Jan. 31, 1928.

1,657,739

J. O. CARREY

VALVE

Filed July 11. 1924

3 Sheets-Sheet 1

Fig. 1

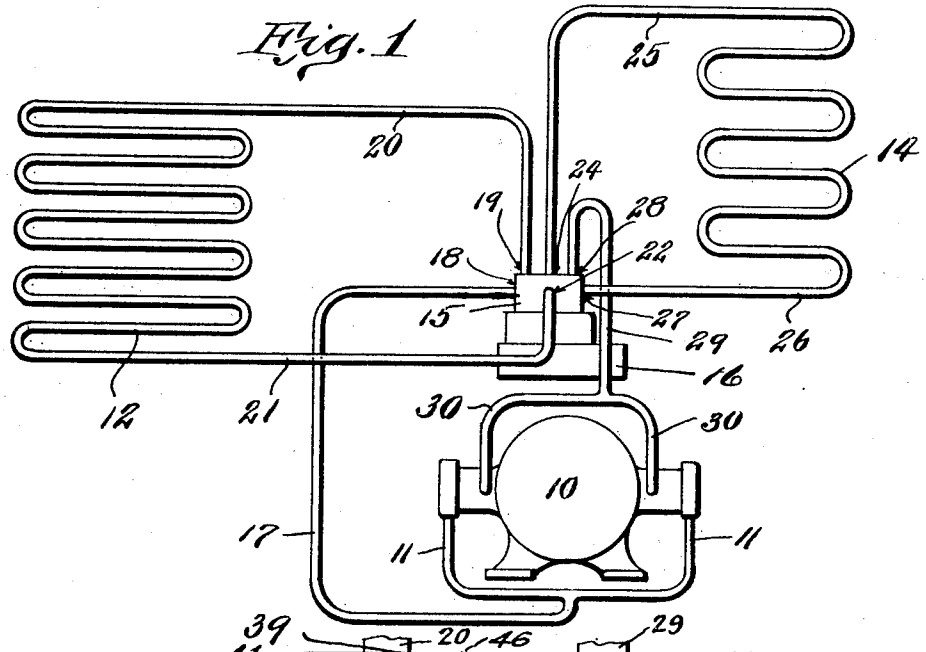
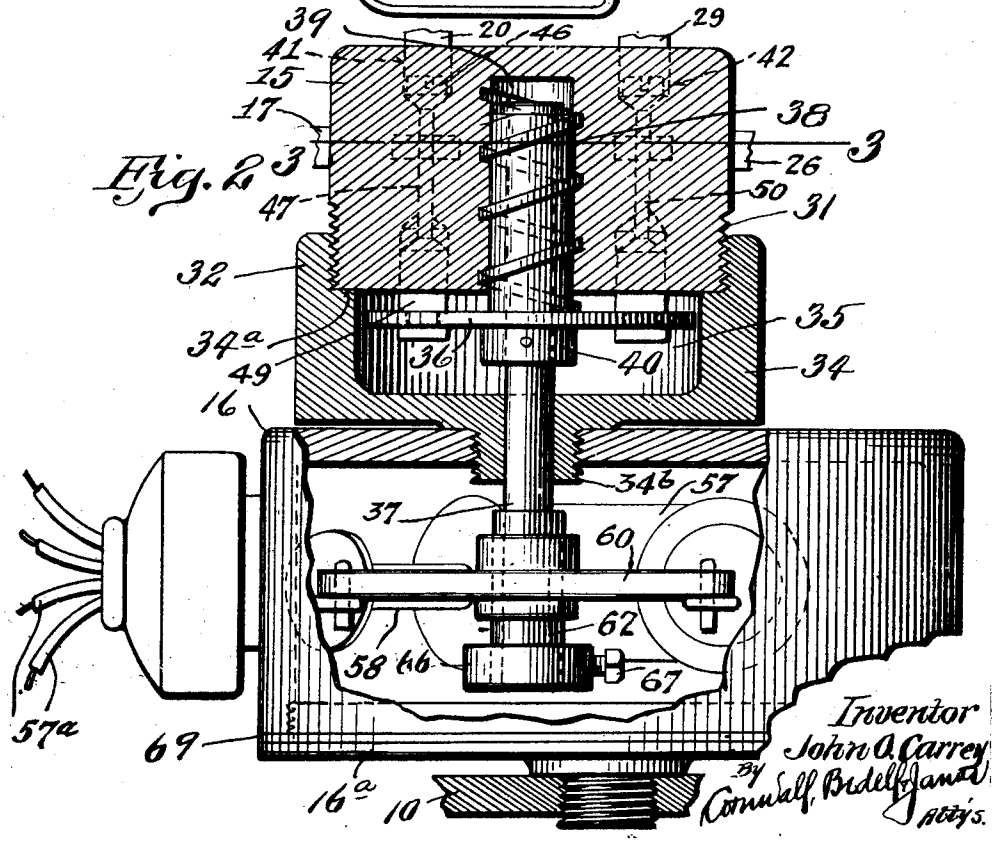



