C. M. MANLY.

VARIABLE STROKE PUMP FOR HYDRAULIC SPEED GEARS.

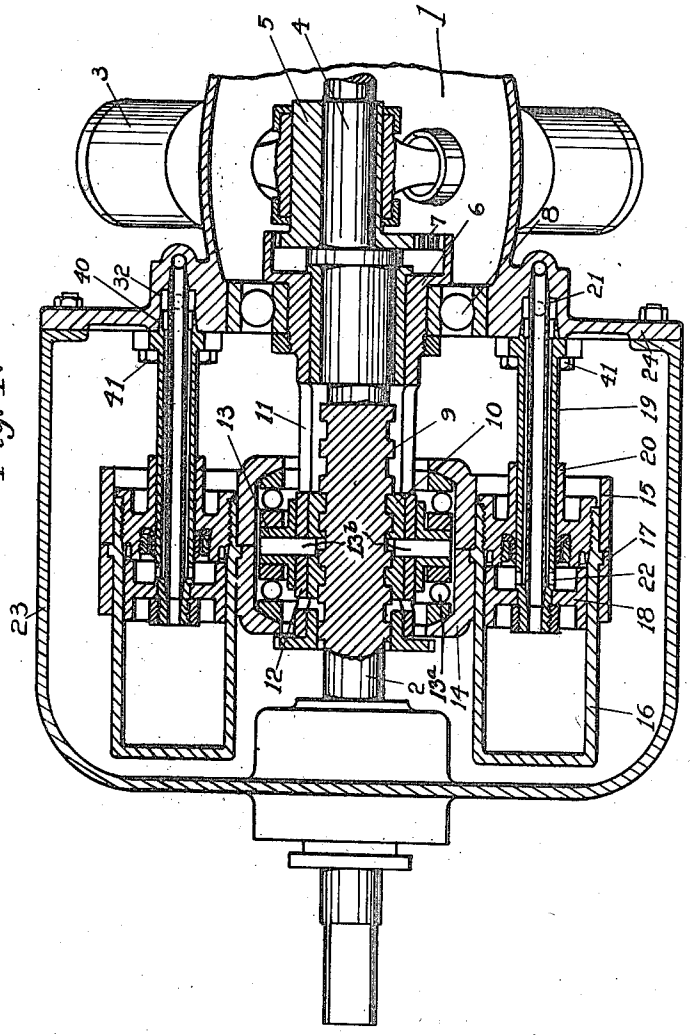
APPLICATION FILED JUNE 29, 1914.

1,283,249.

Patented Oct. 29, 1918.

2 SHEETS—SHEET 1.

Fig. 1.



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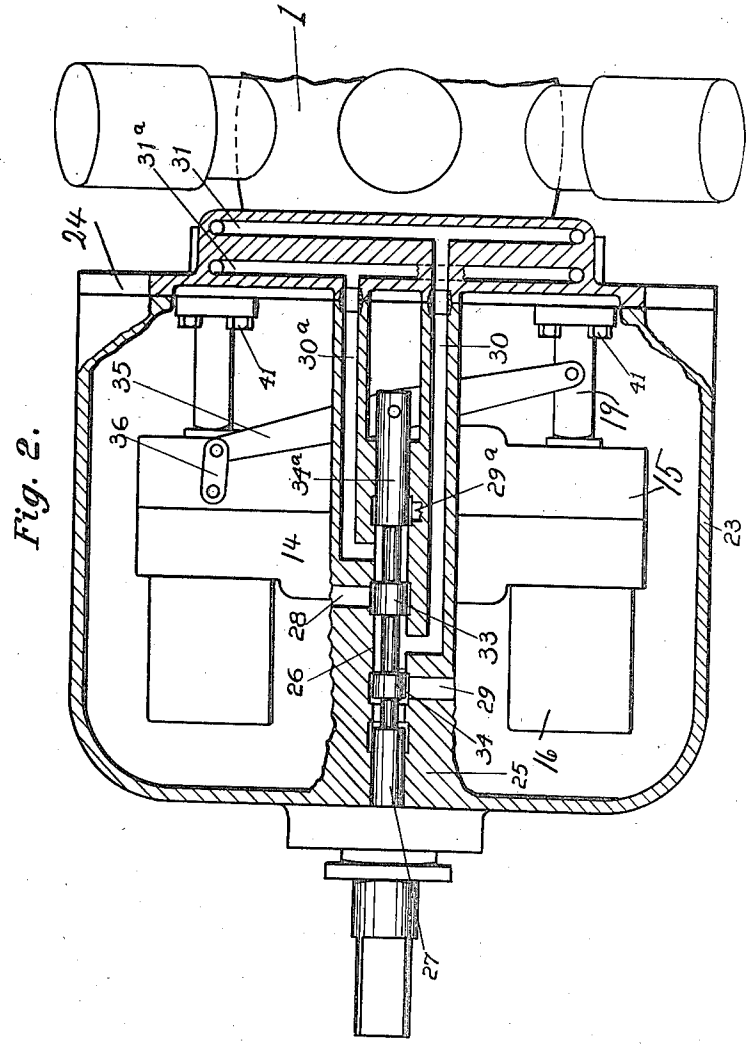


