

Dec. 29, 1931.

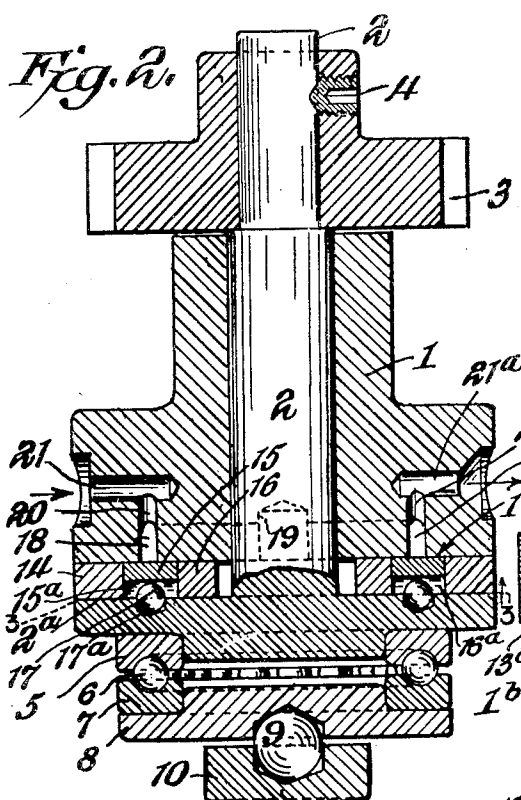
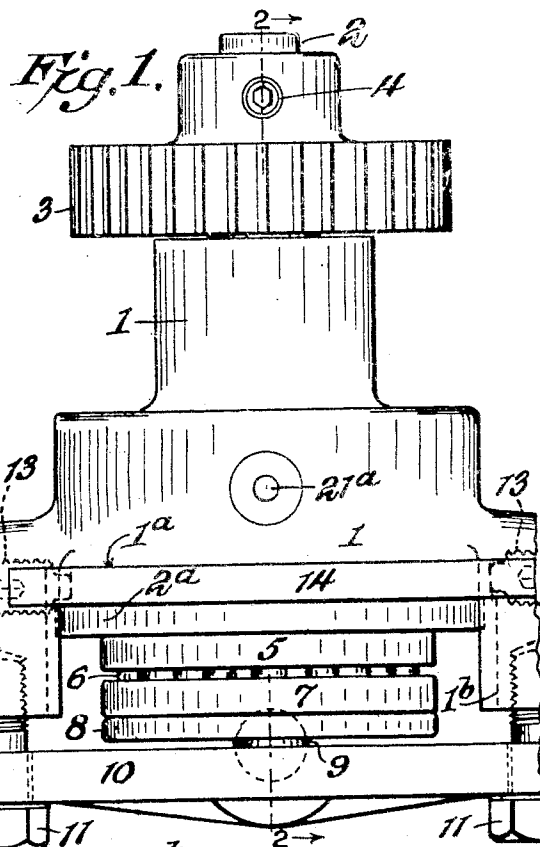
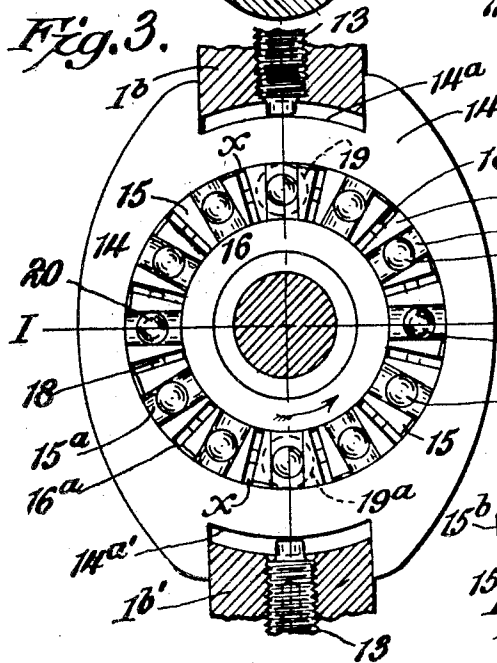
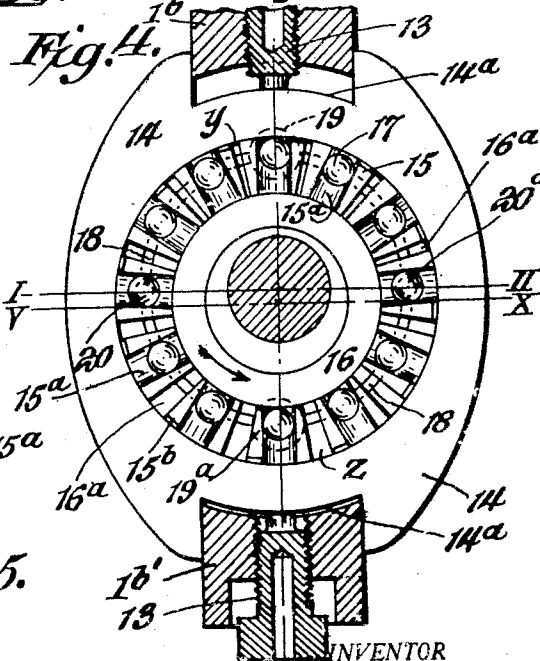
B. D. COPPAGE