Fig. 2




Inventor
John O. Carrey
By Connolly, Bidell & Sandt
Atty's.

Jan. 31, 1928.

1,657,739

J. O. CARREY

VALVE

Filed July 11. 1924

3 Sheets-Sheet 2

Fig. 3

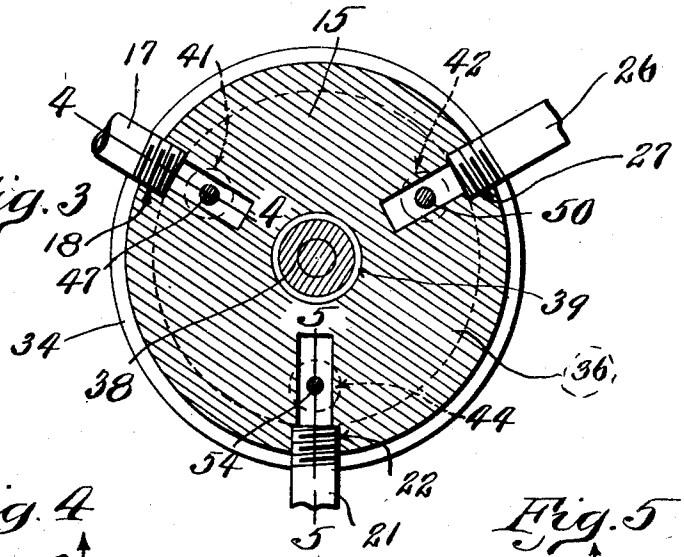



Fig. 4

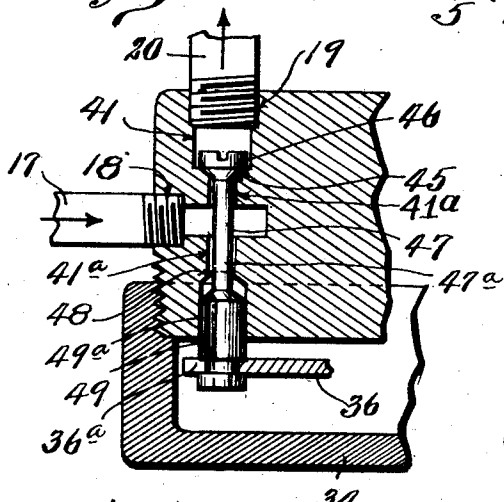



Fig. 5

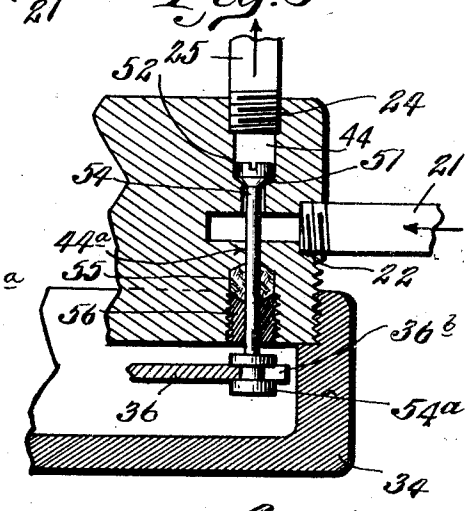



Fig. 6

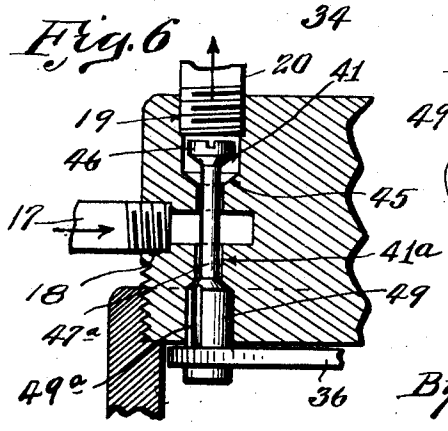



Fig. 7

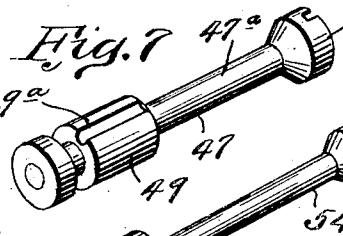
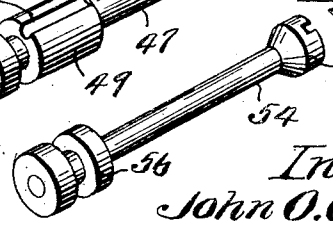



Fig. 8




Inventar
John O. Carrey
By Cornwall, Bedell & James
Attys.

