Nov. 14, 1933. L. W. EGGLESTON ET AL 1,935,548

EXPANSION VALVE

Filed Feb. 10, 1927 2 Sheets-Sheet 1

Fig. 1.

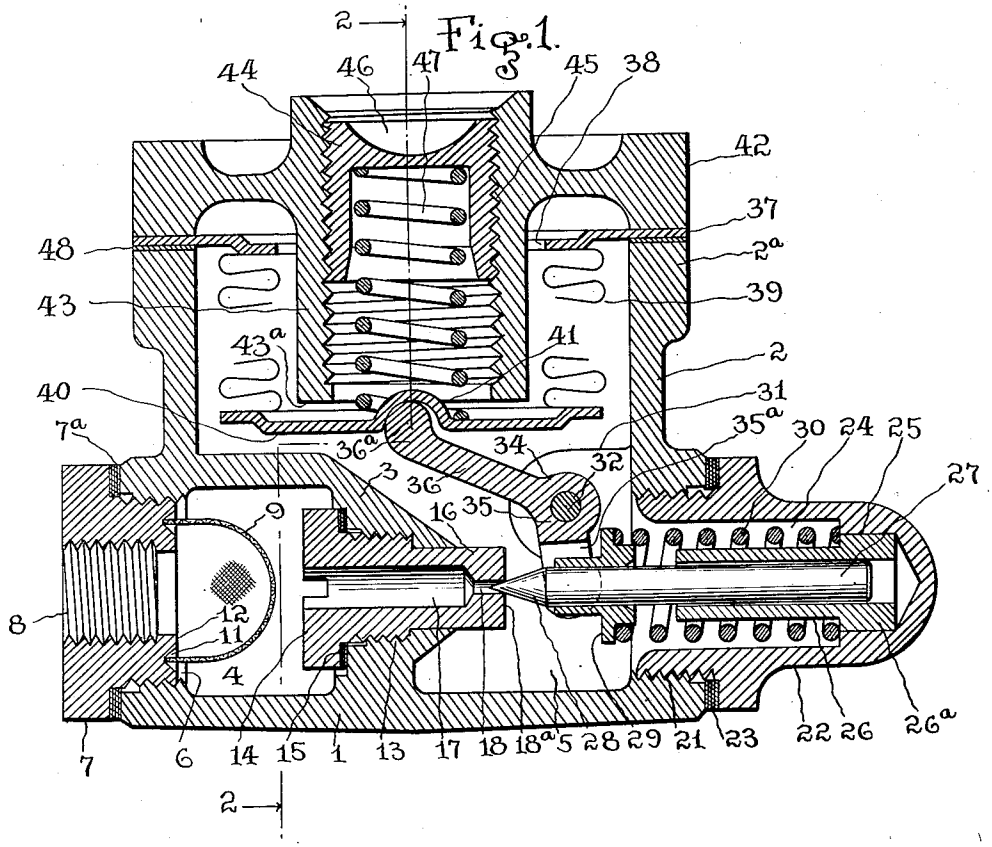
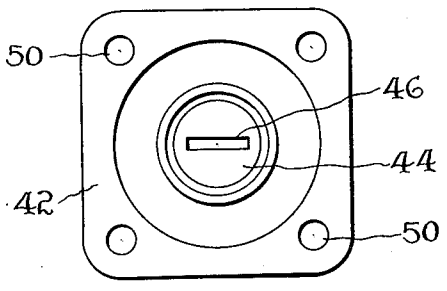


Fig. 4.



INVENTOR
Lewis W. Eggleston and
Edward Lupfer Durand
BY
C. A. Heylmun
their ATTORNEY

Nov. 14, 1933. L. W. EGGLESTON ET AL 1,935,548

EXPANSION VALVE

Filed Feb. 10, 1927 2 Sheets-Sheet 2

Fig. 2.

