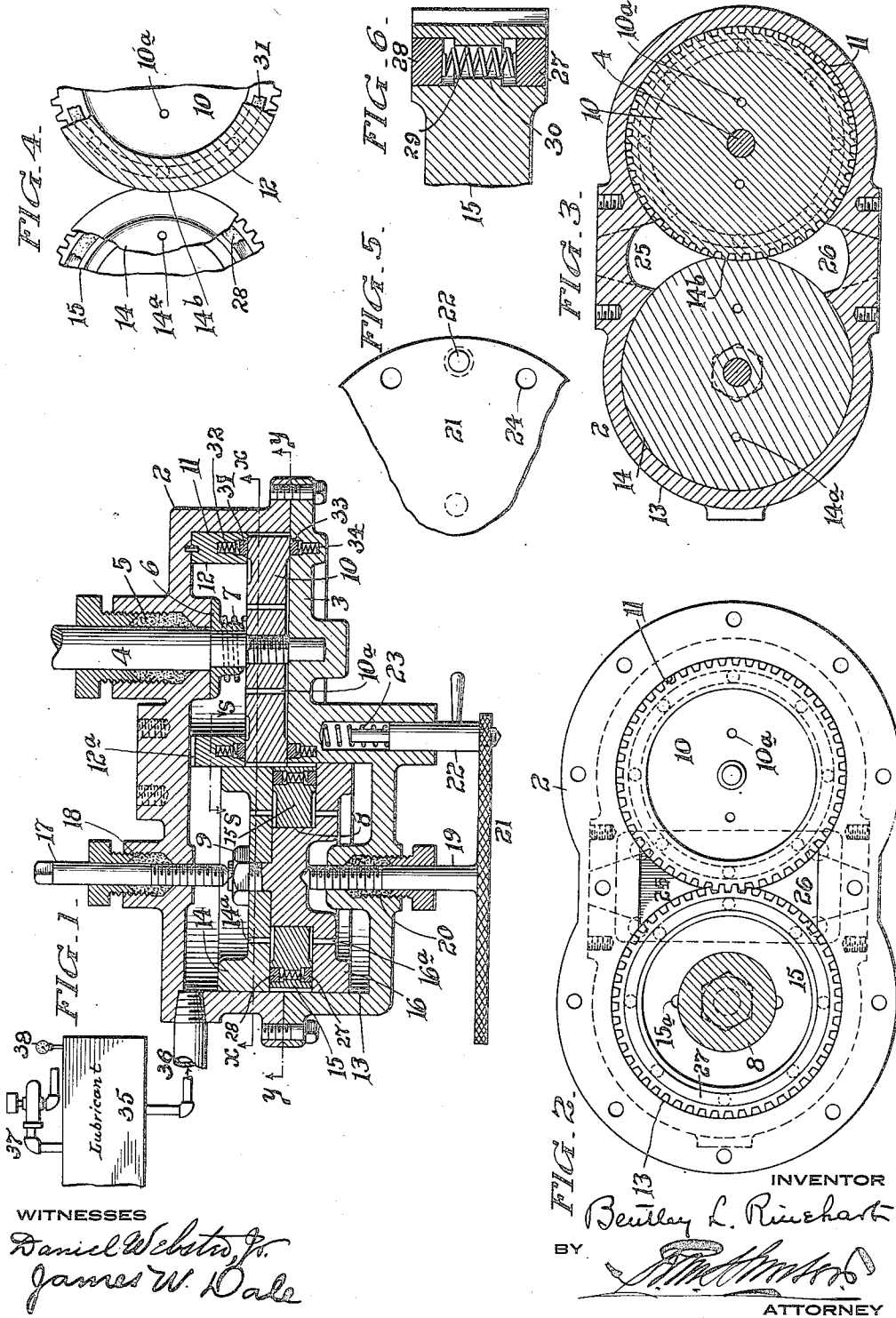


B. L. RINEHART.
 ROTARY PUMP.
 APPLICATION FILED MAR. 1, 1915.

1,223,734.