Jan. 31, 1928. 1,657,739

J. O. CARREY

VALVE

Filed July 11. 1924 3 Sheets-Sheet 3

Fig. 9

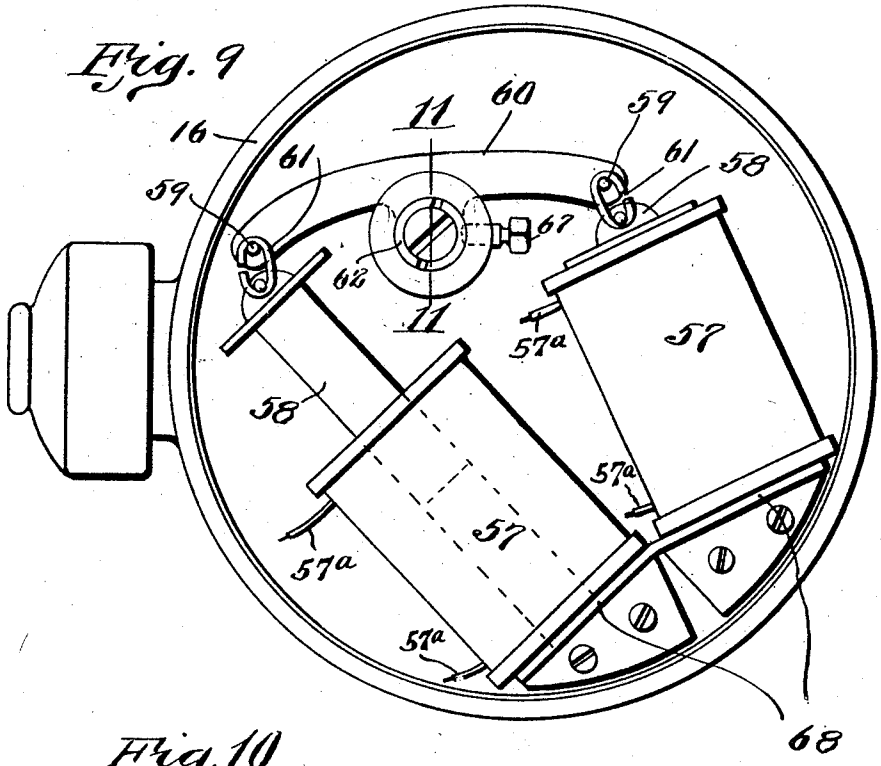



Fig. 10

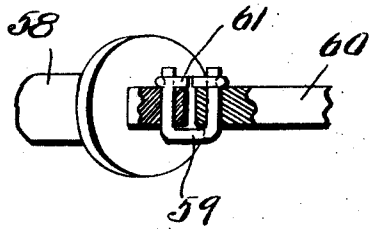



Fig. 11

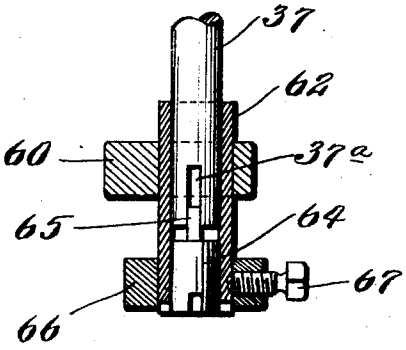



Fig. 12.

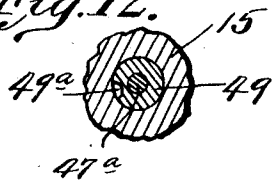
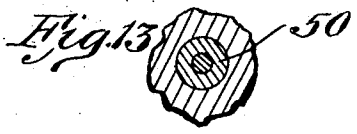



Fig. 13




Inventor
John O. Carrey
By Cornwall, Bedell & Janus
Atty's.

Patented Jan. 31, 1928. 1,657,739

# UNITED STATES PATENT OFFICE.

JOHN O. CARREY, OF ST. LOUIS, MISSOURI, ASSIGNOR TO CARREY-MORSE ENGINEERING COMPANY, OF ST. LOUIS, MISSOURI, A CORPORATION OF MISSOURI.

## VALVE.

Application filed July 11, 1924. Serial No. 725,413.

This invention relates generally to valves and more particularly to multiple control valves wherein a plurality of fluid circuits are simultaneously controlled by the operation of the valve.

The objects of the invention are to provide a valve which can be automatically operated to open and close the ports of the respective pipe circuits so that certain of said circuits when closed are maintained at the operative pressure while certain other circuit or circuits are exhausted or by-passed so as to relieve such circuit or circuits of the operating pressure.

Further objects of the invention are to provide a valve for controlling the fluid circuits of a refrigerating apparatus whereby when said apparatus is inactive certain of said fluid circuits and mechanism associated therewith are held under operating pressure while certain other circuit or circuits are by-passed in order to relieve the pressure on the compressing or other mechanism.

