July 22, 1924. 1,502,195

G. C. HICKS, JR

PUMP

Filed June 7, 1922

Fig. 1.

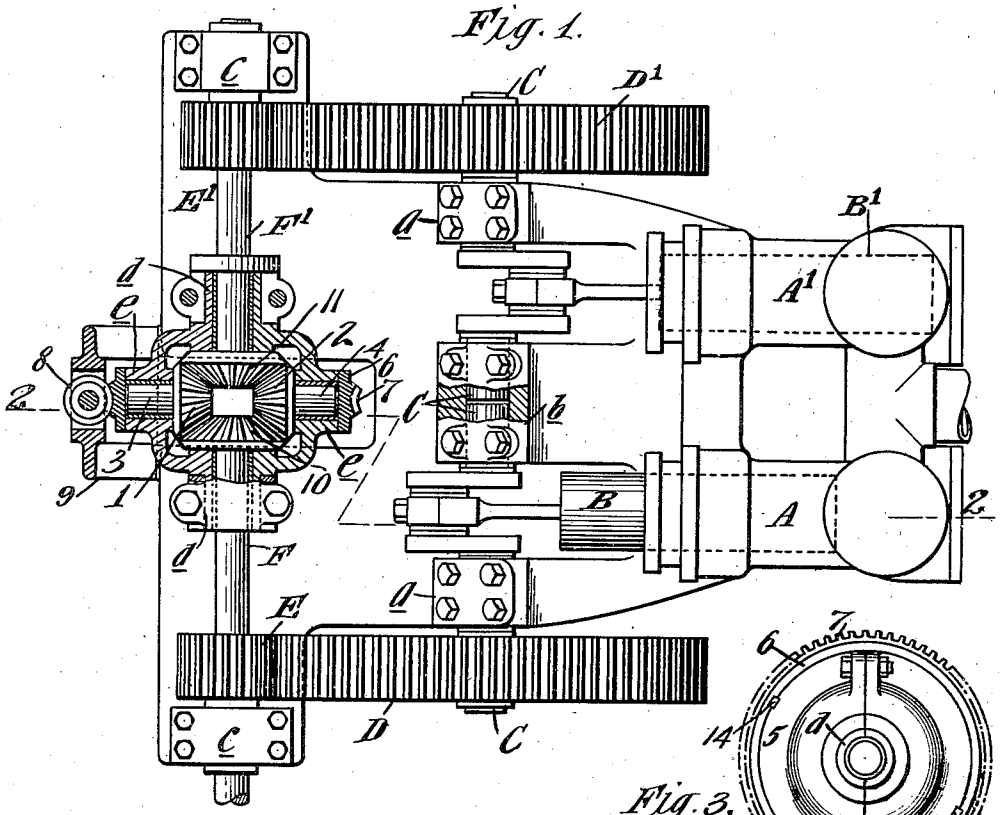
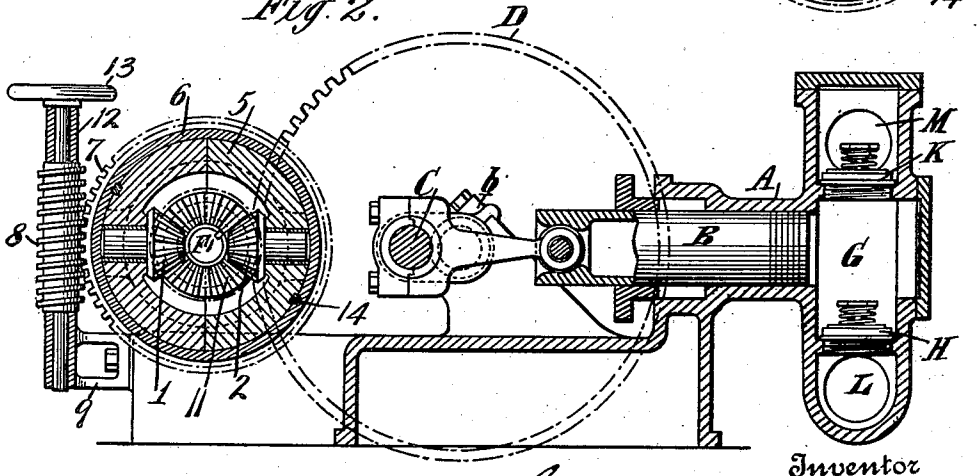


Fig. 3.

Fig. 2.



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By his Attorneys

Philipp, Sawyer, Rice & Kennedy

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UNITED STATES PATENT OFFICE.

