

Aug. 16, 1932.

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1,872,503

PROPORTIONAL PUMPING APPARATUS

Filed April 30, 1930

4 Sheets-Sheet 1

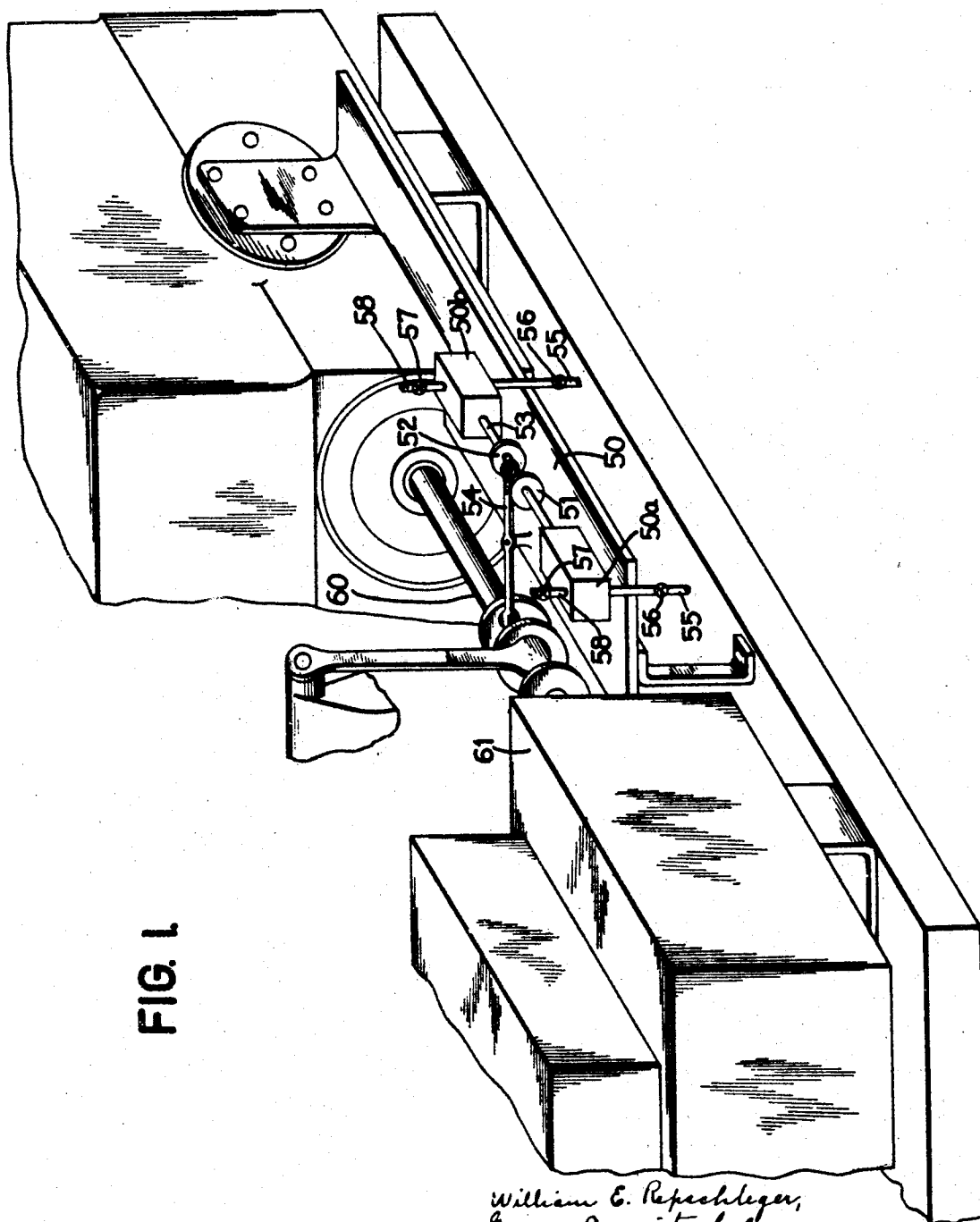


