

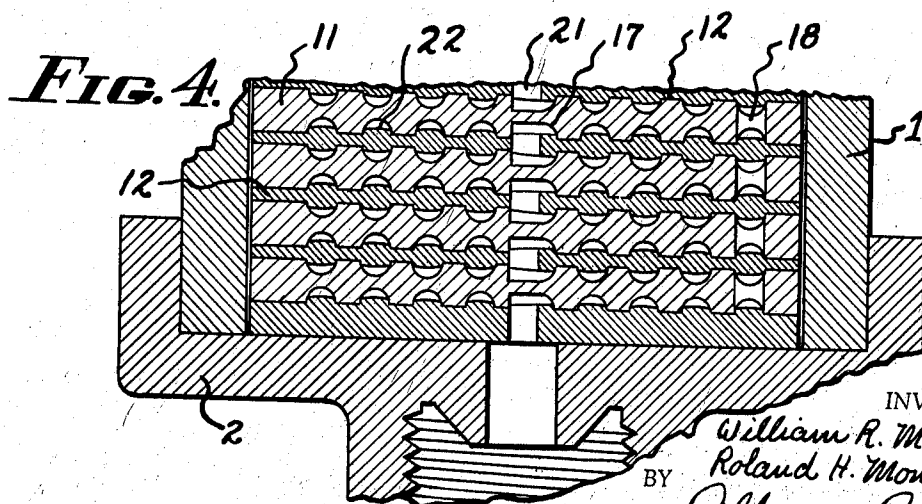
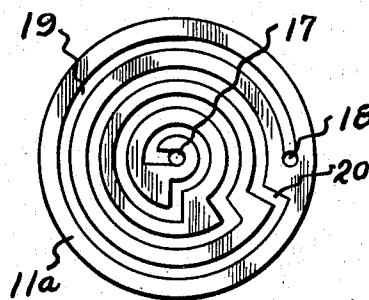
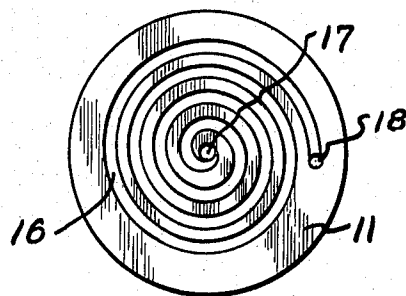
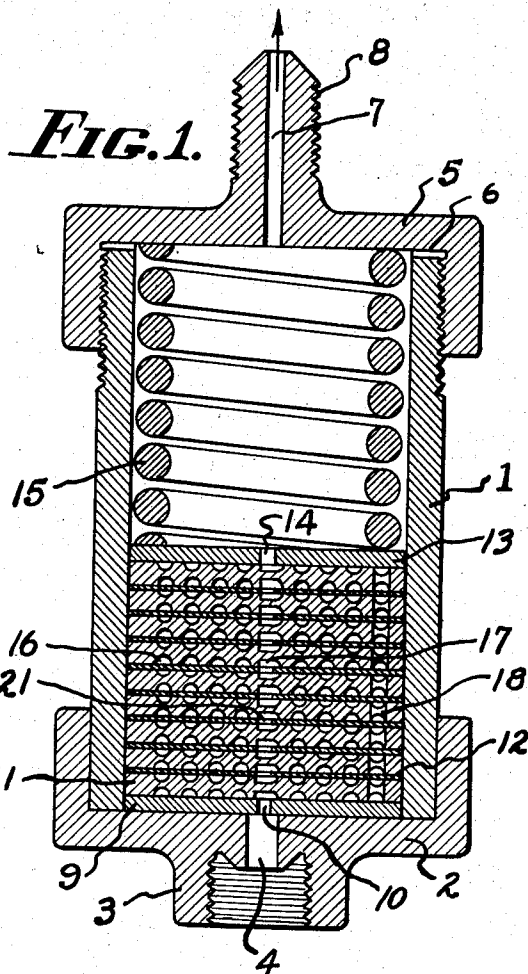
Nov. 12, 1935.

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2,021,079

RESTRICTED FLOW DEVICE

Filed April 23, 1934



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2,021,079

RESTRICTED FLOW DEVICE

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Application April 23, 1934, Serial No. 722,049

7 Claims. (Cl. 138—42)

Our invention relates to restricted flow devices in general, and while it has many other applications, we will describe it for the purpose of an exemplary disclosure in an embodiment which is a device to be inserted between the high pressure and low pressure portions of a refrigeration device. As is well known, it is necessary to provide some means which will control the flow of liquefied refrigerant from the condenser in a refrigerating device to the evaporator. Float valve mechanisms have been used for this as well as pressure reducing valve mechanisms. These are properly not restricted flow devices, but rather controlled flow devices. Elongated capillary tubes have also been used for the purpose.