Still further objects of the invention are to provide simple and efficient means for operating said valve and to provide suitable means, preferably electrically operated, for controlling said valve actuating means.

With these and other objects in view my invention consists in certain novel features of construction and arrangement of parts, hereinafter more fully described and claimed, and illustrated in the accompanying drawings, in which—

Figure 1 is a diagrammatic view of the refrigerating apparatus and its connections and showing the arrangement of the valve in relation to said connections.

Figure 2 is a vertical cross section through the valve and showing the housing of the operating mechanism partly broken away.

Figure 3 is a horizontal cross section taken on line 3—3 of Figure 2.

Figure 4 is a vertical section taken on line 4—4 of Figure 3.

Figure 5 is a vertical cross section taken on line 5—5 of Figure 3.

Figure 6 is a view similar to Figure 4 and showing the valve moved to open position.

Figure 7 is a perspective detail view of the valve shown in Figures 4 and 6.

Figure 8 is a perspective detail view of the valve shown in Figure 5.

Figure 9 is a view looking toward the upper end of the casing containing the actuating mechanism.

Figure 10 is a detail view showing the operative connection between the rock arm and one of the armatures.

Figure 11 is a vertical cross section taken on line 11—11 of Figure 9.

Figure 12 is a horizontal cross section through the lower part of one of the valve stems and showing the by-pass passage formed therein.