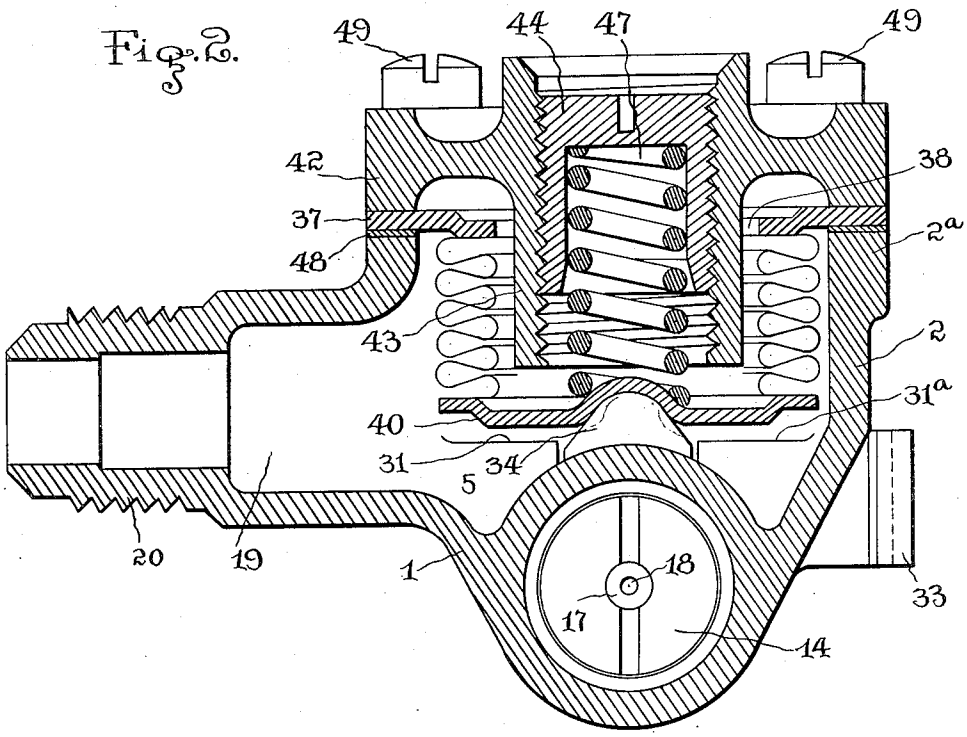
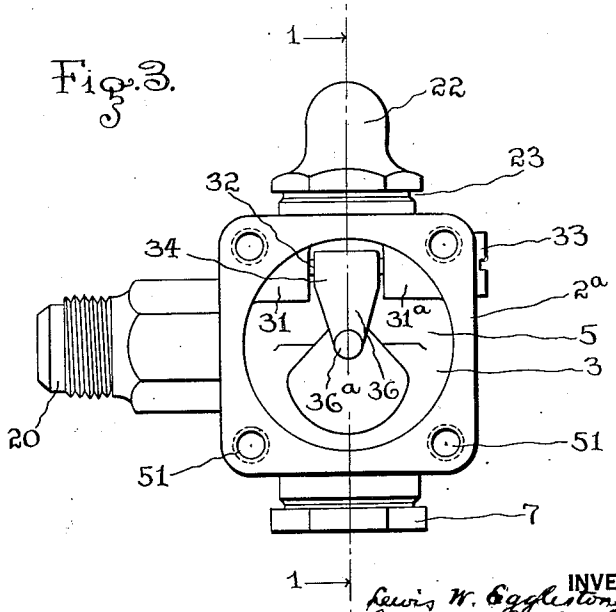


Fig. 3.



INVENTORS
Lewis W. Eggleston and
Edward Lupfer Durand
BY
their ATTORNEY

Patented Nov. 14, 1933 1,935,548

UNITED STATES PATENT OFFICE

1,935,548

EXPANSION VALVE

Lewis W. Eggleston, Clarence Township, Erie County, and Edward Lupfer Aurand, Buffalo, N. Y., assignors to American Radiator Company, New York, N. Y., a corporation of New Jersey

Application February 10, 1927. Serial No. 167,152

11 Claims. (Cl. 50—26)

Our invention is for a new and useful improvement in expansion valves, particularly for use in refrigeration systems.

An object of our invention is to provide an expansion valve of the pressure-controlled type which is compact in construction, thereby utilizing a minimum of space in the assembly of the system in which it is employed.

Another object of our invention is to so construct the device that the valve will close against pressure and prevent accumulation of dirt or other foreign matter at the valve seat.

