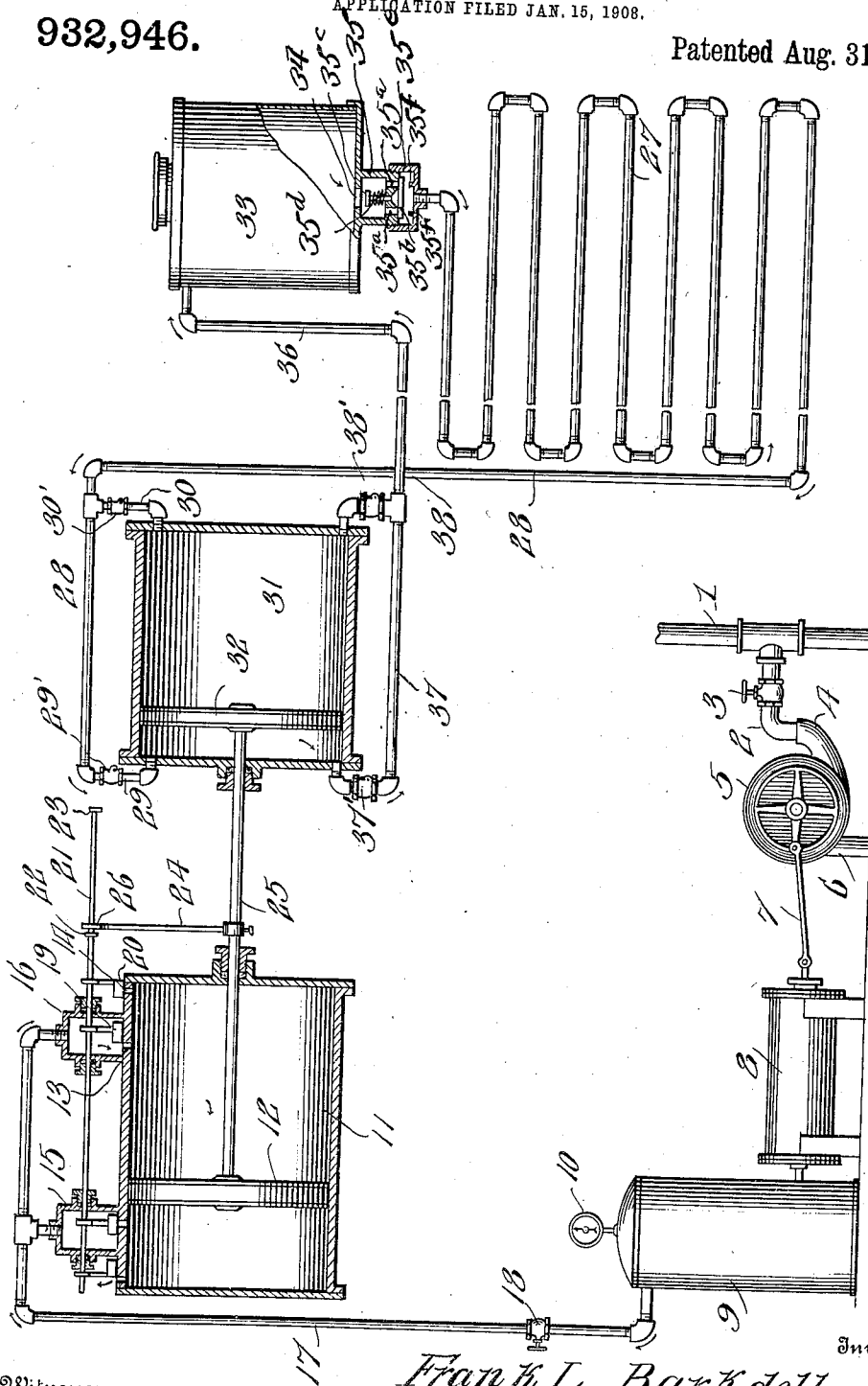


F. L. BARKDOLL.
REFRIGERATING APPARATUS.
APPLICATION FILED JAN. 15, 1908.

932,946.

Patented Aug. 31, 1909.



Witnesses

Frank Tough

C. C. Hines.

Frank L. Barkdoll,

By

Victor J. Evans

Inventor

Attorney

UNITED STATES PATENT OFFICE.

FRANK L. BARKDOLL, OF GREENCASTLE, PENNSYLVANIA.

REFRIGERATING APPARATUS.

932,946.

Specification of Letters Patent.

Patented Aug. 31, 1909.

