(No Model.) 3 Sheets—Sheet 1.

C. E. PEIRCE.

REFRIGERATING APPARATUS.

No. 483,500. Patented Sept. 27, 1892.

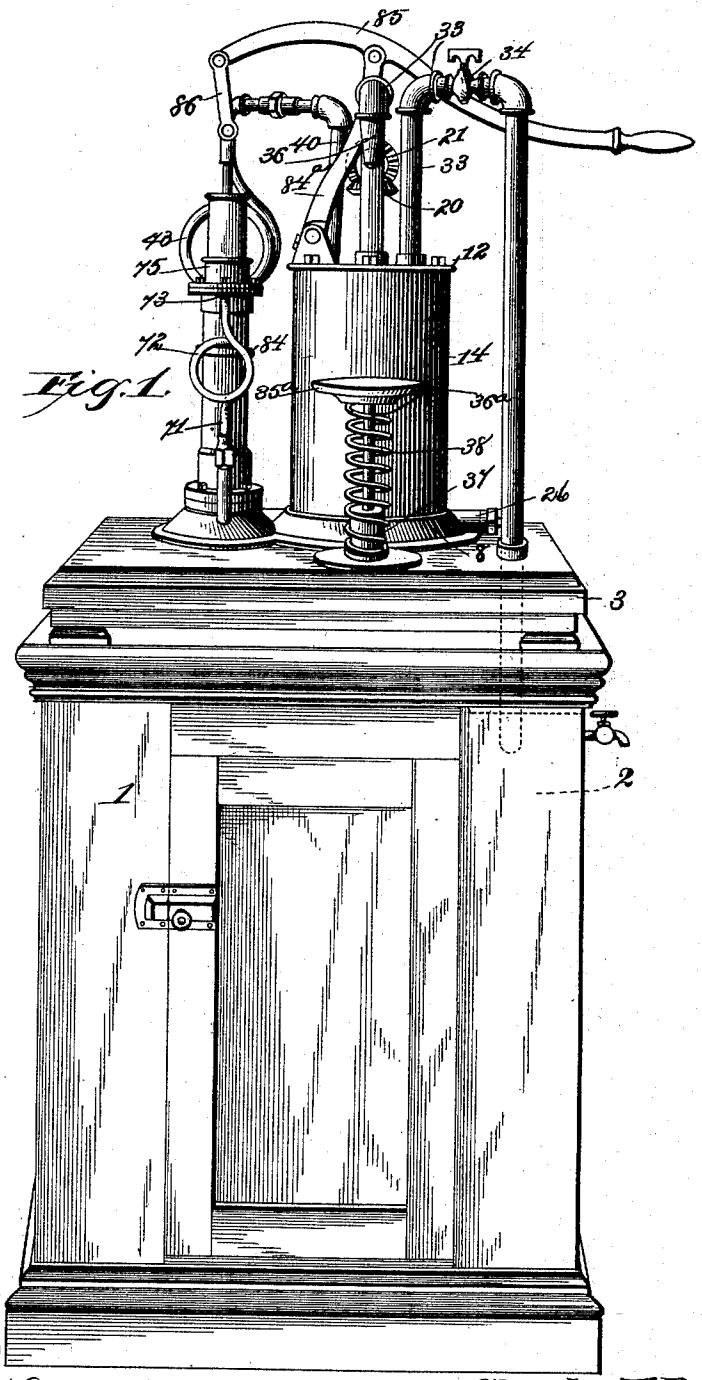

Fig. 1.

Witnesses

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Inventor

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 3 Sheets—Sheet 2.

C. E. PEIRCE.

REFRIGERATING APPARATUS.

