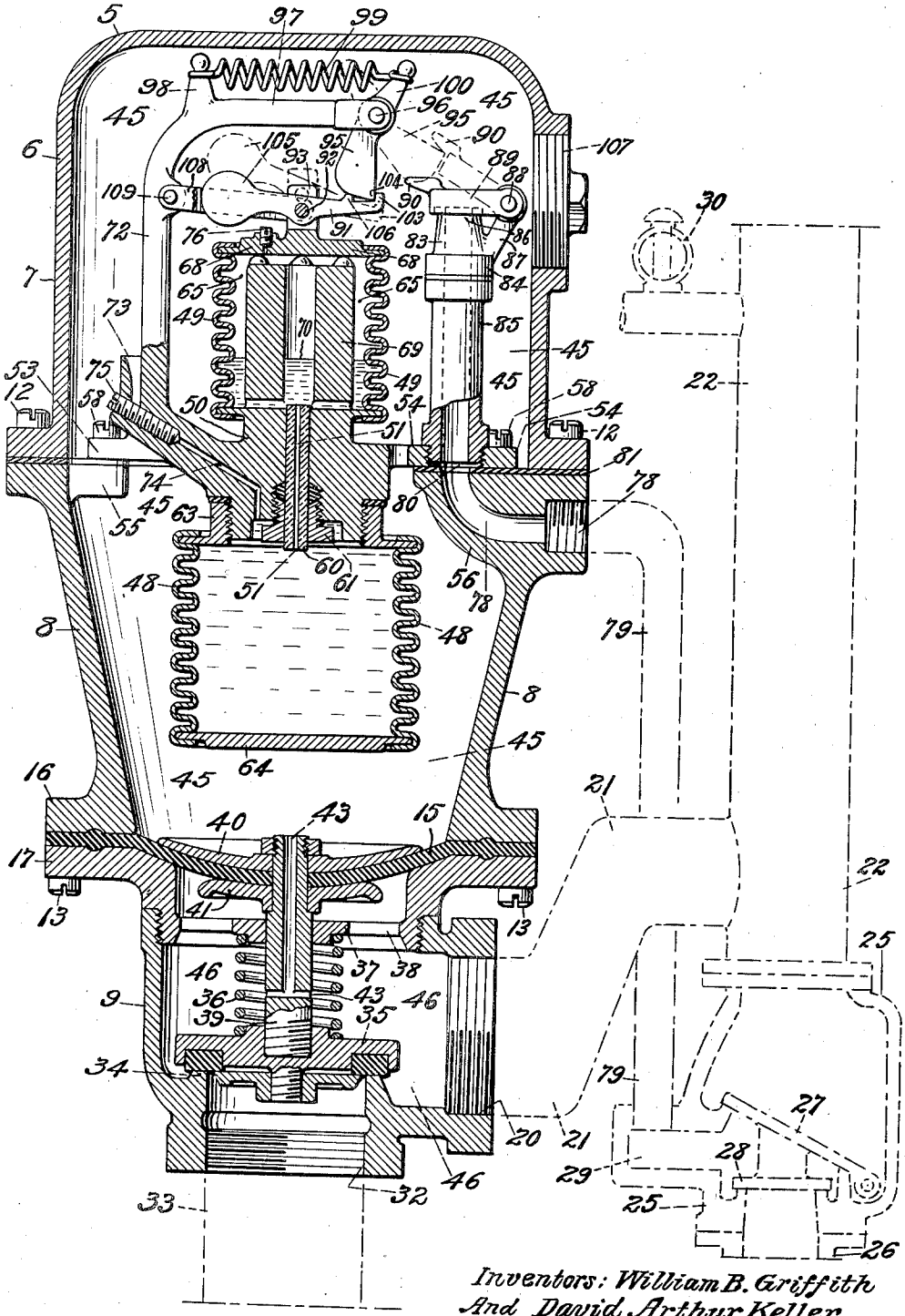
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EXHAUSTER FOR SPRINKLER SYSTEMS

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EXHAUSTER FOR SPRINKLER SYSTEMS

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Our invention relates to improvements in dry pipe sprinkler fire extinguishing systems containing air under pressure for holding the dry pipe valve closed against water under a supply pressure. The invention particularly relates to systems including apparatus for rapidly exhausting the air pressure and for accelerating the opening of the dry pipe valve upon the opening of a sprinkler head.

