

March 10, 1936.

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2,033,845

COOLING APPARATUS

Filed Oct. 20, 1933

2 Sheets-Sheet 1

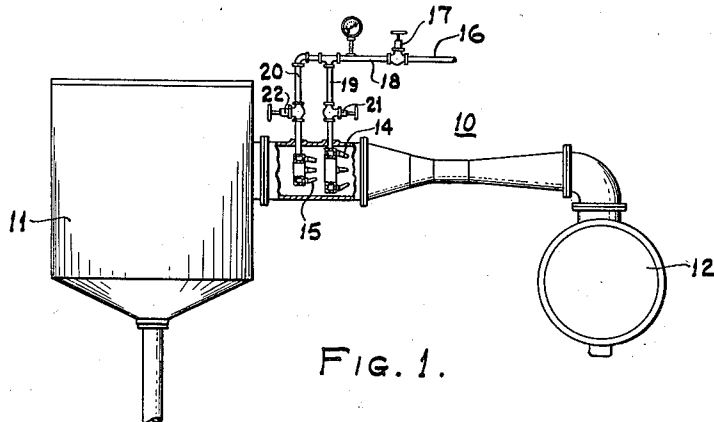


FIG. 1.

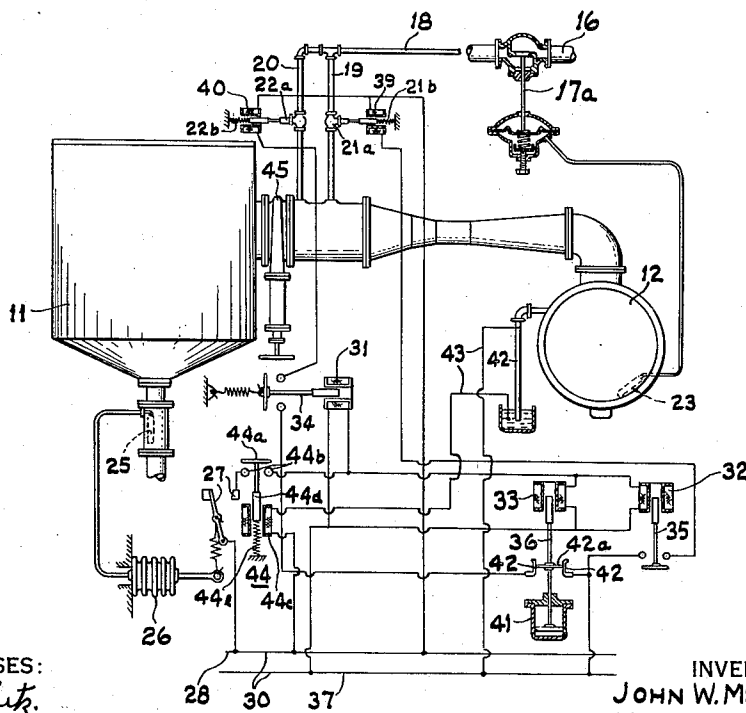


FIG. 2.