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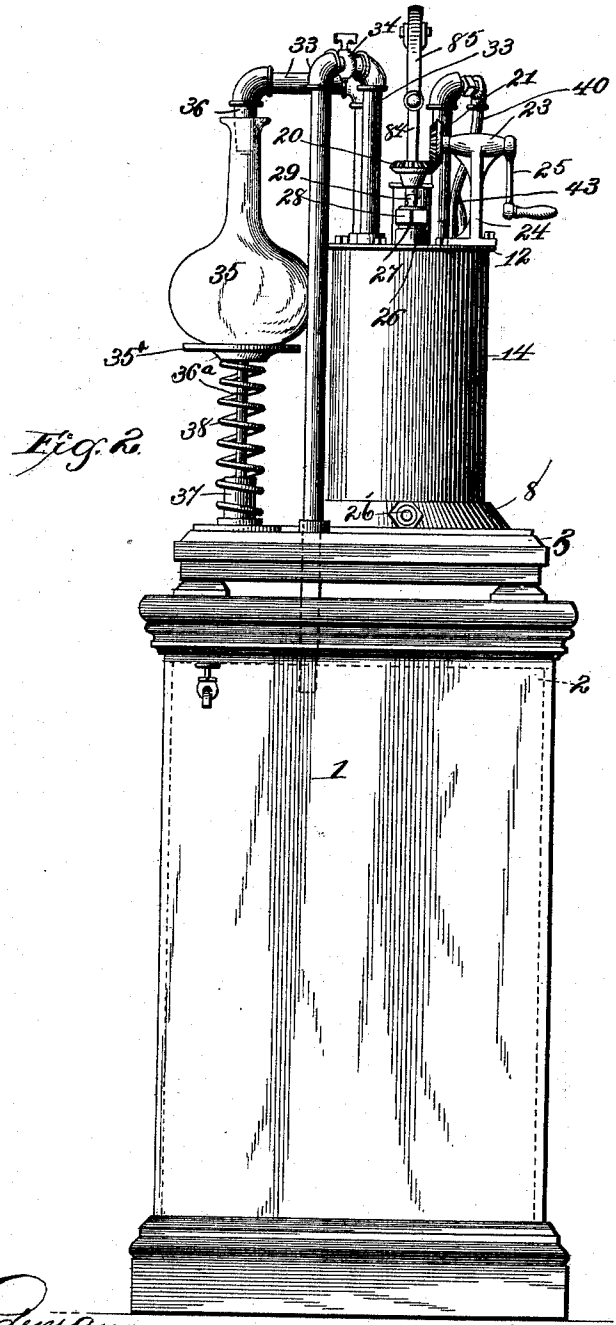

Fig. 2.

Witnesses
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(No Model.) 3 Sheets—Sheet 3.

C. E. PEIRCE.

REFRIGERATING APPARATUS.