This invention particularly relates to further improvements in exhausters disclosed in an application filed by us on the 14th day of May, 1935, Serial No. 21,364.

The object of our present invention is to provide novel means for sealing the restricted passageway, or orifice, communicating with the retaining chamber of the exhauster, and thereby eliminating the possibility of failure of operation due to the restricted orifice being obstructed.

A further object is to provide an exhauster having a retaining chamber with a sealed variable capacity container forming a reservoir in communication with the retaining chamber. The sealed container prevents the air of the system from coming into direct contact with the pressure medium contained and sealed within the reservoir and the retaining chamber.

A further object is to provide two variable capacity containers in communication through a restricted orifice, and sealing the containers for excluding the air of the system so that foreign particles cannot be carried by the system air into and obstruct said orifice.

A further object is to provide sealed containers arranged so that air may be utilized as the fluid medium within the containers, or both air and a liquid may be utilized as the pressure medium and the liquid will be retained in any position in which the exhauster may be placed during shipment, without the loss of any of the liquid.

A further object is to provide an exhauster with means for supporting the sealed containers, one above the other, so that both air and liquid may be employed within the containers and the air will rise above the liquid and form a freely expansive medium in the upper container, or retaining chamber, when the exhauster is placed in the operating position.

A further object is to construct an exhauster having a casing forming a pressure chamber, locate two sealed flexible containers and an exhaust valve in said pressure chamber and provide novel valve opening mechanism, operatively associated with one of the containers for opening the valve, and provide said casing with an inlet chamber in which is located a drain valve, and means for opening the latter upon the opening of said exhaust valve.

These together with various other novel features of construction and arrangement of the parts, which will be more fully hereinafter described and claimed, constitute our invention.

The accompanying drawing is a vertical sectional view of our improved exhauster and shows, diagrammatically, the exhauster connected with a dry pipe sprinkler system, in dot and dash lines.

Referring to the drawing, 5 represents a combination accelerator and exhauster, comprising a casing 6 formed of sections 7, 8, and 9, which sections are secured together by fastening devices 12 and 13. A diaphragm 15 is positioned between the flanges 16 and 17 of the sections 8 and 9. The lower section 9 is provided with an inlet connection 20. A pipe 21, shown in dot and dash lines, connects section 9 with the riser pipe 22 of a sprinkler system shown diagrammatically. The system includes a dry pipe valve 25, connected with the riser 22 and a water supply pipe 26. The valve 25 has an air clapper 27, a water clapper 28 and an intermediate chamber 29, formed between the clappers. The clappers are held closed against the water pressure in the pipe 26 by air under the system pressure contained in the riser 22 and the branch pipe having automatic sprinkler heads 30.

The section 9 of the casing is provided with a drain aperture 32 for the connection of a drain pipe 33. A valve seat 34 is provided upon the section 9 and surrounds the drain aperture 32. A drain valve 35 is normally held closed upon the seat 34 by a spring 36, interposed between the valve and a bearing 37, supported by arms 38 extending from the walls of the section 9. The drain valve 35 is secured upon a shaft 39, movably mounted in the bearing 37. The upper end of the shaft is secured by clamp plates 40 and 41 to the diaphragm 15. The shaft 39 is provided with a small passageway 43 through which air under the system pressure may slowly equalize in the chambers 45 and 46 formed on opposite sides of the diaphragm 15, thus permitting the spring to normally hold the drain valve 35 closed upon its seat. When the pressure is exhausted from the pressure chamber 45, as more fully hereinafter described, the system pressure in the inlet chamber 46 will move the diaphragm and lift the drain valve 35 against the action of the spring 36, and allow the air to rapidly exhaust through the drain pipe 33.

The novel features of the present invention include two flexible containers 48 and 49, located within the pressure chamber 45, said containers are preferably in the form of sylphons, having end heads which are movable by unequal pressures within and without the containers.