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2 Sheets-Sheet 2

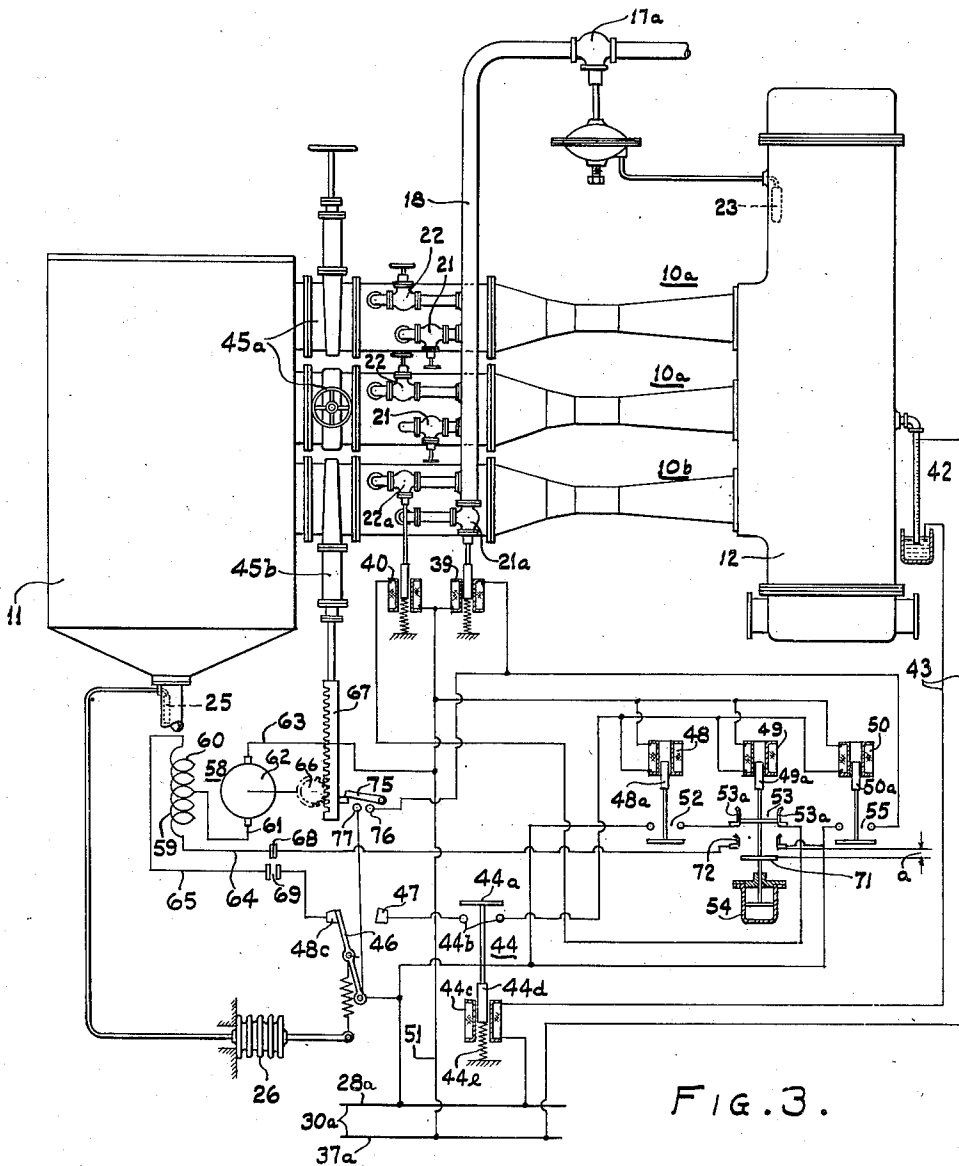


FIG. 3.

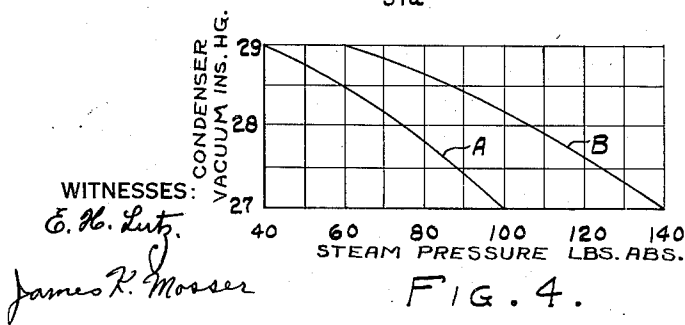


FIG. 4.

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2,033,845

COOLING APPARATUS

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Application October 20, 1933, Serial No. 694,513

9 Claims. (Cl. 62—152)

Our invention relates to ejectors and it has for an object to improve the performance thereof so as to minimize the consumption of motive fluid, for example, steam.

