J. G. CALLAN.

PUMP.

APPLICATION FILED APR. 7, 1906.

**924,730.** **Patented June 15, 1909.**

2 SHEETS—SHEET 1.

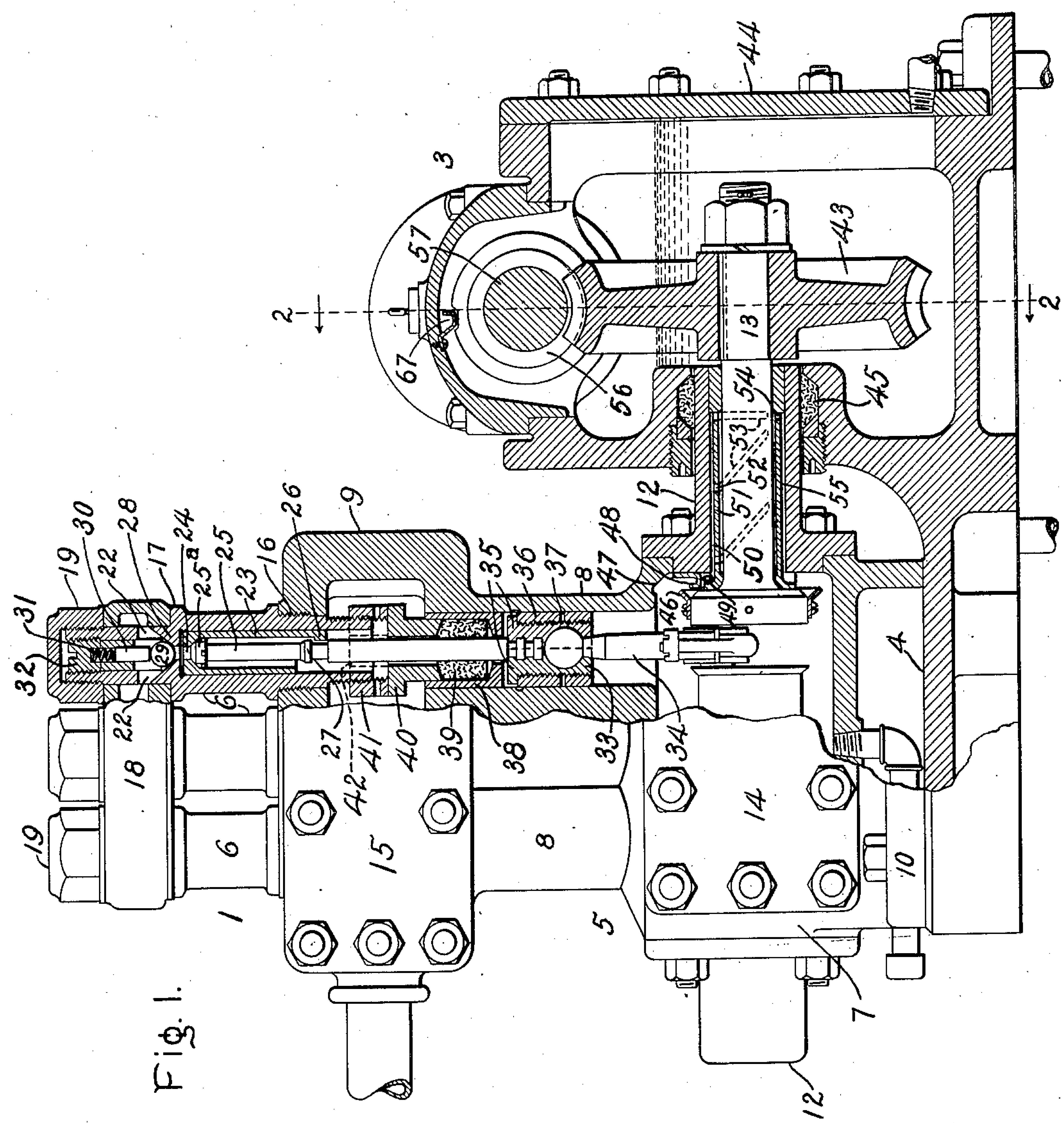


Fig. 1.