The containers 48 and 49 are sealed so that the air under the system pressure cannot enter the same. The system pressure acts externally upon the containers for compressing a fluid medium contained within the containers. A bearing 50

has a passageway, or orifice 51 formed through the same. The passageway 51 forms a means of communication between the containers through which the pressures within the containers may slowly equalize.

The bearing 50 forms a support for the containers 48 and 49. Said connection 50 is provided with lugs 53 and 54 which rest upon inwardly projecting lugs 55 and 56 formed upon the section 8 of the casing. Fastening devices 58 are provided for removably mounting the connection 50 upon the section 8.

The passageway 51 formed through the connection 50 is provided with a tube 60, formed of glass or other material impervious to corrosion due to the presence of the liquid within the containers. The aperture through the tube 60 forms the restricted passageway, or orifice 51 for retarding the equalization of the pressures within the containers. The tube 60 is secured in the bearing 50 by a packing gland 61.

The head or top wall 63 of the container 48 is detachably secured to the bearing 50, making the gland 61 accessible. The lower wall 64 is free to move and allows the container 48 to expand and contract, thus forming a variable capacity container or reservoir.

The container 49 is mounted above the bearing 50 and forms an expansible pressure retaining chamber 65 for containing air placed under pressure by the compression of the reservoir or container 48 by the system pressure within the pressure chamber 45. The upper head or member 68 of the container 49, is movable outwardly by the expansive action of the air retained under pressure within the container 49, upon the sudden reduction of the system pressure within the pressure chamber 45.

The bearing 50 has an extension 69 which extends into and occupies the container 49 and reduces the capacity of the air retaining chamber 65, and said extension 69 forms a stop for limiting the movement of the head 68 by external pressure acting upon the head 68.

The containers 48 and 49 may be entirely filled with air, or they may contain air and a body of liquid 70, such as water, oil or mercury. When air and liquid are employed, the liquid fills the container 48 and partially fills the container 49. The volume of air is contained in the retaining chamber 65 between the surface of the liquid and the head 68, and the air is compressed by the liquid to a pressure equal to the external pressure to which the containers are subjected.

The bearing 50 is provided with a post 72 having a spout 73 formed thereon. Said bearing 50 also has formed therein a filling aperture 74 in communication with the spout and through which the liquid may be poured for filling the containers up to the level of the spout, thus leaving sufficient space between the liquid and the head 68 to form the air retaining chamber 65. A plug 75 is provided for normally sealing the aperture 74. The head 68 is provided with an air vent which is normally closed by a plug 76.

The lug 56 of section 8, is of hollow construction and forms an exhaust passage 78, and a connection for a pipe 79 connected with the intermediate chamber 29 of the dry pipe valve. The lug 54 of the connection 50 has an aperture 80 which aligns with the exhaust passage 78. A gasket 81 forms an air tight joint between the facing surfaces of the lugs.

An exhaust valve 83 is located in the pressure chamber 45. Said valve comprises a body portion 84, mounted on a tubular fitting 85, which in turn is secured in the aperture 80 of the lug 54. Said body portion 84 has a valve seat 86 and a bearing arm 87 for a shaft 88, on which shaft is pivotally mounted a clapper 89, having a projection or tongue 90. Said clapper 89 is movable to and from the valve seat 86, for controlling the flow of air from the pressure chamber 45. The clapper 89 is normally held closed upon the seat by the air pressure within the chamber 45.

The exhaust valve 83 is opened by valve opening mechanism comprising a latch lever 91, pivotally mounted upon a pin 92, which in turn is mounted upon a post 93, forming part of the movable head 68. A valve opening member 95 is pivotally mounted upon a pin 96, supported upon an arm 97 secured upon, or forming part of the bearing post 72. A lug 98 upon the post 72 forms a point of attachment for one end of a spring 99. The opposite end of the spring is secured to an arm 100 forming part of the valve opening member 95.

The latch lever 91 has a projection, or shoulder 103, which engages the tooth 104 formed upon the end portion of the member 95, and holds said member against movement by the action of the spring 99. The opposite end of the lever 91 has a weight 105 which tends to hold the end of the lever carrying the shoulder 103 in engagement with the member 95.