FIG. 1

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4 Sheets-Sheet 2

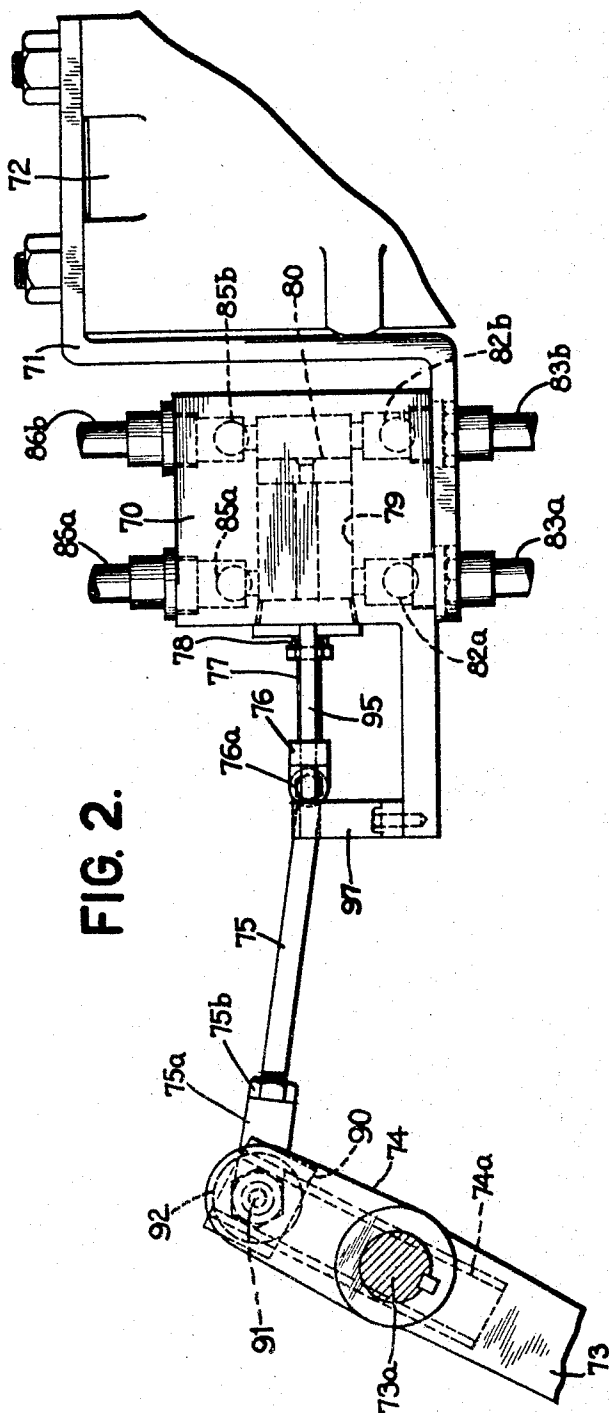


FIG. 2.

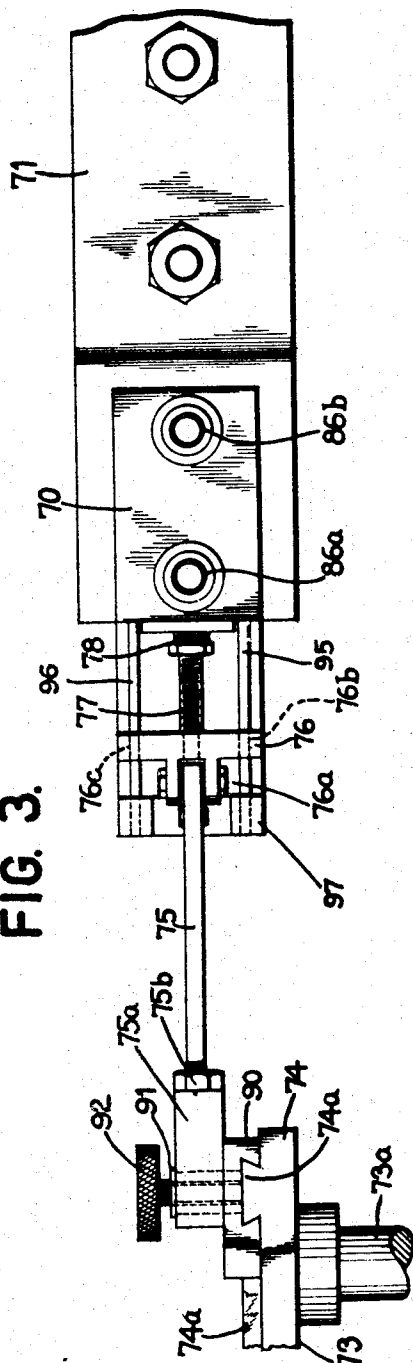


FIG. 3.