WITNESSES:

Burchard V. Kelley

Helen Orford

INVENTOR:

JOHN G. CALLAN,

BY Albert G. Davis

ATTY.

J. G. CALLAN.

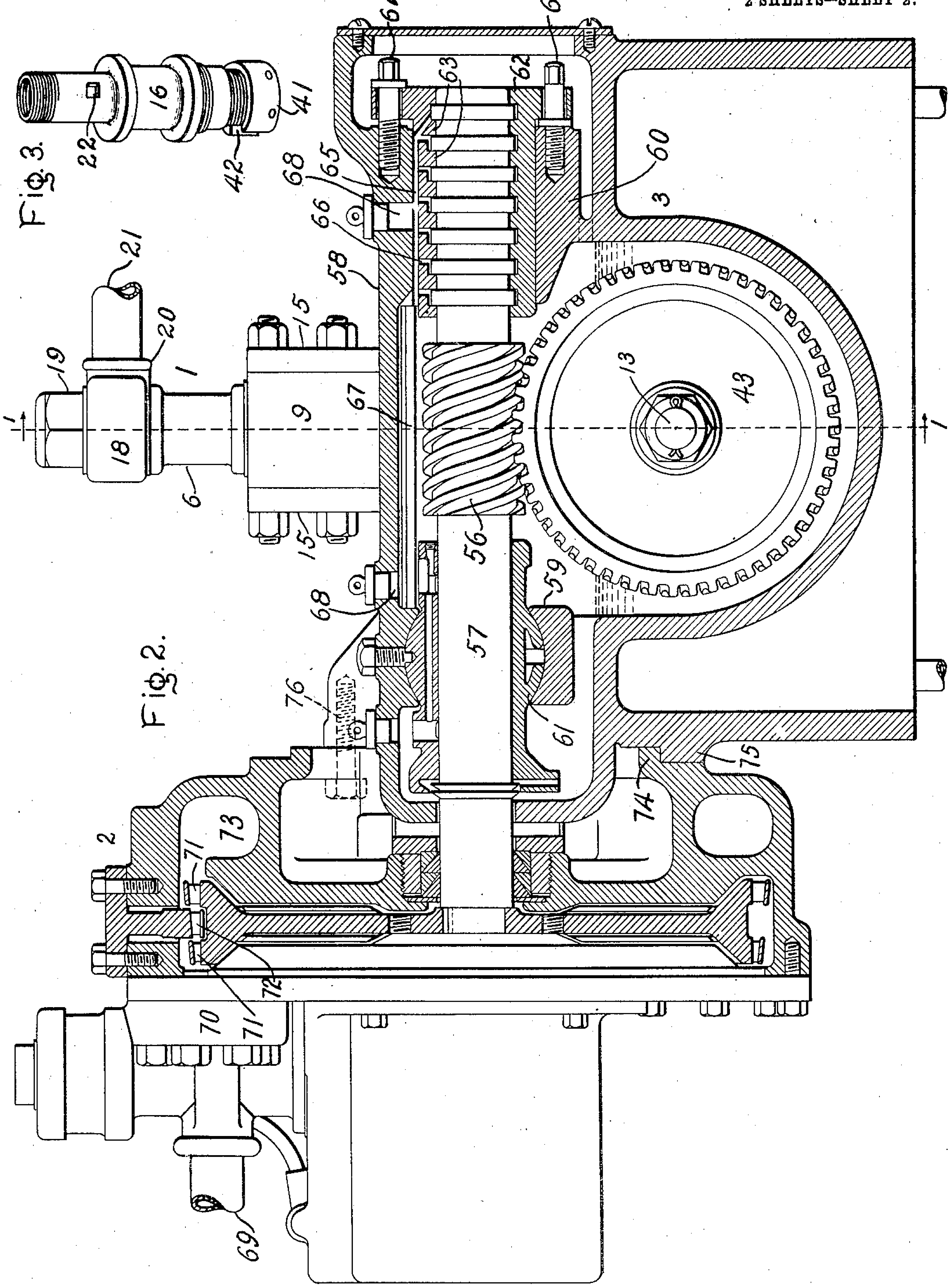
PUMP.

APPLICATION FILED APR. 7, 1906.

**924,730.**

Patented June 15, 1909.

