June 27, 1933. T. J. KICKLER 1,915,827

PUMP UNIT

Filed May 2, 1929 3 Sheets-Sheet 1

Fig. 1

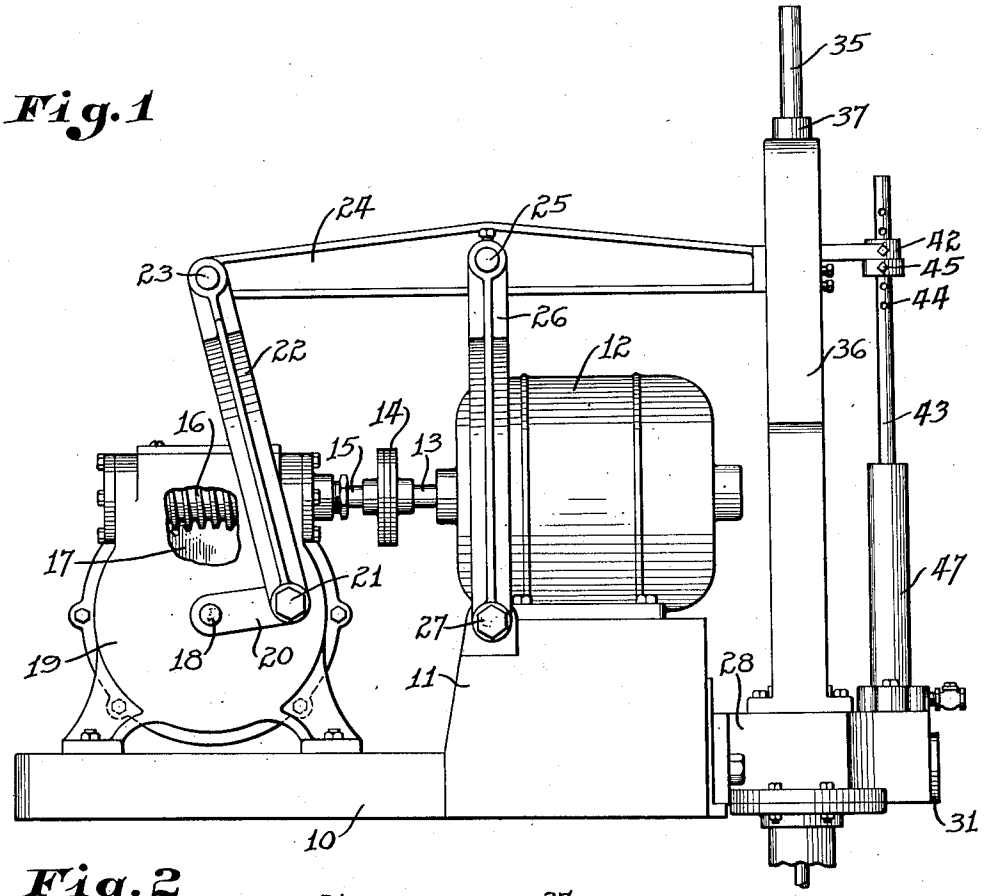
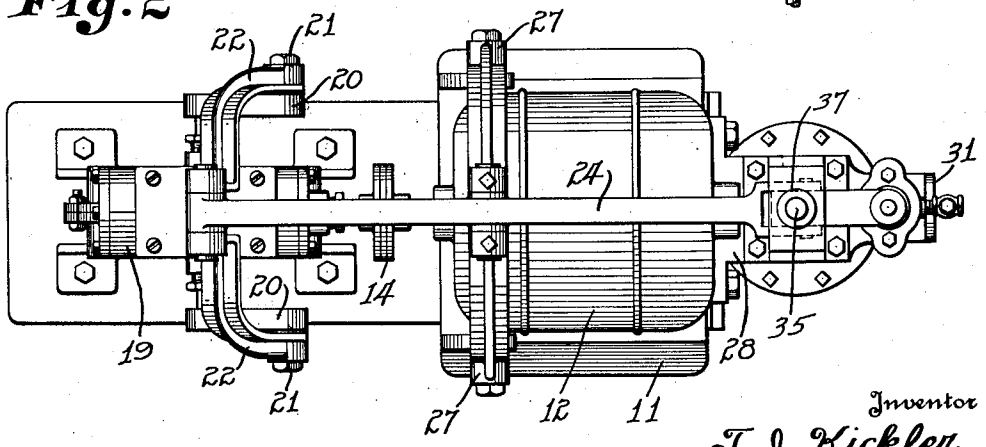