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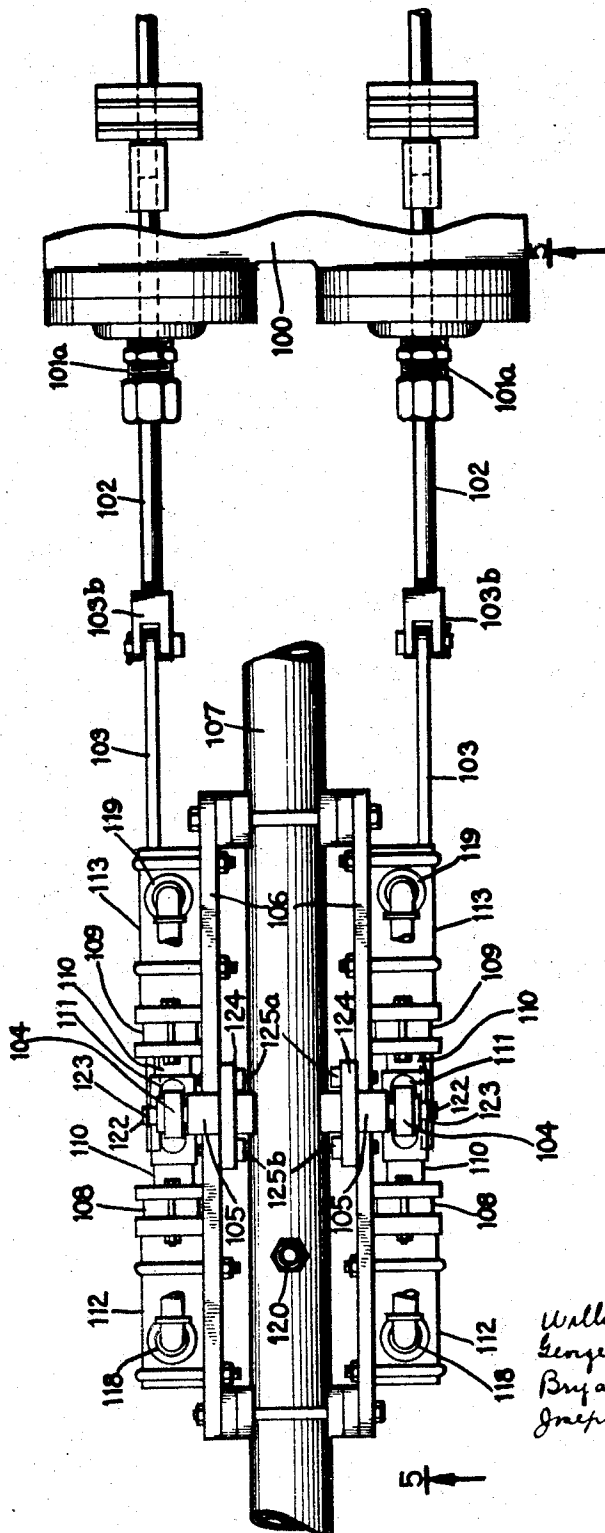
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FIG. 4.



