Feb. 6, 1951 C. H. BOYLAN 2,540,649

SECTIONAL REFRIGERATION SYSTEM WITH DIRECTLY CONNECTED BACK-SEATING VALVES

2 Sheets-Sheet 1

Original Filed Jan. 24, 1946

Fig. 1.

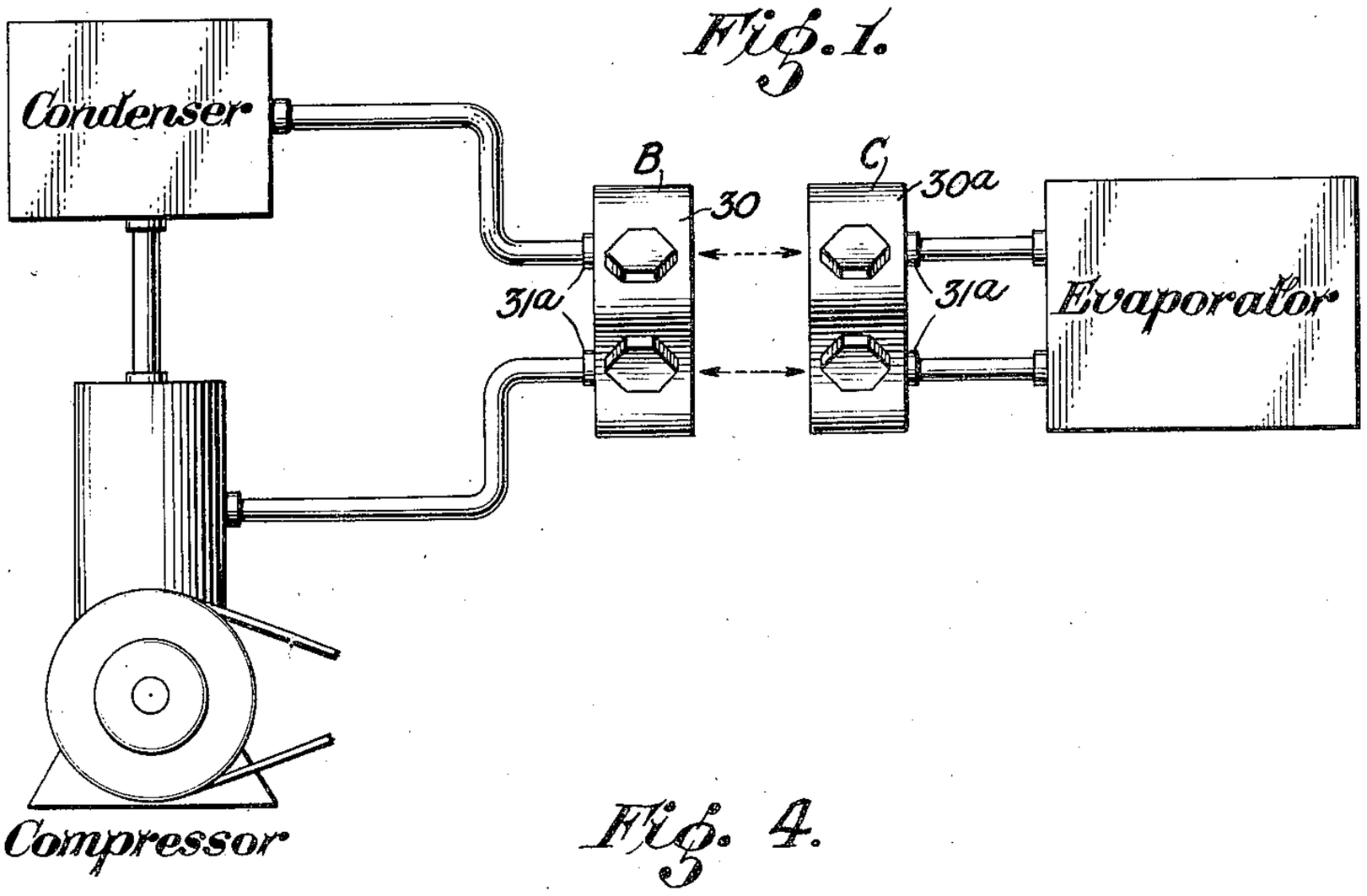
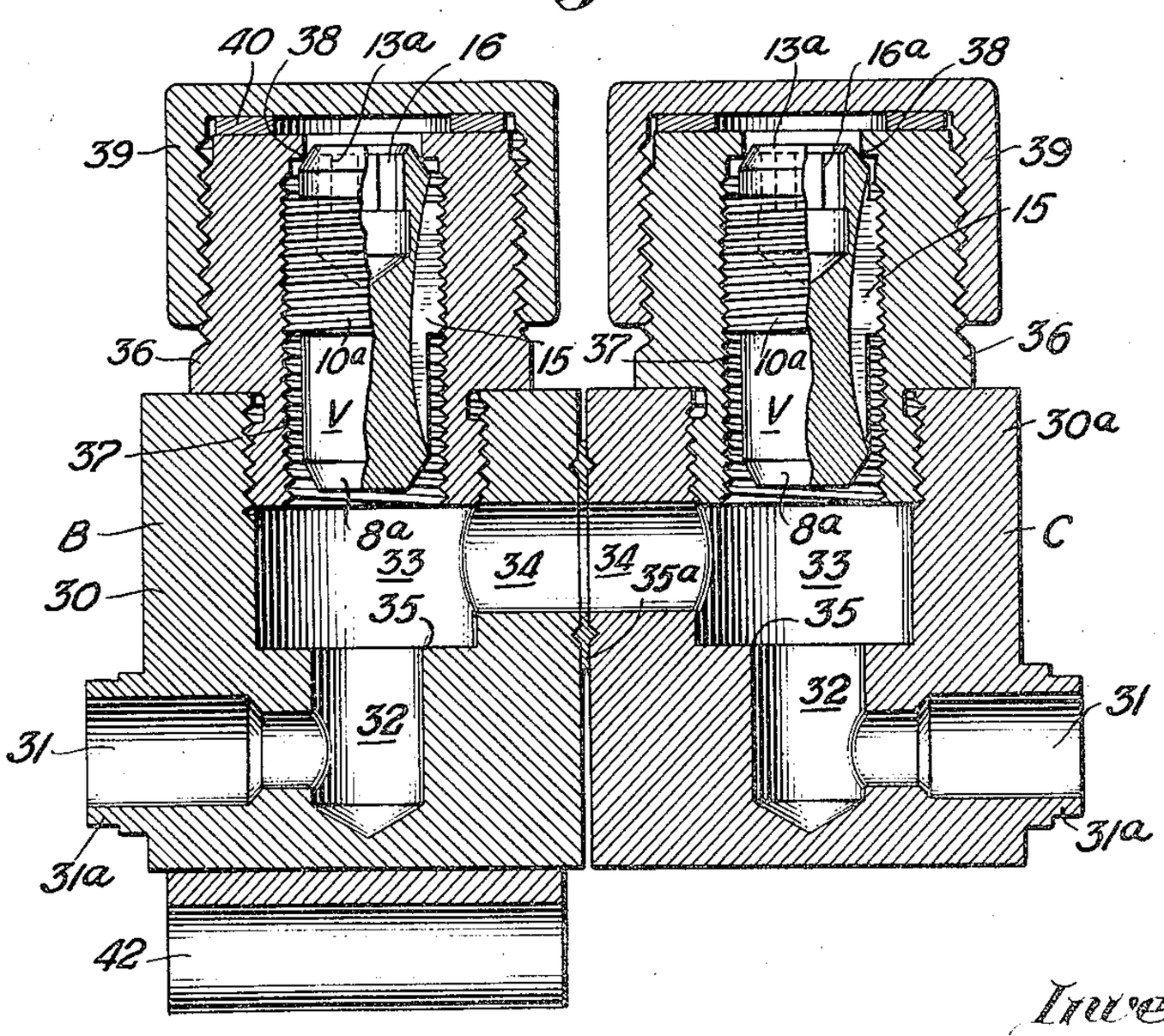


Fig. 4.



