Aug. 29, 1933. E. J. SVENSON 1,924,423

PLUNGER PUMP

Filed May 28, 1930

Fig. 1

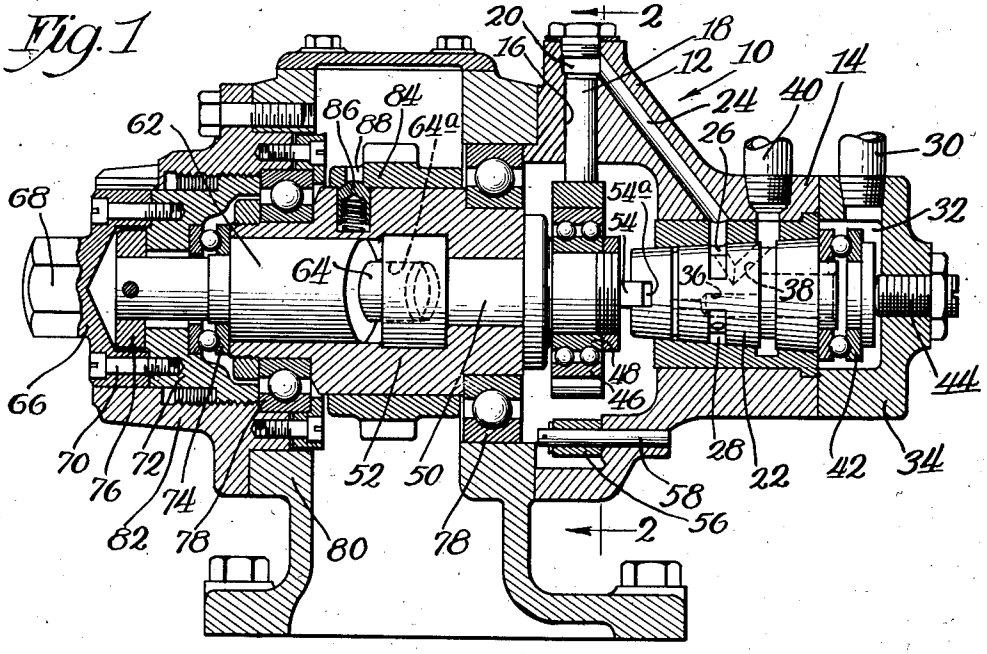
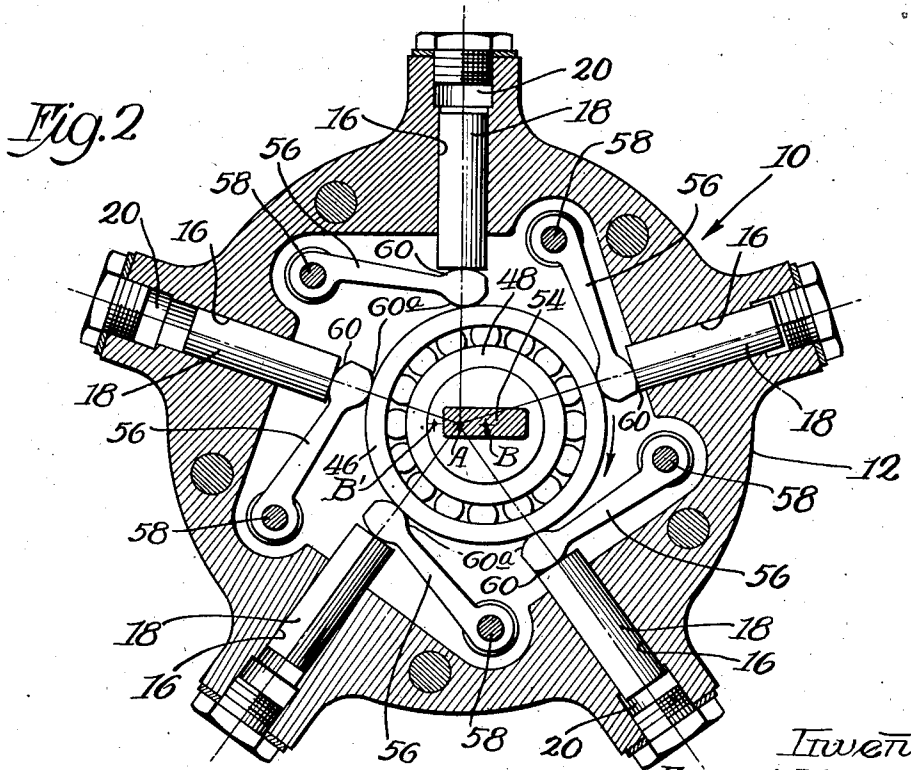


Fig. 2



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PLUNGER PUMP

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Application May 28, 1930. Serial No. 456,572

8 Claims. (Cl. 103—174)

My present invention relates generally to plunger pumps, and more particularly to improved means for eliminating side thrust in radially reciprocable pistons of such pumps or motors.

