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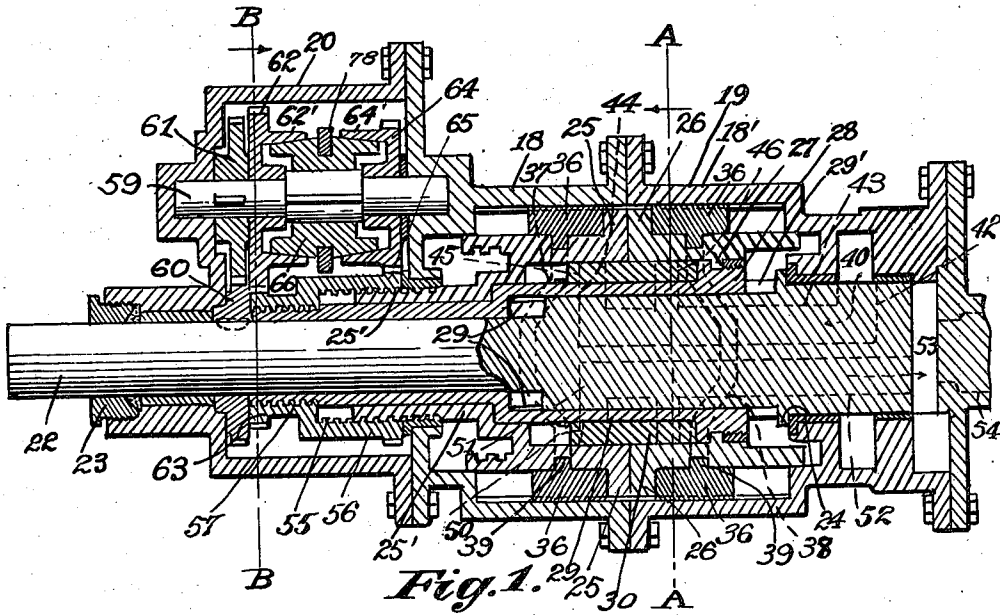
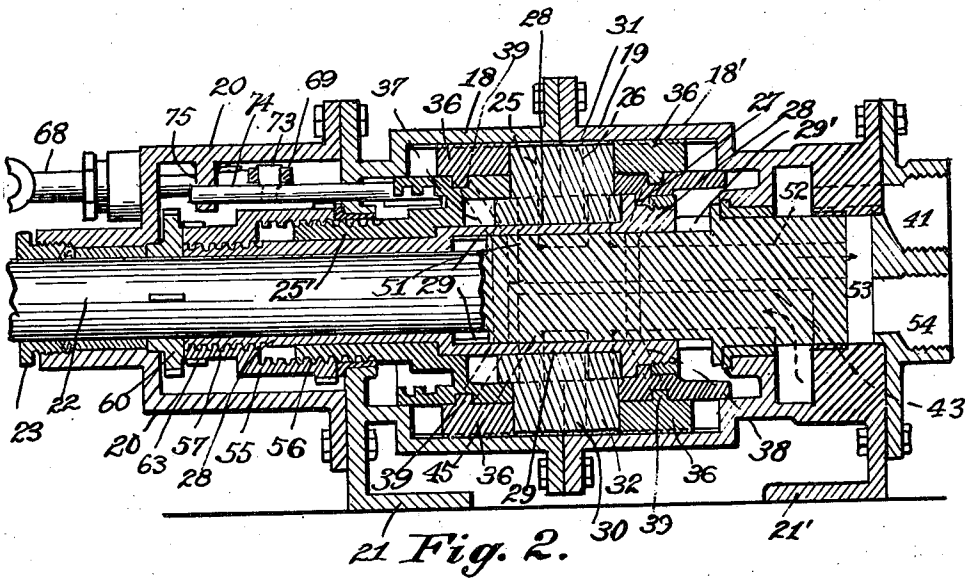
ROTARY PUMP.

APPLICATION FILED JUNE 21, 1916.

Patented Aug. 20, 1918.

4 SHEETS—SHEET 1.

1,276,372.