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2 Sheets-Sheet 2

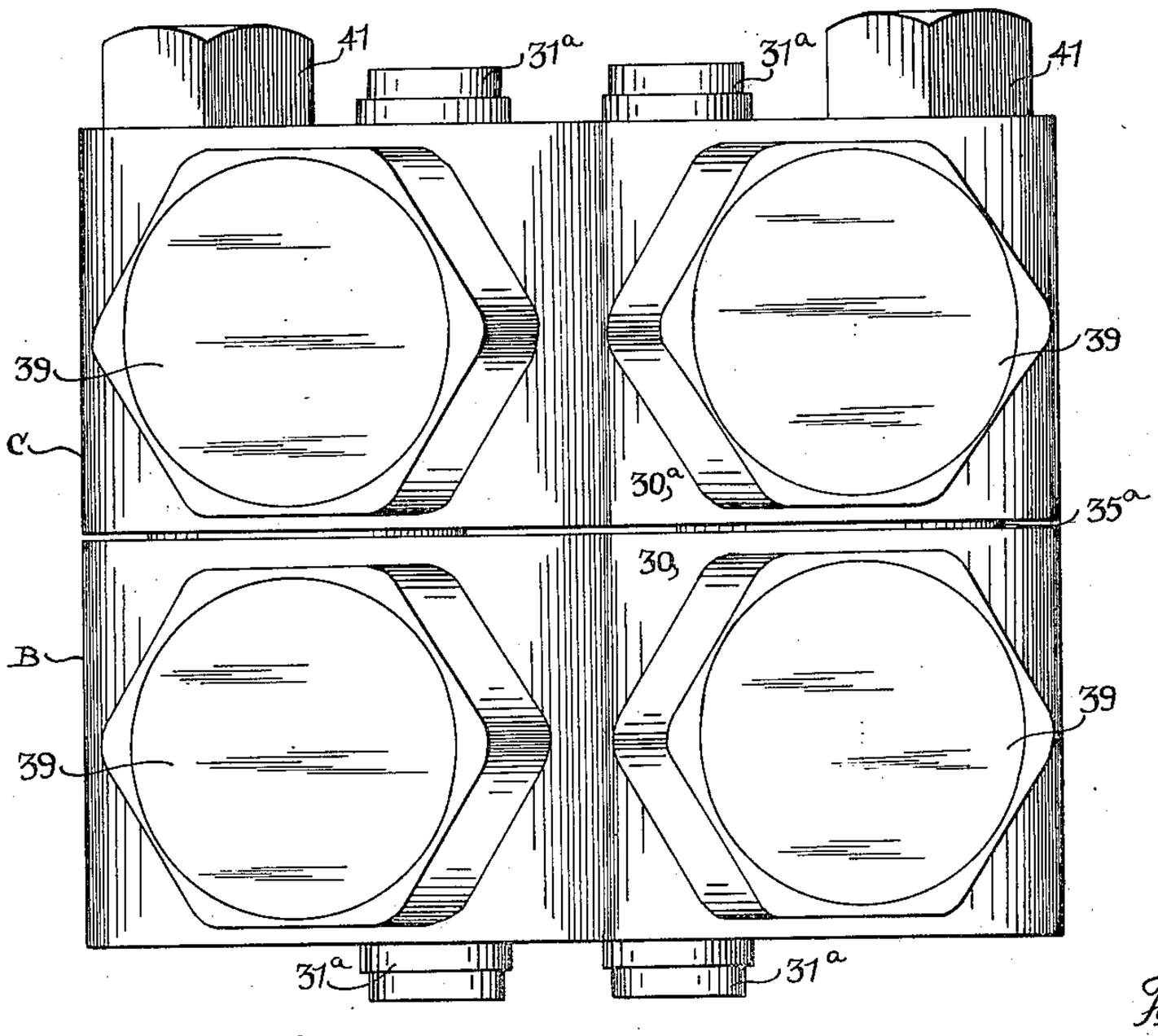

Fig. 3

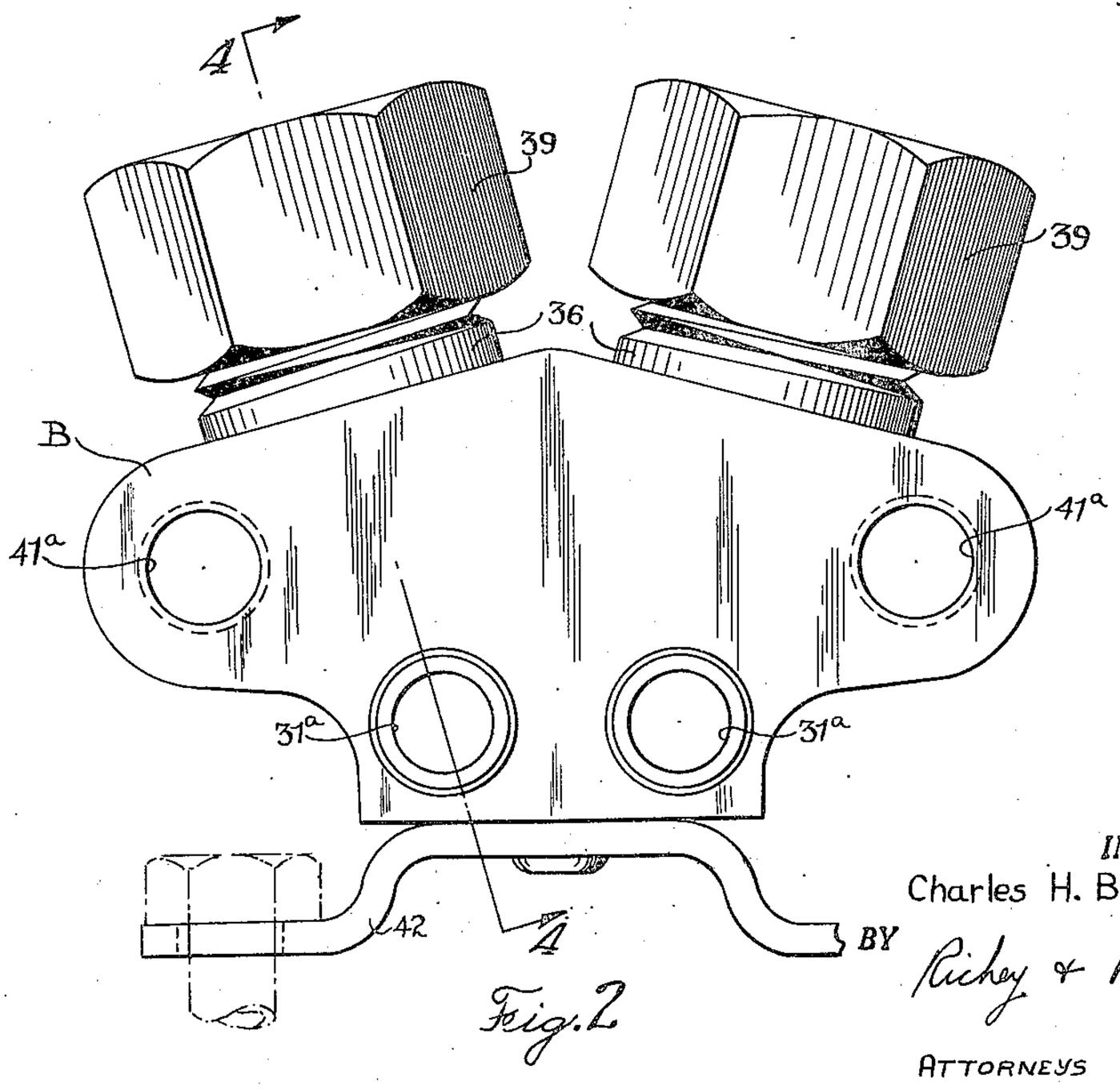

Fig. 2

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Patented Feb. 6, 1951 2,540,649

UNITED STATES PATENT OFFICE

2,540,649

SECTIONAL REFRIGERATION SYSTEM WITH DIRECTLY CONNECTED BACK-SEATING VALVES

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Original application January 24, 1946, Serial No. 643,008. Divided and this application September 20, 1947, Serial No. 775,345

7 Claims. (Cl. 62—115)

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This invention relates to refrigeration systems, and more particularly it relates to an improvement in back-seating valves adapted to be connected together to couple charged sections of refrigeration apparatus without intermediate fittings.

