June 23, 1953 F. Y. CARTER 2,642,724

INSERT TYPE THERMOSTATIC EXPANSION VALVE

Original Filed Feb. 18, 1946 2 Sheets-Sheet 1

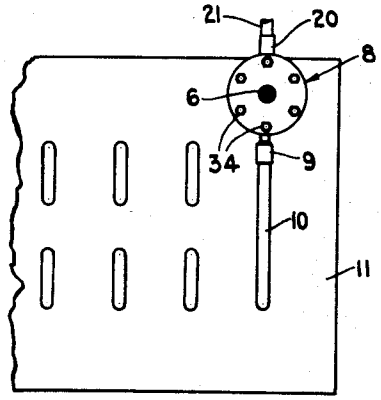


FIG. 2

FIG. 1

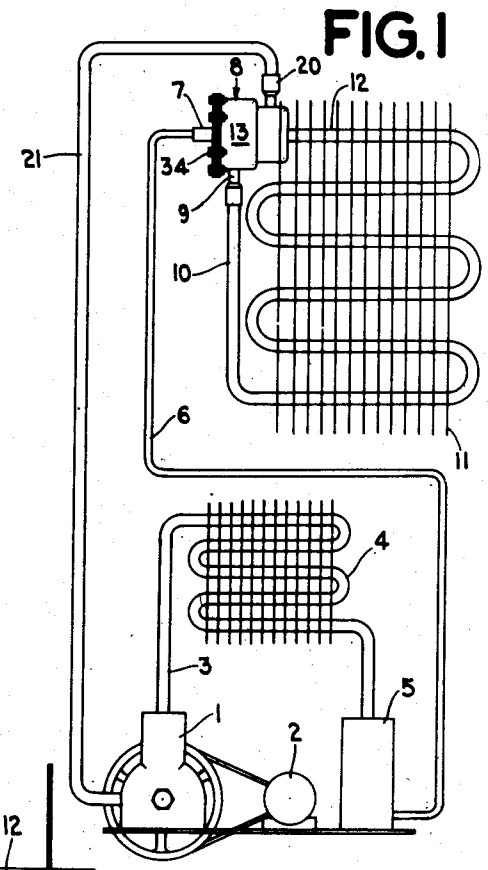
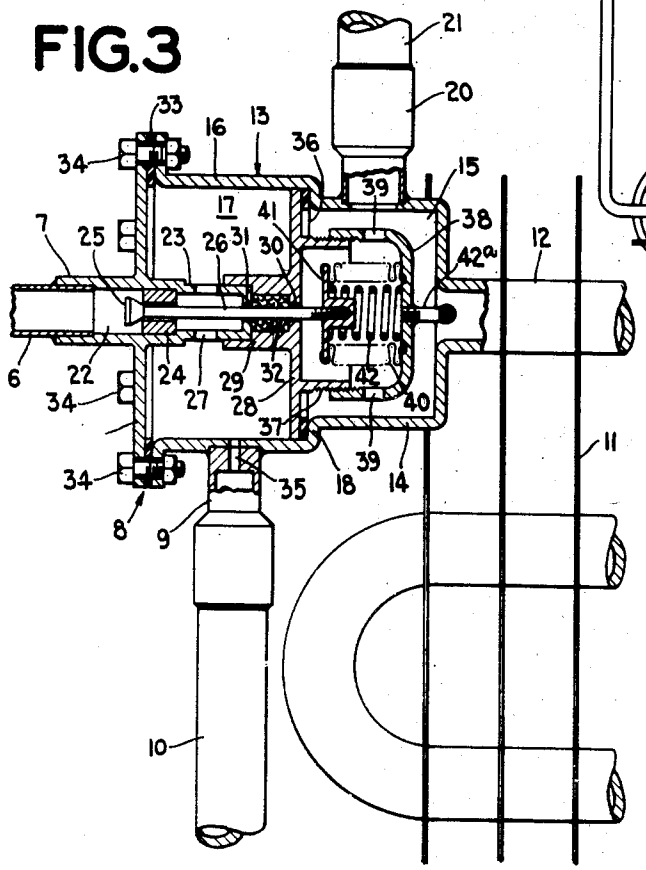


