

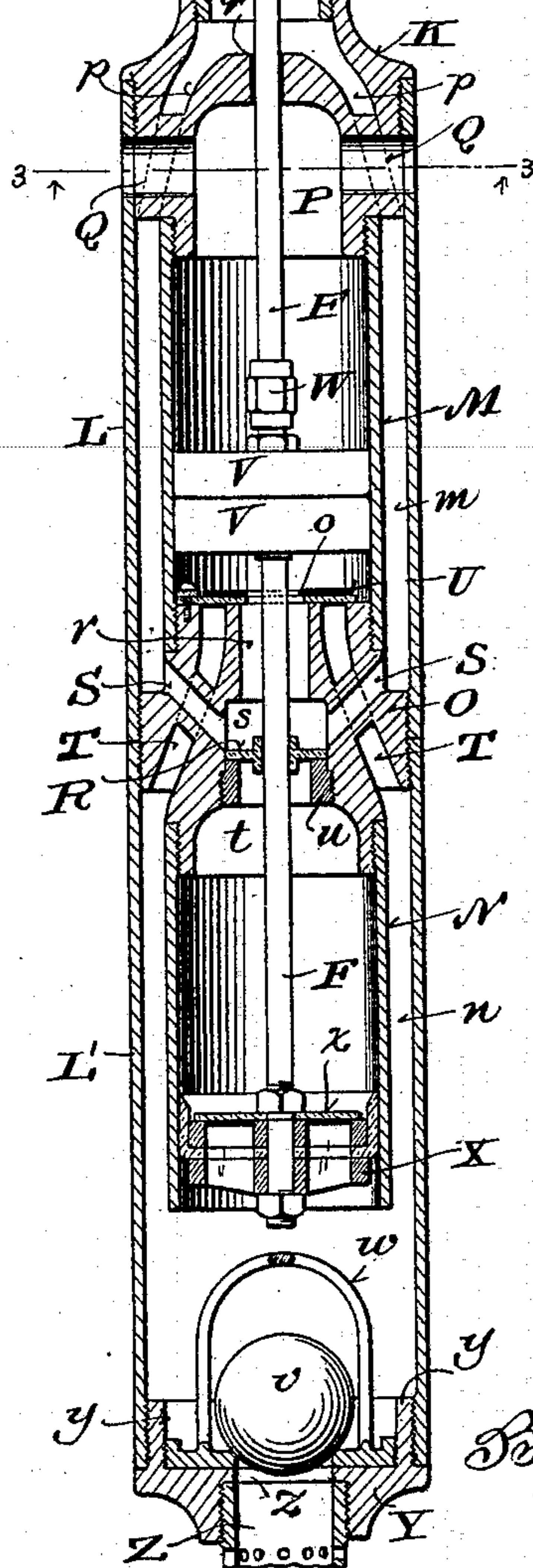
