H. R. ROSS.

TRAVELING REFRIGERATING PLANT.

APPLICATION FILED DEC. 22, 1919.

1,352,533.

Patented Sept. 14, 1920.

2 SHEETS—SHEET 1.

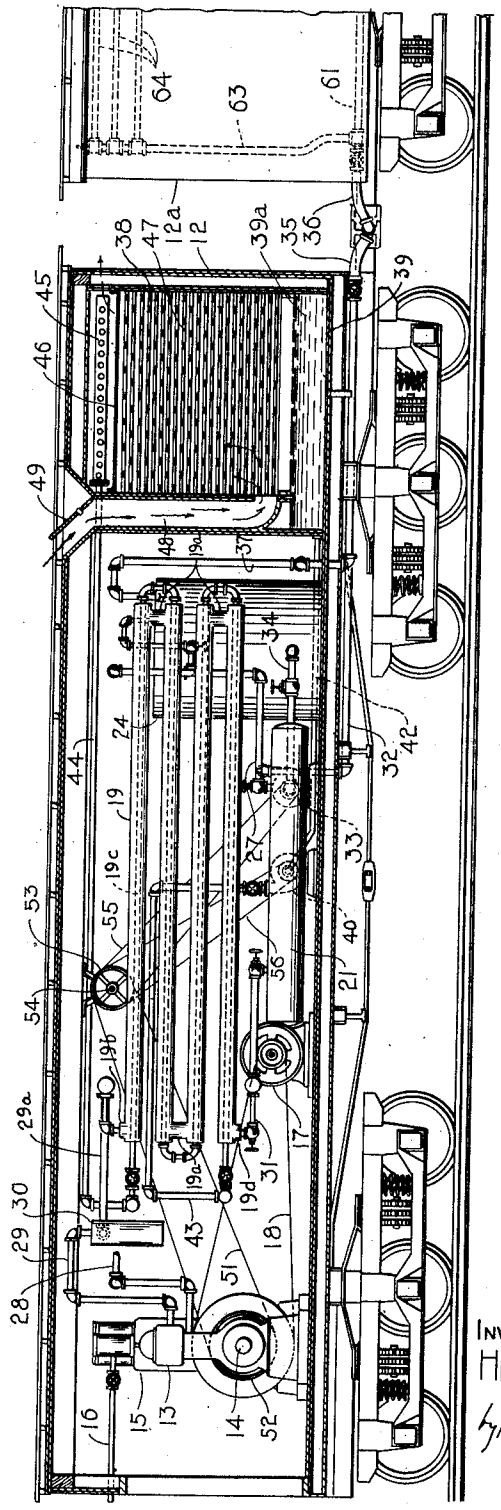


FIG. 1.

INVENTOR:
HENRY RUSSELL ROSS

by Wright Brown Quinby & May

ATTYS.

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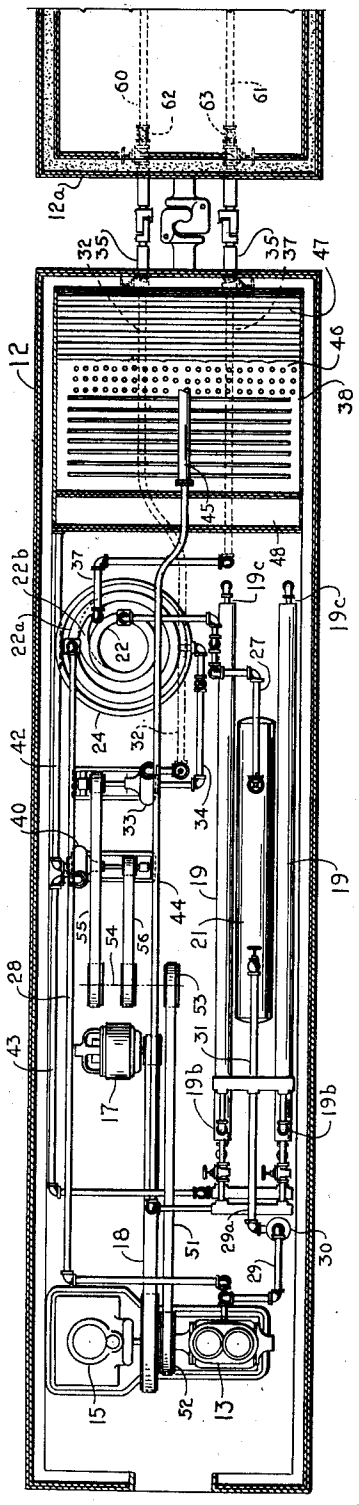


FIG. 2.