FIG. 3



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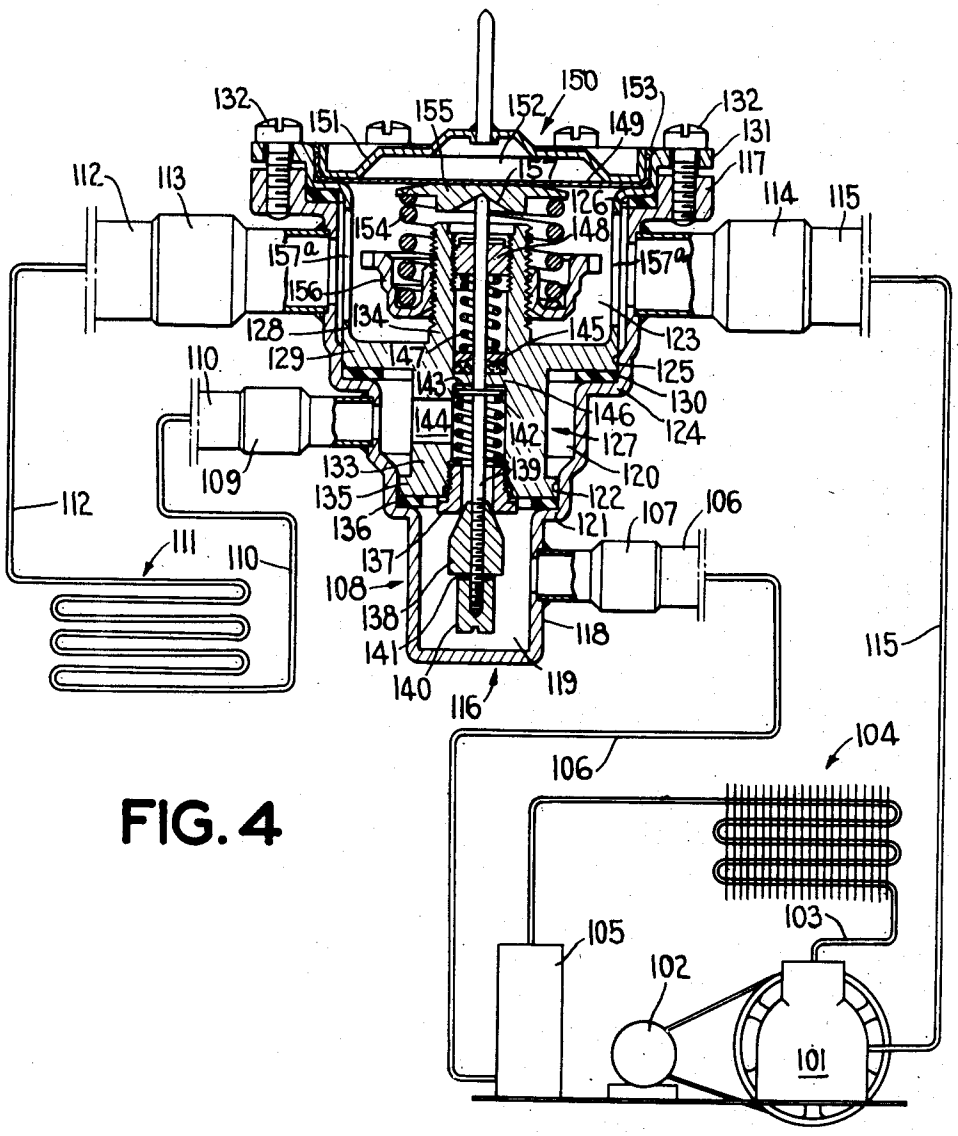


FIG. 4

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UNITED STATES PATENT OFFICE

2,642,724

INSERT TYPE THERMOSTATIC EXPANSION VALVE

Franklyn Y. Carter, Dearborn, Mich., assignor to Detroit Controls Corporation, Detroit, Mich., a corporation of Michigan

Continuation of applications Serial No. 648,222, February 18, 1946, and Serial No. 657,747, March 28, 1946. This application July 20, 1949, Serial No. 105,861

18 Claims. (Cl. 62—8)

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This invention relates to new and useful improvements in refrigerating apparatus and more particularly to a thermostatic expansion valve for use in the apparatus.

An object of the invention is to provide a novel valve structure in which the temperature responsive valve operating element is positioned in the valve casing for direct contact with the refrigerant suction line gases which pass through the valve casing.

Another object of the invention is to provide a valve which can be permanently sealed in the supply and discharge lines or pipes of an evaporator.

Another object of the invention is to provide a valve which may be disassembled in the field without the necessity of breaking the refrigerating system conduit connections.

Another object is to provide a cartridge-like valve mechanism which is bodily removable as a unit from the valve casing.

Another object is to provide such a valve in which the valve mechanism including its thermostatic operating parts is a unit readily separable from the valve casing.

Another object is to provide a valve mechanism unit which may be adjusted for valve operation in a master casing or fixture prior to its final assembly and use.

Other and further objects will appear from the following specification.

The invention consists in the improved construction and combination of parts to be more fully set forth hereinafter and the novelty of which will be particularly pointed out and distinctly claimed.