This application is a division of my co-pending application, Serial No. 643,008, filed January 24, 1946, and assigned to The Weatherhead Company, now Patent No. 2,438,776.

The usual refrigeration system includes three basic devices connected by suitable pipes, valves and fittings. These are the compressor which compresses the gaseous refrigerant, the condenser which removes the heat of compression and liquifies, and the evaporator wherein the refrigerant expands absorbing heat in the process. It has been found convenient both in manufacture and in the distribution of these units to produce the system in several sections. For example, one section may include the compressor and the condenser connected together with a fitting extending from each for connection with the other section. The other section may comprise the evaporator and connecting piping. Of course, it is also possible to provide three sections so that the compressor, condenser and evaporator are all separate. Very often the compressor and condenser sections are manufactured separately, assembled and shipped to the refrigerator manufacturer for connection to an evaporator incorporated in the refrigerator unit. Assembly of the refrigerator sections is greatly simplified if it is possible to charge each section with refrigerant separately with valves provided which permit sealing off the sections from the atmosphere after charging.

However, prior valve and fitting arrangements have required the coupling in of at least two lengths of tubing in order to join the sections. This introduces an appreciable volume of air into the system and reduces its effectiveness.

It is an object of this invention to permit connection of charged and sealed refrigeration sections together and to establish fluid communication therebetween without employing intermediate piping or lines that would contaminate the system with air. In a preferred form of the invention this is accomplished by bringing the inlet and outlet connections of a given section together into a dual valve block, each block including a pair of back-seating valves. This dual valve block has fluid sealing means formed thereon, such as a flat face, for direct connection to a companion valve block associated with another

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section of the refrigeration system and with certain valve ports in communication. In this manner the refrigerator sections may be separately charged, such as at their place of manufacture, and connected together without employing intermediate tubing and hence without introducing air into the system.

Prior refrigerators have generally included several charging and sealing valves at spaced locations, many of which were inaccessible for servicing. It is an advantage of the present construction that the four valves are disposed in contiguity, which simplifies the construction and facilitates servicing, charging and testing the sections.

Other objects and advantages of my invention will become apparent from the following description of preferred forms of this invention, reference being made to the accompanying drawings, in which:

Fig. 1 is a diagram of a refrigerating system arrangement incorporating valve units made in accordance with this invention;

Fig. 2 is a front elevation of one valve unit;

Fig. 3 is a plan elevation of a pair of the valves assembled together; and

Fig. 4 is a cross-sectional view of a pair of the valves taken on the line 4 of Fig. 2.

As can be seen in Fig. 1, a typical refrigerator system built in accordance with this invention may be formed in two sections, one of which may include connected compressor and condenser units and the other the evaporator unit. According to my invention, the compressor-condenser section of a refrigerator system is connected to a dual valve block B by means of nipples **31***a* and the evaporator section is connected to a companion dual valve block C by means of corresponding nipples **31***a*. Each valve block includes a pair of open ports **34** for communication with similar ports in the companion valve block. Valve blocks B and C are made up of valve bodies **30** and **30***a*, respectively, and separately formed sections **36** that form charging ports, these parts being substantially identical in construction and function.

Details of a preferred embodiment employing a pair of the dual valve blocks appear in Figs. 2 to 4. Referring to Fig. 2, one of the valve bodies B is shown in front elevation. It includes the body portion **30**, nipples **31***a* for connection to the section as described, and a supporting bracket **42**. Figs. 3 and 4 show a pair of dual valve bodies bolted together, the companion valve body C having been bolted to valve body B by means

of bolts 41. A gasket 35*a* may be placed between the plane transverse walls, these walls acting as fluid sealing surfaces. A preferred method of connecting the bodies resides in having plain bores for reception of bolts in one valve body (such as body C) and threaded apertures 41*a* for the bolts in the other valve body (such as body B). However, any convenient method of fastening the two bodies B and C together may be employed. As mentioned previously, each pair of nipples 31*a* in a given valve block form the inlet and outlet nipples for a section of the refrigeration system.

