No. 746,792. PATENTED DEC. 15, 1903.

C. J. COLEMAN.

REFRIGERATION SYSTEM.

APPLICATION FILED JAN. 12, 1900. RENEWED APR. 21, 1903.

NO MODEL.

Fig. 1.

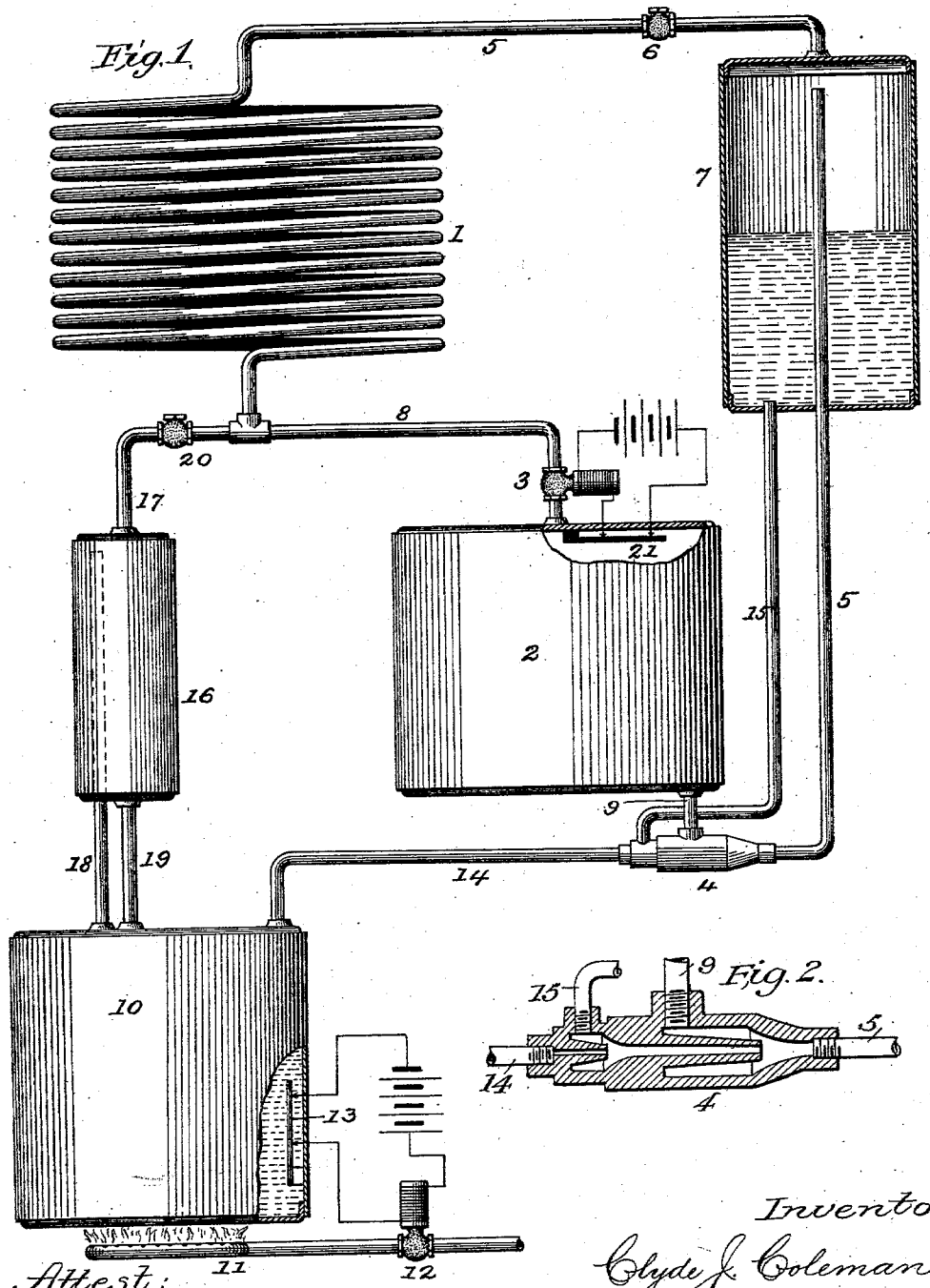

Fig. 2.

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No. 746,792. Patented December 15, 1903.

UNITED STATES PATENT OFFICE.

CLYDE J. COLEMAN, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO CLARENCE W. COLEMAN.

REFRIGERATION SYSTEM.

SPECIFICATION forming part of Letters Patent No. 746,792, dated December 15, 1903.

Application filed January 12, 1900. Renewed April 21, 1903. Serial No. 153,721. (No model.)

To all whom it may concern:

Be it known that I, CLYDE J. COLEMAN, a citizen of the United States of America, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Refrigeration Systems, of which the following is a specification.

The present invention relates more particularly to the type of refrigeration system and apparatus which constitutes the subject-matter of my prior application for Letters Patent, Serial No. 733,689, filed October 19, 1899, in which the positive transfer of the refrigerant medium from the cooling-chamber to the storage-chamber is effected in an automatically-controllable manner.