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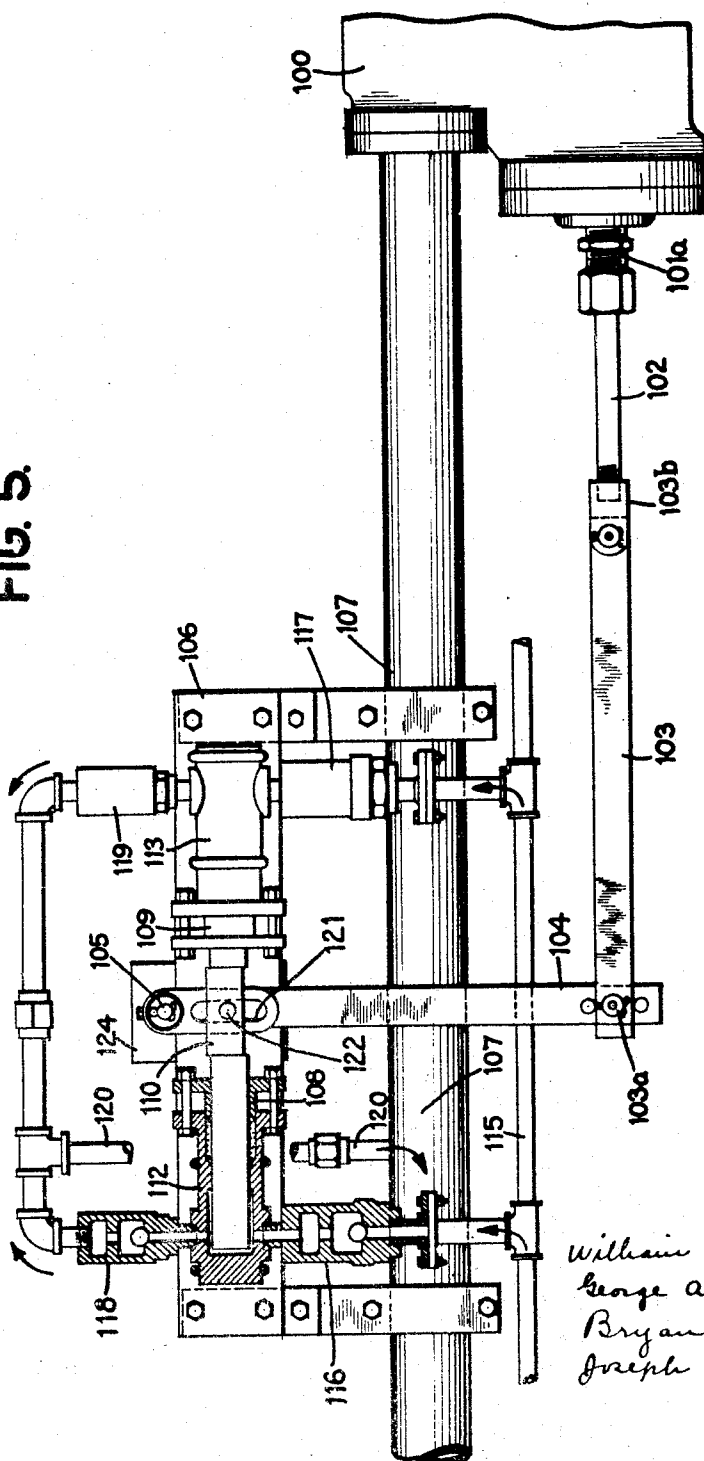
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PROPORTIONAL PUMPING APPARATUS

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UNITED STATES PATENT OFFICE

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PROPORTIONAL PUMPING APPARATUS

Application filed April 30, 1930. Serial No. 448,592.

The present invention relates to proportioning pumps and more especially to reciprocating pumps for moving two or more liquids at proportionally regulated rates by a single source of actuating power.

These pumps are more or less rigidly interconnected either in tandem or parallel and each group consists of a main pump, that is the one moving the greatest quantity of liquid, which is power driven and one or more auxiliary pumps each usually moving a lesser amount than the main pump and each of which is actuated directly or indirectly by some moving part of the main pump. Thus by avoiding the use of gears or other ordinary means of power transmission, one device is capable of positive synchronous or simultaneous operation of parts and at the same time possesses flexible features of adjustment.

The invention particularly contemplates setting up a main pump for moving fluid in considerable quantities, for example, gasoline distillate which is being delivered to treating means such as agitators, and one or more smaller pumps for moving treating reagents such as acid or caustic soda, etc., together with means for commingling the various fluids in smaller quantities, wherein the success of the treatment may depend upon the accuracy of the proportional regulation of reagent commingled with the liquid undergoing treatment.

