No. 639,870. Patented Dec. 26, 1899.

W. F. SMITH.

PUMP.

(Application filed Mar. 29, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig 1

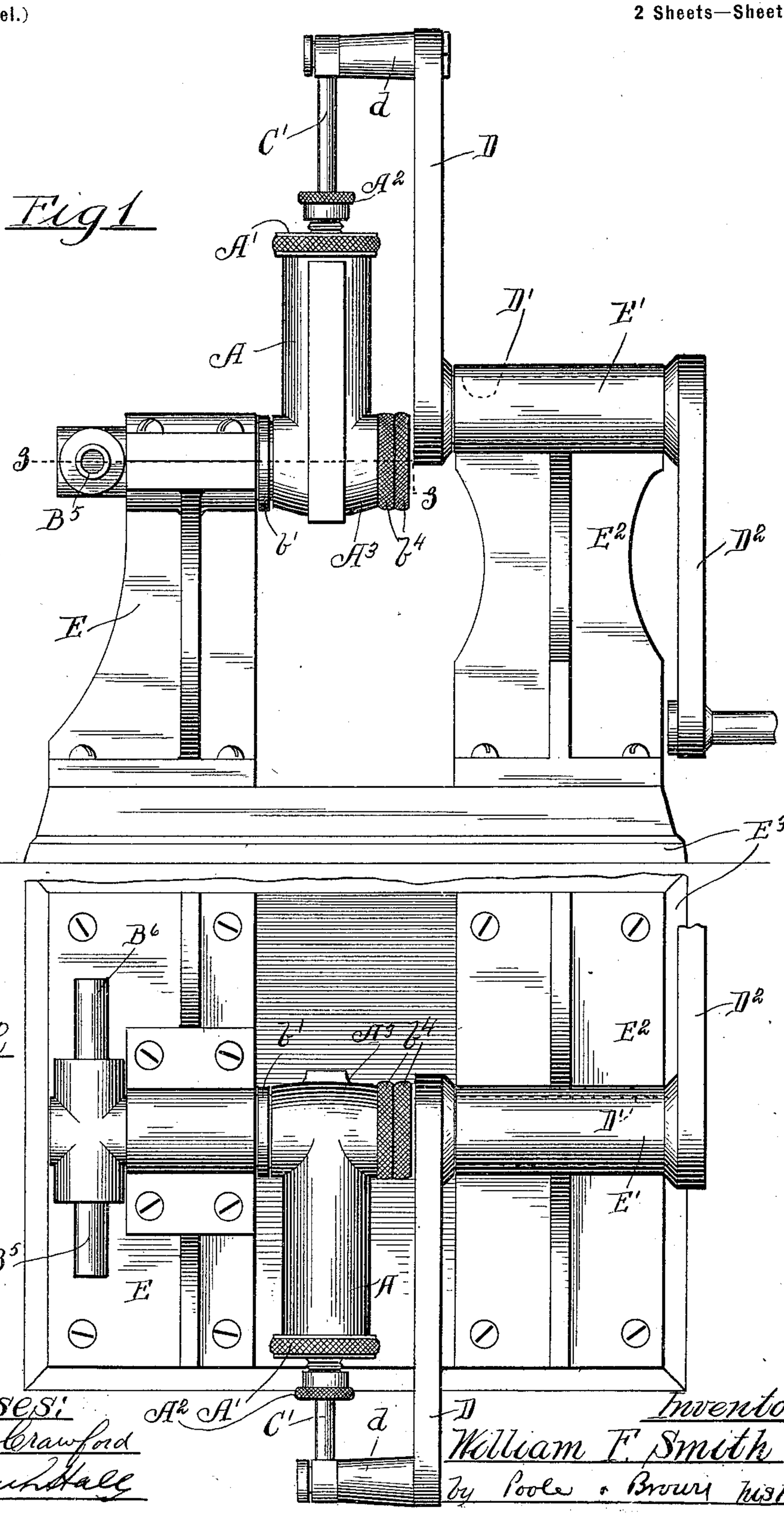

Fig 2

Witnesses:
Carl H. Crawford
William Hall

Inventor:
William F. Smith
by Poole & Brown his Attys

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

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Fig 3

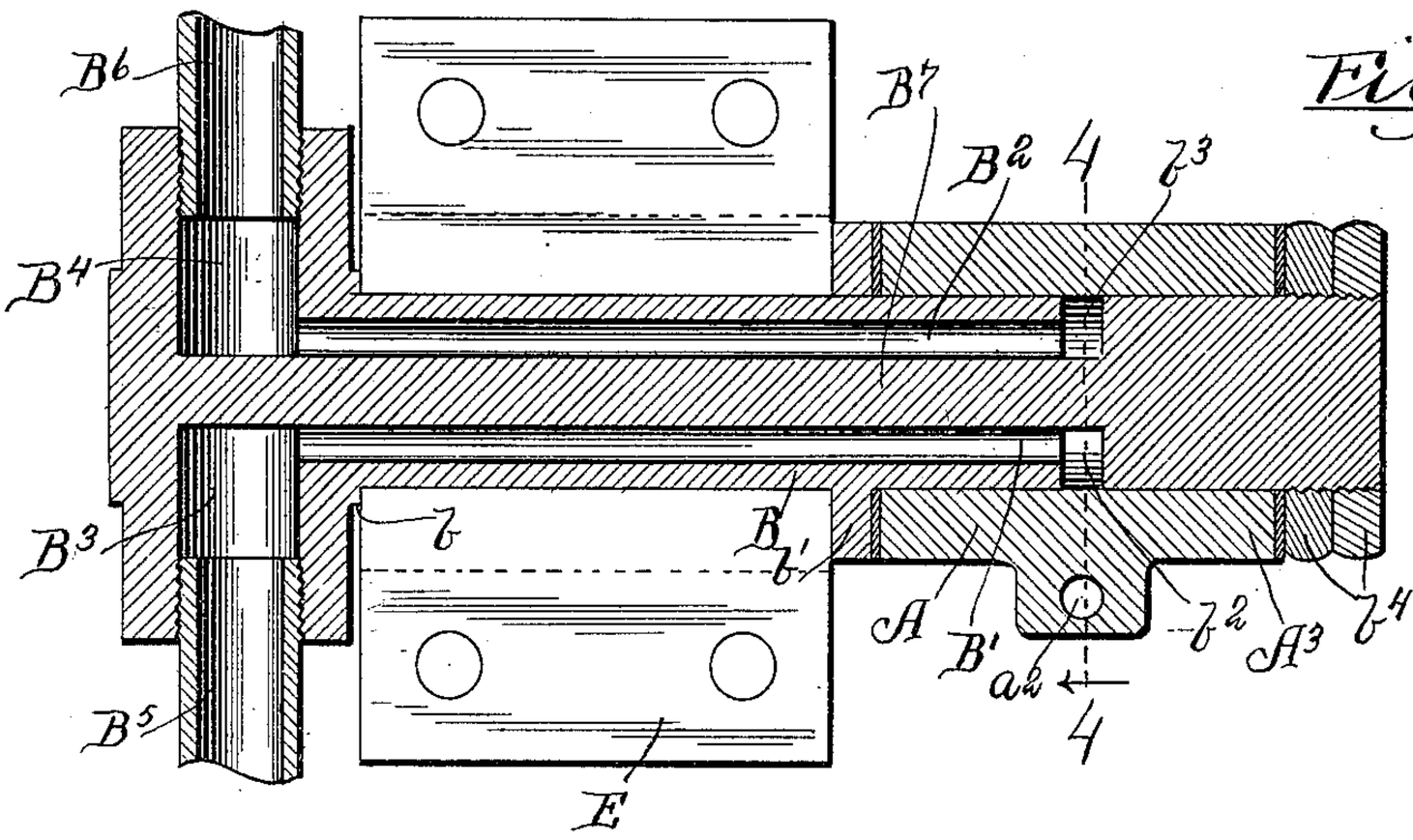


Fig 4

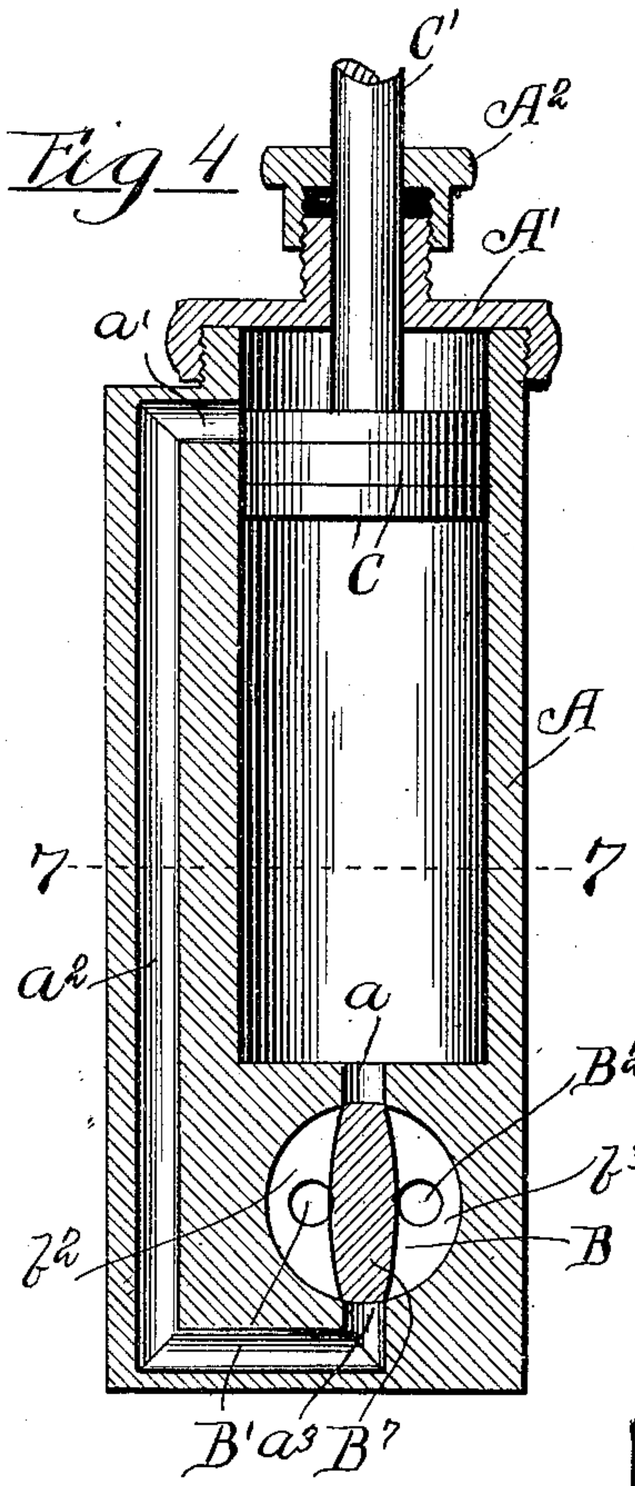


