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A. J. LOEPSINGER

AUTOMATIC SPRINKLER SYSTEM

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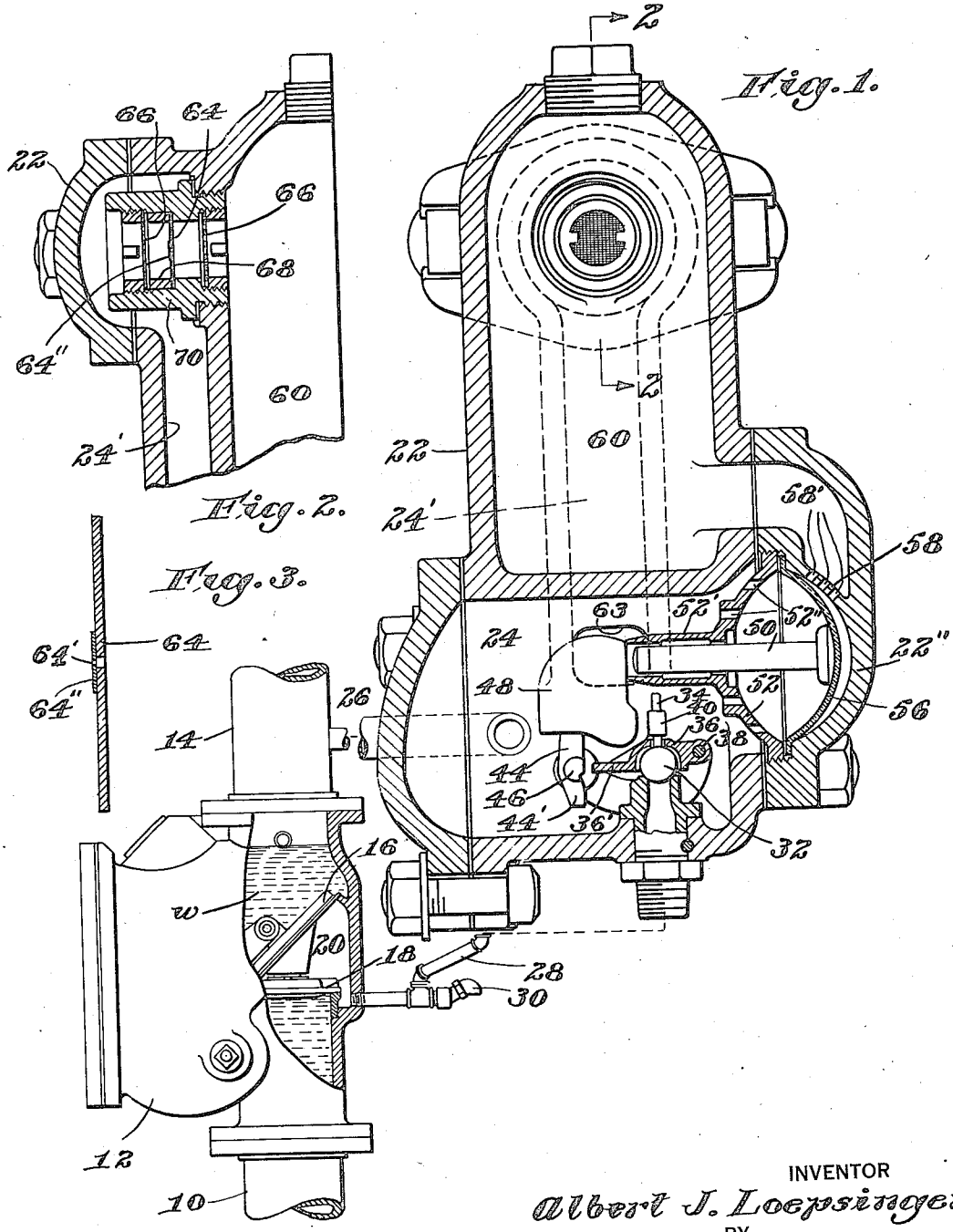

Fig. 1.

Fig. 2.

Fig. 3.

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UNITED STATES PATENT OFFICE.

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AUTOMATIC SPRINKLER SYSTEM.