Fig. 2.

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UNITED STATES PATENT OFFICE.

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VARIABLE-STROKE PUMP FOR HYDRAULIC SPEED-GEARS.

1,283,249. Specification of Letters Patent. Patented Oct. 29, 1918.

Application filed June 29, 1914. Serial No. 847,971.

To all whom it may concern:

Be it known that I, CHARLES M. MANLY, a citizen of the United States, and a resident of Freeport, county of Queens, and State of New York, have invented certain new and useful Improvements in Variable-Stroke Pumps for Hydraulic Speed-Gears, of which the following is a specification.

This invention relates to variable stroke pumps for hydraulic speed gears, such for example as described in my prior Patents No. 1,212,791, granted January 16, 1917, and No. 1,206,453, granted November 28, 1916.

This invention has for its object to improve stroke adjusting mechanism of the pumps disclosed in said applications, to render it simpler in construction, cheaper to manufacture, more efficient in operation, and less liable to leakage of fluid than the adjusting mechanism illustrated in the prior applications.

With the above objects in view my invention consists of the construction hereinafter described and shown in the accompanying drawings, in which Figure 1 is a horizontal sectional view along the shaft line of the pump, and Fig. 2 is a horizontal section on a plane above the shaft of the pump and showing the connections for the adjusting fluid.

Referring now to the drawings, and particularly Fig. 1, 1 indicates the crank casing in which is suitably supported the main crank shaft 2 for operating the pistons of the radial pump cylinders 3 of which there are preferably five, although the number may be varied more or less as desired. The crank shaft 2 has a fixed crank pin 4 and rotatably mounted on the crank pin is an eccentric bushing 5, whose eccentricity is equal to the throw of the crank pin whereby when the bushing is in one position of adjustment it will exactly compensate for the eccentricity of the crank pin so that the shaft will rotate without reciprocating the pump pistons, while in the opposite position of adjustment it will give the pump pistons their maximum stroke equal to twice the stroke which would be effected by the crank pin alone. At any intermediate position of adjustment the pump pistons will obviously have a corresponding partial stroke.

