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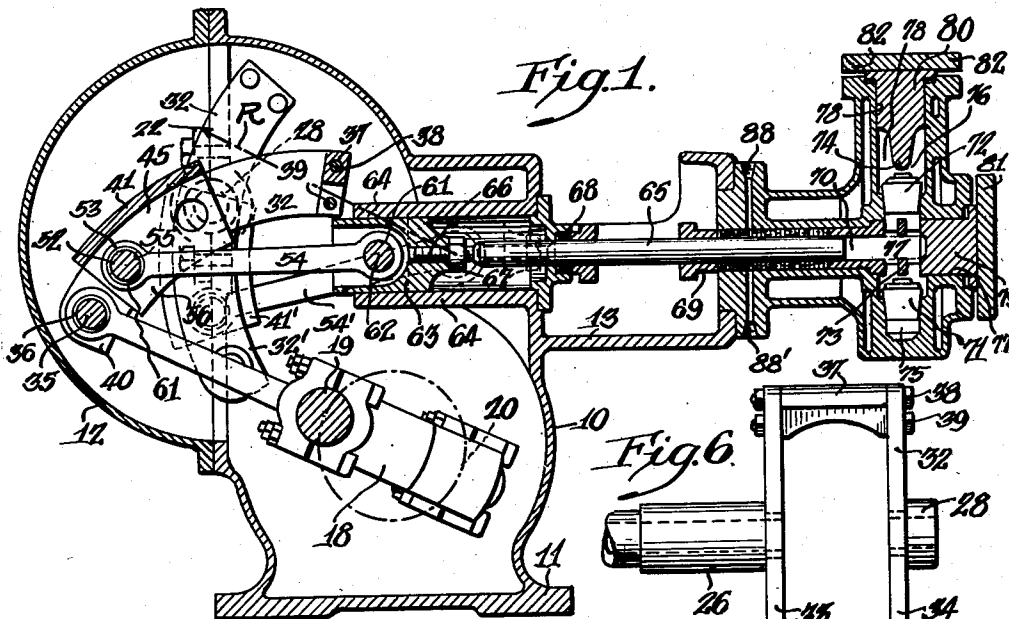
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PROPORTIONING PUMP