Fig. 2



Inventor

T. J. Kickler

By Owen & Owen

Attorneys

June 27, 1933. T. J. KICKLER 1,915,827

PUMP UNIT

Filed May 2, 1929 3 Sheets-Sheet 2

Fig. 4

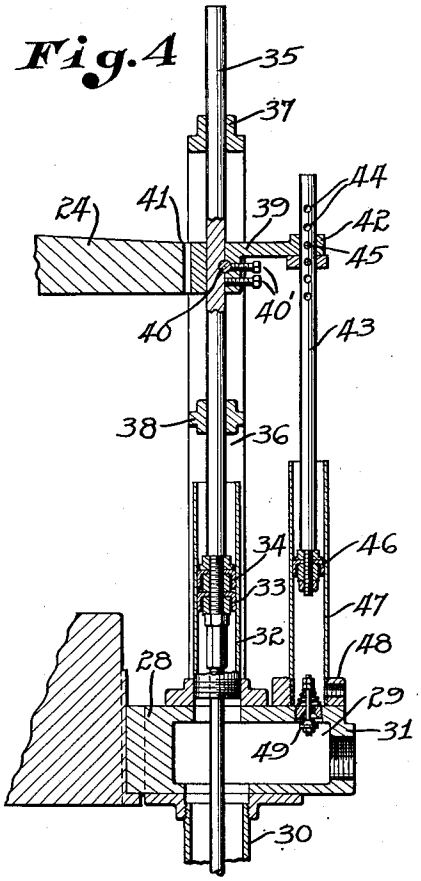


Fig. 3

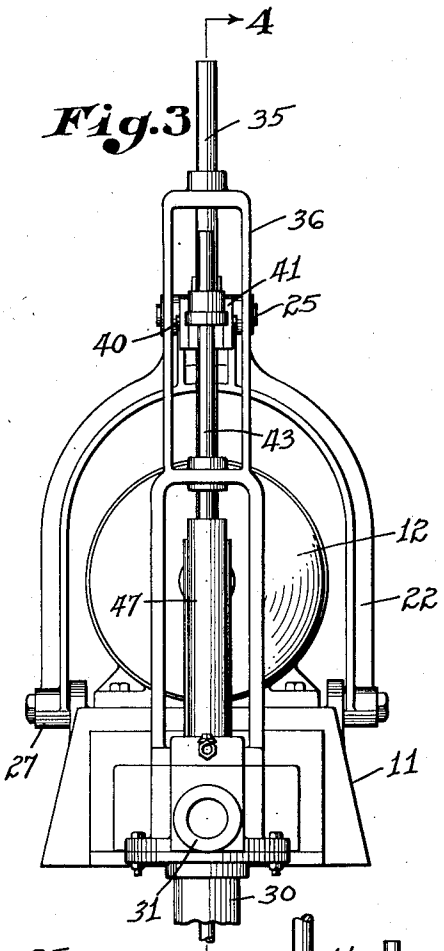
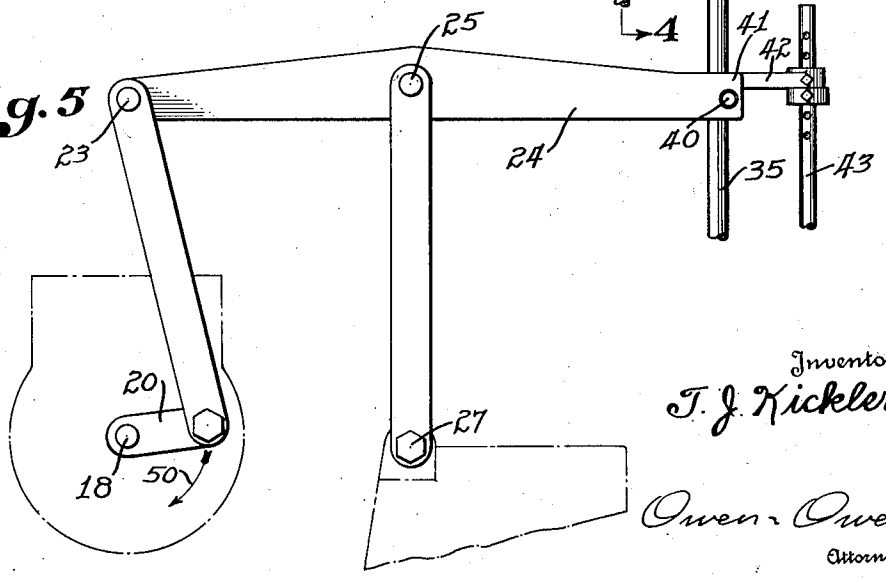