The interior arrangement of the valve bodies appears in Fig. 4. Here can be seen the two valve bodies B and C in juxtapositon. The parts of each valve body are identical except for the means provided to receive the bolts or fastenings which connects them, and for this reason reference designations for the internal valve parts are the same. The valve bodies B and C include the main body sections 30 and 30*a*, respectively, and the sections 36 threaded thereto. In each individual valve, bore 31 at nipple 31*a* may receive tubing connected with a refrigerator section and bore 31 communicates with vertical bore 32 which, in turn, connects with an enlarged or central chamber 33. Port 34 leads from central chamber 33 and opens to exterior sealing surface of the valve, this port being open when the blocks B and C are separated unless they are sealed off by a temporary closure or by valve member V as will be described. As a result of the above construction, each of valve members B and C can be considered to have a pair of through passageways that may be closed off internally by engagement of a valve member with intermediate seats 35. In normal operation, with the blocks connected in the system there is a passage through both blocks via 31, 32, 33 and 34. In the preferred form the surface of each body surrounding the open ports 34 is a plane surface formed for union with the mating valve body except for a gasket therebetween. A valve seat 35 is formed at the junction of bore 32 and chamber 33 and another valve seat 38 is formed at the outer portion of nipple 36. Sections 36 are bored to provide the charging ports for each valve.

Each valve member V has formed thereon threads 10*a* which engage threads 37 formed in the sections 36. Valve member V includes a pair of opposed conical seats 8*a* and 13*a* for cooperation with seats 35 and 38 in the valve body. A slot 15 may be formed in valve member V to permit fluid to flow past the threads during the charging operation. Splined recess 16 is formed in each member V for reception of a tool for manipulation of the valve. Seat 8*a* on the valve member V is arranged to cooperate with seat 35 in the body for sealing off the open ports 34 of the charged sections before installation in the manner described previously and seat 13*a* may engage lip 33 forming a charging port to close the charging port during operation of the system.

In operation, after the valve blocks are connected to their associated refrigerator sections, and at least one of open ports 34 in each section has been provided with a temporary closure, the assembly is ready for the charging operation. Both valve members V will preferably be at an intermediate position during charging. A special tool including a charging nipple is threaded to one nipple 36 for charging each refrigerator section as described in detail in my divisional application, Serial No. 643,008, filed January 24, 1946, and assigned to The Weatherhead Company, 300 East 131st Street, Cleveland 8, Ohio.

When gas emits from the other charging nipple or from the associated port 34 (if this port has not been plugged), it indicates that the refrigerator section is charged and both valve members V are run against seats 35. The valve member V in the valve that was used to admit the charge is manipulated with the tool that forms part of the charging nipple. The other valve member is run against its seat 35 by any suitable tool. The temporary closure or closures for ports 34 may now be removed if desired and the charging nipple and tool may be disconnected from the valve and the charged sections may be shipped to the refrigerator assembly point where they are connected to companion sections in the refrigerator box by merely bolting valve bodies B and C together. Of course, removal of the temporary closure for the open ports is mandatory at this time. Thus, a sectional refrigeration employing my valve blocks dispenses with all intermediate connecting fittings and tubing between the sections and prevents the introduction of an objectionable volume of air into the system.

The bolt or other fastening means provided to connect valve body B with valve body C provides a very rigid, strong and leak-proof connection, a connection which will not vibrate loose and which contains no fittings to crystalize and break. Likewise, an advantage is offered by the provision of the supporting brackets 42, these brackets enabling the designer of the unit to provide for firm anchoring of the piping at these points.

Another advantage of the preferred form of construction is that two valve blocks are bolted together to perform functions usually requiring four separate valve bodies. In fact, upon assembly the valves are all in effect one rigid unit. Of course, it is understood that in the broader aspects of the invention four valve bodies could be employed and bolted together in pairs, which construction would have one of the major advantages of the preferred form in that the intermediate pipes and introduction of air would be eliminated.