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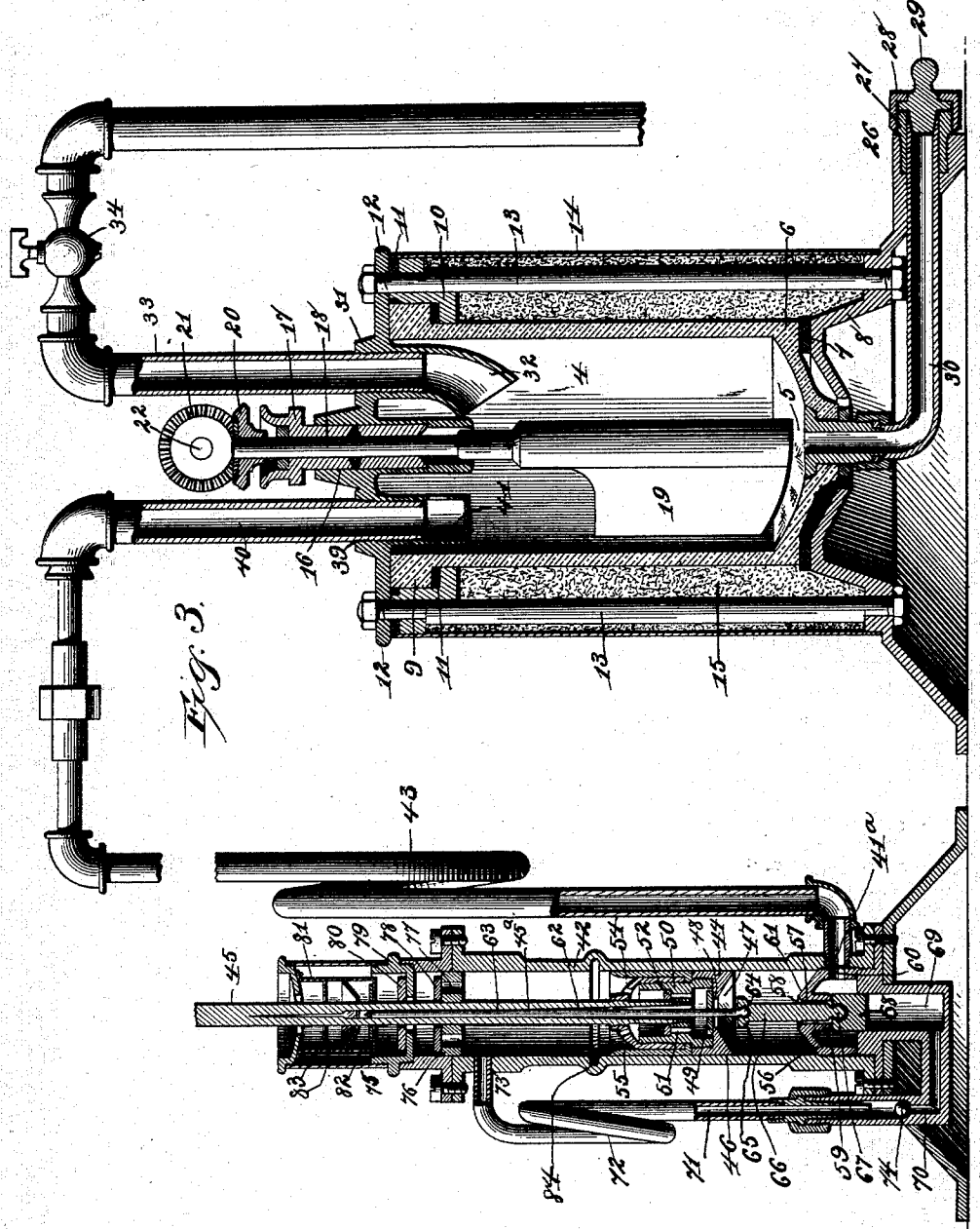

Fig. 3.

Witnesses
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UNITED STATES PATENT OFFICE.

CHARLES E. PEIRCE, OF ALTAMONTE SPRINGS, FLORIDA.

REFRIGERATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 483,500, dated September 27, 1892.

Application filed December 15, 1891. Serial No. 415,172. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. PEIRCE, a citizen of the United States, residing at Altamonte Springs, in the county of Orange and State of Florida, have invented a new and useful Refrigerating Apparatus, of which the following is a specification.

This invention relates to ice-making machines or refrigerating apparatus; and it has for its object to provide a machine of this character which is especially applicable for use in connection with ordinary family refrigerators, whereby means are provided for the congealing of ice in suitable tanks within the refrigerator, and also an apparatus that is particularly adapted for freezing water in the ordinary table-carafes.

A principal and important object of this invention is to provide in connection with the absorption apparatus an exhauster which will completely exhaust the air above the water and the vapors rising therefrom, thereby creating an extremely-high vacuum, which can be held for any length of time without the return of air therein, thus causing a rapid congealing of the water.

With these and many other objects in view, which will be readily understood by those skilled in the art, the same consists in the novel construction, combination, and arrangement of parts hereinafter more fully described, illustrated, and claimed.

In the accompanying drawings, Figure 1 is a perspective view of a refrigerating apparatus mounted upon and connected with an ordinary refrigerator as contemplated by my invention. Fig. 2 is an end elevation of the same. Fig. 3 is an enlarged vertical longitudinal sectional view of the pump and absorber of the refrigerating apparatus removed from the refrigerator and separated from each other for the purposes of illustration.