A further object is to provide an expansion valve which is efficient in operation, and which has an adjustable range of operation.

The invention consists in the improvements to be more fully set forth and described hereinafter, and the novelty of which will be particularly pointed out and distinctly claimed.

In the accompanying drawings we have fully and clearly illustrated a preferred embodiment of our invention, to be taken as part of this specification, and in which—

Figure 1 is a vertical, central, sectional view of our invention on line 1—1 of Fig. 3;

Fig. 2 is a vertical, central, sectional view on line 2—2 of Fig. 1;

Fig. 3 is a top plan view of our valve with the cap or cover and certain other parts removed to better show the internal construction of the device, and

Fig. 4 is a plan view of the cap or cover.

In the drawings, reference numeral 1 designates the expansion valve casing or body upon which is mounted a hollow, open-ended extension or boss 2 having a side wall terminating in a flange 2^a, the boss preferably being formed integral with the casing 1, though not necessarily so, as the casing and the extension may be initially separate elements. Within the casing 1 and also preferably integral therewith, is a partition or wall 3 which divides the casing into an inlet compartment 4 and an outlet compartment 5. The open end of the extension 2 which is fixed to the casing 1 opens into the outlet compartment 5, while the other end is sealed in a manner to be described.

The inlet compartment 4 has an opening 6 through the side wall of casing 1, which is preferably internally threaded to receive a plug 7 having an inlet passage 8 therethrough. A suitable gasket 7^a is inserted between the plug 7 and casing 1 to seal the same to the casing. The outer end of passage 8 is internally threaded for union with a conduit (not shown), which conveys the refrigerant liquid from a source of supply to the valve. Within the inlet compartment 4 and surrounding or overlying the inner end of the passage 8 is a foraminous screen or filter 9 of cup-shape and preferably of fine wire gauze, which is fixed along its edge 11 to the inner end 12 of the plug 7. The partition wall 3 which forms the inlet compartment 4 has an aperture 13 therethrough in the axial line of passage 8. The aperture 13 is internally threaded for a portion of its length and receives a threaded plug 14 which projects beyond the wall 3 into the outlet compartment 5, as at 16, and which is sealed in aperture 13 by a gasket 15. Through the plug 14 is a passage 17 for the flow of refrigerant from the inlet to the outlet compartment, which is constricted, as at 18, in the plug projection 16, the end 18^a of the plug 14 adjacent constriction 18 being ground to form a valve seat.

The side wall of the casing 1 at a point diametrically opposite the inlet passage 8, has an internally threaded opening 21 closed by an externally threaded and internally recessed cap 22 having a gasket 23. At the inner end of recess 24 in cap 22 is a socket 25 in which is mounted the flanged end 26^a of a cylindrical tubular guide and supporting member 26. Slidably mounted in the guide tube 26 is the stem 27 of a valve 28, preferably of the needle type, which aligns with the constricted passage 18 and cooperates with the valve seat 18^a to close the passage 17, 18 from the inlet compartment 4. Fixed on the stem 27 in spaced relation to the free end of the guide 26 is a spring support or collar 29. Surrounding the tubular guide 26 is a coil spring 30 positioned and held under compression between the collar 29 and the inner end of recess 24, so that it normally tends to force valve 28 to its seat 18^a. Spring 30 also abuts the flange 26^a to aid in maintaining the guide 26 in its socket 25.

The casing 1 is also provided with an outlet 19 from the outlet compartment 5 which passes through an externally threaded nipple 20 which preferably extends at right angles to the inlet passage 8 of plug 7 (Fig. 3). Within the outlet compartment 5 are a pair of spaced bosses 31, 31^a adjacent the threaded opening 21. The boss 31 has a socket therein, and boss 31^a has a passage therethrough to the outside of the casing 1 and which is in alignment with said socket. A pivot pin or fulcrum 32 extends between the bosses 31, 31^a and is fixed in the socket and passage. The outer end of the passage is closed by a screw plug 33. Journaled on the pin 32 is a lever 34, preferably of the bell-crank type. One arm 35 of this lever is bifurcated to form a yoke 35^a

which straddles the valve stem 27, and which acts on collar 29 against spring 30, as will be later described. The other arm 36 extends substantially to the longitudinal center line of extension 2 and is provided at its extremity with an upstanding lug or nose 36a.