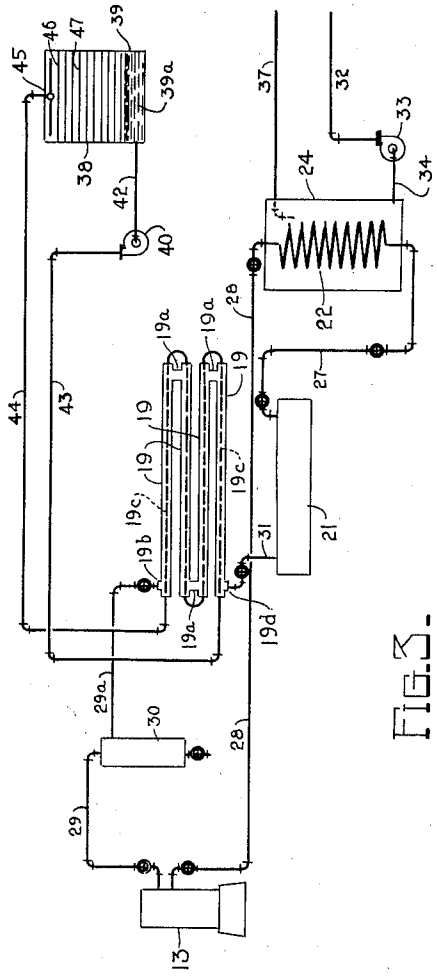


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UNITED STATES PATENT OFFICE.

HENRY RUSSELL ROSS, OF ST. JOHN, NEW BRUNSWICK, CANADA.

TRAVELING REFRIGERATING PLANT.

1,352,533. Specification of Letters Patent. Patented Sept. 14, 1920.

Application filed December 22, 1919. Serial No. 346,760.

To all whom it may concern:

Be it known that I, HENRY R. ROSS, a subject of the Dominion of Canada, residing at St. John, New Brunswick, Dominion of Canada, have invented new and useful Improvements in Traveling Refrigerating Plants, of which the following is a specification.

This invention has for its object to provide, as a unit of a railway train, an improved refrigerating plant including a housing car and refrigerating apparatus, adapted to utilize any usual or suitable volatile liquid or substance such as ammonia, carbon dioxid, etc., for the purpose of cooling, within the car, a refrigerating fluid such as brine, and also adapted to circulate the brine through a refrigerator car coupled to the housing car, and to return the brine to the housing car for re-cooling, the organiaztion being such that the operation of coupling a refrigerator car to the refrigerating plant completes a brine-circulating system adapted to conduct cooled brine from the refrigerating plant to and through the refrigerator car, and from the latter back to the former.

The invention is embodied in the improvements hereinafter described and claimed.

Of the accompanying drawings forming a part of this specification,—

Figure 1 is a longitudinal section of a housing car and a side elevation of a refrigerating apparatus contained therein, parts of the apparatus being shown in section.

Fig. 2 is a plan view of the refrigerating apparatus, and a horizontal section of the car.

Fig. 3 is a diagrammatic view of the refrigerating apparatus.

The same reference characters indicate the same parts in all of the figures.

In the drawings, 12 represents a housing car carrying the elements next described. 13 represents a compressor of any suitable type, adapted to compress ammonia, carbon dioxid, or any volatile liquid or substance used for refrigerating purposes, and hereinafter called the refrigerant.

The shaft 14 of the compressor may be driven by any suitable motor, such as a steam engine 15, operated by steam from a locomotive boiler conducted through a pipe 16. When steam power is not used to propel the train of which the car 12 forms a unit, the compresser may be operated by an electric motor 17, or by an oil or a gasolene engine, power being transmitted therefrom to the compressor shaft through a belt 18.

A condenser provided for liquefying the refrigerant, may include a series of parallel conduits or headers 19, connected by transverse conduit portions 19^a, as shown diagrammatically by Fig. 3, the upper header 19 receiving the refrigerant from the compressor 13 at 19^b. The headers 19 and connecting portions 19^a constitute, in effect, a refrigerant-conducting casing. The condenser also includes a sinuous cooling pipe 19^c extending through the casing headers 19, and adapted to conduct cooling fluid through the headers to liquefy the refrigerant therein. The lower header delivers the liquefied refrigerant at 19^d, and through a pipe line 31 to a receiver 21, in which a suitable charge of the refrigerant is stored.

In practice I prefer to provide two series of connected headers 19, as indicated by Fig. 2, each series being connected with the compressor and with the receiver, and each having a cooling pipe 19^c.

A cooler is provided for the refrigerating fluid, such as brine, which is to be circulated through a train unit constituting a refrigerator car, or through a plurality of such units.

