

Dec. 26, 1939.

F. P. PEISERICH ET AL

2,185,107

REFRIGERATION CONTROL

Filed Feb. 8, 1937

2 Sheets-Sheet 1

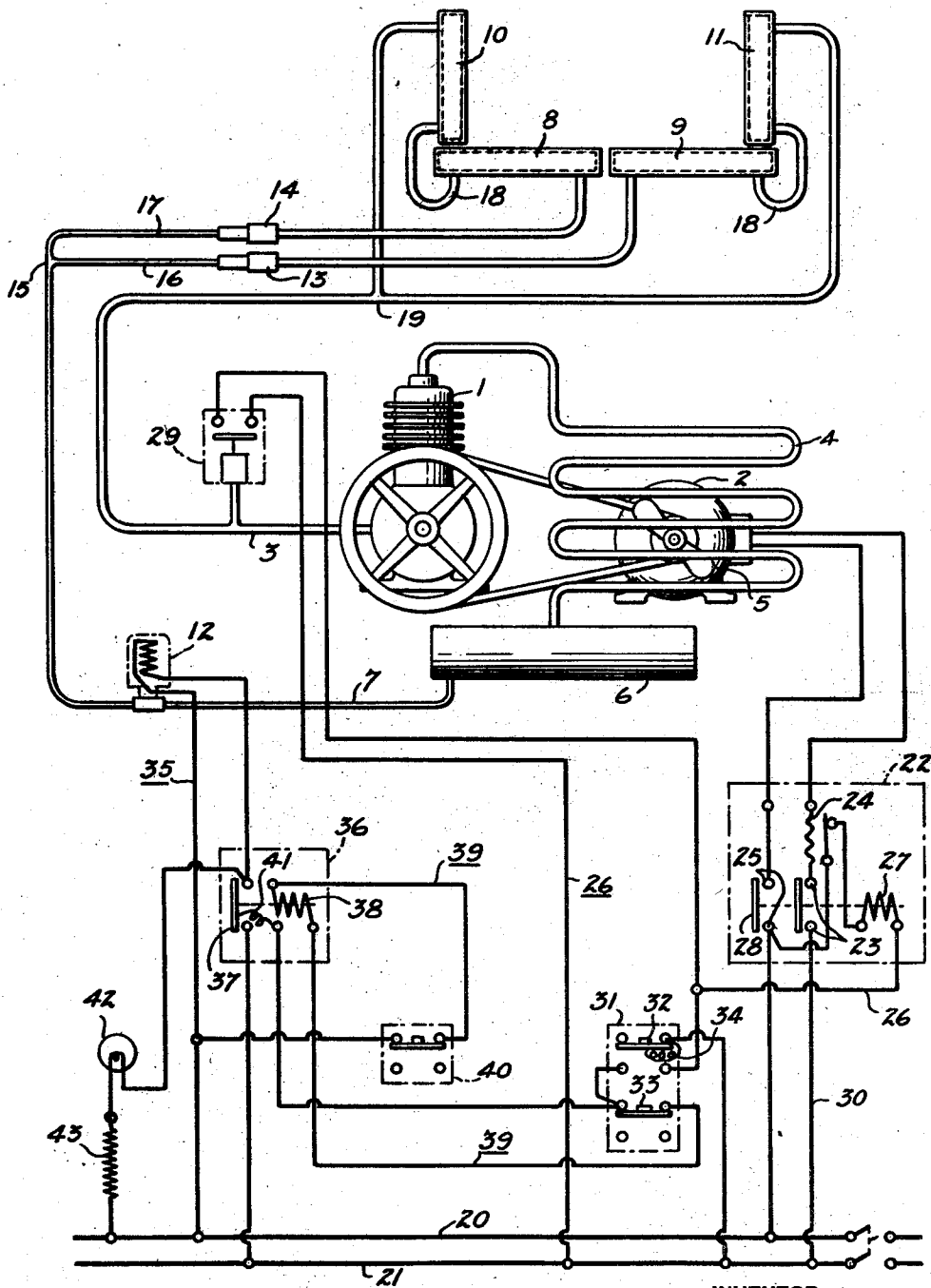


Fig. 1

INVENTOR
Frederick P. Peiserich
Carl F. Bielenberg
BY *Evans & Mc Coy*
ATTORNEYS

Dec. 26, 1939.