Inventor
Sinclair J. Johnson
by his Attorney *John O. Seifert*

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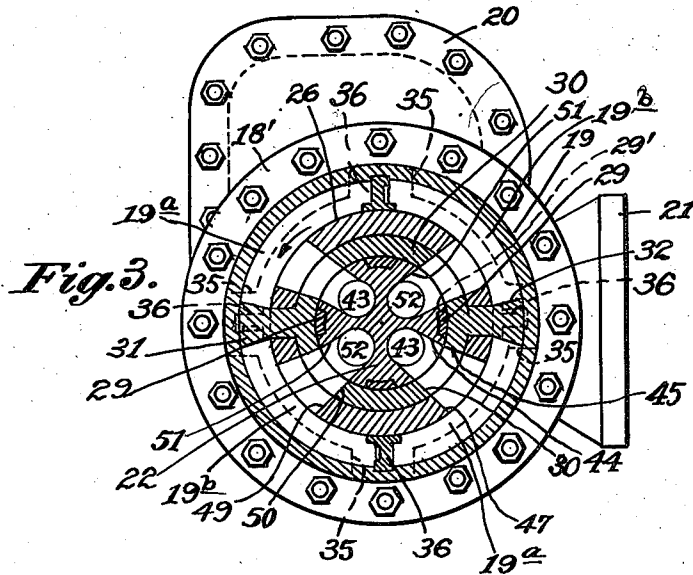
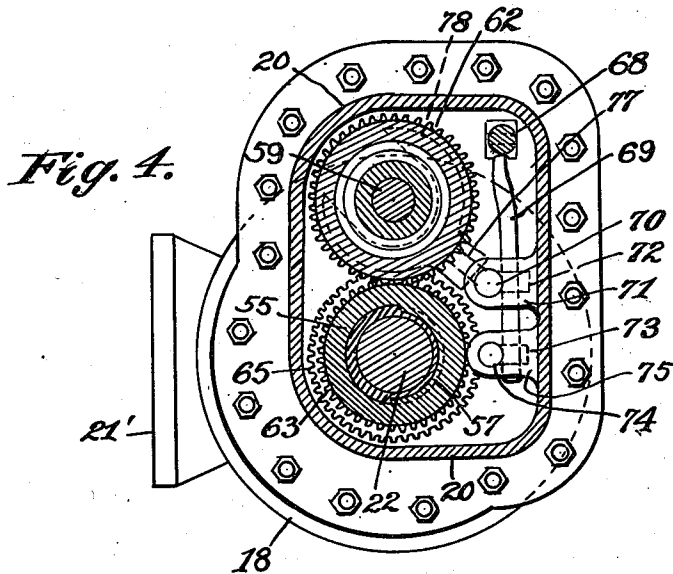
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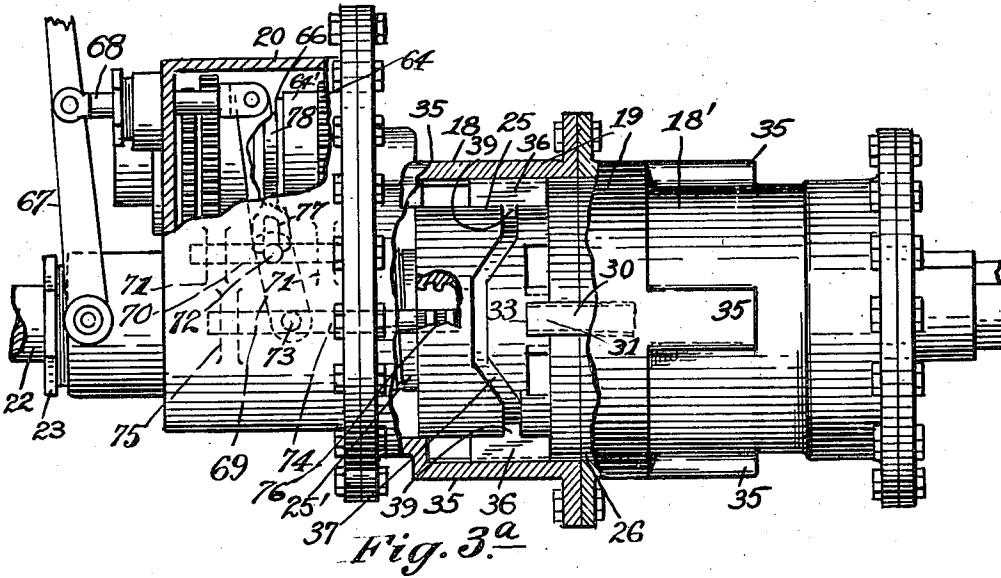
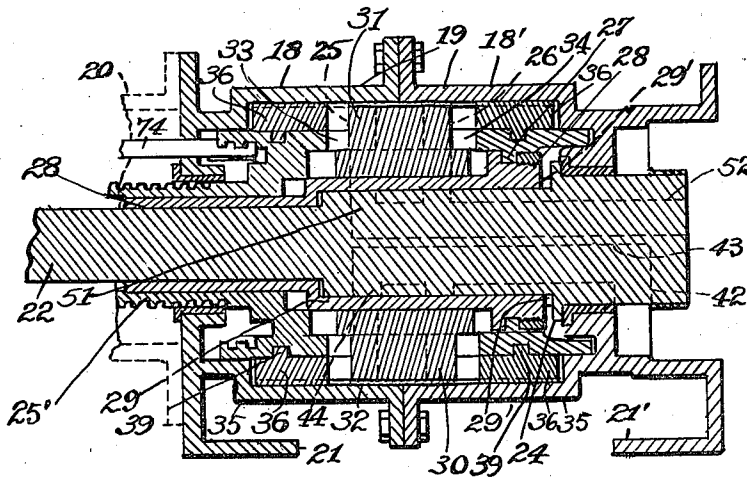
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4 SHEETS—SHEET 4.

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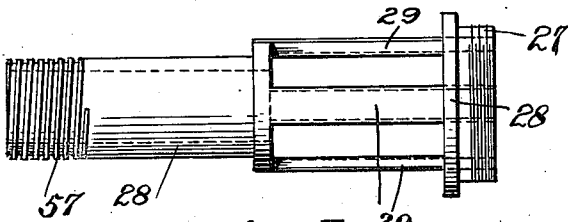


Fig. 5.

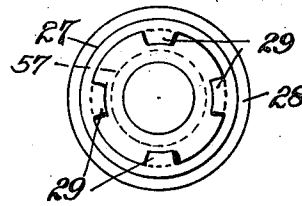


Fig. 6.

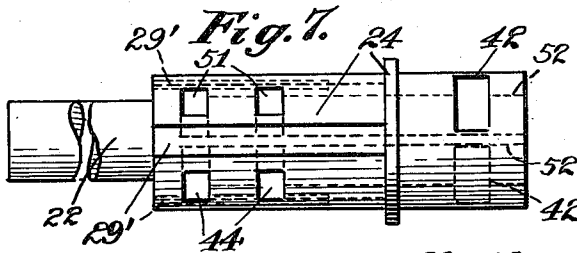


Fig. 7.

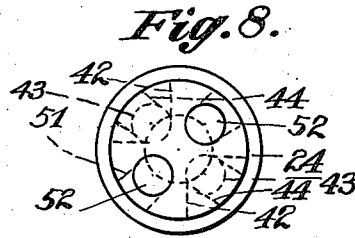


Fig. 8.