In my co-pending application, Serial No. 430,867, filed February 24, 1930, I have disclosed a plunger pump which relates generally to the type of plunger pump covered in the present application. My present invention, however, relates to improvements in certain structural features not shown or suggested in the above mentioned co-pending application. My present invention contemplates the provision of a stationary supporting means or cylinder block which is adapted to support a plurality of radially reciprocable pistons.

In order to insure efficient functioning of these pistons over an extended period of time, they must experience a minimum degree of side thrust. Unless this side thrust is eliminated, the wear to which they are subjected, may cause leakage and improper functioning of the pump.

It is one of the important objects of my present invention to provide improved means which may be interposed between the inner extremities of the above mentioned radial pistons and the centrally positioned rotary driving means so as to take up all of the side thrust, which would be imparted to the pistons, were said pistons to directly engage the peripheral surface of said centrally positioned driving means.

More specifically, it is an object of my invention to provide in combination with a plurality of radially reciprocable pistons and a central laterally shiftable rotary driving means, a member interposed between the peripheral surface of said driving means and the inner extremity of each of said pistons which will serve to impart a radially acting force to the pistons regardless of the relative position of said rotary driving means.

Another object of my invention is to provide means interposed between said shiftable rotary driving means and the inner extremities of said pistons, which will permit said driving means to be shifted for the purpose of varying the stroke of said pistons without disturbing the timed relationship between said pistons and a valve for controlling the flow of fluid toward and away from said pistons.

Still more specifically, my invention contemplates the provision of a plurality of pivoted members or fingers, in combination with a plunger pump having a plurality of pistons reciprocable within a stationary cylinder block and a rotary valve for controlling the flow of fluid toward and away from said pistons, said fingers being so arranged as to eliminate all side thrust in the pistons and to permit a central driving ring to be laterally shifted without disturbing the timing of the piston movements with the movement of said rotary valve.

It is also an object of my present invention to provide a plunger pump which is equipped with a new and practical arrangement for imparting movement to the rotary driving means thereof.

These and numerous other objects and advantages will be more apparent from the following detailed description when considered in connection with the accompanying drawing, wherein—

Figure 1 is a central vertical sectional view of a plunger pump which is constructed in accordance with the teachings of my invention; and

Figure 2 is an enlarged transverse vertical sectional view of the pump taken substantially along the line 2—2 of Figure 1.

Referring now to the drawing more in detail, wherein like numerals have been employed to designate similar parts throughout the various figures, it will be seen that one embodiment of my invention comprises a fluid propelling device, which includes a stationary supporting means or stator designated generally by the numeral 10, and this stator includes a housing or enlarged annular section 12 and a reduced annular bearing section 14. The stator section 12 is provided with a plurality of radial chambers 16 which house complementary pistons 18. The upper extremities of the chamber 16 are designated by the numeral 20, and these chamber sections 20 are adapted to communicate with a rotary valve member 22 through passages 24 in the stator section 12. While Figure 1 discloses only one of the passages 24, it will be understood that there is a passage connecting each chamber section 20 with the rotary valve 22. For a more detailed disclosure of the stator and its associated parts, reference is made to my above mentioned co-pending application, Serial No. 430,867, filed February 24, 1930.

The valve 22 is provided with a peripheral port 26 and a peripheral port 28. The peripheral port 28 constitutes the intake port and as such is adapted to receive fluid from an outside source (not shown) which is conducted through a pipe 30 into a chamber 32 provided within an end casing 34. From this chamber 32 the fluid passes through a longitudinal valve passage 36, and thence into the peripheral port 28. The peripheral valve port 26, which is an outlet port, is adapted to conduct fluid from the passages 24 through a valve passage 38 and thence into a discharge pipe 40. The valve 22 is of a tapered construction so as to eliminate the leakage of fluid longitudinally thereof and is secured against longitudinal displacement by means of a friction reducing end thrust bearing 42 and a companion abutment screw 44.

Movement is imparted to the pistons 18 by means of a central laterally shiftable driving

ring 46 which is supported by a friction reducing bearing 48. This bearing 48 is, in turn, carried by a driving member 50, which is rotatable with and laterally shiftable of a companion rotary driving sleeve 52. One extremity of the driving member 50 is provided with a tongue 54 which is received by a complementary groove 54*a* in the rotary valve 22. Thus, rotation of the member 50 will impart rotation to the rotary valve. Interposed between the inner extremities of each of the pistons 18 and the periphery of the ring 46 is a finger 56, which is pivotally mounted upon a pin 58 carried by the stator 10. Attention is directed to the fact that the outer or free extremity of each of the fingers 56 is provided with opposed curved surfaces 60 and 60*a*, the surface 60 engaging the inner extremity of its companion piston, and the surface 60*a* resting upon the periphery of the ring 46, Figure 2.