F. P. PEISERICH ET AL

2,185,107

REFRIGERATION CONTROL

Filed Feb. 8, 1937

2 Sheets-Sheet 2

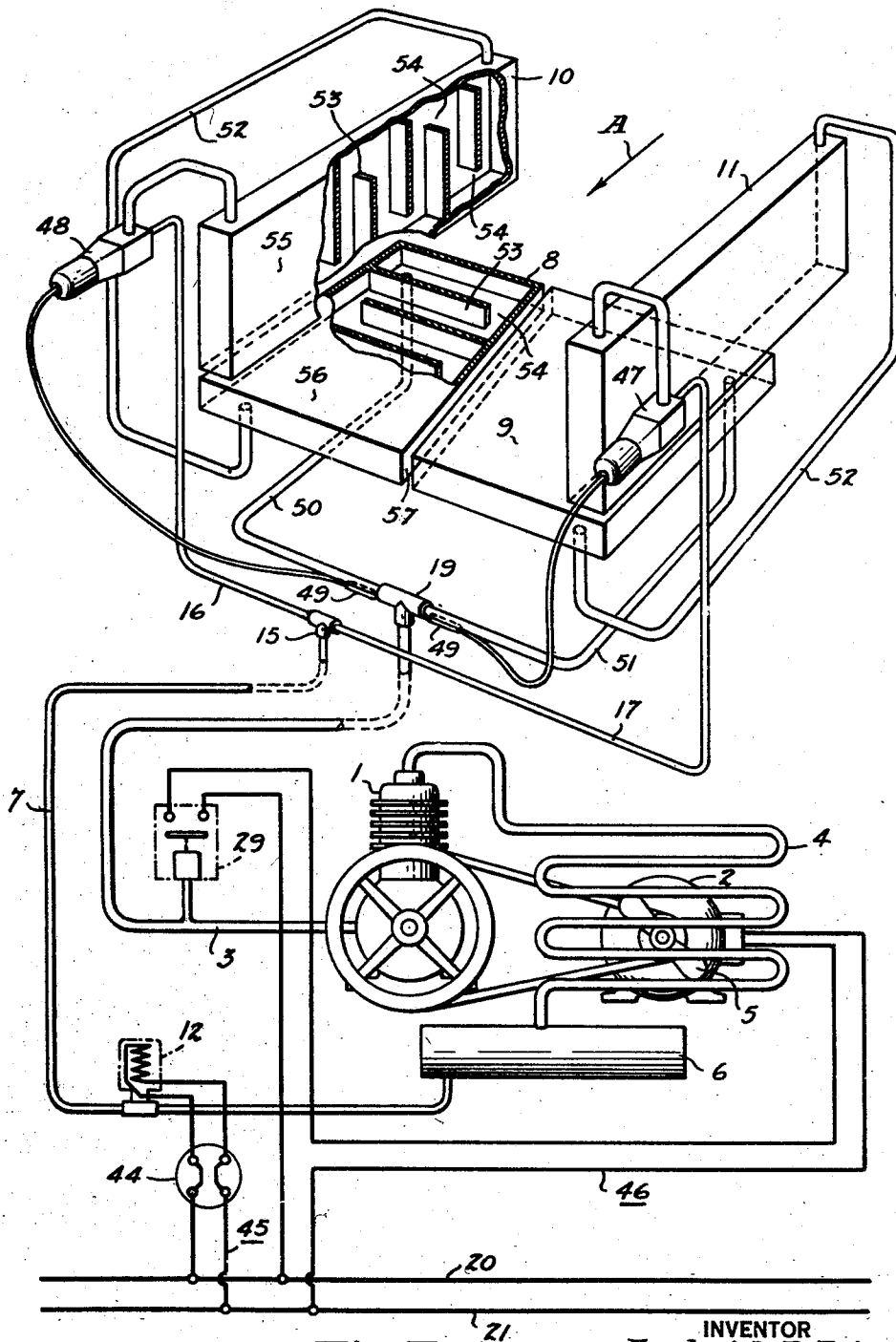


Fig. 2

INVENTOR
Frederick P. Peiserich
Carl F. Bielenberg
BY Evans & Meloy
ATTORNEYS

UNITED STATES PATENT OFFICE

2,185,107

REFRIGERATION CONTROL

Frederick P. Peiserich, Bettendorf, and Carl F. Bielenberg, Davenport, Iowa, assignors to Micro-Westco, Inc., Bettendorf, Iowa, a corporation of Delaware

Application February 8, 1937, Serial No. 124,536

12 Claims. (Cl. 62-4)

This invention relates to automatically controlled refrigerating systems and particularly to such a system for use in connection with wrapping machines for cooling the overlapped portions of a wrapped article to effect an efficient seal thereof.

An object of the invention is to provide a system for the control of a refrigerating apparatus which will automatically operate to maintain the pressure in the evaporator or refrigerant plates and related parts below a predetermined pressure whether the system is idle or in use to seal wrapped articles in order that such elements of the system will not be likely to rupture or burst.

Another object is to provide such a control in which the refrigerant circulation may be put into or out of operation by a single switch which switch may be arranged to be operated at more than a single station.

A further object is to provide a control of this character in which a signal lamp indicates when the refrigerant is circulating.

Another object is to provide an improved arrangement of refrigerating members and refrigerant conduits for carrying refrigerant to and from the refrigerating members which will more efficiently chill the overlapped portions of the wrapper of a wrapped article.

Other objects and advantages will become apparent from the following detailed description made with reference to the accompanying diagrammatic illustrations of systems constructed according to the present invention.

Figure 1 is a diagrammatic illustration of a refrigeration system embodying a control constructed according to the present invention; and

Fig. 2 is a modification of the control illustrated in Fig. 1 and showing a preferred arrangement of and connections for the refrigerating plates.