In the accompanying drawings to be taken as a part of this specification there are fully and clearly illustrated two preferred embodiments of this invention, in which drawings:

Figure 1 is a diagrammatic view of a refrigerating apparatus including an insert type thermostatic expansion valve,

Fig. 2 is a detail view in end elevation of a fin type evaporator forming part of the refrigerating apparatus and showing the expansion valve of Fig. 1,

Fig. 3 is an enlarged detail view showing a part of the evaporator in elevation and showing the expansion valve and its insert mechanism in longitudinal central section, and

Fig. 4 is a diagrammatic view of a refrigerating apparatus showing another form of insert type expansion valve connected to the refrigerant evaporator.

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Referring to the drawings by characters of reference and more particularly to Figs. 1 to 3, the reference numeral 1 designates a compressor driven by an electric motor or the like 2 and discharging through an outlet conduit 3 into a condenser 4 and thence into a receiver 5. A refrigerant liquid line or pipe 6 leads from the receiver 5 and connects to the inlet fitting 7 of the thermostatic suction line type expansion valve 8 having an outlet fitting 9 which is connected to the inlet portion 10 of the finned tube evaporator 11. The outlet portion 12 of the evaporator terminates in the expansion valve casing 13 which is preferably formed integrally with the evaporator. The casing 13 is of enlarged internal diameter as at 14 to provide a suction line chamber 15 and is further enlarged as at 16 to provide a liquid supply chamber 17. These chambers are separated by an internal annular shoulder 18 which faces toward the open end of the casing 13 concentric with the evaporator portion 12 and closed by a circular or disk-shaped cover member 19 which carries the fitting 7. The side wall of the casing portion 14 is provided with an outlet fitting 20 which receives the suction line conduit or pipe 21 which leads to the inlet of the compressor 1.

The cover member 19 has a transverse passageway 22 therethrough within the tubular fitting 7 and a tubular portion or extension 23 within the chamber 17. The passageway 22 contains a valve seat member 24 which provides a valve port controlled by a valve member 25 carried by a thrust rod or stem 26 which extends through the valve seat port. The tubular extension 23 is provided with one or more ports 27 which open into the chamber 17. Carried by the extension 23 there is a partition member 28 having a tubular extension 29 with an internal recess or counterbore at its free end to receive and fit tightly upon the extension 23. The partition member 28 has an aperture 30 therethrough concentric with the valve seat port and with an aperture 31 through the end wall of the extension 23. The stem 26 extends through the apertures 30 and 31, the clearance space around the stem being sealed by packing material 32 within the tubular member 29 and held in place by the end wall of extension 23. The cover member 19 is tightly secured and sealed to a lateral surrounding flange on the casing 13 by an annular gasket 33 and nuts and bolts 34. The liquid refrigerant supply chamber 17 communicates with the evaporator inlet through a restricted or calibrated port 35 through the casing side wall.

The partition member 28 seats on the annular shoulder 18 and has interposed therebetween sealing gasket 36 so that the chambers 15 and 17 are sealed and closed from each other. Within the chamber 15 the partition member 28 has an annular flange 37 which is externally screw threaded and concentric with the valve port. Adjustably screw threaded onto the flange 37 there is a cup-like supporting member 38 having a plurality of flow ports 39 through its side wall so that the chamber 15 is in open communication with the interior of the flange and cap member 38. The end wall of the member 38 carries a temperature and pressure responsive power element formed by an expansible-contractible metal bellows 40 having a movable end wall or head 41. The stem 26 is screw threaded into or otherwise rigidly secured to the power element head 41. Within the power element there is a helical coil spring 42 normally tending to expand the same and normally tending to move the valve member 25 toward open position and which determines the pressure of the refrigerant medium on the wall 41 at which the valve member 25 will engage its seat member 24 for closing off flow through the passageway 22. The power element is provided with a filling tube 42a which is secured in and through the supporting member 38 and through which the interior of the bellows 40 is charged with a temperature responsive liquid such as Freon.