Where ejector apparatus is used for vacuum producing purposes, for example, with steam jet cooling or refrigeration, economy in steam consumption may be secured by careful attention to the steam flow requirements and by designing the nozzles for maximum efficiency for specific steam conditions and condenser vacuum. Greater steam flow is required to start an ejector than to maintain it in operation. Accordingly, therefore, if greater steam nozzle capacity is provided to secure greater flow for starting and less steam nozzle capacity with less flow is provided to maintain the ejector in operation, more economical performance may be secured. Since flow is a function of the pressure of steam supply, an ejector may be maintained in operation, with improved economy because of the low pressure of the supply, by steam supplied at such a pressure to nozzles of such a design that it is not self-starting. To secure the economical advantage of providing only the necessary flow to maintain the ejector in operation, we provide a set of running nozzles having such design and giving such flow as will maintain operation. However, as the running nozzles, for the pressure supplied, are not self-starting, we provide an additional or starting set of nozzles which are effective, with the running nozzles, to start the ejector, the starting nozzles being stopped after stable operation of the ejector is secured. It is to be understood, of course, that the set of running nozzles would be self-starting if the pressure of steam supplied were increased to a sufficient point, but better performance is to be had by maintaining the steam pressure at a value consistent with safely maintaining the ejector in operation after it is started. For example, a nozzle may have such a design, that, if steam were supplied to it at a pressure of 125 pounds per square inch or above, it would be self-starting; and, after being started, it would be maintained in operation until the pressure supply declined to the "break" point, for example, 100 pounds per square inch. Economy of consumption may, therefore, be secured by supplying steam to a nozzle at a pressure slightly above the "break" point, for instance, in the example assumed, at a pressure around 105 pounds per square inch. Therefore, a further object of our invention is to provide an ejector furnished with

steam whose pressure is controlled in such a way that the nozzles necessary to maintain stable operation do not provide sufficient flow for starting but wherein additional, or starting, nozzles are employed to be used, with the running nozzles, to start the ejector, the starting nozzles being stopped after stable operation of the ejector is secured.

Assuming an ejector is arranged between an evaporator and a condenser, if the absolute pressure in the condenser rises, this represents an increase in the back pressure for the ejector. On the other hand, if the absolute pressure in the condenser declines, this represents a reduction in such back pressure. The compression ratio of the ejector is fixed within reasonable limits and the increase in condenser temperature and pressure has to be met by increase in steam consumption in the ejector and vice versa; however, in order to minimize the steam consumption and to maintain the best operation, as pointed out in the application of E. F. Stalcup, Serial No. 681,645, filed July 21, 1933, assigned to the Westinghouse Electric & Manufacturing Company, the pressure of steam supplied to the ejector is controlled by the condenser pressure and temperature conditions, this relation assuring low steam consumption. When the pressure of steam is controlled in this way, it is desirable that the apparatus be arranged for the operation already referred to, that is, the pressure shall not fall below a value somewhat above the "break" point of the nozzle, thereby entailing two sets of nozzles, a running set and a starting set. Furthermore, with condenser temperature control, while the running jets might be self-starting under certain conditions, under other conditions they would not be; and, therefore, the combination of running and starting jets is advantageous in assuring starting under all conditions within the performance range of the apparatus. It is desirable to maintain the evaporator within reasonably narrow limits of temperature in order that refrigeration may be best effected; and, to this end, we provide a thermostat in the evaporator or tank which controls the operation of the ejector—upon a predetermined minimum temperature being attained in the tank or evaporator, the ejector is stopped at that point and upon a predetermined maximum temperature of the tank or evaporator, the ejector is started. Starting of the ejector and maintenance of the best pressure for operation of the latter with our two sets of jets entails control of the latter so that the ejector may be started

and then maintained in operation. Hence, the thermostat associated with the tank or evaporator operates mechanism to render both sets of jets effective, the mechanism including suitable delay means, effective after a predetermined period, for cutting out the starting nozzles. Therefore, a further object of our invention is to provide apparatus having these advantageous features of construction and of operation.

These and other objects are effected by our invention, as will be apparent from the following description and claims taken in accordance with the accompanying drawings, forming a part of this application, in which:

Fig. 1 is a side elevation of an ejector embodying our invention;

Fig. 2 shows an embodiment of our invention wherein the ejector is automatically controlled;

Fig. 3 shows a further embodiment wherein a multiplicity of ejectors with automatic control of one of them is employed; and,

Fig. 4 is a diagram illustrating an operating principle involved in our invention.

