May 20, 1924. 1,495,125

J. WILLMANN

REFRIGERANT SYSTEM FOR ICE CREAM FREEZERS

Filed Oct. 19, 1922 2 Sheets-Sheet 1

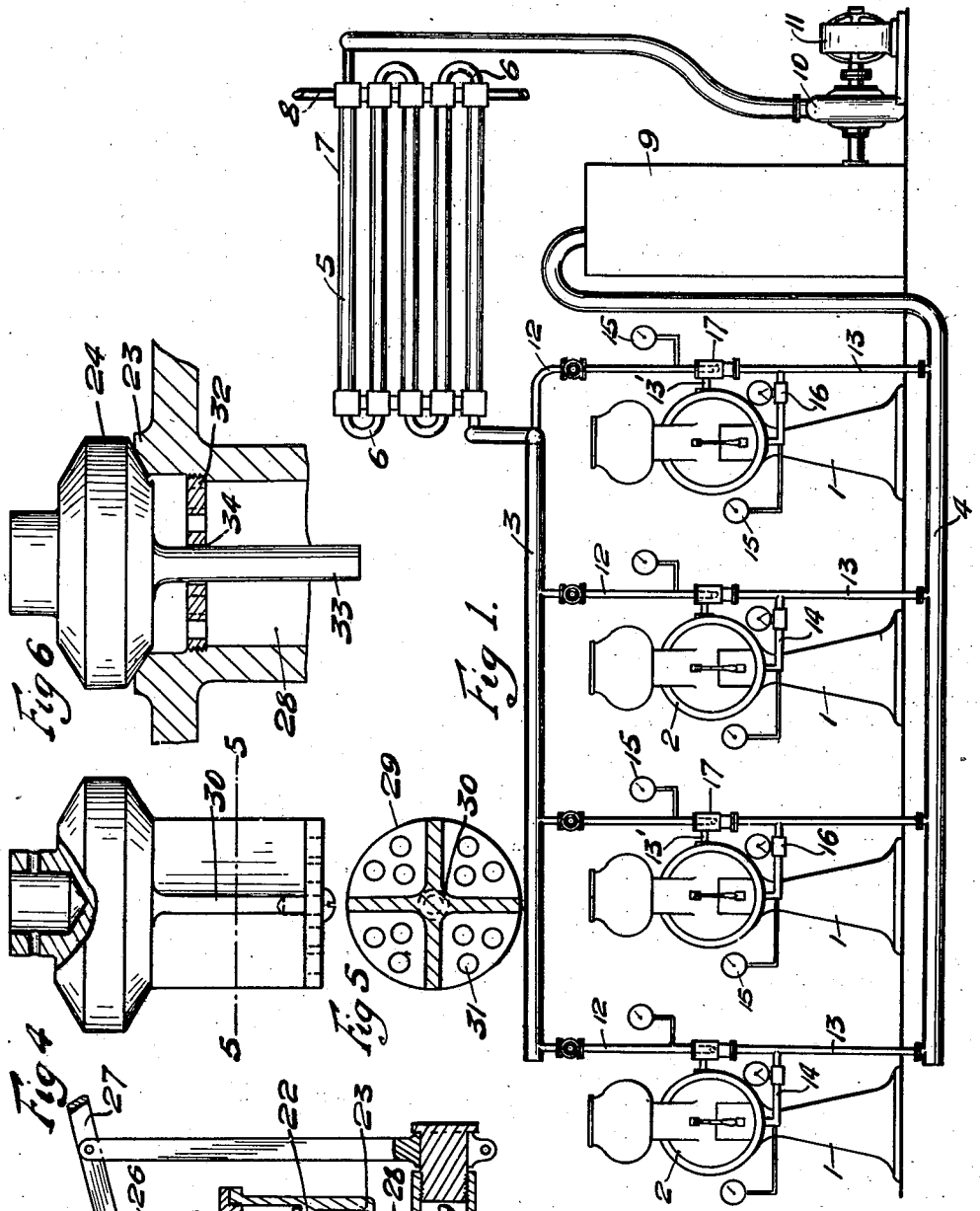


Fig 1.