The operation of the apparatus and expansion valve is as follows: Before the expansion valve is permanently and hermetically sealed to the evaporator inlet portion 10 and the suction line conduit 21, the mechanism cartridge is removed from the casing 13 by undoing the nuts and bolts 34 and withdrawing the mechanism. The connections to the conduits 10 and 21 which are preferably by brazing therefore do not result in temperatures which might injure the temperature responsive power element or the sealing gaskets 33 and 36, these of course being also removed. The temperature of soldering or brazing the liquid line 6 to the fitting 7 due to its remoteness from the power element is not sufficient to injure the same. When the valve mechanism has been reassembled and the nuts and bolts 34 tightly pulled up and the apparatus charged with refrigerant medium, then the compressor 1 may be placed in operation for the start of a refrigerating cycle. The valve member 25 will be in open position due to the expanded power element so that liquid refrigerant medium will flow through the valve seat port and into the chamber 17 but due to the restriction 35 will not fully expand in the chamber 17. As the temperature of the coil or evaporator 11 decreases due to the expansion of the refrigerant medium therein, the temperature of the power element which is subjected to the suction line refrigerant gas flowing into the chamber 15 through the evaporator outlet portion 12 will have its internal pressure decreased so that the pressure of the gas in chamber 15 will act against the spring 42 and throttle flow through the valve port. When the evaporator 11 has been completely refrigerated such that the superheat temperature in the chamber 15 is say 10° F., then the pressure of the volatile liquid in the power element will have decreased sufficiently so that the pressure in the chamber 15 can just overcome the spring 42 sufficiently so seat the valve member 25. The slight warming up of the evaporator due to closing of valve member 25 will increase temperature of the power element thereby opening the valve member 25 and accordingly valve member 25 will be throttled so as to keep the evaporator completely refrigerated. When the temperature of the space cooled by the evaporator or the suction line pressure or temperature decreases to the desired point then the motor 2 will be stopped in any of the well known manners until the temperature increases to the point where a new cycle of operation should commence.

In the form of the invention shown in Fig. 4 there is a refrigerant compressor 101 driven by a motor 102 which may be controlled in any conventional manner. The outlet of the compressor is connected by a conduit 103 to a condenser 104 which discharges into a receiver 105. The refrigerant liquid line or conduit 106 extends from the receiver 105 and connects to a tubular fitting 107 in which the conduit is hermetically sealed. The fitting 107 forms the inlet of the expansion valve 108 which has an outlet fitting 109 connected by a conduit 110 hermetically sealed therein and leading to the inlet of the evaporator 111. The refrigerant suction line or conduit 112 from the evaporator outlet connects and is hermetically sealed in a tubular inlet fitting 113 which opens into a suction or pressure chamber within the expansion valve casing. The outlet from this chamber is provided with a tubular outlet fitting 114 in which is hermetically sealed one end of a suction or return conduit 115 having its other end connected to the inlet of the compressor 101. The refrigerating system is charged as is well understood in the art with any suitable refrigerant medium such as "Freon." The valve 108 includes a cup-like casing 116 which is of internally stepped decreasing diameters from its open end which is provided with a surrounding annular flange 117. The cylindrical end portion 118 of smallest diameter or cross sectional area provides an inlet and valve chamber 119 from the side wall of which the fitting 107 projects. Between the chamber 119 and the valve larger diameter outlet chamber 120, the casing has an internal annular shoulder 121 and a cylindrical guide portion 122. Between the outlet chamber 102 and the still larger diameter suction or pressure chamber 123 with which the fittings 113 and 114 communicate, there is an annular internal shoulder 124 and a cylindrical guide portion 125. The flange 117 is provided with an annular recess which receives a packing material sealing washer or gasket 126.

Extending into the casing 116 and readily movable therefrom there is a valve mechanism unit having a housing 127 with an externally cylindrical cup-like portion 128 which slidably fits the guide portion 125 and has its bottom or end wall 129 seating on the shoulder 124. A sealing gasket 130 of suitable packing material seals the joint against communication between the outlet chamber 120 and the pressure chamber 123. The cup-like portion 128 has a recessed rim or surrounding flange 131 which fits and seats in the casing recess upon the gasket 126. Surrounding the washer receiving recess, the flange 117 has a plurality of circumferentially spaced bolt receiving apertures into which clamping bolts or screws 132 are screw threaded and which pass through alined apertures in the flange 131 to tightly clamp the housing member 127 to and within the casing 108. Projecting from the opposite faces of the bottom wall 129 concentric with the side wall of the cup-like portion 128 there is an external tubular extension 133 and an alined internal tubular

