Aug. 20, 1940. F. R. GOEHRING 2,212,343

THREE-WAY VALVE

Filed Dec. 9, 1937 2 Sheets-Sheet 1

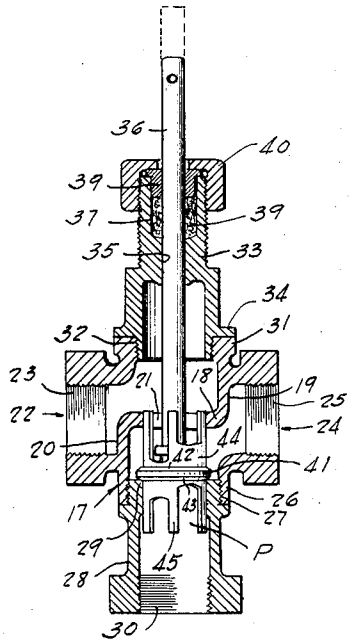


FIG. 2

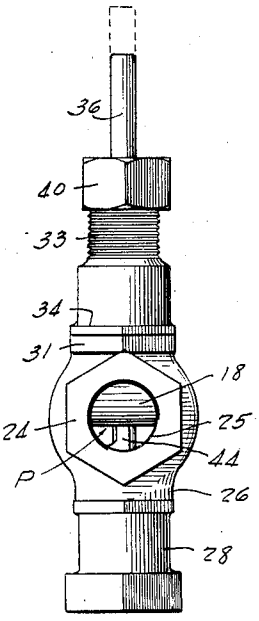


FIG. 3

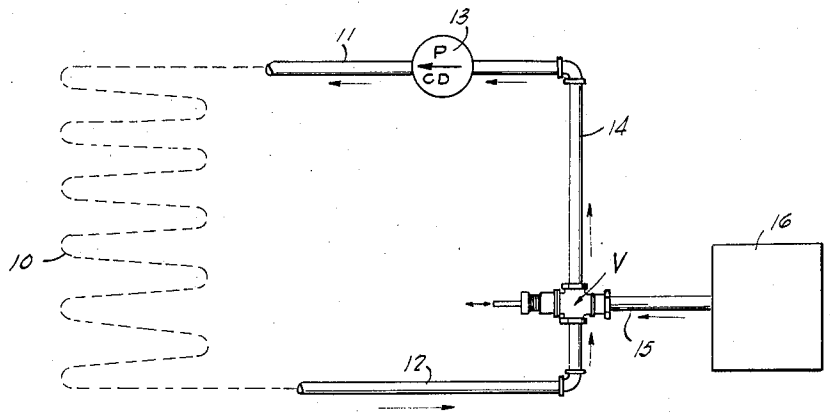


FIG. 1

INVENTOR.
FRANCIS RUDOLPH GOEHRING
BY Joshua R. H. Potts
ATTORNEY.