The simple form of cooler shown by Fig. 3, includes an evaporating conduit, here shown as a coil 22, connected at one end with the receiver 21, and at the opposite end with the compressor 13, and a brine reservoir 24 containing said coil. In practice I prefer to embody the evaporating conduit in two concentric coils 22 and 22^a, connected in series by an intermediate pipe portion 22^b, as shown by Fig. 2, and both contained in the reservoir 24. The refrigerant passes first through one coil, and then through the connecting portion 22^b, and through the other coil. The brine reservoir should be provided with a heat-insulating jacket.

The refrigerant is conducted under condensing pressure and in liquid form, from the receiver 21, by a pipe line 27, to the inner coil 22. The liquid evaporates at a low pressure and temperature, in the coils 22 and 22^a, taking heat from the brine in the reservoir 24, which is kept continuously full of brine by means hereinafter described.

The vapor formed by the evaporation of the refrigerant in said evaporating conduit

is drawn into the compressor 13 through a pipe line 28 communicating with the discharge end of said conduit, the compressor acting to compress the vapor to a pressure and temperature at which it will liquefy.

The compressed gas or vapor is conducted through a pipe line 29, an oil trap 30, and a pipe line 29a, to the receiving end of the upper header 19 of the condenser casing, and in passing through said casing, is condensed into a liquid by the action of cool water circulated through the condenser cooling pipe line 19c, preferably by means hereinafter described.

The condensed or liquefied refrigerant is conducted from the delivering end of the condenser casing by the pipe line 31, to the receiver 21, the circuit of the refrigerant being thus completed. The described circulation of the refrigerant is continuous, so long as the compressor is kept in operation.

To conduct the cooled brine from the refrigerating plant to the refrigerator car, I provide a flow pipe line 32, one end of which is connected with the outlet of a brine pump 33. The intake of said pump is connected by a pipe line 34 with the lower portion of the brine reservoir 24. The pump, therefore, draws cooled brine from the brine reservoir and forces it through the flow pipe line 32. Said line extends to one end of the car 12, and its outer end is provided with a flexible conduit member 35, adapted to be coupled to a refrigerator car 12a, which is provided internally with brine-circulating means.

To conduct the warmed brine from the refrigerator car back to the brine reservoir, I provide a return pipe line 37, extending from a point at the end of the car 12 beside the outer end of the flow pipe line, to the reservoir 24, and adapted to discharge brine into said reservoir. The outer end of the return pipe line 37 is provided with a flexible conduit member 35 for connection with a complemental conduit member on a return main carried by the refrigerator car.

In a concurrently filed application, I disclose a refrigerator car provided with the above-mentioned longitudinal flow and return mains, and with the branch pipe lines and brine-circulating means, the arrangement being such that cooled brine forced by the pump 33 through the flow pipe line, flows through the refrigerator car, and back through the return pipe line 37, to the brine reservoir.

Water is cooled and circulated through the condenser headers 19, preferably by the means next described.

38 represents a box-like structure, located at one end of the car 12, and constituting a cooling tower. At the bottom of the tower is a reservoir 39, containing a body 39a of water. 40 represents a water-circulating pump, the intake of which is connected by a pipe line 42 with the reservoir. The outlet of the pump 40 is connected by a pipe line 43 with the cooling pipe 19c, so that the cold water from the reservoir is circulated through the condenser casing to take up the heat of compression of the refrigerant, forced through the casing by the compressor.

After the cooling water has passed through the cooling pipe in the condenser casing, it is conducted to the upper portion of the cooling tower by a return pipe line 44, provided with a water-distributing header or manifold 45, adapted to subdivide the water into a multiplicity of small streams. These fall onto a perforated horizontal plate 46, the perforations of which are formed and arranged to cause the water to fall like rain, evenly on to a tier of grids 47, formed by closely spaced slats or strips through which the water drips from grid to grid until it reaches the reservoir 39. The descending drops meet and are cooled by an ascending current of air induced by the motion of the car, an air duct 48 being provided which extends from an opening in the roof of the car to the lower portion of the tower. Air is guided into the upper end of the duct 48 by a shutter or deflector 49, which projects above the roof of the car to act as a scoop, taking air into the duct and causing it to rush down the same at a velocity dependent on the speed of the train. The air is delivered by the duct into the lower portion of the tower and passes from thence upwardly through the grids 47, perforated plate 46, and the upper end of the tower, cooling the descending water in its passage, the upper end of the tower being in communication with the outside air through a suitable opening or openings in the roof of the car, or elsewhere, so that the ascending air escapes freely.

Power may be transmitted from the compressor shaft 14 to the shafts of the brine pump 33 and water-circulating pump 40 by a belt 51 running on a pulley 52 on the compressor shaft, and a pulley 53 on an intermediate shaft 54, and by belts 55 and 56 running on pulleys on the shaft 54, and on the shafts of said pumps.