Fig. 5



Inventor
T. J. Kickler

Owen & Owen
Attorneys

June 27, 1933. T. J. KICKLER 1,915,827

PUMP UNIT

Filed May 2, 1929 3 Sheets-Sheet 3

Fig. 6

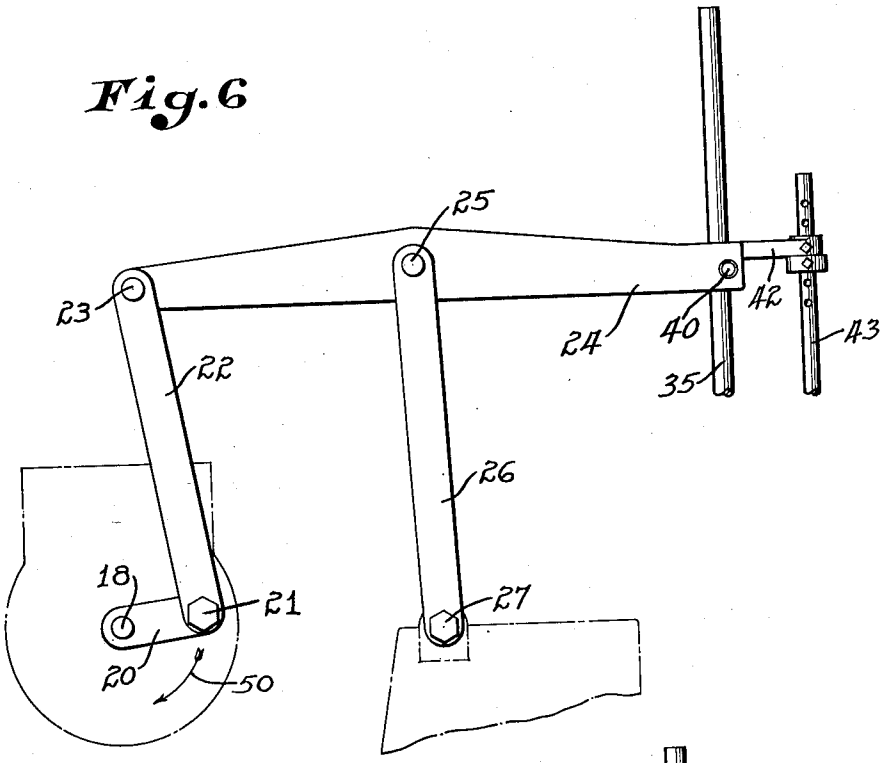
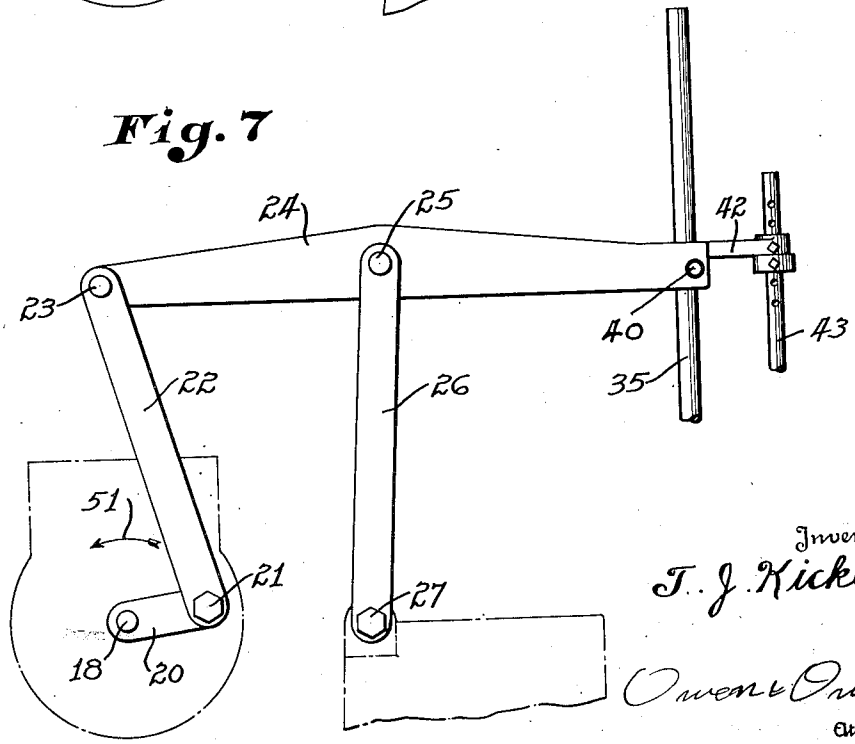