The lever 91 is also provided with a lug 106 which is normally in engagement, or contact, with the surface of the member 95, as shown in full lines in the drawing. When the head 68 and lever pivot pin 92 are moved upwardly by the expansive action of the air in the container 49, the lever 91 will be rotated upon the pin 92 and about a fulcrum point formed between the lug 106 and the member 95, which movement of the lever will cause the shoulder 103 to withdraw from and release the member 95, as shown in dot and dash lines. When the member 95 is released from the lever 91 the spring 99 moves the member 95 into engagement with the tongue 90, formed on the clapper 89, and moves the clapper into the open position, shown in dot and dash lines, thus opening the exhaust valve and exhausting the air from the pressure chamber 45.

The upper section 7 of the casing is provided with an opening which is normally sealed by a plug 107. By removing the plug the clapper 89 may be reset upon its seat and the member 95 may be engaged with the latch lever 91, as shown in full lines.

Links 108 are loosely pivoted upon the pins 92 and 109. Said links are provided for preventing the spring 99 from tending to move the head 68 out of vertical alignment with the longitudinal axis of the container 49.

The operation of the invention is as follows: The air under the system pressure tends to keep the drain valve 35 and the exhaust valve 83 closed, also the clappers 27 and 28 of the dry pipe valve closed. The air under the system pressure passes through the passageway 43 and equalizes the pressures in the chambers 45 and 46, located on opposite sides of the diaphragm 15, during slow changes in the system pressure due to leakage.

The air under the system pressure in the chamber 45 will tend to compress the containers 48 and 49. The movable member, or head 68 is prevented from moving downwardly, by the extension 69, a sufficient distance to release the

latch lever 91 from the exhaust valve opening member 95. The air under pressure in the chamber 45 will continue to compress the container 48 until the air in the retaining chamber 65, within the container 49 and immediately below the head 68, is under a pressure equal to the pressure in the pressure chamber 45 acting upon the upper surface of the head 68, therefore said head will not be moved.

During slow changes in the system pressure, due to leakage, the pressure in the pressure chamber 45 will vary the external pressure upon the containers and the pressure medium within the containers will slowly pass through the restricted passageway or orifice 51, and allow the pressures in the containers to equalize.

A sudden reduction in the system pressure, caused by the opening of a sprinkler head 30, reduces the pressure in the chambers 45 and 46. The reduction of the pressure in the chamber 45, causes a reduction of the pressure upon the exterior of the containers 48 and 49 and upon the upper side of the head 68, and also upon the exhaust valve clapper 89. The air under pressure within the retaining chamber 65 is retained for a relatively long period of time by the restricted orifice 51, and the expansive action of the air within said retaining chamber 65 moves the head 68 upwardly and causes the latch lever 91 to rotate about the lug 106, as a fulcrum riding upon the member 95, and releases the shoulder 103 from the member 95. The spring 99 then rotates the member 95 and opens the clapper 89, thereby allowing the air to exhaust from the chamber 45 and pass to the intermediate chamber 29 of the dry pipe valve and accelerate the opening of the clappers 27 and 28.

When the air pressure is exhausted from the chamber 45 by the opening of the exhaust valve 83, the system pressure still remaining in the inlet chamber 46 will act upon the under surface of the diaphragm 15, due to the small restricted passageway 43, and cause the diaphragm 15 to lift the drain valve 35 from its seat, thus allowing all the air under the system pressure to rapidly exhaust through the drain pipe 33. When the pressure again equalizes on opposite sides of the diaphragm 15 the drain valve 35 will be closed by the action of the spring 36, thus preventing the flow of water into the drain pipe 33, when the air is replaced by water throughout the system by the opening of the dry pipe valve.

Should the exhauster casing 6 be filled with water after the opening of the dry pipe valve, the water will not enter the containers 48 and 49 due to the employment of sealed containers, thus avoiding the necessity of draining the containers and refilling them, with the proper quantity of fluid, after each operation of the system for testing purposes or actual operation for fire protection.

The sealed containers permit the exhauster to be placed in any position during shipment without the loss of the liquid from the containers. When the exhauster is installed in a vertical position, the arrangement of the containers one above the other will insure the rising of the air into the retaining chamber instead of forming an air pocket within the container 48.