Filed Nov. 24, 1939

2 Sheets-Sheet 1



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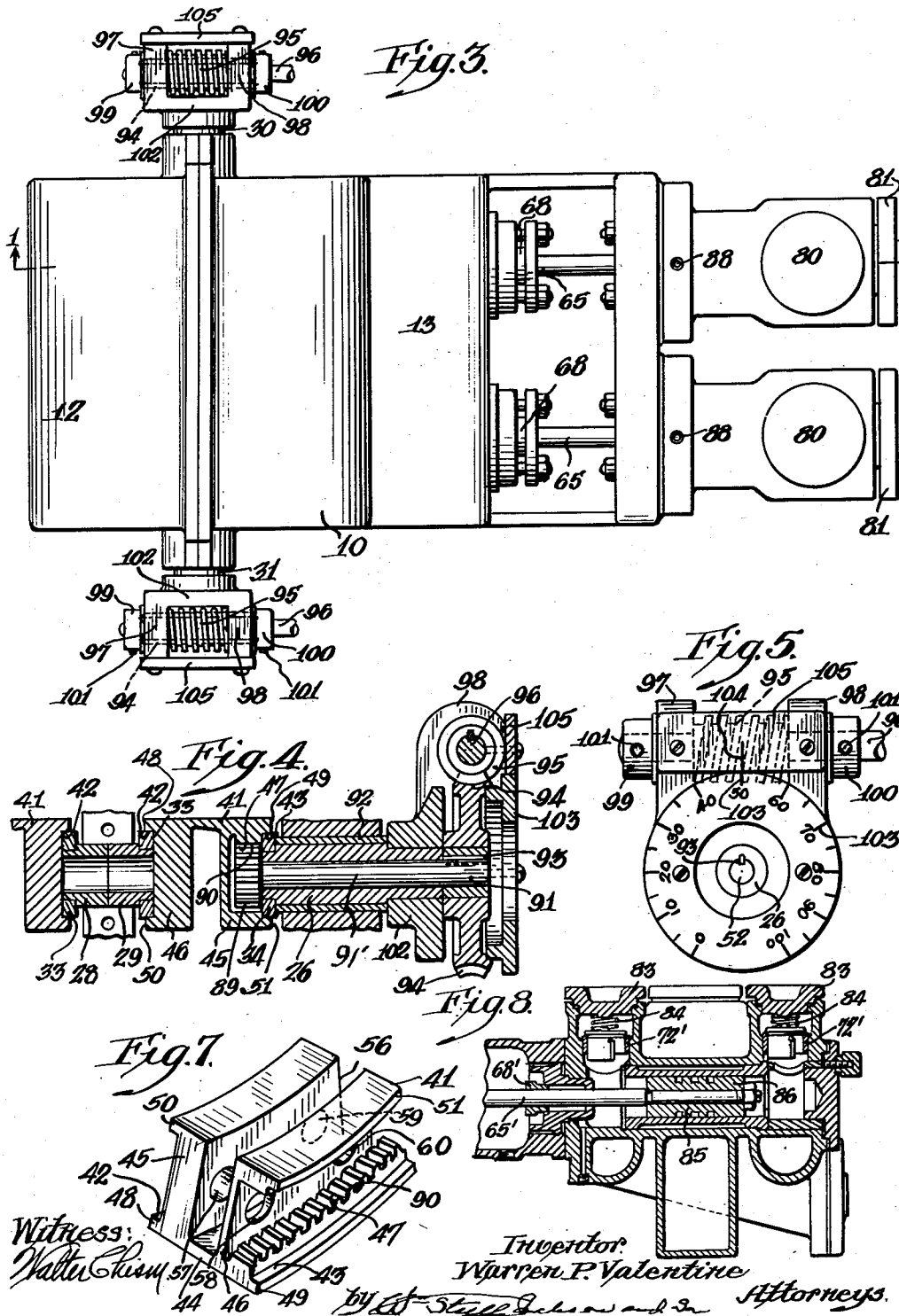
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UNITED STATES PATENT OFFICE

2,259,713

PROPORTIONING PUMP

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8 Claims. (Cl. 103—38)

The invention relates to variable capacity liquid pumps, of a type generally known as proportional pumps.

One of the purposes of the invention is to provide reliable positive action throughout the range of stroke adjustment of a proportional pump.

A further purpose is to provide for adjustment of the pumping capacity by a self-locking worm and worm wheel during the operation of the pump.

A further purpose is to equip a duplicate pump with separate adjustments of the pumping capacity of the individual pumps.

A further purpose is to provide a rocking link arm having uniform rocking movement with a block positively adjustable along it to vary the stroke of a pump.

A further purpose is to shift an operating sleeve on a rocking link by rack and pinion movement operated positively as through a worm and worm gear and capable of adjustment during the pumping action.

A further purpose is to rock a curved link about a center, to adjust a pumping connection along the curved length of the link and to place the drawing pin for the pump at the center of the curvature of the link when the pump is at the innermost portion of its stroke, whereby the inward stroke ends at the same point whatever the extent of stroke.

A further purpose is to form the link guide for block adjustment as a truncated segment about pump cross head pin, when in innermost plunger position, so that the plunger will always have same inner stroke terminal, whatever the adjustment.

Further purposes will appear in the specification and in the claims.

I have illustrated the invention by a single form only among various forms by which the invention may be shown, selecting therefor one which is practical and effective and which at the same time well illustrates the principles involved.

Figure 1 is a vertical elevation upon lines 1—1 of Figure 3 showing a duplex pump embodying the invention.

Figure 2 is a partial end elevation and partial section, upon line 2—2 of Figure 1, parts being removed for clearness of illustration.

Figure 3 is a top plan view of the structure of Figure 1.

Figure 4 is a fragmentary section of Figure 1 upon line 4—4.

Figure 5 is an end elevation of Figure 4 showing parts of the stroke-adjusting mechanism.

Figure 6 is an end elevation of the rocking link of Figure 1.

Figure 7 is an inverted perspective of a sleeve block adjustable along the link.

Figure 8 is a fragmentary section of a form applied to a double-action pump.

In the drawings similar numerals indicate like parts.