Application filed January 15, 1908. Serial No. 411,021.

To all whom it may concern:

Be it known that I, FRANK L. BARKDOLL, a citizen of the United States, residing at Greencastle, in the county of Franklin and State of Pennsylvania, have invented new and useful Improvements in Refrigerating Apparatus, of which the following is a specification.

This invention relates to a novel and improved refrigerating apparatus, one object of the invention being to provide an apparatus in which the suction and force pump for circulating the refrigerant may be driven by means primarily operated by a water motor receiving its power from an ordinary service system, whereby the apparatus may be continuously and economically operated.

A further object of the invention is to provide a simple, effective and inexpensive type of apparatus for domestic or commercial use in connection with ice boxes, soda fountains, etc., and which is also designed to utilize as the refrigerating agent, a combination or mixture of ethyl chlorid and olive oil, which is adapted to rapidly expand into vapor and may be liquefied at a low pressure, thus enabling a simple and cheap type of apparatus to be employed.

A still further object of the invention is to provide a refrigerating apparatus in which the parts are driven continuously by a water motor operating an air pump or compressor from which the air is forced into a receiving tank in communication with a double acting air engine, which engine operates the suction and force pump of the apparatus, whereby the vaporized refrigerant is withdrawn from the freezing coil and forced into a condenser and the liquefied refrigerant simultaneously forced from the latter into the coil.

With these and other objects in view, the invention consists of the features of construction, combination and arrangement of parts hereinafter fully described and claimed, and shown in the accompanying drawing, which represents a view partially in elevation and partially in section of the complete apparatus.

Referring to the drawing, 1 designates a water supply pipe, forming part of an ordinary water service system, from which extends a spout 2 having a controlling valve 3, which spout is coupled to the inlet 4 of a water motor 5 having an outlet 6 through which the spent water is exhausted. The rotary piston or wheel of the motor is con-

nected by a rod 7 to the piston of an air pump or compressor 8, from which the compressed air is forced into a receiving tank 9 having a pressure gage 10.

The air stored in the tank 9 is utilized to drive a double acting air engine comprising a cylinder 11 in which operates a piston 12, said cylinder being provided at each end with an inner inlet port 13 and an outer exhaust port 14, the inlet ports being in respective communication with air chests or boxes 15 and 16, which are in communication with the tank 9 through pipe 17 in which is a controlling valve 18.

The sets of ports 13 and 14 are controlled by supply and exhaust valves 19 and 20 fixed for simultaneous operation to a rod 21 arranged to slide through stuffing boxes in the respective valve chests 15 and 16 and provided with contact heads or tappets 22 and 23 for engagement by a rod 24 carried by the rod 25 of the piston 12 which extends externally through one end of the cylinder 11, the said rod 24 having an apertured head 26 through which the rod 21 passes and which is adapted to engage said contacts 22 and 23. It will be obvious from the foregoing description of the construction of the valve mechanism that the piston 12 will be automatically operated in reverse directions by the alternate admission and exhaust of air to and from the opposite ends of the cylinder.

The freezing coil 27 is in communication at one end through a suction pipe 28 with branch pipes 29 and 30 communicating with the opposite ends of the cylinder 31 of a suction and force pump, in which cylinder operates a piston 32 connected with the rod 25, whereby both pistons 12 and 32 will be simultaneously moved in the same direction. The pipe 28 has a suction valve for the exhaust of the spent refrigerant vapor from the coil 27, and the flow of vapor therefrom through the branches 29 and 30 into the pump cylinder 31 is controlled by check valves 29' and 30' disposed in said branches, which permit of the inlet of the vapor from the suction pipe into the pump and prevent its return from the pump to the pipe. The opposite end of the coil 27 is in communication with a condenser 33 having an outlet 34 controlled by a spring closed check valve 35, which valve is normally held seated against the pressure of the liquid refrigerant in the condenser and is adapted to be

forced open under pressure on the feed movement of the piston 32 to force a prescribed amount of the liquid refrigerant into the coil to take the place of the spent vapor withdrawn from the coil by the pump. The condenser is connected with a pipe 36 provided with branches 37 and 38 communicating with the opposite ends of the pump cylinder 30, and having arranged therein check valves 37' and 38' adapted to open in the direction of flow of the vapor from the pump to the condenser, thus allowing such vapor to be forced through the pipe 36 to the condenser while preventing its return to the pump.

