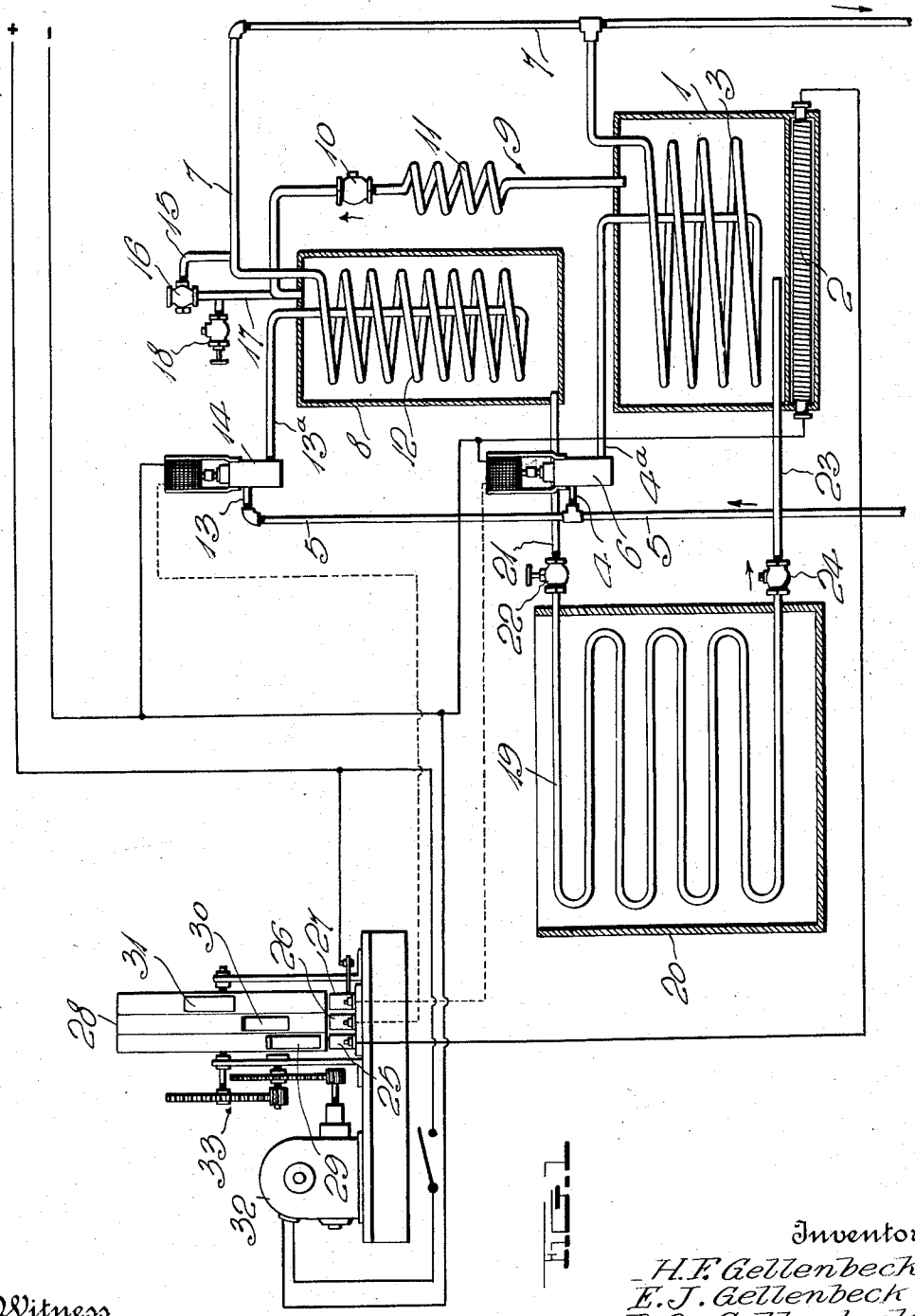
June 14, 1927. 1,632,701

H. F. GELLENBECK ET AL

INTERMITTENT ABSORPTION REFRIGERATING SYSTEM

Filed Jan. 8, 1925 3 Sheets-Sheet 1



Witness
H. Woodard

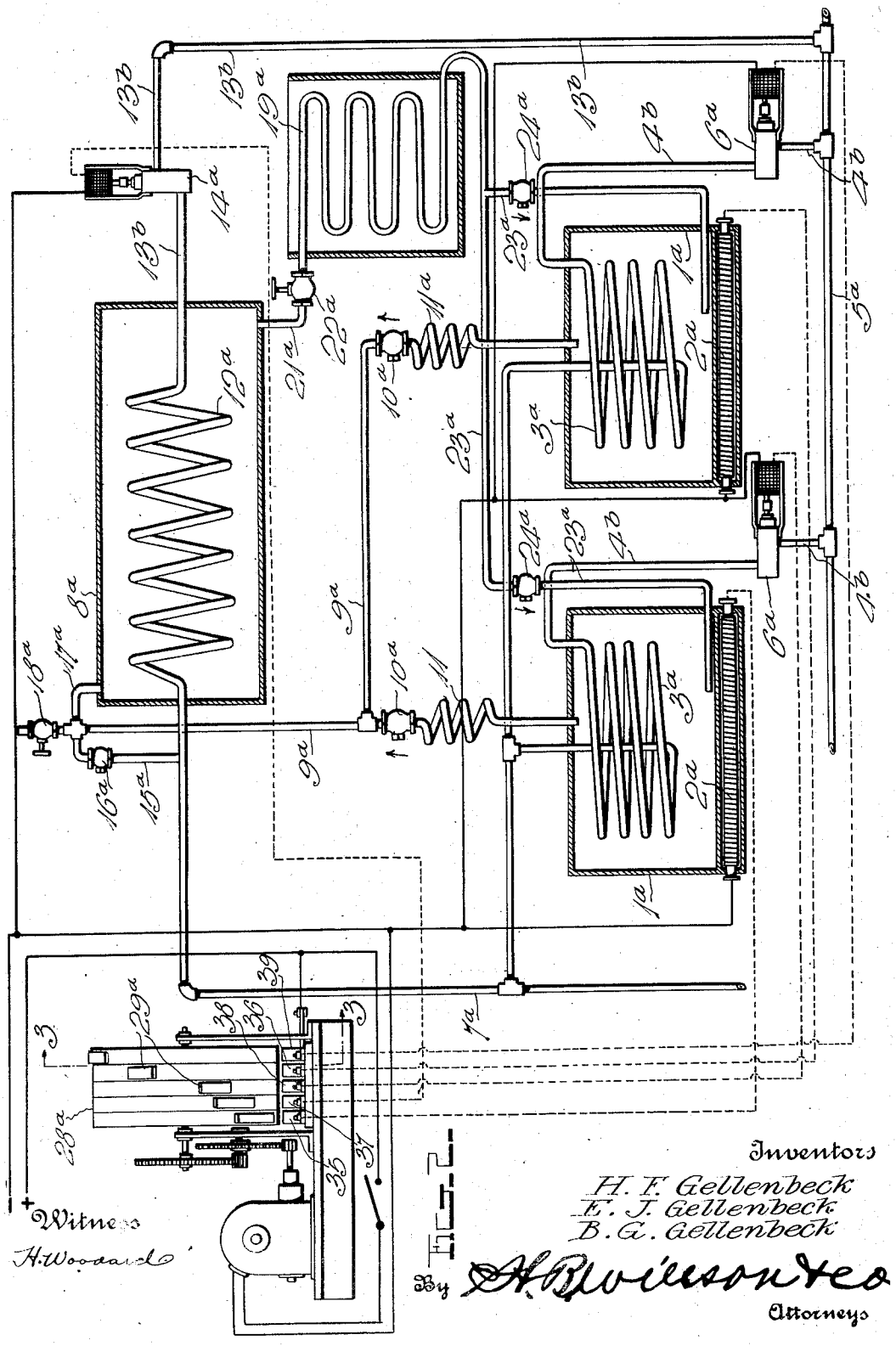
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INTERMITTENT ABSORPTION REFRIGERATING SYSTEM

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INTERMITTENT ABSORPTION REFRIGERATING SYSTEM

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Fig. 3.

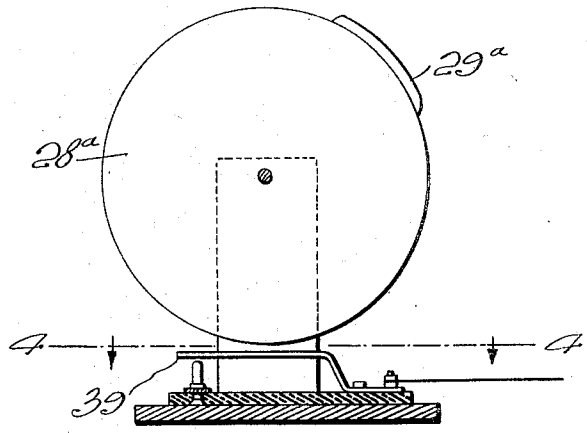


Fig. 4.

