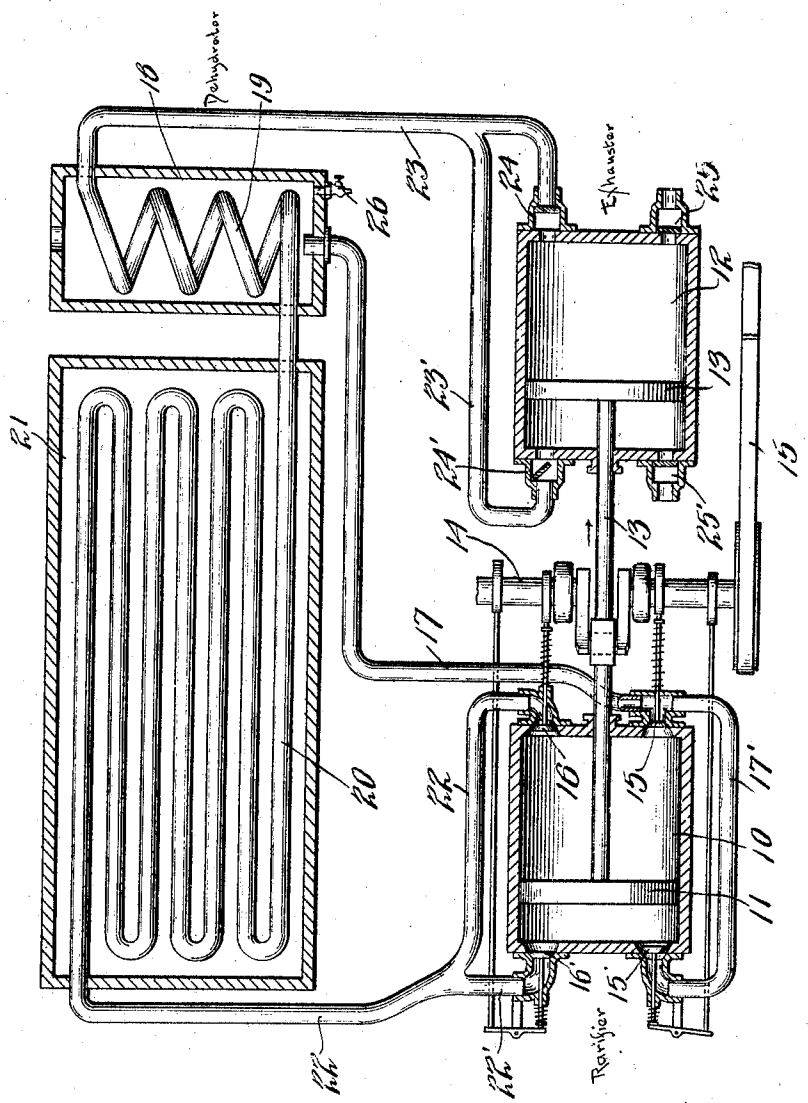
E. R. CANDOR.

APPARATUS FOR REFRIGERATION.

APPLICATION FILED OCT. 24, 1919.

1,402,716.

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UNITED STATES PATENT OFFICE.

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APPARATUS FOR REFRIGERATION.

1,402,716. Specification of Letters Patent. Patented Jan. 3, 1922.

Application filed October 24, 1919. Serial No. 333,035.

To all whom it may concern:

Be it known that I, EDWARD R. CANDOR, a citizen of the United States, residing at Montclair, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Apparatus for Refrigeration, of which the following is a specification.

This invention relates to methods of refrigeration and machines for practising the method, and has for an object to provide a method embodying new and improved features for expanding air as a cooling medium, and employing the expanded air in the cooling chamber with the necessary and desirable mechanical means for carrying out the method.

The drawing is a purely diagrammatic view of the apparatus for practising the method, it being understood that the method is not limited to the identical apparatus shown and described.

As disclosed in the type of apparatus shown in the drawing, the complete installation consists of a rarifier and cooling chamber, a dehydrator and an exhauster. The dehydrator, while a desirable element of the installation, may be dispensed with under some conditions, but it is believed that the other elements in some physical form will be necessary in the carrying out of the method. The mechanism of the drawing consists of a cylinder (10), having a piston (11), operating therein as an air pump, preferably, though not necessarily, in alignment with a second cylinder (12) with piston (13), the first mentioned cylinder and piston operating as a rarifier, the last mentioned cylinder and piston operating as an exhauster. A convenient means of operating is to continue the piston rod (13) through both cylinders and to drive from a single shaft (14), receiving power from any convenient source as the belt (15). It is to be understood, however, that the manner of connecting the pumps and driving the same, is not essential to the present invention.