Referring now to the drawings more in detail, in Fig. 1, we show an ejector, at 10, for translating medium from a suitable source, for example, from the tank or evaporator, at 11, the translated medium being compressed and discharged against a suitable back pressure, for example, to that existing in the condenser, shown at 12. The ejector, at 10, is of conventional construction, the suction end being connected to the evaporator or tank, at 11, and the discharge end communicating with the interior of the condenser, at 12. Our invention consists in the modified arrangement for supplying steam and for controlling motivation of jets so as to secure most economical operation.

The rate of steam consumption during the starting period is higher than that required to maintain the ejector in operation after being started. Therefore, we provide two sets of jets or nozzles, a set of running jets or nozzles 14 and a set of starting jets or nozzles 15, both sets being effective when the ejector is to be started and the starting set 15 being cut out after the ejector is started and is in normal operation. The reason why two sets of nozzles are employed to satisfy the above conditions is that the motive steam for the jets is supplied at such a pressure that most economical operation can be secured, the pressure being such that, for the design and capacity of running nozzles required for normal operation, the flow of the latter nozzles is insufficient to effect starting and it is, therefore, necessary to increase the flow at such time by starting nozzles.

If the characteristics of an ordinary jet are considered, it will be found that a considerable range exists between what might be termed the self-starting point and the "break" point. For example, it might be assumed that the nozzle set 14 would have sufficient flow to start the ejector if steam were supplied thereto at 125 lbs. per square inch and that, after starting, the ejector would be maintained in operation by the nozzle set 14 until the pressure dropped to 100 lbs. per sq. in. This will be clear from a consideration of Fig. 4, wherein the line A represents the "break" limit for a nozzle, that is, if the pressure of motive steam supplied to the nozzle falls below the line A for any condition, then the nozzle will cease to operate. The line B represents the limit below which the nozzle is not self-starting and above which it is self-starting, and may, therefore, be termed the curve or line of starting pressures. A substantial margin, therefore, occurs between the

lines A and B where a nozzle is not self-starting but where it is able to maintain operation after being started. From the point of view of economy of steam consumption, the ejector apparatus is operated to the best advantage, if steam is supplied thereto within the margin between the lines A and B and slightly above A. In accordance with our invention, steam is supplied to the nozzles at a pressure somewhat above the "break" point, the steam consumption being more and more economical as the break point is approached; and to compensate for the inability of the nozzles or jets 14 to be self-starting, the additional nozzles or jets 15 are employed, the nozzles or jets 15 serving to assist the nozzles 14 during the starting period and being rendered inactive after the ejector is started and is in normal operation. To this end, we show a steam line 16 having a pressure control valve 17 for controlling the pressure of steam supplied to the header 18 and from the latter through the passages 19 and 20 to the running and starting jets, the passages 19 and 20 having valves 21 and 22 arranged therein. To start the ejector, both valves 21 and 22 are opened; and, after the ejector is in stable operation, the valve 22 is closed.

In Fig. 2, the apparatus shown in Fig. 1 is subject to automatic control. A thermostat 23 in the condenser, at 12, controls a pressure-reducing valve 17a so as to supply steam from the main 16 to the branches 19 and 20 at the most economical operating pressure. The tank or evaporator, at 11, is provided with a thermostat 25 which controls mechanism for stopping and starting the ejector, such mechanism opening both valves 21a and 22a to start the ejector and then closing the valve 22a. The valves 21a and 22a are preferably self-closing, by springs 21b and 22b. Assuming that a predetermined low temperature is attained in the tank or evaporator at 11, then the thermostat 25 would initiate operation of the control mechanism to bring about closure of the valve 22a; and, upon attainment of a predetermined high temperature in the evaporator or tank 11, the thermostat would initiate operation of the control mechanism to start the ejector, the valves 21a and 22a being opened to start and place the ejector in stable operation, whereupon the starting valve 22a is closed.