Application filed April 18, 1922. Serial No. 554,912.

To all whom it may concern:

Be it known that I, ALBERT J. LOEPSINGER, a citizen of the United States, residing at Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Automatic Sprinkler Systems, of which the following is a specification.

This invention relates to improvements in automatic sprinkler systems of the dry pipe type. In such systems of the type in common use the water supply under pressure is normally stopped at the "dry pipe valve", beyond which are the distribution pipes, normally filled with air at a pressure sufficient to hold the dry pipe valve closed. When a sprinkler opens, the ensuing escape of air and reduction of air pressure permit the water supply to force the dry pipe valve open for supply of water to the sprinkler. Valuable time elapses while the air is escaping. It is a purpose of the invention to provide improved means for accelerating the opening of a dry pipe valve, after a sprinkler has opened, without waiting for the air pressure at the valve to have become sufficiently reduced through escape of air to be overpowered. A type of device suitable for this purpose has already been disclosed by me in my pending application for United States patent, Serial No. 169,653, filed May 19, 1917. It is an object of the present invention to provide improvements in the apparatus there shown. The type of accelerator therein disclosed provides apparatus for expediting action of the dry pipe valve by causing pressure on the larger clapper to be balanced as a result of the escape of air that occurs when a sprinkler opens. This idea may be applied in various ways, one method there shown, for illustration, and shown also herein, being to provide a rate of change apparatus such that when the air pressure in the distribution system falls more rapidly than a slow rate which has been predetermined as permissible, to allow for ordinary leakage, etc., the apparatus admits fluid under pressure, as, from the air system to the under side of the air clapper or diaphragm whose function it is to yield on fall of pressure in the air system. Thus, before such wall has actually preceeded far enough to trip the valve, the accelerator anticipates it by balancing the air pressure thereon and so neutralizing such air pressure as remains, letting the water or trip mechanism work to open the water clapper. As illustrated the invention is applied to a differential valve, the intermediate chamber of which is typical of the chamber in any sort of dry pipe valve wherein a sufficient change of pressure causes tripping of the valve. In particular the invention provides a single unit which contains in itself parts which in said earlier apparatus were separated structurally, the functions of much piping in the former apparatus being performed in the improved apparatus by a simple cast iron wall. Another feature is improved communications, according to which one chamber herein called the "system chamber" both contains the operating valve, and supplies the operating air of the other chamber, herein called the "power chamber", these two chambers being at one place connected through a restricted opening and at another place being separated only by a flexible diaphragm. The said restricted opening furnishes the power which is later exerted through the diaphragm as a motor on a plunger in the system chamber for actuating the operating valve. This direct communication and compact arrangement is made possible by the unitary arrangement above mentioned. As incidental to this, it is preferred that the power chamber be placed above the system chamber; and a passage forming a long upward extension of the latter, and which preferably is cast in a wall of the structure, leads from the body of the chamber to the restricted opening through which air enters the power chamber. Preferably, the said opening is placed in the upper part of the power chamber, being thereby removed from contact with any water or dust that may rise in either chamber. This opening is a minute hole in a wafer of platinum set in the middle of a septum guarded on both sides by screens of thousand fold area. Another feature relates to the arrangement of the operating valve so that it can be tightly seated, and consists in the making of the said valve as a ball, or the like, loose in a

cage, which cage can be moved to open or close the valve, and providing said ball with a stem and hand grip by which it can be rotated in order to grind it upon its seat while remaining in its said cage.

Another feature of the invention claimed herein is the motor by which the operating valve is opened, to wit: the arrangement of a movable weight which is upheld while the apparatus is set ready for use and which is guided in its falling so that the momentum of the falling weight throws open the operating valve, striking it with powerful leverage. As illustrated herein and in said pending application the weight is arranged on a swinging lever; and when set is swung upward through and a little past the vertical position, where it rests adjacent to a plunger, or the open end of a bushing containing the plunger, set horizontally at a considerable distance above the pivot of the lever, so that but little difference of pressure is required between the system chamber and the power chamber for the latter to have sufficient energy to topple the weight and thus to open the valve. The energy is expended in pushing the plunger and weight substantially horizontally until the weight is past the vertical, whereupon it falls by gravity plus whatever initial momentum it received from the plunger and power chamber; and this total of momentum acts through a leverage compounded of the weight lever and the valve lever to throw the operating valve open, irresistably overcoming any tendency of that valve to stick.