extension 134 having their bores in communication through a central aperture in the wall 129. The external extension 133 has an end flange 135 which has a lateral sliding fit with the guide portion 122 and which together with the extension end face seats on the shoulder 121 with a sealing gasket 136 of suitable packing material therebetween. It may be noted that when the bolts 132 are pulled up or tightened that the gaskets 126, 130 and 136 permit of manufacturing tolerances while providing for sealing of the chambers 119, 120 and 123 from each other. In the inlet chamber end of the external extension bore there is a valve seat member 137 with which a valve member 138 having a conical or needle type valve portion cooperates to throttle and control flow through the valve seat member port. The valve member 138 is adjustably screw threaded upon a thrust rod or valve stem 139 and is clamped in adjusted position by a cap nut 140 which is screw threaded upon the end of the stem 139. Leakage through the bore of the valve member 138 around the stem 139 is eliminated by a sealing gasket 141 clamped between the valve member 138 and the nut 140. The valve member 138 is urged toward closed position and in engagement with the seat member 137 by a helical spring 142 which surrounds the stem 139 and is held under compression between the outlet end of the seat member 137 and a flange 143 secured to the stem 139. The bore of the extension 133 communicates with the outlet chamber 120 through a side wall aperture or port 144. The stem 139 extends longitudinally through the bore of the internal extension 134 and projects therefrom. Communication from the outlet chamber 120 with the pressure chamber 123 around the stem 139 is prevented by packing material 145 which is held under compression against an annular flange 146 by a helical spring 147 which abuts a guide member 148 within the extension 134 and through which the stem 139 slidably passes. The opening of the cup-like housing portion 128 is closed and sealed by a metal diaphragm 149 which is movable by pressure changes in the chamber 123. The diaphragm 149 also forms the pressure movable wall of a thermostatic power element 150 having a cap or cover member 151 which forms with the diaphragm an expansible chamber 152. The diaphragm 149 is hermetically sealed to the cap member 151 and to the flange 131 by a solder seal as at 153. The chamber 152 is charged with a minute quantity of volatile liquid such as "Freon" or methyl chloride such that at temperatures above the operating temperature of the valve or system, the volatile liquid will be all in gas phase as is well understood in the art. The temperature at which the valve member 138 will be opened by the power element 150 is determined by a helical coil spring 154 which surrounds the extension 134 and is held under compression between a pad or pressure plate 155 which abuts the diaphragm and adjustable spring supporting member 156 which is screw threaded for longitudinal movement on the extension 134. The plate member 155 has a central conical recess 157 which receives and locates the free end of the valve stem 139. The cup-like housing portion 128 has opposite apertures 157a through its side wall and registering with the fittings 113 and 114 so that refrigerant medium returning to the compressor from the evaporator passes through the interior of the housing cup-like portion 128.

The operation of this form of insert type valve is as follows: After the casing 108 has been hermetically sealed to the liquid and suction line conduits at the fittings 107, 109, 113 and 114 and the valve mechanism unit has been adjusted in a master casing or fixture by the desired tensioning of the spring 154 and adjustment of the valve member 138, the valve mechanism unit is inserted into the casing 108 and clamped and sealed in position by the bolts or screws 132. When the motor 102 is placed in operation, refrigerant medium will be discharged through the open valve into the evaporator 111 and as unevaporated refrigerant medium approaches the pressure chamber 123, the temperature of the refrigerant medium in the chamber 123 will decrease. When the temperature and therefore the pressure in the power element 150 is thus reduced substantially to the operating range of the system, then the spring 154 will act to overcome the power element 150 and move the valve member 138 toward closed position. When the evaporator 111 is completely refrigerated, the power element 150 will operate in its normal manner as is well understood in the art, to throttle the flow of refrigerant medium to the evaporator to maintain it at maximum efficiency.

Should it be desired to replace the valve mechanism unit, it is only necessary to "pump down" the system and then remove the mechanism unit 127 by unscrewing the bolts 132. A new unit can then be bolted in place without breaking the hermetically sealed tube connections.

It should be noted that the restriction 35 shown in Fig. 3 is equally applicable to the type of expansion valve shown and described in Fig. 4 to prevent premature expansion of refrigerant and the resulting possibility of "freeze up" of the valve. It should also be noted that in either form of expansion valve shown the outlet restriction could be eliminated in which case the valve would function properly most of the time but would be subject to occasional "freeze up." The term "freeze up" as herein used refers to a condition which occurs occasionally in suction line type expansion valves wherein the premature expansion of refrigerant passing through the throttled valve opening results in excessive cooling of the valve which causes the thermostatic power element to close the valve prematurely.

This application is a continuation of my copending applications Serial No. 648,222, filed February 18, 1946, and Serial No. 657,747, filed March 28, 1946. The latter application is now abandoned.

Having thus described the invention what is claimed and desired to be secured by Letters Patent is:

1. An expansion valve comprising a casing having an open end portion, a cover member for said open portion, a partition member dividing said casing into a suction line chamber and a refrigerant supply chamber, a valve member for controlling admission of refrigerant to said refrigerant supply chamber, responsive means open to said suction line chamber and responsive to the temperature and pressure of the refrigerant passing therethrough, means operatively connecting said responsive means to said valve member and operable to move said valve member upon movement of said responsive means, and said cover member, said partition member, said valve member, said responsive means, and said connecting means being operatively interconnected

as a unit for insertion or withdrawal from said casing.