1,838,252

ROTARY PUMP OR LIQUID FLOW REGULATOR

Filed April 7, 1930

4 Sheets-Sheet 1



INVENTOR
Benjamin D. Coppage,
 BY *Mauro & Lewis*
 ATTORNEYS

Dec. 29, 1931.

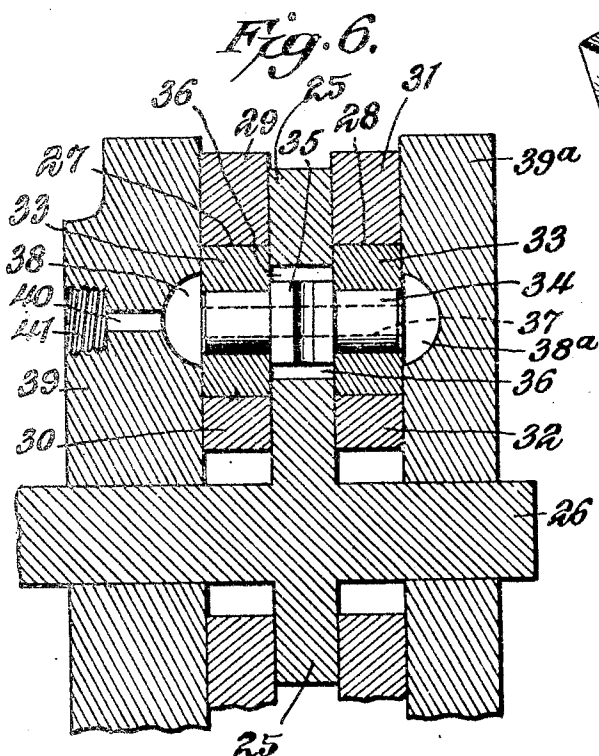
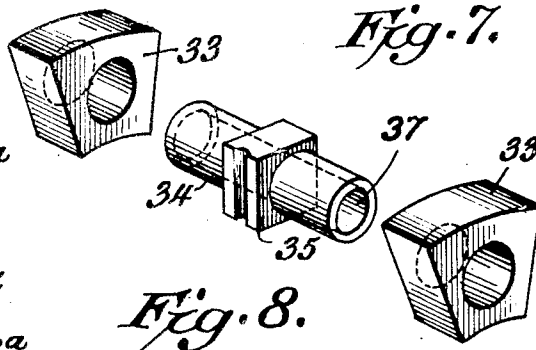
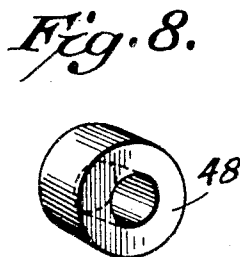
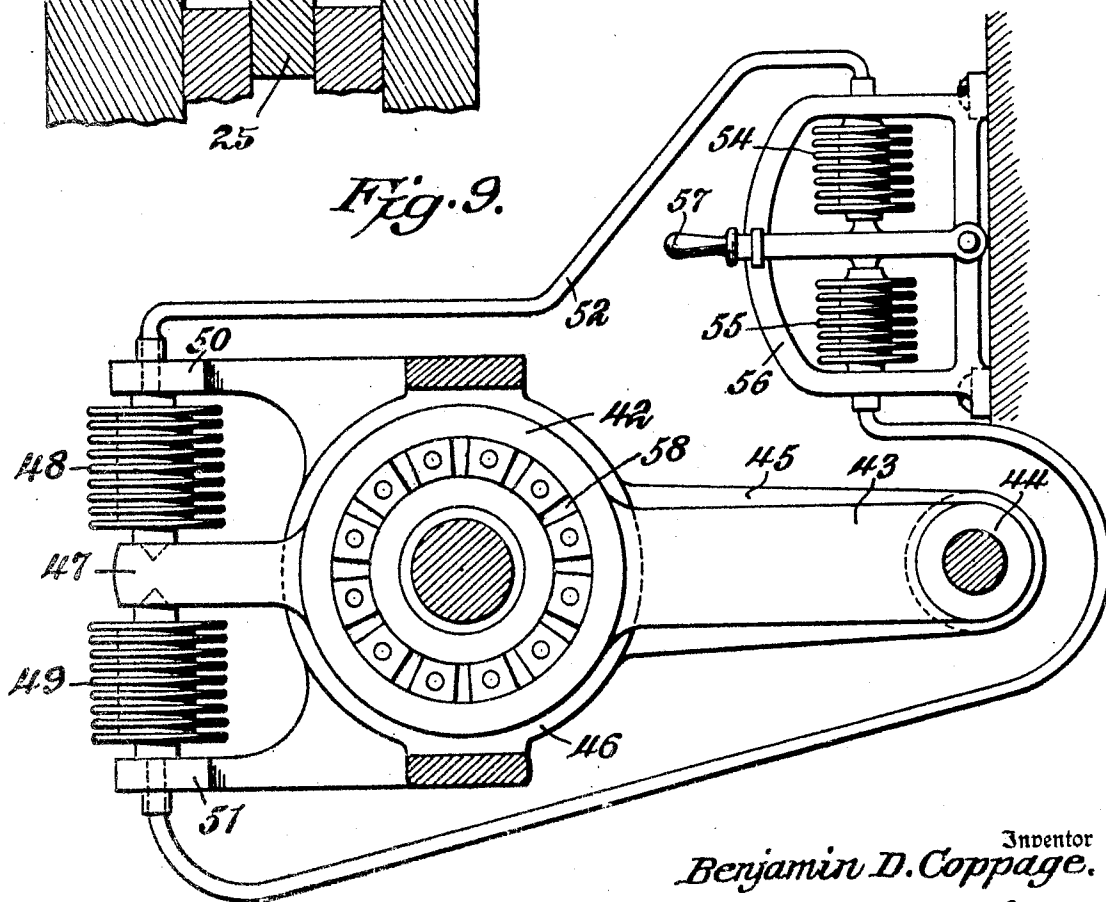
B. D. COPPAGE

