(No Model.) 2 Sheets—Sheet 1.

W. COOPER & G. P. HAMPTON.

ROTARY RECIPROCATING PUMP.

No. 511,044. Patented Dec. 19, 1893.

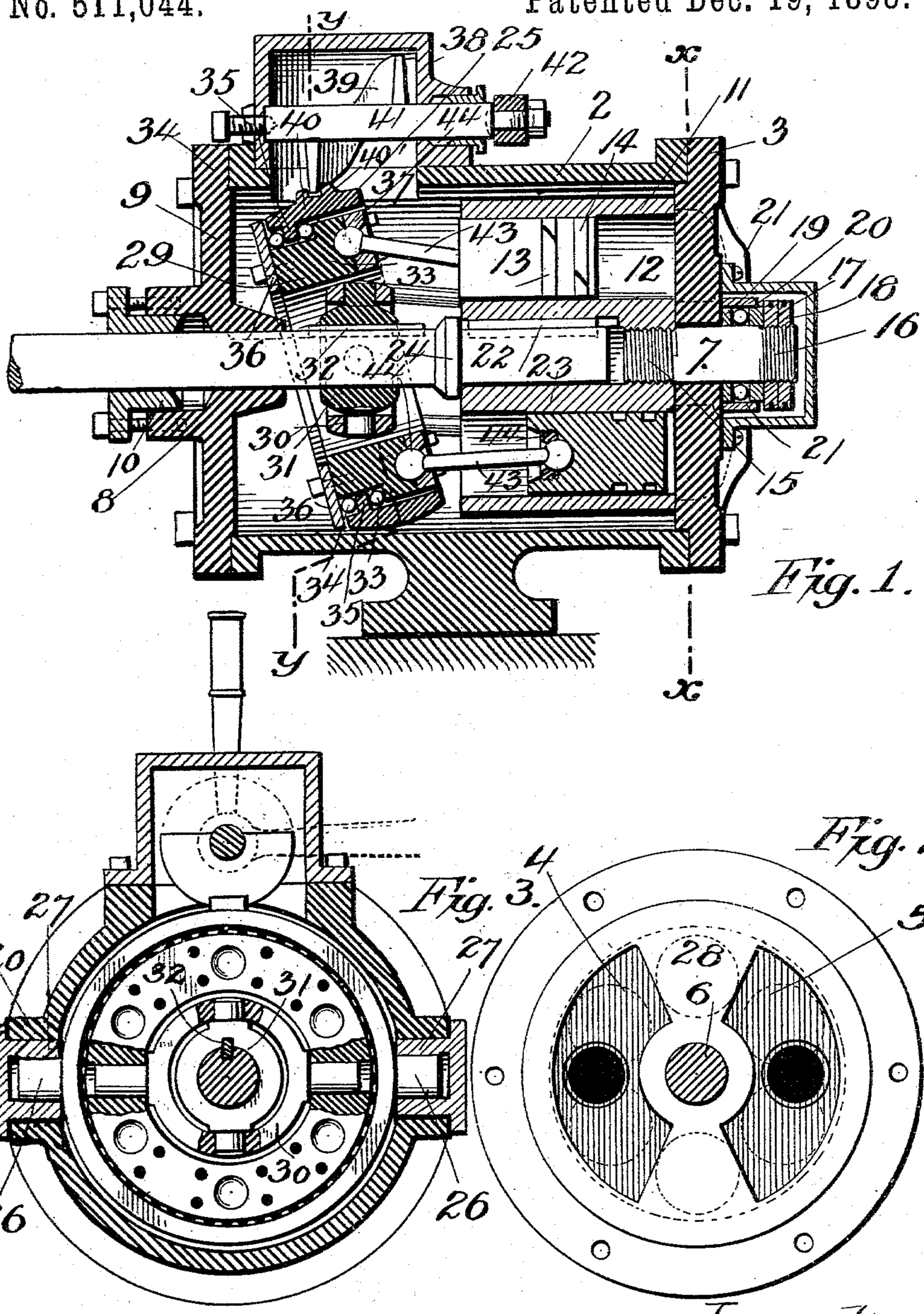

Fig. 1.

Fig. 3.

Fig. 2.

Witnesse
F. A. Lyon
G. E. Purple

Inventors:
William Cooper
George P. Hampton.
By Paul & Sheerwin
Atty's.

