July 22, 1952 B. H. HUGHES 2,604,119

RESTRICTOR FOR REFRIGERATION SYSTEMS

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FIG. 1.

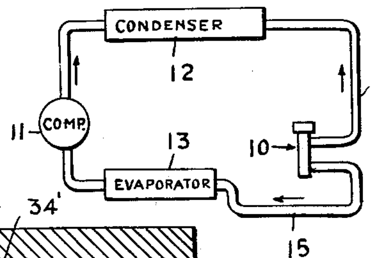


FIG. 2.

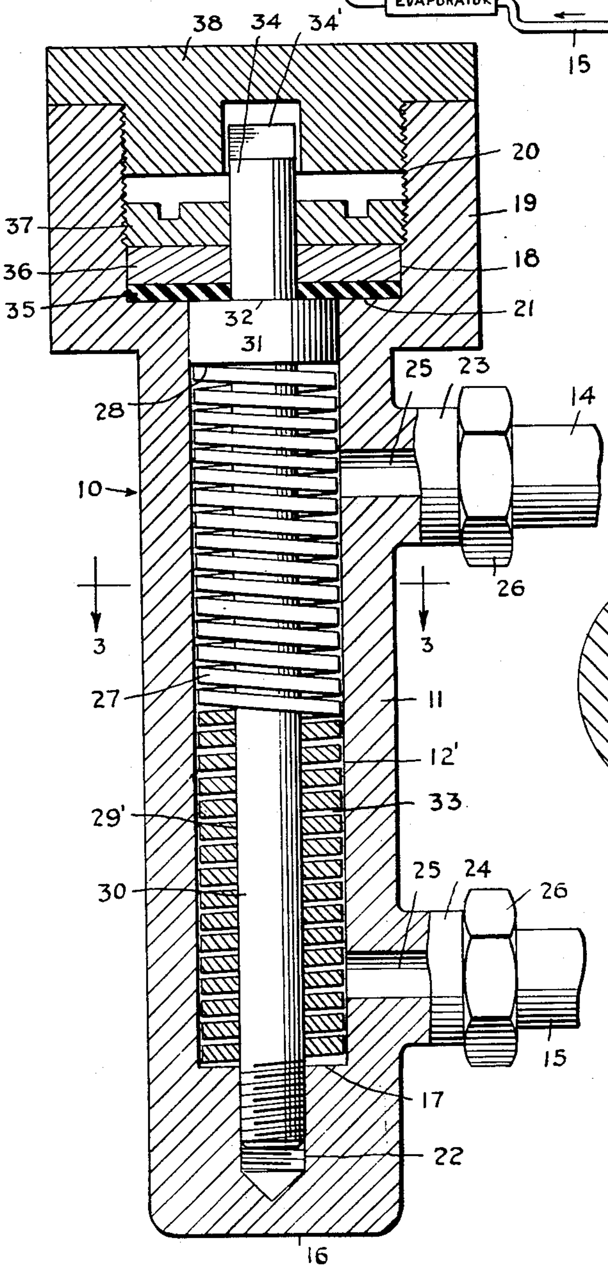


FIG. 4.

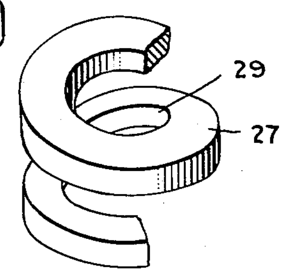
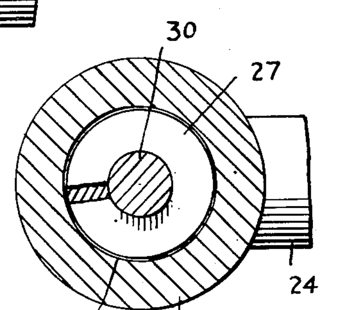


FIG. 3.



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RESTRICTOR FOR REFRIGERATION SYSTEMS

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5 Claims. (Cl. 138—43)

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My invention relates to a fluid pressure reducing device.

An important object of the invention is to provide an adjustable fluid pressure reducing device or restrictor for refrigeration systems, wherein it is necessary to reduce the pressure of the coolant between the condenser or high pressure side of the system and the evaporator or low pressure side thereof.

A further object of the invention is to provide a restrictor of the above mentioned character, wherein the restricted passage is formed by the coils of a spring, a casing holding the spring, and a stem passing axially through the spring, the spring being compressed to vary the cross-sectional area of the restricted passage.

A further object of the invention is to provide a restrictor of the above mentioned character which is very easy to adjust, assemble and dismantle.

Other objects and advantages of the invention will be apparent during the course of the following description:

In the accompanying drawings, forming a part of this application, and in which like numerals are employed to designate like parts throughout the same,

Figure 1 is a diagrammatic view of a refrigeration system including a restrictor embodying my invention,

Figure 2 is a greatly enlarged central vertical longitudinal section through the restrictor,

Figure 3 is a horizontal transverse section taken on line 3—3 of Figure 2, and,

Figure 4 is a fragmentary perspective view of a coil spring embodied in the restrictor.