Patented Apr. 24, 1917.



WITNESSES

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UNITED STATES PATENT OFFICE.

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ROTARY PUMP.

1,223,734.

Specification of Letters Patent.

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Application filed March 1, 1915. Serial No. 11,199.

To all whom it may concern:

Be it known that I, BENTLEY L. RINEHART, a citizen of the United States, and resident of Philadelphia, county of Philadelphia, and State of Pennsylvania, have invented an Improvement in Rotary Pumps, of which the following is a specification.

The object of my invention is to provide a construction of a rotary or gear pump, which shall have capacity for pumping or circulating fluid in a practically continuous manner, and which shall also be provided with means of adjustment whereby the volume of fluid pumped per revolution may be varied to suit the requirements of use. Heretofore, gear pumps have usually been constructed to give constant volumes per revolution and to obtain a reduced flow it was necessary to reduce the speed of the pump. My object is also to provide a gear pump with suitable means whereby leakage may be prevented so that the pump will be accurate as to the quantity of fluid discharged per revolution so that the pump may be relied upon as a measuring device in addition to a circulating pump. By my improvements, the speed of the pump may remain constant and its capacity may be adjusted so as to discharge anything, from approximately nothing up to the maximum volume, and by reason of the fact that leakage is prevented by a system of balancing the pressures of the fluid being pumped and the fluid surrounding the gears the accuracy of the quantity pumped is positively insured and the lubrication of the pump may be efficiently accomplished. In this manner, the pump may be used for a variety of purposes, as capacity per speed impressed upon it may be adjusted to suit the particular requirements of the installation.

Among the special uses of my improved pump are those relating to the measuring and feeding of hydrocarbon fluids for combustion processes whether for continuous burning or for explosive engines, in which latter the pump is an element of the carbureter; my improved pump may also be used as a circulating pump for the water employed as the cooling medium for explosive engines where regulated use is advantageous and for any and all purposes, such as in chemical plants; scientific tests and engineering work generally.

My invention consists of a gear pump in which there are two meshing gears arranged

within a casing and provided for relative adjustment axially of the gears, said gears provided with packing means for opposite faces of the gears whereby the inlet and outlet chambers of the casing have a circulating connection only through the space traversed by the teeth of the gears, and means for supplying a balancing fluid of a lubricating character or otherwise, and maintaining it within the casing under pressure sufficient to balance the pressure of the fluid being pumped, whereby the tendency of leakage of said fluid from the gears is substantially prevented.

My invention also comprehends other features of construction which, together with those above specified, are fully described hereinafter and specifically recited in the claims.

My invention will be better understood by reference to the drawings, in which:—

Figure 1 is a sectional plan view through my improved pump; Fig. 2 is a sectional elevation of the same taken on line $y-y$; Fig. 3 is a sectional elevation of the same taken on line $x-x$; Fig. 4 is a sectional elevation of a portion of the same taken on line $s-s$; Fig. 5 is an elevation of a portion of the adjusting means; and Fig. 6 is an enlarged view of a portion of Fig. 1 and showing a part of one of the propelling gears thereof and the packing means thereof.

2 and 3 are parts of the main casing of the pump, which casing has its interior formed with two cylindrical portions 11 and 13 blending or opening into each other, but in this case the cylindrical portion 13 is considerably the deepest. The parts 2 and 3 are made separable so as to provide access to the interior of the pump. The driven gear 10 is arranged in the cylindrical part 11 of the casing and the engaging gear 15 is arranged in the other cylindrical part 13 thereof. The gear 10 is connected with and rotated by a shaft 4, which may be driven in any suitable manner. Arranged in the casing part 11 adjacent to the gear 10 is an annular or ring part 12, which is stationary and has a curvature which corresponds to that of the perimeter of the said gear 10, and between which and the wall 3 of the case the gear rotates. The gear 15, which meshes with the gear 10, is preferably of the same diameter and also snugly fits the cylindrical portion 13 of the cas-

ing. This gear 15 is journaled on a boss 8 between the follower disk portions 14 and 16, the latter being circular and of a diameter equal to the perimeter diameter of the gear 15, and the former being of similar diameter but having a curved notch or recess 14^b (Fig. 4), through which a portion of the teeth of the gear 10 may travel. The disk portions 14 and 16 are secured together by the boss 8 and nut 9, and are held against rotating by the annular part 12 acting as a spline for the notched portion 14^b of the disk 14.

