Aug. 8, 1950 C. F. ERIKSON 2,517,645

PUMPING MECHANISM

Filed July 11, 1947 2 Sheets-Sheet 1

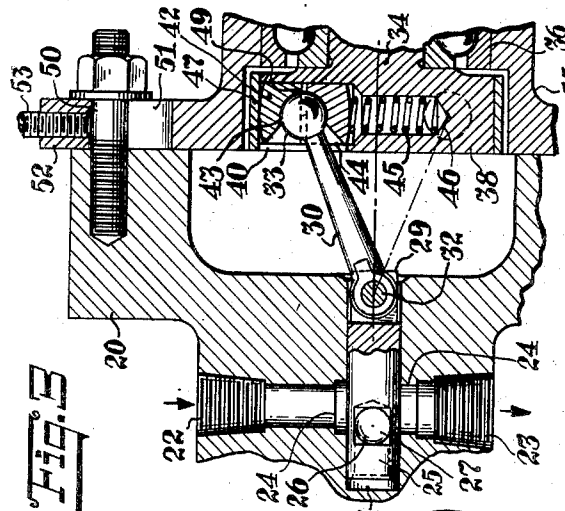


Fig. 3

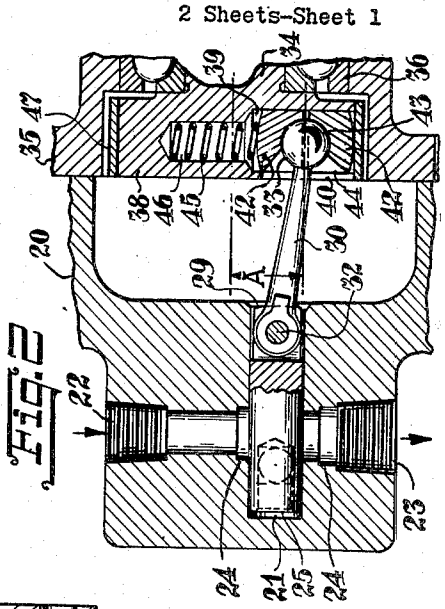


Fig. 2

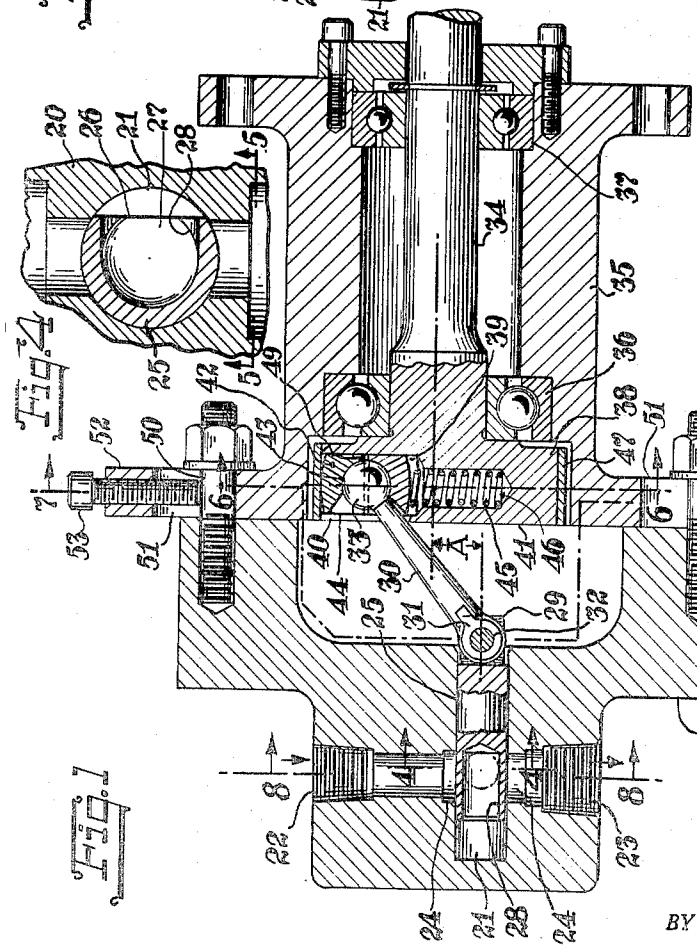


Fig. 4

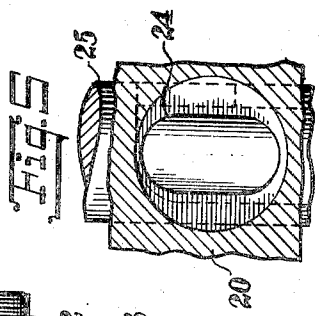


Fig. 5

Fig. 1

