(No Model.)

A. CONACHER.

AIR PUMP.

No. 397,780. Patented Feb. 12, 1889.

FIG. 1.

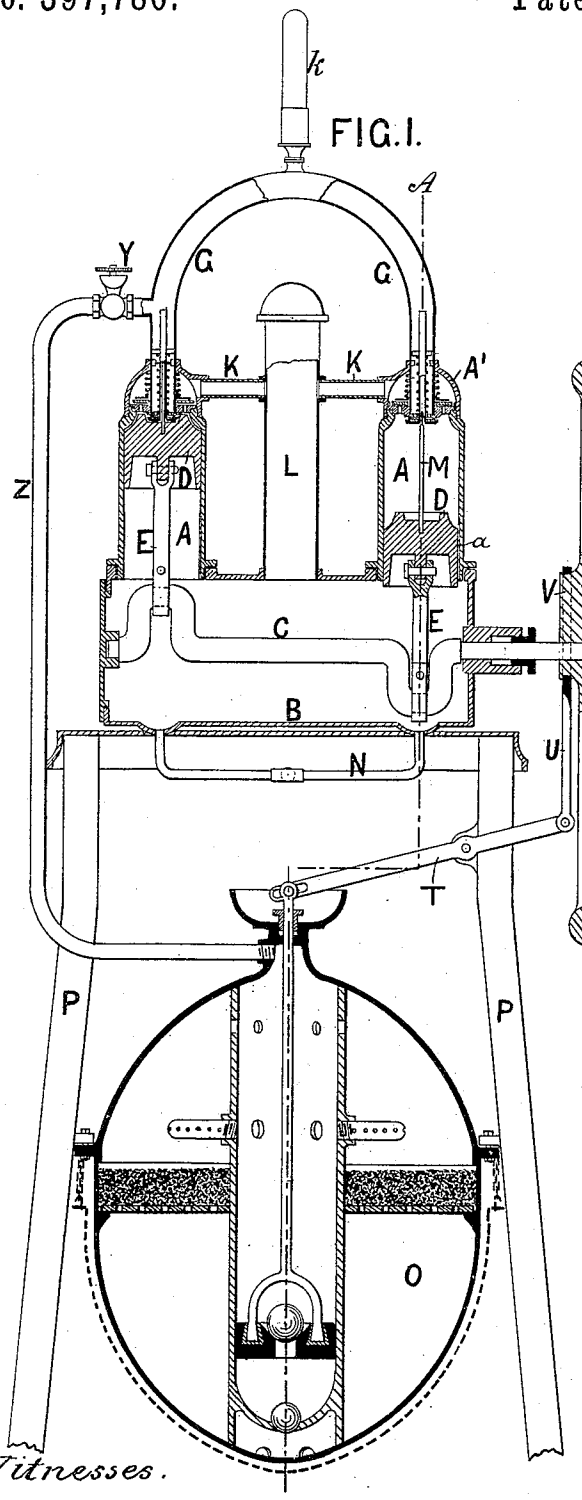


FIG. 2.

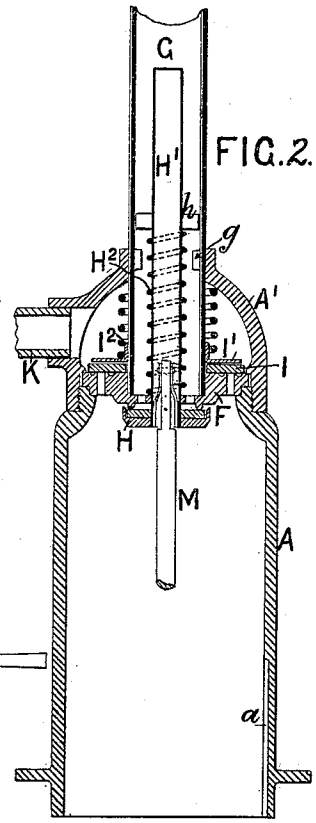
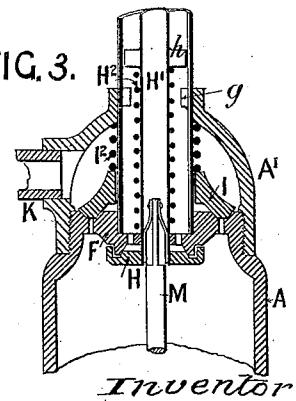


FIG. 3.



Witnesses.
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N. PETERS. Photo-Lithographer. Washington, D. C.

UNITED STATES PATENT OFFICE.

ALEXANDER CONACHER, OF AUGUSTA, GEORGIA.