Figure 13 is a similar cross section through the lower part of the other valve stem, which is formed without the by-pass connection.

Referring by numerals to the accompanying drawings, 10 indicates a compressing element of a refrigerating apparatus, said element being of any desired design and having high pressure outlet pipes 11. 12 designates a condensing element or coil of the refrigerating apparatus and 14 is a cooling element or expansion coil. 15 is a valve casing and 16 is the casing of the valve actuating mechanism.

The high pressure pipes 11 are connected by a pipe 17 to a high pressure inlet port 18 of casing 15 which port communicates with an outlet port 19 to which is connected, by a pipe connection 20, one end of condensing element 12. The refrigerant in passing through this condenser is condensed and is conveyed in a liquid state by a pipe 21 to an inlet port 22 of casing 15 from which it is then conducted by means of an outlet port 24 and a pipe connection 25 to the cooling coil or element 14 where said refrigerant is allowed to expand and thereby cool the compartment in which it is located. The opposite end of this cooling element is connected by a pipe 26 to an inlet port 27 in valve casing 15 from which it is then led through an outlet port 28 and a pipe connection 29 to branch pipes 30 which communicate with the intake ports of the compressing element 10. Thus the refrigerant is circulated and recirculated through the different elements of the refrigerating apparatus and the intercommunication between said elements is controlled by valve 15.

In the operation of refrigerating systems, it is desirable that certain circuits, when the apparatus is inactive, be maintained under the operating pressure, thereby eliminating waste of energy necessary to build up the

pressure again in the circuits where they are left open and the pressure built up therein is allowed to be dissipated. At the same time, the control of the circuits independently of each other and of the compressing element increases the efficiency and responsiveness of the refrigerating apparatus to the demands made upon it. It is also desirable to drain or by-pass certain circuit or circuits so as to relieve the compressing unit or element from pressure when starting said element, thereby facilitating the operation thereof, eliminating noises, and effecting saving in power consumed in driving said compressing liquid. To this purpose, valve casing 15 is provided with suitable valves operable to open and close the communication between the respective ports at the appropriate time, said valves being operable by a mechanism controlled in any suitable manner.

Casing 15 is preferably of a cylindrical shape and is provided at its lower end with an external thread 31 for receiving the threaded annular flange 32 of a cover 34. An inwardly disposed annular shoulder 34[a] forms a stop for casing 15 and limits the extent thereof into the cover 34, whereby a chamber 35 is formed in the cover for the reception of a disk 36. Cover 34 has a threaded boss or extension 34[b] which is screw-seated in one of the end walls of the casing 16 in which the actuating mechanism hereinafter more fully described is located. A rock shaft 37 is journaled in the threaded extension 34[b] and extends upwardly into chamber 34 and its upper end has fixed thereto a screw 38 which operates in a threaded recess 39 axially arranged in casing 15. Disk 36 is loosely mounted on shaft 37 and is held in position thereon by the lower end of screw 38 and a collar 40 which latter is pinned to shaft 37, as shown in Figure 2.

The rocking motion of shaft 37 causes screw 38, by virtue of its engagement with the threaded recess 39, to move in an axial direction, thereby moving disk 36 toward or away from the lower end of casing 15 depending on the direction in which the shaft 37 is rocked.

Casing 15 is provided with three longitudinally disposed bores 41, 42 and 44, respectively. These bores are preferably equally spaced about the axis of casing 15 and bores 41 and 42 are substantially of the same diameter while bore 44 is of smaller diameter than the before-mentioned bores. Bore 41 has its upper end terminating in the outlet port 19 while inlet port 18 which is formed in the side wall of casing 15 extends transversely thereinto and communicates with the central or intermediate portion of bore 41. This intermediate portion is reduced in diameter as indicated at 41[a] and the upper end of said intermediate portion terminates in a valve seat 45 adapted to receive a valve head 46 of a valve 47. The lower end of portion 41[a] terminates in a valve seat 48 which is adapted to receive a valve head 49 carried by the lower end of valve 47. The lower end of valve head 49 extends beyond the lower end of casing 15 and is provided with an annular groove adapted to receive the slotted portion 36[a] of disk 36 whereby the movement of disk 36 actuates valve 47. The stem 47[a] of valve 47 is of slightly smaller diameter than the diameter of intermediate portion 41[a] in order when the valve head 46 is unseated, to alllow the refrigerant to pass from port 18 through said portion 41[a] to port 19.