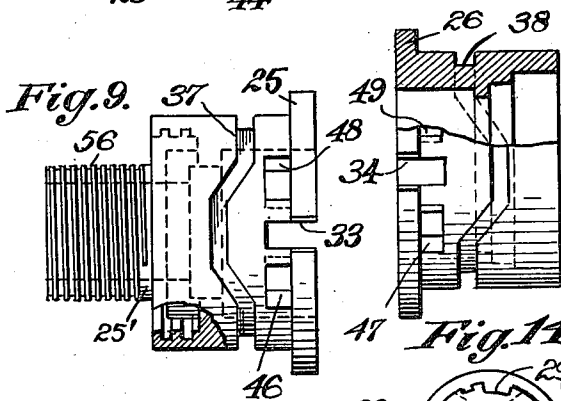


Fig. 9.

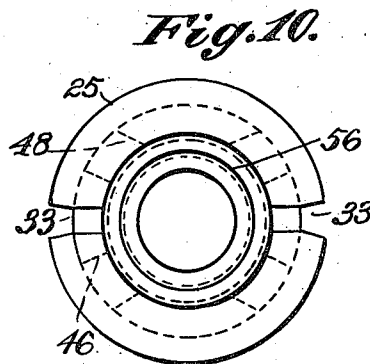


Fig. 10.

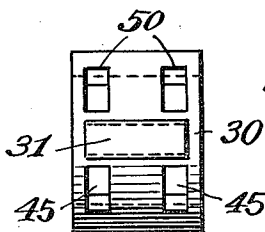


Fig. 12.

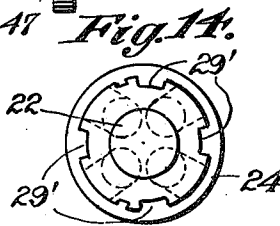


Fig. 11.

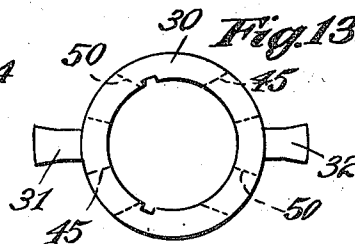


Fig. 13.

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UNITED STATES PATENT OFFICE.

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ROTARY PUMP.

1,276,372.

Specification of Letters Patent.

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Application filed June 21, 1916. Serial No. 104,844.

To all whom it may concern:

Be it known that I, SINCLAIR J. JOHNSON, a citizen of the United States, residing in Montclair, in the county of Essex and State of New Jersey, have invented new and useful Improvements in Rotary Pumps, of which the following is a specification.

This invention relates to rotary fluid pumps, and it is the primary object of the invention to improve the general construction of pumps of this type to increase the efficiency thereof.

It is a further object of the invention to provide a rotary fluid pump in which all of the moving parts are at all times in equilibrium to prevent binding and the consequent frictional retardation and wear of said moving parts.

Another object of the invention is to provide improved means to vary the working area of the piston chamber and pistons, the said means being adapted to be manually controlled, whereby the capacity of the pump may be changed at will.

Other objects and advantages will hereinafter appear.

In carrying out the invention I provide a cylinder having an annular enlargement to constitute a piston chamber, a shaft rotatable in the cylinder carrying a wing piston or pistons to revolve in the piston chamber with abutments reciprocable transversely of the piston chamber during the rotation of the shaft to intercept the path of movement of the piston or pistons, the said piston chamber having a fluid inlet and outlet through the shaft on opposite sides of the pistons. The shaft also carries annular means to engage in the piston chamber, said means being longitudinally adjustable to vary the working area of the piston chamber and piston or pistons by a nut having screw threaded connection with said annular means and adapted to be rotated from the shaft through gearing at different velocities with relation to the rotation of the annular means.

In the drawings accompanying and forming a part of this specification, Figure 1 is a longitudinal sectional side elevation of a rotary fluid pump illustrating an embodiment of my invention.

Fig. 2 is a longitudinal sectional plan view.

Fig. 3 is a sectional end elevation taken on the line A—A of Fig. 1 looking in the direction of the arrow.

Fig. 4 is a sectional end elevation taken on the line B—B of Fig. 1 looking in the direction of the arrow.

Fig. 3^a is a sectional side elevation of the means to throw the nut into operative connection with the piston shaft to adjust the annular means longitudinally in the piston chamber.

Fig. 4^a is a sectional side elevation of the cylinder and piston mechanism showing the annular means adjusted to a position to partially reduce the working area of the piston chamber and pistons.

Figs. 5, 9 and 14 are side elevations, and Figs. 6 and 10 are end elevations looking at the right of Figs. 5 and 9, respectively, of details of the annular means to reduce the working area of the piston chamber and pistons.

Fig. 7 is a side elevation of the piston shaft.

Fig. 8 is a view looking at the right of Fig. 7.

Fig. 11 is an end elevation looking at the left of Fig. 7.

Fig. 12 is a side elevation of the piston.

Fig. 13 is an end elevation of the piston.

Similar characters of reference designate like parts throughout the different views of the drawings.

In the embodiment of my invention shown in the drawings there is provided a cylinder consisting of a pair of axially separably connected sections 18, 18' having an annular enlargement where the sections are connected, as shown at 19 Fig. 3, to constitute what will be herein termed a "piston chamber", and each section having a flange portion 21, 21' to secure the cylinder in a fixed position. Secured to the cylinder section 18 is a casing or extension 20 for a purpose to be hereinafter described. A shaft 22 having two diameters is journaled in suitable bearings in the cylinder section 18' and extension 20 and is driven from a suitable source of power (not shown). A stuffing box 23 is provided for the end of the shaft of smaller diameter to seal said end of the shaft, and a flange 24 on the shaft of larger diameter coöperates with the bearing for said end of the shaft to seal the same.

A pair of juxtaposed annular members or heads 25 and 26 rotatable with the shaft having a portion of the same diameter as the portion of the cylinder sections of least diameter and an annular flanged port to engage in the cylinder sections of larger diameter or piston chamber separating said chamber into two compartments and are adapted to be adjusted longitudinally and in opposite directions to each other to increase or decrease the area of said compartments. The member 26 is connected, as at 27, to a sleeve 28 mounted on the shaft 22 to rotate therewith and have sliding movement thereon by ribbed portions 29 of said sleeve engaging in longitudinal recesses or grooves 29' in the shaft. The annular member 25 is constructed integral with a sleeve 25' mounted on the sleeve 28 to rotate therewith and have longitudinal movement thereon.