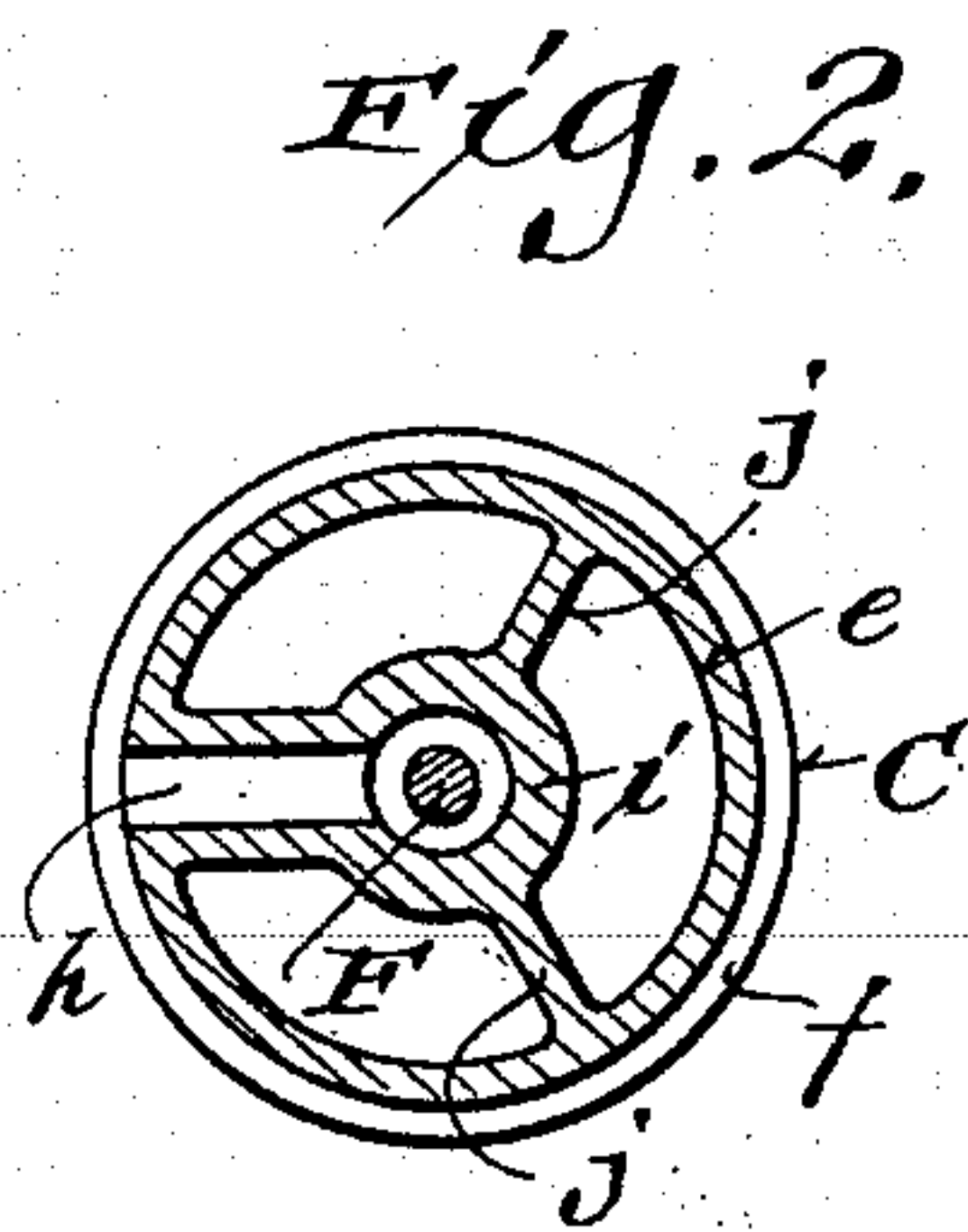
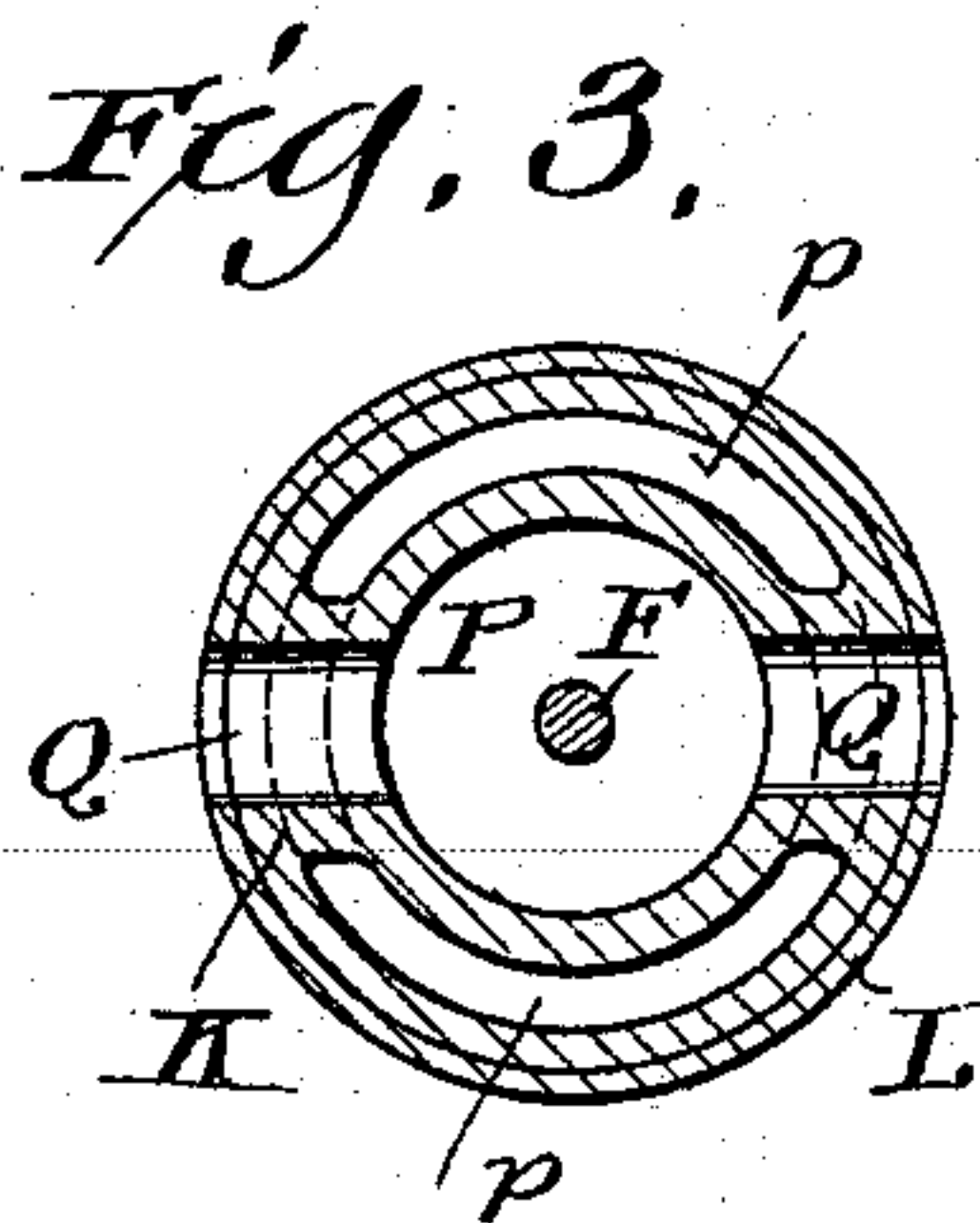