2 SHEETS—SHEET 2.




WITNESSES:

Burchard V. Kelley

Helen Orford

INVENTOR:

JOHN G. CALLAN,

BY Albert G. Davis

ATT'Y

# UNITED STATES PATENT OFFICE.

JOHN G. CALLAN, OF LYNN, MASSACHUSETTS, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

## PUMP.

No. 924,730. Specification of Letters Patent. Patented June 15, 1909.

Application filed April 7, 1906. Serial No. 310,412.

*To all whom it may concern:*

Be it known that I, JOHN G. CALLAN, a citizen of the United States, residing at Lynn, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Pumps, of which the following is a specification.

The present invention relates to a pump suitable for high speed high pressure service and relates more particularly to a pump intended for use in connection with hydraulic shaft-bearings, such as are employed in large turbo-generators and similar apparatus. There are certain features of the invention, however, which have a general application to pumps.

It has for its object to provide a pump which is highly efficient in operation and of compact and substantial construction.

The novel features of construction and arrangement of the parts will be more fully described hereinafter and set forth in the claims appended hereto.

In the accompanying drawings which illustrate one of the embodiments of the invention, Figure 1 is a partial section of the pump on line 1—1 of Fig. 2, looking in the direction indicated by the arrows; Fig. 2 is a section on line 2—2 of Fig. 1 looking in the direction indicated by the arrows; and Fig. 3 is a perspective view of one of the cylinders.

In carrying out the invention, I employ a reciprocating pump of the single-acting type and therefore, in order to obtain a discharge with substantially no pulsation, I employ a plurality of pumps and connect the pistons thereof with a multi-throw crank shaft. The crank shaft is adapted to be driven by a suitable high speed prime mover, such as an elastic fluid turbine. As an illustration, I may use a turbine running at 5000 r. p. m., which drives the crank shaft at a suitably reduced speed through a worm gearing. In practice I employ a ten to one reduction so that the effective number of delivery strokes per minute of the three-piston pump will be 1500. From this it follows that a substantially constant pressure of delivery can be maintained without perceptible pulsations, thus rendering the pump well adapted for shaft bearings where a constant pressure is important.

Referring to the drawings, 1 represents the pump, 2 the turbine and 3 the gear casing. The latter is provided with a base extension 4 projecting laterally therefrom, Fig. 1, upon which the pump is mounted in an upright position. The pump comprises a frame 5 which supports the piston cylinder 6. The frame is preferably an integral casting containing a crank chamber section 7, a section 8 for the cross-heads and a suction chamber section 9 common to all the piston cylinders. The base of the frame is provided with flanges 10 at its front and rear which receive bolts for securing the pump in the base extension 4. At the sides of the crank casing are bearings 12 bolted to the frame, in which the crank shaft 13 is mounted. To permit access to the crank casing the front and rear walls comprise removable cover plates 14. The front and rear walls of the suction chamber for a similar reason also comprise removable cover plates 15. The piston cylinders 6 are made separate and are mounted in the upper wall of the suction chamber. This wall is provided with tapped openings 16 into which the shouldered and threaded ends of the cylinders extend. The upper ends of the cylinders are reduced in diameter to form shoulders 17. These reduced ends extend through registering openings in the top and bottom walls of the discharge chamber 18, and projecting beyond the top wall receive the nuts 19 which hold the discharge chamber in place on the shoulders 17. The rear wall of the discharge chamber is provided with a tapped boss 20 into which screws the threaded end of the delivery pipe 21, Fig. 2. Communication between the cylinders and the discharge chamber is provided through ports 22, one of which is shown clearly in Fig. 3.

Each piston 23 is hollow and its head is provided with a central port 24 controlled by a valve $25^a$ formed on or secured to the inner end of the piston rod 25. The rod projects into the piston from the inlet end thereof and is united with the piston through a lost-motion connection which comprises a lip 26 adapted to be engaged by the shoulder 27 on the rod. By this arrangement, as the rod moves out of the cylinder a short distance it opens the valve $25^a$ and uncovers the port 24. Subsequently the shoulder engages the lip 26, causing the piston to move with the rod. The port now being open, the fluid in the hollow piston is transferred through the port from the inlet to the discharge side of the head so that on the instroke, the fluid will be forced out of the cylinder by the piston, whose port is closed by the valve at the initial part of the instroke. The cylinder is provided with a head 28 having a port that is controlled by a spring-pressed ball valve 29, which opens outwardly from the piston cylinder and permits the fluid to pass through the laterally extending ports 22 to the discharge chamber 18. The valve 29 is normally seated by a follower 30 arranged within the screw plug 32 which screws into the upper end of the cylinder and incloses the spring 31 that acts through the follower upon the ball valve.