Fig 5

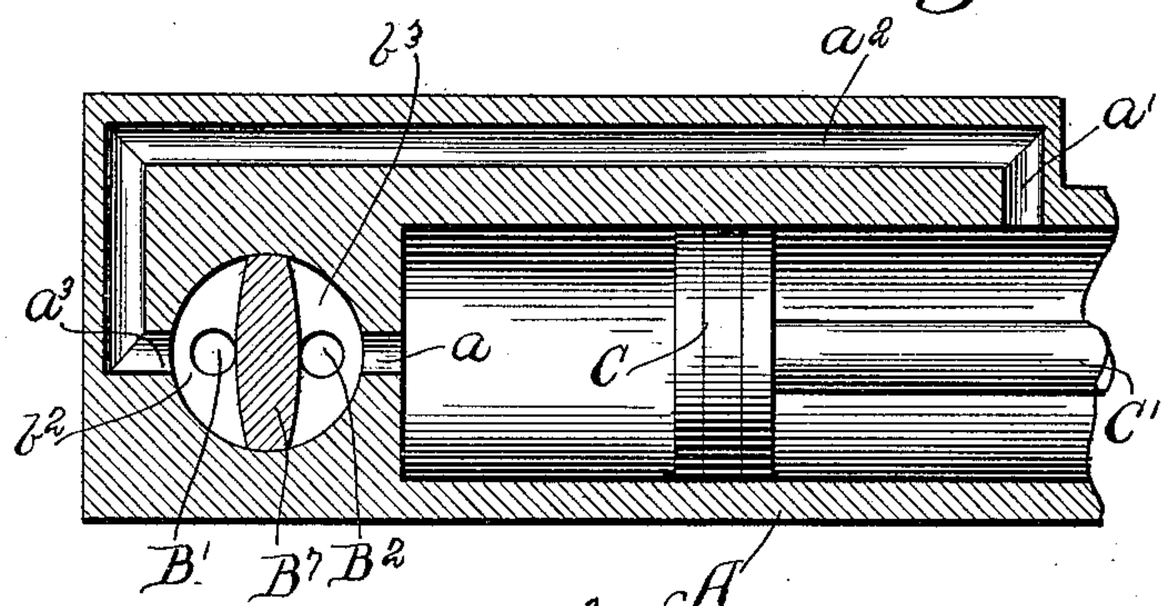


Fig 6

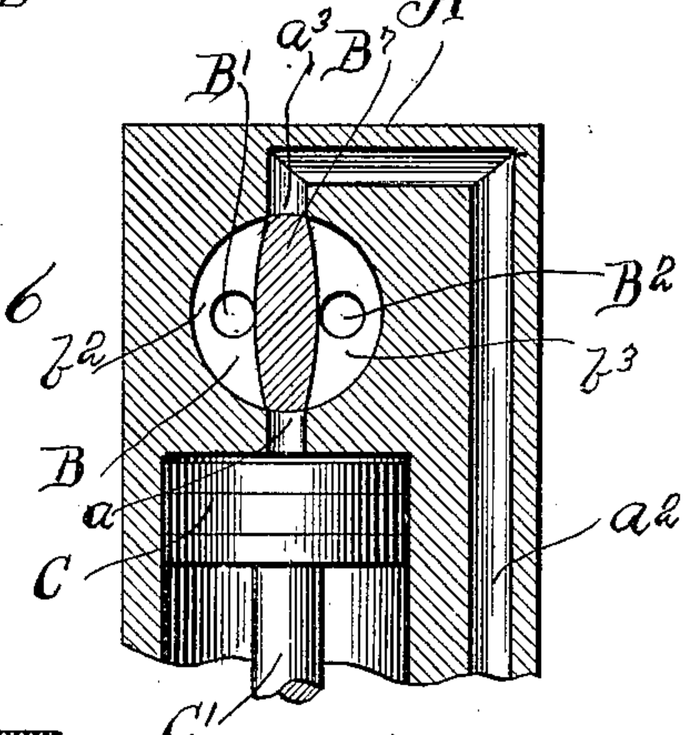
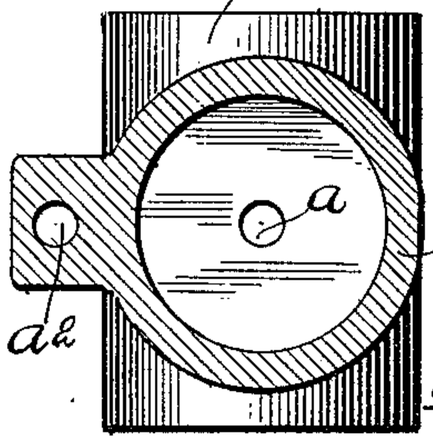


Fig 7



Witnesses:-
Carl H. Crawford
William H. Hall

Inventor:-
William F. Smith
by Poole & Brown his Attys

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

UNITED STATES PATENT OFFICE.

WILLIAM F. SMITH, OF MACKSBURG, OHIO, ASSIGNOR OF SEVEN-EIGHTHS TO SAMUEL B. LONGFELLOW, ROBERT STEPHENS, AND OSCAR C. WILLIAMS, OF SAME PLACE.