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Fig. 7

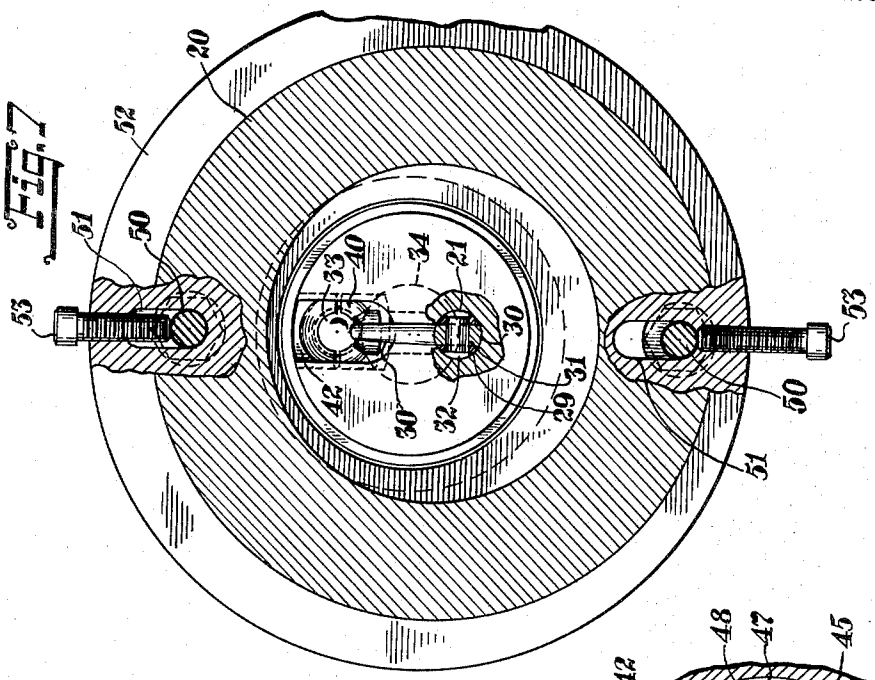


Fig. 11

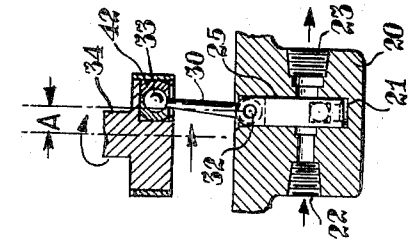


Fig. 10

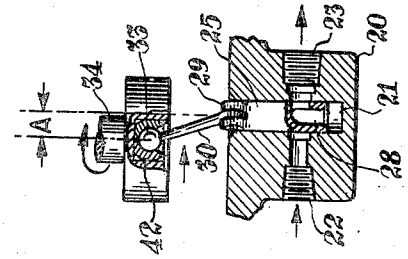


Fig. 9

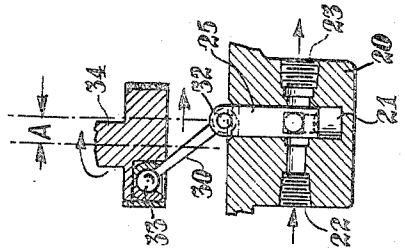


Fig. 5

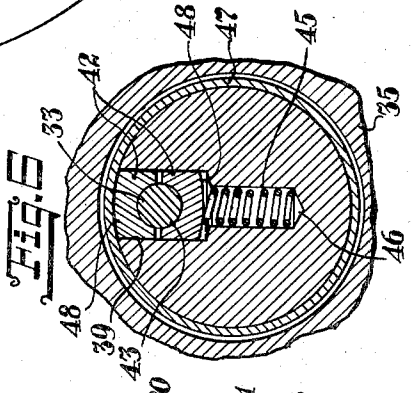
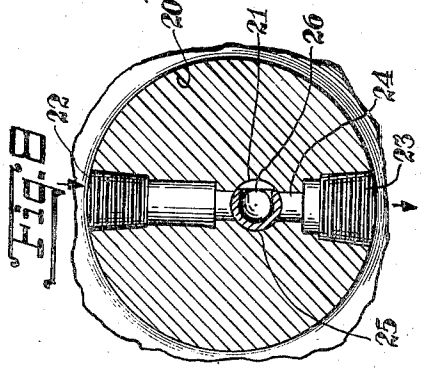


