

April 16, 1940.

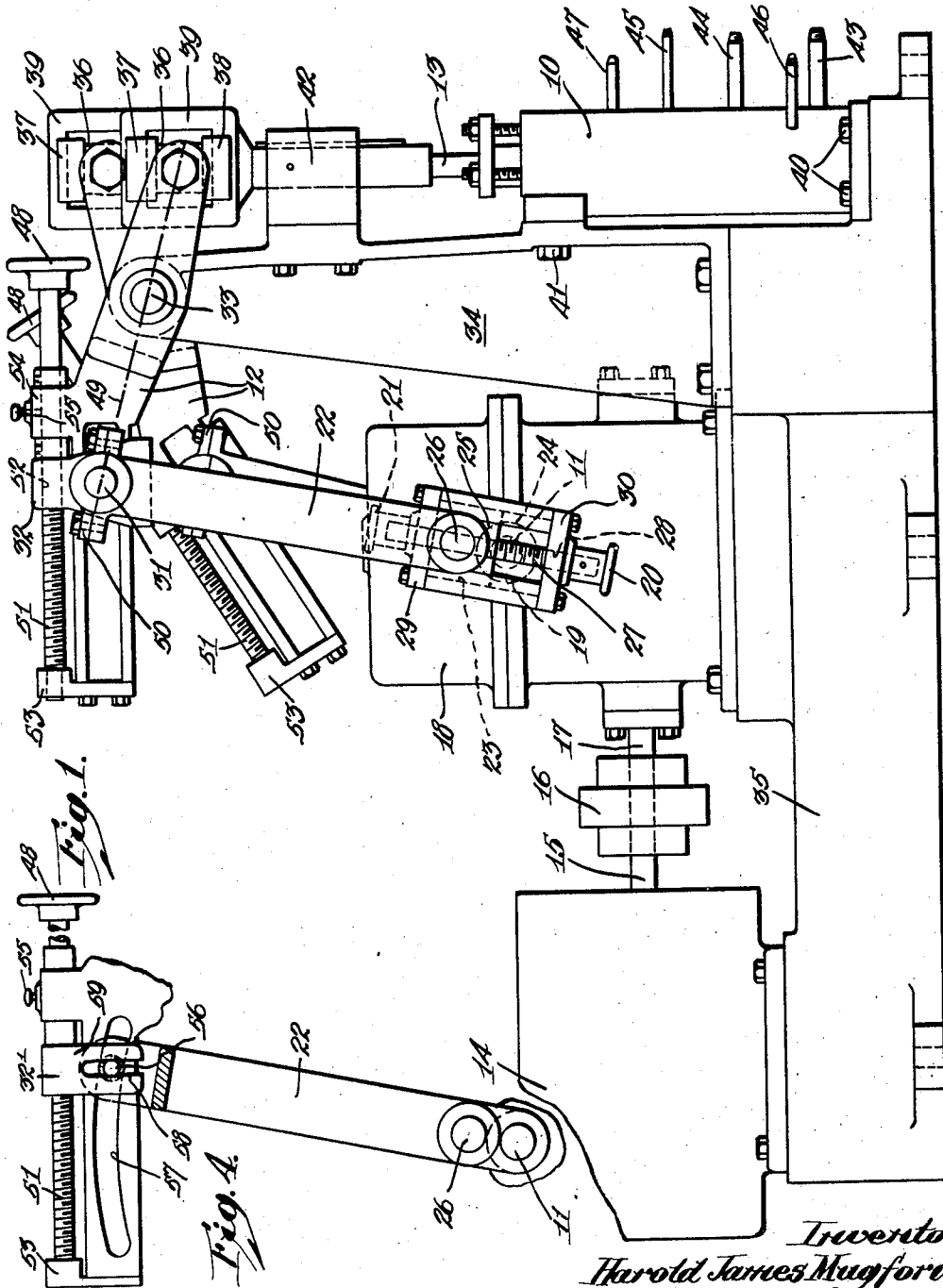
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2,197,730