Fig 6

Fig 4

Fig 5

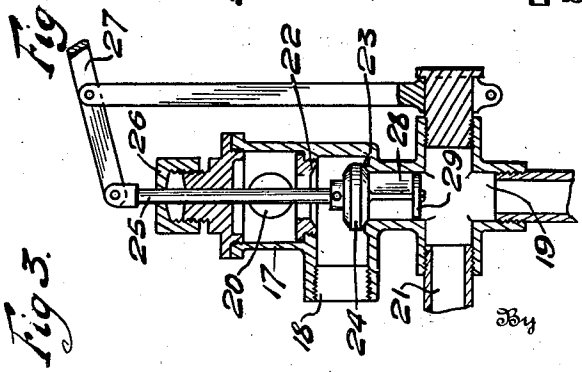


Fig 3.

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Fig 2.

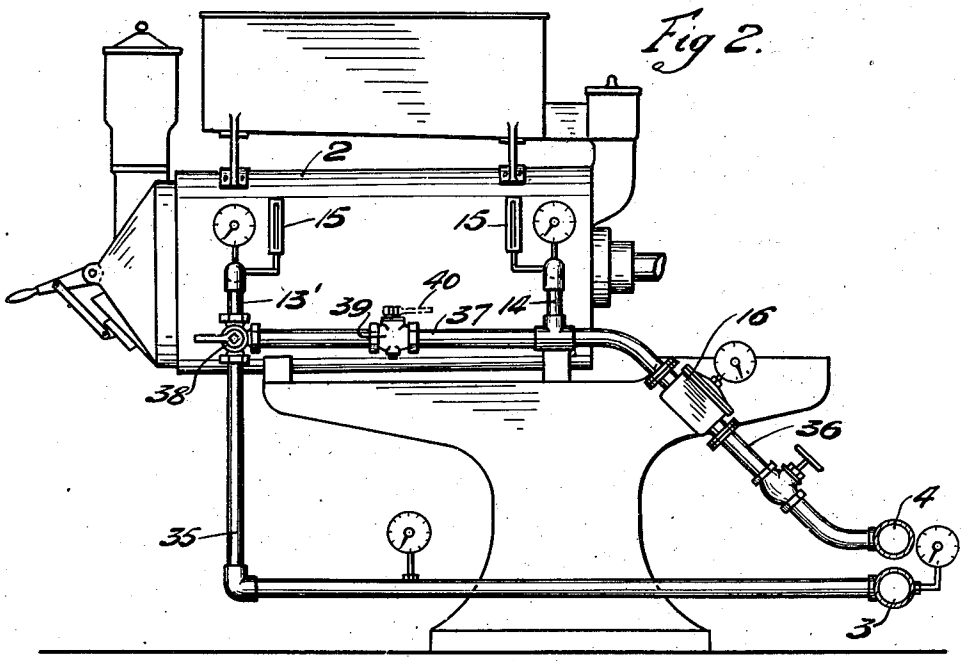


Fig 7.

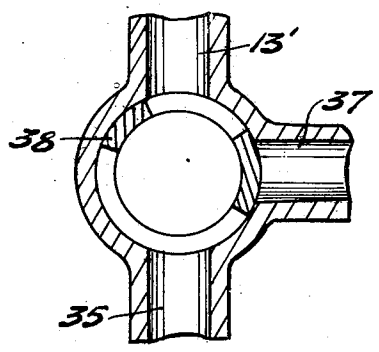
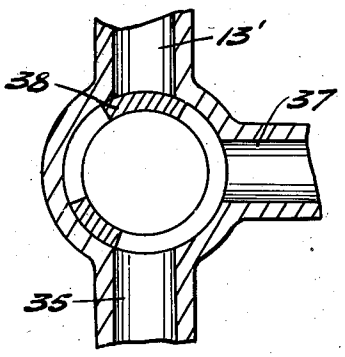


Fig 8.