The rarifier is provided with mechanically operated valves (15) and (15′), being the inlet valves, while (16) and (16′) are the outlet valves. These several valves are operated mechanically from any source of power in timed relation to the operation of the pump and preferably actuated from the shaft (14) through the usual valve operative mechanism as disclosed.

The inlet valves (15) and (15′) receive air through the conduit (17) and branch conduit (17′) from the dehydrator. The dehydrator may take any physical form found desirable, but is here shown as a housing (18), having a coil (19) located therein, forming a continuation of the tubing (20), forming the coil in the cooling chamber. This cooling chamber (21) may be the compartment which is to be refrigerated from the installation, or it may be a brine tank, or any of the usual or desirable means employed in refrigerating systems. The coil (20) receives air through the conduit (22) and branch (22′) from the outlet valves (16) or (16′) of the rarifier.

The air from the cooling coil (20), after passing through the coil (19) of the dehydrator, passes through the conduit (23) and branch (23′) to the check valves (24) and (24′) which are the inlet valves of the exhauster. Outlet check valves (25) and (25′) are also provided for the exhausting the air from the exhauster. In the bottom of the dehydrating chamber (18) means for discharging the water of condensation is provided here shown as the pet cock (26).

While the complete installation has thus been shown and described, it is to be understood that the method involved herein may be carried out in an installation varying widely from the installation disclosed, both in its combinations and its units. Whatever the combinations and units, the air is introduced into the rarifier exemplified by the piston (11). The inlet valves (15) and (15′) are so actuated from the timing mechanism that they are opened for the inlet of air only for a portion of the travel of the piston (11). The interval of inlet may be varied as circumstances may require. Assume that the piston (11) has traveled one-fourth of the stroke with the inlet valve (15′) open, at such point the inlet valve is closed and throughout the remainder of the stroke the air at the rear of the piston operates against the rear face of the piston to expand and assist in the movement of the piston, doing work thereon and delivering up to the piston and the surrounding parts its heat. Simultaneously the previously rarified air at the front of the piston is discharged through the discharge valve (16) and conduit (22) into the cooling coil (20). The degree of rarefaction always present in some degree may be varied as

found desirable by the adjustment of the timing of inlet valves.

The rarefication in the cylinder is carried to a point substantially equal to the rarefication in the coil, so that the rarefied air passes from the cylinder to the coil without performing work, thereby avoiding raising the temperature. The conduits and valve openings are made relatively large to offer little resistance and thereby prevent raising the temperature of the air which has been reduced by rarefication upon the stroke of the piston in the opposite direction. Also to assist in the practically unobstructed passage of the rarified air from the cylinder to the coil, the exhauster is continually operating to withdraw air from the coil. The rarified air is inducted through the check valve (24′). The air has been drawn into the exhauster upon the opposite stroke of the piston through the valve (24′) and is being compressed in front of the piston until the pressure overbalances the atmospheric pressure without the cylinder, whereupon the check valve (25) will automatically open and the air again returned to normal pressure is discharged into the atmosphere. The two cylinders (10) and (12) may be equal in size, as it is obvious that the exact amount of air exhausted by the exhauster must be supplied by the rarefier. As, however, the several conduits offer resistance, it is desirable to make the exhauster a small percentage larger than the rarifier to overcome this tendency to inertia by reason of the resistance.

As will also be noted, the cooling coil, after performing its function in the cooling chamber (21), passes into the dehydrator. The cooling of the air by coming into contact with the coil (19) adds materially to the efficiency as a cooling agent after being rarified and entering the cooling chamber, but the cooling of the air for this purpose is not the real function of the dehydrator, which is to so reduce the temperature of the air that it will precipitate its moisture whereby the moisture will not enter the rarefier and cooling coil to clog up the passages and conduits. The water of condensation in the dehydrator will be drawn off through the pet cock or any other convenient means of handling.

I claim:

An apparatus for refrigerating consisting of a cooling chamber, a dehydrating chamber apart from the cooling chamber having an opening communicating with the atmosphere and provided with means for conducting the condensate away from the dehydrating chamber, an air pipe within the cooling chamber extending therefrom and into the dehydrating chamber wherein it is coiled, a rarefier with inlet and outlet ports, a pipe connecting the inlet ports with the portion of the dehydrating chamber opposite the said opening therein, a pipe connecting the cooling chamber air pipe with the rarefier, an exhauster of greater capacity than the rarefier arranged to exhaust air directly from the dehydrating chamber air pipe, a power shaft between the rarefier and the exhauster adapted to operate both the rarefier and the exhauster, substantially as set forth.

In witness whereof, I have hereunto set my hand and seal at New York, N. Y., this 14″ day of October, A. D. nineteen hundred and nineteen.

EDWARD R. CANDOR. [L. S.]

Witnesses:
PAUL B. BARRINGER, Jr.,
PHILIP HUETWOHL.