AIR-PUMP.

SPECIFICATION forming part of Letters Patent No. 397,780, dated February 12, 1889.

Application filed August 26, 1887. Serial No. 247,918. (No model.)

To all whom it may concern:

Be it known that I, ALEXANDER CONACHER, gentleman, a subject of the Queen of Great Britain, of Augusta, in the county of Richmond and State of Georgia, in the United States of America, but at present residing at 51 Thames Street, Windsor, in the county of Berks, in England, have invented certain new and useful Improvements in Air-Pumps Mainly for Refrigerating-Machines, of which the following is a specification.

In the accompanying drawings, Figure 1 is a vertical longitudinal section through pumps constructed in accordance with my invention and mounted upon a frame carrying the acid-reservoir of a refrigerating-machine. Fig. 2 is a sectional detail view of the pump-valves on a larger scale. Fig. 3 is a sectional detail view of a modification of the pump-valves.

The air-pump consists of two perpendicular pump-barrels, A, resting on a horizontal closed chamber, B. This latter has a crank-shaft, C, passing through it, one end having a bearing in a "boss" in the interior of one end of the chamber B, and the other end passing out through the opposite end with bearing and stuffing-box. The boss and the stuffing-box may be in covers screwed onto the ends of the chamber B. This crank-shaft has two cranks placed oppositely to each other, each of which is directly below center of one of the pump-barrels A. The pistons D are operated from the cranks by connecting-rods E. The tops of the barrels are domed, and in the center of the dome part A′ a circular metal plate, F, is seated, having the seats of the suction and discharge valves of the pump. The suction-pipe G, leading to pump-barrel, is screwed into a recess bored down into the plate F, or otherwise united thereto.

k is a vacuum-gage.

The suction-valve H is made of a metal disk faced with "dermatine" or leather or other suitable material not affected by hydrocarbon oils, and it seats on the under side of the plate F.

H′ is a tubular stem closed at top and passing through the plate F, and extending upward inside the suction-pipe for a length exceeding the length of the stroke of the pump. This valve-seat is formed of a beading on the under side of the plate F. The metal disk of suction-valve H is made larger in diameter than the beading on which the valve seats, and its outer edge is cupped upward to a sufficient height to insure the recess thus formed holding the dermatine or other facing, and also to insure that the top edge of this cup shall, when the valve is seated, be above the level of the bottom of the beading which forms the valve-seat; or I may omit the dermatine facing and make the beading conical or wedge-shaped in section, and cause said beading to seat itself directly against a corresponding conical part recessed in the valve H, as shown in Fig. 3. A number of holes are drilled round the center hole through which the valve-stem passes, which holes form the inlet from the suction-pipe G into the pump-barrel.

The discharge-valve I consists of an annular disk of dermatine or other suitable material resting on top of plate F, which has a number of holes drilled through it to form outlets from pump-barrel and over which the valve rests.

Referring to Fig. 3, it will be seen that the dermatine is dispensed with and the annular part I is provided with a beading of a conical section which has its seating in the part F; but in Fig. 1 the top face of the plate F is formed with annular grooves to reduce the bearing-surface of the valve I. A domed cap, A′, is fitted to screw or bolt onto the barrel A and over the plate F, to make the latter seat tightly on top of barrel. There is a hole in center of top of dome to admit the suction-pipe G, and an outlet at the side for discharge-pipe K to be screwed into the outlet, the bottom of the pipe being slightly above the level of the seating of discharge-valve I. The discharge-pipe K from each barrel leads into a trap cylinder or pipe, L, placed on top of the chamber B and communicating therewith. This trap-cylinder is open to the air at top, but covered with a light cover.

The pump-pistons D are formed as to their upper side to fit the shape of the pump-barrels, and are of sufficient thickness to admit of a recess being made in the center of each on the top side to receive the bottom of suction-valve at the end of the upstroke, while

the rest of the face of piston fits close up to the bottom of discharge-seat and dome at end of stroke. In the center of this recess, in top of piston, a small perpendicular rod, M, is fixed, the upper end of which enters into the hollow stem H′ of the suction-valve. The upper end of rod M is fitted with springs, so as to hold the stem H′ with any desired tension or friction.

Each discharge-valve has a metal washer, I′, on top, and is held to its seat by a spiral spring, I^2, pressing between it and the interior of the cap A′. The suction-valves H are held up to their seats by spiral springs H^2 round the stem H′, and the travel of the suction-valves is limited by stops *h* on the stems H′, which come against lugs *g* in the pipes G, and also serve to guide the stems H′ in the pipes G.