THE NATIONAL LITHOGRAPHING COMPANY.
WASHINGTON, D. C.

(No Model.) 2 Sheets—Sheet 2.

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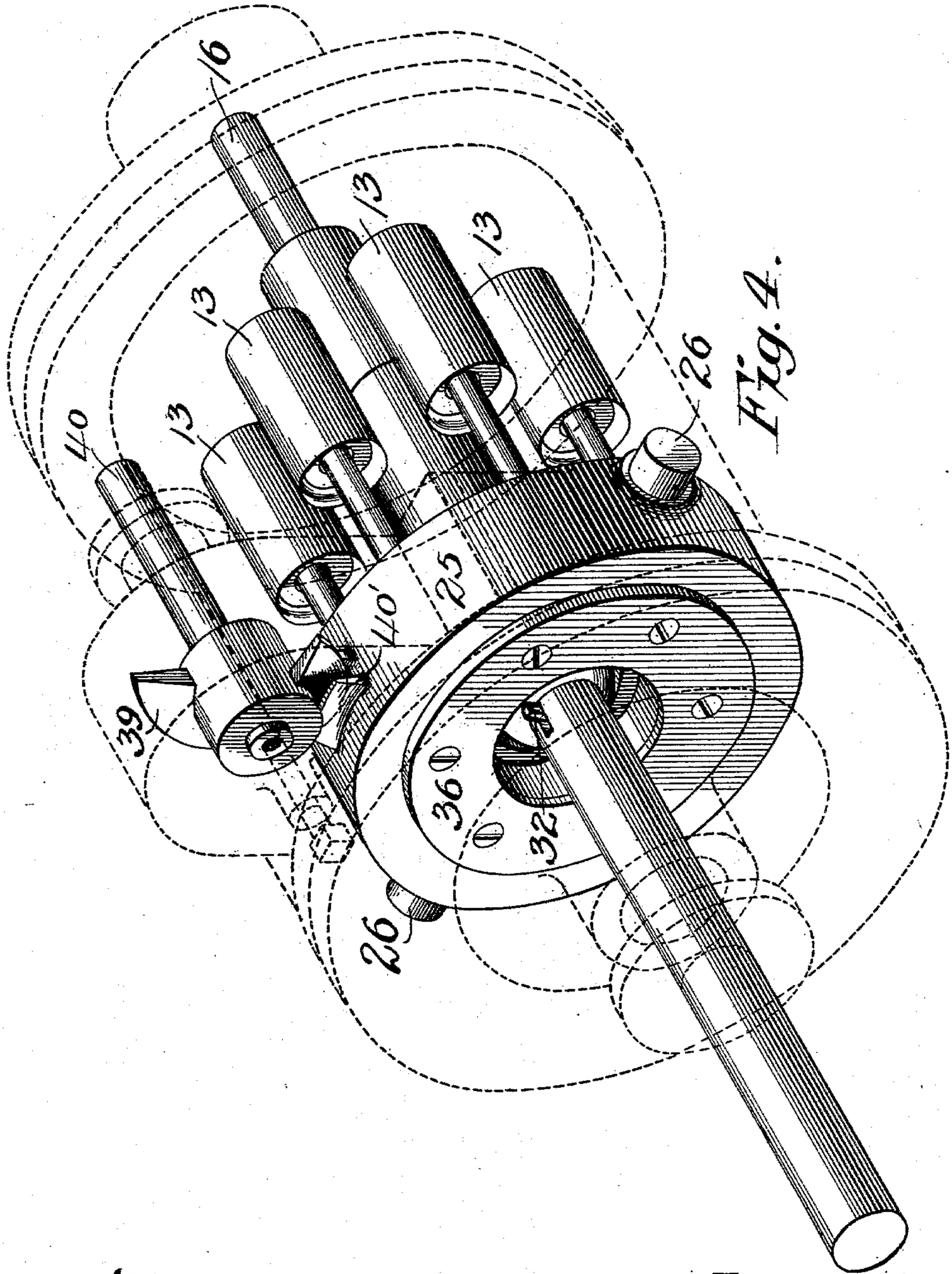

Fig. 4.

Witnesses,
F. D. Lyon
G. E. Purple.