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UNITED STATES PATENT OFFICE.

JOSEPH WILLMANN, OF DERBY, CONNECTICUT.

REFRIGERANT SYSTEM FOR ICE-CREAM FREEZERS.

Application filed October 19, 1922. Serial No. 595,689.

To all whom it may concern:

Be it known that I, JOSEPH WILLMANN, a citizen of the United States, residing at Derby, in the county of New Haven and State of Connecticut, have invented certain new and useful Improvements in Refrigerant Systems for Ice-Cream Freezers, of which the following is a specification.

This invention relates to ice cream freezing machinery and particularly to an arrangement of apparatus in which a battery of jacketed freezing units are connected in parallel between the mains of a refrigerant circulation system.

One of the objects of the invention is the provision in such an installation of means to automatically maintain a predetermined refrigerant pressure in each or any number of the freezing units, unaffected by the by-passing of the refrigerant incident to the shutting off of the flow of the refrigerant from the jacket of one of the freezing units. In present systems of the type designated the flow of refrigerant around the jacket of a freezing unit is controlled by a valve which when closed by-passes the refrigerant through the branch conduit in which the freezing unit is located, the refrigerant suffering a drop in pressure due to its being relieved of the resistance of its tortuous path through the freezer jacket, which drop is communicated to the entire circulation system causing a lessening in the velocity of flow of the refrigerant through the other freezing units thereby altering the conditions in said units which are conducive to the most efficient production of ice cream.

Another object of the invention is the provision of means associated with each freezing unit for interposing in the common circulation system a resistance equal to the resistance which is removed therefrom by the closing of the refrigerant valve of said unit, so as to maintain the pressure head at its normal operating pressure throughout the circulation system.

More specifically the object of the invention is the provision of a by-pass valve and means associated therewith for throttling the branch conduit sufficiently to produce a pressure in the general circulation system when the by-pass valve is open to the by-pass equal to the pressure in said system when the flow is directed through the freezing jacket.

The further objects thereof will be hereinafter more fully set forth in the description of the invention which consists in the new and novel features of construction and combination of parts hereinafter set forth and claimed.

In the accompanying drawings:—

Figure 1 is a side elevation, more or less diagrammatic in character, showing a battery of freezing units in a circulation system to which one form of my invention has been applied.

Figure 2 is a side elevation of a single freezing unit equipped with another form of my invention.

Figure 3 is a side sectional view of my combined by-pass and throttling valve.

Figure 4 is a side elevation, party in section of a portion of the valve mechanism shown in Figure 3.

Figure 5 is a cross section taken along the line 5—5 of Figure 3.

Figure 6 is a detail view partly in cross section showing a modified form of the invention.

Figures 7 and 8 are sectional views which show in two positions, the preferred form of by-pass valve when a separate throttling means is used.

Referring now in detail to the several figures, the numeral 1 represents one of a battery of ice cream freezing units each of which is provided with the refrigerant jacket 2. A circulation system is provided for supplying brine or other liquid refrigerant under pressure to the jackets 2, said system comprising the supply and discharge mains 3 and 4 respectively, the former of which proceeds from a refrigerating coil 5 which consists of a plurality of connected jacketed tubes 6, the jackets 7 of which are in communication with the expansion conduit 8 of an ammonia refrigerating machine. The discharge main 4 empties into a brine tank 9 the lower portion of which communicates with the pump 10 driven by a source of power 11. The pump 10 elevates the brine or other refrigerant to the top of the refrigerating coil 5 and supplies the brine under pressure to the several freezing units. The latter are connected to the supply and discharge mains by means of branch conduits 12 and 13 which are arranged in parallel between said main so that brine is supplied to the jacket of each of the freezing units at the same pressure and temperature. The jackets are connected to

the branch conduits by means of inlet pipes 13′ and outlet pipes 14. A temperature indicator 15 is arranged on the supply and discharge sides of each jacket so that the temperature of the incoming and outflowing brine may be accurately ascertained, and a brine meter 16 is located in the discharge pipe 14 of each jacket to measure the quantity of brine flowing therethrough in a given time.