It is accordingly preferable to interconnect the pumps in such a manner that each time the main pump completes a stroke, a stroke is also completed by the auxiliary pumps, each of which are predeterminedly calibrated and adjusted to deliver the proper proportion of liquid which they handle. Different modes of arranging the pumps are considered herein, each being capable of varying the amount of liquid to be delivered from the pump, but the most preferable mode of arrangement is that where the auxiliary pumps are situated so as to receive power impulses through a rockable lever or other means, connecting, preferably adjustably, the plungers or piston rods of the auxiliary pumps with

the piston rods or other moving parts of the larger pump.

The present invention is comparatively simple as to design and while capable of very fine adjustment as to the proportion of fluid to be delivered is yet accurate and effective as to control. The liquid or material to be proportioned may be delivered by the auxiliary pumping means into the discharge line of the main pump through which the liquid undergoing treatment is flowing and wherein the liquids are subsequently commingled as the admixture continues to flow through the discharge line or conduit, a portion of which may be of sufficiently restricted cross sectional area or contain baffling devices so as to impart considerable turbulence to the admixture flowing therethrough in order to facilitate effective mixing or commingling of the liquids.

On the other hand it is also contemplated delivering the liquid to be proportioned to other suitable portions of apparatus in connection with which the main pump may be operating as, for example, to an agitator vessel, a dephlegmating or fractionating column, a still or reaction chamber or the like.

Referring now to the drawings illustrating different types of pumps which may be constructed according to the invention and to the following description which takes up in detail the different features of the drawings in which:

Figure 1 is a diagrammatical view of a proportioning pump arranged along side a main pump.

Figure 2 is a view in elevation of a piston type of proportioning pump situated on a fluid end of the main pump.

Figure 3 is a plan view of the same pump.

Figure 4 is a plan view of two pairs of single acting reciprocating plunger pumps situated on the discharge line of the main pump.

Figure 5 is a view in elevation taken on the line 5-5 of Figure 4.

Figure 1 illustrates a single acting plunger pump 50 of appropriate design preferably comprising two cylinder units 50a and 50b set in tandem with respect to a main rod 53

each end of which serves as a plunger as it projects within its respective cylinder unit and is provided with collars 51 and 52 adjustably mounted or secured intermediate the ends of its main rod 53. A rocker arm 54 arranged preferably in a horizontal position and mounted on the base of the pump 50 whose ends are preferably bifurcated, one end of which is engaged by the main rod 60 of a main pump 61 while the other end cooperates with the main rod 53 of the pump 50 and serves to impart a reciprocating motion to the main rod 53 of the pump 50 thereby effecting alternate strokes of its plungers.

Accordingly upon the suction stroke of a plunger liquid is drawn through a supply pipe 55 and a check valve 56 into the cylinder and then discharged during the discharge stroke through the check valve 57 and the discharge pipe 58.

The pumping rate of the auxiliary pump is varied by varying the distance between the collars 51 and 52 on the piston rod 53. Thus as the distance between the collars is increased the proportioning pump end of the rocker arm engages or cooperates with each collar for a shorter period of time during its reciprocating travel thereby correspondingly decreasing the length of the plunger stroke in each cylinder.

Referring now to Figures 2 and 3, a double acting piston type proportioning pump 70 is suitably mounted on, and attached to the body of a main pump 72, by means of a bracket member 71. A valve rocker arm or bell crank 73 rigidly mounted on shaft 73a having an extension 74 is provided with a dove-tailed tongue or tenon 74a extending along one side throughout a substantial portion of the arm and so adapted to make a dove-tailed sliding joint with a groove or slot mortised or cut in one side of a slidable member 90 which is adapted to slide laterally along the tongue 74a while remaining engaged therewith.

The slidable member 90 has a crankpin 91 attached thereto and to which one end of a connecting rod 75 is rockably attached through a coupling 75a and a locknut 75b screwed on to the threaded portion at the end of the connecting rod. A threaded tension or lock screw 92 having a knurled head extends longitudinally through the crank pin 91 to bear against the face of the tongue 74a thereby holding the member 90, carrying the crank pin 91, at any desired position on the extension 74 of the rocker arm 73.