In Fig. 1, a compressor 1, belt driven from an electric motor 2, is designed to receive a suitable gaseous refrigerant such as methyl chloride from a low pressure conduit or line 3 and deliver it in a compressed condition to a condenser 4 over which a current of air may be directed by a fan 5 carried on the motor shaft. After being cooled in the condenser the refrigerant flows into the reservoir 6.

A high pressure line 7 conducts the liquid refrigerant to the bottom evaporator or refrigerant plates 8 and 9 and side evaporator plates 10 and 11, the flow of the refrigerant through the high pressure line being controlled by an electromagnetic or solenoid valve 12 and expansion valves 13 and 14.

It will be seen that beyond the solenoid valve 12 the high pressure line 7 divides at 15 into two branches 16 and 17, the flow of the refrigerant through the branch 16 being regulated by the expansion valve 13 and the flow of the refrigerant through the branch 17 being controlled by the expansion valve 14. The refrigerant conduit branch 16 includes expansion valve 13, evaporator plates or tanks 9 and 11, and connecting tubular conduits. The conduit from the expansion valve 13 is connected to the under side of the bottom evaporator plate 9 and the refrigerant, after flowing through the evaporator plate 9, is directed through the conduit 18 into the lower portion of the side evaporator plate 11 which is thus connected in series with the bottom evaporator plate 9. In a similar manner the refrigerant in branch 17 which includes expansion valve 14, evaporator plates or tanks 8 and 10, and tubular connecting conduits flows through bottom evaporator plate 8 and side evaporator plate 10. The two branches 16 and 17 join again at 19 and the refrigerant flows from this point to the compressor 1 through the low pressure conduit or line 3, after which the cycle may be repeated.

The motor 2 receives its energy from an electric power line having sides 20 and 21 and controlled by the magnetic switch 22. One pole 23 of the magnetic switch is connected to the side 21 of the power line and provided with an overload cut-out 24 arranged to break the circuit in case of excessive load on the motor and compressor in order to prevent damage thereto. The other pole 25 of the magnetic switch is connected to the side 20 of the power line and is tied into the side 21 of the power line through the series circuit 26 consisting of an electromagnet 27, which operates armature 28 of the magnetic switch, and a pressure actuated switch 29. The pressure switch 29 is connected to the low pressure line 3 of the refrigerant circuit, and is arranged to open the series electric circuit 26 when the pressure in the line 3 is reduced to a predetermined value and to close the circuit 26 when such pressure is raised to a predetermined value. In this manner the circuit 26, controlled by the pressure switch 29, will actuate the armature 28 of the magnetic switch 22 and close or open motor circuit 30 solely in response to the pressure of the refrigerant in the low pressure line 3 and independently of other controls.

A control switch 31 having a start button 32 and a stop button 33 is provided to place the refrigerating mechanism into or out of operation. The start button has a pigtail 34 tied into the

side 21 of the power line so that pressure on the start button 32 shunts the circuit 26 across the pressure switch 29, thereby energizing the magnet 27 of the magnetic switch 22 and starting the motor 2.

The electromagnetic or solenoid valve 12 in the high pressure line 7 is arranged to open and permit the flow of refrigerant when energized and to close the high pressure line when de-energized. Its circuit 35 consists of a direct connection to the side 20 of the power line and indirect connection to the side 21 thereof through a single pole relay 36. Armature 37 of the relay 36 is actuated by electromagnet 38 energized through a circuit 39 comprising a tie to the side 20 of the power line through a remote control stop switch 40 and a tie to the stop button 33 of the control switch 31. When the start button 32 of the control switch is pressed the current from the side 21 of the power line carried thereby through the pigtail 34 is shorted into the circuit 39 as well as the circuit 26, thereby energizing the electromagnet 38 of the relay 36 and closing the circuit 35 which opens the solenoid valve 12 to permit the flow of high pressure refrigerant to the expansion valves 13 and 14. A pigtail 41 on the armature 37 is also tied to the relay circuit 39 so that the electromagnet 38 will remain energized, after the start button 32 is released. In this case the current from the side 21 comes from the armature 37 and is carried through the stop button 33. Thus, the solenoid valve 12, when once opened by pressing start button 32, remains open until the relay circuit 39 is broken either by actuating the stop button 33 or remote control stop switch 40.

When a refrigerating mechanism such as that described above is used in connection with a wrapping machine for cooling the overlapped portions of wrapping material to effect a seal thereof it may be desirable to provide a means for shutting off the refrigerating unit simultaneously with the wrapper unit so that an operator of the wrapping machine will not be likely to stop the wrapping machine and inadvertently leave the refrigerating mechanism in operation. In the present invention this is accomplished by providing the remote control switch 40 which may be situated so that it is automatically operated simultaneously with the turning off of the wrapping machine.

As a further precaution and in order that an operator may readily determine when the refrigerating system is operative a pilot or signal light 42 is provided. This light is connected in series with a suitable resistance 43 to the side 20 of the power line and a contact of the relay 36 so that it is energized only when the armature 37 closes the relay.