It is an object of our invention to provide a new type of restricted flow device which will have the following signal advantages over any other type of restricted flow devices heretofore used:

(1) It is adjustable without substitution of parts to provide a normal rate of flow which can be varied to suit the requirements of any particular job.

(2) By the use of standard parts with or without adjustment, as hereinabove set forth, smaller or larger normal rates of flow may easily be secured.

(3) In operation the device is self compensating for great changes in pressure.

(4) The device is self-freeing of clogging obstructions.

(5) The device is economical of manufacture, easy to replace or repair and economical of space.

The general object of our invention set forth hereinabove, and other objects which will be apparent to one skilled in the art upon reading these specifications, we accomplish by that certain construction and arrangement of parts, of which we shall now describe the aforesaid exemplary embodiment, it being understood that the particular embodiment chosen for this disclosure and the exemplary circumstances of its use, are not limitations upon our invention.

Reference is made to the drawing, wherein: Figure 1 is a cross-sectional view of an assembled restricted flow device embodying our invention.

Figures 2 and 3 are plan views of suggested forms of grooved discs.

Figure 4 is an enlarged cross-sectional view of an assembly of discs and washers showing a way in which adjustment can be secured.

Briefly in the practice of our invention, we provide a plurality of members having tortuous

grooves in a face or faces thereof, and we assemble these members with or without intervening members, to provide a construction in which a fluid must follow a tortuous path normally determined by said grooves. It will be obvious that the several members will be perforated to the end of connecting up the grooves so as to provide a continuous restricted passage-way, or a plurality thereof. The various members are assembled in a casing and are preferably held together therein by resilient means. Where this is done the device becomes non-clogging, because it is responsive to extraordinary pressures, since such pressures can cause the members to separate against the pressure of the resilient means, thereby temporarily providing less restricted paths for the passage of fluid. It will be clear that in a device of this kind, the effective length of the fluid passage-way or passage-ways, may be modified by using more or less of the grooved members; so that restricted flow devices of differing fundamental rates of flow may easily be made from the same standard parts. Moreover, where washers or non-grooved metal pieces are employed between the grooved members, individual adjustment of each device may be made very accurately to a predetermined standard, or to the particular requirements of a specific job, by making the intervening pieces or washers of relatively softer metal than the grooved members, and subjecting the grooved members and washers in assembled form, to pressure, whereby the metal of the washers is caused to be extruded to a greater or less extent into the grooves of the grooved members, thereby varying the cross-sectional area of the passage-way formed by the said grooves.

We will now describe the aforesaid exemplary embodiment of our device in detail.

It is most convenient to provide both the grooved members and the washers in the form of round discs, and to assemble these in a cylindrical casing. We have shown in Figure 1 such a cylindrical casing at 1, closed at one end by a cap or the like 2, which may be threaded thereon, otherwise attached thereto, or made integral if preferred, with the casing 1. The cap 2 will be provided with a fitting 3 for the reception of a tube leading from the condenser, or for attachment directly to the condenser if that should be preferred. A central passage-way 4 permits the flow of fluid to the interior of the casing 1. This end of the device is the inlet end. The other end of the casing is closed by a cap 5 either threaded

on the casing or otherwise detachably connectible therewith; and a pressure tight connection may be assured by the use of the gasket 6. The cap 5 is provided with a central fluid passage-way 7 and a fitting 8 for attachment to the evaporator of a refrigerating device, or to a tube leading to the evaporator. We have shown in the casing and next to cap 2, a preliminary plate 9 having a central perforation 10. Above this plate we have shown a series of grooved discs 11 with washers 12 between each disc and the next succeeding one. The assembly is completed by a plate 13 having a central perforation 14 and a spring 15, abutting at one end against the assembled plates, discs and washers, and at the other against the cap 5. This spring holds the assembly of discs, washers and plates together, and it will be obvious that the compressive strength of this spring may be varied to make the device responsive to different maximum pressures.

The discs are grooved and perforated to provide the passage-ways for fluid aforesaid; and we prefer so to groove and perforate them as to provide a normally single continuous and connected passage-way for the fluid, from one end of the assembly to the other. The discs and washers and the plates 9 and 13 are preferably accurately fitted into the casing 1, so as to prevent a flow of fluid about the edges thereof.

We have shown in Figure 2, an exemplary disc 11 having a spiral groove 16 therein, starting at a central depression 17 in the disc and ending at a perforation 18 passing through the disc. The spiral groove 16 will thus provide a continuous elongated and restricted passage-way for fluid from the point 17 to the point 18, or vice versa as the case may be. We have shown in Figure 3, another exemplary form of grooved disc 11a, provided with a series of circular grooves 19, which are incomplete, but which are connected one with another by radial grooves 20, so as to provide a continuous passage-way from the point 17 to the point 18. Other forms of grooving may, of course, be employed, as well as other shapes for the grooved members. The discs may be grooved upon one or both sides. Preferably they are grooved on both sides, since in this way a greater length of restricted passage-way may be provided in a given space. Where 17 is a depression and 18 is a perforation, the intervening washers 12 will have central perforations shown at 21 in Figure 1. If 17 were a perforation and 18 a mere depression, or the end of a groove, the washers 12 would be solid at the center and perforated near their peripheries with holes which could be made to register with the ends 18 of the grooves.