1,838,252

ROTARY PUMP OR LIQUID FLOW REGULATOR

Filed April 7, 1930

4 Sheets-Sheet 2



Inventor
Benjamin D. Coppage.
Mauro + Lewis

Attorney

Dec. 29, 1931.

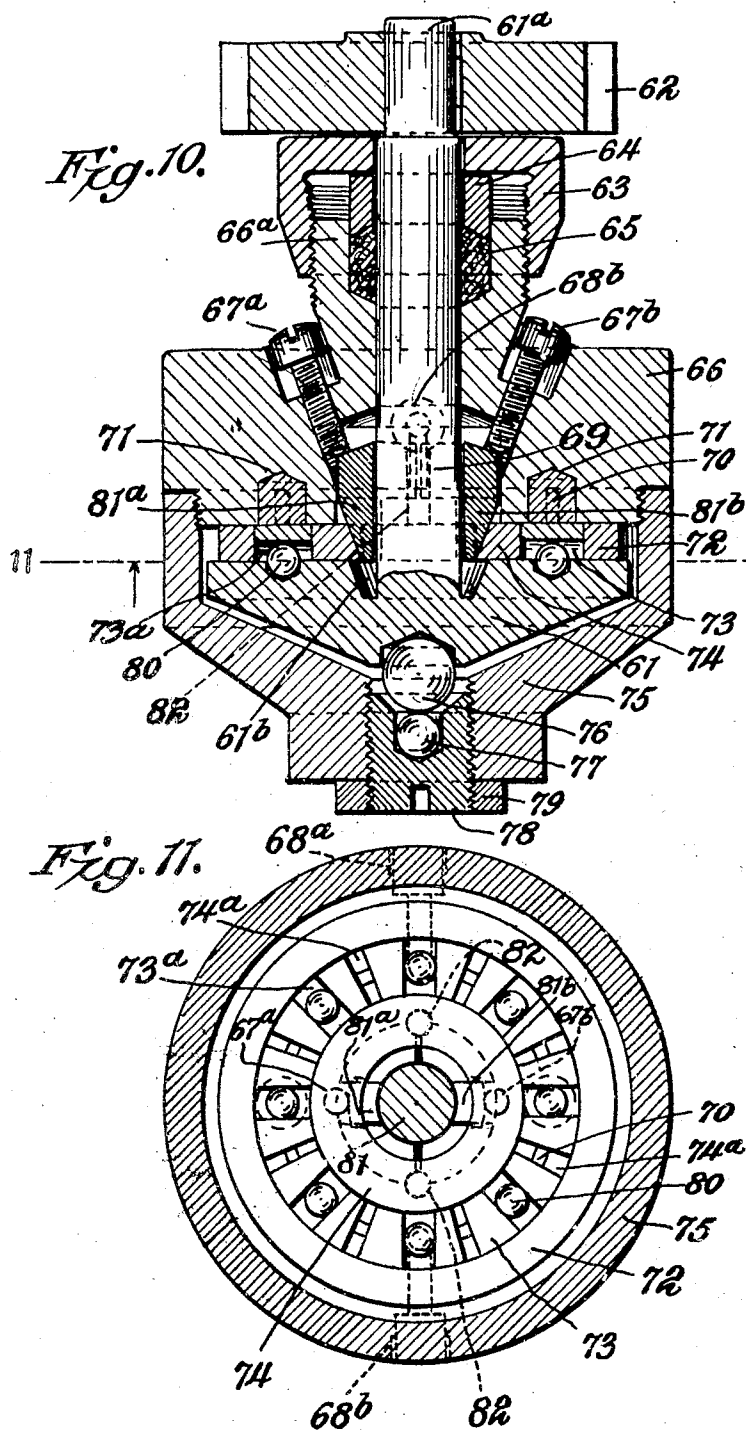
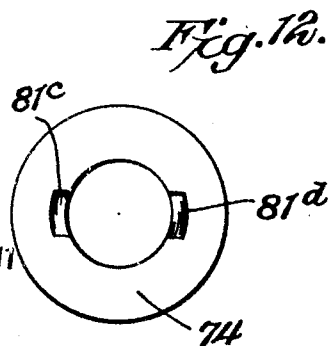
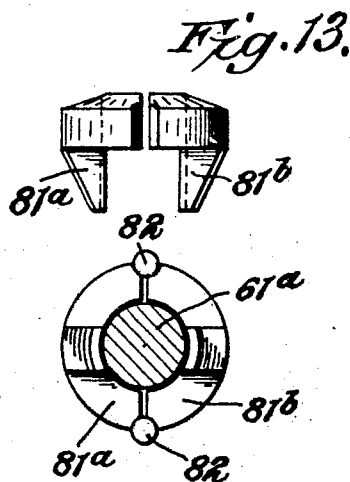
B. D. COPPAGE

1,838,252

ROTARY PUMP OR LIQUID FLOW REGULATOR

Filed April 7, 1930

4 Sheets-Sheet 3



INVENTOR,
Benjamin D. Coppage,

BY *Morris & Lewis*
ATTORNEYS.

Dec. 29, 1931.