The thermostat 25 operates in response to predetermined tank or evaporator temperature to open the valves 21a and 21b against the force of biasing means, for example, springs 21b and 22b, and to a low predetermined temperature so that the springs may close the valves. Also, the mechanism which opens the valves in response to the thermostat includes time-delay means providing for automatic closing of the starting valve 22a after a sufficient interval has elapsed for stable ejector operation to be established. By way of example, I show the thermostat 25 including a bellows 26, which expands with rise in temperature and which contracts with decrease in temperature. Expansion of the bellows, incident to increase in evaporator temperature to a sufficient extent, closes the contacts 27 to complete a circuit from one side 28 of the line 30 through the solenoids 31, 32, and 33 of the relays 34 and 35 and the dash pot switch 36 back to the other side 37 of the line 30. Closure of the relays 34 and 35 places the solenoids 39 and 40 in circuit and the consequent energization of the latter results in opening of the valves 21a and 22a against the pressure of the springs 21b and 22b. The dash pot 41 provides for delay in action of the

solenoid 33 so that the starting jet is not interrupted until after a desired interval has elapsed subsequent to starting of the ejector, the fixed contacts 42 being elongated to permit of relative travel of the movable contact 42a due to cooperation of the solenoid 33 and the dash pot 41 during the desired interval of maintaining the starting ejector in operation. As soon as the contacts 42 and 42a open, the circuit for the starting jet solenoid 40 is broken and the spring 22b immediately closes the starting valve 22a, thereby stopping the starting jets. Upon the attainment of a predetermined low temperature in the evaporator 11, the thermostat opens the contacts 27, whereupon the circuit including the running jet solenoid 39 is interrupted and then the spring 21b closes the valve 21a to stop the running jet. Also, with opening of the contacts 27, the relays 34 and 35 and the dash pot switch 36 assume the positions shown in Fig. 2.

Preferably, the apparatus shown in Fig. 2 is provided with a gate valve 45 so as to isolate the evaporator from the condenser, this being necessary where it is desired to prevent the ejector passage from functioning as an equalizer between the evaporator and the condenser; and the gate valve may be operated by any suitable means, manually-operated as shown or preferably automatically operated as hereinafter described in connection with Fig. 3.

The apparatus may incorporate means to prevent the automatic control mechanism from being effective to place the ejector in operation unless a predetermined vacuum in the condenser has been reached. To this end, we show a vacuum gauge, at 42b, wherein the mercury column functions as a contact to open and close the local circuit at 43, which operates the relay, at 44. The relay includes a movable contact 44a cooperating with fixed contacts 44b so that, when the contacts are closed, current may flow from the line side 28 through the contacts 27, when the latter are closed, to the control mechanism as hereinbefore pointed out; however, if the contacts 44a and 44b are open, the automatic control mechanism is isolated from the supply circuit 30 even though the contacts 27 are closed. Upon the attainment of a predetermined vacuum in the condenser 12, the local circuit 43 is completed, and the solenoid winding 44c is energized so as to move the core 44d downwardly to bring about closure of the contacts 44a and 44b against the force of suitable biasing means such as the spring 44e.

In Fig. 3, we show a further embodiment of our invention wherein a plurality of ejectors is arranged between the evaporator or tank, at 11, and the condenser, at 12, the ejectors at 10a being of the type generally shown and described in Fig. 1 and the ejector 10b being of the type shown and described in connection with Fig. 2. The ejectors 10a and 10b are supplied with steam from the header 18 through a reducing or pressure controlled valve 17a controlled by a thermostat 23, steam at header pressure is supplied to the running and starting jets of each of the ejectors 10a through the intermediary of control valves 21 and 22 as already described. Preferably, the non-automatic ejectors have different capacities so that any one or different combinations thereof with the automatic ejector may be arranged to suit the load demand. The ejector passages of the ejectors 10a and 10b are provided with stop valve 45a and 45b, respectively, the stop valve of an ineffective ejector being closed