The gear 15 and the disk followers 14 and 16 may be adjusted axially by the adjusting screw spindles 17 and 19. The spindle 17 is screwed through the part 2 of the casing and presses against one side of the disk portions and has a stuffing box 18 to make a liquid tight joint where it passes through the casing. The other spindle 19 is screwed through the other part 3 of the casing and presses upon the opposite side of the disk portions, so that they are held between it and the first mentioned screw spindle 17. A stuffing-box 20 may be provided to make a liquid tight joint where the spindle 19 passes through the casing. The outer end of this spindle 19 may have a locking wheel 21 having holes 24 near its periphery which are engaged by the bolt 22, forced outward into engagement by the spring 23. By turning these screw threaded spindles 17 and 19, the disks 14 and 16, together with the gear 15, are adjusted in the casing.

While the surface contact between the faces of the gear 15 and the follower disk portions 14 and 16 may be reasonably tight when the pump is put into operation, the tendency of the rotating gear between the stationary followers 14 and 16 produces a sufficient wear to permit the leakage of the fluid being pumped between the faces of the gear and the faces of the follower disk portions 14 and 16, and to prevent this I prefer to provide suitable annular packing rings 27 and 28 in the faces of the gear 15 close to the teeth thereof. As shown these annular packing rings 27 and 28 set in annular grooves in the faces of the gear and are pressed apart and in respective contact with the follower disks 16 and 14 by the springs 29, of which there may be a number as indicated in dotted lines in Fig. 2, and extending through apertures 30 connecting said fluid channels. In this manner the packing rings 27 and 28 are maintained under elastic pressure in contact with the follower disks and thereby prevent leakage of the fluid from the gear spaces into the casing. In practice I prefer that these packing rings shall be made of comparatively dense textile packing, though they may be of metal or any suitable packing commercially used that may be suitable to withstand the character of fluids em-

ployed in the pump. While I have shown coiled springs 29 for pressing the packing rings apart, I do not restrict myself to any particular character of spring or means for putting the packing under elastic pressure. In the case of the gear 10 I have shown the annular packing rings 31 and 33 as arranged in the annular part 12 and in the casing part 3 respectively, said packing rings pressing upon the opposite faces of the gear 10 adjacent to the teeth thereof with an elastic pressure so as to prevent leakage from the teeth spaces into the casing proper. The elastic pressure of these packing rings 31 and 33 may be supplied by the springs 32 and 34 or by any other suitable means. In the case of the gear 15 the packing rings rotate with the gear, whereas in the case of the gear 10 the packing rings are stationary in the casing, and while I prefer this difference in the two arrangements of the packing I do not in any wise restrict myself thereto, as it is manifest that the packing for both gears may be provided in the same manner. The presence of these packing rings may be relied upon as the sole means for preventing leakage of the fluid being pumped from the gear spaces into the casing, but I prefer to employ in connection with such packing a fluid within the casing which will provide not only a lubricating action between the rotating gears and the adjacent portions, but will also provide a means to balance the pressure of the fluid being pumped so that the tendency of leakage is nullified or reduced to a minimum.

