

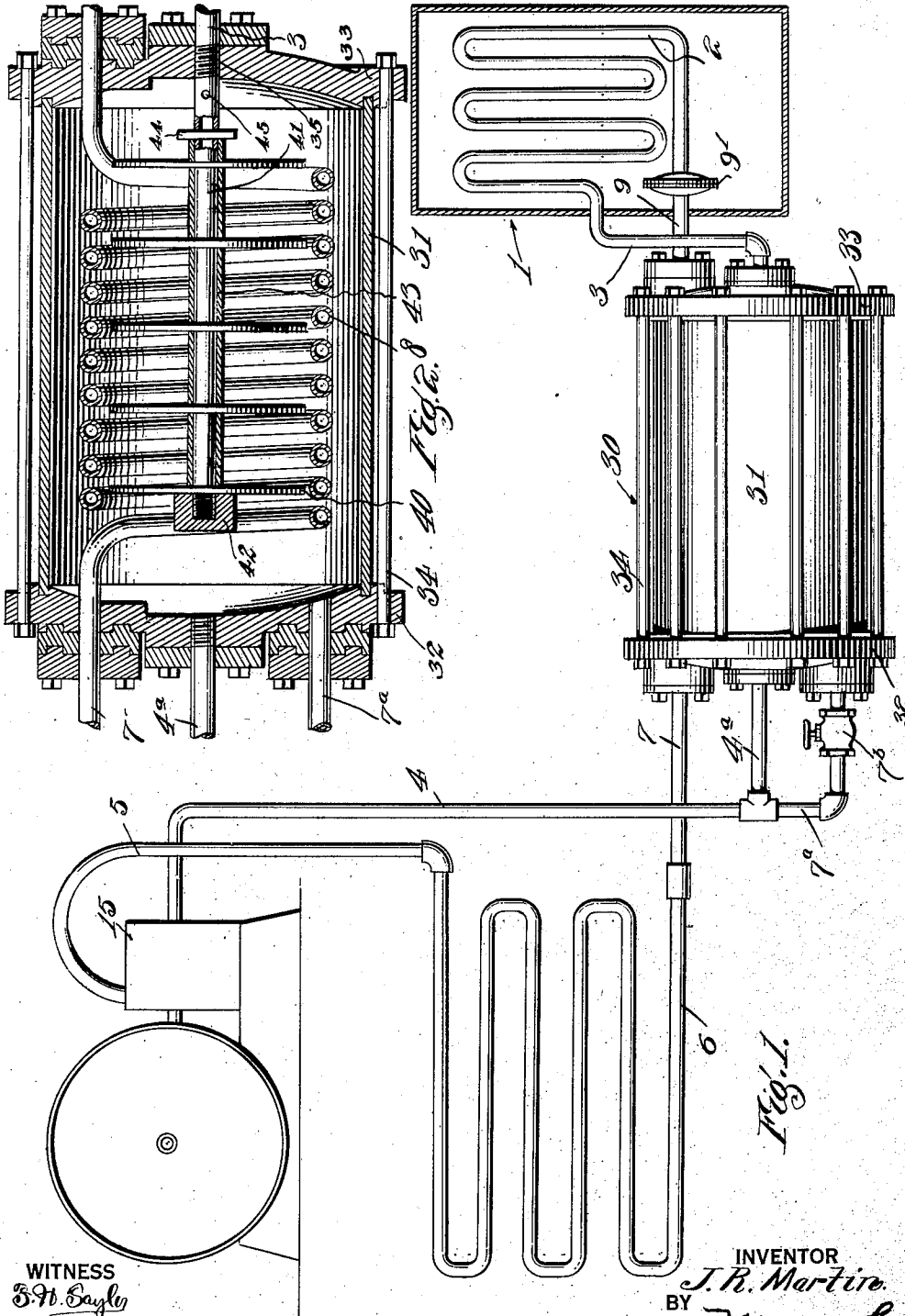
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J. R. MARTIN

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LIQUEFIED GAS COOLER FOR REFRIGERATING APPARATUS

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WITNESS
B. H. Bayley

INVENTOR
J. R. Martin
BY
Munn & Co.
ATTORNEY

UNITED STATES PATENT OFFICE

JAMES RIVERS MARTIN, OF WINTER HAVEN, FLORIDA, ASSIGNOR TO HENRY C. FRIERSON, OF WINTER HAVEN, FLORIDA

LIQUEFIED GAS COOLER FOR REFRIGERATING APPARATUS

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This invention relates to that type of refrigerating apparatus in which a volatile liquid is employed as the refrigerant to absorb the heat of surrounding bodies or substances, and the gas or vapor resulting from the evaporation of the liquid is re-liquefied, so that the same refrigerant is used over and over again in a continuous cycle.

The great amount of gas created, aside from doing little net refrigeration work in the coils, occupies very valuable space; entrains considerable mist or spray to the suction line; causes sluggish circulation, and retards evaporation due to its insulating effect on the inner surface of the cooling coils.