The other end of the connecting rod 75 is rockably attached by a wrist pin 76a to a cross head 76 rigidly secured to the end of a piston rod 77. The cross head 76 is provided with holes 76b and 76c so as to slip over and slide along two guide rods 95 and 96, respectively, which are supported at one end by projecting into holes 95a and 96a pro-

vided in the body of the proportioning pump and at the other end by projecting into holes provided in a suitable guide block 97 rigidly attached to the base of the proportioning pump.

The piston rod 77 projects through a suitable packing gland 78 into a cylinder chamber 79 in the pump 70 and is rigidly attached to a piston head 80 which may be of conventional design, adapted to fit tightly within the cylinder chamber while moving backward and forward therein in response to the movement of the piston rod 77. Accordingly when the valve rocker arm 73 is actuated by the main pump piston rod or other moving parts and thereby caused to rock back and forth in the conventional manner, its extension 74 serves as a crank imparting reciprocating motion to the piston rod through the connecting rod 75.

One or more proportioning units of this type may be employed there being preferably a unit to correspond to each cylinder of the main pump in order to effect strictly uniform proportioning, that is, for every stroke of the piston in the main pump there is a corresponding stroke in the proportioning pump.

Thus as the piston 80 is moved away from the liquid end of the main pump, liquid is drawn through a suction pipe 83b and a check valve 82b into the cylinder chamber 79 on the suction side of the piston while liquid already drawn into the cylinder on the other side of the piston head during the preceding stroke is discharged through the check valve 85a into the discharge line 86a. Similarly on the return stroke of the piston liquid is drawn into the cylinder through the suction line 83a and the check valve 82a, while the liquid already drawn into the cylinder during the preceding suction stroke is discharged through the check valve 85b into the discharge line 86b.

In order to vary the quantity of liquid delivered by the proportioning pump the piston stroke may be varied by altering the position of the slidable member 90 on the tenon 74a of the main pump valve rocker arm. Thus when the block 90 is moved along the tenon 74a away from or towards the shaft 73a the stroke of the piston rod 77 is either increased or decreased accordingly so that either a greater or a lesser quantity of liquid is drawn into the cylinder and discharged therefrom.

Accordingly by moving the block 90 along the tenon 74a to a position such that the crank pin 91 is on dead centre with the shaft 73a no motion will be imparted to the piston of the proportioning pump and no fluid will be pumped by it although the main pump continues to pump liquid which it is handling.

The suction lines 83a and 83b are preferably manifolded into a common suction line, not shown, leading to a supply tank containing the liquid to be pumped in a proportion-

ate quantity while the discharge lines 86a and 86b are similarly manifolded into a common discharge line, also not shown, which conducts the liquid to the desired point of delivery which may be some suitable point either in the discharge line of the main pump to commingle therein with the main body of fluid being delivered by the main pump, or else in some other but related piece of apparatus such as an agitator, a still or a fractionating column in conjunction with which the main pump is operating.

Figures 4 and 5 illustrate a proportioning plunger type pump having two or more pairs of cylinders each pair aligned in tandem with respect to a plunger rod and clamped or secured to a frame 106 which is in turn secured preferably to a discharge line 107 from a main pump 100 though it may be supported on a suitable stationary portion of the pump. The plunger rod of each pair of cylinders is separately actuated to cooperate with a corresponding cylinder of the main pump, and since each pair is identical both in design and method of operation it will be sufficient to refer to one pair only in the following detailed description relating to Figures 4 and 5.

The piston rod of each cylinder of the liquid end of the main pump 100 has an extension 102 projecting through a suitable packing gland 101a in the end wall of the cylinder. A coupling 103b is attached to the projecting end of the extension 102 and is rockably connected to one end of a connecting rod 103 the other end of which is also rockably attached to the lower end of a vertical rocker arm or rockable lever 104 by a bolt 103a. The upper end of the rocker arm 104 is rockably mounted on a shaft 105 mounted in a supporting block 124 which is adjustably secured by screws 125a and 125b to the pump frame 106. The rocker arm 104 which is provided with an elongated aperture or opening 121 extending therethrough intermediate its ends, or preferably nearer its upper end, projects through another opening or slot 111 cut vertically through the middle portion of a plunger rod 110. The rocker arm 104 engages through the opening 121, a horizontal pin 122 traversing or extending horizontally across the midpoint of the vertical opening 111 in the plunger rod 110 and projecting through both sides of the opening 111, preferably secured therein by cotter pins 123.