A small groove, *a*, Fig. 2, is formed in the lower part of each barrel A, and reaching slightly above top of piston when it is at its lowest point in the pump, for the passage of oil. The crank-shaft is driven by hand or other power, in the usual way.

A hydrocarbon oil having a boiling-point of 450° to 600° Fahrenheit is poured into the pump until it fills the whole space up to the under sides of the pistons D and fills part of the trap-cylinder L. The pump being operated, a very high vacuum is obtained, as at each stroke of each piston, when it passes below the top of the small groove *a*, a minute quantity of oil is passed up through the groove and onto top of piston and toward end of the stroke. This oil fills up the space between top of piston and interior of dome A′, pressing every particle of air or vapor out through the discharge-valve I, and itself also passing out through this valve, and thence into the trap cylinder L, and thus "liquid-sealing" the discharge-valve. The suction-valve H is mechanically opened at the beginning of the downward stroke of the piston by the small rod M, which passes up the interior of hollow valve-stem H′. The springs press against the interior of the latter, their friction thus pulling the suction-valve open the proper distance; but just before the end of the downstroke of the piston the rod M passes so far out of the stem H′ that the springs on the rod cease to act on the stem H′, and the spiral spring H^2 then pushes the valve H to its seat, while the cup, forming a raised rim around the valve H, insures the valve-seat being covered with oil and being "liquid-sealed," thus preventing any of the air or vapor drawn into the pump escaping through the suction-valve. This pump differs from previous constructions in the construction of the "barrels," the simplicity of its form, its compactness, and relative cheapness, the almost entire absence of joints liable to leak under high vacuum, and the novel construction of the valves, their simplicity and effectiveness, and the method of opening the suction-valves and of liquid-sealing the same; also in the automatic discharge of a small portion of oil into the pump at each stroke to insure complete discharge of all air or vapor at each stroke. The oil beneath the pistons being exposed to the atmospheric pressure, because the top of trap-cylinder L is open to the air, insures the pistons doing good work, even if they do not fit the barrels very closely. The pistons D are by preference made solid, as shown, or may be provided with cup-leather fitted over a plate which is underneath it, and having a metal "piston-head" to fit the shape of top of barrel, as before named, resting on top of the leather. The first-named plate is screwed up to this piston-head or block, the leather being cut away for the purpose in the center. A small gutter or depression is left in the chamber B under each crank and provided with a pipe, N, and cock to empty the pump. Each barrel A being cast in one piece, with a seat turned on top to receive the plate F, and with a thread chased to fit screw of valve-cap or with a flange, there is only this one joint in pump requiring to be made absolutely air-tight, thus minimizing the risk of leaks, which is very important in a pump for forming a high vacuum; or the barrel A and plate F may be cast in one piece, as shown in the detail view, Fig. 3.

The shaft C can be rotated by means of the fly-wheel W, mounted thereon, and said wheel can also be used to operate the piston of an agitating-pump in the acid-vessel O of a refrigerating-machine, the piston-rod of said pump being connected to one end of a lever, T, pivoted to the frame P, the opposite end of said lever being connected with the eccentric-rod U of an eccentric, V, on the boss of the fly-wheel. The acid-vessel O, supported by the frame P, is connected with the air-pumps by means of the pipe Z, controlled by the valve Y upon said pipe.

Having fully described my invention, I claim—

1. The combination of the air-exhausting pumps A, a chamber, B, carrying and connected with said pumps, the pump-barrels having the longitudinal passage *a*, the connecting-rods E, and the crank-shaft C, having its bearings in said chamber, the suction-valves H, having their upper face recessed, the hollow stem H′, secured to said valves and having the guide-collar *h* and spring H^2 thereon, the suction-pipes G, having the internal stops, *g*, the rod M, secured to the piston and having springs on the side thereof, the perforated diaphragm F, the annular valves I and springs thereon, the delivery-pipes K, and oil-trap L, substantially as set forth.

2. The combination of the pumps A, a chamber carrying them, a crank-shaft having its cranks therein, a perforated diaphragm in the upper end of the pump, a discharge-valve on top, and a suction-valve under said diaphragm, a hollow stem upon said suction-valve, a piston having its upper face recessed

to receive the suction-valve, a rod secured to the top of said piston, and springs secured to said rod, substantially as and for the purpose described.

3. The combination of the pump-barrel and its piston, a perforated diaphragm in the upper end of said barrel, a discharge-valve on top, and a suction-valve under said diaphragm, a hollow stem upon said suction-valve, a piston, a rod secured to the top of said piston, and springs secured to said rod, substantially as and for the purpose described.

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