The means shown in the particular illustration of apparatus embodying my invention for supplying the balancing fluid consists of a lubricant tank 35, from which the lubricant is led by a pipe 36 discharging into the casing. The lubricant tank may have a pressure formed therein by a suitable pump 37 and this pressure may be indicated by a gage 38. It is manifest that if the pressure of the lubricating fluid within the casing is equal to the pressure of the fluid being pumped by the gears there would be no tendency for the latter to leak backward from the gears into the casing and I therefore place particular importance upon this feature of my invention. It permits a reasonable wear between the gears and their inclosing portions without objectionable leakage. The oil supplied to the casing by a pipe 36 may circulate from the chamber 13 to chamber 11 by passage 12^a in the end face of the annular or ring part 12. A collar 6 surrounding the shaft 4 is forced against the casing by spring 7 and assists the stuffing-box 5 in maintaining a tight joint about the shaft. The oil from within the said part 12 may flow through apertures 10^a in gear 10 to the other side thereof so that the gear is rotating in oil. The fit

between the gear faces and the parts 12 and 3 is such that the oil does not pass. The oil from chamber 13 flows through holes 14^a in a follower disk 14 to the recessed face 5 portion of the gear 15 and thence through apertures 15^a (Fig. 2) to the other recessed face of the gear, thence through holes 16^a of the follower 16 into the outer part of the chamber 13. In this manner, the gear 15 10 is running in oil, but as in the case of gear 10, the fit between gear 15 and the followers 14 and 16, and especially so if packing rings are employed, prevents passage of oil to the gear teeth in appreciable quantities. 15 If the pressure of the fluid being pumped is the same as the pressure of the oil within the casing the opposite pressures would tend to arrest the flow of the fluids at the places where the packing rings are arranged 20 whether said packing rings are employed or not. If they are employed the space for passage of fluid would be less and consequently the resistance of the two fluids comingling would be that much better insured. However, by giving a slightly 25 greater pressure to the lubricant fluid than the pressure of the fluid being pumped, it is manifest that sufficient circulation of the lubricant may be caused to take place between the packing rings and their opposing 30 surfaces, and insure the desired degree of lubrication. This same slight overbalancing by the lubricant pressure may be employed where the packing rings are not used, in 35 such cases where great accuracy in the measuring quantities of the pumped fluid is not so important. For example, if the pump was pumping water the escape of a little lubricant between the surfaces of the 40 gears and the inclosing disks or rings would not be especially objectionable and would insure good lubrication, but where great accuracy is required and the packing rings are employed there is no necessity for the slight- 45 est loss of lubricant fluid except so much as may be usefully employed in lubrication. The joint between the casing and the follower parts 12, 14 and 16 may be made so tight (because they do not rotate) that prac- 50 tically no leakage will occur through these joints between the gear spaces and the casing, and ordinarily no packing would be required. By this method of lubrication, the pump mechanism is maintained in perfect 55 running condition and the fluid being pumped is kept from being objectionably mixed with the oil used for lubrication.

By providing small pitches to the screw threads of the spindles 17 and 19, a very 60 accurate adjustment of the gear 15 may be obtained and hence a very delicate adjustment of the capacity secured. It is further to be understood, that the finer the teeth of the gears 10 and 15, the more delicate 65 may be the adjustment of the pump, but

for ordinary uses this will not be necessary, especially where the volume of liquid to be pumped is large.

The means shown for adjusting the relative position of gear 15 to gear 10 is only 70 by way of illustration of the principle, for it is to be understood that any other suitable means for securing this adjustment may be employed in lieu of that shown.

As shown, only a small portion of the 75 teeth of each of the gears 10 and 15 are in engagement, and in this condition only a small measuring or pumping action is accomplished; or in other words, only a small quantity of fluid is measured and pumped 80 with each revolution of the gears. By turning the shafts 17 and 19, the gear 15 may be brought more or less into alinement with the gear 10 to increase the extent of engage- 85 ment and, to a corresponding degree, increase the pumping and measuring action with each revolution of the gears. By proper adjustment, the measuring or pumping action may be anything from nothing 90 to a maximum, with each revolution of the gears; and whatever the adjusted capacity per revolution may be, it will remain the same for all speeds of rotation of the shaft 4 and gears 10 and 15.