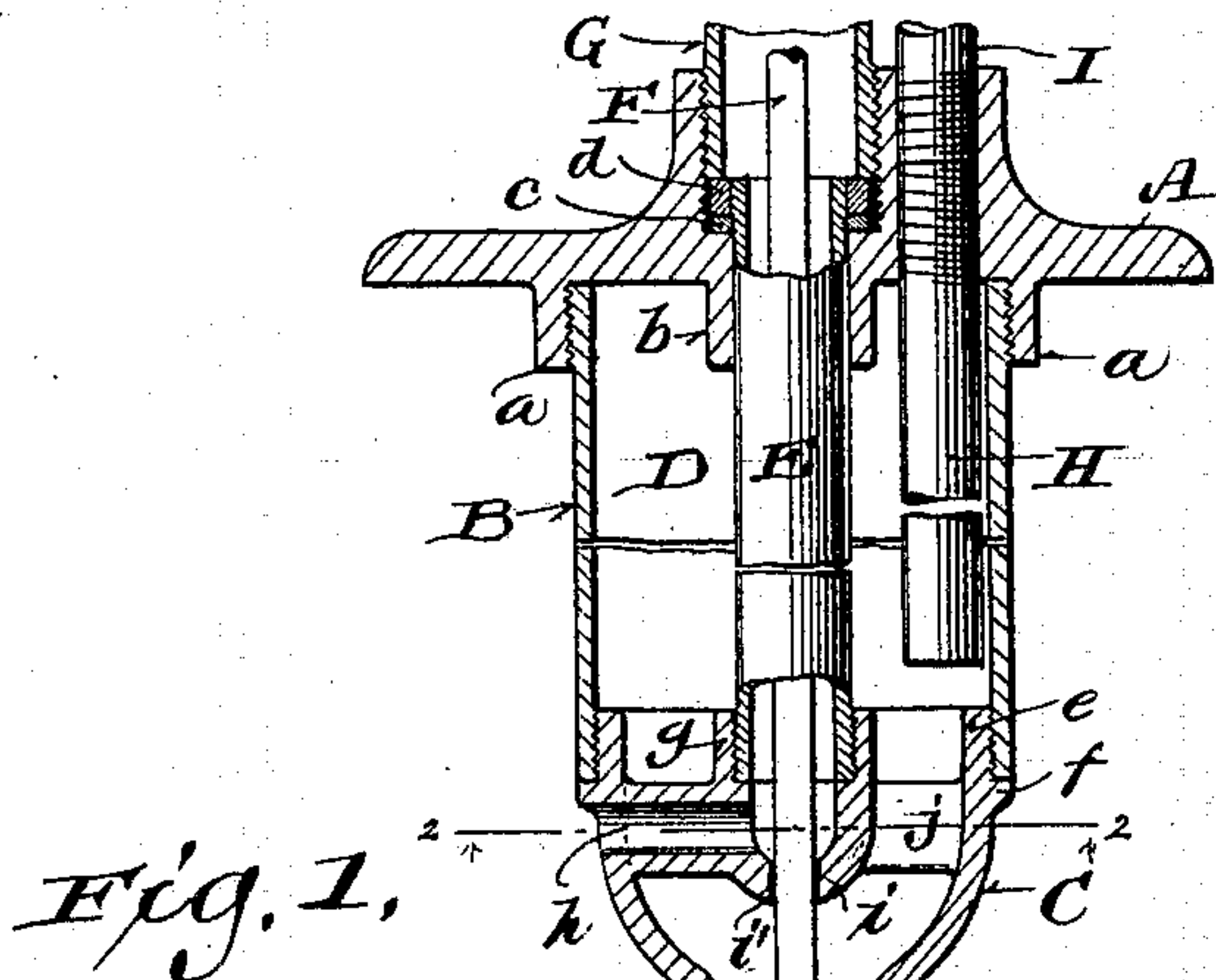
No. 615,470.