Each end of the piston rod 110 is projected through suitable packing glands 108 and 109 into cylinder chambers 112 and 113 aligned in tandem and serves therein as a plunger as it moves back and forth when actuated by the rocker arm 104 which is oscillated through the connecting rod 103 in response to the reciprocating motion of the expansion of the piston rod in the liquid end of the pump 100.

Thus as the rocker arm 104 is moved alter-

nately back and forth liquid is drawn through a suction line 115, alternately through the suction valves 116 and 117 into the cylinder chambers in the cylinder blocks 112 and 113 and discharged therefrom alternately through the valves 118 and 119 into a common discharge line 120 through which it may be introduced into the main pump discharge line 107, as shown, or may instead be delivered to some other suitable part of the apparatus in conjunction with which the main pump is operating.

As in the case of the proportioning pumps previously described, the quantity of liquid or reagent to be handled by the proportioning pump just described may also be varied by altering the length of the stroke of the plunger rod which is accomplished by securing the end of the connecting rod 103 at a point on the rocker arm 104 either closer to or further away from its fulcrum point thereby directly increasing or decreasing the distance through which the rocker arm 104 is swung or oscillated.

On the other hand the length of the stroke may be adjusted by raising or lowering the supporting block 124 on the frame 106 so that the distance between the fulcrum point of the rocker arm and that part of the arm engaging the pin 123 is increased or decreased thereby correspondingly increasing or decreasing the length of the stroke.

The suction and discharge valves are preferably vertical ball check valves although any other suitable type may be employed. The suction valves may preferably be larger than the discharge valves in order to facilitate easy access of the reagent or other liquid to the cylinder chambers during the suction strokes of the plungers.

It is seen that with the modification of a proportioning pump illustrated in Figures 4 and 5 there is a proportioning pump stroke corresponding to each stroke of the main pump. Consequently during each discharge stroke in the cylinders of the main pump a desired quantity of reagent or other liquid is simultaneously delivered by the proportioning pump thereby bringing about a completely satisfactory degree of proportioning and delivery of the reagent of the reagent liquid.

Depending upon the nature of the fluids handled by the proportioning or auxiliary pumps, it may be desirable to employ various materials such as corrosion resisting alloys or metals in the construction of those portions of the pumps with which liquid comes into contact such as the valves, cylinder chambers and pistons or plungers.

Obviously many modifications and variations of the invention, as hereinbefore set forth, may be made without departing from the spirit and scope thereof, and therefore,

only such limitations should be imposed as are indicated in the appended claims.

We claim:

1. Fluid proportioning means comprising a plurality of reciprocating pumps consisting of a power driven main pump and auxiliary pumps whose piston rods are actuated by power transmitted through a rocker arm rocking about a point intermediate its ends, one end of which is engaged by a piston rod of the main pump while the other end adjustably cooperates with the rod of an auxiliary pump.

2. Fluid proportioning means comprising a plurality of reciprocating pumps consisting of a power driven main pump and auxiliary pumps whose piston rods are actuated by power transmitted through a rocker arm rocking about a point intermediate its ends, one end of which is engaged by a piston rod of the main pump while the other end cooperates with collars adjustably secured to the rod of an auxiliary pump whereby the length of the stroke of the auxiliary pump rod is varied.

3. Fluid proportioning means comprising a plurality of reciprocating pumps consisting of a power driven main pump and auxiliary pumps whose piston rods are actuated by power transmitted from a main pump rod through a rocker arm and a connecting rod connecting the rocker arm to the piston rod of an auxiliary pump and means for adjustably securing the connecting rod to the rocker arm to vary the length of the piston stroke of the auxiliary pump.