2. An expansion valve comprising a casing having an open end portion, an insert assembly insertable through and closing said casing open end portion, a partition carried by said insert assembly and dividing the space within said casing into a suction line chamber and a refrigerant supply chamber, sealing means cooperating with said insert assembly and said casing at a point between said chambers and preventing flow therebetween around said insert assembly, an inlet and an outlet to said suction line chamber, an inlet and an outlet to said refrigerant supply chamber, a valve seat member having a valve port between said last-named inlet and outlet and carried by said insert assembly, a valve member closing said port and a valve stem cooperable therewith carried by said insert assembly, and temperature and pressure responsive means carried by said insert assembly and open to said suction line chamber for response to refrigerant flowing therethrough, said responsive means being cooperable with said valve stem for controlling movement of said valve member.

3. An expansion valve comprising a cup-shaped casing having a closed base and an open end, an insert assembly insertable through and closing said casing open end, said insert assembly having an intermediate portion cooperable with the walls of said casing to seal and divide the same into a suction line chamber and a refrigerant supply chamber, an inlet and an outlet to said suction line chamber, an inlet and an outlet to said refrigerant supply chamber, said insert assembly carrying on one end a responsive means open to the suction line chamber for response to pressure of refrigerant flowing therethrough, said insert assembly having at its other end a passageway and valve port interposed between the inlet and outlet of said refrigerant supply chamber for controlling flow therebetween, a valve member controlling flow through said port, and a valve stem guided in and carried by said insert assembly and operated by said responsive means.

4. An expansion valve comprising a cup-shaped casing having a closed base and an open end, an insert assembly insertable through and closing said casing open end, said insert assembly having a portion forming a partition cooperable with the walls of said casing to seal and divide the same into a suction line chamber and a refrigerant supply chamber, an inlet and an outlet to each of said chambers, said insert assembly having a small tubular projection extending from one side of said partition portion and a larger tubular projection extending from the other side thereof and a bore interconnecting said projections, said small projection extending into said refrigerant supply chamber and being communicable at its end with the inlet to said chamber and having a side wall aperture open to said chamber in communication with the outlet therefrom, said small projection having a valve seat portion forming a valve port between the inlet and outlet of said refrigerant supply chamber, a valve stem extending through said projections and said interconnecting bore and carrying on one end a valve member cooperable with and controlling flow through said valve port, said larger projection extending into said suction line chamber and carrying on its end a thermostatic power element, one or more passageways opening into the space within said larger projection to permit flow of refrigerant therein for power element response, and said power element acting on said valve stem to modulate the position of said valve member in accord with the temperature and pressure of refrigerant in said suction line chamber.

5. In a refrigerating apparatus, an evaporator having an outlet portion terminating in a valve casing having an open end and an internal shoulder concentric with said end, a partition member seating on said shoulder and separating said casing internally into a suction line chamber and a refrigerant supply chamber, said casing having an outlet from said suction chamber and an outlet from said supply chamber connected to the inlet of said evaporator, a cover member for said casing open end and having a transverse passageway therethrough opening into said supply chamber, said passageway having a valve port, a valve member in said passageway for controlling flow through said port, means in said suction chamber and responsive to pressure and temperature of the refrigerant therein, said partition member having an aperture therethrough, means extending through said aperture and operatively connecting said responsive means to said valve member, and means reducing vaporization of refrigerant in said supply chamber.

6. In a refrigerating apparatus, an evaportor having an outlet portion terminating in a valve casing having an open end and an internal shoulder concentric with said end, a partition member seating on said shoulder and separating said casing internally into a suction line chamber and a refrigerant supply chamber, said casing having an outlet from said suction chamber and an outlet from said supply chamber connected to the inlet of said evaporator, a cover member for said casing open end and having a transverse passageway therethrough opening into said supply chamber, said passageway having a valve port, a valve member in said passageway for controlling flow through said port, said partition member having an aperture therethrough, an expansible-collapsible sealed casing having a movable wall, means rigidly securing said sealed casing to said partition member, means extending through said aperture and operatively connecting said movable wall to said valve member, and means reducing vaporization of refrigerant in said supply chamber.

7. An expansion valve, comprising a casing having an open end and an internal annular shoulder facing said end, a cover member for said open end and having an inlet passageway therethrough, a partition member having an aperture therethrough and seating on said shoulder, said partition member separating said casing into a suction line chamber and a refrigerant supply chamber, a valve member in said passageway, movable means in said suction line chamber and responsive to changes of temperature and pressure in said suction line chamber, operating means extending through said partition member aperture and operatively connecting said movable means to said valve member, said casing having an outlet from said supply chamber and having an inlet to and an outlet from said suction line chamber, and means restricting flow from said supply chamber outlet.