In refrigerant circulation systems embracing the features which have been described up to this point it is customary to place a valve at the point of juncture between each branch conduit and the supply pipe to the jacket of the freezing unit by means of which the flow of brine may be selectively turned into said jacket, or excluded therefrom and permitted to by-pass through the branch pipe to the discharge main. The path of flow of the brine through the jackets, and particularly in present constructions in which the brine flows through tortuous or spiral passages in the jackets, offers considerable resistance to the flow of brine, which resistance determines the pressure head of the circulating liquid. When one of the valves is closed so as to exclude the flow of brine from a jacket 2, the resistance of said jacket is removed from the circulation system and the flow of brine which is diverted from said jacket is permitted to pass in an unimpeded path through the branch conduit back to the discharge main. This, of course, lowers the pressure head of liquid in the entire circulation system causing a lessening of pressure in those jackets through which the brine is still flowing, producing a retardation in the velocity of flow of brine through said jackets and a consequent alteration in the freezing temperature of said brine within said jackets and of the period of duration of the freezing process. As there is a critical temperature and a critical freezing period for the most efficient production of ice cream, it is obvious that any disturbance of the rate of brine flow in some of the freezing units due to cutting off of the brine flow from other of said units is detrimental to the best results both from the standpoint of economy and quality of product in the manufacturing of ice cream.

My invention, which aims to eliminate this drawback by maintaining the pressure head unaffected by the exclusion of any of the jacketed freezing units from the refrigerant circulation system may be exemplified by numerous constructions, one of which is illustrated in Figures 1, 3, 5 and 6 and consists of the valve casing 17 having a chamber which communicates with the branch conduit by means of the inlet 18 and outlet 19 and with the inlet and outlet pipes of the jacket 2 by means of the passages 20 and 21. The casing 17 is provided with a pair of aligned valve seats 22 and 23 with which the valve 24 is adapted to cooperate respectively, at the opposite extremes of its range of movement. A valve stem 25 projects through a stuffing gland 26 at the upper part of the casing 17 and is connected to an operating lever 27. When the valve 24 engages the seat 23 as shown in Figure 3 the brine circulation enters the inlet 18 from the branch conduit 12, flows through the passage 20 and the inlet pipe 13′ into the jacket 2 from which it returns by way of the pipe 14 into the passage 21, through the outlet 19 again to the branch conduit 13. In its passage through the jacket the refrigerant encounters the frictional resistance of the walls of said jacket, which is considerable if said walls are of tortuous or spiral form. In the course of the ice cream making process the step is arrived at where the brine is shut off and the beating of the mix in the freezing unit is continued without further lowering of its temperature. The brine flow is cut off from the jacket 2 by operating the lever 27 so as to raise the valve 24 to a position of engagement with the upper seat 22. This stops the flow of brine from the inlet 18 through the passage 20 which leads to the jacket and permits the by-passing of said brine through the passage 28 directly back to the branch conduit 12. In order to prevent the drop in pressure head which would ordinarily accompany the flow of refrigerant through the by-pass I have provided a throttling means 29 for the passage 28 which is designed to be adjusted so as to make the resistance which it opposes to the flow of brine through the by-pass equal to the resistance within the jacket 2. Thus while the brine flowing through the by-pass is relieved of the resistance within the jacket, it encounters an equal resistance in the presence of the throttling means so that the pressure head of the circulating liquid remains unchanged. The throttling means 29 is preferably a disk carried on an extension 30 of the valve and is provided with a plurality of apertures 31, the number and size of said apertures being chosen with a view to giving the proper resistance value to said throttling means. In the manufacture of the throttling means it is preferable to provide a number of apertures 31 in excess of the number that will be properly required and later to plug one or more of said apertures as may be found necessary, to give the desired balance in resistance between the alternate limbs of the circulation system passing through the jacket 2 and the by-pass. The peripheral edge of the throttling means 29 loosely fits the passage 28 so that said throttling means also serves as a guide for the valve 24.