The disks 14 and 16, acting as followers of 95 the gear 15, prevent escape of the gear; and the recess 14^b of follower 14 fitting snugly against the curvature of the annular or ring part 12, permits an adjustment of the former over the latter, while maintaining a comparatively liquid tight joint. The depth of 100 the recessed portion 14^b is equal to the depth of the teeth of the gear 10, as will be readily understood, and is to provide a space in which the teeth of said gear may rotate 105 when the pump or measuring device is pumping at less than its full capacity, such as by the adjustment shown.

While rotary gear pumps are well known and ordinarily a detailed description of their 110 method of operation would not be required, it is desirable to point out that such pumps operate by displacement due to the intermeshing teeth on the discharge side, and that, simultaneously therewith, the liquid is 115 carried from the supply side by the pockets between the teeth of the gears as they travel around the curved inner wall of the casing. Ordinarily, the amount of the conveyance of fluid and displacement thereof is equal and 120 constant, and of the full capacity of the pump per revolution, but in my improved pump, the extent of interengagement of the two gears 10 and 15 will dictate or govern 125 the amount of displacement, and hence the normal capacity of the pump per revolution for any particular adjustment; and this can be changed by simply turning the ad- 130 justing screws 17 and 19 in one direction or the other, according to whether an increased

or decreased pumping capacity per revolution is required. The liquid, which fills the spaces between the teeth of the gears, not displaced on the discharge side, is simply carried around and around and, being non-compressible, acts just as if so much of the gear spaces were filled up or cast solid. This construction of pump has capacity from nothing to the full sum of the spaces between the teeth, which coact to displace the fluid on the discharge side, per revolution of the shaft 4 and gear 10.

As before explained, the maintenance of the pressure in the casing equal to or in excess of the pumping pressure produced by the gears prevents leakage of the fluid being pumped, and where the pressure in the casing is produced by the employment of a lubricant such leakage prevention also provides thorough lubrication. This lubrication is especially effective in that it is accomplished under pressure and therefore the oil finds its way to every part that requires lubrication.

It is manifest that, while it is most desirable that the gears 10 and 15 should be of the same diameter or pitch, this is not at all essential, as the requirements will be satisfied if the teeth are of the same pitch and shaped to properly engage; though where one of the gears, 15 for example, is of smaller diameter, the tooth spaces are relatively larger and the absolute maximum capacity of the pump would be larger than where both gears are of the same diameter; similarly, the smaller the gears and larger the teeth, the greater will be the total capacity of the pump per tooth displacement, but of course, the speed at which the pump is rotated must be increased to compensate for the fewer teeth employed.

The fluid is delivered to the interior of the pump by the inlet 26, where it is received by the gear spaces of the gears 10 and 15 as above described. The fluid is thus conveyed into the chamber communicating with the discharge or outlet 25, from which it is forced by the displacing action of the meshing portions of the teeth of the gears 10 and 15.

Whether this pump is simply a measuring mechanism or a combined measurer and force pump, is immaterial to the spirit of the invention. If the fluid should be fed to the mechanism under a sufficient head or pressure to insure positive feed, then the measuring device need only subdivide the fluid and deliver its measured portions, and may be considered as measuring devices, especially so when used as a part of a carbureter, as in most explosive engines the gasoline or hydrocarbon fluid is fed to the carbureter or mixer by gravity or by a forced feed, thereby removing from these gear devices the necessity of pumping to provide

a circulating pressure. It is evident, however, that the mechanism may be used as a means for providing suction for moving the fluid where the tank or source of supply is below the same, and thus do away with the necessity of auxiliary pressure supplying devices for securing a forced feed. In general, therefore, the pumping devices here described may be used for suction and delivering at atmospheric or higher pressure, or may be used for circulating purposes only; and in such uses, it may be employed as a pump without necessity for great accuracy as to duty, or as a "measuring" device for delivering accurately measured quantities of fluid.