The flange 2a supports a flange or annular plate 37 having a central aperture 38. Hermetically sealed to plate 37 along the periphery of the aperture 38 is one end of a tubular, longitudinally expansible-collapsible, resilient element 39, preferably in the form of a corrugated metallic cylindrical bellows. The other end of the bellows 39 is closed by a head 40 sealed thereto and having a central depression or socket 41 which caps the nose 36a to provide operative engagement between the bellows head 40 and lever 34. Overlying the plate 37 is a cap or cover 42 which has a transverse cylindrical hollow boss 43 substantially concentric with cover 42. The inner end 43a of boss 43 extends adjacent the inner surface of bellows head 40 and serves as a stop to limit the upward movement or collapse of the bellows. The boss 43 is closed by a plug 44 which is adjustably secured therein, preferably by means of threaded engagement, as at 45, between the plug 44 and inner surface of the hollow boss 43. Suitable means, such as a slot 46, in the outer end of the plug 44 permits ready longitudinal adjustment of the plug in the boss 43. A compression spring 47 which may be of the coil type is positioned within the boss 43 and abuts the stationary plug 44 to thereby exert its force upon the bellows head 40 which supports it. The depression or socket 41 in bellows head 40 projects upwardly within the bellows to retain the coil spring 47 in proper position centrally of the bellows head 40. A packing ring or gasket 48 is inserted between the plate 37 and flange 2a to hermetically seal the casing 1. Fastening means, such as machine screws or bolts 49, are passed through holes 50 in the cover 42 and through correspondingly disposed holes in the plate 37 and gasket 48, and are screwed into tapped holes 51 in the flange 2a to secure the gasket, plate and cover in position. However, it is to be noted that the interior of the bellows 39 and boss 43 are maintained at atmospheric pressure by leakage between cover 42 and plate 37, as well as through the loose threaded engagement of plug 44 in boss 43, but the leakage is not sufficient to admit moisture.

In operation the expansion valve is used in a refrigerating system with the conduit from the high side (not shown) connected at inlet port 8, and with the outlet port 19 through nipple 20 connected with the low side (not shown). Compression spring 47 is adjusted by plug 44 to exert sufficient force on the bellows head 40 to normally maintain the lever arm 36 depressed, thereby overcoming and compressing spring 30 and holding valve 28 open. When the pressure in the low side has reached a predetermined degree, the pressure will act upon the bellows head 40 to compress the spring 47, permitting valve spring 30 to expand and close valve 28. Upon decrease in pressure in the low side and on bellows head 40, the spring 47 will act to compress spring 30 and open valve 28 from the inlet compartment 4. As above described, the valve 28 is forced to its seat by spring 30 against the refrigerant entering through passage 18, and by so constructing the expansion valve foreign matter will not collect on the valve seat 18a, and the flow of refrigerant against the valve face when the valve 28 is open will keep the valve clean and free from dirt so that efficient action will be insured.

It is of course understood that our valve may be used otherwise than in refrigerating systems, and in any system wherein a valve is employed to operate on a differential of pressures to control the pressures on the outlet side of the valve.

What we claim and desire to secure by Letters Patent of the United States is:—

1. In an expansion valve, a casing having an open side, an inlet compartment in said casing, an inlet passage to said compartment, an outlet compartment in said casing, an outlet passage from said outlet compartment, a wall between said compartments, said wall having an opening therethrough providing a valve seat in axial alignment with said inlet passage, said outlet compartment having a socket in axial alignment with said opening, a valve guide positioned in said socket, a valve slidably mounted in said valve guide for engagement with said seat, resilient means abutting said valve guide to hold said guide in its socket and normally tending to seat said valve, a spring-pressed pivoted lever engaging said valve to oppose said resilient means and a resilient member sealing said open side and engaging said lever.