The object of the present improvement is to provide a simple and efficient apparatus in which the various operations of the system are performed in succeeding cycles and automatically controlled to maintain a predetermined temperature in the cooling-chamber, all as will hereinafter more fully appear, and be more particularly pointed out in the claims.

In the accompanying drawings, illustrative of the present invention, Figure 1 is an elevation, partly in section, of a refrigerating apparatus embodying the present improvements; Fig. 2, a detail sectional view of the duplex injector of the same.

Similar numerals of reference indicate like parts in both views.

Referring to the drawings, 1 represents the storage-chamber; 2, the cooling-chamber; 3, the expansion-valve, and 4 the compression apparatus by means of which the expanded refrigerant medium is drawn from the cooling-chamber and forced into the storage-chamber. In the construction shown the outlet end of the compression apparatus 4 is connected by pipe connection 5 with the storage-chamber 1, such pipe connection being provided with a check-valve 6 to prevent a return flow from said storage-chamber and with a separating tank or trap 7, as hereinafter more fully described. The storage-chamber 1 is connected in turn to the cooling-chamber 2 by a pipe connection 8, in which is arranged the expansion-valve 3, heretofore described, and the cooling-chamber is in turn connected with the inlet or suction end of the compression apparatus 4 by the return-pipe connection 9, as shown.

One part of the present invention involves the use of a jet-pump or injector for exhausting the expanded refrigerant medium from the cooling-chamber and forcing the same into the storage-chamber of the system and in connection therewith the employment of a thermally-actuated generator and a jet-pump or injector for effecting a constant and positive circulation of a motive fluid having a different, denser, and less volatile nature than the refrigerant medium and which denser motive fluid in turn operates the compression pump or injector, which exhausts the refrigerant medium from the cooling-chamber and forces the same into the storage-chamber in a substantially continuous manner.

The employment in the above-mentioned connection of an intermediate fluid having a different and at the same time a denser and less volatile nature than the refrigerant medium employed imparts greater efficiency to the system in that a too-rapid dissipation and condensation of the primary vaporous motive fluid is prevented, so that such vaporous motive fluid does not come into direct contact with the cooled and attenuated refrigerant medium until after such vaporous motive fluid has imparted its momentum to the intermediate denser and less volatile motive fluid, in consequence of which a very economical and efficient compression of the refrigerant medium will be effected in a continuous manner during the use of system.

In the construction shown in the accompanying drawings as illustrative of this part of the present improvement, 10 is a thermal pressure-generator provided with a gaseous-fuel supply and burner 11, the supply of fuel-gas thereto being regulated and controlled by an electromagnetic controlling-valve 12 and a thermostat 13, located within the influence of the thermal generator 10 and adapted to open or close the electromotive circuit of the operating-electromagnet of the valve 12 to regulate the supply of fuel-gas in accordance with the variations of temperature within the thermal generator.

4 is a jet-pump or injector receiving its sup-

ply of actuating gaseous pressure from the thermal generator 10 through pipe connection 14. In the present improvement the jet-pump or injector 4 will be of the duplex type and adapted to receive a supply of denser intermediate actuating fluid, preferably mercury, from the elevated tank or trap 7 in the pipe connection 5 between such injector and the storage-chamber 1, such supply of intermediate fluid being carried to the injector by the pipe connection 15.

The elevated trap or tank 7 will be of any usual construction which will admit of the ready separation of the intermediate actuating fluid from the combined actuating gaseous pressure fluid and refrigerant medium taken from the cooling-chamber by such injector.

Another part of the present invention involves, broadly, the use or employment of the same fluid medium in both the cooling portion and in the thermally-actuated portion of the system, and to this end a single storage-chamber 1, as shown in the drawings, may be used in common or separate cooling or condensing chambers for such different portions of the system may be employed and coupled together as in my former application, Serial No. 733,689.

16 is an elevated tank having pipe connection 17 with the storage-chamber 1 and pipe connections 18 and 19 with the thermal generator 10 in manner similar to that described in my aforesaid application, Serial No. 733,689, such elevated tank constituting a stand-pipe to receive a portion of the condensed liquid from the storage-chamber and return the same to the thermal generator 10 in an automatic manner to preserve a substantially uniform liquid-level in said generator.

The elevated tank or chamber 16 is continuously supplied with liquid from the storage-chamber 1, principally by reason of the weight of the liquid collecting in the chamber 1, assisted by the high pressure in the pipe 5, and such tank or chamber 16 will contain any usual and well-known automatic appliance, known in the kindred art as an "automatic feedway-supply for steam-boilers" and adapted in the present connection to effect the same result—to wit, maintain a predetermined quantity of fluid in the thermal pressure-generator of the apparatus during a continued operation of the same.

20 is a check-valve in the pipe connecting 17 to prevent a return flow from the tank 16 into the storage-chamber 1.