A valve 50 is arranged in bore 42 and controls the communication between ports 27 and 28. The construction and operation of valve 50 is identical with the construction and operation of valve 47 and therefore will not be described in detail.

Bore 44 establishes communication between the inlet port 22 and the outlet port 24 and is provided in its upper end with a valve seat 51 adapted to receive valve head 52 of a valve 54, the stem of which extends through the intermediate portion 44[a] and is provided at its lower end, which extends beyond the lower end of casing 15, with a grooved collar 54[a] adapted to be engaged by the slotted portion 36[b] of disk 36.

The lower end of bore 44 is provided with a suitable packing 55 and said end is closed by a gland 56 which is screw-seated therein. The stem of valve 54 operates through said gland and packing 55. Thus it will be seen that when shaft 37 is rocked in the proper direction the screw 38 through its interengagement with the threaded recess 39 causes said shaft and disk 36 to move upwardly, thereby unseating valve heads on 47, 50 and 54 in bores 41, 42 and 44 respectively and establishing communication between the respective ports so that the refrigerant can circulate through the refrigerating system. When shaft 37 is rotated in opposite direction this disk 36 is caused to move away from casing 15 thereby seating all of the last mentioned valves and closing communications between the respective ports. When valve 46 which controls the communication between ports 18 and 19 is seated, valve 49 is unseated, thereby permitting the refrigerant fluid contained in pipe 17 and branch pipes 11 to drain or by-pass through a groove 49[a] longitudinally disposed in the periphery of valve 49 into chamber 35. From chamber 35 the refrigerant can be returned to the compressor either directly by a pipe connection or it can be allowed to pass through the bearing in extension 34[b] into casing 16 then pass therefrom into the compressor 10. In this manner while the refrigerant contained in coils 12 and 14 is

trapped therein and held under pressure, the refrigerant contained in pipes 17 and branch pipes 11 and in the pressure chambers of compressor 10 is by-passed to the low pressure side of said compressor so that upon starting said compressor the high pressure side thereof is relieved of high pressure, thereby facilitating the starting operation of the compressing mechanism.

The means for actuating the shaft 37 consists preferably of a pair of electro-magnets 57 arranged in casing 16. Cooperating with these electro-magnets are armatures 58, the outer ends of which are connected by U-shaped pieces 59 to the ends of a rock arm 60. The open ends of U-shaped pieces 59 after being passed through the apertured ends of armatures 58 and the ends of arm 60 are closed by clamps 61 which prevent the accidental displacement of said U-shaped pieces. Electro-magnets 57 are connected by suitable connections 57ª to a switch (not shown) which may be operated in any suitable manner to alternately energize said electro-magnets whereby the armatures 58 are alternately attracted by the respective electro-magnets, thereby causing quick rocking movement of arm 60 which is operatively connected to shaft 37 and causes the latter to turn in the proper direction to operate, through disk 36, the valve mechanism controlling the various pipe circuits.

Since shaft 37 has to move in an axial direction, when actuated, and since arm 60 occupies a fixed position relative to the axis of the electro-magnets 57, I provide a sleeve 62 which receives the lower end of shaft 37 and carries arm 60. The lower end of sleeve 62 is provided with a plug 64 which is loosely mounted in said sleeve and has an upwardly projecting fin or blade 65 which slides freely in the downwardly presented slot 37ª diametrically disposed in the extreme lower end of shaft 37.