Referring to the accompanying drawings, 1 designates a refrigerator of ordinary construction, within which is located a suitable tank or receptacle 2, conveniently located within the refrigerator, so as to accommodate the water that is to be frozen by the apparatus, which is preferably located on the top of the refrigerator, as is illustrated in the drawings. The vacuum refrigerating apparatus is mounted upon a suitable base 3, placed upon the top of said refrigerator, although it may be placed in any suitable location from which suitable piping may connect the machine with the water-tank within the refrigerator.

The receiver of the apparatus comprises an inclosed glass vessel or cylinder 4, within which is placed concentrated sulphuric acid, which is designed to absorb the vapors from the rarefied air as the same passes through said receiver as it is exhausted from the refrigerator water-tank or other vessel containing water which is to be frozen. The glass acid-vessel 4 is provided with a bottom discharging-opening 5 and the bottom annular shoulder 6, which is designed to rest upon the elastic packing 7, supported upon the base 8, secured to the main base 3, upon which the entire apparatus is located. The upper open end of the acid-vessel 4 is also provided with a surrounding annular flange 9, beneath which takes the clamping flanged ring 10, between which and the under shoulder of the flange 9 of the vessel is also placed elastic packing 11, while said ring and the flange of said vessel are tightly clamped together by the inclosing lead-lined cap 12, inclosing the upper open end of the vessel 4, and clamped thereon and to the base 8 by means of the vertical tie-rods 13, bolted outside of the vessel and which spring said base and inclosing cover together on account of the elastic packing interposed between all contacting points, thereby rendering a perfectly-air-tight vessel. A metallic cylindrical shell 14 surrounds and incloses the tie-rods and the inner acid-vessel and is designed to hold in place a plaster-of-paris packing 15, filling the space between the inner vessel and the outer shell, in order to provide a non-conducting wall or lining, which will neither conduct the cold from within the receiver nor the outer heated air into the same. The top of the inclosing cover 12 is provided with a central opening 16, into which is inserted an ordinary stuffing-box 17, accommodating the agitator-shaft 18, upon the lower end of which, within the receiver, is secured the agitator-blade 19, which when revolved through the acid stirs the same and prevents the formation of superficial dilute stratum of the acid, which would render the

same less effective as an absorbing agent. To the upper end of the agitator-shaft 18 is keyed the horizontal bevel-gear 20, that meshes with the vertical bevel-gear 21, carried upon the inner end of the horizontal operating-shaft 22, mounted in a horizontal bearing 23, supported above the receiver by the bracket 24. A crank 25, secured to the outer end of the horizontal shaft 22, controls the same for stirring the acid within the receiver whenever it is deemed necessary. The receiver may be conveniently filled through the capped opening 26 in the top of the cover 12. Said opening is provided with a surrounding screw-threaded sleeve 27, that is engaged by the screw-cap 28, working over the top of the stopper 29, fitting in said opening or projecting through, as the case may be, and tightly clamped therein by said screw-cap. The bottom discharge-opening 5 in the bottom of the vessel 4 is connected with the discharging-pipe 30, extending from the bottom of the receiver through the base thereof, and is provided at its outer end with a capping device (shown in section in Fig. 3) similar in construction to that described for filling the receiver, and similarly lettered to show the identical constructions of the filling and discharge openings, the latter discharge-opening allowing the acid to be drawn off when the same has become too dilute for effective use. The cover 12 is further provided with receiving-openings 31, communicating with the interior of the acid-vessel and from which depend the spouts or tubes 32 for directing the air into the receiver. Receiving and suction pipes 33 are secured in said openings and communicate with the water-tank 2 within the refrigerator or other receptacle within which the liquid is placed that is designed to be frozen. As illustrated in the drawings, the pipe 33, leading to the water-tank in the refrigerator, is provided with a stop-cock 34, which may be turned off while the other is being used, and which, as shown, is designed to be used in creating a vacuum within an ordinary water-bottle or carafe 35, and the said pipe terminates in a stopper-nozzle 36, which tightly fits within the neck of the carafe. The said water-bottle or carafe is conveniently supported upon the spring-actuated stool 35^a, having the leg 36^a, working vertically in the perforated base 37, and surrounding which and said leg is the coil-spring 38, which normally presses said stool upward, and thus holds the vessel upon the stopper-nozzle.