Aug. 20, 1940. F. R. GOEHRING 2,212,343

THREE-WAY VALVE

Filed Dec. 9, 1937 2 Sheets-Sheet 2

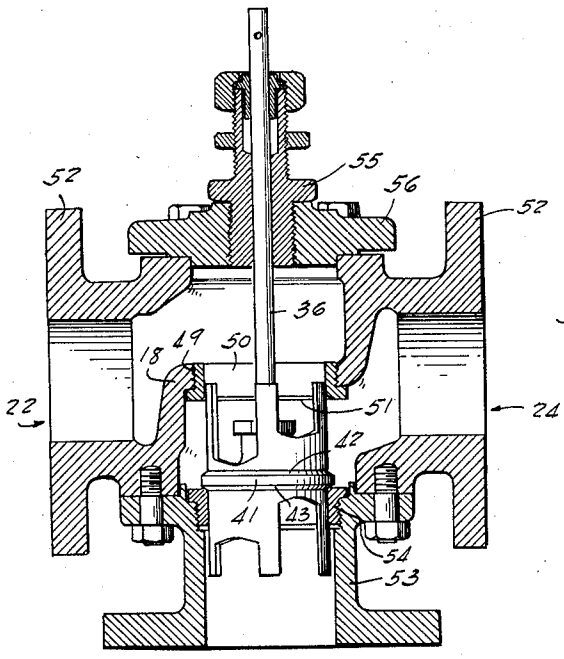


FIG. 4

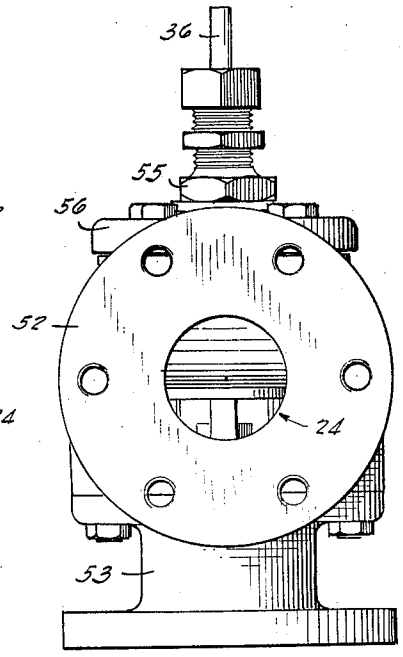


FIG. 5

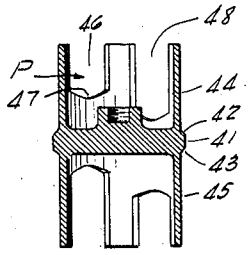


FIG. 6

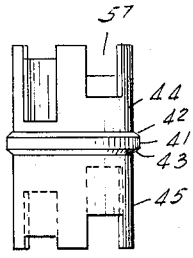


FIG. 7

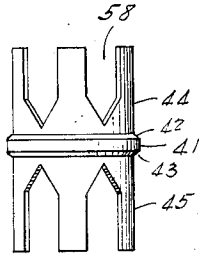


FIG. 8

INVENTOR.
FRANCIS RUDOLPH GOEHRING.
BY Joshua R. H. Potts
ATTORNEY.

Patented Aug. 20, 1940 2,212,343

UNITED STATES PATENT OFFICE

2,212,343

THREE-WAY VALVE

Francis Rudolph Goehring, Philadelphia, Pa., assignor to H. Belfield Company, Philadelphia, Pa., a corporation of Pennsylvania

Application December 9, 1937, Serial No. 178,937

4 Claims. (Cl. 251—22)

This invention has to do with valves and is concerned primarily with that type of valve which is known in the art as a three-way valve.

At the present time installations for air conditioning and similar purposes usually include a circulating system comprising coils through which an appropriate refrigerating medium such as brine is circulated under the influence of a pump. From the very nature of the purpose for which the system is installed the temperature of the refrigerating medium rises as it picks up heat, and it becomes necessary from time to time to inject a required amount of colder refrigerant into the system to bring the temperature thereof down to a proper point.

From the viewpoint of proper and efficient operation of the air conditioning installation it is important that the circulating pump be constantly and uniformly operated at a certain predetermined volume, but this uniformity has, prior to this invention, been partially impaired at the time of injecting fresh refrigerant into the system.

It has been conventional practice in this art to employ a three-way valve including a refrigerant inlet in addition to the usual inlet and outlet ports of the circulating system proper. When the refrigerant inlet is maintained closed the flow of the fluid through the valve is generally uniform, and the pump operates in the manner desired. However, when the three-way valve is opened to admit a required amount of refrigerant into the system the uniformity of the volume of flow is disturbed, which is an undesirable and unsatisfactory condition.

With the foregoing conditions in mind this invention has in view, as its foremost objective, the provision of a three-way valve which is designed to maintain constant and uniform the volume of flow at the outlet port thereof so that when installed in the circulating system of air conditioning apparatus the circulating pump will have a constantly uniform volume of fluid to maintain in circulation.