Inventors:
William Cooper,
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THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

WILLIAM COOPER AND GEORGE P. HAMPTON, OF MINNEAPOLIS, MINNESOTA, ASSIGNORS TO THE COOPER-HAMPTON ELECTRIC COMPANY, OF SAME PLACE.

ROTARY RECIPROCATING PUMP.

SPECIFICATION forming part of Letters Patent No. 511,044, dated December 19, 1893.

Application filed October 31, 1892. Serial No. 450,429. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM COOPER and GEORGE P. HAMPTON, of the city of Minneapolis, county of Hennepin, State of Minnesota, have invented certain Improvements in Rotary, Reciprocating Pumps, of which the following is a specification.

Our invention relates to a pump adapted for use at either high or low speeds, and especially adapted for use with electric motors or other constant rotary power— the pumps being either coupled direct with the motor shaft, or belted or geared thereto.

The object of the invention is to provide a pump which shall have a rotary movement adapting it for use in connection with electric motors, and which at the same time shall have a reciprocating movement or operation, securing for the pump a durability and efficiency equal to that of the old type reciprocating pumps.

To this end our invention consists in the combination with a suitable casing provided with inlet and outlet ports, of a shaft extending into said casing, a drum provided thereon and covering said inlet and outlet ports and provided with a series of barrels or cylinders, plungers arranged in said barrels, a plate or disk with which said plungers continuously engage, said plate arranged about said shaft and adapted to be adjusted at any incline with respect to the same to increase or decrease the throw of said plungers, said disk or drum being secured upon the shaft while the other portion is independent therefrom, all substantially as hereinafter described and particularly pointed out in the claims.

The invention will be more readily understood by reference to the accompanying drawings, in which—

Figure 1 is a vertical longitudinal section of a pump embodying our invention. Fig. 2 is a vertical elevation of the head of the casing containing the inlet and outlet ports seen on the line *x*—*x* of Fig. 1. Fig. 3 is a transverse vertical section on the line *y*—*y* of Fig. 1. Fig. 4 is a perspective view showing the tilting disk, the worm for operating the same, and the plungers attached to the disk— the outline of the casing being shown in dotted lines.

As shown in the drawings, 2 represents a cylindrical casing provided with the head 3, containing the inlet and outlet ports 4 and 5 and the bearing 6 for the shaft 7— the other end of which shaft is supported in the bearing 8 of the opposite head 9, which is provided with the stuffing box 10 to prevent leakage around the shaft. Upon the shaft is mounted the drum 11 provided with a series of barrels or cylinders 12, preferably six in number as indicated by dotted lines in Fig. 2, and each containing a piston or plunger 13 provided with metal packing rings 14 for making close joints with the walls of the cylinders. The shaft is made in two parts; the short section 7 having the threaded inner end 15 screwed into the forward ends of the drum 11, and having the threaded outer end 16 to receive the two locking nuts 17 and 18 by means of which the end of the drum is adjusted with respect to the inner face of the head 3.

In order to prevent friction between the locking nuts forming a thrust bearing, we provide the two steel bearing rings 19 between which are arranged a series of balls 20 held therein by the loose outer ring 21—thus the locking nuts bearing upon the outer ring 21 engage the anti-friction ball bearings, which in turn roll upon the inner ring 19 resting against the head. The other part 22 of the shaft is longer and is that to which the power is attached. The drum is prevented from turning upon the shaft by the key or feather 23, and the shaft is prevented from driving into the drum by the shoulder or collar 24 formed thereon. Between the rear end of the drum and the head 9 is a considerable space in which is arranged the tilting disk, which part is composed of the tilting ring 25 having the trunnions 26 securely pivoted in the boxes 27 of the casing, and at right angles to the bridge 28 formed between the two ports 4 and 5. In order that the plungers may continuously engage the tilting disk, which is in fact a cam, without friction thereon, the tilting disk is made in two parts—one the trunnioned ring by which the proper in-