to prevent pressure equalization between the condenser and the evaporator. Assuming that a certain capacity of refrigeration is required, then one or more of the ejectors 10a are placed in operation in the manner as hereinbefore pointed out and the ejector 10b is used in connection therewith to take care of variations in the selected base load. The ejector 10b, as pointed out in connection with Fig. 2, is subject to automatic control, that is, a thermostat 25 in the evaporator controls the operation of the valves 21a and 22a as well as the stop valve 45b. Upon the attainment of a predetermined low temperature in the evaporator, the ejector 10b is cut out, the remaining ejector or ejectors 10a continuing in operation; and, as already pointed out, when the ejector 10b is cut out, both the valves 21a and 22a are closed and the stop or gate valve 45b is closed in order to avoid a by-pass connection between the evaporator and the condenser. By way of example, we show the following means for effecting automatic control: the solenoid bellows 26 moves a switch arm 46, which engages either the contact 47, upon the attainment of a predetermined high evaporator temperature, or the contact 48c, upon the attainment of a predetermined low evaporator temperature. With engagement of the arm 46 with the contact 47, a circuit will be completed from the side 28a of the line 30a through the relay solenoid 48, the dash pot solenoid 49, and the relay solenoid 50, to the return 51 going to the other side 37a of the line 30a. Energization of the solenoid 48 pulls up the core 48a to close the contacts 52, energization of the solenoid 49 pulls up the core 49a to open the moving contact 53 relative to the elongated contacts 53a after a suitable interval to provide for delayed cutting off of the starting jets, and energization of the solenoid 50 raises the core 50a to close the contacts 55.

Closing of the contacts 55 completes a circuit from the line side 28a through the solenoid 39 to the return 51, thereby providing for opening of the running jet valve 21a. The starting jet solenoid 40 is energized at the same time, current therefor passing from the line side 28a, through the contacts 52 and 53, to the solenoid 40, and from the latter to the return line 51 going to the other line side 37a. As before, the dash pot 54 associated with the core 49a assures sufficient delay in interruption of the starting jet solenoid 40 to provide for stable operation of the automatic ejector 10b before the starting jets are stopped.

Upon the attainment of a predetermined low temperature in the evaporator 11, the arm 46 will move away from the contact 47, whereupon the circuits for the valve solenoid 39 and the circuits for the relay solenoids 48 and 50 and the dash pot switch solenoid 49 will be interrupted, whereupon the steam supply to the ejector will be completely shut off and the relays and the dash pot switch will resume the position shown in Fig. 3.

The gate valve 45b serves to close the passage of the ejector 10b when the latter is not in operation, whereby such passage is prevented from equalizing pressures in the evaporator and in the condenser. Preferably, the gate valve is operated in timed relation with the control of the ejector. To this end, by way of example, we show the gate valve opened and closed by the reversible electric motor, at 58, having split field elements 59 and 60 having a common lead 61 going to the armature 62, the latter being con-

connected by a lead 63 to the return 51 going to the line side 37a. Leads 64 and 65 are connected to the field elements 59 and 60, respectively, and it will be apparent that, if a circuit is completed through one lead, the motor will run in one direction, and, if the circuit is completed through the other lead, the motor will run in the other direction. Motion of the armature 62 is applied to the gate valve so as to open and close the latter, the armature being shown as provided with a pinion 66 meshing with a rack 67 connected to the gate valve.

The motor, at 58, is provided with a conventional limit switch having contacts 68 and 69, one of these contacts being closed incident to opening of the other, that is, opening of contacts 68 to end the necessary motor travel to open the gate valve closes the contacts 69 so that when the lead 65 is later energized the motor will operate in the other direction to close the gate valve. With the contact 46 engaging the contact 47, the ejector 10b will be energized and thereafter the starting jet will be interrupted due to the time delay afforded by the dash-pot controlled contacts 53 and 53a. Incident to rendering the automatic ejector effective, current also passes from the line side 28a through the contact 68 and the lead 64 to the field element 59 to cause rotation of the motor 58 in such a direction as to open the gate valve 45b. If the arm 46 moves away from the contact 47 and engages the contact 48c incident to attainment of a predetermined low evaporator temperature, then a circuit will be completed from the line side 28a through the contacts 69, the lead 65 and the field element 60 to operate the motor in the other direction so as to bring about closing of the gate valve 45b.

The relay 52 is provided to interrupt a circuit from the line side 28a, the contacts 53, and the solenoid 40 after the arm 46 moves away from the contact 47 and the dash pot contacts 53 and 53a are again closed.