The various objects of the invention are accomplished, according to the principles set forth above, by the apparatus which has been partly described above and which is set forth more in detail in the description which follows showing one form in which it may be applied. It is obvious, however, that variations may be made from the specific embodiment of the invention herein shown without departing from the scope of the invention. It is intended that the patent shall cover, by suitable expression in the appended claims, whatever features of patentable novelty exist in the invention disclosed.

In the accompanying drawings:

Figure 1 is an elevation showing on a relatively large scale a medial section of the apparatus of the present invention, and showing on a smaller scale, partly in section, the portion of a sprinkler system, including the dry pipe valve, with which the same is associated;

Figure 2 is an elevation in section on line 2—2 of Figure 1; and

Figure 3 is an elevation of part of the same detail, enlarged.

Referring to the drawings, the water supply pipe 10, dry pipe valve 12 and the distribution riser 14 containing air represent a dry-pipe system with the water supply pressing up against the water clapper 18, tending to open it. Air in 14 presses down on the air clapper 16 (above the small body of sealing water *w* which is seen in the drawing) maintaining it closed, while the system is static, set ready for operation. The intermediate chamber 20 stands open to atmosphere through drip valve 30, which permits slow drainage but closes with any considerable rush of fluid. The valve 12 may be any suitable form of the so-called dry-pipe valve type, differential or mechanical in principle, that illustrated being a well known type or differential valve such as is described in United States Letters Patent No. 1,196,875 granted to me September 5, 1916. In this particular type, the air and water clappers are connected and swing practically as a unit; and the relation of the area of the air clapper 16, to the area of the water clapper 18, and the ratio of the moments of the forces acting on each clapper, are such that air under pressure in 14, acting on the air clapper, balances supply water having six times its intensity of pressure upward on the water clapper. In practice, the air pressure may be normally maintained during static condition of the system at about 25 pounds and the water pressure at about 60 to 90 pounds. It is therefore necessary to reduce the effective pressure on the air clapper to some 10 or 15 pounds per square inch before the water pressure can overpower the air to swing the clappers open. When the reduction occurs through a single open sprinkler, as most often happens, the lapse of time entails an objectionable delay during which the fire is spreading. To eliminate this delay is the purpose of the accelerator, accomplished in the particular type here shown, by causing the air pressure to neutralize itself at the air clapper 16. This is effected by providing a normally closed passage from the upper to the under side of the air clapper, that is, from the riser 14 to the intermediate chamber 20, together with means to open said passage automatically whenever the air pressure begins to fall at as fast a rate as that caused by the opening of a single sprinkler. This balances air pressure on the air clapper, and instantly eliminates it with its favorable area and leverage from the forces opposing opening of the water clapper. The invention provides a shell or casing 22 interiorly divided into a valve chamber or "system chamber" 24 and a "power chamber" 60. The former is responsive to pressure conditions in the distribution system 14 by its connection thereto through a short pipe 26 of ample diameter; and has a normally closed passage to an intermediate chamber 20 by another

short pipe 28, which is opened at the proper time by a motor comprising plunger 50 in the system chamber, actuated by air in the power chamber 60. This latter connection 28 may discharge air into the intermediate chamber 20 through the automatic drip pipe 30 whenever the ball valve 32 at its entrance in system chamber 24 is open. This ball valve has a stem 34 rising loosely through a valve cage consisting of a lever 36, pivotally mounted at 38 on the shell. Whenever this lever swings upward it engages a collar 40 on the stem 34 and so raises the ball from its seat. This stem also can rotate the ball about the axis of the stem to grind it on its seat, initially, and occasionally while in service, whenever the inspector turns the collar 40 with his fingers to remove any deposit or sediment thereon. The end 36′ of the lever 36 extends horizontally beyond the ball, in position to be kicked up by the short arm 44′ of a lever 44, whose weighted top end when it operates, starts from the nearly vertical position illustrated and swings over through the vertical and down about its axis 46 to provide the force by which the ball is unseated and the transfer passage opened. When set, as in Figure 1, the center of gravity of the weight is almost over the axis 46, being but slightly on the side thereof toward the ball valve, on which it gently rests. Thus only a slight force will be needed to move its center of gravity across the vertical, for the weight to fall and with its momentum by kinetic energy to throw the ball valve 32 open.