B. D. COPPAGE

1,838,252

ROTARY PUMP OR LIQUID FLOW REGULATOR

Filed April 7, 1930

4 Sheets-Sheet 4

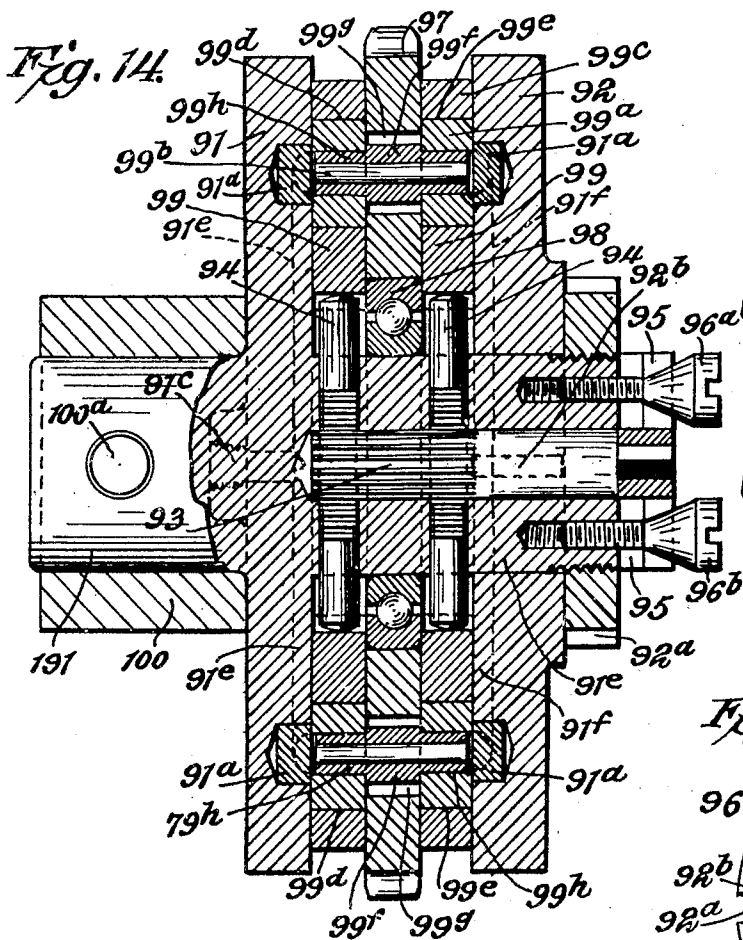


Fig. 15.

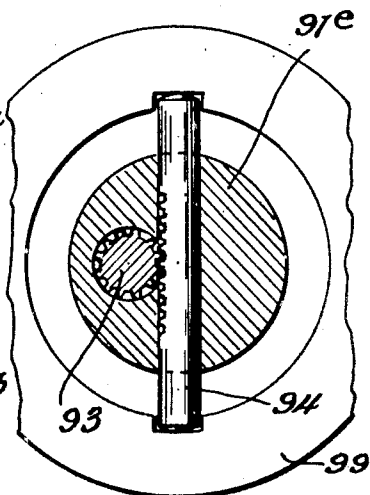


Fig. 16.

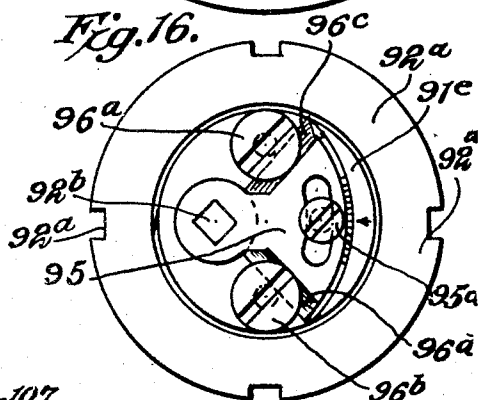


Fig. 17.

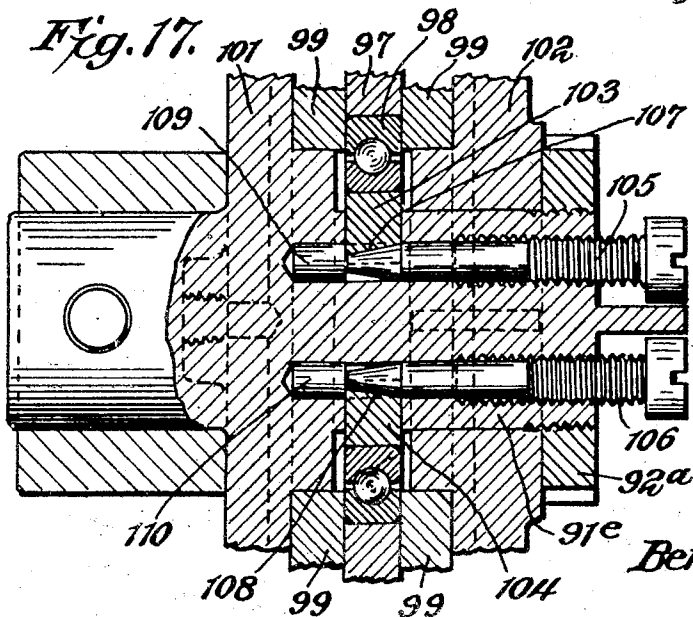
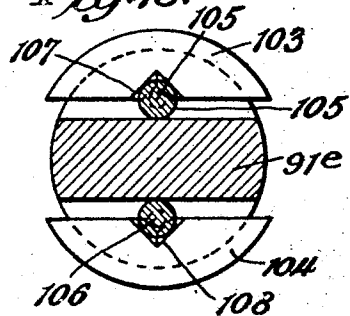


Fig. 18.



INVENTOR

Benjamin D. Coppage,

BY

Mauro & Lewis

ATTORNEYS.