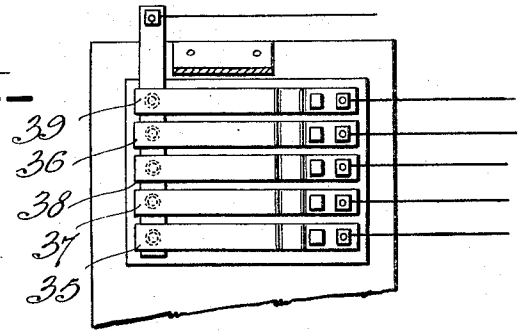
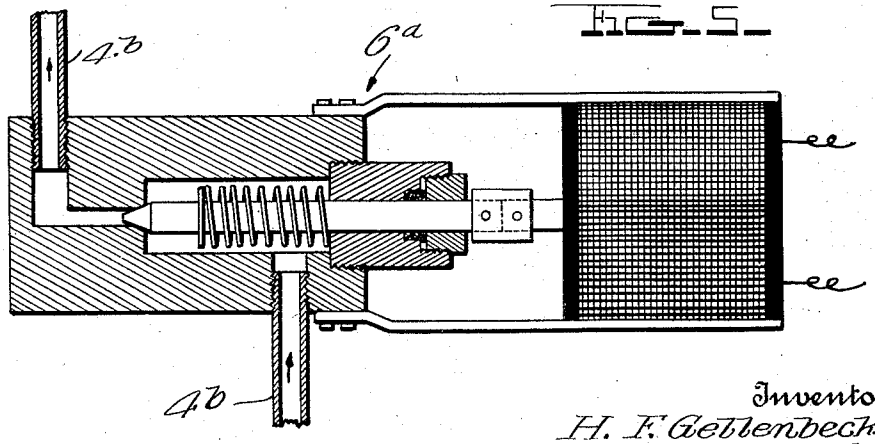


Fig. 5.



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UNITED STATES PATENT OFFICE.

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INTERMITTENT-ABSORPTION REFRIGERATING SYSTEM.

Application filed January 8, 1925. Serial No. 1,228.

Our invention relates to improvements in refrigeration systems of the intermittent absorption type, which make use of aqua ammonia or its equivalent, as a refrigerating medium.

The primary object of the invention is to generally improve and simplify the construction of refrigerating systems of the type set forth, to such an extent that they can be manufactured at a very reasonable cost and will possess so few working parts that there is practically no liability of failure to function properly.

In carrying out the above end, a further object is to supply the system with a positive, inexpensive, automatic control which is based entirely on time and does not rely for its operation upon delicate and complicated thermostats, pressure-operated controls and similar devices, which are liable to cause trouble.

A still further object is to discharge any excess pressure of refrigerant into a liquid waste pipe which usually leads to a sewer, so that no obnoxious odors will exist in the vicinity of the system, should the latter blow off.

With the foregoing in view, the invention resides in the novel subject matter hereinafter described and claimed, the description being supplemented by the accompanying drawings.

Figure 1 is a diagrammatic view showing a system in which only a single, combined generating and absorbing tank is used.

Figure 2 is a view similar to Fig. 1 but showing the twin type of system in which two combined generators and absorbers are employed.

Figure 3 is a detail vertical section as indicated by line 3—3 of Fig. 2, showing a part of the motor-driven controlling means.

Figure 4 is a horizontal section on line 4—4 of Fig. 3.

Figure 5 is an enlarged longitudinal section through one of the magnetically opened valves which are used to admit cooling liquid into cooling coils or the like associated with the generating and absorbing tank or tanks and a combined gas condensing and liquid collecting tank which is also employed.

In the form of construction shown in Fig. 1, the numeral 1 designates a combined generating and absorbing tank which may be of any desired materials and construction and is adapted to receive a solution of water and ammonia or some other equivalent refrigerating medium. This tank is provided with an electric heater 2 of any preferred form and with a coil or the like 3 which is adapted to circulate water or some other cooling liquid. Liquid supply piping 4—4ª leads to the coil 3 from a main liquid supply pipe 5, and said piping 4—4ª is provided with a normally closed magnetically opened valve 6. The coil 3 discharges into a liquid waste pipe 7.