8. An expansion valve, comprising a casing having an open end and an internal annular shoulder facing said end, a cover member for said open end and having an inlet passageway therethrough, a partition member having an aperture therethrough and seating on said shoulder, means on said cover member holding said partition

member against said shoulder, said partition member separating said casing into a suction line chamber and a refrigerant supply chamber, a valve member in said passageway, movable means carried by said partition member within said suction line chamber and responsive to changes of temperature and pressure in said suction line chamber, operating means extending through said partition member aperture and operatively connecting said movable means to said valve member, said casing having an outlet from said supply chamber and having an inlet to and an outlet from said suction line chamber, and means restricting flow from said supply chamber outlet.

9. An expansion valve, comprising a casing having an open end and an internal annular shoulder facing said end, a cover member sealing said open end, tubular means extending transverse to and projecting from opposite sides of said cover member, a partition member carried by and extending radially from said tubular means and seating at its outer periphery on said annular shoulder, said partition member dividing said casing into a refrigerant supply chamber and a suction line chamber, said tubular means forming a valve chamber having an inlet and a valve seat and an outlet into said supply chamber, said partition member having an aperture therethrough in line with said valve seat and having an annular flange in said suction chamber and surrounding said aperture, a cup-like supporting member carried by said flange, a fluid charged power element responsive to pressure and temperature changes in said suction chamber and mounted on and within said supporting member, said power element having a movable wall facing said aperture, a valve member cooperable with said seat, an operating rod interconnecting said wall and said valve member, means sealing said aperture around said rod, said casing having an outlet from said supply chamber and having an inlet and an outlet for said suction chamber, and means to restrict flow from said supply chamber outlet.

10. An expansion valve comprising a casing having an open end portion, a cover member for said open end portion, a partition member dividing said casing into a suction line chamber and a refrigerant supply chamber, a valve member for controlling admission of refrigerant to said refrigerant supply chamber, means in said suction line chamber responsive to the temperature and pressure of refrigerant passing therethrough, means operatively connecting said responsive means to said valve member and operable to move said valve member upon movement of said responsive means, means operable to reduce vaporization of refrigerant in said refrigerant supply chamber; and said cover member, said partition member, said valve member, said responsive means, and said connecting means being operatively interconnected as a unit for insertion or withdrawal from said casing.

11. An expansion valve comprising a casing having an open end portion, a cover member for said open end portion, a partition member dividing said casing into a suction line chamber and a refrigerant supply chamber, a valve member for controlling admission of refrigerant to said refrigerant supply chamber, responsive means open to said suction line chamber and responsive to the temperature and pressure of refrigerant passing therethrough, means operatively connecting said responsive means to said valve member and operable to move said valve member upon movement of said responsive means, means restricting flow of refrigerant from said refrigerant supply chamber thereby to reduce vaporization of refrigerant in said refrigerant supply chamber; and said cover member, said partition member, said valve member, said responsive means, and said connecting means being operatively interconnected as a unit for insertion of withdrawal from said casing.

12. A thermostatic expansion valve, comprising a casing having an open end and having inlet and outlet chambers with an annular shoulder between them and having a suction line chamber with an inlet and an outlet with an annular shoulder between it and said chambers, a valve mechanism bodily removable from and insertable into said casing and having a housing with an end portion seatable on said first-named shoulder to separate said inlet and outlet chambers, said housing having a side wall apertured cup-like portion positioned within said suction line chamber and having its base seatable on said second-named shoulder to separate said suction line chamber from said inlet and outlet chambers, said housing having an end flange seatable on the open end portion of said casing to close said suction line chamber, said housing having a passageway therethrough connecting said inlet and outlet chambers, a valve member carried by said housing and operable to control flow through said passageway, temperature and pressure responsive means having a pressure-movable wall closing the open end of said housing cup-like portion, said pressure-movable wall being subjected to pressure in said suction line chamber through the apertured wall, and means operatively connecting said pressure-movable wall to said valve member.

13. A thermostatic expansion valve comprising a cup-like casing having a plurality of different internal diameters with annular shoulders therebetween separating said casing into an end inlet chamber, an intermediate outlet chamber and an end pressure chamber, said casing having an inlet and an outlet for said pressure chamber, an inlet to said inlet chamber and an outlet from said outlet chamber, a flange on said casing surrounding the open end of said pressure chamber, a housing member having a cup-like portion extending through said pressure chamber and having a bottom wall seating on the shoulder between said pressure chamber and said intermediate chamber, said cup-like portion having side wall apertures for flow therethrough via said pressure chamber inlet and outlet and having a flange seating on said casing flange, said housing member having a tubular extension concentric with and projecting from said bottom wall, said extension having a side wall aperture opening into said outlet chamber and having its free end seating on the annular shoulder between said inlet chamber and said intermediate chamber, a temperature responsive power element having a movable wall closing and sealing the open end of said cup-like portion, a valve member in said inlet chamber and controlling flow through said extension, and a thrust rod extending longitudinally through said tubular extension and operatively connecting said movable wall to said valve member.