Accordingly, when the relay 36 is energized to close the circuit 35 of the electromagnetic valve 12, the signal lamp 42, which is connected in parallel with the solenoid coil of the valve 12, is illuminated and indicates to the attendant that the valve 12 is open. The attendant is thus informed that refrigerant is being supplied to the evaporators and the system is operative to cool articles, the maintenance of a sufficiently low pressure in the evaporators by the compressor 1 being automatically controlled as previously explained. It is apparent that without the signal lamp 42, the operator would be unable to determine, without an extensive investigation, whether the system is in condition to chill a series of wrapped articles because the compressor may or may not be in operation when the valve 12 is open

and may even operate when such valve is closed.

The operation of the system is as follows:

Assuming that the motor is idle and the evaporator plates are warm, pressure on the start button 32 of the control switch 31 energizes the circuit 26 which actuates the armature 28 of the magnetic switch 22 and closes the motor circuit 30, thus starting the motor 2 which drives the compressor 1.

Simultaneously, the pressure on the start button 32 also energizes the circuit 39 to close the relay 36 which lights the signal lamp 42 and opens the solenoid valve 12, thus admitting high pressure refrigerant into the branches 16 and 17 of the refrigerating mechanism. This refrigerant is throttled through the expansion valves 13 and 14 and enters the bottom evaporator plates 8 and 9 at a low pressure.

The refrigerant partially vaporizes in the evaporator plates 8 and 9, thereby absorbing heat from the same to give them an efficient chilling effect so as to withdraw heat from the bottom of a wrapped article. From the bottom of the evaporator plates the low pressure refrigerant, part of which is vaporized, flows into the bottom of the side evaporator plates 10 and 11 through the conduits 18, where it is further vaporized with the absorption of heat, so that the ends or sides of the wrapped article positioned between the side evaporator plates are properly chilled.

As will be seen in the drawings, the evaporator or cooling plates are so arranged that wrapped articles to be sealed, such as loaves of bread, may be passed successively over the bottom plates 8 and 9 and between the side plates 10 and 11. The article to be sealed may have its bottom portion engaged directly with plates 8 and 9 and its ends engaged with plates 10 and 11 respectively, or if desired, suitable conveyors or plates may be interposed between the cooling plate and wrapped article to be sealed.

After the start button 32 is released the circuit 39 is not broken, since the armature 37 of the relay 36 has been closed and the side 21 of the power line is tied to the circuit 39 through the pigtail 41. However, the motor circuit 30 is dependent upon the magnetic switch 22 and upon release of the start button 32 the circuit 26 controlling the armature 28 of the magnetic switch will be broken unless the pressure in the low pressure conduit 3 is high enough to close the pressure switch 29, in which event, of course, the circuit 26 will remain closed and the motor and compressor continue in operation.

Assuming, however, that the pressure in the low pressure line 3 is insufficient to close the switch 29, the circuit 26 is therefore broken, opening the circuit 30, and stopping the motor and compressor. In this case the refrigerant continues to flow through the expansion valves 13 and 14 and vaporize in the evaporator plates. This vaporization, of course, gradually builds up the pressure in the evaporator plates and low pressure line 3 until it is sufficient to actuate the switch 29 and close the circuit 26, whereby the magnet 27 is energized to close the magnetic switch 22 and start the motor and compressor, which reduces the pressure in the low pressure line 3 and evaporator plates until it reaches the predetermined pressure at which the switch 29 opens to break the circuit 26, thereby stopping the motor and compressor.

When it is desired to stop the operation of the refrigerating mechanism either the stop button 33 or the remote control switch 40 is pressed,

thus breaking the circuit 39 to open the relay 36 which breaks the circuit 35, thereby closing the electromagnetic or solenoid valve 12 and also turning off the signal lamp 42. However, as pointed out above, the circuit 26 is independent of the stop button 33 or remote control stop switch 40 so that if the pressure in the low pressure line 3 is high enough to keep the pressure switch 29 closed the motor and compressor will continue in operation until such pressure is reduced sufficiently to open the switch 29. If, however, continued vaporization of refrigerant remaining in the evaporator plates should build up pressure in the low pressure line after the motor and compressor have stopped and the solenoid valve 12 is closed, the switch 29 would again close and put the motor and compressor in operation to pump the vaporized refrigerant out of the evaporator plates and low pressure line until pressure therein has been reduced to the low pressure setting of the pressure switch 29.

In Fig. 2 is diagrammatically illustrated a modified refrigerating system for cooling the overlapped portions of the wrapper of a wrapped article. In this drawing the parts which correspond to parts described in connection with Fig. 1 have been indicated by the same numerals of reference.

It is to be observed that in this modification the refrigeration control system has been considerably simplified from that shown in Fig. 1. The magnetic switch 22, control switch 31, relay 36, and remote stop switch 40 have been replaced by a single control switch 44. This switch may be simply a snap type and is arranged to make and break the solenoid circuit 45, which corresponds to the circuit 35 described in connection with the control mechanism of Fig. 1. This circuit is energized from the power lines having sides 20 and 21. Upon closing the circuit by means of switch 44 the solenoid valve 12 opens the high pressure line 7 from the refrigerant reservoir 6 and permits the liquid refrigerant to flow into and through the refrigerating members or plates, as will be hereinafter described.