In carrying out this general objective the invention has in mind, as a further object, the provision of a three-way valve including a pair of inlet ports and an outlet port. One of the inlet ports is intended to be connected with the circulating system, while the other inlet port is designed for connection with the source of supply of the refrigerant. The outlet port is connected with the circulating system that extends to the circulating pump. Associated with the inlet ports are a pair of spaced valve seats between which operates a valve disk, and in accordance with this invention this valve disk is provided with a cage structure which is so designed that regardless of the position of the valve disk with respect to the seats, the combined volume from the inlet ports which comes from the outlet port is uniform and constant.

More in detail this invention has in view, as a further object, the provision of a valve disk of the type above indicated with which is associated a cage structure that extends on opposite sides of the valve disk. This cage structure preferably takes the form of a cylinder which is formed with ports of appropriate design to achieve this condition of maintaining uniform the combined volume of flow from the two inlet ports; the particular design of these ports in each instance being an important part of the present invention.

At this point it is well to note that while the present invention is designed primarily for use with air conditioning installations it is to be clearly understood that the invention is not to be limited to this particular use. Obviously the three-way valve is susceptible of being installed any place where conditions require that the combined volume of flow from two inlet ports be maintained uniform and constant.

Various other more detailed objects and advantages will in part become apparent and in part be hereinafter stated, as the description of the invention proceeds.

The invention, therefore, comprises a three-way valve that includes a pair of inlet ports and an outlet port. Associated with the inlet ports are a pair of spaced valve seats with which is operatively associated a valve disk that is designed to be seated on either of the seats. The valve disk includes as an essential element thereof cage structure which is disposed on each side of the valve disk, and which takes the form of cylindrical walls which are formed with ports that are so designed that in any position of the valve disk the combined volume of flow from the inlet ports to the outlet port is uniform and constant.

For a full and more complete understanding of the invention reference may be had to the following description and accompanying drawings, wherein

Figure 1 is a plan view, somewhat diagrammatic, of a circulating system including a three-way valve that embodies the precepts of this invention,

Figure 2 is a vertical section through a three-way valve of this invention,

Figure 3 is a side elevational showing of the valve shown in Figure 2,

Figure 4 is a section somewhat similar to Figure 2 of a slightly modified type of valve, while

Figure 5 is a side elevational showing of the valve shown in Figure 4,

Figure 6 is a transverse section through the valve disk and cage structure,

Figure 7 is a view developing a modified form of disk and cage, and

Figure 8 is a view similar to Figures 6 and 7 of still another modified type of disk and cage.

Referring now to the drawings, wherein like reference characters denote corresponding parts, the circulating system of an air conditioning installation is represented diagrammatically in Figure 1, and is shown as including coils at 10 through which an appropriate refrigerating medium such as a brine is intended to be circulated. As shown in the drawings, a conduit 11 is connected at the upper end of the coils 10 and is intended to feed the refrigerant to the coils, while a similar conduit 12 at the bottom is intended to take the brine away from the coils.

The conduit 11 includes a pump of any desired type which is represented diagrammatically at 13. Connecting the conduits 11 and 12 is another tubular conduit 14 which includes a three-way valve such as contemplated by this invention, and which is referred to generally by the reference character V. One of the inlet ports of the valve V, to be hereinafter described in detail, is shown as connected by a conduit 15 with a source of refrigerant supply represented diagrammatically at 16.

Referring now more particularly to Figures 2 and 3, a construction of one three-way valve V which may be employed is described by noting that the valve includes a valve casing referred to in its entirety by the reference character 17. This valve casing is of a hollow construction, and the central portion thereof is formed with a web 18 that is connected by walls 19 and 20 with the casing 17. It is notable that the casing 17, web 18 and walls 19 and 20 are an integral structure. The web 18 is formed with an opening 21 the peripheral edge of which is intended to constitute a valve seat.