It will now be seen that I have provided an incomplete brine-circulating system, which includes the brine reservoir 24, the brine pump, the flow pipe line 32, and the return pipe line 37. Said system is adapted to be completed by connecting the flow and return pipe lines to flow and return mains carried by the refrigerator car shown by my concurrently pending application.

It will also be seen that I have provided a complete refrigerant-circulating system, which includes the evaporating conduit in

the brine reservoir, other parts of said system being the compressor 13 and the receiver 21. The two systems meet and cooperate at the brine reservoir.

The refrigerating plant embodied in the housing car 12, and the apparatus carried thereby, constitute an element of a combination whereof a refrigerator car 12[a] and brine-circulating means carried by it, constitute another element.

Said brine-circulating means, shown in part by Figs. 1 and 2, and more fully by the drawings of my co-pending application above referred to, may include flow and return mains 60 and 61, extending lengthwise of the car 12[a], branch pipe lines 62 and 63, extending upwardly from the said mains at one end of the car, and a plurality of circulating conduits 64 connected with the said branch lines, and adapted to circulate brine horizontally in the upper portions of the car 12[a], the arrangement being such that brine withdrawn from the brine reservoir 24 by the brine pump 33, flows in the flow pipe line 32, the flow main 60, the branch pipe line 62, the circulating conduits 64, the branch line 63, the return main 61, and the return pipe line 37, back to the brine reservoir 24.

The operation of coupling together the conduit members 35 and 36 completes the brine-circulating system.

The described brine circulating apparatus may be utilized for heating, instead of cooling a refrigerator car or cars.

I claim:

1. A traveling refrigerating plant comprising a housing car, a brine reservoir therein, a brine pump having its intake connected with said reservoir, a flow pipe line communicating with the outlet of the pump and extending therefrom through the rear end of the car, a return pipe line extending through the same end of the car to the reservoir, said flow and return pipe lines being provided with means outside the car for connection with flow and return pipe lines on a refrigerator car, a complete refrigerant-circulating system carried by the housing car and including an evaporating conduit within the brine tank, a compressor, a conduit constituting a condenser element and a receiver, said compressor, condenser element, and receiver being connected in series with the evaporating conduit, whereby a volatile refrigerant may be supplied in liquid form to the evaporating conduit, and conducted in gaseous form therefrom, the said condenser element being provided with a cooling conduit for cooling the refrigerant in its passage from the compressor to the receiver, means for circulating a cooling liquid through said cooling conduit, and means for cooling said liquid while it is circulating.

2. A traveling refrigerating plant substantially as specified by claim 1, said cooling liquid-circulating means being organized to subdivide the cooling liquid at a given point, and allow the subdivided liquid to fall through an air space, the car being provided with means for inducing an upward flow of air through the falling subdivided liquid.

3. A traveling refrigerating plant comprising a housing car, an incomplete brine-circulating system carried by the car and including a brine reservoir constituting a part of said system, a brine pump having its intake connected with said reservoir, a flow pipe line communicating with the outlet of the pump and extending to one end of the car, and a return pipe line extending from said end to the brine reservoir, said flow and return lines being adapted, outside the car, to be coupled to means on a refrigerator car for completing said brine-circulating system, a complete refrigerant-circulating system carried by the housing car and including an evaporating conduit within the brine reservoir, in which conduit a volatile refrigerant in liquid form may evaporate to take up the heat of the brine in said reservoir, a compressor, means for conducting the evaporated refrigerant from the said evaporating conduit to the compressor wherein the refrigerant may be compressed to a liquefying pressure and temperature, a receiver, a cooling tower having a liquid reservoir at its base, an air duct extending from the exterior of the car into the cooling tower and adapted to induce a forcible flow of outside air into the lower portion of the tower, when the car is in motion, a water-circulating pump, a pipe line connecting the tower reservoir with the intake of said pump, a pipe line connecting the discharge of the said pump with the condenser cooling pipe, and a return pipe line extending from the cooling pipe to the cooling tower, water-distributing means being provided within the tower adapted to present the downwardly flowing returned water in subdivided form, to air passing upwardly through the tower, a flow pipe line communicating with the discharge of the brine pump and extending to one end of the car, a return pipe line extending from the same end of the car to the brine reservoir, the said flow and return pipe lines being provided outside the car with flexible conduit members, adapted to be coupled to complemental members connected with flow and return mains on a refrigerating car, a motor, and driving connections between the motor, the compressor, the brine pump, and the water-circulating pump.

In testimony whereof I have affixed my signature.

HENRY RUSSELL ROSS.