A primary object of this invention is to provide means whereby the condensed ammonia before reaching the expansion valve is reduced in temperature and thus reducing the percentage of loss of total available refrigerant at time of or at moment of expansion—eliminate excessive gases created by such high temperature of condensed ammonia resulting in greater weight of ammonia expanding in coils, quicker and more complete refrigeration work—drier atmosphere in storage room—better refrigeration service generally.

Another object of the invention is to provide a cooler for the liquefied gas employed in such system whereby the operating cost will be reduced and the capacity of the ice-making machine increased.

Still another object of the invention is to provide a liquefied gas cooler connected to the suction line from an ice tank or cold storage room and through which the return liquid from the tank or room passes and which includes a coiled pipe connected with the condenser line at one end and an expansion line at the other whereby liquefied gas flowing through such coiled pipe is cooled by the returned ice tank gas and liquor to within a few degrees of the tank or cold storage temperature.

In carrying out these objects, the invention is susceptible of a wide range of modification without departing from the spirit or sacrificing any of the advantages of the claimed invention; there being shown in the

drawings for illustrative purposes a preferred and practical form, in which:

Figure 1 is a diagrammatic view with parts in section of a part of a refrigerating system equipped with a liquefied gas cooler embodying this invention; and

Fig. 2 is a longitudinal section of the gas cooler shown in Fig. 1;

In the form shown in Fig. 1, the gas cooler 30 embodying the invention is illustrated in connection with an ice tank or cold storage chamber 1 having mounted therein cooling coils or pipes, one of which is shown at 2 and from one end of which a pipe 3 leads to and discharges into the shell 31 of the liquefied gas cooler 30. This cooler is always mounted horizontally and has mounted therein a coiled tube or pipe 8 for a purpose presently to be described. The shell 31 of the cooler 30 is shown made cylindrical in form with a casting 32 forming one end thereof and a casting 33 forming the opposite end. These ends are connected and secure the shell body in place by means of tension rods 34. The head 33 has an opening 35 in the center thereof thru which passes pipe 3 of the suction line of the system. This pipe enters the shell and is surrounded by a suitable bushing to provide a fluid tight closure around such pipe. A second bushed opening in this head 33 is also provided, its purpose being presently described. Head 32 is provided with three bushed openings thru one of which passes a pipe 7 which connects the coil 8 with a condenser 6 and a branch 7a which in turn connects with the suction pipe 4 there being introduced in a pipe 7a a shut off valve 7b which is normally closed and preferably placed near the lower side of head plate 32.

Head 32 is provided with a bushed central opening for the passage of pipe 4a leading from the shell 31 and which constitutes a continuation of the suction pipe 4 leading back to compressor 15.

The pipe 4 is connected with the suction side of the compressor 15. The discharge side of the compressor 15 is connected by a pipe 5 with a condenser 6 from which the pipe 7 leads to and is connected with the coil 8 within and extending entirely thru the cool-

er 30 and terminating in the second bushed opening in head 33. Said coil 8 being connected and extended into the cooling room 1 by means of pipe 9 having thereon an expansion valve 9'.

As shown pipe 3 communicates with a pipe 41 which is screwed into the head plate 33 of the cylinder and extends to a point near the other end thereof where it is equipped with a screw cap 42. This pipe extends through the center of the coil 8 and has mounted thereon a plurality of baffle plates 40 located within the coil but not contacting therewith. These baffle plates 40, any desired number of which may be employed, five being here shown are preferably made of steel discs and are separated from each other by short spacing sleeves 43 slidably mounted on the pipe 41. These discs and sleeves are held assembled on the pipe by means of a pin 44 extending transversely through the pipe near its connection with head 33 and between which and the cap 42 the plates and sleeves are clamped so that by turning on the cap 42 all the parts will be held securely together. A gas inlet 45, about one-half inch in diameter more or less is drilled entirely through the pipe 41 and provides the only inlet to the cylinder for the gas from the suction line pipe 3.

This assembly of the baffle plate is designed to distribute the gas entering through the pipe 3 around the coils 8 giving them the full benefit of the low temperature of the suction line gas. Obviously this arrangement provides a maximum volume of gas in the cylinder and a maximum distribution of it.

In the operation of the apparatus gaseous ammonia after being compressed by compressor 15 to say 150 to 200 pounds passes down pipe 5 into and thru condenser coils 6 where its temperature is reduced to that of the condensing water say 85 to 90° and is liquefied. Continuing thru pipe 7 and coil 8, pipe 9 and expansion valve 9' and expansion coils 2 within the ice tank or storage chamber where the condensed liquid is vaporized resulting in effective refrigeration work.

The gases there created and having a temperature of from 32 to 36° pass from coils 2 thru outlet provided on end thereof, thru pipe 3 and into the cylinder 31 thru opening 45 in pipe 41 and is there distributed by baffle plates 40.