This slight force is furnished by air in the power chamber 60, acting through a flexible diaphragm 56 of its wall to move a plunger 50 against the weight. The plunger is guided in a cylindrical extension or bushing 52′ on a perforated partition 52 which guards the diaphragm 56 and supports it to relieve it of stress when bulged toward system chamber 24. When bulged toward the power chamber 60, set ready for action, the diaphragm is similarly guarded and supported by the partition 58 in the power chamber 60 and by part of the outer wall of the shell, the cover plate 22″. The perforations 52″ and 58′ in these partitions make the diaphragm practically subject to whatever pressure conditions exist in the power and the system chambers. The power chamber is connected with the system chamber 24 by means of a cored passage or extension 24′ of chamber 24, leading upward from the opening 63 in the wall of the system chamber. The actual connecting passage however is restricted to a small opening 64′, say about .007 of an inch in diameter, exaggerated in the drawing, preferably arranged in a small platinum disk 64″ set in a disk 64 of non-corrosive material, such as bronze. For guarding against possible closure of this very small opening by particles floating in the air or water, screens 66 are provided on each side of the bronze disk, held in place by removable hollow screw plugs 68. The disk, strainers, and hollow plugs are all arranged in a removable tube 70, one end of which is screwed into the wall of the storage chamber 60 and the other end of which projects into the cavity of a hand hole cover 72, so that when the latter is taken off the sleeve is left protruding and may be reached by a wrench and removed for cleaning or examination.

It is a feature of the invention to provide a compact inexpensive and durable construction for the elements thus described. To this end the system chamber and the power chamber are cast in a single shell, with division wall and connecting passages; and the said operating connections are set in bushings fitted into exterior openings of the casting and covered by plates bolted over them. There is, for example, the removable bushing 70 containing the platinum disk with guarded restricted passage 64′, and covered by exterior plate 22′. And there is the motor, comprising power chamber 60, plunger 50 and its actuating diaphragm 56, which latter project into system chamber 24 through an exterior opening in the shell 22, being mounted in the cover plate 22″ thereof and held by a bushing 52 which constitutes a perforated partition of the chamber. This cover plate 22″ also covers and in part includes that part of power chamber 60 whose terminal wall is the diaphragm 56. By these means and by connecting the power chamber to the valve chamber, instead of to the riser as heretofore, the piping involved in the accelerator is eliminated, except of course the single external connections to air system and to intermediate chamber; and the separate tank or chamber structures heretofore proposed are combined in one small shell; and all operating parts are accessible under simple cover plates, for inspection and setting. By arrangement of the power chamber above the system chamber, and making its entrance at the end of a long vertical extension 24′ of the latter, the likelihood of dust or water reaching the diminutive restricted passage 64′, before the valve is tripped, is reduced; yet that part is instantly accessible. And by making the same plate 22″ cover both chambers, a diaphragm connection,—i. e. a flexible wall,—between them is provided in the cover whereby all is made tight by simple bolts and bushings; and any water that has entered the power chamber during operation of the system is drained by the mere act of removal.

When the system is being charged, the air and water clappers 16, 18, are to be closed

and the former sealed with the water *w*, and the ball valve 32 seated. The plunger 50 being pushed back against the diaphragm 56 in the illustrated position, the weight 48 is then swung up into the position shown in Figure 1, ready to be toppled over by the plunger. Air under pressure is then introduced into the distribution system to the desired degree. This air entering the system chamber 24 freely through the pipe 26 while atmospheric pressure remains in the power chamber holds the diaphragm away from the plunger 50, because the air enters power chamber 60 only from the system chamber, and flows only slowly through the restriction 64′, so that pressure in the power chamber changes with, but lags greatly behind, all changes of pressure in the sensitive system chamber 24. Ultimately the pressure in these chambers becomes equal, and this condition prevails while the system is ready and waiting for action; the small opening 64′ being large enough to let air flow back from the chamber 60, to compensate for any slow drop in pressure in the distribution pipes by reason of normal leakage. Water may then be admitted under pressure to the under side of the water clapper 18 in the supply pipe 10. In the intermediate chamber 20 there is atmospheric pressure, vent 30 being open to the atmosphere.