As in my prior applications, I provide a fluid pressure operated mechanism for adjusting the eccentric bushing around the crank pin. This mechanism comprises a sleeve 6 surrounding the shaft 2 and having at its end an internal gear 7 meshing with a pinion formed integral with the bushing 5. Within the supporting bearing 8 a bushing is interposed between the shaft and the sleeve to properly support the shaft, and beyond the bearing the shaft is threaded as indicated at 9 for the reception of a nut 10 working on the thread between shaft 2 and the sleeve which is provided with longitudinal slots 11 throughout the length of the tread. Attached to the nut and working in the slots of the sleeve are shoes 12 which are carried by a ring 13 having a flange around its middle which is inclosed in a suitable yoke 14. Ball bearings 13^a are interposed between the flange of the ring 13 and the inturned end flanges of the yoke 14, whereby the yoke may be held against rotation and adjusted longitudinally of the shaft, thereby producing a relative rotation of the sleeve and the shaft with corresponding adjustment of the pump stroke. The nut 10, the ring 13 and interposed shoes 12 are all connected together by radial pins 13^b set in the middle flange of the ring 13 at points corresponding with the position of each shoe and projecting through the ring 13 and through the shoes 12 and into the nuts 10 so that the parts all move together upon the reciprocation of the yoke.

The mechanism so far described is substantially the same as that shown in my prior applications. My present invention has to do specifically with the mechanism for adjusting the yoke longitudinally of the shaft. As shown the yoke is provided with a central annular part inclosing the shaft and the ring 13 and at each side it is provided with integral annular ears 15 of a smaller diameter than the central part. The yoke is preferably formed of similar longitudinal halves whereby it may be clamped over the central ring 13 as shown in Fig. 1. Set in the ears 15 are adjusting cylinders 16 whose open ends face the crank casing 1. The cylinders are held in place by means of collars 17 formed on the cylinders adjacent their open ends and clamped in the groove between the two halves of the yoke as shown in the drawing. Within the cylinders 14 are pistons 18 fixedly attached to hollow piston rods 19.

The open ends of the cylinders 16 are closed by suitable caps 20 which surround the piston rods 19 and have a fluid-tight fit therewith. The piston 18 is recessed on its

face adjacent the cap of the cylinder to permit the adjusting fluid as received through the bore of the piston rod to pass into the cylinder between the piston and the cap of the cylinder. To provide a fluid connection with the opposite side of the piston a tube 21 preferably of steel and of smaller diameter than the bore of the rod 19 is inclosed in the bore and connects through the hollow end of the piston rod with the closed end of the cylinder. The fluid is admitted to the cylinder between the cap and piston through transverse bores 22 in the piston rod.

The adjusting fluid is delivered to the piston rod 19 and the inner tube 21 through the medium of a control valve mechanism, which will now be described. As shown in Fig. 2 the adjusting mechanism is inclosed in a casing 23 which is rigidly bolted to a flange 24 formed on the adjacent end of the crank chamber 1. The casing 23 is provided with a transverse web 25, a portion of which is shown in Fig. 2 and extending longitudinally and central of this web is a valve chamber 26 in which is mounted the control valve 27 similar in all essential respects to the control valve employed in my prior applications. Connecting with the middle of the valve chamber 26 is a passage 28 which is connected with a suitable source of fluid under pressure, not shown. Also connecting with the valve chamber 26 near the ends thereof are passages 29, 29^a which connect with a suitable exhaust chamber or other fluid circuit of low pressure. Between the passage 28 and the passages 29, 29^a, the chamber 26 connects with longitudinal passages 30, 30^a respectively formed in the web 25 and extending to the end thereof where they have fluid-tight connection with transverse passages 31, 31^a extending across the crank chamber casting. In Fig. 2 the passages 30, 30^a and 31, 31^a are shown for convenience as on the same plane, but it is to be understood, however, that the passages 30^a, 31^a, are on a level slightly lower than the other two passages to permit the passage 31^a to cross beneath the other passage. The passages 31, 31^a terminate at each end in vertical bores in the crank chamber casting, the bores of the passage 31 connecting with the seat of the inner tube 21, while the bores at the ends of the passage 31^a connect with cavities 32 surrounding the tube 21 and forming seats for the piston rods 19. In this manner the portion of the valve chamber 26 on one side of the middle high pressure passage 28 is at all times connected with the adjusting cylinders on one side of the pistons 18, while the other side of the piston is at all times connected with the opposite end of the valve chamber.