The motor 2 is automatically controlled by the pressure switch 29, connected in series with the motor and the side 20 and side 21 of the power line.

Normally the motor circuit just described and indicated by the numeral 46 is at all times connected to the power line. Consequently, energization of this circuit to actuate the motor 2 is dependent upon the pressure switch 29. Thus, regardless of whether the refrigerating unit or system is being used to cool the overlapped portions of the wrapper of a wrapped article or whether it is standing idle, the pressure in the low pressure line 3, and consequently in the evaporator plates 8, 9, 10 and 11, will be automatically maintained within a predetermined range by the operation of the pressure switch 29. This operation of the pressure switch 29 to maintain the pressure in the low pressure line 3 within a predetermined range is similar to the operation previously described in connection with the system illustrated in Fig. 1.

Refrigerant admitted to the high pressure line 7 through the opening of the solenoid valve 12 divides at 15 into the two branches 16 and 17 of the high pressure line and is then throttled through the expansion valves 47 and 48. Each branch of the high pressure line 7 is provided with a separate expansion valve which is ther-

mostatically controlled by means of bulb 49 positioned against the refrigerant outlet line of the refrigerant circulating branch for which the particular expansion valve is a control. The bulb 49 of the expansion valve 47 is positioned against the outlet line 51, through which is drawn the spent refrigerant from the refrigerant circulating branch comprising the tanks 9 and 11 and adjacent the joint 19 where the several outlet lines are combined to form the single low pressure refrigerant line 3. Thus the flow of refrigerant through this branch is separately regulated by means of its individual thermostatically controlled expansion valve 47. In a similar manner the expansion valve 48 regulates the flow of refrigerant through the branch comprising the tanks 8 and 10 by means of the thermostatic bulb 49 positioned adjacent the outlet line 50 through which is drawn the spent refrigerant from this branch. Expansion valves 47 and 48 are of the type which are arranged to permit a greater rate of flow of refrigerant when the thermostatic bulbs 49 are at an elevated temperature than when such bulbs are at a lower temperature. Consequently the temperature of the refrigerant leaving the cooling plates of the respective branches through the conduits 50 and 51 will control the rate of flow through the respective branches, and if each of a series of wrapped articles has one end which is heated to a higher degree than the opposite end, a refrigerating system constructed according to the present invention is adapted to furnish sufficient refrigerant to adequately cool both ends without excessively cooling one end and insufficiently cooling the other. That line or branch of the refrigerating system which is arranged to cool the ends of the articles elevated to the higher temperature will automatically adjust itself to the greater demand for refrigerant.

A pair of spaced parallel vertically disposed refrigerating plates or tanks, previously identified by the numerals 10 and 11 each receives refrigerant from one of the expansion valves 47 and 48. These tanks define the sides of a cooling zone through which the wrapped articles are passed in the direction indicated by the arrow A in order to chill the overlapped portions of the wrapper. The bottom refrigerating members or tanks 8 and 9 form the bottom of the cooling zone which is in the nature of a trough. It is to be understood that wrapped articles are to be passed through the cooling zone in any suitable manner well known in the art. This may be accomplished by one or more endless conveyors having one lap arranged to ride over one or more of the refrigerating members and carry the articles through the cooling zone by frictional engagement therewith. Another contemplated method is to have a succession of articles pushed through the cooling zone trough by some suitable means exterior of the cooling zone, such as a flight conveyor or other pusher means. In such a construction the wrapped articles could be arranged to have direct contact with the refrigerating members 8, 9, 10 and 11. However, the particular means used to advance the wrapped articles through the cooling zone forms no part of the present invention and accordingly has not been shown in the drawings. As shown, fresh refrigerant enters each of the side cooling plates or refrigerant tanks at the top of the end thereof adjacent the discharge end of the cooling zone. Intermediate conduits 52 carry the refrigerant from the side