The containers may be filled entirely with air as the sealed containers exclude all foreign particles which would otherwise be carried into and obstruct the restricted orifice. We prefer to partially fill the containers with liquid and a relatively small volume of air which will readily expand and move the head 68.

By using a large body of liquid and a relatively small volume of air in the containers the latter will have less movement, and they may be smaller in size, than when air alone is used as the pressure fluid.

Various changes may be made in the construction of the parts and the operation thereof without departing from our invention.

We claim:—

1. In a combined accelerator and exhauster for a dry pipe fire extinguishing system containing air under pressure, a pressure chamber adapted to communicate with the piping of said system, a sealed pressure retaining chamber of variable volume located in said pressure chamber and containing a compressible pressure medium, said retaining chamber subjected externally to the pressure in said pressure chamber, means controlling the exhausting of the air under pressure from said system actuated by a release of pressure from the pressure chamber at a rate greater than can be admitted, the release of said pressure being effected by means actuated by the expansion of said retaining chamber caused by the expansive action of excess pressure in the retaining chamber relatively to the pressure in said pressure chamber, a sealed flexible container located in said pressure chamber and subjected externally to the pressure in said pressure chamber, and a connection forming a restricted passageway between said container and the retaining chamber through which said pressure medium may slowly equalize.

2. In a combined accelerator and exhauster for a dry pipe fire extinguishing system containing air under pressure, a casing forming a pressure chamber adapted to communicate with the piping of said system, sealed variable capacity containers located in the casing and subjected externally to the pressure in said casing, said containers encasing a pressure medium, a connection between said containers through which the pressures within the containers slowly equalize, a valve controlling the exhausting of the pressure from the casing, and means operatively associated with the valve and one of said containers and operable by the expansive action of the last mentioned container for opening said valve upon the occurrence of a sudden reduction in the pressure in said casing.

3. In a combined accelerator and exhauster for a dry pipe fire extinguishing system containing air under pressure, a pressure chamber adapted to communicate with the piping of said system and containing air under the system pressure, a sealed expansible air retaining container located in said pressure chamber and subjected externally to pressure in said pressure chamber, means associated with said container and said pressure chamber adapted to slowly equalize the pressure within said container relatively to the pressure in said pressure chamber, a valve controlling the flow of air under pressure from said pressure chamber, a valve opening member movably mounted within the pressure chamber, a spring tending to move said member into engagement with the valve for opening the latter, a lever pivotally mounted upon and movable with said container, a part upon one end of the lever detachably engaging said member for holding the latter against the action of the spring, a weight upon the opposite end of the lever tending to hold said part in engagement with said member, and a part upon the lever normally fulcrumed

upon said member and arranged to release said member from the lever by a movement of said container caused by the expansive action of air retained under excess pressure within said container relatively to the pressure in the pressure chamber.

4. In a combined accelerator and exhauster for a dry pipe fire extinguishing system containing air under pressure, a casing forming a pressure chamber adapted to communicate with the piping of said system, sealed variable capacity containers located in said casing, a pressure medium comprising air and liquid within said containers, a connection forming a restricted passageway between said containers through which the pressures within said containers may slowly equalize and the air may rise to the upper one of said containers, said restricted passageway arranged for retarding the equalization of the pressures in said containers upon the occurrence of a sudden reduction in the pressure in said casing, a valve controlling the exhausting of the pressure from said casing and valve actuating mechanism operatively associated with said valve and one of said containers and operable by the expansive action of of the pressure medium retained in the last mentioned container by said restricted passageway upon the sudden reduction of the pressure in said casing.

5. In a combined accelerator and exhauster for a dry pipe fire extinguishing system containing air under pressure, a casing forming a pressure chamber adapted to communicate with the piping of said system, a sealed flexible container forming a reservoir and containing a pressure medium, a sealed flexible container forming a pressure retaining chamber, a connection between said containers and arranged for the slow equalization of the pressure medium within said containers, said containers located within the casing and subjected externally to the pressure in said casing, means operatively associated with said retaining container and arranged to limit the movement of said retaining container by excess external pressure relatively to the pressure within the retaining container, a valve controlling the exhausting of the pressure from said casing, and valve opening mechanism arranged to be actuated by a movement of the retaining container caused by the expansive action of the pressure medium within the retaining container upon the occurrence of a sudden reduction in the pressure in said casing.