A collar 66 is carried by the lower end of sleeve 62 and said collar is provided with a set screw 67 which engages sleeve 62 and when tightened distorts said sleeve and thereby secures plug 64 to sleeve 62, thereby establishing a fixed operative connection between arm 60 and plug 64. This plug has non-rotative engagement with shaft 37, whereby the rocking movement of arm 60 is transmitted to said shaft. The slot 37ª in the lower end of shaft 37 is of sufficient depth to permit axial movement of said shaft without affecting the non-rotative engagement between plug 64 and the shaft.

As shown in the drawings, the electro-magnets 57 are preferably mounted on a bracket 68 which is then fixed to the upper wall of casing 60. The lower end wall 16ª is detachable from casing 16 having a threaded engagement with the peripheral wall of said casing, there being a gasket 69 of lead or other material interposed between the annular edge of casing 16 and detachable wall 16ª in order to form a fluid-tight seal and prevent the escape of the refrigerant, which may find its way into said casing, to the atmosphere.

I claim:

1. A valve mechanism comprising a member having a plurality of valve chambers and inlet and outlet ports communicating with the respective valve chambers, a valve movably mounted in each chamber for opening and closing the communication between the respective ports, valve stems slidably mounted in said valve chamber member and projecting outwardly therefrom, a movable member connected to all of said valve stems for simultaneously operating all of said valves, a revoluble member screw-seated in said valve chamber member and disposed parallel with said valve stems for actuating said movable member and a cover secured to said valve chamber member for enclosing said movable member and the projecting ends of said valve stems.

2. A valve mechanism comprising a one-piece member having a plurality of valve chambers and inlet and outlet ports communicating with the respective valve chambers, a valve movably mounted in each chamber for opening and closing the communication between the respective ports, valve stems slidably mounted in said member and carrying said valves at one of their ends, the opposite ends projecting beyond said valve chamber member, a movable member disposed below said valve chamber member and engaging the projecting ends of said valve stems for simultaneously operating all of said valves, a revoluble member screw-seated in said valve chamber member for actuating said movable member, and electro-responsive means for actuating said revoluble member.

3. A valve mechanism comprising a cylindrical member having a plurality of valve chambers and inlet and outlet ports communicating with the respective valve chambers, valve stems slidably mounted in said member parallel with the axis thereof, a valve mounted on each stem and disposed in each chamber for opening and closing the communication between the respective ports, a movable member arranged parallel with said cylindrical member and connected to said valve stems, simultaneously operating all of said valves, a revoluble member for actuating said movable member, and electrically controlled means for operating said revoluble member.

4. A valve mechanism for controlling a plurality of fluid circuits comprising a casing having a plurality of valve chambers each provided with inlet and outlet ports, a valve member longitudinally movable in

said casing and extending into said valve chamber for controlling the communication between the respective ports, a revoluble member screw-seated in said casing parallel with said valve member, a disk fixed to said revoluble member and having slot connection with said valve member for causing longitudinal movement of said valve member when said disk is moved in axial direction by said screw member, and a mechanism for actuating said revoluble member.

5. A valve mechanism for controlling a plurality of pipe connections comprising a single-piece casing having a plurality of valve chambers provided with inlet and outlet ports, valve stems slidably mounted in said casing parallel with each other, valves carried by said stems in said valve chambers for controlling communication between the respective ports, a member in engagement with all of said valve stems and movable in parallelism therewith, a rock arm operatively connected to said member, and means for imparting rocking action to said arm.

6. A valve mechanism for controlling a plurality of pipe connections comprising a casing having a plurality of ports, a valve member movably arranged in said casing and controlling communication between said ports, a valve stem slidably arranged in said casing and carrying said valve member at one end, the opposite end of said valve stem projecting beyond said casing, a revoluble member screw-seated in said casing parallel with said stem, an operating member extending radially from said revoluble member and having an operative connection with said valve stem for actuating said valve stem longitudinally when said screw member is actuated, and electro-responsive means for actuating said screw member.

In testimony whereof I hereunto affix my signature this 3rd day of July, 1924.

JOHN O. CARREY.