or vertically disposed refrigerant tanks to the bottom refrigerant tanks. The refrigerant is drawn off from the top of the end of each vertically disposed refrigerant tank which end is disposed adjacent the entering end of the cooling zone and intermediate conduits 52 introduce such refrigerant to the end of a bottom refrigerant plate which end is positioned adjacent the discharge end of the cooling zone. Each intermediate conduit 52 conducts the refrigerant from a side heater plate to a bottom heater plate which are both positioned on the same side of the cooling zone. The spent refrigerant is drawn from each of the bottom evaporator plates 8 and 9 at the end thereof which is positioned adjacent the entering end of the cooling zone through their respective outlet lines 50 and 51 and carried to the compressor 1 through the low pressure line 3. The refrigerant is preferably made to take a circuitous path through the refrigerant tanks or cooling plates by means of baffles 53. These baffles may be in the form of webs or partitions which extend between the walls of the refrigerant chambers and form openings 54 to permit the refrigerant to flow from one side of the baffle to the other. As shown by the sectioned parts of the drawings, the vertically disposed or side evaporator plates have the baffles arranged vertically in the refrigerant circulating chambers with the openings 54 at alternate ends of successive baffles so that refrigerant is directed in an up and down path progressively through the refrigerant chambers. In this manner the wall 55 of the side refrigerant plates which is disposed toward the cooling zone has its internal surface swept over a plurality of times by the refrigerant passing through the refrigerant chamber. This back and forth sweeping action of the refrigerant over the inside surface of the evaporator plates is progressive from the end thereof adjacent the discharge end of the cooling zone toward the inlet end of the cooling zone. Consequently the refrigerant which has a lower temperature when entering the refrigerant tank than when leaving tends to maintain the wall 55 thereof coldest at the discharge end of the cooling zone with a progressive increase in temperature toward the entering end of the cooling zone. In a similar manner the bottom evaporator plates or refrigerant tanks 8 and 9 are each provided with baffles to direct the refrigerant in a back and forth motion across the inner surface of the wall 56 thereof which is disposed towards the cooling zone. The bottom cooling or refrigerating plates are tapered in plan view so that the wide end of one plate is positioned adjacent the narrow end of the other plate. Consequently the space or slot 57 which separates the two bottom refrigerant plates 8 and 9 is disposed at an angle to the direction of movement of wrapped articles over such plates. Thus there is no portion of the bottom of a wrapped article which is not in contact with a chilling plate during a substantial portion of its travel through the cooling zone. In each branch of the refrigerant system which forms a portion of the cooling zone, the freshest or coolest refrigerant entering each particular cooling or refrigerating plate does so at the end of such plate which is adjacent the discharge end of the cooling zone. In this manner the warmest portion of each of the respective refrigerating plates is positioned adjacent the entering end of the cooling zone and the coldest portion thereof is positioned adjacent the discharge end of the cooling zone so that wrapped

articles being passed in continuous succession through the cooling zone are first subjected to the warmest portion of the cooling zone and then finally to the coldest portion of the cooling zone to provide an efficient and effective chilling action thereon.

It is of considerable advantage to have the cooling system arranged in branches as previously mentioned so that in the event each of a succession of wrapped articles has one end at a higher temperature than the opposite end, the system will be able to adjust itself so that adequate cooling will be furnished the ends of the articles which have been elevated to the higher temperature without excessively cooling the ends of the articles which were not so highly heated. Accordingly, this invention provides a cooling zone through which articles may be advanced to chill overlapped portions of the wrappers of wrapped articles, and which zone includes a plurality of refrigerating members each having its colder end disposed adjacent the discharge end of the cooling zone and which refrigerating members are arranged in a plurality of thermostatically controlled branches, each branch arranged to chill the same relative portion of each of a series of wrapped articles. Furthermore, the flow of refrigerant through each branch is automatically controlled so that the portion of each article cooled by such branch is chilled the proper amount regardless of the temperature of another portion of the article cooled by a separate branch, and articles may be uniformly chilled which enter the cooling zone with different portions of their wrappers at different temperatures.

It will thus be seen that the present invention provides a control system for a refrigerating mechanism in which the evaporator plates are protected against excessive pressures, so that they will be less likely to burst or become ruptured with a resultant loss of refrigerant. Furthermore, the invention provides a control of this character in which a means is provided for remotely controlling the stopping of the apparatus and in which a signal lamp is arranged to indicate to the operator when the mechanism is operative.

It is to be understood that this invention is not limited to the specific arrangement herein shown or suggested, since the invention is adapted to different conditions according to the judgment of one familiar with the art, nor are the particular types and forms of control media shown and described herein essential, since they may be varied to suit different conditions.

We claim as our invention:

1. In a refrigerator having a circulating refrigerant, a compressor, a condenser, an evaporator, conduits for carrying refrigerant from the compressor to the condenser, from the condenser to the evaporator and from the evaporator to the compressor, and a control system comprising an expansion valve for regulating the flow of refrigerant into the evaporator, a second valve in the conduit which carries refrigerant to the evaporator, valve operating means, a manually operable starting button and a manually operable stopping button, said operating means being responsive to said starting button for opening said second valve and responsive to said stopping button for closing said second valve, and means for starting the compressor at a predetermined refrigerant pressure in the conduit which carries refrigerant from the evaporator

to the compressor and for stopping the compressor at a predetermined pressure in said last named conduit, said starting and stopping means being operative independently of the starting and stopping buttons, whereby the pressure in the evaporator is continuously controlled.

2. In a refrigerator having a circulating refrigerant, a compressor, a condenser, an evaporator, conduits for carrying refrigerant from the compressor to the condenser, from the condenser to the evaporator and from the evaporator to the compressor, and a control system comprising an expansion valve for regulating the flow of refrigerant into the evaporator, a second valve in the conduit which carries refrigerant to the evaporator, valve operating means, a manually operable starting button, a manually operable remote control button, and a manually operable stopping button, said operating means being responsive to said starting button for opening said second valve, said starting and stopping buttons being disposed adjacent one another and said manually operable remote control button being removed from the starting button, said valve operating means being responsive to both said stopping button and said remote control button for closing said second valve, and means for starting the compressor at a predetermined refrigerant pressure in the conduit which carries refrigerant from the evaporator to the compressor and for stopping the compressor at a predetermined pressure in said last named conduit, said starting and stopping means being operative independently of the starting, remote control and stopping buttons, whereby the pressure in the evaporator is continuously controlled.

