve —5— is normally held open by a retracting spring —4′— and is provided

with an upwardly projecting stem having a relatively movable section —5′— spring-pressed upwardly by spring —5²— which is slightly stiffer than the retracting spring —4′—, the upper end of said extension —5′— being adapted to be engaged by the under side of the piston head —10— when the latter is moved to its extreme down position for closing the valve —5—, and thereby preventing the escape of any fire extinguishing liquid which might accidentally leak around the piston from the upper side to the lower side thereof while the fire extinguisher is at rest, the spring —5²— serving to allow the spring —5′— to move a limited distance downwardly after the valve is closed by the downward movement of the piston, thereby assuring pressure upon the valve to hold it closed.

A spring buffer —60— is seated on the lower head —2— of the cylinder around the adjacent end of the screw —12— to afford a yielding abutment for the lower end of the piston or cap —16— when the piston is locked in its normal down position, thereby avoiding any liability of injury to the gland of which the cap —16— forms a part, and at the same time allowing the lever —40— to be brought to its locking position as the piston approaches the limit of its downward movement, said spring also exerting an upward pressure upon the piston to cause a tight fit between the threads of the piston and screw in case there should be any lost motion between said threads, thereby further reducing the liability of leakage along such threads.

For example in returning the piston to its extreme downward position by the rotation of the lever —40— to the left, the operator may readily determine by the sense of feeling when the lower end of the piston strikes the spring —60—, and if the lever does not then happen to be in registration with the locking lugs —54—, the operation of holding the piston may be continued against the action of the spring —60— until the locking members —55— are registered with the lug —54—, whereupon the extension —51— may be rocked downwardly to its normal locking position.

In operation, assuming that the piston is in its extreme down position and the lever is locked against rotation and that the cylinder is filled with the fire extinguishing liquid, under which conditions the valve —43— will be closed and the pawl —44— in operative engagement with the ratchet teeth —45—, the valve —5— being also closed.

Now, in case of fire, the operator takes the cylinder in one hand and with the other hand rocks the extension —51— from its normal position upwardly to the position shown by dotted lines, thereby unlocking the lever from engagement with the cylinder, whereupon the lever may be rotated clockwise, the initial turning movement being independently of the cross shaft —31— and about the nut or collar —37— until the threaded portion —42— of the nut frictionally engages the outer end abutment —39—.

This initial turning movement of the lever —40— relatively to the shaft —31— causes said lever to be moved outwardly to the position shown by dotted lines, until limited by the engagement of the nut —37— with the lock nut —39—, the axial movement of the lever also causing the simultaneous endwise movement of the valve —43— in the same direction to open communication between the interior of the cylinder and discharge opening —8—.

The engagement of the nut —37— with the limiting stop —39— serves to lock the lever to the shaft —31— so that the continued rotation of the lever in the same direction clockwise causes the rotation of the screw through the medium of the gears —30— to move the piston —9— from its starting position toward the end head —3—, thereby expelling the fire extinguishing fluid in a continuous stream through the discharge nozzle —7— as long as the rotation of the lever in the same direction continues.

This initial outward axial movement of the lever —40— also withdraws the ratchet teeth —45— out of engagement with the adjacent end of the pawl —44— which is prevented from further outward movement by the engagement of the pin —4— with the outer end of the slot —50—, thus preventing any interference whatever with the free rotation of the lever clockwise in the operation of discharge of the liquid from the container.

On the other hand, if it is desired to hold the piston in any intermediate position, or to return it to its starting position, the direction of rotation of the lever is reversed or turned from right to left, by which operation the initial turning movement causes it to be restored axially to its innermost position through the medium of the nut —37— and threads —42— until the wear-plate —36—, which is soldered or otherwise secured to the nut —37—, engages the adjacent face of the screw cap —35—, whereupon the lever will be again locked to the shaft —31—, it being understood that during this reverse movement of the lever, the pawl —44— is forced inwardly out of engagement with the ratchet teeth —45— and held in such position against the action of the retracting spring —48— by means of the handle —49—.

At this time the lever —40— may be locked in its starting position by simply

withdrawing the locking bolt —58— and rocking the extension —51— downwardly until the lugs —55— are interlocked with the lug —54—, thus holding the piston in its adjusted position, or, the extension —51— may be left in its operative position, as shown by dotted lines in Fig. 1, and the reverse movement of the lever continued until the piston is restored to its lowermost starting position, the valve —43— remaining closed during such return movement of the piston, or as long as the lever —40— remains in its innermost position.

When the piston is brought to its normal starting position, the extension —51— will be rocked downwardly to its locking position for holding said piston and its operating mechanism, together with the valve —43—, in their normal positions, the pawl —44— being released for engagement with the teeth of the ratchet wheel ready for a repetition of the operation for discharging the fire extinguishing fluid after the container is re-filled.

In all of the devices of this character, so far as I am aware, in which a piston is operated by means of a single screw, suitable means has been provided for preventing rotation of the piston, but in actual practice I have discovered that there is a distinct advantage in leaving the piston free to rotate, providing the friction between the screw and piston is equal to or greater than that between the piston and cylinder, but under normal conditions with the piston of relatively large diameter, as compared with that of the screw, and the contacting surfaces between the piston and cylinder also of relatively large area and close fitting, it is evident that the friction produced between the piston and cylinder, together with the relatively long radius or leverage of the piston, as compared with the friction surface between the screw and piston and the relatively small radius of the screw, tends to hold the piston against rotation while being moved endwise in either direction by the rotation of the screw.