GEORGE C. HICKS, JR., OF ST. LOUIS, MISSOURI, ASSIGNOR TO WORTHINGTON PUMP AND MACHINERY CORPORATION, OF NEW YORK, N. Y., A CORPORATION OF VIRGINIA.

PUMP.

Application filed June 7, 1922. Serial No. 566,486.

To all whom it may concern:

Be it known that I, GEORGE C. HICKS, Jr., a citizen of the United States, residing at St. Louis, county of St. Louis, and State of Missouri, have invented certain new and useful Improvements in Pumps, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to improvements in pumps.

It is the especial object of the present invention to provide improved means for quickly and easily adjusting or varying the strokes of a plurality of pump plungers relatively to each other in variable capacity pumps of that type in which the plungers are arranged to enter and withdraw from a plunger chamber common to all of the plungers, so that, without stopping the pump or changing the speed of the driving means, a predetermined and variable quantity of liquid may be displaced by such plungers in the plunger chamber and the volume of the pump discharge thereby increased or decreased to meet different requirements.

For a full understanding of the invention, the same will now be described in detail in connection with the accompanying drawings showing a preferred embodiment of the device, and the novel features of the invention will then be pointed out in the claims.

In the drawings—

Figure 1 is a top plan view, partially in section, of a two-plunger pump and driving gear therefor;

Figure 2 is a section on the irregular line 2—2 of Fig. 1, and

Figure 3 is a side elevation of the casing enclosing the plunger shifting gear mechanism.

Referring now to the drawings, and particularly to Figs. 1 and 2, A, A′ indicate the plunger cylinders; B, B′ cylindrical plungers arranged to be reciprocated therein by direct or other connection with a shaft C divided into a plurality of crank carrying parts arranged in longitudinal alinement and each such part being journaled in outer bearings *a* and a single central bearing *b*, the latter being arranged to receive the juxtaposed ends of the two part crank shaft shown. On the outer ends of shaft C are mounted gears D, D′ driven by pinions E, E′ mounted on the outer ends of stub shafts F, F′ rotating in bearings *c*, *d*. G indicates a plunger chamber common to both plungers B, B′; H, K are the suction and discharge valves, and L, M, suction inlet and discharge outlet, respectively. Stub shaft F is arranged to be driven by direct connection with any suitable power unit (not shown), but obviously may be driven by a gear or belt drive, if desired. With a direct drive, however, a flexible connection of ordinary construction will preferably be used. The power driven shaft F causes shaft F′ to rotate at the same speed in the opposite direction by a bevel gear drive comprising gears 10, 11 mounted on the ends of the shafts F, F′, which mesh with like gears 1, 2 mounted on stub shafts 3, 4, and the bearings of these latter gears are within a casing 5 which is arranged to be given a rotary movement by means hereinafter described for changing the angular relation of the cranks when it is desired to vary the pump delivery to meet different requirements.

From the foregoing it will be readily seen that when the cranks are, as shown, set at 180°, the plungers B, B′ will, through the driving means above described, be reciprocated in opposite directions to each other at the same speed, so that as one plunger is entering chamber G the other plunger is withdrawing therefrom at the same rate of speed, and the effective liquid-holding area of chamber G thus remains the same, the liquid therein merely flowing from one side to the other as it is displaced by an entering plunger into the space previously occupied by the outwardly moving plunger. With the cranks in the positions shown, therefore, there will be no delivery. From this position of the cranks, the delivery of the pump may easily and quickly be varied to any desired quantity up to maximum by adjusting the cranks to any point intermediate 180° and a point where they will cause the plungers to reciprocate in unison when, of course, the maximum displacement of liquid in chamber G will take place at each stroke and the full capacity of the pump be secured. The means for so positioning the cranks, without stopping or varying the speed at which the pump is being driven, consist of the casing 5, which is preferably of circular

form and made in two parts secured together by bolts as shown in Fig. 3, such casing being so formed as to provide bearings *d* for the stub shafts F, F′, whereby it will be capable of rotary movement with respect to said shafts. The casing 5 also has formed on its interior, bearings *e* at diametrically opposite points for the reception of stub shafts 3, 4 of gears 1, 2. Secured to the periphery of the casing 5 is a ring 6 having gear teeth 7 formed on the exterior thereof for engagement with a worm 8 having its lower spindle journaled in a suitable bearing in a bracket 9 secured to the pump frame by bolts, as shown, while the upper end of the worm spindle is provided with a sleeve 12 to prevent vertical movement, and a hand wheel 13 for a purpose hereinafter stated. The toothed rim 6 may be secured to the casing 5 in any convenient manner, and is prevented from turning independently of such casing by keys 14.