4. Fluid proportioning means comprising a plurality of reciprocating pumps consisting of a power driven main pump and auxiliary pumps whose pistons are actuated by power transmitted from a main pump rod through a rocker arm and a connecting rod connecting the rocker arm to the piston rod of an auxiliary pump and adjustable means for varying the length of piston stroke of the auxiliary pump comprising a dove-tailed tenon attached to and extending along one side of said rocker arm, a slidable member carrying a crank pin to which the crank end of the connecting rod is secured having a slot adapted to engage and slide along said tenon and a threaded lock screw extending longitudinally through the crank pin adapted to bear against the face of the tenon thereby securing the slidable member rigidly in any desired position along said tenon.

5. A proportioning pump comprising a pump frame, a plurality of pairs of cylinder chambers in tandem having suction and discharge valves secured to said frame, plunger rods having each end projected through a packing gland into a cylinder chamber and serving therein as a plunger, rocker arms rockably attached to the pump frame with openings intermediate their ends

through which to engage pins secured to the midpoints of said plunger rods and adapted to connect with the reciprocating part of a main pump thereby imparting reciprocating motion to the plungers.

6. A proportioning pump comprising a pump frame, a plurality of pairs of cylinder chambers having suction and discharge valves secured to said frame, plunger rods having each end projected through a packing gland into a cylinder chamber to serve therein as a plunger and having vertical openings through their midportions, rocker arms projecting through said vertical openings with their upper ends rockably attached to the pump frame having openings intermediate their ends through which to engage pins extending horizontally across and midway between the ends of the vertical openings in the plunger rods while the lower ends of the rocker arms connect with a reciprocating part of a main pump to thereby impart reciprocating motion to the plunger rods.

7. In combination with a main pump, a proportioning pump comprising a pump frame adapted to be secured to the main pump, a plurality of pairs of cylinder chambers having suction and discharge valves secured to said frame, plunger rods having each end projected through a packing gland into a cylinder chamber to serve therein as a plunger, rocker arms rockably and adjustably attached to the pump frame adapted to engage the plunger rods and impart reciprocating movement of regulatable extent thereto, connecting rods having one end rockably attached to the lower end of a rocker arm and having the other end attached to a projection of a main pump piston and by means of which reciprocating motion is imparted to the plunger rods of the proportioning pump.

8. In combination with a main pump, a proportioning pump comprising a pump frame adapted to be secured to the main pump, a plurality of cylinder chambers having suction and discharge valves secured to said frame, plunger rods having each end projected through a packing gland into a cylinder chamber to serve therein as a plunger, rocker arms provided with a slot intermediate their ends to slidably engage a pin secured to the plunger rods having their fulcral ends rockably attached to supporting members mounted on the pump frame and having their other ends connected to a reciprocating part of the main pump, and means for adjusting the position of said supporting members on the pump frame so as to vary the distance between the fulcral point of a rocker arm and that portion thereof engaging the pin of a plunger rod to thereby regulate the length of the stroke of a plunger.

9. In combination with a main pump, a proportioning pump comprising a pump

frame adapted to be secured to the main pump, a plurality of cylinder chambers having suction and discharge valves secured to said frame, plunger rods having each end projected through a packing gland into a cylinder chamber to serve therein as a plunger, adjustable means adapted to transmit reciprocatory movement of regulatable extent to the plunger rods from a moving part of the main pump while maintaining the movement of the plungers coextensive with the movement of a main pump piston irrespective of the length of the plunger stroke comprising rocker arms provided with a slot inter-
mediate their ends to slidably engage a pin secured to the plunger rods having their fulcral ends rockably attached to supporting members adjustably mounted on the pump frame and having their other ends adjustably connected to a connecting rod cooperating with the moving part of the main pump whereby the distance between the fulcral point of a rocker arm and that portion thereof engaging a plunger rod may be varied to thereby adjust the length of the plunger stroke.

In witness whereof I have hereunto set my hand this 22nd day of March, 1930.

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In witness whereof I have hereunto set my hand this 22nd day of March, 1930.

GEORGE ARMISTEAD, JR.

In witness whereof I have hereunto set my hand this 21st day of March, 1930.

BRYAN B. TALBOT.

In witness whereof I have hereunto set my hand this 22nd day of March, 1930.

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