6. In a combined accelerator and exhauster for a dry pipe fire extinguisher system containing air under pressure, a casing forming a pressure chamber adapted to communicate with the piping of said system, a sealed flexible container forming a reservoir, a sealed expansible air retaining container, a connection forming a restricted passageway between said containers, a body of liquid in said reservoir and said connection and occupying a portion of the retaining container, said containers located within the casing and subjected externally to the pressure in said casing, a valve controlling the flow of air under pressure from the casing, and mechanism operatively associated with the valve and the retaining container and arranged for opening the valve by a movement of the retaining container caused by the expansive action of the air retained in the retaining container by the liquid upon the occurence of a sudden reduction in the pressure in said casing.

7. An exhauster for a dry pipe sprinkler system comprising a casing forming a pressure chamber adapted to communicate with the pressure region of said system, a sealed variable container forming a reservoir, a sealed variable pressure retaining container, said containers located in said pressure chamber, a pressure medium within said containers, a connection forming a restricted passageway between said containers through which the pressure medium slowly equalizes within said containers, means for exhausting the air from said pressure chamber, and means operatively associated with said first mentioned means and with said retaining container and actuated by the expansive action of the pressure medium retained within said retaining container upon the sudden reduction of the pressure in the pressure chamber for exhausting the air under pressure from said pressure chamber.

8. An exhauster for a dry pipe sprinkler system comprising a casing forming a pressure chamber adapted to communicate with the pressure region of said system, a sealed flexible container forming a reservoir, a sealed flexible container forming a pressure retaining chamber, a pressure medium within the containers, a restricted connection between said containers and arranged for the slow equalization of the pressures within the containers, a part movably mounted upon said retaining container and movable by excess pressure in the retaining container, said containers located in said pressure chamber of the casing, a valve controlling the flow of air from said pressure chamber, and means operatively associated with said part and the valve for opening the latter upon the movement of said part caused by excess pressure retained in the retaining container upon the sudden reduction of the pressure within the pressure chamber of the casing.

9. An exhauster for a dry pipe sprinkler system comprising a casing forming a pressure chamber adapted to communicate with the pressure region of said system, a sealed flexible container forming a reservoir, a sealed expansible air retaining container, a restricted connection forming a restricted passageway between said containers, a body of liquid in the reservoir and in said connection and occupying a portion of the retaining container and arranged for compressing the air in the retaining container, said containers located in said pressure chamber, a valve controlling the flow of air from said pressure chamber, and valve opening mechanism operatively associated with the valve and said retaining container and arranged to be actuated by a movement of the retaining container caused by the expansive action of the air retained under pressure in the retaining container by the liquid upon the occurrence of a sudden reduction in the pressure system.

10. An exhauster for a dry pipe sprinkler system comprising a casing forming a pressure chamber adapted to communicate with the pressure region of said system, a sealed flexible container forming a reservoir, a sealed expansible air retaining container said containers located within said pressure chamber, a body of liquid occupying said reservoir, a connection between said containers through which the liquid passes to and from the retaining container, said connection having a part having a restricted orifice, said part formed of material impervious to corrosion by the presence of the liquid, and means operatively associated with said retaining con-

tainer and arranged for exhausting the air from said pressure chamber by the movement of said retaining container caused by excess pressure in the latter relatively to the system pressure.

11. An exhauster for a dry pipe sprinkler system comprising a casing forming a pressure chamber adapted to communicate with the pressure region of said system, a sealed flexible container forming a reservoir, a pressure medium within said reservoir, a sealed flexible container forming an air pressure retaining chamber, said containers located in said pressure chamber, a member supported upon said casing and forming a common wall for said containers, said member having a restricted passageway formed through the same and arranged for the slow equalization of the pressure medium in said containers, an extension upon said member and arranged for limiting the compression movement of said retaining container, an exhaust valve controlling the flow of air from said pressure chamber, and means actuated by a movement of the retaining container caused by the expansive action of air under excess pressure relatively to the system pressure and retained in the retaining container for opening the exhaust valve.