It will be apparent that when the ring 46 is positioned in axial alinement with the driving sleeve 52 and the rotary valve 22, no movement will be imparted to the pistons 18. The axis of rotation of the sleeve 52 and the valve 22 is indicated by the letter A in Figure 2, while the axis of the driving ring 46 is designated by the letter B. When the axis B of the driving ring 46 has been shifted to the position shown in Figure 2 as a result of the shifting of the driving member 50 within its companion sleeve 52, and rotation is imparted to said driving member, movement will be imparted to the pistons 18 during each complete rotation of the driving member 50. In other words, as the driving ring 46 is swept through its orbit during one complete rotation of the driving member 50, each finger 56 will experience one complete oscillation. Also, during this period each piston will experience one complete reciprocation. In Figure 2 I have shown the maximum degree of shifting to which the ring 46 may be subjected. Obviously, said ring may be shifted in an opposite direction so as to carry the axis B to the point which I have designated by the numeral B'.

In my above mentioned co-pending application I have shown the manner in which pivoted fingers may be interposed between a driving ring and a plurality of radial pistons, but my present invention presents a decided improvement over the former structure. This will be readily appreciated when it is understood that the peripheral ports 26 and 28 of the rotary valve must operate in absolute timed relation with respect to the positions of the pistons 18 in their respective chambers. In other words, the peripheral port 28 must always be in communication with those pistons which are experiencing a compressing stroke. That is to say, fluid must be introduced to the pistons from the peripheral valve port 28 and withdrawn from the pistons through the valve port 26. If this timing relationship is varied, it seriously impairs the functioning of the pump. Hence, in shifting the ring 46 from one position to another, the timing of the pistons with the valve should not be affected. By providing pivoted fingers of the type shown in the drawing, I am able to preclude any possibility of disturbing the timed relationship. In this connection attention is directed to the provision of the curved surfaces 60 and 60*a*. Regardless of the position occupied by the pistons, these curved surfaces 60 and 60*a* engage their respective adjacent surfaces at points which are positioned along a radial line from the fixed axis A, as indicated by the radial dot-and-dash lines in Figure 2. In other words, no matter what position the ring 46 may occupy with respect to the fixed axis A, the curved surfaces 60 and 60*a* of the fingers will always engage the piston and the ring at points which lie substantially along the lines radiating from the axis A and passing through the center of the pistons. By this arrangement I am able to shift the driving ring 46 to any position without disturbing the timed relationship between the pistons and the valve. Obviously, if the driving ring 46 is shifted to a point somewhere between the positions designated by the letters A and B, the degree of movement of the pistons will be less, but the timing of the piston movements and valve rotation will be unaffected.

It will be noted also that by having a point of contact between the curved surface 60 and the center of the inner end of its companion piston 18, a force will always be imparted to the piston which acts substantially along one of the radial dot-and-dash lines. By having the force acting along this radial line, said piston will be free from any side thrust, which is an important factor in connection with devices which are to be subjected to severe and continuous usage.

In order to control the lateral shifting of the driving member 50, which carries the ring 46, I employ a longitudinally shiftable member 62. This member 62 is provided with a projection 64, which is oblique with respect to the axis of the sleeve 52 and extends into a companion recess 64*a* provided in the driving member 50. By longitudinally shifting the member 62 within the sleeve 52, lateral movement is imparted to the member 50. This longitudinal shifting of the member 62 is accomplished through the agency of a cap 66, which is provided with a multi-sided head 68 designed to receive a suitable turning element, such as a wrench (not shown). This cap 66 is secured by suitable bolts 70 to a threaded member 72. This threaded member 72 has an annular projection which is interposed between a friction reducing thrust bearing 74 and a collar 76. Thus, by imparting a turning movement to the head 68, the member 62 will be moved longitudinally within the sleeve 52.

The sleeve 52 is mounted by means of suitable anti-friction bearings 78 within a pump housing 80. This pump housing serves as a support for the stator 10, as well as support for an end casing or plate 82 in which the threaded member 72 is mounted.

A gear or sprocket 84 is mounted upon the sleeve 52 and a resiliently mounted pin 86 carried by the sleeve 52 is adapted to project into an aperture 88 provided in the gear 84. By means of this construction, power will be transmitted from the gear 84 to the sleeve 52 under normal operating conditions. However, if the sleeve 52 is subjected to overload conditions, the gear 84 will click past the depressible stop or pin 86.