CHEMICAL PUMP

Filed Dec. 3, 1932

3 Sheets-Sheet 1



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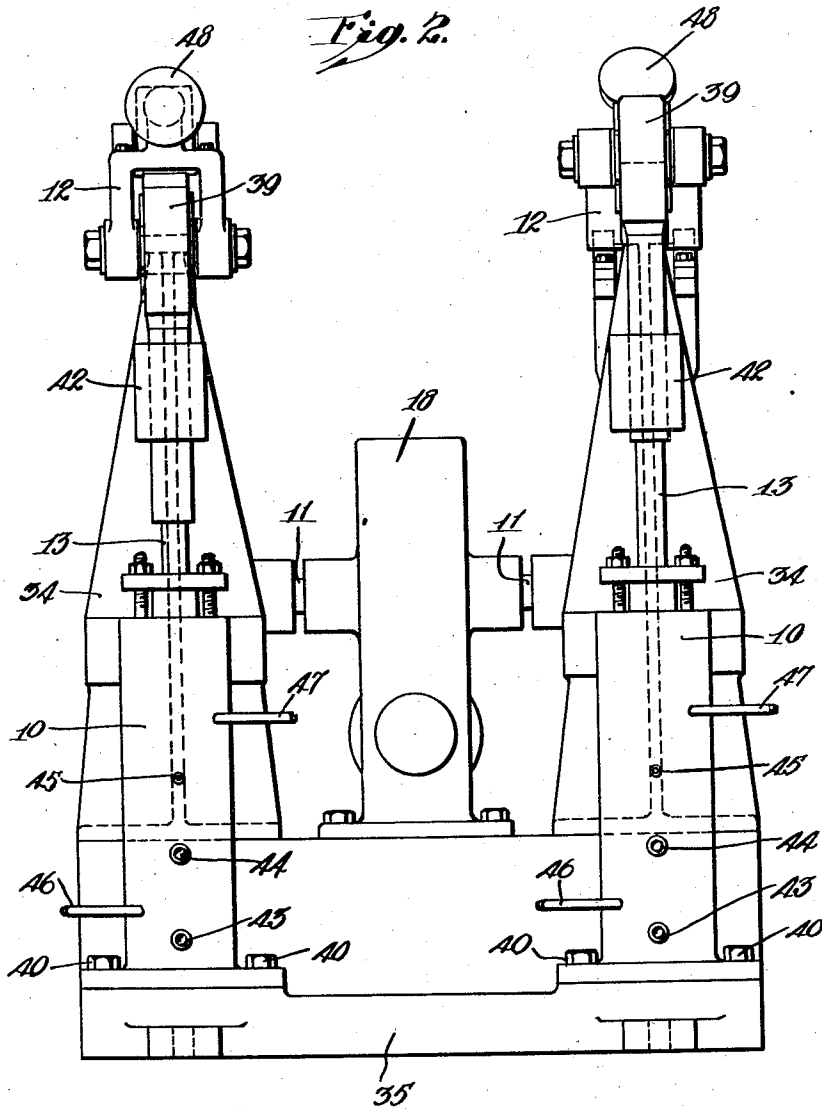
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3 Sheets-Sheet 2

Fig. 2.