A head 30, which is in the nature of a piston head, is mounted on and keyed to the sleeve 28 to engage between the ribbed portion 29 of said sleeve and the annular members 25 and 26, the said head having diametrically opposite extending wing pistons 31, 32 adapted to pass through diametrically opposite recesses 33 and 34 in the flanged ends of the portions 25 and 26 to engage and work in both compartments of the piston chamber, said pistons being of a shape to correspond with the cross sectional dimensions of said chamber. The members 25 and 26, excepting the part engaging in the piston chamber, are of the same diameter as the cylinder sections 18, 18' of less diameter and constitute one wall of the piston chamber to completely close the same.

Slidably mounted in projections 35 extending axially and parallel of the cylinder sections and at opposite sides of the piston chamber, are slides 36, herein termed "abutments", the lower ends of the abutments bearing upon the annular members 25, 26. These abutments are reciprocable transversely of the piston chamber during the rotation of the shaft with the piston head to intercept the path of movement of the pistons, and in one position thereof constitute transverse partitions or walls in said chamber, and in such position coöperate with the annular members to make said partitions substantially fluid-tight. There are four pairs of these abutments with one abutment of each pair located in alinement with the other and at opposite sides of the piston chamber, and when these abutments are in position to intercept the path of movement of the pistons they coöperate with said pistons to separate or divide the piston chamber into fluid inlet chambers 19^a and fluid outlet chambers 19^b. To reciprocate the abutments transversely of the piston chamber in proper timed sequence with the movement of the pistons there are provided

peripheral cam grooves 37, 38 in the annular members 25 and 26 respectively, in which projections 39 of the abutments engage, said projections being in the nature of cam followers.

The entrance of fluid into the piston chamber is from a chamber 40 connected at 41 with a suitable source of supply, and with which chamber 40 lateral inlet ports 42 in the periphery of the shaft 22 to a pair of ducts 43 in the shaft communicate, said ducts having outlets 44 in the periphery of the shaft communicating with ports 45 in the piston head and ports 46 and 47 in the annular members 25 and 26 respectively to one side or the back of the pistons or the compartments 19^a of the piston chamber, assuming the pistons to be revolving in the direction of the arrow indicated in Fig. 3. The discharge of the liquid from the piston chamber or the compartments 19^b is through ports 48 and 49 in the annular members 25, 26 respectively and ports 50 in the piston head at the front or side of the pistons opposite to the ports 45, the said ports 48, 49 and 50 communicating with ports 51 in the periphery of the shaft 22 communicating with a pair of ducts 52 extending through and to the end of the shaft and communicate with a chamber 53 having an outlet 54 to which an outlet or discharge pipe (not shown) is adapted to be connected.

The operation of a pump as thus described is as follows:—Assuming the parts to be in the positions indicated in Figs. 2 and 3 with the pistons in line with the abutments 36 at opposite sides (Fig. 3) and the abutments at the top and bottom engaging in the piston chamber and intercepting the path of movement of the pistons, thus providing a fluid inlet chamber 19^a at the back of each of the pistons with which the ducts 43 in the shaft are in communication and an outlet compartment 19^b at the front of each of the pistons with which the outlet ducts 52 in the shaft are in communication. With the ports in this position and motion being imparted to the pistons through the shaft the fluid in front of the pistons is forcibly ejected through the ducts 52. During the continued movement of the pistons from the position shown in Fig. 3 movement will be imparted to the abutments at the sides (Fig. 3) to move said abutments into the piston chamber, and when the pistons assume substantially a position midway between the abutments at the top and one side and at the bottom and the other side, the abutments at the side will be moved entirely across the piston chamber and all of the abutments will extend across the piston chamber and intercept the path of movement of the pistons.

During the further forward movement of the pistons the abutments at the top and bottom will be moved out of the path of

movement of the pistons and when the pistons assume a position directly opposite the abutments at the top and bottom the fluid will be forcibly ejected from the piston chamber between the piston at the bottom and the abutment at the right and between the piston at the top and the abutment at the left through the shaft ducts 52 and the fluid will enter the piston chamber between the piston at the top and the abutment at the right and between the piston at the bottom and the abutment at the left through the shaft ducts 43. It will be obvious that upon the continued movement of the pistons the operation of the abutments will be repeated to alternately place the space at opposite sides of said abutments into communication with the inlet ducts 43 and the outlet ducts 52 and that the force of the pistons will at all times be exerted to forcibly eject the fluid from the piston chamber in front of the pistons.

As stated it is an object of the invention to vary the working area of the piston chamber and pistons to decrease or increase the capacity of the pump, and for this purpose means are provided to adjust the annular members 25 and 26 longitudinally and in opposite directions to cut off the piston chamber and pistons, consisting of a nut 55 having two internal diameters and screw threaded connection with the sleeves of the annular members 25 and 26, the nut portion of larger diameter having a right hand threaded connection with the sleeve 25', as at 56, and the nut portion of less diameter having a left hand threaded connection with the sleeve 28, as at 57. In the normal operation of the pump the sleeves with the connected annular members are rotated at the same velocity as the shaft and pistons. To adjust the annular members laterally of each other, as shown in Fig. 4^a, and thereby cut off or reduce the working area of the piston chamber and pistons, the nut 55 is rotated at an increased velocity with relation to the rotation of the sleeves, and to adjust said annular members relative to each other to increase the working area of the piston chamber the nut is rotated at a reduced velocity with relation to the rotation of the sleeves.