Patented Dec. 6, 1898.

H. BENDER.
FORCE PUMP.

(Application filed Sept. 7, 1897.)

(No Model.)



Witnesses:
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UNITED STATES PATENT OFFICE.

HIRAM BENDER, OF MILWAUKEE, WISCONSIN, ASSIGNOR OF ONE-THIRD TO
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FORCE-PUMP.

SPECIFICATION forming part of Letters Patent No. 615,470, dated December 6, 1898.

Application filed September 7, 1897. Serial No. 650,741. (No model.)

To all whom it may concern:

Be it known that I, HIRAM BENDER, a citizen of the United States, and a resident of Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Force-Pumps; and I do hereby declare that the following is a full, clear, and exact description thereof.

My invention relates to that class of force-pumps which employ double cylinders—such, for example, as is shown in my prior patent, No. 524,237, granted to me August 7, 1894, on which my present device is an improvement; and my said present invention consists in certain peculiarities of construction and combination of parts, as will be fully set forth hereinafter and subsequently claimed.

In the drawings, Figure 1 is a central vertical sectional view of my improved force-pump. Figs. 2 and 3 are horizontal sectional views thereof, taken, respectively, on the lines 2 2 and 3 3 of Fig. 1.

One object of my present invention is to make a pump which may be inserted and used in tubular wells, and to that end the upper and lower cylindrical casings of said pump, below the base-plate or platform from which said casings are suspended, are of equal diameter, so that all may be inserted within the well-tube when my pump is employed in connection therewith, although my said pump is equally well adapted for use in open wells.

Referring to the drawings, A represents the base-plate or platform hereinabove referred to and which is formed with a depending annular flange *a*, screw-threaded on its inner surface for the reception of the cylindrical casing B, similarly screw-threaded on its exterior surface at its upper end and forming with the said base-plate A an air-chamber D. The base-plate A has two vertical openings therethrough, one of said openings through the center of said base-plate being continued by means of an inner annular flange *b* to receive the vertical central sleeve E, hereinafter described, and the upper part of said central opening is increased in diameter and screw-threaded, and after the sleeve E (which forms a casing or passage-way for the piston-rod F) is inserted within said opening, fitting snugly and held within the lower part thereof,

it is surrounded by a washer *c* and metallic ring or collar *d*, the said metallic ring or collar *d* having a smooth bore therethrough, so as to simply surround the sleeve E, as stated, but without direct connection thereto, and then the hollow pump-post G, which surrounds the said piston-rod F above the base-plate or platform A and serves to support the operating-lever (not shown) of said piston-rod, and which pump-post has exterior screw-threads on its lower end, is screwed down within the said enlarged central opening in the base-plate upon the said ring or collar *d*, thereby making a tight packing of the washer *c* around the sleeve E. The base-plate A is provided with another vertical opening alongside the central opening just described, and this second opening is screw-threaded, receiving the lower section H of the water-discharge pipe, which projects down into the air-chamber D and whose upper end is screw-threaded to extend up about half-way in said opening, where it is met by the lower screw-threaded end of the upper section I of the water-discharge pipe.