Where this pumping mechanism is employed for pumping a lubricant, there will be no necessity for auxiliary lubrication, but the packing provision will prevent the lubricant from objectionably escaping from the gears, and in those cases where the lubricant being pumped is of a fine grade of oil a pressure may be maintained in the casing to restrict the escape of the lubricant into the casing beyond what is essential for the lubrication, and if desired a heavier grade of oil may be employed for the lubricating of the pump than that which is being circulated for some other purpose; but where it is employed for pumping gasoline, water, or other fluid not a lubricant, I prefer to lubricate its working parts by the means heretofore described.

While I have referred to the part 12 as an annular or ring shaped part, it is evident that part may be an integral part of the casing 2, as the only material feature of it is the curved face which extends into the recess 14^b of the follower disk 14 and the flat surface against which the gear 10 fits. The difficulty of making an accurate fit of the curved portion is the reason for making this part 12 separable so that it can be turned up accurately in a lathe and may be replaced when worn. It is also evident that while the part 12 in annular form is held against rotation, this is not necessary as it might rotate with the gear 10 if so desired.

While I have described my invention in so far as it relates to the balancing of the pressure of the pumped fluid by a pressure of the lubricating fluid at the joints between the moving and stationary parts of the pump in connection with a specific construction of gear pump I do not restrict myself to the particular details of this pump in respect to the application of the principle of lubrication as this counterbalancing of the pressures of the pump fluid and the lubricating fluid across the working surfaces may be employed in various constructions of pumping devices. I have shown the features of construction which I prefer to employ in the general make-up of the pump, but I do not

restrict myself thereto, as the details may be greatly modified, so long as the essential feature of the relative adjustment of the meshing gears is employed. It will also be understood that while my invention is specifically described as a pump for fluids, it may also be employed as a motor to be driven by fluids, for a machine of this character is reversible, and therefore in designing the machine as a pump I wish it to be understood that my invention is equally applicable to the devices operating as a motor when the pressure of the fluid is sufficiently great to overcome the resistance to rotation of the pump gears, or the devices which may be driven by the mechanism when employed as a motor.

Having now described my invention, what I claim as new and desire to protect by Letters Patent is:—

1. In a pump, the combination of a casing having an inlet and outlet, two gears fitting the casing and meshing with each other at a point between the inlet and outlet one of which gears is driven and the other loose, a shaft to rotate one of the gears, means for maintaining the two gears in different relative transverse positions of alinement whereby a greater or less portion of the teeth are caused to mesh for producing a corresponding change in fluid displacement, and means for maintaining a fluid under pressure within the casing and outside of the space occupied by the two gears, whereby the pressure of the fluid being pumped is substantially balanced and leakage prevented.

2. In a pump, the combination of a casing having an inlet and outlet, two gears fitting the casing and meshing with each other at a point between the inlet and outlet one of which gears is driven and the other loose, a shaft to rotate one of the gears, means for maintaining the two gears in different relative transverse positions of alinement whereby a greater or less portion of the teeth are caused to mesh for producing a corresponding change in fluid displacement, means for maintaining the teeth spaces at and adjacent to the place of meshing inclosed to prevent lateral flow of the fluid, and means for maintaining a fluid under pressure within the casing and outside of the space occupied by the two gears whereby the pressure of the fluid being pumped is substantially balanced and leakage prevented.

3. In a pump, the combination of a casing having an inlet and outlet, two gears fitting the casing and meshing with each other at a point between the inlet and outlet one of which gears is driven and the other loose, a shaft to rotate one of the gears, means for adjusting the other of the gears in different positions of transverse adjustment relatively to the driven gear to change the extent of meshing contact of the two gears for provid-

ing a corresponding change in fluid displacement, and means for maintaining a fluid under pressure within the casing and outside of the space occupied by the two gears whereby the pressure of the fluid being pumped is substantially balanced and leakage prevented.