The valve 27 which controls the admission of fluid to the adjusting cylinders is provided with a middle head 33 of a width to exactly close the passage 28 and with heads 34, 34^a which when the passage 28 is closed cut off the passages 29, 29^a from connection with the passages 30, 30^a. When the valve is adjusted in either direction from the central neutral position just described and shown, the passage 28 will be connected with one of the passages 30, 30^a to admit fluid under pressure to one side of the adjusting cylinders while the other of the passages 30, 30^a will be connected to one or the other of the exhaust passages 29, 29^a to receive the fluid forced out of the other side of the adjusting cylinders.

For operating the valve 27 I preferably provide a floating lever 35 connected at its middle point to the valve and provided at one end with a rod or other suitable connection for manual operation. The other end of the lever is connected through a link 36 with the yoke 14. When the rod is operated to shift the valve the lever will turn on its connection with the yoke as a fulcrum and open the valve to an extent determined by the extent of its movement. When the fluid under pressure passes into the cylinders as described, the yoke will be shifted in the opposite direction to the movement of the rod, thereby closing the valve and stopping the yoke after it is moved through a distance proportional to the movement of the rod. In this way the position of the rod exactly determines the position of the yoke and consequently the relative positions of the eccentric and the crank pin which determines the stroke of the pump.

An impotant advantage of my present invention is the construction and arrangement of the parts to provide fluid-tight connections at all the joints in the passage of the adjusting fluid. As explained in my prior applications the fluid in a hydraulic transmission is sometimes under very high pressure and cannot be held satisfactorily by ordinary packed joints. The piston rods 19 are connected with the flange 24 of the crank chamber casting to have fluid connection with the chambers 32 by means of tapered extensions 40 formed on the ends of the piston rods and fitting correspondingly tapered seats in the casting. The extensions 40 are thin enough to be slightly compressed by the pressure which can be exerted on the clamping bolts 41. This joint is tight under any pressure of fluid for the reason that the pressure of fluid on the inside of the extension will expand the metal against its seat with a force proportional to the pressure of the fluid. In like manner the inner tubes 21 are tapered at each end and seated in correspondingly tapered sockets in the piston rod and casting respectively. These joints will obviously be drawn tight by the

bolts 41 and by having tapered surfaces sufficiently long any slight inaccuracies in the relative length of the piston rod and the inner tube will be taken up by the compression of the joints. It will be observed also that all the joints and passages from the valve to the adjusting cylinders are in the casing 23 where the fluid will be collected and returned through the circuit heretofore described in the prior applications.

A further feature of advantage of my improved mechanism is that the parts may be made much lighter than heretofore possible. The reaction from the adjusting force is taken up by the crank chamber, thereby permitting a lighter casing 23 to be employed and without requiring a complicated casting for the crank casing.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:—

1. In a fluid pressure operated adjusting mechanism of the class described, the combination of a rotatable shaft having a variable stroke crank, a crank case inclosing said crank, said shaft projecting beyond the end of said case, a member to be adjusted on the projecting portion of said shaft for effecting the adjustment of said crank, the end of said casing constituting a fixed abutment member, a closed cylinder attached to said adjustable member, a piston in said cylinder and fixedly connected to said abutment member, and means for supplying fluid under pressure to the opposite sides of said piston within said cylinder.

2. In a fluid pressure operated adjusting mechanism of the class described, the combination of a rotatable shaft having a variable stroke crank, a crank case inclosing said crank, said shaft projecting beyond the end of said case, a member to be adjusted on the projecting portion of said shaft for effecting the adjustment of said crank, the end of said casing constituting a fixed abutment member, a closed cylinder attached to said adjustable member, a piston in said cylinder, a hollow piston rod connecting said piston to said abutment member and means for transmitting the fluid under pressure through said piston rod to the opposite sides of said piston in said cylinder.