The gases entering cylinder 31 at 32 to 36 degrees temperature being well distributed around coils 8 (thru which flows condensed ammonia at 85 to 90 degrees F.) produces a cooling effect on these coils and passing on out of the cylinder thru pipe 4 to the compressor 15. It will be observed that pipe 3—cylinder 31—and pipe 4 constitutes the suction line and that pipe 5—coil 6—pipe 7—

coil 8—pipe 9, etc., the discharge or liquor line.

The gases entering cylinder 31 thru pipe 3 entrains the before mentioned liquid ammonia from coils 2, precipitating the same thru openings 45, in baffle plate assembly shaft 41, to the lower half of cylinder 31. The latter serving as a trap to separate liquid from gas and thus prevents an excess of liquor getting over to the compressor which is not desirable. The liquid in trap (cylinder 31) surrounding and submerging lower half of coils 8 produces a cooling effect thereon and continually vaporizes and passes out of the cylinder 31 thru pipe 4 to compressor 15. The liquid being denser than the gas and approximately the same temperature can absorb considerably more heat than the gas considering the space occupied by each in cylinder. But of course the gas is in transit and a colder volume is being supplied constantly while liquid is replenished at gas temperature about as fast as liquid evaporates.

The gases passing out of cylinder 31 into pipe 4 and back to compressor are not unduly super-heated but enough to prevent any liquid getting into the compressor. No cooling before entering compressor is required. Owing to length of coil 8 which is about 30 feet, and the close adjustment of expansion valve 9' which does not permit any great volume of ammonia to pass in a given time, and the reduced pressure of ammonia in coils 8 caused by its being cooled in passage thru coils 8, all tend to render passage thru coils 8 sluggish which is desirable since the longer the ammonia is in cooling touch with cooling gas and liquid in cylinder, the more heat will be extracted for a given quantity for a given time. On the other hand the gas in cylinder 31 under 15 pounds pressure having a distance of less than 24 inches to traverse from entrance to exit, and considering a given quantity, absorbs very little heat owing to its quick transit thru cylinder, and very much less timed contact with coils 8. It is the constant flow of large quantities of cold gas that accomplishes the effective cooling and the temperature absorbed is distributed thruout the maximum quantity of suction gas going into the compressor. The approximate ratio between temperature loss of liquid in coil 8 and temperature gain of gas in cylinder 31 for a given volume is very high, we will say 10 to 15 to 1 and the time of contact of gas with coils or we would say the time required for the passage of a given quantity of gas entirely thru cylinder as compared with passage of liquid entirely thru coils 8 has inverse ratio.

On refrigerating machines thermostatically controlled, the following occurs—when cooling room reaches a predetermined temperature the compressor is automatically stopped but the discharge and suction, mostly the discharge, continues to flow under ac-

cumulated pressure of condensed ammonia and continues during the interval of stoppage. The two circuits tend to become equalized, the liquid losing pressure—the suction gaining by reason of accumulation of gas having no outlet thru compressor. In time the gas in upper half of cylinder 31 is more or less stationary and slightly compressed and its heat absorbing qualities exhausted. The liquid being denser, continues its cooling effect on coils, vaporizes and automatically empties the cylinder of itself. On restarting the compressor, the circuits start in motion and for a considerable period the entire cylinder, (upper and lower half) is completely filled with fresh cold supplies of gas from the expansion coils and the entrained liquor gradually filling the lower half or trap.

If for any good reason the machine is pumped to a vacuum such as is necessary for adjustments or repairs to machinery or to cooler 30 without waiting for liquid in cylinder to evaporate—valve 7b is opened and thus provision is made to force liquid out of cylinder thru suction line and thru compressor.

Without further description it is thought that the features and advantages of the invention will be readily apparent to those skilled in the art, and it will, of course, be understood that changes in the form, proportion and minor details of construction may be resorted to, without departing from the spirit of the invention or its scope as claimed.

I claim:

1. A liquefied gas cooler for freezing apparatus comprising a cylindrical member closed fluid tight at both ends, a liquefied gas coil located within said cylinder and having its ends extending through the ends of the cylinder, means for supplying liquid gas to said coil, means for supplying expanded gas from a cooling coil to said cylinder, said means comprising a pipe extending longitudinally through said coil, and a plurality of baffle plates carried by said pipe within said coil for distributing the expanded gas in regard to the coil.

2. A liquefied gas cooler for freezing apparatus comprising a cylindrical member closed fluid tight at both ends, a liquefied gas coil located within said cylinder and having its ends extending through the ends of the cylinder, means for supplying liquid gas to said coil, means for supplying expanded gas from a cooling coil to said cylinder, said means comprising an expanded gas supply pipe extending into said cylinder inside said coil, a plurality of baffle plates mounted on said pipe, spacing sleeves arranged between said plates, and means for clamping and connecting the plates and sleeves to the pipe.

JAMES RIVERS MARTIN.