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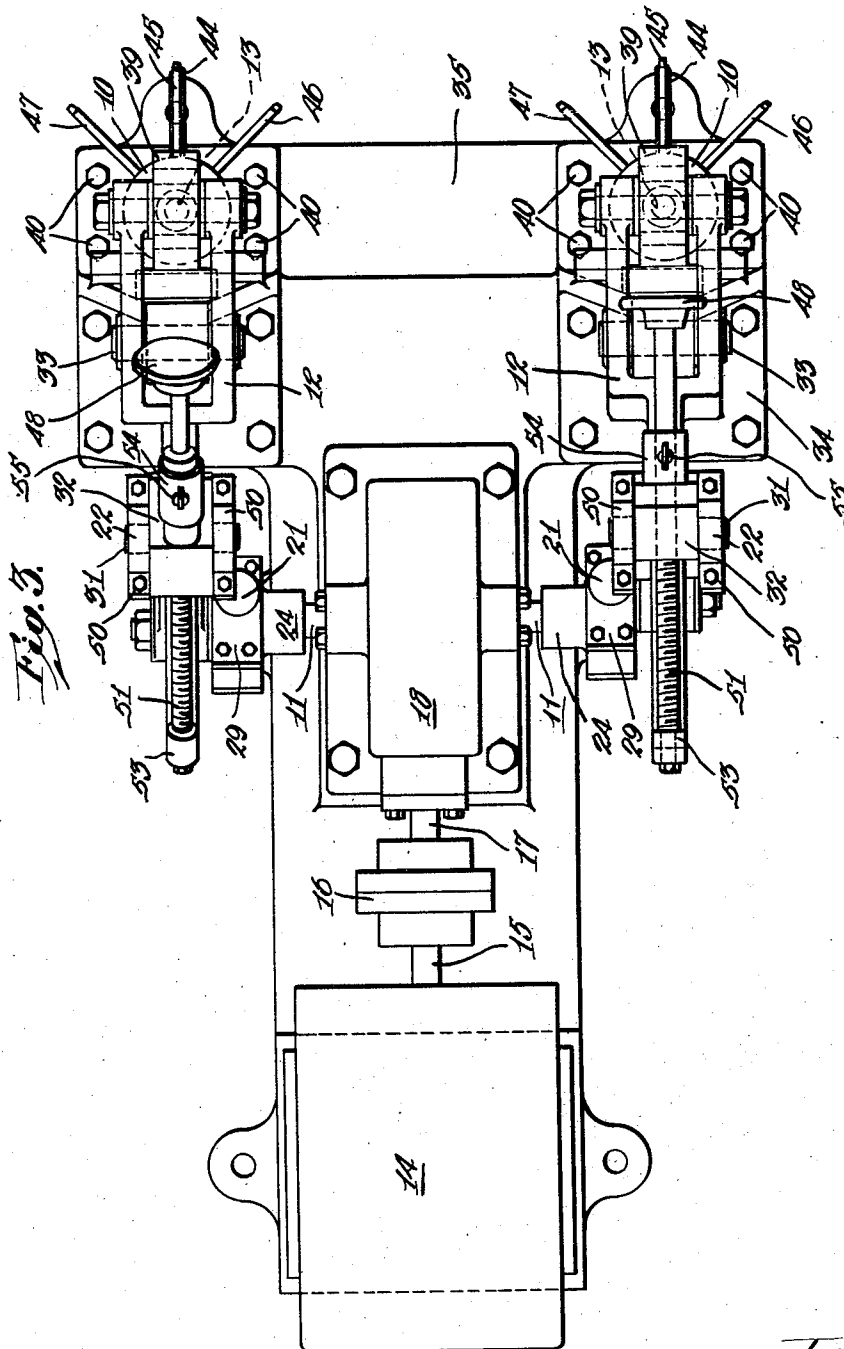
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CHEMICAL PUMP

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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,197,730

CHEMICAL PUMP

Harold James Mugford, Philadelphia, Pa., assignor to The Wicaco Machine Corporation, Philadelphia, Pa., a corporation of Pennsylvania

Application December 3, 1938, Serial No. 243,690

5 Claims. (Cl. 74-41)

My invention relates to a multiple pump intended for any use to which it may be adapted but believed to have its widest application as a proportioning pump for delivering liquids positively and proportioning at selectively variant predetermined rates and in many cases against relatively high liquid pressures. More specifically the invention relates to a type of proportioning pump that includes a plurality of usually substantially like plunger pumps of selectively adjustable strokes and driven from a common drive shaft having crank-and-connecting-rod driving connections with rockers operating the respective plungers and with individual adjustments of the crank and rocker arms at opposite ends of the connecting rods.

A purpose of the invention is to provide novel structure of the character indicated, well suited to the needs of service.

A further purpose is to provide plunger pumps of the type indicated with stroke adjustments of the plungers that do not materially vary the end-of-the-pumping stroke positions of the plungers for the same crank arm adjustment.

A further purpose is to provide easy adjustments in the effective lengths of rocker arms operating plunger pumps and themselves operated by connecting rods and cranks.