In the drawings, where for the purpose of illustration is shown a preferred embodiment of my invention, the numeral 10 designates generally a fluid pressure reducing device or restrictor connected in a refrigeration system embodying the usual compressor 11, condenser or radiator 12 and cooler or evaporator 13. In the system, the refrigerant flows from the compressor to the condenser, as shown, and from the condenser into the restrictor 10, by way of a conduit or tube 14. After flowing through the restrictor 10, and having its pressure reduced thereby, the refrigerant flows through a conduit or tube 15 to the evaporator 13.

The restrictor 10 comprises an elongated cylindrical body or casing 11′ having a central longitudinal cylindrical recess or bore 12′ terminating inwardly of one end 16 of the casing 10 for forming a bottom or shoulder 17. The opposite end

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of the bore 12′ opens into an enlarged counter-bore or recess 18 formed centrally in an enlarged cylindrical extension or housing 19, integral with the casing 10. The counter-bore 18 and bore 12′ are concentric, as shown. The counter-bore 18 opens through the outer end of the head 19 and has its outer portion screw-threaded as shown at 20. A wide flat annular shoulder or seat 21 is provided at the top or open end of the bore 12′ by the bottom of the counter-bore 18 and surrounding the bore 12′, as shown. A central reduced screw-threaded bore or opening 22 is formed in the end 16 and is concentric with the bore 12′. Near and inwardly of the opposite ends of the bore 12′, the casing 10 is provided with a pair of longitudinally spaced radial tubular extensions or nipples 23 and 24, integral therewith, and having inlet and outlet passages or bores 25 leading into the bore 12′ near its opposite ends. The nipples 23 and 24 are connected with the conduits 14 and 15 respectively by coupling devices 26 of any suitable type.

Mounted within the bore 12′ and removable therefrom and extending for substantially the entire length of the bore 12′ is a resilient spirally wound coil spring 27 formed of wire which is rectangular in cross-section as shown. One end of the spring 27 engages the bottom or shoulder 17 and its opposite end terminates inwardly of or below the seat 21, as at 28. The outside circumference of the spring is grounded while the spring is compressed, to provide an accurate cylindrical form, and the inside circumference of the spring is grounded when the spring is at its free length. When the spring 27 is inserted into the bore 12′ and the spring is in its free state or under no compression, the outside circumference of the spring is slightly smaller than the diameter of the cylindrical bore 12′, providing an annular clearance between the same which may be from .003 to .005 inch. The inside circumference or bore 29 of the spring is accurately ground and is cylindrical and is concentric with the bore 12′ and opening 22, for receiving an elongated straight cylindrical stem or rod 30, which has a close sliding or liquid tight fit within the cylindrical bore of the spring 27, when the spring is free or elongated. The stem or rod 30 extends through the entire length of the spring and has its inner end screw-threaded to engage within the screw-threaded opening 22, as shown. Adjacent to the outer end of the spring, the stem or rod carries an enlarged cylindrical head 31, integral therewith and slidably engaging within the bore 12′ and its outer end or face 32 is flush with the seat

21. The cylindrical head 31 contacts with the adjacent end of the coil spring 27, as shown. A restricted passage 33 is formed by the turns of the coil spring 27, between the periphery of the stem or rod 30 and the bore 12′ and this restricted passage 33 is in communication with the bores or passages 25. The restricted passage 33 is continuous and uninterrupted throughout the entire length of the spring so that the liquid refrigerant can pass from the conduit 14 to the conduit 15.

Outwardly of the head 31, there is a stem or rod extension 34 having a flat 34′ by means of which the stem or rod 30 may be turned. The extension 34 is in effect a continuation of the stem 30. The extension 34 terminates within the counter-bore 18.

A flat compressible sealing gasket or washer 35 surrounds the extension 34 within the counter-bore 18 and engages the seat 21 and head 31. A flat washer or disc 36 engages the outer side of the gasket 35, and a flat compression nut 37 is mounted within the screw-threaded portion 20 of the counter-bore 18 outwardly of the washer 36 for tightly clamping the gasket 35 against the shoulder 21 and head 31. A removable screw-threaded cap or plug 38 is provided for the outer end of the head 19, as shown.

In use, with the parts assembled as shown and described, the liquid refrigerant flows from the condenser 12, through the conduit 14 and nipple 23 into the upper end of the restricted passage 33 of the restrictor. The refrigerant passes through the restricted passage 33 and is expanded and is delivered through the conduit 15 to the evaporator 13 and is returned to the intake side of the compressor, and passes from the outlet side of the compressor to the condenser 12. This is the usual cycle of operation occurring in a refrigerator.