The piston rods are connected to their respective crank pins by cross heads 33 and connecting rods 34. The cross heads are designed with special reference to the high speed at which the pump is adapted to work. Each comprises two pieces 35 split axially and secured together by the threaded sleeve 36. In the plane of division of the pieces is formed a socket and a shouldered bore to receive, respectively, the spherical end of the connecting rod and the shouldered end of the piston rod. The shoulders of the cross head and the connecting rod form a thrust-joint, which reduces to a minimum the wear due to the rapid change in the direction of reciprocation of the moving parts. The guides or cylinders for the cross heads are carefully finished and the sleeve of each cross head makes a working fit therewith. In order to screw or unscrew the sleeve 36, perforations 37 are arranged in the periphery of the latter to receive the teeth of a spanner wrench. Intermediate the suction chamber and each cross head is a packing. This comprises a stationary shell 38 fitted in the upper end of the cross head guide and containing a packing ring 39 of suitable material. Extending into the shell and bearing against the packing ring is a gland 40. This is made in two parts by dividing it longitudinally so that it can be readily assembled or removed without withdrawing the piston rod. The gland is adjusted and held in place by means of a nut 41 that screws on the lower end of the piston cylinder, as shown in Figs. 1 and 3. The nut is slotted at 42 to form the suction port or inlet of the cylinder. A number of perforations are provided in the nut to receive a spanner wrench, these perforations also serving as inlet passages communicating with the cylinder. To remove the packing the nut 41 is screwed back on the inner end of the cylinder a sufficient distance to permit the two-part gland to be withdrawn and the parts removed in a lateral direction, after which the packing can be removed.

The crank shaft of the pump extends into the gear casing 3 and keyed thereto is the worm wheel 43. The latter is adapted to run in lubricant, and for this purpose the casing is made fluid-tight. The three walls of the casing are formed integral with the base, and the fourth comprises a removable plate 44 by which access is had to the worm gearing. The opening through which the shaft extends is provided with a suitable packing 45 to prevent the leakage of lubricant from the casing. Owing to the high speed of rotation of the crank shaft efficient provision for lubricant is required. On the crank shaft is provided a deflector 46 which throws off lubricant upon the wall of the crank casing at 47 and here it flows down and is collected by a device 48. From the collecting device the lubricant discharges through openings 49 therein into a pocket 50 extending along the top of the lining 51 of the shaft bearing. From this pocket lubricant passes through openings 52 in the lining and lubricates the internal surface thereof which is provided with distributing grooves 53. The exhaust lubricant passes back to the crank casing through the opening 54 and the passage 55.

Arranged over the gear wheel and meshing therewith is a worm 56 on the turbine shaft 57. The gear casing is provided with a cover 58 which separates along the axis of the turbine shaft. At each side of the worm are bearings 59 and 60 forming part of the gear casing. In the bearing 59, located between the turbine and the worm, is a lining or sleeve 61 which may be of ordinary construction, permitting the shaft to center itself. In the second bearing is a lining 62 which is provided with a plurality of annular shoulders 63 that engage with corresponding shoulders formed on the shaft, the arrangement being such as to take the thrust due to the worm. The lining of the thrust bearing is held in place and adjusted by means of the bolts 64. In order to lubricate the thrust bearing, a longitudinal passage 65 is arranged above the shaft which communicates with the grooves formed between the shoulders of the lining through openings 66. The passage 65 is supplied from a longitudinally extending trough 67 located above the worm so as to receive the lubricant that is thrown off from the worm and shaft due to their high speed. The lubricant collecting in the trough, discharges continuously into the passage communicating with the grooves of the lining and thereby keeps the thrust bearing properly lubricated. Covered oil pockets 68 are arranged in the cover of the gear casing over each bearing so that the same can be supplied with lubricant upon initial starting of the pump. The trough 67 also supplies lubricant to the bearing 59.