At one side the valve casing 17 is formed with an inlet port 22 that is threaded as shown at 23 for connecting the same with a section of the tubular conduit 14. At the other side of the valve casing 17 there is an outlet port 24 that is threaded as shown at 25, for connecting the same with another section of the conduit 14.

Intermediate the inlet and outlet ports 22 and 24 the casing 17 is formed with an extension 26 that is interiorly threaded, as shown at 27, and screwed into the threads 27 is a coupling member 28 having an open end at 29 which constitutes a valve seat. It is notable that the valve seat 29 is substantially coaxial with the opening 21 and in spaced parallel relationship with respect thereto. The valve seats of the openings 21 and 29 are also of substantially the same diametrical dimension.

The coupling member 28 is interiorly threaded at 30 for connecting the same with the conduit 15 that extends to the refrigerant supply 16.

Disposed on the side of the casing 17 opposite from the extension 26 is another extension 31 which is interiorly threaded as shown at 32, and screwed into the threads 32 is a packing casing 33, the latter being formed with a flange 34 that engages the end of the extension 31. The casing 33 is formed with a bore 35 which slidably receives a valve stem 36. Above the bore 35 the casing 33 is formed with a packing chamber 37 in which is disposed packing identified at 38. A packing gland 39 is maintained in engagement with the packing 38 by a thimble shown at 40, which is threaded on the casing 33.

The valve stem 33 extends through the opening 21 and at its lower extremity carries a valve disk and associated cage structure. The valve disk proper is identified by the reference character 41, and is shown as having oppositely beveled edges 42 and 43. The beveled edge 42 is designed for engagement with the valve seat defined by the edge of the opening 21 while the beveled edge 43 similarly engages the edge of the opening 29, as shown in Figure 2.

Extending on opposite sides of the disk 41 are cylindrical walls 44 and 45. The cylindrical walls 44 and 45 may be of duplicate construction, and are shown as having an outer diametrical dimension substantially equal to the diameter of the openings 21 and 29. The cylindrical walls 44 and 45 slide in the openings 21 and 29, and are thus constituted guides for the valve disk 41. The cylindrical walls 44 and 45 are also provided with a plurality of ports referred to generally as P.

The ports P may take several different forms, but they must be so designed that in any relative position of the valve disk 41 with respect to the openings 21 and 29 the combined volume of flow coming through these openings would be uniform and constant.

As shown in Figures 2 and 6, the ports P may take the form of short slots 46 that extend inwardly from the edges of the cylindrical wall, and which terminate in V-shaped bottoms designated 47. Alternately disposed with respect to the slots 46 are longer slots 48 that also extend inwardly from the free edge of the cylindrical walls 44 and 45, and which terminate in V-shaped bottoms similar to the V-shaped bottoms 47.

It is believed that the operation of the above described three-way valve V is obvious. However, it may be briefly described by noting that with the valve disk 41 in the position shown in Figure 2 the flow of the refrigerating medium through the tubular conduit 14 is permitted, as the fluid passes through the opening 21. There is a certain amount of resistance offered to the flow of the fluid by the cylindrical cage 44, but the ports P permit of the flow therethrough.

When the temperature of the refrigerant has reached a predetermined point the valve stem 36 is raised to unseat the disk 41 from the opening 29. Refrigerant from the source of supply 16 is now admitted through the opening 29. However, as the stem 36 is moved upwardly the cage 44 is also moved upwardly in the opening 21 so as to partially close the ports P. At the same time the ports P on the cage 45 have been partially opened by the upward movement of the disk 42. Thus as fresh refrigerant is added to the volume of fluid circulating through the tubular conduit 14 the volume of fluid coming through the opening 21 has been restricted, thus maintaining uniform the volume of fluid which comes from the outlet port 24.

Referring now more particularly to Figures 4 and 5 a slightly modified form of valve is shown. Generally speaking the construction of the casing 17 remains the same. However, the opening 21 in the web 18 is threaded as shown at 49, and screwed thereinto is a removable valve seat 50 which has a beveled edge, as shown at 51, that is complemental to the beveled edge 42 of the disk

41. There is also a slightly different manner of connecting the inlet opening 22 and outlet opening 24 with the conduit 14 as shown; the flange structures 52 taking the place of the threads 23 and 25 in the form shown in Figure 2.