Below the casing B is the part C, forming the base of the said casing, and the top of said part C is provided with an upper annular flange *e*, projecting on a line just within the periphery thereof, so as to leave an annular shoulder *f*, and the said flange *e* has exterior screw-threads whereby it is united to the lower part of the cylindrical casing B, while the lower end of the described sleeve E has exterior screw-threads for engagement with the interior screw-threads on an upright central annular flange *g*, rising from the upper surface of said part C, and below the lower end of the sleeve E there is an outlet or passage-way *h*, formed in the part C and communicating with said sleeve E, so that any water which may find its way into said sleeve by reason of the opening *i'* for the piston-rod in the central flange *i* within said part C may escape therefrom outside the said part C and the danger of freezing from any accumulation of such water in winter-time be thereby obviated. The described central flange *i* is braced and supported by the walls of the passage-way *h* and by ribs *j j*, there being free upward vertical passage for the water from

below into the air-chamber D between said ribs and walls, as shown best in Fig. 2, and the lower portion of the part C is reduced in diameter and provided with an annular depending vertical flange *k*, having screw-threads to receive the correspondingly screw-threaded upper end of the service-pipe J, whose lower end is similarly screw-threaded for engagement with the reduced upper end of the cap K of the lower cylindrical casing, which surrounds the cylinders of the pump, as hereinafter described. The said lower casing is most conveniently made in two parts, (marked L L', respectively,) and said casing is, as hereinbefore stated, of the same diameter as that of the casing B of the air-chamber D. Suspended within the said casing L L' are two cylinders M N, arranged one above the other in the same axial line and separated by a head O, connected to said casing, there being annular spaces around each cylinder, the space between the cylinder M and part L of the casing being marked *m* and the space between the cylinder N and part L' of the casing being marked *n*. The piston-rod F extends through both cylinders and is fitted with two pistons, one in each cylinder, and the head O is provided with ports connecting the interior of each cylinder with the space surrounding the other cylinder, all as hereinafter more specifically described, and the reducing-cap K, above the upper cylinder M, is provided with ports *p p*, leading from the annular space *m* around the said upper cylinder to the service-pipe J. The upper part of this cap K is centrally perforated, as shown at *q*, for the passage of the piston-rod F therethrough, and said cap K and the part L of the casing are transversely perforated, as shown at *Q*, to form air-passages communicating with the central space P within said cap above the cylinder M. The cap K is provided with exterior screw-threads for engagement with the screw-threaded upper ends of the cylinder M and upper part L of the casing, the lower ends of said parts L M being similarly screw-threaded for engagement with the exterior screw-threads on the head O.

The head O has a central vertical perforation therethrough, shown as having three different diameters at different elevations, the upper and smallest part being marked *r*, the central part being marked *s*, constituting a valve-chamber, as hereinafter explained, and the lower part being marked *t*. The wall of the lower part of the central opening *s* is screw-threaded to receive a collar *u*, which is screwed to place after a vertically-movable valve R has been slipped to place within the chamber *s*, the top of the said collar *u* forming the lower seat of said valve R, and the top wall of said chamber *s* forming the upper seat of said valve. Ports S S lead from the chamber *s* to the space *m* around the upper cylinder M, while other ports T T extend through the head O in opposite directions to the ports S S and lead from the space *n*

around the lower cylinder N to the interior of the upper cylinder M, said ports T T being controlled by the hinged valve U, which latter has a central opening *o* around the piston-rod F, and which valve is preferably of leather or like flexible material with a metal top.

The piston V within the upper cylinder M is an ordinary piston without any valve therein or passage-way therethrough, slipped on the piston-rod F and secured by a nut and collar in the ordinary manner, the piston-rod being preferably divided for convenience in this adjustment and united by the nut W. The piston X in the lower cylinder N consists of a chambered or channeled piston-head secured to the lower end of the piston-rod F and with the said chambers or channels covered by a flap-valve *x*, secured at its center to the said piston-rod by a suitable nut, as shown. The cylinder N is formed with interior screw-threads at its upper end for engagement with the screw-threaded lower end of the head O, and the lower part L' of the lower cylindrical casing has likewise screw-threads at each end, on the inner surface thereof, and the upper end is secured to screw-threads on the said head O, while the lower end of the casing is secured to the vertical annular screw-threaded flange *y* of a base-piece Y. This base-piece Y has a central opening *z*, controlled by a check-valve of any suitable construction, such as the ball-valve *v* within the cage *w* shown, and the suction-pipe Z is secured to said base-piece Y in line with the said opening *z*, as shown.