The turbine for driving the pump may be of any approved construction. The one shown is of the well-known Curtis type. Motive fluid is supplied to the turbine through a conduit 69 communicating with nozzles arranged in the plate 70. These nozzles discharge the fluid successively against the wheel and intermediate buckets

71 and 72, and it then passes to the exhaust conduit 73 which may connect with the condenser of the main turbine. The turbine casing is provided with an annular shoulder 74 which engages with the partial annular shoulder 75 on the gear casing. The turbine is supported on this latter shoulder by means of bolts 76, one of which is shown in dotted lines, Fig. 2. By this arrangement the pump, gear and turbine forms a self-contained structure of compact and substantial construction.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative, and that the invention can be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. A pump comprising a plurality of pistons, cylinders in which the pistons operate, each of said cylinders having a shouldered end portion, a valve chamber in said end portion, an axially arranged port between the interior of the cylinder and the valve chamber, a valve controlling the flow through the port, a discharge chamber, the walls of which have openings to receive the ends of the cylinders, nuts on the ends of the cylinders which secure said chamber between them and said shoulders, there being ports in the walls of said ends between the valve chamber and the interior of the discharge chamber, a suction chamber attached to the other ends of the cylinders, valves controlling the flow between the suction chamber and the interior of each of the cylinders, and means for reciprocating the pistons.

2. A pump comprising a plurality of cylinders which are threaded at their ends, a structure containing a suction chamber and having tapped openings into which corresponding ends of the cylinders screw, a discharge chamber, the opposite walls of which have registering openings through which the ends of the cylinders project, cap nuts on the projecting threaded ends of the cylinders for securing the discharge chamber in place, and pistons for the cylinders.

3. A pump comprising a plurality of cylinders which are each shouldered at one end, a structure containing a chamber common to all the cylinders, which rests upon the shoulders thereof, nuts for securing the structure and cylinders together, ports in the cylinders communicating with the chamber, a valve in each cylinder controlling the flow of fluid through the ports of the latter, and pistons for the cylinders.

4. A pump comprising a structure containing a suction chamber, a cylinder mounted at one end on a wall of the chamber and having a projection extending through the wall into the chamber, a piston in the cylinder, a piston rod extending through the opposite wall of the chamber, a packing for the rod located in the latter wall, a gland on the rod for the packing, a nut on the projection which engages one end of the gland to adjust it and hold it in position, and a cover-plate on the suction chamber which affords access to the gland and to the packing.

5. A pump comprising a plurality of pump cylinders, a frame supporting the cylinders comprising a cross-head section and a suction chamber section, cross-heads in the first section, pistons in the cylinders, piston rods connecting the pistons and cross-heads, and a packing for each rod which is located in the cross-head section.

6. A pump comprising a cylinder, a structure containing a chamber through one wall of which the cylinder extends, a piston in the cylinder, a piston rod extending through the opposite wall of the chamber and provided with a shouldered end, a packing for the rod arranged in said latter wall, a two-part gland for the packing assembled around the piston rod, means for holding the gland in place, a guide in said wall beyond the packing, a two-part crosshead arranged for movement in the guide, means for clamping the parts of the crosshead to the shouldered end of the piston rod, and means for reciprocating the crosshead.

7. A pump comprising a cylinder, a structure containing a chamber arranged at one end of the cylinder and through one wall of which the cylinder extends, a piston rod extending through the wall of the chamber at a point opposite to the cylinder, a packing for the rod located at the point where the latter extends through the chamber wall, a two-part gland assembled around the rod, and a nut which screws on the cylinder for holding the gland in place.

8. A pump comprising a frame composed of a crank section and a suction chamber section connected by a cross-head section, a plurality of cylinders supported by and communicating with said chamber section, pistons in the cylinders, crossheads in the cross-head section, rods connecting the pistons and crossheads, a crank-shaft mounted in the crank section, and connecting rods between the cranks and the crossheads.

In witness whereof, I have hereunto set my hand this fourth day of April, 1906.

JOHN G. CALLAN.

Witnesses:
JOHN A. MCMANUS, Jr.,
PHILIP F. HARRINGTON.