In proportional pumping of liquids it is very desirable not only to have positively pumping action but to have the capacity of the pump positively and very exactly capable of adjustment so that it can be used to proportion the flows of liquids one to another by variation of one or both flows and for long periods of time may reliably supply the same proportions desired of liquids pumped.

Each of the two units grouped in my illustration is an opposite counterpart of the other and each embodies the features of my invention. They are shown together for the reason that there is considerable demand for duplicate units and proportional control of two liquids together greatly increases the range of the proportioning possible.

In my pump as shown the duplicate units operate side by side from the same source of power and within the same casing but are capable not only of handling wholly separate and distinct liquids or gases but of pumping at different rates with the different pumps.

The casing 10 rests on a base 11 and an otherwise open end is closed by a cover 12. All frame parts are united through suitable flanges. The casing frame is connected with the pump unit frame 13.

Within the lower part of the casing are mounted heads 14, 15 carrying bearings 16, 17 for crank shaft 18, having two cranks 19 and 20. The crank shaft is driven by shaft 21 through any suitable source of power not shown. Ordinarily this will be a direct electric motor drive or a belt or gear connection from another driving shaft.

The casing carries bearings 22, 23, 24 provided with caps 25 supporting hollow rock shafts 26 and 27 and stub shafts 28 and 29. These are all axially in line. The shafts 26 and 27 are supported respectively in the bearings 22 and 24 and the stub shafts 28 and 29 lie facing, closely adjacent, and both within the same bearing 23. Each of the shafts 26 and 27 is extended outside of the casing, at 30 or 31 for an adjusting purpose hereafter more fully explained.

As the parts of the two constructions are duplicate and the differences between the two units are differences in opposite counterpart placing merely, it has not been considered necessary to show the detail of both constructions and the description will follow one, the same reference characters being used for corresponding parts of the other where these parts appear.

Between each shaft and its cooperating stub shaft is located a link 32 comprising arc-shaped parallel straps 33 and 34, both apertured and

connected one to the shaft and the other to the stub shaft. The straps are united at the ends through bolted spacers to hold the parts together and to maintain the spacing of the straps.

The connection between the straps comprises at one end a bolt 35 surrounded by a loose sleeve 36 and at the other end a strut 37 bolted to the straps at 38 and 39. The shaft is rocked by a pitman 40 having bearing upon a crank of the crank shaft at one end and upon loose sleeve 36 at the opposite end.

By the above construction each link is rocked about the shaft and stub shaft as in the familiar locomotive link reversing mechanism.

The straps of the link guide a block or sleeve 41 having curved grooves 42 and 43 in its side faces which cooperate with the straps of the link in guiding the block.

The block is bifurcated in cross section, as seen best in Figure 7 so as to provide an outer convex connecting shell 44 and truncated segment sides 45 and 46 within which sides are formed the guiding grooves. One of the sides further carries a longitudinally curved driven rack 47, concentric in curvature with the curvature of the segment shell and grooves. Inner and outer flanges 48, 49 and 50, 51 form the limits of the lateral grooves.

The block is thus capable of moving along the curved length of the link so as to vary the throw of a pin 52 supported at both ends, one end in each of the sides 45, 46 of the block and free at its center to be surrounded by one bearing 53 of a connecting rod 54. The rod oscillates about the pin or about a sleeve 55 surrounding the pin within a space 56 between sides 45, 46. The pin 52 may fit in either of the holes 57 and 58 axially in line near one end of the block, or holes 59 and 60 axially in line at the other end of the block, thus accommodating the block and pin to either of its alternative (opposite counterpart) positions.

Except as the pin is fitted in one or other of the two pairs of openings 57 and 58 or 59 and 60, when the block is used in one or other of the two (duplicate) pumps shown, the blocks are not only opposite counterparts in the two pumps, but are exact duplicates. Each connecting rod 54 extends from its pin 52 to a bearing 61 about crosshead pin 62 in crosshead 63 travelling in guides 64 supported in the casing.