An exhaust-opening 39 in the top of the receiver-cover 12 receives the lower end of the exhaust-pipe 40 and has projecting therefrom into the acid-vessel the receiving spout or cage 41, which not only secures in place and protects from the effects of the acid the lower end of the exhaust-pipe 40, but also readily receives the air or vapor from the receiver. The exhaust-pipe 40 by suitable connections is connected with the bottom receiving-opening 41^a, located in one side of the pump-cylinder 42 and near the bottom thereof, and intermediate of its connection with said receiver and the pump-cylinder the exhaust-pipe 40 is provided with a siphon-turn 43, which is usually used in devices of this character to create a greater suction in the pipe, and also serving to collect moisture carried with the air through the pipe.

A valved plunger or piston 44 snugly fits the bore of said cylinder and works therein upon the lower end of the piston-rod 45, extending above the top of the cylinder. The plunger or piston 44 comprises a lower disk 46, fitting said cylinder and provided with a conically-recessed bottom end 47, having a central perforation 48, and over which works the disk-valve 49, while said disk 46 is carried upon the lower end of the valved sleeve or tube 50, provided with a series of valve-openings 51, formed in the solid body thereof, and which are closed and opened by the ring-valve 52, which surrounds the extreme lower end of the piston or plunger rod 45, secured between said valve-openings in said solid body, and said piston-rod, while carrying the main body of the plunger, also forms a guide for said ring-valve. A perforated or open cage 54 is secured to said piston-rod and to the outside of said sleeve or tube 50 and clamps between the lower end thereof and the top of the piston-disk 46 the leather packing 55, extending the full height of the valved piston above the bottom disk, and thus completes a tightly-fitting piston which effectually prevents the escape of air around the same and provides only for a passage therethrough.

A conical valve-block 56 is located in the bottom of the cylinder 42 and is provided with a central perforation 57, extending therethrough and terminating at the apex of the cone in a beveled valve-seat 58, while surrounding said perforation and projecting within the hollow body of said block is formed the annular stop 59, the function of which will be fully described, and said hollow block is provided with a lateral perforation 60, communicating with the receiving-opening 41 in the side of the cylinder near the bottom thereof, thus providing a passage for the air through said block and up through the perforation therein. Said cone-block forms a gutter 61, surrounding the apex thereof, into which a certain amount of oil is designed to fall at the end of each upstroke of the piston in order to insure a complete expulsion of air on the return of the piston when the conically-recessed bottom disk of the same strikes upon said cone-shaped block and the oil which has fallen into the gutter surrounding the same, which will be hereinafter readily apparent.

The piston or plunger rod 45 is split nearly its entire length, as at 45^a, to form therebetween clamping-jaws, and the inner sides of the opposite spring-sections of said rod are provided with opposing rounded grooves 62, extending a sufficient length to grasp and