Fig. 7



Inventor

T. J. Kickler

Owen & Owen

Attorneys

Patented June 27, 1933 1,915,827

UNITED STATES PATENT OFFICE

THOMAS J. KICKLER, OF QUINCY, ILLINOIS, ASSIGNOR TO MODERN IRON WORKS, OF QUINCY, ILLINOIS, A CORPORATION OF ILLINOIS

PUMP UNIT

Application filed May 2, 1932. Serial No. 608,668.

This invention relates to a pump unit comprising a motor, a pump, and means for driving the pump from the motor.

An object of the invention is to provide a unit of the class mentioned in which the parts are compactly arranged and are simplified and at the same time the transmission of power is effected in such a manner that the parts are subjected to a minimum of jar or unbalanced stress. Other details and objects of the invention will appear as the description proceeds.

In the accompanying drawings forming a part of this specification, Figure 1 is a side elevation of a unit embodying the invention, partly broken away; Figure 2 is a plan view of the parts shown in Figure 1; Figure 3 is an elevation of the pump, viewed from the right of Figure 1; Figure 4 is a section on the line 4—4 of Figure 3; Figures 5, 6 and 7 are diagrammatic views of the driving connections to the pump, arranged in three different ways.

In the apparatus disclosed, there is a base 10 having attached thereto a block 11 on which there is mounted a motor 12. The shaft 13 of the motor is connected by a coupling 14 with a shaft 15 which drives a worm 16 engaging a worm wheel 17 mounted upon a shaft 18 in a casing 19 attached to the base 10, at one side of block 11. Shaft 18 is provided at each end with a crank arm 20. Pivoted at 21 to these crank arms there are bent links 22 which have their upper ends pivoted at 23 to an end of a lever 24 directly above worm 16. Lever 24 is provided with a floating fulcrum 25 which is attached by links 26, similar to links 22, to the block 11 by pivots 27.

Attached to base 10 at the right of block 11, as viewed in Figure 1, there is a bracket 28 having therein a chamber 29. To the under side of bracket 28 there is attached the pump pipe 30, and at the right of chamber 29 there is an internally threaded boss 31 to which may be attached a suitable discharge pipe. Attached to the upper side of bracket 28, in alignment with pipe 30, there is a cylinder 32 within which there are pistons 33 and 34 upon a piston rod 35 which extends downward through chamber 29 and pipe 30 to a pumping cylinder, not shown. Mounted upon the upper side of bracket 28 there is a bracket 36 substantially inverted U-shaped and having the bottoms of its legs bolted to casting 28, and being provided at its upper end with a guide 37 for piston rod 35, and also being provided with a cross piece 38 above cylinder 32, cross piece 38 being likewise provided with a guiding perforation receiving piston rod 35.