From the foregoing it will be understood that my invention presents a plunger pump of improved practical construction, in which means are provided for positively preventing the transmission of side thrust to the plungers or pistons. In addition to preventing the transmission of side thrust, I am able to maintain proper timed relationship between the piston movements and the movements of the rotary valve, as the central driving ring is shifted from one position to another. The provision of the arcuate or curved surfaces on these fingers insures the proper positioning of the points of engagement of said fingers and the peripheral surface of the driving ring. In fact, the points of engagement of each

finger with its complementary piston and the peripheral surface of the driving ring remain substantially along a line extending radially from the fixed axis regardless of the shifted position of the driving ring. The means for actuating the driving ring presents a new and practical arrangement, which is completely housed within the pump casing, and all of the associated parts may be manufactured by practicing conventional machine shop methods.

While I have described the particular adaptation of my invention to plunger pumps, it will be understood that said invention is by no means limited to pumps, but may be very effectively employed in fluid motors. In other words, in instances where the radial pistons serve as the means for imparting movement to the central driving member or ring, as distinguished from the described arrangement wherein the driving means causes the actuation of the pistons, my invention may be very effectively employed. Therefore, my present invention should be limited only by the scope of the appended claims.

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

1. In a propelling mechanism a stationary supporting means, a plurality of radially reciprocable pistons in said supporting means, rotary driving means operatively associated with said pistons, and means associated with each piston and having a surface adapted to make a line contact with the piston and an oppositely disposed surface adapted to engage the periphery of the rotary driving means to prevent said piston from experiencing side thrust, all of the oppositely disposed points of engagement of the piston and periphery with said surfaces being positioned in a plane parallel to the line of action of said piston.

2. In a propelling mechanism a stationary supporting means, a plurality of radially reciprocable pistons in said supporting means, rotary driving means operatively associated with said pistons, and means associated with each piston and having a surface adapted to make a line contact with the piston and an oppositely disposed surface adapted to make a line contact with the periphery of the rotary driving means to prevent said piston from experiencing side thrust, all of the oppositely disposed points of engagement of the piston and periphery with said surfaces being positioned in a plane parallel to the line of action of said piston.

3. In a propelling mechanism a stationary supporting means, a plurality of radially reciprocable pistons in said supporting means, rotary driving means operatively associated with said pistons, and means associated with each piston and having a surface engaging the piston and an oppositely disposed surface engaging the periphery of the rotary driving means to prevent said piston from experiencing side thrust, all of the oppositely disposed points of engagement of the piston and periphery with said surfaces during the rotation of said driving means defining a line parallel to the line of action of said piston.

4. In a propelling mechanism a stationary supporting means, a plurality of radially reciprocable pistons in said supporting means, rotary driving means operatively associated with said pistons, and means associated with each piston and having a surface engaging the piston and an oppositely disposed surface engaging the periphery of the rotary driving means to prevent said piston from experiencing side thrust, all of the oppositely disposed points of engagement of the piston and periphery with said surfaces during the rotation of said driving means defining a line substantially coincident with the axis of said piston.

5. In a propelling mechanism, a stationary supporting means, a plurality of radially reciprocable pistons in said supporting means, rotary driving means operatively associated with said pistons, and means associated with each piston and having a pair of oppositely disposed surfaces, at least one of said surfaces being curved, one of said surfaces engaging the piston and the other the periphery of the rotary driving means, the configuration and disposition of said surfaces being such as to cause all of the oppositely disposed points of engagement of the piston and periphery therewith to define a line parallel with the line of action of said piston during the rotation of said driving means.

6. In a propelling mechanism, a stationary supporting means, a plurality of radially reciprocable pistons in said supporting means, rotary driving means operatively associated with said pistons, and means associated with each piston and having a pair of oppositely disposed curved surfaces, one of said surfaces engaging the piston and the other the periphery of the rotary driving means, the configuration and disposition of said surfaces being such as to cause all of the oppositely disposed points of engagement of the piston and periphery therewith to define a line parallel with the line of action of said piston.

7. In a propelling mechanism, a stationary supporting means, a plurality of radially reciprocable pistons in said supporting means, rotary driving means operatively associated with said pistons, and means associated with each piston and having a pair of oppositely disposed curved surfaces, one of said surfaces differing in curvature from the other, one of said surfaces engaging the piston and the other the periphery of the rotary driving means, the configuration and disposition of said surfaces being such as to cause all of the oppositely disposed points of engagement of the piston and periphery therewith to define a line parallel with the line of action of said piston.

8. In a propelling mechanism, a stationary supporting means, a plurality of radially reciprocable pistons in said supporting means, each of said pistons having an inner end surface adapted to be engaged by a shiftable means, rotary driving means operatively associated with said pistons, and shiftable means for preventing side thrust associated with each piston and having a surface engaging the periphery of the rotary driving means and an oppositely disposed surface engaging the inner end surface of the piston, at least one of said latter engaging surfaces being curved and restrictedly engaging the other surface, oppositely disposed points of engagement of the piston and said periphery with the surfaces of said shiftable means defining a line substantially parallel with the line of action of said piston during the rotation of said driving means.

ERNEST J. SVENSON.