A further purpose is to locate the hand wheel of an adjustment screw controlling the effective length of a rocker arm operating a plunger pump near to and laterally offset from the rocker pivot, correspondingly laterally offsetting the line of screw adjustment from the pivot.

A further purpose is to adjust easily crank arm lengths whatever the angular positions of the cranks.

A further purpose is to provide a crank block having an adjustment screw with adjustment wheels at both ends of the screw.

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

I have elected to illustrate one only of the different main forms of my invention, showing this however in two forms of which both are practical and efficient in operation and well illustrate the principles involved.

Figures 1 and 2 are front and right elevations respectively of structure embodying a desirable form of my invention.

Figure 3 is a top plan view of the structure of Figures 1 and 2.

Figure 4 is a view corresponding to a modified portion of Figure 1 to reduced scale.

Like numerals refer to like parts in all figures.

Describing in illustration and not in limitation and referring to the drawings:

The pumps to which this invention is directed are adapted to extensive use in pumping simultaneously and often against high pressures a plurality of chemical liquors that need to be maintained at continuing definite, adjustable and relatively proportional rates of flow, for the maintenance of some desired condition of continuing reaction responsively contributed to by the liquors delivering from the pumps.

The proportioning pump selected to illustrate the present invention includes permissibly duplicate plunger pumps 10, 10 having selectively adjustable strokes and driven from a common drive shaft 11.

Crank-and-connecting-rod driving connection between the common drive shaft 11 and rockers 12, 12 include each an adjustment in the effective length of the crank arm and an adjustment in the effective length of the rocker arm for operation of the respective plungers 13, 13.

The pump units driven from the common drive shaft 11 being permissibly alike, a description of one applies to both and therefore they have been given the same reference characters for the same parts.

The drive shaft 11 may be driven in any suitable way.

In the structure shown, a motor 14, through shaft 15 and flexible coupling 16 drives the driven shaft 17 of a speed reduction unit 18 operating the drive shaft 11 at speed suitably reduced from that of the motor.

Since speed reduction units and motors are both well known and available in many different types it is considered unnecessary to explain either in greater detail than to remark that any one of different standard commercial motors and any one of different standard commercial speed reduction units may be used. The drive shaft 11 of the speed reduction unit passes through the unit to be available on both sides of the unit to drive the respective pumps from cranks 19 located on opposite sides of the unit.

Each crank 19 is adjustable as to effective length of crank arm and adjustment wheels 20 and 21 are provided on the two ends, respectively of the crank structure on opposite sides of the drive shaft 11, making crank adjustments easy whatever the position of the cranks with respect to the connecting rods 22.

As shown, each crank comprises a crank body having a slideway 23 integral with a hub 24 keyed to the end of the drive shaft 11. Opposite

V grooves of the slideway receive the correspondingly formed sides of a slide block 25 carrying the crank pin 26. This is at the crank end of the connecting rod 22. A crank adjustment screw 27 threads through the slide block 25. It journals at 28 in caps 29 and 30 fastened to the crank body across the ends of the slideway and, beyond the caps, carries the crank adjustment wheels 20 and 21.

One of the desirable features of the present invention is the provision of adjustment wheels at both ends of the crank structure for more easy crank adjustments whatever the relative positions of the cranks and connecting rods.

The connecting rod 22 forks at its driving end to journal aligned pin projections 31 from opposite sides of rocker slide 32, the slide 32 being adjustable along the rocker to determine the effective length of the driven arm of the rocker.

The rocker 12 is pivotally supported at 33 on a standard 34 and all of the main parts named are supported from a base 35. At its driving end the rocker 12 presents a sliding block 36 between upper and lower abutment blocks 37, 38 within head 39 of the plunger.

As shown, the rockers 12, 12 fork to both sides of the standard 34 and of the head 39 of the plunger.

The plunger pumps 10 may be of commercial type. As illustrated, the pump bodies are bolted at 40 to the base 35 and at 41 to the standard. Guide bearings 42 of the plunger also are bolted to the standard 34. Inlet and outlet pipes to the pump are indicated at 43 and 44, respectively.