The operation of my said pump will be readily understood from the foregoing description of its construction, taken in connection with the accompanying drawings, it being stated, by way of preface, that the pump is continuous in its operation, one cylinder filling while the other is emptying, and that the water or other liquid that passes around the lower cylinder enters the lower end of the upper cylinder, while the liquid that enters the lower end of the lower cylinder passes out at the upper end of that cylinder, outside of the lower end of the upper cylinder, and that the liquid from each cylinder passes first into the annular space *m* around the upper cylinder M, and thence out through the ports in the cap K into the service-pipe J, up through the part C into the air-chamber D, and out finally through the discharge-pipe H I. In detail the movements of my pump are as follows, it being understood that at the beginning the parts are in the relative positions shown in Fig. 1, with the lower cylinder N full and the upper cylinder M empty. As the piston-rod F rises, carrying with it both pistons, the liquid (hereinafter called "water," although my pump will work with any liquid) in the lower cylinder N is carried upward by the piston X, the water within said cylinder keeping the valve *x* of said piston closed, and this water

forces the movable valve R from its lower to its upper seat, opening thereby the passage through the valve-chamber *s* to the ports S S, and the said water is forced by the piston X through said ports into the annular space *m* around the upper cylinder M, thereby emptying the lower cylinder N. At the same time the piston V in the empty upper cylinder M is being raised by the rod F, and this being a tight or solid piston it has the usual sucking action, which action raises the hinged valve U and sucks up the water which is in the annular space *n* around the lower cylinder N through the ports T T, thereby filling the upper cylinder M under its piston V. On the return stroke of the piston-rod F as the pistons in the two cylinders begin to descend the valve *x* of the lower piston yields upwardly and the water rushes into the lower cylinder N, filling the same, while the water in the upper cylinder M is forced downward by the tight or solid piston V, closing the hinged valve U, and passing down through the central opening *o* in said valve into the chamber *r*, forcing the movable valve R against its lower seat and passing through the valve-chamber *s* and ports S S to the annular space *m* around the upper cylinder M, this upper annular space *m* being the common outlet or passage-way for water from both cylinders, while the annular space *n* around the lower cylinder is only the passage-way to enable the water from the suction-pipe Z to reach the upper cylinder M. The foregoing movements are repeated with each complete vertical reciprocation of the piston-rod F, the water from both cylinders in the upper annular space *m* being thereby forced up through the ports *p p* in the cap K into the service-pipe J, and thence through the channels or chambers of the part C into the air-chamber D and out through the discharge-pipe H I. The air-chamber D acts precisely like an air-dome in a steam-pump to insure the water being discharged in a continuous stream rather than in jets or spurts, it being understood, of course, that the inlet of the discharge-pipe is near the bottom of the air-chamber D below the level of the water in the casing B.

It will be understood that while in describing the construction of the pump as illustrated in the accompanying drawings I have minutely specified the screw-threaded connection of the various parts shown I do not limit myself to such means of connection, as the various casings, cylinders, pipes, and their adjuncts shown may be connected together in any approved way—such as by riveting, seaming, soldering, or otherwise—so long as tight joints are secured, which latter may be further insured by suitable packings of any proper description.

While in ordinary cases I prefer that my pump should be constructed with the described air-chamber, the double-cylinder construction described will work perfectly in the

manner set forth whether there is an air-chamber or not, and similarly it is not necessary that the discharge-pipe be placed within the air-chamber except when it is desired to secure a continuous even discharge from the pump in the manner hereinbefore stated; but I deem it a great advantage to have the air-chamber when such is used located wholly below the platform or base-plate of the pump and of such diameter as to be inserted within the well-tube when such is employed. Furthermore, I do not limit myself to the exact forms of valves herein described and illustrated, as in practice I have constructed these pumps with a hinged valve similar to valve U in place of the ball-and-cage valve *v w* to serve as a check-valve in the base-piece Y over the suction-pipe Z and have otherwise modified various details of construction, and hence reserve the right to do this as circumstances require without departing from the spirit of my invention.