In the modified form shown in Figure 6, the throttling means is arranged independ-

ently of the valve 24 in the form of a detachable bushing 32 which is inserted through the opening in the valve seat 23 and screwed into a threaded portion of the wall of the passage 28. A number of the bushings 32 having different resistance values may be kept on hand and the proper one selectively used to balance the resistance of the jacket of the freezing unit. In this instance the valve 24 is formed with a stem 33 projecting from its lower face and passing through a hole 34 in the bushing 32, the latter serving as a guide for the valve.

What is perhaps the preferred embodiment of my invention is illustrated in Figures 2, 7 and 8 in which the jacketed freezer 2 is in communication with the supply main 3 by means of the branch conduit 35 and with a discharge main 4 by the common discharge outlet conduit 36. A branch pipe 37 connects the supply and discharge conduits providing an alternate path of flow through which the brine may be directed, to the exclusion of the jacket of the freezer, by means of the by-pass valve 38. This valve, may take the form of the usual plug valve and is shown in cross section in Figures 7 and 8, said valve being ported so as to provide a continuous passage from the supply conduit to the freezer jacket when turned to the position shown in Figure 7, the by-pass conduit 37 being simultaneously closed. When the by-pass valve is turned to the position shown in Figure 8 the inlet passage to the freezer jacket is closed and the inlet conduit 35 placed in communication with the by-pass conduit 37.

The by-pass conduit 37 is supplied with throttling means, which in the present instance is shown in the form of a plug valve 39 which may be turned by the handle 40 so as to restrict to any desired degree the area of the bore of the by-pass conduit. It will thus be apparent that in this modification of my invention the by-pass valve does not function as a control valve, the controlling function being performed entirely by the throttling valve 39. To the end that said throttling valve may be adjusted to a position in which the resistance in the by-pass conduit is the same as the resistance to flow within the freezer jacket, a brine meter 16 is intercalated into the common discharge conduit 36. To properly adjust the valve 39 the by-pass valve is turned to admit the brine flow to the freezer jacket, excluding it from the by-pass conduit. The reading of the meter is then taken and shows a certain pressure head due to the resistance within said jacket. The by-pass valve is then positioned to permit flow from the supply conduit 35 to the by-pass conduit 37, excluding the jacket of the freezer. The meter will at once show a drop in pressure due to the relief of the brine flow from the resistance within the freezer jacket. The valve 39 is then gradually turned in a closing direction until the reading of the meter has arisen to the point at which it stood when the brine was flowing through the freezer jacket. This is the correct position of adjustment for the valve 39. The handle 40 may be removed to prevent the adjustment being tampered with. During the adjusting of the valve 39 of one of the freezing units, it is essential that the brine be flowing through the jackets of all the other units of the system.

Having described my invention what I claim as new and desire to secure by Letters Patent, is:—

1. A circulation system for ice cream freezers comprising supply and discharge mains, branch conduits arranged in parallel between said mains, means for circulating refrigerant through said system, a plurality of jacketed freezing units, the jacket of each unit being in communication with one of said branch conduits, a valve for each unit constructed to divert the flow of refrigerant from said branch conduit through said jacket and means for throttling said branch conduit when said valve is closed to exclude flow from said jacket.

2. A circulation system for ice cream freezers comprising supply and discharge mains, branch conduits arranged in parallel between said mains, means for circulating refrigerant through said system, a plurality of jacketed freezing units, the jacket of each unit being in communication with one of said branch conduits, means for selectively diverting the flow of refrigerant through said jacket and branch conduit or through said branch conduit to the exclusion of said jacket and means for imposing a resistance in said branch conduit substantially equal to the resistance in said jacket, when the flow is excluded from said jacket.