14. A thermostatic expansion valve comprising a casing, a housing member telescoped within said casing, said casing having an open end and a plurality of stepped internal cylindrical portions, an inlet chamber defined by the small-

est of said cylindrical portions and opening into a larger portion forming a guide, the wall of said guide cooperating with said smallest portion to form an annular shoulder, an outlet chamber defined by the cylindrical portion next larger than said guide, a second guide defined by the cylindrical portion next larger than said outlet chamber and having its wall cooperable with said outlet chamber to form an annular shoulder, a pressure chamber adjacent the casing open end and defined by the largest of said cylindrical portions, said housing member having a surrounding end flange seating on the open end portion of said casing, said housing member having a cylindrical cup-like portion slidably fitting said second-named guide and with its bottom wall seating on said second-named shoulder and separating said outlet chamber and said pressure chamber, said housing member having a tubular extension with a cylindrical portion slidably fitting said first-named guide and with the cylindrical portion end face seating on said first-named shoulder, a thermostatic power element having a pressure-movable wall closing and sealing the open end of said cup-like portion, said tubular extension having an outlet aperture opening into said outlet chamber, a valve seat member in the inlet chamber end of said tubular extension, a valve member in said inlet chamber and engageable with said seat member, a tubular extension alined with and opening into said tubular extension and projecting into said cup-like portion from said bottom wall, a thrust rod extending longitudinally through said extensions and operatively connecting said valve member to said pressure-movable wall, means in one of said tubular extensions between said outlet aperture and said cup-like portion and operable to close off flow around said thrust rod, said casing having an inlet to an outlet from said pressure chamber, said cup-like portion having apertures through its side wall alined with said inlet and said outlet, and means resisting operation of said valve member by said thermostatic element.

15. A valve mechanism comprising a housing member having an externally cylindrical cup-like portion with opposite openings through its side wall and with a rim flange, oppositely extending alined tubular extensions projecting from the end wall of said portion, said end wall having an aperture therethrough alined with the extension bores, the external one of said extensions having a side wall aperture, a valve seat member in the bore of said one extension, a valve member external of said housing member and engageable with said seat member, a diaphragm closing and sealing the open end of said cup-like portion, a thrust rod secured to said valve member and having operative engagement with said diaphragm, a flange on said thrust rod, a coil spring surrounding said rod and interposed between said flange and said seat member and urging said valve member toward said seat member, a spring supporting member adjustably screw threaded on the internal one of said extensions, a helical spring interposed between said supporting member and said diaphragm and opposing valve member opening movement by said diaphragm, and means closing off flow from said extension bores into said cup-like portion.

16. A valve insert assembly for a refrigeration expansion valve comprising a larger and a smaller disc-shaped wall member, a tubular extension connecting the centers of said wall members, said extension having side wall apertures at a point between said wall members, a valve seat member providing a valve port in said extension adjacent said larger wall member, an enlarged tubular extension on said smaller wall member, said last-named extension having an end closure carrying a thermostatic power element, one or more passageways opening into the space enclosed by said enlarged extension and end closure, a valve stem extending from said power element through said first-named extension and through said valve port, and a valve member carried by said stem and cooperable with said valve port.

17. A valve mechanism comprising a housing member having an externally cylindrical cup-like portion with opposite openings through its side wall and with a rim flange, oppositely extending alined tubular extensions projecting from the end wall of said portion, said end wall having an aperture therethrough interconnecting the bores of said tubular extensions, the external one of said extensions having a side wall aperture, a valve seat member in the bore of said one extension, a valve member external of said housing member and engageable with said seat member, a diaphragm closing and sealing the open end of said cup-like portion, a valve stem guided in said extension bores and carrying said valve member at one end and arranged for operation by said diaphragm at the other end, a spring supporting member adjustably screw threaded on the internal one of said extensions, a helical spring interposed between said supporting member and said diaphragm and opposing valve member opening movement by said diaphragm, and means closing off flow from said extension bores into said cup-like portion.

18. An expansion valve comprising a casing having an open end portion, a cover member for said open portion, a partition member dividing said casing into first and second chambers, a valve seat member having a valve port for admission of refrigerant, a valve member for controlling flow of refrigerant through said valve port, a temperature and pressure responsive single power element carried by said cover member and open to said second chamber for response to a condition of refrigerant therein, means operatively connecting said power element to said valve member for responsive movement thereby; and said cover member, said partition member, said valve member, said power element, and said connecting means being operatively interconnected as a unit for insertion or withdrawal from said casing.

FRANKLYN Y. CARTER.

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