carry the upper end of the vacuum-valve rod 63, extending below the piston-rod, through the lower piston-valve 48, and connected by means of a loose ball-joint 64 with the vacuum-valve disk 65, that is designed to fit within the valve-seat 58 in the conical valve-block 56, and thus control the passage of air through said cone-block and between the same and the bottom of the piston working thereover. An elongated valve-stem 66 is connected with or forms a part of the valve-disk 65 and, extending through the perforation 57 in said block and below the bottom of the cylinder, is connected by means of a suitable ball-joint 67 with the vacuum plunger-block 68, working in the lower reduced supplemental cylinder 69, extending beneath and communicating with the bottom of the cylinder 42 and the hollow conical block therein. Said supplemental cylinder 69 is connected by means of suitable piping 70 with the suction-pipe 71, provided with a siphon-turn 72, similar to the siphon-turn 43, and said pipe is connected with the cylinder 42 near its upper end at 73. The siphon-turn 72 also prevents the small quantities of oil which might escape into the pipe 71 as the plunger rises from falling into the lower cylinder 69. The piping 70 is provided at a suitable point with a check-valve 74, which effectually prevents any return or forcing of air through the pipe 71, back of the check-valve, so as to enter the space between the same and the bottom of the vacuum plunger-block 68. It is, of of course, understood that the said plunger or piston head is worked in the cylinder with a suitable amount of oil above the same to provide for the complete expulsion of the air, while at the same time the oil is unaffected by the high vacuum produced, as will be apparent to those skilled in the art. Supported upon and coupled to the top of the cylinder 42 is the oil and air escape cylinder or chamber 75, through which the oil is fed to the pump, and is so constructed that, while allowing for the escape of air, it prevents the splashing of the oil up through said cylinder. The top of said cylinder or chamber 75 is provided with a suitable air-escape opening, as illustrated, and the bottom thereof is provided with a plate 76, having a series of valve-openings 77, over which works the ring-valve 78, which, encircling the piston-rod 45, working through said plate, allows the escape of air, while at the same time at the first operation of the pump it allows the oil to fall into the cylinder above the piston moving therein. Directly above the valve 78 is located a pan 79, carrying a valve 80, which supplements the lower valve and plate and provides a receptacle for the oil which may be splashed therein by the upwardly-moving piston or drip from the inner enclosed chamber 81, located above said pan and provided with a bottom valve 82 and a series of straight and inclined stop-plates 83, which effectually prevent the oil from being forced without the cylinder 75 under pressure with the air, thus completing a combined reservoir and exhausting-cylinder, which, while allowing the oil to be fed within the pump, at the same time prevents its escape above its reservoir.

At a point below the top of the cylinder which will lie below the bottom of the piston 44 when the same is at its upper limit is located an annular oil-groove 84, which fills with oil as the piston rises to the same and after the said piston has passed just above its plane allows the oil therein to fall into the gutter 61, surrounding the conical block at the bottom of the pump-cylinder. Upon the descent of the conically-recessed piston the same is forced down upon the conical block in the bottom of the cylinder and into the gutter formed around the same and therefore forces the oil and air therein up through the valves 48 and 52 above the same and through the oil above the plunger. The presence of the oil in said gutter provides for the complete expulsion of every portion of the air between said piston and conical block.

Pivotally connected with the bracket 84^a, extending above the top of the receiver, is the operating-lever 85, one end of which is connected witn the upper end of the piston 45 by means of a suitable link connection 86, whereby the piston within the pump-cylinder may be readily operated.

When the handle 85 is operated to raise the piston in the pump-cylinder, the spring-clamping piston-rod carries the bottom vacuum-valve 65 and its stem upward therewith, thereby opening the passage for the air through the conical block and beneath the ascending piston. This stroke of course sucks the air from the water-receptacles through the receiver and the pipe 42 into the pump and through the valve-opening 57 into the space between the valve-block and the ascending plunger. The valve 65 and its stem 66 continue to rise with the piston-rod until the top of the plunger-block 68 strikes upon the annular stop 59 within said conical block, thereby holding or arresting the motion of said valve and stem, while the piston-rod still continues in its upward travel, and on account of the length of the rounded clamping-grooves within said piston-rod the plunger-block 68 is thereby held to the stop 59 until the piston just passes the oil-groove and has expelled the air above the same through the valves of the top oil and air escape cylinder. At this moment the oil falls from the groove 84 into the gutter around the valve-block, as already described, and the plunger starts to descend. Immediately a suction is created in the pipe 71, and consequently causes a vacuum or partial vacuum in the closed cylinder 69, which vacuum or partial vacuum in said supplemental cylinder is sufficient to draw the plunger-block downward in quick advance of the plunger, and thereby throw the vacuum-actuating valve to its seat, of course drawing the valve-rod 63 quickly downward from within

its clamping-jaws. As the piston now descends it allows the accumulated air or vapor above the now closed conical block to rush through its valves and collect above the plunger and oil ready to be expelled in the manner just described on the next upstroke of the plunger.