PUMP.

SPECIFICATION forming part of Letters Patent No. 639,870, dated December 26, 1899.

Application filed March 29, 1899. Serial No. 710,879. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM F. SMITH, of Macksburg, in the county of Washington and State of Ohio, have invented certain new and useful Improvements in Pumps; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention embraces a novel construction in force-pumps, and has for its objects to simplify the construction of such pumps and increase their efficiency.

The invention consists in the matters hereinafter set forth, and more particularly pointed out in the appended claims.

In the drawings, Figure 1 is a side elevation of a pump embodying one form of my invention. Fig. 2 is a top plan view thereof with the operative parts in changed position. Fig. 3 is a plan section taken on line 3 3 of Fig. 1. Figs. 4, 5, and 6 are longitudinal sections of the cylinder, taken on line 4 4 of Fig. 3, said figures showing the cylinder in three positions in its rotation about the shaft. Fig. 7 is a cross-section taken through the cylinder on line 7 7 of Fig. 4.

As shown in said drawings, A designates a pump-cylinder, and B a horizontal stationary shaft upon which said cylinder is pivoted and about which it rotates as an axis. C designates a piston within said cylinder, C′ a piston-rod connected with said piston, and D a crank-arm which is connected at its outer end with the outer end of the piston-rod by means of a pivot-pin *d*, said crank being attached to a rotary shaft D′, which is adapted to be rotated by means of a crank or handle D^2. Said rotary shaft D′ is arranged parallel with the shaft B and slightly out of line therewith or eccentric thereto. With this construction the axis of rotation of the crank-arm D is eccentric to the axis of rotation of the cylinder A, so that when said crank is rotated it serves not only to rotate the cylinder, but to give reciprocatory movement to the piston within said cylinder, the length of the stroke being determined by the eccentricity of the shaft D′ to the shaft B.

The shaft B is mounted upon the upper end of a standard E, while the shaft D′ has rotative bearing in a suitable sleeve E′, attached to the upper end of a standard E^2. Both of said standards E and E^2 are mounted on the opposite ends of a suitable base-casting E^3. The upper end of the standard E has the form of a two-part bearing, thereby permitting the shaft B and the attached cylinder to be removed when desired. The shaft B is provided on opposite sides of the bearing, at the upper end of the standard E, with two flanges *b b′*, which serve to hold the same from lengthwise movement in said bearing. Said cylinder is held in place on said shaft between nuts b^4, which are screw-threaded on the outer end of the shaft, and the adjacent flange *b′*.

The outer end of the cylinder A′, through which the piston-rod extends, is made removable for the purpose of inserting the piston therein, said outer end of the cylinder being herein shown as made in the form of a cap and having screw-threaded engagement with the exterior wall of the cylinder. Said cap is provided with the usual stuffing-box A^2, which affords a fluid-tight joint between the same and the piston-rod.

So far as the features of my invention just described are concerned any suitable form of valve mechanism may be employed. As a further and separate improvement I propose to employ in connection with this feature of the invention, or in connection with any pump embracing a cylinder and a reciprocating piston, a positively-actuated valve or valves operated by connection with a movable part of the pump. Such construction embraces in the instance illustrated a port or ports communicating with the interior of the cylinder and a part provided with ports communicating, respectively, with the outlet and discharge passages of the pumps, said last-mentioned part and cylinder having relative rotation, whereby the cylinder port or ports may have alternate communication with the inlet and discharge ports, respectively. Referring now to said illustrated form of this feature of my invention, these parts are made as follows: As herein shown, the cylinder port or ports are located in a cylindric opening in the

end wall of the cylinder, which constitutes a seat or bearing for the shaft B, about which the cylinder rotates, and the outlet and inlet ports are located in the part of said shaft contained within said opening. The stationary shaft B is provided with two longitudinal passages B' B^2, which extend from the outer end thereof to a point adjacent to its inner end. Said passages are connected at their outer ends with two passages B^3 B^4, which are formed in an integral transverse portion of said shaft and to which are adapted to be connected detachable pipes B^5 B^6, which lead, respectively, to the vessel to be emptied and to the point to which the fluid is to be forced. Said shaft B is provided adjacent to its inner end with two ports b^2 b^3, located on opposite sides thereof, which are in communication at their inner sides with the passages B' B^2, respectively, and open at their outer sides in the outer surface of the shaft. Said ports are separated by a partition B^7, which is made of a length, longitudinally of the shaft, equal to the width of the ports.