4. In a pump, the combination of a casing having an inlet and outlet, two gears fitting the casing and meshing with each other at a point between the inlet and outlet one of which gears is driven and the other loose, a shaft to rotate one of the gears, means for adjusting the other of the gears in different positions of transverse adjustment relatively to the driven gear to change the extent of meshing contact of the two gears for providing a corresponding change in fluid displacement, circular followers on opposite sides of the adjustable gear and movable with it for maintaining the teeth spaces at and adjacent to the place of meshing of the gears inclosed to prevent lateral flow of fluid, and means for maintaining a fluid under pressure within the casing and outside of the space occupied by the two gears whereby the pressure of the fluid being pumped is substantially balanced and leakage prevented.

5. In a pump, the combination of a casing having an inlet and an outlet, two gears fitting the casing and meshing with each other at a point between the inlet and outlet, one of which gears is driven and the other loose said loose gear having annular packing grooves on its opposite faces near the teeth and a plurality of transverse apertures through the body of the gear communicating with said annular grooves, a shaft to rotate the driven gear, circular followers on opposite sides of the loose gear and by means of which said gear is adjusted transversely to the driven gear, annular packing rings on each side of the loose gear arranged in the annular grooves and respectively sliding in contact with the surface of the circular followers, springs in the transverse holes of the loose gear and common to both of the packing rings for simultaneously forcing them apart with equal pressures to insure the same tightness of the packing on each side of the loose gear, and means for adjusting the followers and the loose gear to change the extent of meshing between the two gears.

6. In a pump, the combination of a casing having an inlet and outlet, two gears fitting the casing and meshing with each other at a point between the inlet and outlet one of which gears is driven and the other loose, a shaft to rotate one of the gears, means for maintaining the two gears in different relative transverse positions of alinement whereby a greater or less portion of the teeth are caused to mesh for producing a corresponding change in fluid displacement,

and means for maintaining the casing space occupied by the various parts of the pump exterior to the teeth of the gears full of lubricant whereby the operative parts are thoroughly lubricated and a solid fluid body is provided to prevent leakage of the fluid being pumped.

7. A fluid motor or pump, the actuating parts of which consist of a plurality of rotary coacting parts, means to move one of said rotary parts relatively to the other along its axis to vary the extent to which said parts coact, and means for providing a fluid pressure within the motor or pump and exterior to the rotary contacting parts sufficiently great to prevent leakage of the fluid acting or acted upon by the rotary parts.

8. In a fluid motor or pump, a chamber having an inlet and an outlet, a plurality of rotary coacting parts inclosed in said chamber and adapted by their coaction to regulate the quantity of fluid fed through said chamber, means to move one of said rotary parts relatively to the other along its axis to vary the extent of the coaction of said rotary parts, thereby varying the quantity of fluid consumed, and means for forcing a lubricant into the casing and around the rotary contacting parts to fill the casing and prevent leakage of the liquid acting or acted upon by the rotary contacting parts.

9. In a fluid motor or pump, a chamber having an inlet and an outlet, a plurality of rotary parts having intermeshing teeth and inclosed in said chamber, means to change the relative position of the rotary parts along their axis to vary the extent to which the teeth mesh, packing portions within the chamber acting upon the radial faces of the rotary parts, and means for maintaining the casing filled with lubricant except that space occupied by the intermeshing portions of the rotary parts whereby leakage of the fluid past the packing portions is prevented.

10. In a pump, the combination of a casing having an inlet and outlet, two gears fitting the casing and meshing with each other at a point between the inlet and outlet one of which gears is driven and the other loose, a shaft to rotate one of the gears, means for adjusting the other of the gears in different positions of transverse adjustment relatively to the driven gear to change the extent of meshing contact of the two gears for providing a corresponding change in fluid displacement, circular followers on opposite sides of the adjustable gear and movable with it for maintaining the teeth spaces at and adjacent to the place of meshing of the gears inclosed to prevent lateral flow of the fluid, adjustable annular packing arranged between the sides of the gears and the followers and casing and close to the peripheral portions of the gears so as to provide annular packed

joints close to the teeth of the gears to prevent leakage, and means to supply the casing and the packing with lubricant under a pressure sufficient to prevent leakage of the fluid being pumped past the packing.