With the crosshead is connected a plunger piston 65 which is shown as threaded into the crosshead at 66 and locked there by nut 67. The piston operates through two glands 68 and 69, one protecting the driving mechanism against injury by leakage into it of liquid pumped and the other protecting against leakage from the pump chamber 70 of the pump. The pumps illustrated are intended to be typical of pumps for such purposes, there being many pumps available which are suitable. In the single action pump of Figure 1 there are shown inlet and outlet valves 71 and 72 limited in their opening stroke at 73 and 74 and respectively allowing the inlet of liquid or gas from intake chamber 75 and discharge into chamber 76. Finishing of the parts is facilitated by openings 77 and 78 closed by plugs 79 and 80. The plugs are held in place by flanges 81 and 82 and by bolts, not shown. Suitable packing, not shown, is applied to prevent leakage.

In Figure 8 gland 83 protects from leakage. The pump is double acting and plugs 83 act through springs 84 to hold outlet valves 72' normally against their seats. The inlet valves are

not shown. Plunger 85 carries a double acting piston 86 whose inward end 86 acts to pump just as does the inward end of plunger 85 and always reaches the same position, whatever the adjustment; as does plunger 85. All of the adjustment becomes effective, therefore, in alteration of the outmost position of the outer face of the piston.

Oil inlet and waste discharge to and from gland 88 are shown at 89.

Since the pumping areas of the piston are unequal in Figure 8, the rates of pumping of the piston will be unequal in opposite strokes. Different fluids can be pumped by the two strokes; and this is true particularly where the two fluids are to be mingled ultimately, so that slight leakage of one into the other becomes immaterial.

The length of the connecting rod 54 is such that pin 52 lies at the center of the curvature of the link and block when the plunger is in its innermost stroke position (i. e. when the link has rocked to its farthest counterclockwise position in Figure 1). No change takes place in the innermost position of the plunger with adjustment of the block 41 and no matter what the position of adjustment the inner end of the plunger stroke is the same. This position is shown for the link 32', block 41' and connecting rod 54' in Figure 1, the radius being shown as R.

Each block is moved positively along its link to adjust by a pinion 89 engaging with rack 90. The pinion is keyed upon a shaft 91 which has bearing within the hollow shaft 26 or 27 connected rigidly with one of the link side plates, in Figure 6 with link plate 33, and is supported through bearing 22 and the frame.

Within the bearing is shown a friction-reducing sleeve 92.

Upon the outer end 91 of the shaft 91' is keyed at 93 a worm wheel 94 with which meshes a worm 95, seen in Figures 2, 3, 4 and 5. The worm 95 is keyed to a shaft 96, turning in bearings 97 and 98 and held by collars 99 and 100 and set screws 101.

The bearings 97 and 98 are carried by the bracket 102 mounted upon a reduced end of hollow shaft 26— or 27—. It oscillates with the shaft.

Shaft 96 is extended to receive an adjusting wheel, not shown, so that the shaft may be rotated by hand to turn the worm and, through the worm wheel, correspondingly to turn the pinion and adjust the position of the block along the arc length of the corresponding link. The position of the adjusted block with respect to any standard position is shown by an indicator 103 in connection with a marking 104 upon plate 105. The plate is supported by the bracket bearings for the shaft 96. It will be noted that the use of the worm and worm wheel maintains the adjustment as made.

The rocking range of each link is set by the throw of its crank and is uniform because there is no adjustment for the spacing between the pin 36 and the axis of the hollow link shaft about which axis the rocking takes place. The entire adjustment therefore is made by movement of the block along the arcuate length of the link.

The permissive range of adjustment of the block extends from the limit of the movement of the section block to the left in Figure 1 approximately as shown in that figure, to a position in which the axis of pin 52 coincides with and then passes the axis of the link shaft. In other words, adjustment of the stroke can be made from the

position shown, not only to zero throw position but past that position to reverse throw on the opposite side of the zero.

The worm and worm wheel adjustment provides for adjustment at minute increments and exact adjustment with respect to predetermined standards. Moreover, the wheel by which the adjustment is accomplished, though it rocks with the shaft, can be grasped and turned by the hand of the attendant during the operation of the pump.

In view of my invention and disclosure variations and modifications to meet individual whim or particular need will doubtless become evident to others skilled in the art, to obtain part or all of the benefits of my invention without copying the structure shown, and I, therefore, claim all such in so far as they fall within the reasonable spirit and scope of my invention.