This resistance to the rotation of the piston is greatly increased by the inertia of the liquid in contact with the piston during the discharge.

I also find that if there is any tendency to force the liquid to the nozzle at a rate faster than it is capable of discharging therethrough, due to the excessive rapidity of rotation of the lever —40— and consequent rapidity of action of the piston, the back pressure upon the piston will cause it to bind upon the screw with greater friction than that produced between the piston and cylinder, thus causing the piston to rotate with the screw, and consequently preventing the advance of the piston until the normal conditions are again restored.

In this manner, the pressure of the liquid at the nozzle and consequent discharge is substantially uniform at all times and assures the discharge of a given quantity of the fluid in a definite time period.

What I claim is:

1. In a fire extinguisher of the character described, the combination of a container for the fire extinguishing fluid having an outlet in one end, a piston movable axially in said container and free to rotate about its axis and provided with a central threaded aperture, a screw engaged in said aperture, means for rotating the screw, and additional means separate from the screw, but actuated by a part of the screw-rotating means for opening and closing the outlet.

2. In a fire extinguisher of the character described, a container for the fire extinguishing fluid having an outlet, a piston movable in the container toward and from the outlet, a screw for operating the piston, means for rotating the screw, a valve movable independently of the screw for opening and closing the outlet, and means operated by a portion of the screw-operating means for operating the valve in advance of the beginning of rotation of the screw in either direction.

3. In a fire extinguisher of the character described, the combination of a container for a fire extinguishing fluid having an outlet, a piston movable in the container, a screw for operating the piston, means for rotating the screw, a valve for the outlet separate from the screw, and connections between said screw operating means and valve for opening and closing said valve in advance of the movement of the piston in either direction.

4. In a fire extinguisher of the character described, the combination of a container having an outlet, a piston movable in the container, means including a rotary hand lever for operating the piston, said lever having a limited movement independently of the piston movement, a valve for the outlet, and connections between the lever and valve for opening said valve during such independent movement of the lever.

5. In a fire extinguisher of the character described, the combination of a container having an outlet, a hollow internally threaded piston movable in the container, a screw engaging the threads of the piston, means including a rotary member for operating the screw, said member having a limited rotary movement in reverse directions independently of the screw, a valve for the outlet, and means actuated by said member during such independent movement for opening and closing the valve.

6. In a fire extinguisher of the character described, the combination of a container having an outlet, a piston movable in the

container, means including a rotary hand lever for operating the piston, said lever having a limited movement independently of the piston, a valve for the outlet, connections between the lever and valve for opening said valve during such independent movement of the lever, and means for preventing such independent rotary movement in one direction.

7. In a fire extinguisher of the character described, the combination of a container having an outlet, a piston and an operating screw therefor, means including a rotary hand-operated member for turning the screw, said member having a limited rotary movement independently of the screw, means for moving said member axially during such independent rotary movement, a valve for the outlet separate from the screw, and connections between said member and valve for opening the latter as the member is moved axially.

8. In a fire extinguisher of the character described, the combination of a container having an outlet, a valve for the outlet, a piston movable in the container, means including a rotary hand lever for operating the piston, said lever having an independent axial movement, and connections between said hand lever and valve for opening and closing the valve as the hand lever is moved axially in reverse directions.

9. In a fire extinguisher of the character described, the combination of a container having an outlet, a piston movable therein, a screw for operating the piston, a rotary shaft, means for transmitting motion from the shaft to the screw, a threaded collar on the shaft, a hand-operated rotary member having screw engagement with the threaded collar for moving the rotary member axially as it is rotated, stops for limiting the axial movement of the rotary member and locking it to the collar to rotate the shaft, a valve for the outlet, and connections between the valve and rotary member for opening said valve as the rotary member is moved axially.

10. In a fire extinguisher of the character described, the combination of a container having an outlet, a valve for the outlet, a piston movable in the container, a screw for operating the piston, means for operating the screw, including a rotary hand-operated member having a limited rotary movement independently of the screw, connections between said member and valve for opening the latter during such independent movement, and means for preventing the operation of the rotary member in one direction when the valve is closed.

11. In a device of the character described, the combination of a container having an outlet, a normally closed valve for the outlet, a piston movable in the container, means including a rotary hand member and a screw for operating the piston, said rotary member having a limited movement in one direction independently of the screw, means for causing said member to move axially during such independent rotary movement, and means actuated by said member during its axial movement for opening the valve.

12. In a device of the character described, the combination of a container having an outlet, a piston movable therein, a screw for operating the piston, means including a rotary hand member for operating the screw, a valve movable independently of the screw for controlling the outlet and means for transmitting motion from said member to the valve independently of the movement of the screw.

13. In a device of the character described, the combination of a container having an outlet in one end and a vent in its opposite end, a valve for the outlet, a piston movable in said container, a screw for operating the piston, means including a rotary hand member for rotating the screw, means actuated by said member for operating the valve independently of the screw, and a self-closing valve for the vent adapted to be engaged and closed by the piston when the latter is moved to its position farthest away from the outlet.

In witness whereof I have hereunto set my hand this 16th day of November, 1915.

WALTER H. TIBBALS.

Witnesses:
H. E. CHASE,
ALICE M. CANNON.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."