UNITED STATES PATENT OFFICE

BENJAMIN DENVER COPPAGE, OF WILMINGTON, DELAWARE

ROTARY PUMP OR LIQUID FLOW REGULATOR

Application filed April 7, 1930. Serial No. 442,255.

This invention relates to rotary pumps, meters, engines or the like, of the positive displacement or piston type, and has for its chief object to produce a pump or positive liquid-flow regulator, whereby the volume or rate of flow of a liquid may be controlled with extreme accuracy, and especially adapted for use in the manufacture of rayon as a spinning pump for feeding the viscous cellulose liquid to the spinners, in which operation the feeding must be effected with meticulous exactitude.

In such use the pump functions primarily as a measuring device which, while it may increase or decrease the pressure, operates to convey a determinate volume of material.

A more general object of the invention is the producing of a rotary pump or the like, having true sliding piston blocks which slidably engage the walls of a working chamber through a contacting surface of substantial area, as distinguished from roller pistons, and in which the number and the spacing of the pistons are to a large extent independent of other structural features; the result being that a large number of pistons may be used and the spacing may be reduced to a point where adjacent pistons may be made to come as close together as desired in discharging the contents of the working chamber between them.

Another object of the invention is to provide a pump or the like of the above type, which is simple and sturdy in construction, and capable of being made of small dimensions yet with a high degree of accuracy.

Other objects and advantages of the invention will be apparent from the following specification and the drawings accompanying the same.

In the drawings:

Fig. 1 is a side view of a preferred embodiment of the invention;

Fig. 2 is a section on the line 2—2 of Fig. 1;

Fig. 3 is a section on the line 3—3 of Fig. 2 with the parts adjusted to neutral position;

Fig. 4 is a section similar to that of Fig. 3

but with the parts adjusted to pumping position;

Fig. 5 is a detail view of one of the piston blocks;

Fig. 6 is a fragmentary axial cross section of a modification in the form of a double chambered pump with a single piston carrier;

Fig. 7 is a detailed perspective view of a hollow carrier pin and its associated pistons showing the pistons removed from the ends of the pin;

Fig. 8 is a perspective view of a roller piston adapted for use in the arrangement of Fig. 6;

Fig. 9 shows a modified arrangement for varying the eccentricity of the working chamber by remote control;

Figs. 10—13 illustrate an enclosed type pump constructed according to the invention;

Fig. 10 being a central vertical section thereof;

Fig. 11 being a horizontal section thereof on line 11—11 of Fig. 10;

Fig. 12 being a detail of the inner chamber ring; and

Fig. 13 showing details of the adjusting wedges;

Figs. 14—18 illustrate a duplex type of pump constructed according to the invention;

Fig. 14 being a vertical section of one form of such pump, and Figs. 15 and 16 details thereof;

Fig. 17 being a vertical section of another form of duplex pump and Fig. 18 a detail thereof.

Referring to the drawings in detail, and first to Figs. 1 to 4, the main body or stator portion 1 is fitted with a driving shaft 2, journaled therein and arranged to be driven by a pinion 3 fixed on the upper end of the shaft by a set-screw 4. At its lower end, the shaft 2 carries as an integral part thereof, or otherwise fixed thereto, a disk-shaped piston carrier 2^a, the lower part of which bears pivotally through the medium of a ball thrust bearing 5—6—7, against a bearing plate 8, which plate is in turn mounted upon a stationary yoke 10 through the medium of a ball 9.

The yoke 10 is secured to the lower end of

the main stator portion 1 by bolts 11 screwed into lugs 1^b carried by said stator portion 1, bolts 11 being secured against turning by lock washers 12. Yoke 10 is thus fixed in relation to, and forms a part of, the stator.

Slidably mounted between the lower flat plane surface of the stator member 1 and the upper flat plane surface of the carrier member 2^a, is an outer ring member 14, and within it is an inner ring member 16, both ring members surrounding the driving shaft 2 and fitted between the flat parallel surfaces of the members 1 and 2^a with a fluid tight fit, thus forming an annular fluid-tight working chamber 16^a. Within this working chamber are slidably fitted a plurality of sector-shaped periphery pistons 15. These, being all of the same radial length, serve to hold the inner ring 16 concentric with the outer ring 14.

The outer ring member 14 is so mounted as to be adjustable transversely by means of adjusting screws 13, which are threaded into the lugs 1^b with their inner ends bearing against said outer ring member 14 at diametrically opposite points, the outer heads of the said adjusting screws terminating in indexed heads 13^a.