An oil pipe is shown at 45 and inlet and outlet connections for water cooling appear at 46 and 47.

Important features of the invention are directed to the rocker structure which permits locating the adjustment hand wheel 48 controlling the effective length of the driven arm of the rocker 12 near to and somewhat above the rocker pivot 33 adapting to easy use during continuing operation of the pump; which lessens the upward reach of the rocker during the up strokes of its driven arm for greater compactness and lower requisite vertical space for the entire mechanism; and which also along a very considerable portion of the range of adjustment permits adjustment of the length of the plunger stroke without substantial change in the end-of-the-stroke (bottom) positions of the plunger, thereby securing unchangingly a more nearly complete discharge of the plunger cylinder at every down stroke of the plunger. The construction permits minimal cylinder and plunger lengths. This latter condition has its greatest importance when the pumped liquor is heavily admixed with air or other gas and the pressure is low enough to permit vaporization. It is then desirable to empty the cylinder as far as possible with each down stroke of the plunger.

The crank arm and rocker, as seen in Figure 1, are both adjusted for the maximum plunger stroke and are shown full-line in their end-of-the-pumping-stroke positions in both pumps. The nearer pump plunger is in its lowest position.

As shown, the axes of the pins 31 at the upper end of the connecting rod and of the rocker pivot 33 and the center of the block 36 at the plunger head, all carried by the rocker, are on a straight line 49, that is horizontal in the mid position of the rocker, the pins 31 being thus as far below the horizontal through the rocker pivot at the beginning of the pumping stroke as they are

above it at the end of the pumping stroke, the reverse being true of the center of the block 36.

In adjustably lengthening the driven arm of the rocker I have made the line of movement of the adjusted block at an angle to the line 49 preferably such as to be horizontal, that is, to be perpendicular to the direction of movement of the connecting rod when the rocker is in the position of the nearer pump in Figure 1, i. e., its end-of-the-pumping-stroke position when the crank is set at its maximum throw and the driven arm of the rocker is set at its minimum effective length.

The adjustment portions of the driven arm sides of the rockers in Figure 1 include straight fork guides for the rocker slides 32, with caps 50 closing and strengthening the fork ends.

Rocker arm adjustment screws 51 thread the slides 32 at 52, journal in bearings 53, 54, respectively, upon the caps 50 and the body portions of the rockers and carry at their rearwardly extended ends the rocker adjustment wheels 48. These are located near to and a little above the rocker pivot 33. Wing headed set screws are shown at 55 to prevent creeping of the adjustment screws 51.

As an illustration of a frequent use, with the rocker wheels 48 set initially near the middle of their respective fork guides, the crank arm adjustments are made to give approximately the desired pump deliveries, after which any readjustment or fine adjustment needed is effected without shut down of the pump by proper hand adjustments of the rocker wheels 48. The location of these wheels near to and a little above the rocker pivots permits easy adjustment without stopping the pump. The two-wheel adjustment of the crank arms, made during shut down of the pump permits easy adjustment of the crank arm by one or other of the wheels, whatever the relative positions of the crank and connecting rod.

Figure 4 is a diagrammatic view intended to show a fragment only of the structure of Figure 1 with the guides for adjustment of the block in arc form, as distinguished from the straight guides of Figure 1. The same reference characters are used except that primes are applied where the structure differs from that of Figure 1.

The arcs representing the path along which the block is adjustable are thrown about a center in the axis of the crank pin. As thus indicated with the parts in position shown in Figure 1 and the chords of the arcs horizontal complete adjustment may be effected without altering the bottom or low position of the pump plunger.

Because the arc of adjustment varies throughout its length in distance from the adjusting screw the contact between the nut 32' and the member—here a pin 56—which with adjustment moves in the arcuate slot 57, is made through the sides 58 of a vertical slot in a wall 59 connected with the nut.