3. In a refrigerator having a circulating refrigerant, a compressor, a condenser, an evaporator, conduits for carrying refrigerant from the compressor to the condenser, from the condenser to the evaporator and from the evaporator to the compressor, and a control system comprising an expansion valve for regulating the flow of refrigerant into the evaporator, a second valve in the conduit which carries refrigerant to the evaporator, valve operating means, a manually operable starting button, a manually operable stopping button, said operating means being responsive to said starting button for opening the second valve in the conduit which carries refrigerant to the evaporator and responsive to said stopping button for closing said last named valve, a signal lamp connected to said valve operating means and arranged to indicate when said last named valve is admitting refrigerant to the evaporator, and means for starting the compressor at a predetermined refrigerant pressure in the conduit which carries refrigerant from the evaporator to the compressor and for stopping the compressor at a predetermined pressure in said last named conduit, said starting and stopping means being operative independently of the starting and stopping buttons, whereby the pressure in the evaporator is continuously controlled.

4. In a refrigerator having a circulating refrigerant, a compressor, a condenser, an evaporator, conduits for carrying refrigerant from the compressor to the condenser, from the condenser to the evaporator and from the evaporator to the compressor, and a control system comprising an expansion valve for regulating the flow of refrigerant into the evaporator, a valve in the conduit which carries refrigerant to the evaporator, valve operating means, a manually operable

starting button, a manually operable remote control button and a manually operable stopping button, said operating means being responsive to said starting button for opening said second valve, said starting and stopping buttons being disposed adjacent one another and said manually operable remote control button being removed from the starting button, said valve operating means being responsive to both said stopping button and said remote control button removed from the starting button for closing said second valve, a signal lamp connected to said valve operating means and arranged to indicate when said second valve is admitting refrigerant to the evaporator, and means for starting the compressor at a predetermined refrigerant pressure in the conduit carrying refrigerant from the evaporator to the compressor and for stopping the compressor at a predetermined pressure in said last named conduit, said starting and stopping means being operative independently of the starting, remote control and stopping buttons, whereby the pressure in the evaporator is continuously controlled.

5. In a refrigerator having a circulating refrigerant, a compressor, an electric motor for operating the compressor, a condenser, an evaporator, conduits for carrying refrigerant from the compressor to the condenser, from the condenser to the evaporator and from the evaporator to the compressor, and a control system comprising an expansion valve for regulating the flow of refrigerant into the evaporator, an electromagnetic valve positioned in the conduit which carries refrigerant from the compressor and condenser to the expansion valve, valve operating means, a manually operable start button and one or more manually operable stop buttons, said operating means being responsive to said start button for opening said electromagnetic valve and responsive to one of said stop buttons for closing said electromagnetic valve, a magnetic switch for opening and closing the electric circuit which energizes the motor, and a switch responsive to the pressure in the conduit which carries refrigerant to the compressor for controlling the magnetic switch, whereby said pressure is maintained within a predetermined range.

6. In a refrigerator having a circulating refrigerant, a compressor for compressing the refrigerant, an electric motor for operating the compressor, a condenser, an evaporator, conduits for carrying the refrigerant from the compressor to the condenser, from the condenser to the evaporator and from the evaporator to the compressor, and a control system comprising an expansion valve for regulating the flow of refrigerant into the evaporator, an electromagnetic valve positioned in the conduit which carries refrigerant from the compressor and condenser to the expansion valve, valve operating means, a manually operable start button, one or more manually operable stop buttons, said valve operating means being responsive to said start button for opening said electromagnetic valve and responsive to one of said stop buttons for closing said electromagnetic valve, a magnetic switch for opening and closing the electric circuit which energizes the motor, and a switch responsive to the pressure in the conduit which carries refrigerant to the compressor for controlling the magnetic switch, whereby said pressure is maintained within a predetermined range, and said start button arranged to energize the magnetic switch to start the motor and compressor simultaneously

with the opening of the electromagnetic valve regardless of said pressure.

7. In a refrigerator having a circulating refrigerant, a compressor, an electric motor for operating the compressor, a condenser, an evaporator, conduits for carrying refrigerant from the compressor to the condenser, from the condenser to the evaporator and from the evaporator to the compressor, and a control system comprising an expansion valve for regulating the flow of refrigerant into the evaporator, an electromagnetic valve for opening and closing the conduit which carries refrigerant from the compressor to the expansion valve, valve operating means, a manually operable start button, one or more manually operable stop buttons and a magnetic relay, said electromagnetic valve being actuated by electric current controlled by said magnetic relay, said operating means being responsive to said start button for opening and one of said stop buttons for closing said electromagnetic valve, a magnetic switch for opening and closing the electric circuit which energizes the motor, and a switch responsive to the pressure in the conduit which carries refrigerant to the compressor for controlling the magnetic switch, whereby said pressure is maintained within a predetermined range.