As herein shown, the transverse cylindric opening within which the shaft B has bearing is formed in a sleeve A^3 at the inner end of the cylinder. Said cylinder is provided at its inner end with a port a, which leads from said inner end to the interior of the sleeve portion A^3, and is provided at its outer end with a second port a', which communicates through an indirect passage a^2, formed in the exterior wall of the cylinder, longitudinally thereof, with the interior of said sleeve through a port a^3, which opens into said sleeve at a point diametrically opposite the port a. Said ports a and a^3 when the cylinder is in place on the shaft B are located in the plane of said shaft-ports, and the arrangement is such that when the port a is in communication with the port b^2 the port a^3 will be in communication with the port b^3. The partition B^7 between the ports b^2 b^3 of the stationary shaft B is of such width as to fit closely upon the cylindric interior walls of the sleeve and is curved at its margins to conform to said interior surface of the sleeve. Said partition is made of greater width at its margins than the diameter of the ports a a^3, so that when it covers said ports it will slightly overlap at each side thereof, and thereby prevent the fluid from passing directly from the port a to the port a^3, and vice versa. The arrangement of the ports obviously constitutes, in effect, a valve which is positively actuated by connection with a moving part of the pump. Suitable packing is interposed between the sleeve a^3 and the flange b' at one end and the nut b^4 at the other end to afford fluid-tight joints between said parts.

The operation of a pump constructed as thus described is as follows: As the pump is shown in Figs. 1, 3, and 4 the piston occupies the outer end of the cylinder and the partition B^7 is in position to cover both cylinder-ports a a^3, so that communication between the intake and outlet passages and the cylinder is cut off. Upon rotating the cylinder to the right the ports a a^3 will move away from the partition B^7 to opposite sides thereof, thereby opening the port a through the port b^3 to the passage B^2, which in this instance is the outlet-passage, and the port a^3 through the port b^2 to the intake-passage B'. The same movement which rotates the cylinder also moves the piston C inwardly, owing to the eccentricity of the axis of rotation of the crank-arm to that of the cylinder, so that the fluid is forced from the cylinder through the port a and b^3 to the passage B^2 and outwardly from thence through the outlet-pipe B^6. At the same time the vacuum created in the cylinder behind the piston will cause the fluid to fill the cylinder behind the piston through the passage B', the ports b^2 a^3, the passage a^2, and the port a'.

In Fig. 5 the piston is shown at the middle of its stroke, and in Fig. 6 said piston is shown at the limit of its inward stroke, at which latter time the cylinder, in the organization herein illustrated, will occupy a vertical position below the shaft B', as shown in Fig. 6. Said Figs. 4, 5, and 6 show, progressively, three relative positions of the ports in one-half of a rotation of the crank-shaft. Upon further rotation of the cylinder from the position shown in Fig. 6 the piston will move outwardly and force the fluid behind the same outward through the port a', passage a^2, ports a^3 and b^3 to the passage B^2 and thence outwardly through the pipe B^6, while the cylinder in front of the piston will be filled through the passage B' and ports b^2 and a. It will thus be seen that practically a constant stream will be forced from the pump, the only interruption of such stream being at the time the piston is changing its direction of travel at each end of the cylinder.

Said pump may be used to force a fluid through either of the passages B' B^2, it being evident that a reversal of the rotation of the cylinder will reverse the direction of movement of the fluid through the pump. This is an important feature of my invention, as it enables the pump to be used as an aspirator where it is desirable to force a liquid into a part and immediately remove it therefrom, such removal being accomplished by reversing the direction of the rotation of the cylinder.