To rotate the nut at variable velocities for the purpose specified there is provided a gear transmission mechanism located in the cylinder extension 20 with the nut 55, and which extension is in the nature of a transmission casing, the said transmission mechanism consisting of a counter-shaft 59 driven from the piston shaft 22 by a gear 60 fixed to said latter shaft meshing with a gear 61 fixed to the shaft 59, both gears being of the same pitch, whereby the counter-shaft is driven at the same velocity as the piston shaft. Loose on the shaft 59 is a gear

62 of greater pitch than the gear 61 meshing with a pinion 63 of less pitch than the gear 61 or the gear 62 fixed to or constructed integral with the nut 55. A pinion 64 loose on the shaft 59 of less pitch than the gear 61 meshes with a gear 65 of greater pitch than the gear 61, the gear 65 being fixed to or constructed integral with the nut 55. The gear 62 and pinion 64 on the counter shaft are constructed to constitute a friction clutch member, as shown at 62' and 64', and either said gear 62 or pinion 64 is adapted to be connected to the countershaft by a duplex clutch member 66 mounted on the countershaft to rotate therewith and have sliding movement thereon. It will be obvious that when the gear 62 is connected to the shaft 59 through the clutch member 66 the nut 55 will be rotated at a reduced velocity with relation to the rotation of the sleeves and the sleeves with the annular members will be adjusted in one direction, and by connecting the pinion 64 to the countershaft through the clutch member 66 the sleeves will be rotated at an increased velocity with relation to the rotation of said sleeves, and the latter will be adjusted longitudinally in a reverse direction. It will be noted that when the clutch member is in operative connection with the gear 62 the pinion 64 will be in inoperative position, and vice versa.

To throw the clutch member 66 into operative engagement with either of the clutch members on the gear 62 or the pinion 64 to adjust the sleeves 25' and 28 and connected members 25, 26, a manually operable lever 67 is provided pivotally connected to one end of a rod 68 slidably supported in the casing 20, the other end of which rod is pivotally connected to one end of a lever 69. The lever 69 has a slidably supported fulcrum consisting of a stud 70 slidably supported in lugs 71 of the casing having a lateral projection, as at 72, on which the lever is pivotally supported. The other end of the lever 69 is pivotally connected to a pin 73 projecting from a slide 74 supported in a lug 75 in the casing 20 and the end of the cylinder section 18, and connected at its inner end with the annular member 25 of the sleeve 25', as at 76. Fixed to a pin 77 projecting laterally from the stud 70 is a bifurcated shifter arm 78 adapted to engage in an annular groove in the clutch member 66.

Assuming it is desired to connect the pinion 64 to the shaft 59 through the clutch member 66 to rotate the nut 55 at a reduced velocity to adjust the annular members 25 and 26, the lever 67 is moved to the right, (Fig. 3^a) to move the rod 68 into the casing 20 and the lever 67 retained in a predetermined position. In this position of the parts, the annular member 25 will be moved

to the left and the member 26 to the right from the position shown in Figs. 1, 2 and 3^a. During this movement of the annular member 25 the slide 74 will be moved with said member, and the lever 67 being retained in a predetermined position, this movement of the slide 74 to which the lever 69 is connected will move said lever on its pivotal connection with the rod 68 moving the fulcrum stud 70 with said lever and with it the shifter 78 throwing the clutch member 66 out of engagement with the clutch member of the pinion 64 and into neutral position when the annular member reaches a predetermined position regulated by the lever 67. To adjust the annular members 25 and 26 in a reverse direction the clutch member 66 is thrown into operative engagement with the clutch member of the gear 62, and when said annular members are adjusted to a predetermined position, or to lie contiguous to each other, the clutch member 66 will be thrown to neutral position through the slide 74.

If desired only a single piston 31 or 32 may be utilized, in which instance only two pairs of abutments are used, located at diametrically opposite points in the cylinder and only one fluid inlet duct 43 and one outlet duct 52. Furthermore, should it be desired to provide abutments without means to increase or decrease the capacity of the pump the annular members 25 and 26 with the adjusting means therefor may be omitted, and in this instance instead of providing abutments in pairs to be reciprocated transversely of the piston chamber from opposite sides of said chamber, a single abutment may be provided for each pair of abutments to be reciprocated transversely of the piston chamber from one side of said chamber only.

Having thus described my invention I claim:—

1. The combination of a piston chamber, a piston to rotate in said chamber, an abutment reciprocable transversely of the chamber to intercept the path of movement of the piston during the rotation thereof, and means to cut off the piston and vary the working area of the piston chamber and simultaneously therewith adjust the abutment, substantially as and for the purpose specified.
2. The combination of a piston chamber, a piston to rotate in said chamber, a slidably supported abutment, means to reciprocate the abutment transversely of the piston chamber during the rotation of the piston to intercept the path of movement of the piston, and means to vary the working area of the piston and piston chamber and simultaneously adjust the abutment reciprocating means with the abutment, substantially as and for the purpose specified.

3. The combination of a piston chamber; a wing piston to rotate in said chamber; a slidably supported abutment; means rotatable with the piston to reciprocate the abutment transversely of the piston chamber during the rotation of the piston to intercept the path of movement of the piston; means to vary the working area of the piston and piston chamber and simultaneously adjust the abutment reciprocating means with the abutment; and a fluid inlet and outlet to the piston chamber at opposite sides of the piston, substantially as and for the purpose specified.

4. The combination of a cylinder having an annular enlargement to constitute a piston chamber; a piston head rotatable in the cylinder having diametrically opposite projecting wing pistons to operate in the piston chamber; abutments reciprocable transversely of the piston chamber during the rotation of the pistons to intercept the path of movement of the pistons; means to vary the working area of the pistons and piston chamber and simultaneously therewith adjust the movement of the abutments; and fluid inlets and outlets from the piston chamber at opposite sides of the pistons through the piston head, substantially as and for the purpose specified.