2. In an expansion valve, a casing having a hollow open extension thereon, an inlet compartment and an outlet compartment in said casing, a wall within said casing dividing said compartments, an inlet to said inlet compartment, an outlet from said outlet compartment, said wall having an opening therethrough provided with a valve seat, a tubular guide in said outlet compartment, a valve slidably mounted in said guide and adapted to engage said seat to close said opening, spring means abutting said valve to seat the same, a lever fulcrumed in said outlet compartment and having one end engaging said valve and having the other end projecting into said extension, resilient means sealing said open extension and directly engaging the other end of said lever, a cover over said resilient means and fixed to said extension, said cover having a transverse hollow boss projecting adjacent said resilient means to limit upward movement thereof, spring means within said transverse boss abutting said resilient means and adjustable in said transverse boss to vary the force of said spring on said resilient means.

3. In an expansion valve, a casing having a hollow open extension thereon, a cup-shaped resilient bellows within said extension and closing the open end thereof, a cover carried by said extension and having a transverse hollow boss extending into said bellows and adjacent the head of said bellows to limit the collapse of said bellows, said casing having an inlet and an outlet, a wall within said casing separating said inlet and said outlet, a passage through said wall, a valve to control said passage, resilient means tending to close said valve, a fulcrum having a lever pivoted thereon, said lever abutting said bellows head and said valve on opposite sides of said fulcrum, spring means within said hollow boss, and a plug in said hollow boss compressing said spring means against said bellows head.

4. In an expansion valve, a casing having a hollow open extension thereon, a cup-shaped resilient bellows within said extension and closing the open end thereof, a cover carried by said extension and having a transverse hollow boss extending into said bellows and adjacent the head

of said bellows to limit the collapse of said bellows, said casing having an inlet and an outlet, a wall within said casing separating said inlet and said outlet, a passage through said wall, a valve to control said passage, resilient means tending to close said valve, a fulcrum having a lever pivoted thereon, said lever abutting said bellows head and said valve on opposite sides of said fulcrum, spring means within said hollow boss, and an adjustable plug within said hollow boss engaging said spring means to compress the same against said bellows head whereby the action of said resilient means is controlled.

5. In an expansion valve, a casing having an inlet compartment and an outlet compartment, a hollow extension on said casing opening into said outlet compartment, an expansible-contractible bellows extending into said extension and having a circumferential flange sealed to the side walls of the extension, a wall within said casing between said compartments having a passage therethrough, the wall of said outlet compartment having an opening therethrough in axial alinement with said passage, a recessed cap member closing said wall opening and having an axial socket therein, a tubular guide having one end seated in said socket, a control valve for said passage having a stem mounted for sliding movement in said guide, a lever pivoted in said outlet compartment between said bellows and said valve and having one arm extending into said extension in contact with said bellows and having the other arm engaging said valve stem, spring means acting on said other arm and tending to close said valve, and adjustable spring means acting on said one arm and tending to open said valve.

6. In an expansion valve, a casing having an inlet and an outlet, a wall within said casing surrounding said inlet, said wall having a passageway therethrough, a valve in said outlet to control said passageway, a stem for said valve, a sleeve in said outlet surrounding said stem to guide said valve to its seat, a spring surrounding said sleeve and abutting said stem and said casing to urge said valve to its seat, a hollow extension on said casing opening into said outlet, a cup-shaped resilient bellows telescoped within said extension, a flange on said bellows projecting outwardly into hermetic engagement with the side walls of said extension, a cap on said extension having a cylindrical hollow boss within said bellows, a coil spring within said boss and abutting the head of said bellows, and a lever pivoted in said casing having one end engaging said head and having the other end engaging said valve stem.

7. In an expansion valve, a casing having an inlet compartment and an outlet compartment, an inlet passage to said inlet compartment, an outlet passage from said outlet compartment, a partition wall between said compartments, said partition wall having an opening therethrough, an apertured plug in said opening having a valve seat in said outlet compartment in axial alignment with said inlet passage, said casing having an opening therethrough in axis alignment with said inlet passage, a cap member having a recess and closing said opening, said cap having a socket opening into said recess, a tubular guide positioned in said socket, a valve for said valve seat, said valve having a stem slidably mounted in said guide, a collar on said stem, a spring abutting said collar and said guide to seat said valve and to hold said guide in its socket, an open-ended hollow boss on said casing communicating with said outlet compartment, a fulcrum in said outlet compartment, a bell crank lever pivoted on said fulcrum, one arm of said lever engaging said collar, the other arm of said lever projecting into said hollow boss, a resilient bellows in said hollow boss, means to seal said bellows to said boss, said bellows having a head engaging said other arm, a cover for said extension, said cover having a hollow transverse boss extending within said bellows adjacent said head to limit movement of said bellows, a spring in said transverse boss engaging said bellows head, means on said bellows head to position said spring, and means to vary the force of said spring on said bellows head.