clination is secured, and the other the inner ring 29 arranged to revolve with the shaft, being connected therewith by the universal joint made up of the part 30, trunnioned in the ring 29, and the part 31 trunnioned in the part 30. The part 31 is secured on the shaft by the feather 32 so that it revolves with the same, while at the same time the shaft may move backward or forward with respect to the same, as required for the proper adjustment of the drum with respect to the port surface of the head 3, before which it revolves. The ring 29 has the groove in its rear side adapted to accommodate the two sets of ball bearings 33 and 34, which operate on the two sides of the annular rib 35, projecting from the inner side of the tilting ring 25. On the back of the ring 29 is the face ring 36 bearing against the ball bearings 34. The plungers 13 are connected with opposite points upon the revolving ring 29, by the short connecting rods 43, having the ball ends fitting in ball sockets in the plungers and the ring and secured in place by removable collars 44, preferably made adjustable in order to take up the wear of the sockets. In the top of the casing is a large opening 37, above which the housing or box 38 is secured. Within the box is a worm 39 engaging the lugs 40 on the top of the tilting disk. The worm is arranged on the shaft 41 which projects out of the housing, and upon which is arranged the operating lever 42 or a suitable wheel, by means of which the worm may be rotated to tilt the disk forward or back from the perpendicular to increase or decrease the capacity of the pump or to entirely stop the passage of water therethrough. Where the water is arranged to flow through the pump, the rear set 34 of the ball bearings in the tilting disk may be dispensed with as there will be no forward strain upon the plungers to draw the revolving ring out of the tilting ring.

The operation of the pump is as follows:—At the time of starting the pump the tilting disk is turned up into a perpendicular position with respect to the shaft. The power is then applied to revolve the shaft at any desired speed, revolving therewith the drum, the ring 29 and the plungers. Inasmuch as the disk is at right angles with the shaft, it will be seen that though the drum may revolve very rapidly the position of the plungers therein will not be altered. Upon throwing the disk at an incline, however, the plungers are rapidly drawn in and out as they flow up and down the incline of the disk. The bridge 28 is of the same width as the diameter of the pointed ends of the cylinders 12 and as the disk is pivoted at right angles with the bridge it will be seen that the plungers reach their maximum stroke forward or back just as the upper and lower cylinders containing them, are closed by the upper ends of the bridge 28. As the drum continues to revolve these two cylinders are carried past the bridge, and the forward plunger being carried up the incline of the tilting disk is drawn back to suck in a load from the inlet port, while the receded plunger is gradually forced forward passing down the incline, to force its load into the outlet port. It will be seen, that the drum being revolved many times a minute this action is so rapidly repeated that the water is practically carried from the inlet port into the outlet port continuously and without perceptible fluctuation in the stream discharge from the outlet port. To reverse the action of the pump while the revolving parts thereof continue the same speed and the same direction of revolution, it is only necessary to tilt the disk into the opposite position, when the relations of the plungers with respect to the inlet and outlet ports are exactly changed, for, where upon one side the pistons were moving forward down the incline of the disk, they will then be continuously drawn back from what was before the outlet port. As a continuous stream is delivered from our pump its load is constant, thereby adapting it for use direct with electric motors which a fluctuating load would seriously affect.

Having thus described our invention, we claim as new and desire to secure by Letters Patent—

1. The combination with the casing, provided with inlet and outlet ports, of a shaft extending into the said casing, a drum arranged upon said shaft and provided with a series of barrels having open ends arranged to pass over said ports, plungers arranged in said barrels, a plate or disk with the side of which said plungers continuously engage, and relatively to which they occupy a substantially lateral position, said plate or disk arranged about said shaft and adapted to be adjusted to assume any incline with respect to the same without stopping or changing the speed of said pump or motor, and said disk or said drum being secured upon the shaft while the other portion is independent thereof, substantially as described and for the purpose specified.

2. The combination with the casing provided with inlet and outlet ports, of the shaft extending into said casing, the drum secured upon said shaft and provided with a series of barrels having openings arranged to pass over said ports as the drum is rotated, plungers arranged in said barrels, a disk against which said plungers are held, said disk being swung upon trunnions arranged in said casing, and means provided in connection with said disk for tilting the same to vary the stroke of said pistons at will, substantially as described.

3. The combination with the casing provided with inlet and outlet ports, of a shaft extending into the said casing, a drum fixed on said shaft, said drum provided with a series of barrels, having openings adapted to pass over said ports, plungers arranged to operate in said barrels, connecting rods extending from the same, a tilting disk pivoted in

said casing, a revoluble ring arranged in said disk and in which said connecting rods are secured and said ring being fixed upon the shaft, and adapted to revolve within said tilting disk substantially as described and for the purpose specified.