Pistons 15 are connected with the piston carrier 2^a for rotation therewith and for radial movement relative thereto, by means of driving balls 17, nested in sockets 17^a in the carrier 2^a and fitting in radial grooves 15^a in the pistons 15. In order to permit the fluid contents of the grooves 15^a to be freely displaced from one side to the other of the balls 17 as the balls move in the grooves relative to the ends of the grooves, each piston is provided with vents 15^b and 15^c between the ends of the groove and one of the ends or working surfaces of the piston (Fig. 5).

An annular groove or channel 18—18^a is formed in the main stator 1. Said channel is closed at diametrically opposite points by plugs 19—19^a to form an intake channel or passage 18 and a discharge channel or passage 18^a separated from each other, each passage being in communication with the working chamber 16^a through approximately one-half the length of the chamber on opposite sides of the closing or separating plugs 19—19^a. The intake passage 18 communicates through a duct 20 with an intake opening 21; while the discharge passage 18^a communicates through duct 20^a with a discharge opening 21^a. The member 1, outer and inner rings 14 and 16, and the yoke 10 with its bearing members 7—8, constitute the stator portion of the pump; while the shaft 2, carrier 2^a and pistons 15 constitute the rotor portion.

The hemi-spherical sockets 17^a in the carrier 2^a are spaced equidistantly from, and equiangularly about, the axis of the shaft 2, so that upon rotation of the shaft, the balls 17, and with them the sector-shaped pistons, will be carried around through the annular

working chamber 16^a in constant angular relation to each other about the axis of rotation of the shaft 2 and carrier 2^a. Thus with the outer ring member 14 adjusted as in Fig. 3, to hold the outer and inner ring members, and consequently the annular working chamber 16^a, concentric with the shaft 2, the pistons 15 will remain equally spaced, as shown in Fig. 3, throughout their travel through the working chamber. But when the outer ring member 14 is adjusted by means of screws 13 to the position shown in Fig. 4, the annular working chamber 16^a is moved into a position eccentric to shaft 2, which causes the pistons to separate as they pass from the top of the chamber (Fig. 4) to the bottom, and to approach each other as they move from bottom to top; this being due to the fact that their radial distance from the axis of the shaft 2 is varied by the eccentricity of the annular chamber, while their angular spacing is controlled by the balls 17 and sockets 17^a. Thus the angular spacing of the pistons varies somewhat, but not to the extent to which adjacent pistons separate.

The operation of the device as shown in Figs. 1 to 4 is as follows:

Assuming first that the parts are in the position indicated in Fig. 3, rotation of the driving shaft 2 in a counter-clockwise direction as indicated by the arrow, will cause the piston carrier 2^a (Figs. 1 and 2) to rotate, carrying with it the pistons 15; motion being transmitted from the carrier 2^a to the pistons through the balls 17. As the annular working chamber 16^a is concentric with the shaft 2, the pistons slide around through the working chamber at a constant radial distance from the axis of the shaft; and as they are held in constant angular relation about said axis, they are maintained equally spaced; and therefore no change takes place in the volume of the space between the pistons.

Assuming now, however, that the parts are in the position of adjustment shown in Fig. 4, that is, with both the adjusting screws 13 moved downwardly so as to move the outer ring member 14 into the position shown (Fig. 4), so that the annular working chamber 16^a is eccentric to the driving shaft 2, rotation of the driving shaft in the same direction as before will cause the piston carrier 2^a to rotate the driving balls 17 about the axis of the shaft 2 carrying the pistons 15 around through the chamber 16^a in a circular path that is eccentric to shaft 2. As the pistons 15 move in a counter-clockwise direction under the intake passage 18 from the upper plug 19 toward the lower plug 19^a, they gradually increase in radial distance from the shaft. This causes them to separate progressively and gradually as they approach the lower plug 19^a, which is the position of maximum eccentricity. Conversely, as the pistons con-

the wedge screws 96^a—96^b threaded into the end of the stub-shaft portion 91^a of the stator and engaging complementary inclined surface extensions 96^c—96^d on the lever 95. A set-screw 95^a is provided for locking the lever in adjusted position.