Uniformity of distance of travel of the plunger downward to substantially the same low or bottom position of said plunger finds its chief importance in permissible metering use of the pump and in reduction of flashing of vaporizable or vapor-containing liquids handled by the pump. This is true notwithstanding variation in the lever arm due to adjustment of the position of the upper end of the connecting rod in the lever arm and the substantially more nearly complete emptying of the minimum length cylinder at each stroke permitted thereby. The form of Figure 4 is of course much more nearly accurate at its

different points of adjustment than is that of Figure 1 where these two functions are desired.

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 all or part 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. A plunger pump having a plunger, a rocker, a pivot supporting the rocker at an intermediate point, operating connections between the plunger and the rocker, an operating arm on the rocker on the side thereof away from the operating connections and extending along a line laterally offset from the pivot, a reciprocating driving rod, connections on the arm with said rod adjustable along the said line for angularly swinging the arm, a screw mounted on the arm, axially offset from the pivot, having an end near the pivot and adapted to adjust the said connections and a handwheel on the screw at the end thereof near the pivot.

2. A pump having a plunger, a rocker, operating connections between the plunger and rocker, a power shaft and crank-and-connecting-rod connections between the shaft and rocker and including a crank comprising a crank arm frame across an end of the shaft and rigidly mounted on the shaft, a block slidable in the frame radially of the shaft, a screw threading the block, journaling in the frame at portions thereof on opposite sides of the shaft and having end extensions beyond the frame, an adjustment wheel on each end and extension of the screw and a crank pin mounted in the block.

3. A power shaft and a plunger pump having a plunger, an intermediately pivoted rocker, operating connections between the plunger and rocker, an operating arm on the opposite end of the rocker from the plunger connections, so located with respect to the plunger and said connections that said rocker arm is perpendicular to the line of travel of the plunger when the plunger is at its end-of-the-stroke position and means adjustable along the arm for operating the rocker to and from its said position and having an operative connection with the power shaft.

4. A plunger pump having a plunger, an intermediately pivoted rocker, a pivot supporting the rocker, operating connections between the plunger and rocker, an operating arm on the opposite end of the rocker from the plunger connections, the operating arm having a line of adjustment with respect to its effective length, so located with respect to the plunger and said con-

nections that the rocker arm line of adjustment is adapted to be perpendicular to the line of travel of the plunger when the plunger is at its end-of-the-stroke position, an adjustment screw mounted on the rocker adapted to determine the effective length of the arm, the screw being offset upwardly from the pivot with an end near the pivot, a handwheel on the screw end near the pivot, a power shaft, a crank arm, a crank pin on the crank arm and adjustable therealong and a connecting rod between the crank pin and rocker arm, at its outer end operatively connected to and adjustable along the rocker arm, and the power shaft, crank arm and connecting rod being so relatively dimensioned and located that the combined length of connecting rod and adjustable crank arm when up is adapted substantially to equal the distance between the shaft axis and any point along the said operating arm of the rocker within the adjustment range of the connecting rod and when the rocker is at its end-of-the-plunger-stroke position.

5. A power shaft and a plunger pump having a plunger, an intermediately pivoted rocker, operating connections between the plunger and rocker, an operating arm on the opposite end of the rocker from the plunger connections, the operating arm having a line of adjustment with respect to its effective length located with respect to the plunger and said connections that the rocker arm line of adjustment is adapted to be substantially perpendicular to the line of travel of the plunger when the plunger is at its end-of-the-stroke position, a crank arm on the power shaft, a crank pin on the crank arm and adjustable therealong and a connecting rod between the crank pin and rocker arm, at its outer end operatively connected to and adjustable along the rocker arm along the said adjustment line, and the power shaft, crank arm and connecting rod being so relatively dimensioned and located that the combined length of connecting rod and adjustable crank arm when up is at one adjustment of the crank arm substantial equal to the distance between the shaft axis and any point along the said operating arm of the rocker within the adjustment range of the connection rod when the rocker is at its end-of-the-plunger-stroke position, and the connecting rod and rocker rocker arm connections including a block operatively connected to the connecting rod and slidable along the rocker arm, a screw upwardly offset with respect to the pivot adapted to be turned and threading the block, bearings on the rocker arm journaling the screw and adapting the screw to position the block along the arm, and an adjustment wheel on the screw near to and upwardly offset from the rocker pivot.

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