4. The combination with a casing having one end provided with inlet and outlet ports, of a shaft extending into said casing, a drum arranged within said casing and fixed upon said shaft, barrels provided in said drum and having openings to pass over said ports, plungers provided in said barrels, a tilting disk pivoted in said casing and surrounding said shaft, means for tilting the same, a ring or disk revolubly arranged upon said tilting disk and universally pivoted upon said shaft, and connecting rods for securing said plungers to said ring, substantially as described.

5. The combination with the casing having an end provided with inlet and outlet ports, a shaft extending into said casing, a drum arranged thereon and having barrels provided with openings to pass over said ports, plungers arranged in said barrels, a tilting disk pivoted upon trunnions having bearings in said casings, a revoluble ring arranged within said disk, a universal joint connection between said ring and said shaft, connecting rods extending between said ring and said plungers, a worm gear fixed in said casing and engaging said disk, and means provided on the outside of said casing to operate the same to tilt said disk, substantially as described.

6. The combination with the closed casing having inlet and outlet ports, of a shaft extending into the same, a drum arranged thereon, and having barrels provided with openings for the reception and discharge of liquid from and into said ports, plungers arranged in said barrels, a tilting disk pivoted in said casing and with which extensions of said plungers are adapted to continuously engage, a box provided on said casing, a worm arranged therein, and engaging the periphery of said disk and the lever provided in connection therewith for operating the same, substantially as described.

7. The combination with the inclosing case, of ports provided therein, a bridge separating said ports, a shaft extending into said casing, a drum provided thereon, and having barrels provided with openings of substantially the width of said bridge, a tilting disk pivoted at right angles to said bridge, means for tilting said disk, a revoluble ring provided in said disk and pivoted on the shaft, anti-friction bearings between said disk and ring, plungers arranged in said barrels, connecting rods and ball bearing for the ends thereof, and said plunger and ring respectively, substantially as described.

8. The combination, with a face disk provided with inlet and outlet chambers and ports, of a drum provided with a series of longitudinal barrels having openings to pass over said inlet and outlet ports, plungers or pistons arranged in said barrels, a transversely pivoted tilting disk against the side of which said plungers are continuously held and means for swinging or tilting said disk to change the throw of said pistons acting against the same as a cam, substantially as and for the purpose specified.

9. The combination, with a face disk provided with inlet and outlet chambers and ports, of a drum provided with a series of longitudinal barrels having openings to pass over said inlet and outlet ports, plungers or pistons arranged in said barrels, a transversely pivoted tilting disk, and anti-friction mechanism interposed between said plungers and said tilting disk and by means of which said plungers are continuously held in engagement therewith, and means for swinging or tilting said disk to change the throw of said pistons, substantially as described.

10. The combination, with a face disk having inlet and outlet ports, of a drum, one end of which is adapted to revolve before said disk, said drum having a series of open ended barrels, plungers or pistons arranged in said barrels, an inclined disk concentric with said drum and face disk, a revoluble anti-friction ring arranged within said disk and connections or ties between said ring and said plungers, substantially as described and for the purpose specified.

11. The combination, with the face disk having inlet and outlet ports, a shaft revoluble with respect thereto, a drum abutting said disk and having a series of open ended barrels, plungers or pistons in said barrels, an inclined disk concentric with said shaft, a ring mounted in anti-friction bearings in said disk and whereto said plungers are connected, and said ring being universally pivoted on said shaft to revolve therewith and with said drum, substantially as described.

12. The combination, with the face disk having the inlet and outlet ports and chambers, of the shaft concentric with said disk, a thrust bearing for said shaft in said disk, a drum having a series of barrels and fixed on said shaft and one end thereof abutting said disk, an inclined disk opposite the other end of said drum and concentric with the shaft, an antifriction ring revoluble in said disk and fixed on said shaft, said ring being universally pivoted on said shaft, and plungers in said barrels and connected with said ring, all substantially as and for the purpose specified.

In testimony whereof we have hereunto set our hands this 20th day of October, A. D. 1892.

WILLIAM COOPER.
GEORGE P. HAMPTON.

In presence of—
F. S. LYON,
C. G. HAWLEY.