Upon the opening of a sprinkler head the air pressure in the system chamber falls with that in the system 14. Air in the power chamber 60 passes out so slowly through the restricted opening 64′, however, that pressure therein responds but slowly to the drop in the system. Very quickly the diminution in the system chamber is great enough so that air in the power chamber, expanding by flexing the diaphragm 56 toward the system chamber moves the plunger to the left in Figure 1, pushing the weight and lever 44 ahead of it until they topple over; and upon this fall the tail 44′ lifts the ball cage 36 and ball 32 and thus opens the way for air to flow from the riser 14 through system chamber 24 to the intermediate chamber 20. This rush closes the drip valve 30 and almost instantly balances the air pressure above and below the air clapper, leaving only the lower air pressure on top of water clapper 18 in the chamber 20 to oppose the powerful hydrostatic pressure in the pipe 10 upward. The opening of the water clapper has thus been greatly accelerated, for the total fall in the air pressure will up to this instant have been but little.

The readiness of the apparatus to operate, and the prevention of its premature operation, may depend on the prevention of the restricted opening 64′ becoming clogged, bearing in mind that the apparatus may have to stand and be instantly ready for long periods of time without inspection. To this end the bronze and platinum septum is guarded on both sides by disk septa of woven nickel wire cloth of extremely fine mesh. The holes therethrough may be smaller than the minute hole through the platinum disk, and said screens may easily be of such relatively large diameter that the passages through them aggregate several thousand in number, so that such flow of current of air as passes through the platinum has no appreciable velocity in passing through the guarding screens, and said screens have ample capacity for having some of their openings become clogged without enough being clogged to interfere with the functioning of the restricted opening 64′.

I claim as my invention:

1. In an automatic sprinkler system the combination with a dry pipe valve of a passage from the air system to the intermediate chamber, comprising in part a casing; a valve in the casing closing said passage; said passage being so ample that it is quickly sensitive to changes of pressure in the air system; and a motor and pressure storage means, also in said casing, the storage means being slowly responsive to changes of pressure in the air system and arranged to operate the motor; and said motor being operatively exposed to said sensitive passage, responsive to a quick rate of fall of pressure therein; the motor being arranged to actuate the valve therein.

2. In an automatic sprinkler system the combination with a dry pipe valve of means for accelerating its action, comprising a shell containing a valve through which a passage leads from one side of the dry pipe valve to the intermediate chamber; said shell also containing a power storage chamber having, within the shell, a restricted entrance from the air system and a flexible wall, the power chamber and flexible wall being arranged as a motor to operate said valve in the shell when the rate of fall of pressure in the air system is substantially quicker than is transmitted through said restricted opening.

3. In an automatic sprinker system the combination with a dry pipe valve of a device for accelerating its opening comprising a shell having a partition forming two chambers, one of which constitutes a part of a passage to the intermediate chamber of the dry pipe valve from one side of the dry pipe valve and the other of which chambers is connected with the air system through a passage in said shell having a restricted opening, the said partition having a flexible portion exposed to air pressure of the system and there being in the first mentioned chamber a valve closing said passage and adapted to be opened by said

flexible wall; whereby upon quick change of pressure in the air system the flexible wall opens the valve in said shell.

4. In an automatic sprinkler system the combination, with a dry pipe valve, of apparatus for accelerating its action, comprising a shell having a valve chamber constituting part of a passage from one side of said dry pipe valve to its intermediate chamber; a valve in said valve chamber closing said passage; a second chamber in said shell connected with the first said chamber through a restricted opening; and a movable wall between said shell chambers responsive to difference of pressure in said shell chambers and adapted upon moving to cause said passage valve to be opened.