5. The combination of a cylinder having an annular enlargement to constitute a piston chamber; a piston head rotatable in the cylinder having diametrically opposite wing pistons to operate in the piston chamber; slidably supported abutments; means rotatable with the piston head to reciprocate said abutments transversely of the piston chamber to intercept the path of movement of the pistons; means to vary the working area of the pistons and piston chamber and simultaneously adjust the abutment reciprocating means with the abutments; fluid inlets through the piston head to the piston chamber at one side of the pistons; and fluid outlets through the piston head from the piston chamber at the side of the pistons opposite to the fluid inlets, substantially as and for the purpose specified.

6. The combination of a cylinder having an annular enlargement to constitute a piston chamber; a shaft rotatable in said cylinder; diametrically opposite wing pistons rotatable with the shaft to operate in the piston chamber; slidably supported abutments; means carried by the shaft to reciprocate said abutments transversely of the piston chamber during the rotation of the shaft to intercept the path of movement of the pistons; means to vary the working area of the piston chamber and pistons mounted on the shaft and rotatable therewith; fluid inlets through the shaft to the piston chamber at one side of the pistons; fluid outlets through the shaft from the piston chamber

at the side of the pistons opposite to the inlets, substantially as and for the purpose specified.

7. The combination of a cylinder having
 5 an annular enlargement to constitute a piston chamber; a shaft rotatable in the cylinder; diametrically opposite wing pistons rotatable with the shaft to operate in the piston chamber; slidably supported abutments;
 10 means rotatable with and adjustable longitudinally of the shaft to vary the working area of the piston chamber and pistons, said means adapted to reciprocate the abutments transversely of the piston chamber to intercept the path of movement of the pistons during the rotation thereof; fluid inlets through the shaft to the piston chamber at one side of the pistons; and fluid outlets through the shaft from the piston chamber
 15 at the side of the pistons opposite to the inlets, substantially as and for the purpose specified.

8. The combination of a cylinder having an annular enlargement to constitute a piston chamber; a shaft rotatable in the cylinder; diametrically opposite wing pistons rotatable with the shaft to operate in the piston chamber; abutments slidably supported in the cylinder; a sleeve rotatable with the shaft having an annular enlargement to engage in the piston chamber, said sleeve being adjustable longitudinally of the shaft to vary the working area of the piston chamber and pistons and adapted to reciprocate the abutments transversely of the piston chamber during the rotation of the shaft; fluid inlets to the piston chamber to one side of the pistons; and fluid outlets from the piston chamber from the side of
 20 the pistons opposite to the inlets, substantially as and for the purpose specified.

9. The combination of a cylinder having an annular enlargement to constitute a piston chamber; a shaft rotatable in the cylinder; diametrically opposite wing pistons rotatable with the shaft to operate in the piston chamber; abutments slidably supported in the cylinder; a sleeve rotatable with and slidable on the shaft having an annular enlargement to engage in the piston chamber; means to adjust said sleeve longitudinally of the shaft whereby the enlargement thereof will operate to vary the working area of the piston chamber and pistons; a cam groove in said sleeve in which a projecting part of the abutments engages whereby as the sleeve is rotated with the shaft the abutments are reciprocated transversely of the piston chamber to intercept the path of movement of the pistons during the rotation of the latter; fluid inlets to the piston chamber to one side of the pistons; and fluid outlets from the piston chamber from the side of the pistons opposite to the inlets, substantially as and
 30 for the purpose specified.

10. The combination of a cylinder having an annular enlargement to constitute a piston chamber; a shaft rotatable in the cylinder; diametrically opposite wing pistons carried by the shaft to operate in the piston chamber; abutments slidably carried by the cylinder at opposite sides of the piston chamber and reciprocable transversely of the piston chamber; a pair of sleeves mounted on the shaft to rotate therewith and have longitudinal movement thereon, each of said sleeves having an annular enlargement to engage in the piston chamber; means to longitudinally adjust said sleeves whereby the annular enlargement thereof serves to vary the working area of the piston chamber and pistons; and cam grooves in said sleeves in which a projecting part of the abutments engages whereby the abutments are reciprocated transversely of the piston chamber, substantially as and for the purpose specified.

11. The combination of a cylinder having an annular enlargement to constitute a piston chamber; a shaft rotatable in the cylinder; a pair of diametrically opposite wing pistons rotatable with the shaft to operate in the piston chamber; four pairs of abutments slidably carried by the cylinder, one abutment of each pair being located at opposite sides of the piston chamber; a pair of sleeves rotatable with and slidable longitudinally on the shaft, each sleeve having an annular enlargement to engage in the piston chamber separating said chamber into two compartments; cam grooves in said sleeves to cooperate with the abutments to reciprocate the same transversely of the piston chamber; and means to adjust said sleeves on the shaft toward and away from each other and simultaneously therewith adjust the abutments whereby the enlargement of the sleeves operates to vary the working area of the piston chamber and pistons, substantially as and for the purpose specified.

12. The combination of an annular piston chamber; a rotatable wing piston to operate in said chamber; a slidably carried abutment; an annular member engaging in the piston chamber rotatable with the piston and adjustable longitudinally thereof to vary the working area of the piston chamber and piston, and said member adapted to cooperate with the abutment to reciprocate the same transversely of the piston chamber during the rotation thereof; a nut having threaded connection and rotatable with the annular member; and means to increase or decrease the velocity of rotation of the nut with relation to the rotation of the annular member, substantially as and for the purpose specified.

13. The combination of an annular piston chamber; a rotatable piston to operate in said chamber; abutments reciprocable transversely of the piston chamber to intercept

the path of movement of the piston; an annular member engaging in the piston chamber rotatable with the piston; a nut having screw threaded connection and rotatable with the annular member; means to vary the velocity of rotation of the nut with relation to the rotation of the annular member to adjust the said member to vary the working area of the piston chamber and piston; and fluid inlets and outlets to the piston chamber on opposite sides of the piston, substantially as and for the purpose specified.