Disposed at any suitable location with respect to the tank 1, is a gas condensing and liquid containing tank 8, and gas conducting means 9, leads from the upper end of said tank 1 to the upper end of the tank 8, said gas conducting means including a check valve 10 which opens away from the tank 1, and also embodying an air-cooled rectifying coil 11 which serves to condense any water vapor which may rise with the generated gases from the tank 1. Within the combined gas condensing and liquid retaining tank 8, we have shown a cooling coil 12 which is connected by piping 13—13ª, with the main liquid supply pipe 5, said piping 13—13ª having a normally closed magnetically opened valve 14. The coil 12 discharges into the waste pipe 7, and we have also shown a pressure-discharge pipe 15 leading to said waste pipe from a pressure blow-off valve 16 for the refrigerant circulating means. In the present showing, the valve 16 is connected with a pipe 17 which may well extend from a portion of the gas conducting means 9, or may otherwise communicate with the interior of the system. Upon the pipe 17, a suitable purge valve 18 has been illustrated.

At 19, an expansion coil has been shown which is adapted to be located in any chamber to be refrigerated, such as a brine tank 20. Leading from the lower end of the tank 8, to the coil 19, is a pipe 21 having an appropriate expansion valve or the like 22, while leading from said coil 19 into the lower end of the combined generating and absorbing tank 1, is a pipe 23 which is provided with a check valve 24 which opens toward said tank 1.

Current supply wiring is provided for the heater 2 and the magnets of the valves 6 and 14, said wiring having independent circuits

for said heater and valves, controlled by normally open switches 25, 26 and 27, and constantly driven means are provided for closing these switches in proper sequence, holding them closed for a predetermined interval, and then effecting opening thereof. In the present showing, a rotary drum 28 is provided with circumferential cams or the like 29, 30 and 31, for controlling the three switches 25, 26 and 27 respectively. The drum 28 is driven by a synchronous electric motor 32 through the instrumentality of appropriate reducing gearing 33, said motor preferably acting to rotate the drum 28 one revolution every twenty-four hours, although it will be understood that this speed of rotation may be varied if desired.

Assuming that the system has been purged of air to the proper extent, and that an adequate quantity of the refrigerating solution has been placed in the tank 1, the operation of the system is as follows: The cam 29 closes the switch 25 and thus brings the heater 2 into operation for a predetermined length of time so as to generate gas in the tank 1. This generated gas passes to the tank 8 and by the time any gas reaches this tank, the cam 30 has closed the switch 26, so that the valve 14 is opened and cooling liquid flows through the coil 12 and out the waste pipe 7. Thus, the gas entering the tank 8 is promptly condensed to a liquid and the liquid collects in the lower end of said tank. At a suitable time after opening of the valve 14, the cam 29 permits the switch 25 to open and throws the heater 2 out of play. Then, after the cam 30 permits the switch 26 to open and effects closing of the valve 14, the cam 31 closes the switch 27 and thus opens the valve 6 for the coil 3. Now, the cooling liquid passing through the coil 3 chills the liquid remaining in the tank 1 and produces a partial vacuum in this tank, as well as in the pipe 23, coil 19 and pipe 21. This vacuum draws the refrigerating liquid from the tank 8, through the expansion valve 22, into the expansion coil 19, where the liquid refrigerant evaporates, changing its state to a gas or vapor, thereby producing refrigeration. This gas or vapor then passes through the check valve 24 and pipe 23, into the tank 1, so that it again mixes with the liquid which has remained in said last named tank. During the drawing of the liquid from the tank 8 back into tank 1, the check valve 10 of course closes, so that there can be no short circuiting of pressure from the "high side" to the "low side" of the apparatus.

After the system is once properly regulated, there should be no blowing off of the safety valve 16, but whenever this valve does open, any gas discharged therethrough will pass into the liquid waste pipe 7 to be carried by the latter to a sewer or to some other point remote from the apparatus, so that there will be no obnoxious fumes around the latter.

In the twin type of construction shown in Fig. 2, the numerals 1^a designate a pair of tanks corresponding to the tank 1, each of said tanks 1^a having its own electric heater 2^a and cooling coil 3^a, these coils being connected by piping 4^b with a cooling liquid supply line 5^a, said piping 4^b having normally-closed magnetically-opened valves 6^a. At 7^a is shown a waste pipe into which the coils 3^a discharge.

8^a indicates a combined gas condenser and liquid collecting tank which is shown horizontally instead of vertically, but may be in either of these positions or in any other position desired. Gas conducting means 9^a leads to the tank 8^a from the tanks 1^a and is provided with a check valve 10^a and a rectifying coil 11^a for each of said tanks 1^a. Within the tank 8^a is a cooling coil 12^a connected by piping 13^b with the cooling liquid supply pipe 5^a, said piping 13^b having a normally-closed magnetically-opened valve 14^a. The coil 12^a discharges into the waste pipe 7^a, and at 15^a, 16^a, 17^a and 18^a parts have been shown which correspond to the parts 15, 16, 17 and 18 of Fig. 1.