5. In an automatic sprinkler system the combination with a dry pipe valve of apparatus for accelerating its action, comprising a passage from one side of the valve to its intermediate chamber, in which passage is a chamber containing a valve for the passage, a lever structurally separate from and controlling said passage valve, and a weighted lever pivoted in said casing adapted to be held with its weight up; and apparatus to topple the weighted lever on occurrence of quick change of pressure in the air system; said weighted lever having a part which engages and opens said valve lever when the weighted lever is toppled.

6. In an automatic sprinkler system the combination with a dry pipe valve of means to accelerate its action comprising a passage from the air system to the intermediate chamber; there being a shell having an interior partition forming two chambers, one of which is a part of said passage and contains a valve therefor, and the other of which chambers communicates only with the first mentioned chamber and communicates therewith only through a restricted opening; said partition between the chambers having a flexible portion; and means whereby the flexing of said portion toward the passage chamber opens the valve therein.

7. In an automatic sprinkler system the combination with a dry pipe valve of apparatus for accelerating its action comprising a passage from the air system to the intermediate chamber; there being a shell having a partition forming two chambers, one of which is a part of said passage, contains a valve therefor, and has a long vertical extension of small cross-section; the other of which chambers is above the first mentioned chamber and beside said extension, communicates therewith through a restricted opening, and has in its lower wall a flexible portion; and means whereby the flexing thereof toward the first mentioned chamber opens said passage valve.

8. In an accelerator for an automatic sprinkler system having a dry pipe valve, the combination of a passage from one side thereof to its intermediate chamber, with a valve in said passage; control means therefor comprising two chambers, one of which has ample connection with the air system, constituting it a sensitive chamber, and the other of which has restricted connection therewith constituting it a power storage chamber; said restricted connection comprising a passage, a barrier disk therein of non-corrosive material containing centrally a minute opening; and disk screens set across said passage guarding said opening; and means for communicating power from said storage chamber to open said valve.

9. In an accelerator for an automatic sprinkler system having a dry pipe valve, the combination of a passage from one side thereof to its intermediate chamber, with a valve in said passage; control means therefor comprising two chambers, one of which has ample connection with the air system, constituting it a sensitive chamber, and the other of which has restricted connection therewith constituting it a power storage chamber; said restricted connection comprising a tubular plug for said power storage chamber having interior shoulders, relatively large disks set against said shoulders, and nuts holding them, said large disks comprising one of bronze having a central small opening, a platinum disk filling said small opening, and a minute hole through said platinum disk constituting said restricted connection; and means for communicating power from said storage chamber to open said valve.

10. In an automatic sprinkler system the combination with a dry pipe valve of a passage from the air system to the intermediate chamber comprising in part a casing having a partition whereby two chambers are made therein, one of which is a part of said passage and has a valve therefor and is below the other chamber; the said casing having a removable part overlying parts of both of said chambers and providing a section of each chamber; and a flexible wall, separating said sections in the cover plate and adapted to be bulged toward either chamber; the whole being arranged for it to open said valve when bulged toward it by a fall of pressure in the valve passage more than in the other chamber; the said passage chamber being sensitive to air system pressure and the said other chamber having only restricted communication whereby it responds thereto only slowly.

11. In an automatic sprinkler system, and in combination with the dry pipe valve thereof, a passage from one side of the dry pipe valve to its intermediate chamber; a casing forming part of said passage containing a valve for the passage; said valve comprising a ball arranged to seat downward

vertically and having a stem projecting upward whereby it can be rotated on its seat; a loosely connected lever for moving it; and means, responsive to change of pressure consequent on escape of air from said chamber, to occasion opening of said valve.

12. In an automatic sprinkler system the combination with a dry pipe valve, of apparatus for accelerating its action, comprising a shell whose interior has a valve, closing connection between one side of the dry pipe valve and the intermediate chamber thereof; and means housed within the shell, responsive to a quick change of pressure in the air system and operated by a quick reduction but not by a slow reduction of said pressure therein, and arranged to open said valve in the shell.

Signed at Boston, Massachusetts, this 17th day of April, 1922.

ALBERT J. LOEPSINGER.