Still another advantage of the dual valve block assembly is that this preferred form results in all service valves positioned in one location and provision can be made in the design of the refrigerator for making all the service valves exceptionally accessible.

The exact shape or design of the valve bodies is not critical, that illustrated merely being one which provides the strength consistent with reasonably light construction. Likewise, the exact location of the ports can be varied without departing from the spirit of the invention. However, paired ports 34 are in communication when the two valve bodies B and C are bolted or otherwise fastened together. Although body section 36 appears as a separate member to facilitate machine work, it may be integral with the remainder of the valve without modifying the method of operation. It is also possible to make a ground joint between the two valve bodies thereby dispensing with the gasket 35*a*. It is only necessary to provide one supporting bracket 42, the other valve body being rigidly held to the supported body by the fastening means. Of course, it is contemplated that a second body bracket 42 may be provided for the other valve body if so desired, this being within the realm of mere mechanical expediency.

Having thus described the present invention so that others skilled in the art may be able to understand and practice the same, I state that what I desire to secure by Letters Patent is defined in what is claimed.

What is claimed is:

1. In a refrigerator, a compressor unit, a condenser and an evaporator unit, said units being arranged in two or more sections each section having inlet and outlet lines, a charging and sealing valve assembly associated with each inlet and outlet line of each section, each of said valve assemblies including a body portion having a fluid conducting passageway extending therethrough, each passageway having terminal inlet and outlet ports with one port of each valve assembly connected to one of the lines of each section and the other port of each valve assembly terminating in sealing means for connection to a complementary port of a valve assembly associated with another section, a section-isolating valve seat in each passageway between the inlet and outlet ports thereof, a charging port in each valve body portion communicating with the associated passageway between the section-isolating valve seat therein and the other port thereof, each of said valve assemblies having a movable valve member threaded into the valve body portion thereof and having a sealing portion formed for engagement with the associated section-isolating valve seat, means for manual manipulation of said valve member through said charging port, means to join each valve assembly of one section to a valve assembly of another section with the fluid sealing means of said other ports in sealing engagement with one another to establish communication between sections, and means to seal off said charging ports from the atmosphere.

2. In a refrigerator, a compressor unit, a condenser unit and an evaporator unit, said units being arranged in two or more sections each section having an inlet and an outlet, the inlet of one section being connected to the outlet of another, a dual valve block connected with each section each valve having one charging and sealing valve associated with the inlet of the connected section and one with the outlet of the connected section, each of said valves having two fluid conducting ports with a valve seat between the ports, a charging port communicating with said first two ports, and a valve seat between said charging port and said first two ports, each of said valves having a movable valve member threaded into the valve body and having portions formed for selective engagement with said valve seats, the threads lying between the charging port and the first two ports, each valve member being formed to permit fluid to flow past said threads, one of said first two ports of each valve in each block being connected to the associated refrigerator section and the other of said first two ports terminating in fluid sealing means formed externally on each block, and means to join the fluid sealing means of two of said dual valve blocks together placing one of said other ports in each dual valve block in fluid communication with its corresponding port in the associated dual valve block.

3. In a refrigerator, a compressor unit, a condenser unit and an evaporator unit, said units being arranged in two or more sections each section having an inlet and an outlet, a dual valve block having charging and sealing valve units associated with the inlet and outlet of each section respectively, each of said valves having two fluid conducting ports with a valve seat between the ports, each of said valves including a charging port communicating with said first two ports and valve seat means between said charging port and said first two ports, each valve having a valve member threaded into the valve body and having portions formed for selective engagement with said valve seats, the threads lying between the charging port and the first two ports, each valve member being formed to permit fluid to flow past said threads, one of said first two ports of each valve being connected to the associated refrigerator section and the other port terminating in means formed on said valve body whereby two of said bodies may be joined together directly with said other ports of each valve in fluid communication.