19^a designates an expansion coil connected by piping 21^a with the lower portion of the tank 8^a and provided with an expansion valve 22^a. Return piping 23^a is provided from the coil 19^a to the lower ends of the tanks 1^a, and this return piping is provided with check valves 24^a. Separate circuits are provided for each of the heaters 2^a and for each of the magnetic valves 6^a and 14^a, each circuit having its own individual switch. At 35 and 36, are shown the switches for the two heaters 2^a; 37 designates the switch for the valve 14^a; and 38 and 39 refer to the switches for the two valves 6^a. These switches are controlled by cams 29^a on a rotary drum 28^a, which is driven in the same manner as the drum 28, and the relation of cams is such that when one of the tanks 1^a is being heated, the other tank 1^a is being cooled by circulation of cooling liquid through its coil 3^a. Thus, pressure is exerted on one side of the system and suction on the other side, which produces unusually advantageous results in drawing the refrigerant through the system. The arrangement of cams is also such that the valve 14^a will be opened as soon as either of the tanks 1^a starts to generate gas, said valve 14^a being closed however between the intervals of generation so as to conserve water or other cooling liquid which may be used.

It will be seen from the foregoing that a system of extreme simplicity has been provided, yet one which will be highly efficient and reliable and is free from a great number of intricate and expensive movable parts which are commonly used. The invention is

therefore particularly adapted for home refrigerating plants, but is by no means restricted to this particular field of use.

Obviously, any desired wiring may be employed, and the current controlling switches, as well as the magnetically-opened valves for the cooling liquid, may be of any preferred design. Probably the most advantageous constructions for switches and valves, is shown in Figs. 3, 4, and 5, and as such constructions will be well understood by anyone skilled in the art, without a description, such description is not herein furnished.

As excellent results are obtainable from the general construction and association shown, such construction and association are preferably followed. However, within the scope of the invention as claimed, numerous modifications may be made. If desired, instead of using an expansion valve, expansion can be accomplished by using what is known as the "flooded system," the principles of which are known to those skilled in the art.

We claim:

1. An intermittent absorption refrigerating system comprising circulating means for the refrigerant, including electrical heating means and valve-controlled cooling means, individual electro-magnetic operating devices for the valves of said cooling means, individual circuits for said valve-operating devices and the aforesaid heating means, a group of individual self-opening switches for said circuits, and drum means directly and constantly driven by a synchronous electric motor, said drum means having cams for closing said switches in predetermined sequence, said cams being of lengths to hold the co-acting switches closed for predetermined intervals.

2. In a refrigerating system, a combined generating and absorbing tank, a combined gas condensing and liquid collecting tank, gas conducting means from said generating and absorbing tank to said condensing and collecting tank, a liquid outlet pipe from said condensing and collecting tank for connection to an expansion coil, a return pipe from the coil discharging into said generating and absorbing tank, electric heating means for said generating and absorbing tank, a liquid-cooled member for this tank having a self-closing liquid inlet valve, a second liquid-cooled member for the condensing and liquid collecting tank having a self-closing liquid valve, individual electro-magnetic opening devices for the two valves, individual circuits for the two magnetic valve-opening devices and the heater, a group of self-opening switches for the three circuits, and drum means directly and constantly driven by a synchronous electric motor, said drum means having cams for first closing the heater switch, then closing the switch of the second named valve, and then closing the switch of the first named valve, said cams being of lengths to hold their co-acting switches closed for predetermined intervals.

3. In a refrigerating system, a pair of combined generating and absorbing tanks, a combined gas condensing and liquid collecting tank, gas conducting means leading from the first tanks to the second tank, a liquid outlet from the condensing and collecting tank for connection with an expansion coil, return piping for the coil leading to the generating and absorbing tanks, individual electric heaters for said generating and absorbing tanks, individual liquid-cooled members for these tanks, a third liquid-cooled member for the condensing and collecting tank, individual self-closing valves for the three liquid-cooled members, individual electro-magnetic opening devices for the three valves, individual circuits for the aforesaid heaters and the magnetic valve-opening devices, a group of self-opening switches for said circuits, and drum means directly and constantly driven by a synchronous electric motor, said drum means having cams for closing the switches in predetermined sequence, said cams being of lengths to hold their co-acting switches closed for predetermined intervals.

In testimony whereof we have hereunto affixed our signatures.

HENRY F. GELLENBECK.
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BENJAMIN G. GELLENBECK.