The discs 11 may be made of iron, brass, bronze, or other materials, and the washers 12 may be made of softer materials such as lead, or lead alloys or the like. If this is done, a further means of adjustment is provided in that the washers and discs may be assembled in a casing in a press and subjected to pressure, whereby the metal of the washers may be caused to enter or be extruded into grooves of the discs, thereby still further restricting the passageways provided by these grooves. We have shown in Figure 4 a magnified sectional view of a part of an assembly of discs 11 and washers 12, which has been subjected to pressure, and we have indicated at 22 how the relatively softer metal of the washers has been forced into the grooves to restrict them. Very accurate control is possible by this method, so that with a specified number of parts, and a specified

cross-sectional area of grooves in the disc, a wide range of flow restriction may be secured below the maximum as determined by the grooves. The grooves are easily made by a machining operation or may themselves be made larger or smaller as any particular case may require.

The washers 12 may, of course, be eliminated and the necessary passage-way formed by an assembly of grooved discs only; or the discs may be grooved only upon one side, and assembled so that each disc acts both as a grooved member and as a washer. The discs may likewise be made of metallic pieces having a harder grooved face and a softer grooved or non-grooved face.

In the assembly of Figure 1, it will be noted that our device is self-freeing. If foreign matter in the fluid should clog any part of the restricted passage-way which we have provided, the building up of pressure which would result therefrom would tend to separate the discs and washers against the force of the spring 15, providing direct and enlarged passage-ways between the perforations 21 in the washers and the perforations 18 in the discs, whereby the obstruction would be washed away or allowed to pass. When the obstruction is gone, the spring 15 returns the assembly to its normal working position. In this way also, our device is made responsive to excess pressure whether or not there is an obstruction.

It will be clear that modifications may be made in our invention without departing from the spirit thereof.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is:—

1. In a restricted flow device, a plurality of members assembled in face to face relationship, certain of said members being grooved, and certain of said members acting to confine fluid to said grooves, means for conducting fluid from one groove to another so as to provide at least one continuous passage-way for fluid through said assembled members, and resilient means urging said assembled members into assembled position, whereby said device is responsive to excess pressure by separation of said members against the force of said resilient means.

2. A restricted flow device comprising a casing of cylindrical form, a plurality of discs assembled in face to face relationship in said casing, at least one of said discs having a continuous groove in its surface, said members being perforated to provide a continuous passage-way for fluid there-through including said groove, said discs fitting closely in said casing so as to prevent the passage of substantial quantities of fluid between said casing and the edges of said discs, and resilient means in said casing for holding said discs in assembled relationship.

3. In a restricted flow device, a cylindrical casing closed at both ends and provided with inlet and outlet connection means, and an assembly in said casing of members in face to face relationship, some at least of said members being grooved, and said members being perforated to provide a passageway for fluid therethrough including said grooves, and resilient means in said casing holding said members in assembled relationship.

4. A restricted flow device comprising a casing and an assembly in said casing of grooved members and intervening washer members, said members being perforated so as to provide through said assembly a continuous restricted passage-way for fluid including said grooves, and resilient

means in said casing for urging said grooved members and said washer members together.

5 5. In a restricted flow device, a plurality of members assembled in face to face relationship, means on said members forming a continuous tortuous passage through said assembly, and means to apply pressure to said assembly of members sufficient to maintain contact therebetween under normal maximum pressure within
10 said passage, said pressure means being adapted to yield when subjected to excessive pressure within said passage due to clogging obstructions, thereby allowing said members to separate and clear the passage of such obstructions.

15 6. In a restricted flow device, a plurality of members assembled in face to face relationship, certain of said members being grooved, and certain of said members acting to confine fluid to said grooves, means for conducting fluid from one
20 groove to another so as to provide at least one continuous passage for fluid through said assembled members, and means to apply pressure to said assembly of members sufficient to maintain contact therebetween under normal maximum

pressure within said passage, said pressure means being adapted to yield when subjected to excessive pressure within said passage due to clogging obstructions, thereby allowing said members to separate and clear the passage of such obstructions. 5

7. In a device adapted to restrict the flow of a liquid from a state of pressure to one of less pressure, the combination of a casing, a series of discs freely confined therein and disposed in face
10 to face contact, said discs being arranged to provide a continuous restricted passageway for liquid through said series of discs, said passageway including a groove in the face side of certain of said discs, and means to apply pressure to said series
15 of discs sufficient to maintain contact therebetween under normal maximum pressure within said passageway, said pressure means yielding when subjected to excessive pressure within said passageway due to clogging obstructions, thereby
20 allowing said discs to separate and clearing said passageway of such obstructions.

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