Another part of the present invention involves the operation of the present system and apparatus in such a manner as to maintain a substantially continuous and maximum operation of the compression portion of this system and in connection therewith to provide means for regulating the temperature of the cooling-chamber by an automatic control of the supply of expanded refrigerant medium from the cooling-chamber 2 to the compression apparatus 4, the purpose being to provide a very simple, durable, and efficient apparatus having but very few complex parts which are liable to become deranged and inoperative during continued use. In the construction shown in the drawings as illustrative of the present invention an electromagnetic controlling-valve, which may be the expansion-valve 3 of the system, as shown in the present illustration, is arranged intermediate of the storage-chamber and the compression apparatus, and preferably between the storage-chamber and the cooling-chamber, as shown, in that the one valve may serve the dual functions described.

21 is a thermostat located within the influence of the cooling-chamber and adapted to open or close the electromotive circuit of the operating-electromagnet of the valve 3 to regulate the admission of the refrigerant fluid to the cooling-chamber, and in consequence the supply of expanded refrigerant medium to the compression apparatus 4.

In some cases the electromagnetic controlling-valve, above described, will be arranged independent of the regular expansion-valve of the system and when so arranged will be preferably located in the pipe connection 9 between the cooling-chamber 2 and the compression apparatus 4.

In the operation of the present system with the application of heat to the thermal pressure-generator 10 vapor under pressure is generated therein to constitute the primary vaporous motive fluid of the present system. Such primary motive fluid passes through the pipe connection 14 to the primary jet of the duplex injector 4 to initially act upon and impart its momentum to the secondary denser and less volatile motive fluid of the present system which is brought to such portion of the duplex injector 4 from the elevated separating-tank 7 by the pipe connection 15 through the combined agency of suction and gravity. The combined primary and secondary motive fluids pass from the primary jet to the secondary jet of the duplex injector in a forcible manner and into the secondary jet-chamber to cause a suction therein and draw the attenuated vaporous refrigerant medium from the expansion-chamber of the system through the pipe connection 9. From such secondary jet-chamber of the duplex injector the combined primary motive fluid, the secondary motive fluid, and the refrigerant medium passes through pipe connection 5 into the separating-chamber 7, wherein the secondary and non-volatile motive fluid separates by gravity from the more volatile primary motive fluid and from the more volatile refrigerant medium, both of which are of the same nature and material and pass through the check-valve 6 in a continuation of the pipe connection 5 into the storage-chamber 1 to be condensed, and from which storage-chamber such fluid is again fed in the usual

automatic manner to the expansion-chamber 2 and to the thermal generator 10, while the secondary motive fluid remains in the elevated separating-chamber to recommence a fresh cycle of movements from such separating-chamber to the duplex injector and back again into said separating-chamber, as before described.

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

1. In a refrigeration system, in which the apparatus operates in a substantially continuous manner, the combination with the pressure-generating chamber, the storage-chamber and the expansion-chamber, of a duplex injector having supply connections with the pressure-generating chamber and with the expansion-chamber and a discharge connection with the storage-chamber, a separating-chamber arranged in said discharge connection intermediate of the storage-chamber and injector and containing a different and less volatile fluid than the refrigerant medium and adapted to separate in said chamber by gravity from the more volatile refrigerant medium, and a supply connection between said separating-chamber and the duplex injector, substantially as set forth.

2. In a refrigeration system, in which the apparatus operates in a substantially continuous manner, the combination with the pressure-generating chamber, the storage-chamber and the expansion-chamber, of a duplex injector having supply connections with the pressure-generating chamber and with the expansion-chamber and a discharge connection with the storage-chamber, a separating-chamber arranged in said discharge connection intermediate of the storage-chamber and injector and containing a different and less volatile fluid than the refrigerant medium and adapted to separate in said chamber by gravity from the more volatile refrigerant medium, a supply connection between said separating-chamber and the duplex injector, and an automatic means for regulating the supply of lighter refrigerant medium to the duplex injector, substantially as set forth.

3. In a refrigeration system in which the apparatus operates in a substantially continuous manner, the combination with the pressure-generating chamber, the storage-chamber and the expansion-chamber, of a duplex injector having supply connections with the pressure-generating chamber and with the expansion-chamber and a discharge connection with the storage-chamber, a separating-chamber arranged in said discharge connection intermediate of the storage-chamber and injector and containing a different and less volatile fluid than the refrigerant medium and adapted to separate in said chamber by gravity from the more volatile refrigerant medium, and a supply connection between said separating-chamber and the duplex injector adapted to deliver the denser fluid medium to the injector in advance of the lighter refrigerant medium, substantially as set forth.

4. In a refrigeration system, the combination with the storage-chamber, cooling-chamber, injector intermediate of the cooling-chamber and the storage-chamber and operated by the thermal generator, and the thermal generator, and an automatic gravity-operated return connection between the storage-chamber and the thermal generator adapted to return a portion of the common fluid medium employed in the system to the thermal pressure-generator, substantially as set forth.

Signed by me at New York, N. Y., this 10th day of January, 1900.

CLYDE J. COLEMAN.

Witnesses:
ROBERT BURNS,
M. H. HOLMES.