8. In an expansion valve, a casing having an inlet compartment and an outlet compartment, a hollow extension on said casing opening into said outlet compartment, an expansible-contractible corrugated resilient substantially cylindrical metallic bellows extending into said extension and having a circumferential flange seated on the end of the wall forming said hollow extension, a cap member resting on said flange over the wall of said extension, means tightly clamping said cap member to said extension whereby to seal said flange to said extension, said bellows having a head member sealing its free end, a wall within said casing between said compartments having a passage therethrough, the wall of said outlet compartment having an opening therethrough in axial alinement with said passage, an elongated cap member extending from said casing and sealing said opening, said cap member having a longitudinal recess therein opening into said outlet compartment, said recess terminating at its inner end in a socket, an elongated valve guide having a longitudinal bore and seated at one end in said socket, a control valve for said passage having a stem mounted for sliding movement in said guide, a lever pivoted in said outlet compartment between said bellows and said valve and having one arm extending into said extension in contact with said head member and having the other arm engaging said valve stem, spring means acting on said other arm and tending to close said valve, and adjustable spring means acting on said one arm and tending to open said valve.

9. In an expansion valve, a casing having an inlet compartment and an outlet compartment, a hollow extension on said casing opening into said outlet compartment, an expansible-contractible corrugated resilient substantially cylindrical metallic bellows extending into said extension and having a circumferential flange seated on the end of the wall forming said hollow extension, a cap member sealing the interior of said bellows against ingress of moisture and resting on said flange over the wall of said extension, means tightly clamping said cap member to said extension whereby to seal said flange to said extension, said bellows having a head member sealing its free end, said head member having a socket opening into said outlet compartment, a wall within said casing between said compartments having a passage therethrough, the longitudinal axes of said extension and said passage being transverse to each other, a valve guide fixed in the casing of said outlet compartment in spaced relation to said wall, a control valve for said passage having a stem mounted for sliding movement in said guide, means tending to close said valve, and a lever pivoted in said outlet compartment between said bellows and said valve and having

one arm extending into said extension in contact with said head member and seated in said socket and having the other arm engaging said valve stem.

10. In an expansion valve, a casing having a hollow open extension thereon, a cup-shaped resilient bellows within and sealing said extension, a cover member having a transverse hollow boss extending into said bellows and terminating adjacent the head thereof to limit collapse of said bellows, a plug adjustably threaded in said boss, a coil spring within said boss and held under compression between said plug and the bellows head, said casing having an inlet and an outlet, a partition separating said inlet and outlet and having a valve port having its axis transverse to the axis of said hollow boss, the casing wall having an internally threaded opening concentric with said port, a cap member having an inwardly open recess and threaded into said opening a valve guide seated in said recess, a needle valve cooperable with said port and having a stem extending into said guide, a collar fixed on said stem, a coil spring seated in said recess and abutting said collar to urge said valve to closed position, and a bell-crank lever pivoted in said casing and having one end engaging the bellows head and having its other end engaging said collar whereby to transmit motion from said bellows to said valve.

11. In an expansion valve, a casing having an inlet compartment with an open side and an outlet compartment, a wall within said casing and separating said compartments, a plug member closing said open side and having an inlet passage therethrough, strainer means for said passage projecting from said member into said inlet compartment, said wall having a bore therethrough alined with said passage, a valve seat member threaded into said bore and projecting therethrough into said outlet compartment, a passage through said seat member of reduced internal diameter at its outlet end within said outlet compartment to provide a valve port, a needle valve in said outlet compartment cooperable with said port, and means to operate said valve.

LEWIS W. EGGLESTON.
EDWARD LUPFER AURAND.