Between cross piece 38 and boss 37 there is attached to piston rod 35 a block 39 by means of suitable fastening devices 40′. Block 39 is pivoted at 40 (see Fig. 3) to the forked end 41 of lever 24. Extending from block 39 there is an arm 42 receiving a piston rod 43. Piston rod 43 is provided with a plurality of holes 44, and a pin 45, passing through arm 42 and one of the holes 44, attaches the piston rod to the arm in adjusted position. At tached to the lower end of rod 43 there is a piston 46 operating in a cylinder 47 parallel with cylinder 32 and attached to the upper side of casting 28. Air is admitted to cylinder 47 through an opening 48 and a check valve not shown, and upon downward movement of piston 46 the air is driven into chamber 29 past check valve 49.

It will be readily understood that the motor drives worm 16 and thereby turns worm wheel 17, shaft 18 and cranks 20, and by means of links 22 alternately lowers and raises the left end of lever 24, as viewed in Figure 1. This lever transmits the motion to piston rods 35 and 43 thereby drives the pump, floating fulcrum 25 being allowed to move horizontally by the oscillation of links 26 to accommodate the motion of the lever to a straight line vertical motion of the piston rods.

The positioning of shaft 18 with respect to pivot 23 and of pivots 27 with respect to fulcrum 25 modifies the lateral force exerted upon the piston rods. This is illustrated in diagrammatic views 5, 6 and 7. In Figure 5, shaft 18 is shown vertically beneath pivot 23, and pivots 27 are shown vertically beneath fulcrum 25, when lever 24 is in substantially horizontal position. It will be understood that, as the lever oscillates in

either direction from its horizontal position, fulcrum 25 is swung to the right because of the vertical movement of the pivot 40 guided by plunger piston rod 35. In the construction shown in Figure 5, downward movement of crank 20 from the position shown in the direction of arrow 50 exerts a component of force horizontally to the right on lever 22 in addition to the downward component of force. As the fulcrum 25 moves to the right, the reaction of the fulcrum likewise exerts a component of force to the right on lever 24, and in that way there is a lateral force applied to piston rod 35 in addition to the vertical lifting force.

In Figure 6 the position of the pivots is modified, shaft 18 being moved slightly to the left of a position directly beneath pivot 23, and pivot 27 being moved slightly to the right of a position directly beneath fulcrum 25. In this construction it will be seen that, when the crank arm 20 moves downward in the direction of arrow 50, the horizontal component of force exerted by links 22 upon lever 24 is at least partially counter-balanced by the horizontal component of force in the opposite direction exerted by the inclined link 26 upon fulcrum 25. As the crank arm continues to move downward, the horizontal component of force exerted by link 22 is lessened by the movement of pivot 23 to the right and the movement of pivot 21 to the left. At the same time fulcrum 25 moves to the right so as to lessen the horizontal component of force of link 26. In this way the positioning of the pivots as shown in Figure 6 tends to reduce the horizontal component of force exerted upon the piston rod 35 during the downward movement of links 22 and the upward movement of the piston rod. It will be readily seen that when pivot 21 passes its downward position and starts upward, it will be out of alignment so that it would exert a considerable horizontal component of force which would not be balanced by the position of link 26; but the weight of piston rod 35 and connected parts ordinarily is sufficient to lower the piston rod so that the work done by the motor in raising the left end of lever 24, and lowering the piston rod, is comparatively little and, therefore, the horizontal component of this small force is not serious.

In the construction shown in Figure 7, the positioning of the relative pivot points is reversed from that shown in Figure 6 to accord with the reversed direction of movement of arm 20, as indicated by arrow 51. This is, shaft 18 is positioned to the right of a point directly beneath pivot 23 when lever 24 is in horizontal position, and pivot 27 is to the left of a point directly beneath floating fulcrum 25. In the position shown in Figure 7, it will be seen that the horizontal component of force exerted by the upwardly moving link 22 and by inclined link 26 both tend to move the lever to the left; but, since this is during the downward stroke of piston rod 35, the resulting horizontal force is not serious. When pivot 21 passes its highest position and starts downward around the left side of shaft 18, it will be seen that it is more nearly vertically beneath pivot 23 than it would be if shaft 18 was directly beneath pivot 23. Likewise the inclined position of links 26 tends to counter-balance the horizontal component of force to the left exerted by legs 22 in their downward movement in a manner similar to that described above in connection with Figure 6. In other words, in order to reduce the horizontal component of force exerted on pivot 40 to a minimum when the major force is exerted during the upward stroke of the piston rod, it is desirable to have pivot point 27 and shaft 18 farther apart than fulcrum 25 and pivot 23 when crank arm 20 moves in a clockwise direction, as viewed in Figure 6, and to have shaft 18 and pivot point 27 nearer together than pivot 23 and fulcrum 25 when arm 20 rotates in an anti-clockwise direction, as viewed in Figure 7.