When it is desired to vary the cross-sectional area of the restricted passage 33, to reduce the same, the cap 38 is removed, and a tool applied to the square 34′ and the stem 30 turned. Since the low end of this stem has screw-threaded engagement within the screw-threaded bore 22, the stem 30 moves downwardly, placing the spring 20 under compression and shortening same. When the spring is placed in the bore 12′, before it is placed under compression, it is free and the restricted passage will have the maximum transverse area. The stem 30 is screwed until the head 31 contacts with the upper end of the spring, but the spring is not compressed. When the stem 30 is turned to place the spring under compression, as stated, the turns of the spring 27 expand radially which is permitted by the slight clearance between the outer circumference of the spring and wall of the cylindrical bore 12′. The inner circumference of the spring will move radially outwardly from the stem 30, and there will be a slight clearance between the inner circumference of the spring and the cylindrical stem 30. Since the clearance between the outer circumference of the spring 27 and the bore 12′ may be from .003 to .005 of an inch, the clearance between the inner circumference of the spring and the stem 30 will be from .003 to .005 of an inch, depending upon the degree of compression of the spring. However, the longitudinal movement of the spring, due to compression, is much greater than the radial movement of the turns of the spring, and the clearance between the inner circumference of the spring and the stem is compensated for by corresponding reduction of clearance between the outer circumference of the spring and the bore 12′. If the compression of the spring 27 is sufficient, the clearance at the outer circumference of the spring is completely closed. A small amount of the liquid refrigerant will pass through the outer or inner clearances, or both, depending upon the degree of compression of the spring and since these clearances are much less than the cross-sectional area of the restricted passage 33, the major portion of liquid refrigerant will pass through the restricted passage 33. It is thus apparent that by turning the stem 30, the spring 28 may be compressed, and the cross-sectional area of the restricted passage 33 varied or decreased.

It is to be understood that the form of the invention herewith shown and described is to be taken as a preferred example of the same and that various changes in the shape, size and arrangements of parts may be resorted to, without departing from the spirit of the invention or the scope of the subjoined claims.

Having thus described my invention, I claim:

1. A restrictor comprising a casing having a cylindrical bore and an inlet arranged near one end and an outlet arranged near the opposite end, said opposite end having a screw-threaded recess concentric with the bore, a cylindrical stem of smaller diameter than the bore of the casing and extending longitudinally of the casing in concentric relation thereto and having one end screw-threaded to engage within the screw-threaded recess, a head secured to the stem and arranged within the opposite end of the bore, and a coil spring arranged within the casing and surrounding the stem, said spring having its turns formed rectangularly in cross-section and having its outer and inner circumferences accurately ground, the spring when free having its inner circumference slidably contacting with the cylindrical stem, and its outer circumference slightly spaced from the casing to permit a radial expansion of the turns of the coil spring when the spring is compressed, and packing means connected with the casing and arranged exteriorily of and adjacent to the head.

2. A restrictor comprising a casing having a cylindrical bore and an inlet near one end and an outlet near the opposite end, one end of the casing being closed and having a screw-threaded recess concentric with the bore, a housing carried by the open end of the casing, a cylindrical stem extending longitudinally within the casing and concentric with the bore and having one end screw-threaded and engaging within the screw-threaded recess of the casing, a head mounted upon the stem and arranged within the bore, the stem extending outwardly beyond the head into the housing, a longitudinally extending coil spring mounted within the casing and surrounding the stem and having spaced turns which are rectangular in cross-section, said spring having an outer cylindrical circumference which is spaced slightly from the casing when the spring is free and an inner cylindrical circumference which slidably contacts with the stem when the spring is free, the spring being compressed by turning the stem, packing within the housing outwardly of the head, and means to compress the packing including a head having screw-threaded engagement within the housing.

3. A restrictor comprising a casing having a cylindrical bore and inlet and outlet openings leading from the bore, a stem extending longi-

tudinally within the bore of the casing and spaced from the side wall thereof for forming an annular passage in communication with said inlet and outlet openings, a cylindrical coil spring mounted within the annular passage and surrounding the stem and having its coils occupying substantially the entire volume of the annular passage, there being a slight space between the periphery of the spring and said side wall, the coils of the spring being spaced to form a restricted passage between the inlet and outlet openings, and means to compress the spring to vary the cross-sectional area of the restricted passage.

4. A restrictor comprising a casing having a cylindrical bore and inlet and outlet openings leading from the bore, a stem extending longitudinally within the bore of the casing and spaced from the side wall thereof and forming a relatively narrow annular passage between the side wall of the casing and the stem which is in communication with the inlet and outlet openings, a coil spring arranged within the annular passage and surrounding the stem and having its coils formed rectangularly in cross-section, the outer circumference of the spring being spaced slightly from the side wall of the casing to permit slight radial expansion of the spring when the same is compressed, the spring substantially filling the annular passage and having its coils spaced apart sufficiently to form a

restricted passage between the inlet and outlet openings, and adjustable means to vary the length of the spring and the cross-sectional area of said restricted passage.

5. A restrictor comprising a casing having a bore and inlet and outlet openings leading from the bore, a stem extending longitudinally within the bore of the casing and spaced from the side wall thereof for forming a passage between the stem and side wall and in communication with said inlet and outlet openings, a coil spring disposed within said passage and surrounding the stem and having its coils occupying substantially the entire volume of the passage, the coils of the spring being spaced apart to form a restricted passage between the inlet and outlet openings, and means to compress the spring to vary the cross-sectional area of the restricted passage.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
960,080	Fay et al.	May 31, 1910
2,451,387	Harvuot	Oct. 12, 1948
2,506,152	Hunter	May 2, 1950