3. In a fluid pressure operated adjusting mechanism, of the class described, the combination of a rotatable shaft having a variable stroke crank, a crank case inclosing said crank, said shaft projecting beyond the end of said case, a member to be adjusted on the projecting portion of said shaft for effecting the adjustment of said crank, the end of said casing constituting a fixed abutment member, a closed cylinder attached to said adjustable member, a piston in said cylinder, a hollow piston rod connecting said piston to said abutment member, said piston rod being formed with two separate fluid passages, and means for transmitting fluid under pressure through said separate passages to the opposite sides of said piston in said cylinder.

4. In a device of the class described, the combination of a rotatable shaft having a variable stroke crank, means for adjusting said crank comprising a member adjustable longitudinally of said shaft, a plurality of cylinders attached to said member on opposite sides thereof and extending parallel with said shaft, a casing for said shaft comprising a crank case having shaft bearings with the shaft projecting beyond the end wall of said crank case, and an inclosing casing surrounding the projecting portion of said shaft, a plurality of stationary pistons attached to said end wall and working in said cylinders and means for delivering fluid under pressure to said cylinders behind said pistons.

5. In a device of the class described, the combination of a rotatable shaft having a variable stroke crank, means for adjusting said crank comprising a member adjustable longitudinally of said shaft, a plurality of cylinders attached to said member on opposite sides thereof and extending parallel with said shaft, a casing for said shaft comprising a crank case having shaft bearings with the shaft projecting beyond the end wall of said crank case, and an inclosing casing surrounding the projecting portion of said shaft, a plurality of stationary pistons attached to said end wall and working in said cylinders and means for delivering fluid under pressure to said cylinders behind said pistons, said means comprising a valve in said casing, and passages formed in the wall of the casing and through said piston rods.

6. In a device of the class described, the combination of a rotatable shaft having a variable stroke crank, means for adjusting said crank comprising a member adjustable longitudinally of said shaft, a plurality of cylinders attached to said member on opposite sides thereof and extending parallel with said shaft, a casing for said shaft, a plurality of stationary pistons attached to said casing and working in said cylinders, hollow piston rods connecting said pistons to said casing, said casing having cavities, a tapered sleeve forming an extension of said piston rod, a tapered socket opening into said cavity, and means for drawing said extension into said socket and compressing the metal of the extension.

7. In a device of the character described, the combination of a mechanism to be adjusted, means for adjusting said mechanism comprising a longitudinally adjustable member, a casing inclosing said mechanism and said member comprising a crank case having shaft bearings with the shaft projecting beyond the end wall of said crank

case, and an inclosing casing surrounding the projecting portion of said shaft, an adjusting cylinder attached to said member, said cylinder being closed at each end, a piston in said cylinder, a hollow piston rod connected to said piston projecting through one end of said cylinder and fixedly connected to said end wall, said piston rod having openings in its wall communicating with the cylinder on one side of the piston, a tube of smaller diameter within the bore of said piston rod and communicating with the opposite side of said piston, a plurality of fluid passages in said casing and fluid tight connections between the bore of said piston rod and said tube respectively and said passages.

8. In a device of the character described, the combination of a mechanism to be adjusted, means for adjusting said mechanism comprising a longitudinally adjustable member, a casing inclosing said mechanism and said member, an adjusting cylinder attached to said member, said cylinder being closed at each end, a piston in said cylinder, a hollow piston rod connected to said piston projecting through one end of said cylinder, said piston rod having openings in its wall communicating with the cylinder on one side of the piston, a tube of smaller diameter within the bore of said piston rod and communicating with the opposite side of said piston, a plurality of fluid passages in said casing and fluid tight connections between the bore of said piston rod and said tube respectively and said passages, said connections comprising a tapered extension on said piston rod, a tapered extension on said tube projecting beyond the end of said piston rod, correspondingly tapered sockets opening into said passages and means for drawing said piston rod against said casing and thereby compressing both said extensions into their respective sockets.

Signed at New York, in the county of New York and State of New York, this 13th day of June, 1914.

CHARLES M. MANLY.

Witnesses:

A. I. MILLER,

RUPERT E. RUNDELL.