11. In a pump, the combination of a casing having an inlet and outlet and also having two cylindrical chambers of different longitudinal depth, a shaft extending into the cylindrical chamber of the casing of shorter depth, a gear secured to the shaft and closely fitting the said casing on its perimeter and also on its side faces adjacent thereto, an annular gear arranged in the cylindrical chamber of the casing of greater depth and also fitting the casing on its perimeter and meshing with the first mentioned gear, a follower fitting against one of the faces of the annular gear and on which said gear is journaled, a second disk follower clamped to the first mentioned follower and fitting against the opposite side of the annular gear, said followers also fitting the cylindrical chambers of the casing on their perimeters, the said several gears and followers having oil passages through them whereby the oil within the cylindrical chambers may circulate to both sides of the gears, means for introducing oil into the casing and entirely filling the same except as to the spaces occupied by the gear teeth, and means for adjusting the followers and the annular gear in position within the chamber of greater depth.

12. In a pump, the combination of a casing having an inlet and outlet, two gears fitting the casing and meshing with each other at a point between the inlet and outlet one of which gears is driven and the other loose, a shaft to rotate one of the gears, means for adjusting the other of the gears in different positions of transverse adjustment relatively to the driven gear to change the extent of meshing contact of the two gears for providing a corresponding change in fluid displacement, circular followers on opposite sides of the adjustable gear and movable with it for maintaining the teeth spaces at and adjacent to the place of meshing of the gears inclosed to prevent lateral flow of fluid, the interior construction of the casing and its association with the gears and their followers providing large oil chambers and in which the gears and the followers are provided with oil ports through them whereby oil may be freely circulated throughout the casing except in those portions constituting the inlet and outlet and as occupied by the gear teeth, and means for supplying oil in volume into the oil chambers whereby it may completely surround the gears and followers except those portions to positively propel the fluid being pumped.

13. In a pump, the combination of a cas-

ing having an inlet and outlet, two gears fitting the casing and meshing with each other at a point between the inlet and outlet one of which gears is driven and the
 5 other loose, a shaft to rotate one of the gears, an outwardly curved part on one side of the meshing portion of the driven gear, a follower of disk form arranged at one side of the other or loose gear and
 10 having a curved recessed part fitting the outwardly curved part and adjustable over it axially of the gears, a second disk part fitting the casing and against the other side of the loose gear, adjusting means for ad-
 15 justing the loose gear and its follower disks transversely of the driven gear to change the extent of meshing of the gears and their extent of displacement, and means for circulating a lubricant within the casing and
 20 about the various parts exterior to the teeth of the gears.

14. In a pump, the combination of a casing having an inlet and outlet, two gears fitting the casing and meshing with each
 25 other at a point between the inlet and outlet one of which gears is driven and the

other loose, a shaft to rotate one of the gears, an outwardly curved part on one side of the meshing portion of the driven gear, a follower of disk form arranged at one
 30 side of the other or loose gear and having a curved recessed part fitting the outwardly curved part and adjustable over it axially of the gears, a second disk part fitting the casing and against the other side of the
 35 loose gear, adjusting means for adjusting the loose gear and its follower disks transversely of the driven gear consisting of two adjustable screws extending into the casing from opposite sides and centering
 40 upon the follower and disk to change the extent of meshing of the gears and their extent of displacement, and packing means about the adjusting screws to form a liquid tight joint and apply a friction against ro-
 45 tation of said screws.

In testimony of which invention, I hereunto set my hand.

BENTLEY L. RINEHART.

Witnesses:

R. M. HUNTER,

FLORENCE DEACON.