As shown, the valve 35 comprises a casing depending from the condenser and in communication at its upper end with the outlet 34 and provided at its lower end with a head 35^a having discharge ports 35^b, the underside of which head forms a seat for an upwardly movable disk valve 35^c, which is adapted to cover the openings 35^a. The stem 35^d of the valve is movable through a guide opening in the head and projects above the same and is provided at its upper end with an enlargement, between which and the head is arranged a coiled spring 35^e, of proper strength to hold the valve closed and permit it to open under variations of pressure in the condenser and refrigerator coil. The casing is externally threaded to receive a cap 35^f provided in its bottom with a threaded opening for the reception of the inlet end of the pipe forming the refrigerator coil, and also provided on its bottom portion with upwardly extending stop lugs or projections 35^g, operating to limit the opening movement of the valve, so that when the valve is fully open a space will be left between the same and the end of the pipe of the coil for the free extension of the refrigerant from the condenser into said coil. The construction and arrangement of the parts of the valve, it will be apparent, is such as to permit of their ready assemblage as well as their convenient disassemblage for repairs when occasion requires.

In operation, the motor 5 works continuously, thus driving the air compressor 8 which supplies compressed air to the tank 9, from which the air passes to the air engine, whose valve mechanism automatically controls the supply of air to move the piston 12 alternately in opposite directions and to thereby transfer corresponding motion to the piston 32 of the suction and force pump. The apparatus being charged with a required amount of the refrigerant mixture or reagent, ethyl chlorid and olive oil combined in suitable proportions, and set in operation by opening the valves 3 and 18, it will be understood that the piston 32 will be operated by the automatic air engine. When said piston 32 moves to the left, the

spent gases in the coil 37 will be drawn therefrom through the pipe 28 and branch 30 into the cylinder, while the vapor previously drawn in on the reverse motion of the piston will be forced through the branch 37 and pipe 36 to the condenser 33. When the piston 32 moves to the right, vapor from the coil will be drawn into the cylinder 31 through the branch 29, and the vapor taken up by its preceding movement to the left discharged through the branch 28 and pipe 36 to the condenser, in which latter, which will be cooled by water in any ordinary way, the vapor will be reduced in temperature under pressure until it is liquefied. As stated, the discharge of the liquefied refrigerant from the condenser 33 to the coil 27 is normally presented by the check valve 35, but when a portion of the vapor is withdrawn from the coil by the pump and a portion forced by the pump into the condenser, under the increased pressure in the latter, the valve will open and allow a portion of the liquid refrigerant to pass into the coil, after which the valve will again close and will not again open until the pressure in the condenser is increased by the succeeding movement of the piston, whereby it will be apparent that a simple and effective automatic means for supplying the coil with required portions of the liquid refrigerant at a time is afforded.

As stated, the refrigerant employed is preferably ethyl chlorid and olive oil, combined in suitable proportions. Such a refrigerant will vaporize at a low temperature and condense at a relatively high temperature and pressure, so that a very simple type of apparatus, such as shown, may be employed as a refrigerant medium for ice boxes, household and store refrigerators, soda fountains and the like, since a powerful pump is not required to withdraw the gas from the coils and place it under high pressure for condensation, as in the ordinary ammonia ice machines. It will be understood that pressure of the vapor within the coil coöperates with the spring of the valve to maintain such valve closed against the head or pressure of the liquid refrigerant in the condenser, so that leakage will be prevented and a sensitive operation secured, the valve positively opening when the pressure in the condenser is increased by the feed of vapor thereto upon each movement of the piston 32.

Having thus fully described the invention, what is claimed as new is:—

In a refrigerating apparatus, the combination of a refrigerating coil, a condenser provided with an outlet communicating with the inlet end of the coil, a suction and force pump having a check-valved inlet communicating with the outlet end of the coil and a check-valved outlet communicating with

the condenser, means for driving the pump whereby the spent vapor will be withdrawn from the coil and forced into the condenser for liquefaction, and a valve controlling the outlet connection between the condenser and the coil, said valve comprising a casing having discharge ports communicating with said outlet, a valve controlling said ports and having an upwardly projecting stem, a cap connected with the inlet end of the coil and detachably connected with the casing, said cap being provided with stops to limit

the downward movement of the valve, and a spring arranged to operate upon the stem of the valve to hold said valve closed under the normal pressure of the liquid in the condenser, substantially as described. 15

In testimony whereof I affix my signature in presence of two witnesses.

FRANK L. BARKDOLL.

Witnesses:

FRANCIS S. DEEKENS,
W. E. McDONALD.