While the gate valve 45b may be closed concurrently with stopping and starting of the automatic ejector 10b in order to prevent the ejector passage from equalizing pressures in the evaporator and in the condenser, this result may be achieved more effectively by providing such sequences that the gate valve is completely closed before the supply of steam to the automatic ejector is cut off and the supply of steam to both the running and starting jets of the automatic ejector is established before the gate valve is opened. Also, I prefer to have the running and starting jets maintained in operation after the gate valve is opened so as to insure stable operation of the ejector before steam is cut off from the starting jets.

Referring to the sequence of the events accompanying starting of the ejector, we show a movable contact 71 connected to the core 49a and arranged to engage with the elongated contacts 72, engagement thereof taking place after a short distance of travel of the core, for example, the distance "a". This provides for a sufficient interval to insure starting of the running and starting jets. Upon engagement of the contacts 71 and 72, current is supplied from the line side 28a, through the contact 68, the lead 64, and the field element 59 to energize the motor, at 58, to open the gate valve, operation of the motor ceasing due to opening of the limit switch contacts 68 and closing of the contacts 69 when the gate valve is fully open. We prefer that the

starting jets shall not be stopped until after the gate valve 45b is open so that the ejector may be stabilized under working conditions, this sequence being easily provided for by making the contacts 53a sufficiently long and the dash pot 54 sufficiently slow in action to provide for disengagement of the contacts 53 and 53a after the motor, at 58, has opened the gate valve, operation of the starting jets being continued until such time as the circuit including the contacts 53 and 53a is interrupted by the opening of such contacts.

When the automatic ejector 10b is stopped, it is desirable to close the gate valve 45b before the steam supply to the running jets is interrupted. To this end, when the contact arm 46 engages the contact 48c to energize the motor, at 58, to close the gate valve 45b, the latter will start to close, but as the rack 67 has a contact 75 engaging a pair contacts 76 and 77, connected, respectively, to the solenoid 39 and to the line side 28a, it will be seen that the solenoid 39 will continue to be energized to maintain the running jet in operation after the arm 46 moves away from the contact 47 and until the rack contact 75 disengages the pair contacts 76 and 77, disengagement of the latter being effected with closure of the gate valve.

As in Fig. 2, the arrangement shown in Fig. 3 is preferably provided with a vacuum responsive relay so that the automatic control for the automatic ejector cannot be operated unless a predetermined vacuum has been attained in the condenser, that is, the condenser 12 is provided with a vacuum gauge 42b which completes the circuit 43 upon a predetermined high vacuum existing in the condenser 12. Completion of the circuit 43 operating the relay at 44 closes the contacts 44a and 44b whereupon current may flow from the line side 28a through the contacts 46 and 47 and the contacts 44a and 44b to the apparatus in the manner hereinbefore pointed out. In case the vacuum is impaired or is not sufficiently high, the circuit 43 will be interrupted and consequently the contacts 44a and 44b will be opened, whereby, irrespective of closure of the contacts 46 and 47, the automatic control mechanism circuits cannot be operated to motivate the automatic ejector.

While we have referred to running and starting jets, which is the running jet and which is the starting jet may depend upon condenser temperature and pressure conditions and the relative capacities of the jets. Assuming that the capacity and steam consumption of the running jets is somewhat larger than that of the starting jets, with a sufficient reduction in condenser temperature and pressure, as may be occasioned by reduced temperature of circulating water, it may be more economical to use the starting jets as the running jets, both sets of jets, as before, being used to initiate operation of the ejector. Then again, under other circumstances, for example, with increase in steam pressure to a sufficient extent or with decrease in condenser absolute pressure to a sufficient point, one set of nozzles may be adequate both for starting and running; however, as already pointed out, it is advantageous to reduce the steam flow, as by stopping the starting nozzles, after the ejector is in stable operation. Also, where we refer to "nozzles" or "set of nozzles"; either starting or running, it is to be understood that one or more nozzles is intended, the number being a matter of design.

The starting and running jet arrangement with control mechanism operating in response to evap-

orator temperature is disclosed and claimed in application of D. W. R. Morgan and J. W. McNulty Serial No. 694,512 filed concurrently herewith and assigned to Westinghouse Electric & Manufacturing Company.