3. A circulation system for ice cream freezers comprising supply and discharge mains, branch conduits arranged in parallel between said mains, means for circulating refrigerant through said system, a jacketed freezing unit for each branch conduit the jacket thereof being in communication with said conduit, a throttling member in said branch conduit imposing a resistance in said conduit equal to the resistance within said jacket and a valve in said branch conduit between said jacket and throttling member for diverting the flow of liquid in said branch conduit selectively through said jacket or past said throttling member.

4. A circulation system for ice cream freezers comprising supply and discharge mains, branch conduits arranged in parallel between said mains, means for circulating refrigerant through said system, a plurality

of jacketed freezing units, the jacket of each unit being in communication with one of said branch conduits, a valve for each unit controlling said branch conduit, constructed to selectively divert the flow of refrigerant through said jacket or through said by-pass to the exclusion of said jacket and a throttling element for each branch conduit movable with said valve and operative to impose a resistance to flow through said branch conduit when said valve is positioned to exclude flow through said jacket.

5. A freezing unit for an ice cream freezing system comprising a freezing jacket, brine supply and discharge conduits leading to and from said jacket and a by-pass conduit connecting said supply discharge conduits and arranged in parallel with said jacket, a by-pass valve for alternating the flow of brine through said jacket and by-pass conduit and adjustable throttling means for said by-pass conduit.

6. A freezing unit for an ice cream freezing system comprising a freezing jacket, brine supply discharge conduits leading to and from said jacket and a by-pass conduit connecting said supply and discharge conduits and arranged in parallel with said jackets, a by-pass valve for alternating the flow of brine through said jacket and by-pass conduit and adjustable throttling means for said by-pass conduit, and a meter in the discharge conduit.

7. A circulation system for ice cream freezers comprising supply and discharge mains, branch conduits arranged in parallel between said mains, means for circulating refrigerant through said system, a plurality of jacketed freezing units, the jacket of each unit being in communication with one of said branch conduits, a valve for each unit controlling said branch conduit, constructed to selectively divert the flow of refrigerant through said jacket or through said by-pass to the exclusion of said jacket and a throttling element for said branch conduit connected to said valve and operative to impose a resistance to flow through said branch conduit when said valve is positioned to exclude flow through said jacket, said throttling element comprising a disk provided with an aperture extending therethrough.

8. A circulation system for ice cream freezers comprising supply and discharge mains, branch conduits arranged in parallel between said mains, means for circulating refrigerant through said system, a plurality of jacketed freezing units, the jacket of each unit being in communication with one of said branch conduits, a valve for each unit controlling said branch conduit, constructed to selectively divert the flow of refrigerant through said jacket or through said by-pass to the exclusion of said jacket and a throttling element for said branch conduit connected to said valve and operative to impose a resistance to flow through said branch conduit when said valve is positioned to exclude flow through said jacket, said throttling element comprising a disk provided with a plurality of apertures therethrough and means for operating said valve.

9. A circulation system for ice cream freezers comprising supply and discharge mains, branch conduits arranged in parallel between said mains for circulating refrigerant through said system, a plurality of jacketed freezing units, the jacket of each unit being in communication with one of said branch conduits, a valve for each unit controlling said branch conduit, comprising a casing, provided with an inlet and outlet connected respectively to the supply and discharge ends of said branch conduit and with a discharge passage communicating with the jacket of said freezing unit, said casing being formed with a valve seat controlling flow between the inlet from said branch conduit and said discharge passage, a second valve seat positioned to control the inlet and outlet for said branch conduit, a valve reciprocable within said casing to selectively close either seat and simultaneously open the other and a throttling disk on said valve for restricting the area of the branch conduit between said inlet and outlet, when said second valve seat is uncovered.

In testimony whereof I affix my signature.

JOSEPH WILLMANN.