Fig. 8



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PUMPING MECHANISM

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Application July 11, 1947, Serial No. 760,202

8 Claims. (Cl. 103—38)

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This invention refers to pumping mechanism in general and has particular application to hydraulic pumps which discharge a liquid into a line to maintain certain pressure or flow conditions.

It is the principal object of the invention to provide simple mechanism for imparting to the piston a reciprocating motion while driven from a rotating shaft.

Another object is to provide connecting means between the drive shaft and the piston which eliminates lost motion.

A further object is to provide means for adjusting the relation between the drive shaft and the piston whereby the quantity of liquid discharged can be varied to suit different requirements.

Still further objects will become apparent in the following specification and in the drawings in which a preferred embodiment of the invention is shown.

In the drawings,

Fig. 1 is a longitudinal sectional view, partly in elevation, of the pump assembly with its piston at the beginning of its forcing stroke;

Fig. 2 is a fragmentary sectional view, partly in elevation, of the pump assembly with its piston at the beginning of its suction stroke, both Figs. 1 and 2 showing the piston adjusted for maximum stroke;

Fig. 3 is a view similar to Fig. 2, but showing the piston adjustment at zero stroke;

Fig. 4 is an enlarged fragmentary cross-sectional view along the plane of line 4—4 in Fig. 1;

Fig. 5 is a cross-sectional view along the plane of line 5—5 in Fig. 4;

Fig. 6 is a fragmentary cross-sectional view along the plane of line 6—6 in Fig. 1;

Fig. 7 is a cross-sectional view along the plane of line 7—7 in Fig. 1;

Fig. 8 is a fragmentary cross-sectional view along the plane of line 8—8 in Fig. 1;

Figs. 9, 10 and 11 are fragmentary sectional views of the piston and its operating means in positions at, respectively, the beginning, the middle and the end of its forcing stroke.

Like characters of reference denote similar parts throughout the several views and the following specification.

20 is a pump body having a cylinder 21. An inlet 22 and outlet 23 in the body are each reduced to an oblong port 24 where they terminate in the cylinder for reasons specified later. 25 is a piston in the cylinder having a flattened portion 26, a duct 27 therethrough at substantially right angles to the piston axis, and an axial bore

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28 in the lower or innermost portion of the piston in communication with duct 27. The top or outermost portion of the piston is slotted at 29.

30 is connecting rod which has one end flattened at 31 and pivoted to the slotted end 29 of the piston by means of a pivot 32 forming a clevis joint between the connecting rod and the piston. The other end of the connecting rod 30 terminates in a ball 33.

34 is a drive shaft adapted to be rotated by suitable means, not shown. The shaft is supported within a housing 35 by ball bearings 36 and 37. 38 is an enlarged circular portion of the drive shaft having a, preferably, round socket 39 substantially at right angles to the axis of the shaft. 40 is a slot through the enlarged portion 38 extending from its end face 41 into the socket.

Within the socket 39 are two symmetrically shaped bearing halves 42, substantially cylindrical in form and adapted slidingly to engage the walls of socket 39. Each of these halves is cupped out at opposing faces at 43 to receive ball terminal 33 of connecting rod 30 between them. One side of each of the bearing halves is chamfered at 44 to provide clearance for the travel of the portion of the connecting rod immediately adjacent the ball terminal. 45 is a spring within a reduced continuation 46 of the socket bore 39. 47 is a circular band around the portion 38 of the drive shaft, closing the socket. Thus spring 45 forces the bearing halves 42 together and confines the ball terminal 33 within them. Bearing halves 42 have ball shaped outer surfaces 48 of the same radius as the inside diameter of band 47, while their inner opposing faces 49 are, preferably, flat.

It is to be noted that the axis of the drive shaft 34 is out of alignment with the axis of the piston 25 by an amount designated A in Fig. 1. The pump body 20 is provided with two bolts 50 which pass through oblong slots 51 of a flange 52 of the drive shaft housing 35. Adjusting screws 53 extend through flange 52 and slots 51 for the purpose of varying the distance A.