While we have shown our invention in three forms, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications without departing from the spirit thereof, and we desire, therefore, that only such limitations shall be placed thereupon as are imposed by the prior art or as are specifically set forth in the appended claims.

15 What we claim is:

1. In refrigeration apparatus, an evaporator; a condenser; a booster ejector having its inlet end connected to the evaporator and its discharge end connected to the condenser, said ejector including one or more running nozzles capable of maintaining operation after the ejector is started but incapable of starting the ejector and one or more starting nozzles, effective with the running nozzles, in starting the ejector; means for interrupting the supply of motive steam to the starting nozzles after the ejector is started; and means for controlling the pressure of steam supplied to the nozzles in accordance with the condenser temperature conditions.

2. The combination, as claimed in claim 1, with means responsive to evaporator temperature conditions for placing the ejector in operation and for interrupting the operation thereof.

3. In refrigerating apparatus, an evaporator; a condenser; an ejector provided with a diffuser having its inlet end connected to the evaporator and its outlet end connected to the condenser; said ejector including running and starting steam jets; a main for supplying steam to the jets; means operating in accordance with the condenser temperature for maintaining steam pressure in the main dependent upon the condenser temperature; and means for controlling the supply of steam from said main to the running and starting jets and providing for the interruption of steam supply to the starting jets after the ejector is in operation.

4. In refrigerating apparatus, an evaporator, a condenser, a plurality of ejectors including an automatic ejector for connecting the evaporator to the condenser, each of said ejectors including running and starting jets, means for maintaining a supply of steam under desired pressure, and means for supplying steam from said supply to the running and starting jets of the ejectors and providing for interruption of the supply to the starting jets after the ejectors are in stable operation, said last-named means including means responsive to evaporator temperature conditions for controlling the supply of steam to the automatic ejector.

5. In refrigerating apparatus, an evaporator; a condenser; a plurality of ejectors connecting the evaporator to the condenser and including one or more non-automatic ejectors and an automatic ejector; each of said ejectors including

running and starting jets; means providing a supply of steam under desired pressure; means for supplying steam from the supply to the running and starting jets of each of the non-automatic ejectors to start the latter and providing for interruption of the supply to the starting jets after said ejector or ejectors are started; and means responsive to evaporator temperature conditions for supplying steam to the starting and running jets of the automatic ejector to start the latter, to interrupt the supply of steam to the starting jets after the ejector is in stable operation and to interrupt the supply of steam to the ejector.

6. In refrigerating apparatus, an evaporator; a condenser; one or more non-automatic ejectors and an automatic ejector connecting the evaporator and the condenser; each of said ejectors including running and starting jets; a header; means for maintaining a pressure of steam in the header dependent upon the condenser temperature; passages for conducting steam from the header to the jets of each ejector; valves for opening and closing the ejector passages; valves providing for opening of the running and starting jet passages of each ejector to start the latter, for closing the starting jet passage after the ejector is in operation, and for closing the running and starting jet passages when the ejector is stopped; and means responsive to evaporator temperature conditions for opening the ejector passage valve and the running and starting jet valves of the automatic ejector to start the latter followed by closure of the starting passage valve after the ejector is started and for closing all open valves incident to stopping the automatic ejector.

7. The combination as claimed in claim 6 wherein a plurality of non-automatic ejectors of varying capacities are employed so that they may be selectively placed in operation to meet different demands.

8. In apparatus of the character described, a chamber, a condenser, an ejector connecting the chamber to the condenser, said ejector including nozzle means, a gate valve for opening and closing the ejector passage, means providing for the opening of the gate valve after the nozzle means is supplied with steam and providing for closure of the gate valve before the supply of steam to the nozzle means is interrupted, and means responsive to pressure conditions existing in the condenser to prevent motivation of the ejector and opening of the gate valve until a predetermined high vacuum exists in the condenser.

9. In vapor jet refrigerating apparatus, the combination of evaporator means, a plurality of non-automatic ejectors and an automatic ejector for withdrawing vapor from said evaporator means to effect cooling by evaporating of liquid, said non-automatic ejectors being of varying capacities and being selectively operable to meet different cooling demands, and means responsive to evaporator temperature for controlling the operation of the automatic ejector.

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