4. For use in a refrigerator system having a compressor unit, a condenser unit and an evaporator unit with said units being arranged in two or more sections and with each section having an inlet and an outlet, a dual valve block having a pair of charging and sealing valves with one valve adapted for connection with the inlet and one with the outlet of each section, each of said valves having two fluid conducting ports with a valve seat between the ports, a charging port communicating with said first two ports, and a valve seat between said charging port and said first two ports, each of said valves having a movable valve member threaded into the valve body and having portions formed for selective engagement with said valve seats, one of said first two ports of each valve in each block being arranged for connection to the associated refrigerator section and the other of said first two ports terminating in fluid sealing means formed externally on each block, and means to join the fluid sealing means of two of said dual valve blocks together placing one of said other ports in each dual valve block in fluid communication with its corresponding port in the other dual valve block.

5. For use in a refrigerator system having a compressor unit, a condenser unit and an evaporator unit with said units being arranged in two or more sections and with each section having an inlet and an outlet, a dual valve block having a pair of charging and sealing valves with one valve adapted for connection with the inlet and one with the outlet of each section, each of said valves having two fluid conducting ports with a valve seat between the ports, a charging port communicating with said first two ports, and a valve seat between said charging port and said first two ports, each of said valves having a movable valve member threaded into the valve body and having portions formed for selective engagement with said valve seats, the threads lying between the charging port and the first two ports, each valve member being formed to permit fluid to flow past said threads, one of said first two ports of each valve in each block being arranged for connection to the associated refrigerator section and the other of said first two ports terminating in fluid sealing means formed externally on each block, and means to join the fluid sealing means of two of said dual valve blocks together placing one of said other ports in each dual valve block in fluid communication with its corresponding port in the other dual valve block.

6. In a refrigerator, a compressor unit, a condenser and an evaporator unit, said units being arranged in two or more sections each section

having inlet and outlet lines, a charging and sealing valve assembly associated with each inlet and outlet line of each section, each of said valve assemblies including a body portion having a fluid conducting passageway extending therethrough, each passageway having terminal inlet and outlet ports with one port of each valve assembly connected to one of the lines of each section and the other port of each valve assembly terminating in sealing means for connection to a complementary port of a valve assembly associated with another section, a section-isolating valve seat in each passageway between the inlet and outlet ports thereof, a charging port in each valve body portion communicating with the associated passageway between the section-isolating valve seat therein and the other port thereof, each of said valve assemblies having a movable valve member threaded into the valve body portion thereof and having a sealing portion formed for engagement with the associated section-isolating valve seat, means for manual manipulation of said valve member through said charging port, means to join each valve assembly of one section to a valve assembly of another section with the fluid sealing means of said other ports in sealing engagement with one another to establish communication between sections, and means to seal off said charging ports from the atmosphere, the body portions of the valve assemblies for each section being unitary.

7. In a refrigerator, a compressor unit, a condenser and an evaporator unit, said units being arranged in two or more sections each section having inlet and outlet lines, a charging and sealing valve assembly associated with each inlet and outlet line of each section, each of said valve assemblies including a body portion having a fluid conducting passageway extending there-

through, each passageway having terminal inlet and outlet ports with one port of each valve assembly connected to one of the lines of each section and the other port of each valve assembly terminating in fluid sealing means for connection to a complementary port of a valve assembly associated with another section, a first valve seat in each passageway between the inlet and outlet ports thereof, a charging port including a second valve seat in each valve body portion communicating with the associated passageway between the first valve seat therein and the other port thereof, threads in the body portion between said first and second valve seats, each of said valve assemblies having a movable valve member threaded into said threads and having sealing portions formed for selective engagement with either of said valve seats, means for manual manipulation of said valve member through said charging port, means to provide for fluid flow past said threads, and means to join each valve assembly of one section to a valve assembly of another section with the fluid sealing means of said other ports in sealing engagement with one another to establish communication between sections.

CHARLES H. BOYLAN.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
1,703,311	Litle, Jr.	Feb. 26, 1929
1,802,659	Loranger et al.	Apr. 28, 1931
1,954,136	King	Apr. 10, 1934
2,338,953	Melke	Jan. 11, 1944
2,438,776	Boylan	Mar. 30, 1948