It is thought that the operation of the herein-described mechanism is quite apparent without further description.

Although the acid-receiver herein described is the preferable form employed by me in connection with the exhausting apparatus as adapted for securing the best results, yet it will of course be readily understood that any receiver of the same character may be employed with the exhausting-pump to complete a refrigerating apparatus comprising a receiver and exhausting device or pump connected with the receiver.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a refrigerating apparatus, the combination, with a receiver, of an air-pump having a supplemental vacuum-cylinder, a valve block or disk located above said cylinder, a valve working upon said block and provided with a plunger working within said supplemental cylinder, a valved piston connected with said valve, and a pipe connecting the pump with the receiver, substantially as set forth.

2. In an apparatus of the class described, an air-pump having a supplemental vacuum-cylinder, a valve block or disk located above said cylinder, a valve working upon said block and provided with a plunger within said supplemental cylinder, a valved piston working above said block, a split piston-rod connected with said piston, and a valve-rod connected with said valve and clamped within said split piston-rod, substantially as set forth.

3. In an apparatus of the class described, an air-pump having a supplemental vacuum-cylinder connected with the bottom thereof and communicating with the top of the same by suitable piping, a hollow conical valve block or disk located above said supplemental cylinder within the pump-cylinder, a vacuum-valve working over and fitting upon said block and provided with a depending stem, a plunger-block or piston loosely connected with said stem and working within said supplemental cylinder, and a valved piston connected with said vacuum-valve, substantially as set forth.

4. In an apparatus of the class described, an air-pump having a supplemental vacuum-cylinder, a hollow valve-block located directly above said supplemental cylinder within the pump-cylinder and provided with an upper valve-seat and lower annular stop within the same, a vacuum-valve fitting said valve-seat and provided with a depending stem, a plunger-block loosely connected with said stem and working within said supplemental cylinder, a valved piston working above said valve-block, a split spring piston-rod, and a valve-rod loosely connected with said vacuum-valve and clamped within said split piston-rod, substantially as set forth.

5. In an apparatus of the class described, an air-pump having a lower supplemental vacuum-cylinder connected with the bottom of the pump-cylinder, a hollow valve-block located above said supplemental cylinder and provided with an upper valve-seat and lower annular stop, a vacuum-valve fitting said valve-seat and provided with a depending stem, a plunger-block loosely connected with said stem within said supplemental cylinder, a split spring piston-rod, a valved piston carried upon the lower end of said rod above said valve-block, a valve-rod loosely connected with said vacuum-valve and clamped within said split piston-rod, and an upper combined oil-reservoir and an air-exhauster, substantially as set forth.

6. In an apparatus of the class described, the herein-described plunger or piston, having a lower valved disk fitting the pump-cylinder, a valved sleeve or tube seated within said disk and receiving the lower end of the piston-rod, a cage secured to the piston-rod and to the outside of said sleeve or tube, and packing extending the full height of the plunger or piston and clamped between the lower end of the cage upon the outside of said tube and the top of the disk, substantially as set forth.

7. In an apparatus of the class described, the combination, with the air-pump, of the combined oil-reservoir and air-exhaust cylinder located above said pump and provided with a lower valved plate through which works the piston-rod of the pump, a valved pan or disk located above said valved plate, and an upper inclosed chamber projecting within said cylinder above said pan and provided with a bottom valve, and a series of horizontal and inclined stop-plates, substantially as set forth.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

CHARLES E. PEIRCE.

Witnesses:
D. A. McDONALD,
E. W. HENCK.