The operation of the arrangement of Figs. 14 to 16 is the same as that of Figs. 6 to 8 except for the adjustment of the eccentricity of the working chambers. As will be clear from the foregoing description of Figs. 14 to 16, this adjustment is made by turning the wedge screws 96^a—96^b in opposite directions, for example 96^a out, and 96^b in, the inwardly moving wedge screw 96^b acting on the inclined surface 96^d to move the lever 95 upwardly (as viewed in Fig. 16), while the outwardly moving screw 96^a permits the inclined surface extension 96^c to move upwardly. This upward movement of the lever 95 imparts a counter-clockwise rotation to the pinion 93 (as viewed in Figs. 15 and 16) which in turn imparts an upward movement to the plunger racks 94 to move the inner rings 99, and with them the working chambers 99^a—99^c, transversely of the stub shaft 91^a and into a position eccentric of the axis of rotation of the rotor 97. After the adjustment is completed, the parts are locked in adjusted position by means of the set-screw 95^a.

The modification shown in Figs. 17 and 18 is similar in structure and operation to that of Figs. 14 to 16, except that the working chambers remain stationary in relation to the stator members 101—102 while the rotor 97 with its ball bearing mounting 98 is arranged to be adjusted transversely of the stub shaft portion 91^a. This adjustment is accomplished by means of the radially movable sector elements 103—104 inserted between the stub shaft member 91^a and the ring-shaped ball bearing 98 of the sprocket rotor 97, and arranged to be shifted transversely of the stub-shaft by means of a pair of taper ended adjusting screws 105—106 threaded into the stub-shaft with their tapered ends in wedging engagement with complementary inclined recesses 107—108 in the sector elements 103—104 respectively, the stator member 101 being provided with recesses 109—110 to permit passage of the ends of the screws in the adjusting movement. From the above, it will be apparent that upon adjustment of the screws 105—106 in opposite directions, for example 105 in and 106 out, the outward movement of the screw 106 will permit the segment element 104 to move upwardly while the inward movement of the screw 105 will exert a wedging effect between its tapered end and the inclined recess 107 to force the segment element 103 upwardly and with it the ball bearing 98 and rotor 97, thus shifting the rotor into a position eccentric to the stator and working chambers.

What is claimed is:—

1. A rotary pump or the like comprising a stator member having a flat plane surface, a driving shaft rotatably mounted in said stator, a piston carrier fixed to the driving shaft and having a flat plane surface parallel to and spaced from said stator plane surface, inner and outer ring members slidably mounted between said stator and carrier each ring member having opposite parallel plane bearing surfaces respectively engaging the said parallel plane surfaces of the stator and carrier, sector shaped pistons slidably mounted between said ring members and said stator and carrier, and driving balls for said pistons each engaging with the carrier through a socket in the carrier and engaging with a piston through a radial groove therein.

2. A rotary pump or the like comprising a stator, a rotor, a pair of inner and outer ring members arranged to form the inner and outer walls of a circular working cylinder and slidably mounted in the stator to effect movement of the working cylinder transversely of the rotor, and means within the inner ring member for effecting sliding movement of the same.

3. A rotary pump or the like comprising a stator, inner and outer ring members arranged to form the inner and outer side walls of an annular working chamber of which the stator body forms the end walls, pistons fitted within the working chamber, a rotor, driving connections between said rotor and said pistons, and means for moving the said inner ring member to shift the working chamber transversely of the axis of the rotor.

4. A rotary pump or the like comprising a stator, an annular piston chamber composed of inner and outer rings, segmental pistons fitted between and in constant contact with both rings, inlet and outlet ports communicating with said chamber, a rotor, driving connections between the same and said pistons, and means for positioning said chamber more or less eccentrically with respect to the axis of said rotor.

5. A rotary pump or the like comprising a stator, an annular piston chamber formed between an inner and an outer ring, one of its parallel faces being formed by a stator element and the other by a rotor element, pistons fitting closely between said rings and in contact therewith, said pistons being slidable towards and from each other, driving connections for said pistons carried by a rotor element, and means for adjusting said annular chamber to varying degrees of eccentricity with respect to the axis of the rotor shaft.

6. A rotary pump or the like comprising a stator, a rotor, an annular piston chamber formed between two concentric ring members and positioned between a stator element

and a rotor element, means for adjusting said chamber with reference to the axis of the rotor, pistons closely fitted between said rings and between the stator element and rotor element constituting walls of said chamber, and connections whereby said pistons are driven continuously all in the same direction while caused to shift their positions relatively to each other to increase and to decrease alternately the space between adjacent pistons.

7. A rotary pump or the like as specified in claim 6 having means for varying the eccentricity of said annular piston chamber with respect to the axis of the rotor.

In testimony whereof I have signed this specification.

BENJAMIN DENVER COPPAGE.