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

1. In a proportioning pump, a longitudinally curved rocking link, crank means for rocking the link, hollow shaft support for the link, a block adjustable along the length of the link, a pump having a piston rod, a connecting rod operating the piston rod from the block and block adjusting means rocking with the link and operating through the hollow shaft.

2. In a proportioning pump, a driving shaft, a longitudinally curved link, a hollow link shaft about whose axis the link is adapted to oscillate, a driving shaft and connections by which the link is rocked, a block having curved guiding connection with the link, whereby it is adjustable along the curved length of the link, a pump having a piston rod, connections between the block and the piston rod, a rack within the block, a pinion engaging the rack, a pinion shaft carrying the pinion and passing through the hollow link shaft, and self-locking means connecting with the pinion shaft for turning the pinion and thus moving the rack to adjust the position of the block along the link length.

3. In a proportioning pump, a hollow link shaft, a link carried by the shaft, bearings for the shaft, pitman-operated rocking means for the link, an adjusting block movable along the curved length of the link, a pump having a piston rod, driving connections between the block and the piston rod whereby adjustment of the block along the length of the link varies the stroke of the piston rod, a rack carried by the block, a pinion engaging the rack, a pinion shaft driving the pinion and operating through the hollow shaft, and worm wheel and worm adjusting means for turning the pinion shaft.

4. In a proportioning pump, a longitudinally curved link comprising spaced curved straps and connections between the straps, having a transverse pin at one end of the link, pitman driving connections for the link engaging the pin, a block having opposite curved grooves receiving and guided by the straps of the link, bifurcated to provide a connecting rod space between the sides, a pin across the space terminating at its two ends in opposite sides of the block, a connecting rod engaging the pin at one rod end, a pump operated by the other end of the connecting rod, a rack carried by one of the sides of the block within its groove, a shaft terminating opposite

the rack, a pinion carried by the shaft and engaging the rack, a support for the shaft rocking with the link and block and shaft-turning means, outside of the shaft support, for turning the shaft and pinion and locking them in turned position, whereby the position of the block along the length of the link is adjusted and the block is retained in adjusted position.

5. In a proportioning pump, a longitudinally curved rocking link, crank means for rocking the link about an axis between the ends of the link, shaft support for the link, a block adjustable along the length of the link to a point opposite the rocking axis, a pump having a piston rod, a connecting rod operating the piston rod from the block and corresponding to a radius of the curve of block adjustment at the innermost rod position and block adjusting means rocking with the link, whereby the block may be adjusted to zero pumping position or to pumping positions having throws different for different distances of block position from the axis.

6. In a proportioning pump, a driving shaft, a link rocked by the driving shaft, having longitudinally curved inner and outer contours, the rocking taking place about an axis between the ends of the curved length of the link, a block adjustable along the curved length of the link, means for adjusting the block, a pin carried by the block, a pump piston rod, a guided crosshead for the piston rod, a crosshead pin, and a connecting rod between the crosshead pin and the block pin, the extent of rocking of the link and the length of the connecting rod being such that at the innermost piston rod position the crosshead pin lies at the center about which the curved contours are formed, whereby there is no variation in the innermost position of the pump piston whatever the adjustment of the block.

7. In a proportioning pump, a crank shaft, a pump having a piston rod, crosshead and crosshead pin, a longitudinally curved link, a shaft and bearings for supporting the link, a pitman between the crank and the link, in one extreme crank position shifting the link to a position where the curved link lies about the crosshead pin as a center, a block adjustable along the curved length of the link, and curved rack and pinion means for adjusting and retaining the adjustment of the block along the curved length of the link.

8. In a proportioning pump, a longitudinally curved link, hollow shaft and bearing means for supporting the link and permitting rocking movement of the link, a pin at the end of the link, crank and pitman means for engaging the pin to rock the link, a pump having a piston rod and crosshead, a crosshead pin, the crosshead pin lying at the center of curvature of the link at the innermost pump piston part of the stroke, a block adjustable along the curved length of the link, a pin in the block, a connecting rod between the block pin and the crosshead pin, curved guides between the block and the link, a curved rack within a groove in one side of the block, an adjusting shaft passing through the hollow of the link shaft, a pinion upon the adjusting shaft and engaging the rack, a worm gear upon the adjusting shaft and a worm mounted to engage the worm gear for adjusting and holding the adjustment of the adjusting shaft.

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