12. An exhauster for a dry pipe sprinkler system comprising a casing forming a pressure chamber adapted to communicate with the pressure region of said system, two sealed flexible containers located in said pressure chamber, a member supported upon said casing and forming a common wall for said containers, said member having a restricted passageway formed through the same and forming a communication between said containers, a body of liquid and a relatively smaller volume of air confined within said containers, an exhaust valve controlling the flow of air from said pressure chamber, and means operably associated with said containers and said valve and arranged for opening the latter upon the occurrence of a sudden reduction of the pressure in said pressure chamber.

13. An exhauster for a dry pipe sprinkler system comprising a casing forming a pressure chamber, a sealed flexible container forming a reservoir, a sealed flexible container forming a pressure retaining chamber said containers located in said casing, a pressure medium within the containers, a connection between said containers and having a restricted passageway between said containers, a head movably mounted upon said retaining container and movable by excess pressure in said retaining chamber relatively to the pressure in said pressure chamber, a latch lever pivotally mounted upon said head, a valve controlling the flow of air from said pressure chamber, a valve opening member movably mounted within the casing, a spring tending to move said member into engagement with the valve for opening the latter, and cooperating parts upon said lever and upon said member tending to hold the latter against the action of the spring and arranged for releasing said member from the lever when said head is moved by excess pressure in said retaining container upon the sudden reduction of the pressure in said pressure chamber.

14. An exhauster for a dry pipe sprinkler system comprising a casing forming a pressure chamber adapted to communicate with the pressure region of said system, a sealed flexible container forming a reservoir, a pressure medium within said reservoir, a sealed flexible container forming an air pressure retaining chamber, said containers located in said pressure chamber, a connection forming a restricted passageway between said containers, a valve controlling the flow of air under pressure from said pressure chamber, a valve opening member movably mounted within the pressure chamber, a spring tending to move said member into engagement with the valve for opening the latter, a lever pivotally mounted upon and movable with said retaining container, a part upon said lever detachably engaging said member for holding said member against valve opening movement by the action of the spring, and a part upon the lever normally fulcrumed upon said member and arranged to release said member from the lever by movement of the retaining container caused by the expansive action of air retained under excess pressure within the retaining container relatively to the system pressure.

15. An exhauster comprising a casing forming a pressure chamber containing air under pressure, a sealed expansible pressure retaining container, a head forming a movable portion of said retaining container, a bearing rigidly mounted within the casing and forming a support for said container, a bearing post upon said bearing, an exhaust valve upon said casing, a valve opening member pivotally mounted upon said post, a spring tending to move said member into valve opening position, a lever pivotally mounted upon said head, cooperating parts upon the lever and said member for holding the latter against the action of the spring, a part upon said lever detachably fulcrumed upon said member and arranged for rotating the lever into a position to release said member from the lever by a movement of the head, means associated with the head for limiting the movement of the head by excess pressure in said pressure chamber, and a sealed flexible container located in the casing, and a connection forming a restricted passageway between said containers.

16. An exhauster for a dry pipe sprinkler system comprising a casing having an inlet chamber and a pressure chamber in communication through a restricted passageway, a diaphragm movably mounted upon the casing and separating said chambers, said casing having an inlet connection through which air under the system pressure is admitted to the inlet chamber, sealed flexible containers located in and subjected externally to the pressure in said pressure chamber, a connection forming a restricted passageway between said containers, a pressure medium within said containers, an exhaust valve controlling the flow of air under pressure from said pressure chamber, means operatively associated with the valve and one of said containers for opening the valve by a movement of the last mentioned container caused by the expansive action of air retained within the last mentioned container upon the sudden reduction of the system pressure within the pressure chamber, a drain valve located in said inlet chamber, and a connection between said diaphragm and the drain valve and arranged for opening the drain valve by a movement of the diaphragm caused by a preponderance of the system pressure remaining in said inlet chamber after the pressure in said pressure chamber has been exhausted through the exhaust valve.

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