Referring to Fig. 1, it will be seen that rotation of drive shaft 34, causes rotation of the ball terminal 33 of connecting rod 30 in a fixed plane. During this rotation, the connecting rod by virtue of its clevis joint with the piston 25 also rotates the piston. In the position shown in Fig. 1, however, because of the eccentricity A between the axes of drive shaft and piston and the fixed length of the connecting rod, the piston during its rotation is forced to travel in a plane perpendicular to the plane of rotation of the ball termi-

nal and drive shaft, and thus is simultaneously reciprocated.

Different positions of the piston and its relation to the inlet and outlet of the pump with the same adjustment A as shown in Fig. 1 are illustrated in Figs. 9, 10 and 11. In Fig. 9, as well as in Fig. 1, the piston is at the beginning of its forcing stroke, or also at the end of its suction stroke. The ball terminal 33 is farthest away from the axis of the piston and, therefore, the piston is in its highest position. The cylinder 21 is filled with liquid and the inlet 22 and outlet 23 are closed by the piston, as shown enlarged in Fig. 4. The piston then is turned by drive shaft 34, the motion of which is transmitted to the piston by connecting rod 30 and its clevis connection with the head of the piston. Simultaneously the piston travels downwardly because the ball terminal 33 moves nearer to the axis of the piston, the outlet 23 is opened, and the liquid is forced from the cylinder through axial bore 28, duct 27 and oblong port 24. Port 24 is of oblong shape so that duct 27 can communicate with it during its downward travel. Fig. 10 clearly shows an intermediate position of the piston, i. e. with the piston at about one-half of its downward travel. In Fig. 11, as well as in Fig. 2, the ball terminal is nearest to the axis of the piston which, therefore, is at its lowest position and at the end of its forcing stroke when the ports 24 are again closed and the piston is ready to begin its upward motion or suction stroke while further rotated. During this suction stroke, the port 24 at the inlet 22 is brought in communication by duct 27 and bore 28 with cylinder 21, in exactly the same manner as explained before in connection with the forcing stroke, except that the piston moves upwardly and the vacuum created in the cylinder 21 thereby draws in the liquid until the piston again assumes the position shown in Fig. 9.

In Figs. 1, 2, 7, 9, 10 and 11 the eccentricity of the piston axis with respect to the drive shaft axis is shown at its maximum, namely A. With this adjustment the piston stroke is also at its maximum. By adjusting the relation between these two axes by means of screws 53 which changes the relation of the pump body 20 and drive shaft housing 35, this piston stroke can be varied. When the axes of the piston and the drive shaft are so adjusted that they coincide, then the piston has no stroke, i. e., it is rotated, but not reciprocated. Such an adjustment is shown in Fig. 3 in which also the position of the connecting rod 30 after a 180° turn is indicated in dotted lines. It is obvious that any adjustment may be made intermediate the maximum and minimum or zero.

While I have shown in the drawings the axes of the drive shaft and piston parallel, in which case, as stated before, if both axes are adjusted so as to coincide, no reciprocation of the piston will take place, these axes can also be disposed angularly with respect to each other, as long as the angle between them is less than 90 degrees. When in angular relation to each other, there will be no zero stroke of the piston, but a minimum stroke depending on the angularity, so that adjustment of stroke is possible from this minimum to a maximum.

It will be noted that the movement imparted to the piston will be free from lost motion regardless of whether or not the adjustment is for maximum or minimum discharge assisted greatly by the unique disposition of the ball terminal 33 of the connecting rod between the bearing halves

42 within the socket 39. While the drawings show the opposed faces 49 of the bearing halves spaced slightly apart, I have also found it advantageous to have them in contact with each other and provide minute clearance only between the cupped-out portions of the halves and the ball terminal. In such case the spring 45 serves to hold the inner bearing half against the outer one. In either case the fact that both bearing halves are identical greatly facilitates assembly.

While I have shown in the drawings, a reciprocatory and rotary piston, controlling the cylinder inlet and outlet, I may use the reciprocating motion of the piston only in combination with inlet and outlet check valves or other similar means well known in the art, in which case the piston, however, will be operated in exactly the same manner.