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

1. The combination, with a suitable casing, of two cylinders arranged therein, a head arranged between said cylinders and connected to said casing, said head being provided with ports connecting the interior of each cylinder with the space surrounding the other cylinder, a piston in each cylinder, and means for operating said piston.

2. In a pump, the combination, with a suitable casing, of two cylinders arranged therein, one above the other, a space being provided between the outer wall of each cylinder and the inner wall of said casing, means connecting the interior of each cylinder with the space outside of the other cylinder, and a suitable piston in each cylinder.

3. In a pump, the combination, with a suitable casing, of two cylinders arranged therein with a space surrounding each cylinder between its outer wall and the inner wall of said casing; a head arranged between said cylinders and connected to said casing, said head being provided with valve-controlled ports connecting the interior of each cylinder with the space surrounding the other cylinder; an inlet-valve in the lower end of said casing; a reducing-cap, provided with suitable ports or outlets, on the upper end of said casing; a service-pipe connected to and extending upward from said cap; a piston in each cylinder, and means for operating said pistons.

4. In a pump, the combination, with a suitable casing, of two cylinders arranged therein with a space surrounding each cylinder between its outer wall and the inner wall of said casing; a head arranged between said cylinders and connected to said casing, said head being provided with valve-controlled ports connecting the interior of each cylinder with the space surrounding the other cylinder; an inlet-valve in the lower end of said casing; a piston-rod extending through both cylinders;

a piston in each cylinder, secured to said rod; a reducing-cap, provided with suitable ports or outlets, on the upper end of said casing; a service-pipe connected to and extending upward from said cap; a casing, forming an air-chamber, connected to said service-pipe; and a discharge-pipe having an inlet extending down within said air-chamber.

5. In a pump, the combination, with a base-plate or platform, of a casing depending therefrom and forming an air-chamber, and having a chambered or channeled base, with reduced lower end; a service-pipe connected to said base; a lower casing of the same external diameter as that of said first-named casing; a reducing-cap, provided with suitable ports or outlets, on the upper end of said lower casing, and connected to said service-pipe; two cylinders arranged one above the other, in the same axial line, within said lower casing with an annular space surrounding each cylinder and separated by a head connected to said casing, said head being provided with valve-controlled ports connecting the interior of each cylinder with the space surrounding the other cylinder; a discharge-pipe extending through said base-plate or platform into said air-chamber beneath the same; a vertical sleeve also extending through said base-plate or platform and entirely through said air-chamber without communication therewith; a piston-rod extending down through said sleeve and service-pipe and through both cylinders in the lower casing; a pair of pistons secured to said rod, one piston within each of said cylinders; and a valve-controlled suction-pipe connected to the lower end of the said lower casing.

6. In a pump, the combination, with a suitable casing, of two cylinders arranged therein with a space surrounding each cylinder between its outer wall and the inner wall of said casing; a head arranged between said cylinders and connected to said casing, said head being provided with valve-controlled ports connecting the interior of each cylinder with

the space surrounding the other cylinder; an inlet-valve in the lower end of said casing; a reducing-cap secured to the upper end of said casing, and connected to an upward-extending service-pipe, said cap having ports or outlets leading from the space surrounding the upper cylinder to the said service-pipe, a central air-dome above the upper cylinder, and air-passages leading from outside the said casing to said central air-dome; a piston-rod extending through said service-pipe, reducing-cap, both cylinders and the head between them; and a pair of pistons secured to said piston-rod, one of said pistons being located in each cylinder.

7. In a pump, the combination, with a base-plate or platform having two vertical openings therethrough, of a casing depending therefrom forming an air-chamber; a chambered or channeled base secured to the lower end of said casing, said base having a hollow central flange extending inward from one side thereof and terminating in a vertical annular flange, and the lower end of said base being contracted for the reception of a service-pipe; a vertical sleeve extending through one of said openings in said base-plate or platform and forming a tight connection with the vertical annular portion of the said hollow central flange; a piston-rod extending down through said sleeve and through an opening in the base of the vertical part of said hollow central flange; and a discharge-pipe extending through the other opening in said base-plate or platform, into said air-chamber, to a point adjacent to the said chambered or channeled base.

In testimony that I claim the foregoing I have hereunto set my hand, at Milwaukee, in the county of Milwaukee and State of Wisconsin, in the presence of two witnesses.

HIRAM BENDER.

Witnesses:

H. G. UNDERWOOD,
B. C. ROLOFF.