It is also notable that the coupling element 28 is replaced by a coupling member 53 that carries a removable valve seat 54 that is also formed with a beveled edge complemental to the beveled edge 43 of the disk 41. The valve stem 36 extends through a packing assembly in the manner above described. However, the packing casing 33 is replaced by another casing 55 which is threaded into a plate 56 that is bolted to the casing 17.

Figures 7 and 8 develop slight modifications which may be carried out in the cylindrical walls 44 and 45 that define the cage associated with the disk 41. It will be noted that in Figure 7 the ports P take the form of rectangularly shaped slots 57, there being long and short slots alternately disposed, as in the form of the invention shown in Figure 6. In Figure 8 the slots 58 are formed with V-shaped bottoms with a more pronounced angle than the V-shaped bottoms 47, as shown at 59, and these slots 58 are all of the same dimension.

While preferred specific embodiments of the invention are hereinbefore set forth it is to be clearly understood that I am not to be limited to the exact constructions illustrated and described, because various modifications of these details may be provided in putting the invention into practice within the purview of the appended claims.

I claim:

1. A three-way valve comprising a valve casing formed with a pair of inlet ports and an outlet port, a valve seat associated with each of the inlet ports, said valve seats being spaced apart, a valve disk movable between said valve seats for controlling the flow of fluid therethrough, and a cage structure associated with the disk, said cage structure consisting of cylindrical walls extending above and below said disk and formed with ports, said ports being arranged so that movement of said disk causes an enlargement of the effective area of the ports on one side of the disk, and a compensating restriction of the ports on the other side of said disk for every position of said disk.

2. A three-way valve comprising a valve casing formed with a pair of inlet ports and an outlet port, a valve seat associated with each of the inlet ports, said valve seats being spaced apart, a valve disk movable between said valve seats for controlling the flow of fluid therethrough, and a cage structure associated with the disk, said cage structure consisting of cylindrical walls extending above and below the disk, said cylindrical walls being formed with ports which are defined by slots in the cylindrical wall which extend inwardly from the free edges thereof, said slot having V-shaped bottoms, said slots being symmetric with respect to the disk and arranged so that movement of said disk causes an enlargement of the effective open area of the slots on one side of the disk, and a compensating restriction of the slots on the other side.

3. A three-way valve comprising a valve casing formed with a pair of inlet ports and an outlet port, a valve seat associated with each of the inlet ports, said valve seats being spaced apart, a valve disk movable between said valve seats for controlling the flow of fluid therethrough, and a cage structure associated with the disk, said cage structure consisting of cylindrical walls extending above and below the disk, said cylindrical walls being formed with ports which are defined by slots in the cylindrical wall which extend inwardly from the free edges thereof, there being slots of different lengths with alternately disposed slots of the same length, said slots being arranged so that movement of said disk causes an enlargement of the effective open area of the slots on one side of the disk, and a compensating restriction of the slots on the other side.

4. A three-way valve of the character described comprising a valve casing formed with an inlet and outlet opening in substantial alignment, said casing being formed with a web that is substantially parallel to the axis of said inlet and outlet openings, said web being formed with an opening defining a valve seat, and said casing being formed with a second inlet opening of the same diametrical dimension as the opening in the web and spaced therefrom, said last mentioned opening defining a valve seat, a valve stem extending into the casing and carrying a valve disk that is disposed between said valve seats, a cylindrical wall on each side of said valve disk and engaging its respective valve seat with a sliding fit, each of said cylindrical walls being formed with slots extending inwardly from the free edge thereof, said slots being symmetric with respect to the disk and arranged so that movement of said disk causes an enlargement of the effective open area of the slots on one side of the disk, and a compensating restriction of the slots on the other side.

FRANCIS RUDOLPH GOEHRING.