In the construction shown, it will be seen that piston 33 is of smaller diameter than pipe 30, and it will be understood that it is of smaller diameter than the pump piston, not shown, at the lower end of piston rod 35. When piston rod 35 is raised, it will be readily understood that the liquid above the comparatively large piston on the lower end of piston rod 35 will be raised and forced into chamber 29. Part of this will be allowed to rise into cylinder 32 by the upward movement of piston rod 33 while part is discharged from chamber 29. During the downward movement of piston rod 35, it will be readily understood that downward movement of the liquid in pipe 30 is prevented by the usual check valve in the pump cylinder, not shown, at the lower end of piston rod 35. In addition, the lowering of piston 33 drives the liquid out of cylinder 32 and into chamber 29 and thereby liquid is discharged from chamber 29 on the downward as well as on the upward stroke of piston 35. At the same time air is compressed beneath piston 46 and, if this compression is sufficient to overcome the back pressure exerted upon the liquid in chamber 29, some air is forced into chamber 29 and passes on with the liquid. The position of piston 46 in cylinder 47 may be adjusted by pin 42 so as to provide for the forcing in of the desired amount of air with the back pressure suitable for the particular situation.

The relative force necessary for raising the piston rod, in proportion to the force exerted on the piston rod during its downward move-

ment, depends upon a plurality of factors, including the distance of the main pump cylinder below chamber 29 and the relative size of piston 33 and the main pump piston. Under some circumstances these factors might be so adjusted as to nearly equalize the force required for lifting the piston rod and forcing it downward, under which circumstances an arrangement such as shown in Figure 5, with shaft 18 directly beneath pivot 23 and pivot 27 directly beneath fulcrum 25, would be preferable for either direction of rotation of shaft 18.

It will be seen that the described construction provides a very compact arrangement of parts with a minimum of moving parts for the transmission of power to the piston rod and with comparatively little horizontal component of force exerted upon the piston rod in view of the simplified arrangement for the transmission of power.

While the preferred construction has been disclosed in considerable detail, it will be readily understood that various changes may be made in the exact construction within the terms of the appended claims.

What is claimed is:—

1. In a pump unit, an elongated base, a motor mounted upon the base with its power shaft longitudinal of the base, a worm on one end of said shaft, a worm wheel meshing with said worm, a shaft carrying said worm wheel and mounted across said base and having a crank arm on each end thereof, a pump portion connected to the base on the other side of the motor from said crank shaft and comprising a vertically guided piston rod, links mounted upon opposite sides of said motor and extending upward and towards each other above the motor and supporting a floating fulcrum pin, a lever fulcrumed upon said pin and pivoted at one end to said piston rod, and links pivoted at their lower ends to said crank arms and extending upward and towards each other and pivoted at their upper ends to the other end of said lever.

2. A pump unit in accordance with claim 1 and in which the force required to move the piston in one direction is greater than the force required to move it in the other direction, and the distance between the ends of the crank shaft and the points at which the fulcrum links are pivoted to the base is different from the distance between the fulcrum pin and the point where the crank links are pivoted to the lever, and the difference is in a direction to lessen the horizontal thrust upon the lever during its movement in the direction requiring most force.

3. A pump unit in accordance with claim 1 and in which more force is required to raise the piston than to lower it, the ends of the crank arms move downward on the side of the crank shaft towards the motor, and the distance between the ends of the crank shaft and the points where the fulcrum links are pivoted to the base is greater than the distance between the fulcrum pin and the point where the crank links are pivoted to the lever.

4. A pump unit in accordance with claim 1 and in which more force is required to raise the piston than to lower it, the ends of the crank arms move upward on the side of the crank shaft towards the motor, and the distance between the ends of the crank shaft and the points where the fulcrum links are pivoted to the base is less than the distance between the fulcrum pin and the point where the crank links are pivoted to the lever.

In testimony whereof I have hereunto signed my name to this specification.

THOMAS J. KICKLER.