It will be evident from the foregoing description that my improvement may be applied to a single-acting pump with the same advantages as to a double-acting pump. In such case the external passage a^2 and its communicating ports will be omitted; but the other parts of the pump will remain the same as herein illustrated and above described. Moreover, the relative movement between the shaft and cylinder to bring the ports into proper relation during the operation of the pump may be accomplished by actual movement of either of said parts, and the arrange-

ment and location of the parts may be varied so long as the proper relation between the cylinder and outlet and inlet ports is preserved.

A pump made in accordance with my invention is very simple in its operation and economical to manufacture and at the same time possesses the greatest degree of efficiency. The greater efficiency of the pump is due to the fact that it has no lift-valves, which are employed in force-pumps heretofore devised, which valves, as is well known, require some force to lift them, get easily out of order, and occasion considerable trouble as well as expense.

Furthermore, the pump herein described is capable when used for exhausting gases—as, for instance, when employed as an air-pump—of producing a more perfect vacuum in the receiver, for the reason that there are no valves which require pressure to raise, so that greater expansion of the air is possible than where it is necessary that a portion of the force of the expanding air be exerted to raise the valve. For a like reason the pump is capable of more efficient work for pumping heated or volatile liquids containing a large proportion of gaseous vapors or steam and obviates the difficulty heretofore experienced in pumps at present in use for said purpose.

Moreover, the pump herein described is especially valuable for pumping heavy liquids containing a residue of adhesive matter—as, for instance, crude oil—as there are no pressure or self-acting valves to become clogged and liable to stick to their seats.

I claim as my invention—

1. A double-acting pump comprising a cylinder, a reciprocating piston therein, said cylinder being provided in its inner end with an annular opening having its axis disposed perpendicularly to the longitudinal axis of the cylinder, said cylinder being provided with two ports which lead from the opposite ends thereof and open into the opposite sides of said annular opening, a shaft seated in said annular opening provided with two separated ports having communication respectively with the outlet and inlet passages of the pump, and means for giving relative rotation to said cylinder and shaft for bringing said cylinder-ports into alternate communication with the shaft-ports.

2. A double-acting pump comprising a cylinder, a reciprocating piston therein, said cylinder being provided in said wall with an annular opening having its axis disposed perpendicularly to the longitudinal axis of the cylinder and provided with two ports which lead from the opposite ends of the cylinder and open into the opposite sides of said annular opening, said shaft being made solid and provided with separate longitudinal passages constituting the inlet and outlet passages of the pump and being cut away at its opposite sides in its part adjacent to said cylinder-ports to provide openings or ports, as b^2 b^3, which are separated by an integral partition, as B^7, and means for giving relative rotation to said shaft and cylinder, to bring said shaft-ports into communication with the cylinder-ports.

3. A double-acting pump comprising a cylinder, a reciprocating piston therein, said cylinder being provided at its inner end with an annular opening having its axis disposed perpendicularly to the longitudinal axis of the cylinder and provided also with a port leading from the inner side of said opening to the inner end of the cylinder and with a port leading from the opposite side of said opening and through a longitudinal passage in the side wall of the cylinder to the outer end of said cylinder, a shaft seated in said annular opening provided with two separated ports which have communication respectively with the inlet and outlet passages of the pump, and means for giving relative rotation to said cylinder and shaft for bringing said cylinder-ports into alternate communication with the shaft-ports.

4. A pump comprising a cylinder, a reciprocating piston therein, said cylinder being provided at its inner end with an annular opening the axis of which is perpendicular to the longitudinal axis of the cylinder, a shaft seated in said opening provided with ports which communicate respectively with the inlet and outlet passages of the pump, a standard provided at its upper end with a two-part bearing within which said shaft is seated, a second standard, a rotative shaft eccentric to said first-mentioned shaft seated in the upper end of said second standard, and an arm on said rotative shaft connected with the piston-rod, said cylinder being closed at its outer end by a removable cap through which the piston-rod extends.

In testimony that I claim the foregoing as my invention I affix my signature, in presence of two witnesses, this 2d day of March, A. D. 1899.

WILLIAM F. SMITH.

Witnesses:
WILLIAM L. HALL,
C. W. HILLS.