14. The combination of a cylinder having an annular enlargement to constitute a piston chamber; a shaft rotatable in the cylinder; a piston rotatable with the shaft to revolve in the piston chamber; a sleeve rotatable with and slidable longitudinally of the shaft having an annular enlargement to engage in the piston chamber; a nut rotatable with the sleeve adapted to be rotated at variable velocities relative to the rotation of the sleeve; and means operable from the shaft to vary the velocity of the nut relative to the rotation of the shaft, substantially as and for the purpose specified.

15. The combination of a cylinder having an annular enlargement to constitute a piston chamber; a shaft rotatable in the cylinder; a piston rotatable with the shaft to revolve in the piston chamber; abutments reciprocable transversely of the piston chamber; a sleeve rotatable with and slidable longitudinally of the shaft, said sleeve having an annular enlargement to engage in the piston chamber; and means to adjust the sleeve longitudinally of the shaft and thereby cause the enlargement of the piston chamber to vary the working area of the piston chamber and piston, comprising a nut having screw threaded connection with the sleeve, a gear on the piston shaft, a counter shaft having a gear fixed thereto meshing with the gear on the piston shaft, a pair of gears loose on the counter shaft meshing with a pair of gears fixed to the nut, and clutch mechanism to connect either one of said loose gears to the counter shaft, substantially as and for the purpose specified.

16. The combination of a cylinder having an annular enlargement to constitute a piston chamber; a shaft rotatable in the cylinder; a piston rotatable with the shaft to revolve in the piston chamber; abutments slidably carried by the cylinder reciprocable transversely of the piston chamber; a sleeve rotatable with and slidable longitudinally of the shaft, said sleeve having an annular enlargement to engage in the piston chamber; fluid inlets and outlets through the shaft to the piston chamber on opposite sides of the piston; a nut having screw threaded connection with the sleeve; and means to vary the velocity of rotation of the nut relative to the rotation of the sleeve to longi-

tudinally shift the sleeve and thereby vary the working area of the piston chamber and piston by the enlargement of the sleeve, comprising a gear rotatable with the piston shaft, a counter shaft, a gear fixed to said shaft meshing with the first gear, a pair of gears loose on the counter shaft each of which gears is constructed to form one member of a clutch, gears fixed to the nut meshing with the loose gears, and a double-acting clutch member rotatable with and slidable on the counter shaft and adapted to cooperate with the clutch member of the loose gears to operatively connect the nut to the counter shaft through either of the loose gears.

17. The combination of a piston chamber; a rotatable shaft; a piston rotatable with said shaft revoluble in the piston chamber; abutments reciprocable transversely of the piston chamber; an annular member engaging in the piston chamber rotatable with the shaft and piston and movable longitudinally to vary the working area of the piston chamber and piston; a nut having screw threaded connection and rotatable with the annular member; and gearing rotatable from the shaft to rotate the nut at a reduced velocity with relation to the rotation of the annular member to adjust said member longitudinally in one direction and to rotate the nut at an increased velocity with relation to the rotation of the annular member to adjust said member longitudinally of in a reverse direction, substantially as and for the purpose specified.

18. The combination of a piston chamber; a rotatable shaft; a piston rotatable with said shaft revoluble in the piston chamber; abutments reciprocable transversely of the piston chamber; an annular member engaging in the piston chamber rotatable with the shaft and piston and movable longitudinally to vary the working area of the piston chamber and piston; a nut having screw threaded connection and rotatable with the annular member and having a pair of gears of different diameters fixed thereto; a counter shaft positively driven from the piston shaft; a pair of gears of different diameters loose on said shaft meshing with the gears on the nut; clutch mechanism to connect one of said loose gears to the counter shaft to rotate the nut at a reduced velocity with relation to the rotation of the annular member to adjust said member longitudinally in one direction and to connect the other loose gear to the counter shaft to rotate the nut at an increased velocity with relation to the rotation of the annular member to adjust said member longitudinally in an opposite direction; and means to shift said clutch mechanism and maintain the annular member in adjusted position.

19. The combination of a piston chamber; 130

a rotatable shaft; a piston rotatable with said shaft revoluble in the piston chamber; abutments reciprocable transversely of the piston chamber; an annular member engaging in the piston chamber rotatable with the shaft and piston and movable longitudinally to vary the working area of the piston chamber and piston; a nut having screw threaded connection and rotatable with the annular member and having a pair of gears of different diameters fixed thereto; a counter shaft positively driven from the piston shaft; a pair of gears of different diameters loose on said shaft meshing with the gears on the nut; clutch mechanism to connect one of said loose gears to the counter shaft to rotate the nut at a reduced velocity with relation to the rotation of the annular member to adjust said member longitudinally in one direction and to connect the other loose gear to the counter shaft to rotate the nut at an increased velocity with relation to the rotation of the annular member to adjust said member longitudinally in an opposite direction; and means to shift said clutch mechanism and maintain the annular member in adjusted position, comprising a pivoted lever, a shifter for the clutch mechanism fixed to the fulcrum of the lever, and a slide connected to the annular member and to which the lever is pivotally connected.

20. The combination of a piston chamber; a rotatable shaft; a piston rotatable with said shaft revoluble in the piston chamber; abutments reciprocable transversely of the piston chamber; an annular member engaging in the piston chamber rotatable with the shaft and piston and movable longitudinally to vary the working area of the piston chamber and piston; a nut having screw threaded connection and rotatable with the annular member and having a pair of gears of different diameters fixed thereto; a counter shaft positively driven from the piston shaft; a pair of gears of different diameters loose on said shaft meshing with the gears on the nut; clutch mechanism to connect one of said loose gears to the counter shaft to rotate the nut at a reduced velocity with relation to the rotation of the annular member to adjust said member longitudinally in one direction and to connect the other loose gear to the counter shaft to rotate the nut at an increased velocity with relation to the rotation of the annular member to adjust said member longitudinally in an opposite direction; and means to shift said clutch mechanism and maintain the annular member in adjusted position, comprising a lever having a slidably supported fulcrum, a shifter for the clutch mechanism fixed to the fulcrum support of the lever, a slidably supported rod pivotally connected to one end of the lever, a hand operated lever connected to the rod, a slide connected to the

annular member and to which the other end of the lever is pivotally connected, substantially as and for the purpose specified.