The construction of the pump and plunger shifting mechanism will be clear from the foregoing, and the operation thereof will be briefly described as follows: Assuming that the pump is being driven at a constant speed and that the driving connection is with stub shaft F, with the cranks set at 180°, as shown, there will be, as explained above, no delivery. Hand wheel 13 is now turned in either direction and, through worm 8 and gear teeth 7 on casing 5, the latter is rotated on the shafts F, F′. According to the direction of rotation of the driven stub shaft F and the direction in which hand wheel 13 and therefore casing 5 is turned with respect to the direction of movement of shaft F, bevel gear 11 will be given a movement in excess of or less than that at which gear 10 is moving in exact proportion to the degree of movement imparted to the gears 1, 2 by rotating the casing 5, and the angular relation of the crank controlling plunger B′ to the crank controlling plunger B be varied as desired. The same adjustment may of course be made when the pump is idle, due to the resistance offered by the driving connection to shaft F, which will hold the same stationary when casing 5 is rotated as above described and gear 11 be rotated due to failure of the gear 10 to move.

It will be understood that various changes and modifications may be made in the construction shown and described while still retaining the invention defined by the claims.

What is claimed is:

1. A variable capacity pump, comprising a plurality of plungers, a plunger chamber common to said plungers, a plurality of longitudinally alined plunger driving shafts, a power shaft and separate driving connections between said power shaft and each of said plunger shafts, and means for changing the timed relation of the plunger strokes.

2. A variable capacity pump, comprising a plurality of plungers, a plunger chamber common to said plungers, a plurality of longitudinally alined plunger driving crank shafts, a plurality of power shafts, driving connections between one of said power shafts and one of the plunger driving shafts, separate driving connections between the other power shaft and the other plunger driving shaft, and means for changing the angular relation of said cranks and the timed relation of the plunger strokes.

3. A variable capacity pump, comprising a plurality of plungers, a plunger chamber common to said plungers, a plurality of longitudinally alined plunger driving crank shafts, a power shaft arranged to drive one of said crank shafts, a shaft driven by said power shaft and arranged to drive the other of said crank shafts, and means for changing the angular relation of said cranks and the timed relation of the plunger strokes.

4. A variable capacity pump, comprising a plurality of plungers, a plunger chamber common to said plungers, longitudinally alined plunger driving shafts, a plurality of power shafts, driving connections between one of said power shafts and one of the plunger driving shafts, separate driving connections between the other power shaft and the other plunger driving shaft, and manually operated means for varying the timed relation of the plunger strokes.

5. A variable capacity pump, comprising a plurality of plungers, a plunger chamber common to said plungers, plunger driving shafts, power shafts, driving connections between one of said power shafts and one of said plunger driving shafts, separate driving connections between the other power shaft and the other plunger driving shaft, and means for temporarily changing the speed of said plunger driving shafts relatively to each other to vary the relative timing of the plunger strokes.

6. A variable capacity pump, comprising a plurality of plungers, a plunger chamber common to said plungers, a plurality of plunger driving crank shafts, a plurality of power shafts, driving connections between one of said power shafts and one of said plunger driving shafts, separate driving connections between the other power shaft and the other plunger driving shaft, and means for temporarily changing the speed of said power shafts relatively to each other to vary the angular relation of the cranks and the timed relation of the plunger strokes.

7. A variable capacity pump, comprising a plurality of plungers, a plunger chamber common to said plungers, longitudinally alined plunger driving crank shafts, longi-

tudinally alined power shafts, a bevel gear driving connection between said latter shafts, a rotatable casing surrounding said bevel gear driving connection and having bearings therein for the bevel gears interposed between the gears on the ends of said power shafts, and means for rotating said casing to change the angular relation of the plunger driving cranks.

8. A variable capacity pump, comprising a plurality of plungers, a plunger chamber common to said plungers, longitudinally alined plunger driving crank shafts, longitudinally alined power shafts, a bevel gear driving connection between said latter shafts, a rotatable casing surrounding said bevel gear driving connection and having bearings therein for the bevel gears interposed between the gears on the ends of said power shafts, gear teeth on the exterior of said casing, and a worm for engaging said gear teeth, whereby said casing may be rotated and the angular relation of the plunger driving cranks changed to vary the timed relation of the plunger strokes.

In testimony whereof, I have hereunto set my hand.

GEORGE C. HICKS, JR.