It is obvious, of course, that the method of driving the piston from a rotary shaft disclosed herein is applicable also to pumps having more than one pumping unit.

The method of adjustment, namely, sliding the shaft housing and the pump body with respect to each other, so as to change the relation between the drive shaft and piston, is subject to many changes and is shown only to illustrate a simple means for doing so.

By admitting fluid under pressure, the pump may be used as a motor, an expedient well known in the art.

Many other modifications in the form, proportion, combination of parts and minor details of construction may be resorted to without departing from the principles or sacrificing any of the advantages of the invention as defined in the appended claims.

What I claim as new, is:

1. A pump comprising a cylinder, a reciprocatory piston in the cylinder, a rotary driving member, and a connecting rod having one end fastened to the piston in line with the axis of the piston and its other end eccentrically to the rotary driving member, the axis of rotation of the member being disposed at an angle less than 90 degrees with the axis of the piston.

2. A pump comprising a housing having a cylinder, a reciprocatory piston in the cylinder, a rotary driving member, a bearing for the member connected to the housing, a connecting rod having one end fastened to the piston in line with the axis of the piston and its other end eccentrically to the rotary driving member, and means to change the axial relation between housing and bearing to vary the stroke of the piston.

3. A pump comprising a housing having a cylinder having an inlet and an outlet, a piston in the cylinder, and means to rotate and reciprocate the piston and alternately place the inlet and outlet in communication with the cylinder as the piston rotates including a rotary driving member, a bearing for the member connected to the housing, and a connecting rod having one end fastened to the piston in line with the axis of the piston and its other end eccentrically to the driving member, and means to change the axial relation between housing and bearing to vary the stroke of the piston.

4. In a pump, a piston, a rotary driving member, a connecting rod between piston and member having one end pivotally fastened to the piston in line with the axis of the piston and its other end formed into a ball terminal, the member having a socket in angular relation to its axis, identical bearing halves fitted within the

socket and cupped out at opposite faces to hold the ball terminal between them and eccentrically with respect to the axis of the member, means confining the bearing halves within the socket, and resilient means to force the bearing halves toward each other.

5. A pump comprising a cylinder, a reciprocatory piston in the cylinder, a rotary driving member, a connecting rod having one end pivotally fastened to the piston in line with the axis of the piston and its other end formed into a ball terminal, the driving member having a socket eccentrically disposed to its axis and in angular relation therewith, bearing halves fitted within the socket and cupped out at opposite faces to hold the ball terminal between them eccentrically with respect to the axis of the member, means confining the bearing halves within the socket, and resilient means to force the bearing halves toward each other.

6. A pump comprising a cylinder having an inlet and an outlet, a piston in the cylinder, and means to rotate and reciprocate the piston and alternately place the inlet and outlet in communication with the cylinder as the piston rotates comprising a rotary driving member, a connecting rod having one end fastened to the piston in line with the axis of the piston and its other end formed into a ball terminal, the driving member having a socket eccentrically disposed to its axis, identical bearing halves within the socket to hold the ball terminal between them, and resilient means to force the bearing halves toward each other.

7. A pump comprising a housing having a cylinder having an inlet and an outlet, a piston in the cylinder, and means to rotate and reciprocate the piston and alternately place the inlet and outlet in communication with the cylinder as the piston rotates including a rotary driving member, a bearing for the member connected to the housing, a connecting rod having one end pivotally

fastened to the piston in line with the axis of the piston and its other end formed into a ball terminal, the driving member having a socket eccentrically disposed to its axis and in angular relation therewith, bearing halves fitted within the socket and cupped out at opposite faces to hold the ball terminal between them, means confining the bearing halves within the socket, resilient means to force the bearing halves toward each other, the axes of the piston and driving member being disposed at an angle of less than 90 degrees to each other, and means to change the axial relation between housing and bearing to vary the stroke of the piston while maintaining their angular relation.

8. In a pump, a piston and a rotary member having a circular portion, a connecting rod between piston and member having one end pivotally fastened to the piston in line with the axis of the piston and its other end formed into a ball terminal, the circular portion of the rotary member having a bore through its periphery constituting a socket, identical bearing halves within the socket adapted to hold the ball terminal between them and eccentrically with respect to the axis of the member, a ring around the circular portion closing the open end of the socket and confining the bearing halves within the socket, and resilient means to force the bearing halves toward each other.

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