21. The combination of a piston chamber; wing pistons revoluble in said chamber; abutments reciprocable transversely of the piston chamber; a pair of annular members engaging in the piston chamber revoluble with the pistons, said members separating said chamber into two compartments and being adjustable longitudinally of the piston chamber; a nut having screw threaded connection with said members; and means to rotate said nut at varying velocities with relation to the rotation of the annular members to adjust said members longitudinally of the piston, substantially as and for the purpose specified.

22. The combination of a piston chamber; wing pistons revoluble in said chamber; abutments reciprocable transversely of the piston chamber; a pair of sleeves slidable with the pistons and movable longitudinally, each sleeve having an annular enlargement to engage in the piston chamber; a nut having screw threaded connection with said sleeves; and means to rotate said nut at varying velocities with relation to the rotation of the sleeves to adjust said sleeves and the annular enlargements longitudinally, substantially as and for the purpose specified.

23. The combination of a piston chamber; a rotatable shaft; wing pistons rotatable with the shaft revoluble in the piston chamber; abutments reciprocable transversely of the piston chamber; a pair of sleeves mounted on the shaft to rotate therewith and have longitudinal movement, said sleeves having an annular enlargement to engage in the piston chamber; a nut having screw threaded connection with the sleeves; means to rotate said nut at varying velocities with relation to the rotation of the sleeves to adjust said sleeves and the annular enlargement longitudinally, substantially as and for the purpose specified.

24. The combination of a piston chamber; a rotatable shaft; wing pistons rotatable with the shaft revoluble in the piston chamber; abutments reciprocable transversely of the piston chamber; a pair of sleeves mounted on the shaft to rotate therewith and have longitudinal movement, said sleeves having an annular enlargement to engage in the piston chamber; a nut having screw threaded connection with the sleeves; means to rotate said nut at varying velocities with relation to the rotation of the sleeves to adjust said sleeves and the annular enlargement longitudinally; and fluid inlets and outlets through the shaft and sleeves to the piston chamber on opposite sides of the pistons, substantially as and for the purpose specified.

25. The combination of a piston chamber; a rotatable shaft; wing pistons rotatable with the shaft revoluble in the piston chamber; abutments reciprocable transversely of the piston chamber; a pair of sleeves mounted on the shaft to rotate therewith and have longitudinal movement, said sleeves having an annular enlargement to engage in the piston chamber centrally thereof; a nut having a right hand screw threaded connection with one sleeve, and a left hand screw threaded connection with the other sleeve; and means to rotate said nut at varying velocities with relation to the rotation of the sleeves to adjust said sleeves longitudinally in opposite directions to vary the working area of the piston chamber, and piston, substantially as and for the purpose specified.
26. The combination of a cylinder having an annular enlargement to constitute a piston chamber; abutments reciprocable transversely of the piston chamber; a shaft rotatable in the cylinder; a sleeve mounted on the shaft to rotate therewith and have longitudinal movement, said sleeve having an annular enlargement to engage in the piston chamber; a piston head mounted on said sleeve to rotate with the sleeve and shaft and having wing pistons to revolve in the piston chamber; a second sleeve mounted on the first sleeve to rotate with the first sleeve and shaft and having longitudinal movement and having an annular enlargement to engage in the piston chamber; and a nut having screw threaded connection with both sleeves and rotatable at variable velocities with relation to the rotation of the sleeves, substantially as and for the purpose specified.
27. The combination of a cylinder having an annular enlargement to constitute a piston chamber; slidably supported abutments; a shaft rotatable in the cylinder; a sleeve mounted on the shaft to rotate therewith and have longitudinal movement, said sleeve having an annular enlargement to engage in the piston chamber; a piston head mounted on said sleeve to rotate with the sleeve and

shaft and having wing pistons to revolve in the piston chamber; a second sleeve mounted on the first sleeve to rotate with the first sleeve and shaft and have longitudinal movement, said sleeve also having an annular enlargement to engage in the piston chamber; cam grooves in said sleeves to cooperate with the abutments to reciprocate said abutments transversely of the piston chamber; a nut having a right hand threaded connection with one of said sleeves and a left hand threaded connection with the other sleeve; and means to rotate said nut at different velocities with relation to the rotation of the sleeves to adjust said sleeves longitudinally in opposite directions, substantially as and for the purpose specified.

28. The combination of a cylinder having an annular enlargement to constitute a piston chamber; abutments slidably carried by the cylinder at opposite sides of said chamber; a shaft rotatable in the cylinder; a sleeve mounted on the shaft to rotate therewith and have longitudinal movement, said sleeve having an annular enlargement to engage in the piston chamber; a piston head mounted on said sleeve to rotate with the sleeve and shaft and having wing pistons to revolve in the piston chamber; a second sleeve mounted on the first sleeve to rotate with the first sleeve and shaft and have longitudinal movement, said sleeve having an annular enlargement to engage in the piston chamber; cam grooves in said sleeves to cooperate with the abutments to reciprocate with said abutments transversely of the piston chamber to intercept the path of movement of the pistons; a nut having a right hand threaded connection with one of said sleeves and a left hand threaded connection with the other sleeve; means to rotate said nut at different velocities with relation to the rotation of the sleeves to adjust said sleeves longitudinally in opposite directions; and fluid inlets and outlets from the piston chamber on opposite sides of the pistons through the shaft, substantially as and for the purpose specified.

SINCLAIR J. JOHNSON.