8. In a refrigerator having a circulating refrigerant, a compressor for compressing the refrigerant, an electric motor for operating the compressor, a condenser in which the refrigerant gives off heat, an evaporator member in which the refrigerant absorbs heat, conduits for carrying the refrigerant from the compressor to the condenser, from the condenser to the evaporator member and from the evaporator to the compressor, and a control system comprising an expansion valve for regulating the flow of refrigerant into the evaporator member, an electromagnetic valve for opening and closing the conduit carrying refrigerant from the compressor to the expansion valve, valve operating means, a manually operable start button, one or more manually operable stop buttons, a magnetic relay, said electromagnetic valve being actuated by electric current controlled by said magnetic relay, said valve operating means being responsive to said start button for opening and one of said stop buttons for closing said electromagnetic valve, an electric signal lamp connected in parallel with the electromagnetic valve to indicate when said valve is open, a magnetic switch for opening and closing the electric circuit energizing the motor, and a switch responsive to the pressure in the conduit carrying refrigerant to the compressor for controlling the magnetic switch, whereby said pressure is maintained within a predetermined range, and said start button being arranged to energize the magnetic switch to start the motor and compressor simultaneously with the opening of the electromagnetic valve regardless of said pressure.

9. In a refrigerating system for chilling wrapped articles, a plurality of bottom refrigerating members and a plurality of side refrigerating members, a refrigerant compressor, an electric motor for actuating said compressor, a condenser, a refrigerant reservoir, refrigerant conduits arranged so that refrigerant may be circulated through said system, and means for controlling the said circulation including valve operating means, a remote manually operable electric switch, a magnetic valve for controlling the admission of compressed refrigerant to the refrigerating members, said valve operating means

being responsive to said remote manually operable switch, expansion valves positioned in the system between the magnetic valve and the refrigerating members for admitting refrigerant to the members, a magnetic switch in the electric motor power circuit for stopping and starting said motor, and a switch responsive to the pressure of the refrigerant on the suction side of the compressor, said pressure responsive switch arranged to energize the magnetic switch and close the motor circuit when the pressure in the refrigerating members exceeds a predetermined range and open the motor circuit when the pressure falls below said range independently of the state of the magnetic valve.

10. In a refrigerating system for chilling wrapped articles, a plurality of bottom refrigerating members and a plurality of side refrigerating members, a refrigerant compressor, an electric motor for actuating said compressor, a condenser, a refrigerant reservoir, refrigerant conduits arranged so that refrigerant may be circulated through said system, and means for controlling the said circulation including valve operating means, a remote manually operable switch, a magnetic valve for controlling the admission of compressed refrigerant to the refrigerating members, said valve operating means being responsive to said remote manually operable switch, expansion valves positioned in the system between the magnetic valve and the refrigerating members for admitting refrigerant to the members, a magnetic switch in the electric motor power circuit for stopping and starting said motor, and a switch responsive to the pressure of the refrigerant on the suction side of the compressor, said pressure responsive switch arranged to energize the magnetic switch and close the motor circuit when the pressure in the refrigerating members exceeds a predetermined range and open the motor circuit when the pressure falls below said range, and a manually operable switch arranged to simultaneously energize the magnetic switch to close the motor circuit and to energize the magnetic valve to admit refrigerant to the refrigerating members.

11. In a refrigerating system for chilling wrapped articles, a pair of vertical, spaced, parallel refrigerating members and a plurality of horizontal refrigerating members arranged to cooperate with the first mentioned members to define a channel having an entering end and a discharge end for the passage of wrapped articles, the vertical members disposed at the sides of the channel and the horizontal members disposed at the bottom of the channel, a refrigerant compressor, an electric motor for actuating the compressor, a supply conduit for carrying refrigerant from the compressor, branch conduits for carrying refrigerant from the supply conduit to the top portions of the vertical members substantially at the ends thereof disposed at the discharge end of the channels, a return conduit for carrying refrigerant from the refrigerating members to the compressor, outlet conduits for carrying refrigerant from portions of horizontal refrigerating members substantially at the entering end of the channel to the return conduit, intermediate conduits for carrying refrigerant from the vertical refrigerating members to the horizontal refrigerating members, an electromagnetic valve for controlling the admission of refrigerant to the refrigerating members, a switch responsive to the pressure of refrigerant in the return conduit and operable independently of the electromag-

netic valve for controlling the electric motor independently of the electromagnetic valve, and manual means for controlling the energization of the electromagnetic valve.

- 5 12. A refrigerating system comprising a plurality of evaporator members, a motor driven compressor unit, conduits for carrying refrigerant to the evaporator members from the compressor unit and from the evaporator members to the compressor unit, said evaporator members being connected in parallel with one another, an expansion valve for each of said evaporator members and arranged to individually regulate the flow of refrigerant into said members, valve means interposed in the conduit carrying refrigerant to the evaporator members,

manually operable means for controlling the opening and closing of said valve whereby the flow of refrigerant to all of said evaporator members can be simultaneously started or arrested at will, and pressure responsive control means for starting and stopping the motor of the compressor unit, said control means being connected to the conduit through which refrigerant returns to the compressor unit from the evaporator members and arranged to start said motor upon the pressure in the last mentioned conduit falling to a predetermined value and to stop said motor upon the pressure rising to a predetermined value.

FREDERICK P. PEISERICH.
CARL F. BIELENBERG.