Dec. 15, 1925. 1,565,819

M. B. SAUNDERS

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Filed June 29, 1922 3 Sheets-Sheet 1

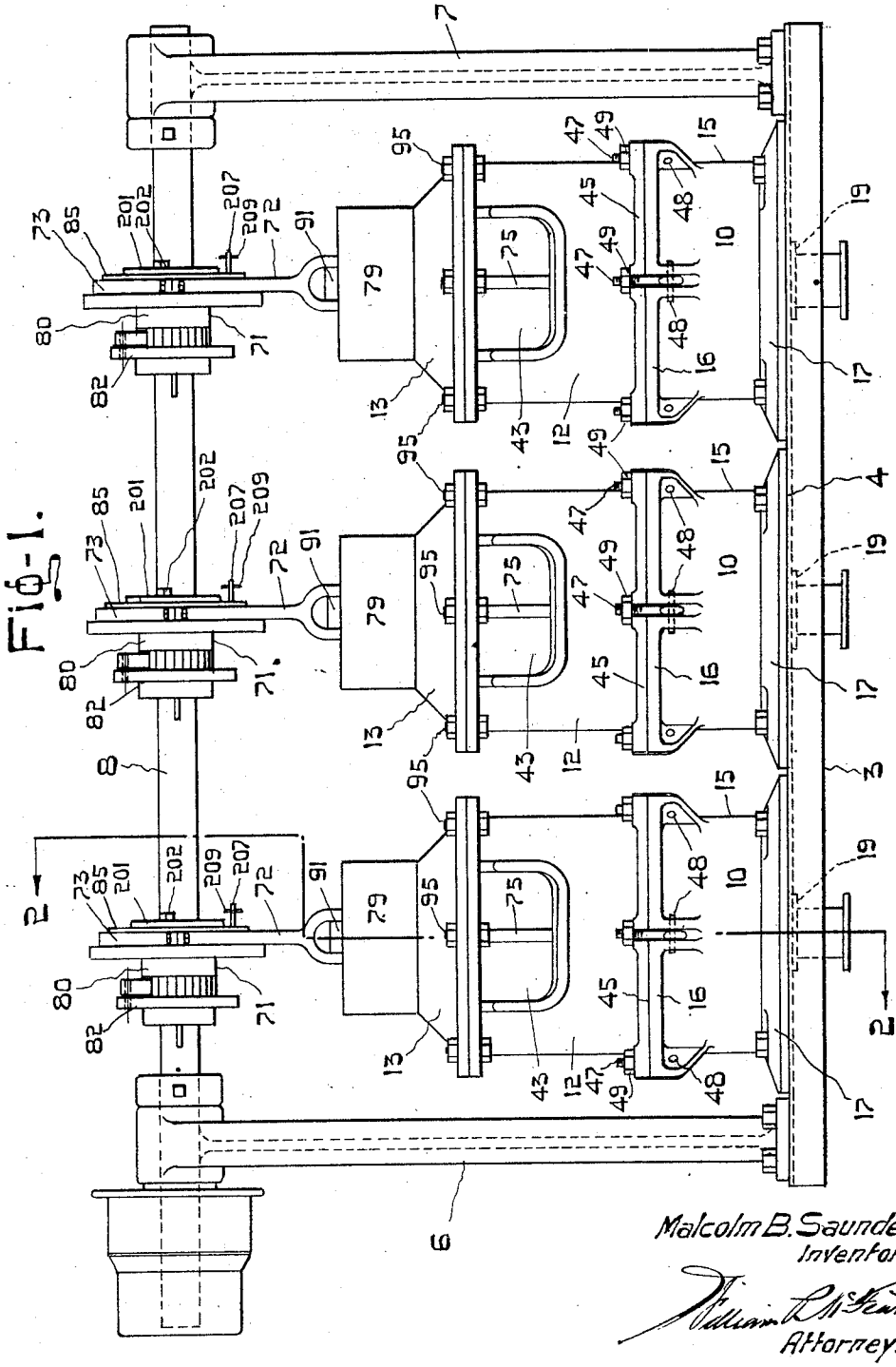


Fig-1.

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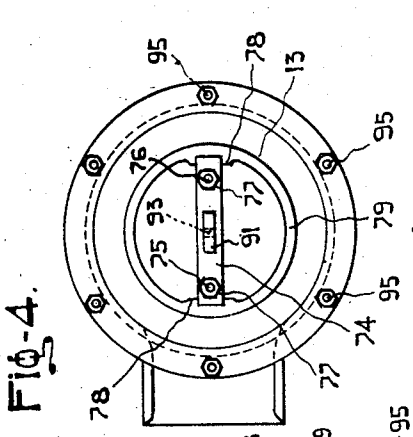


Fig-4.

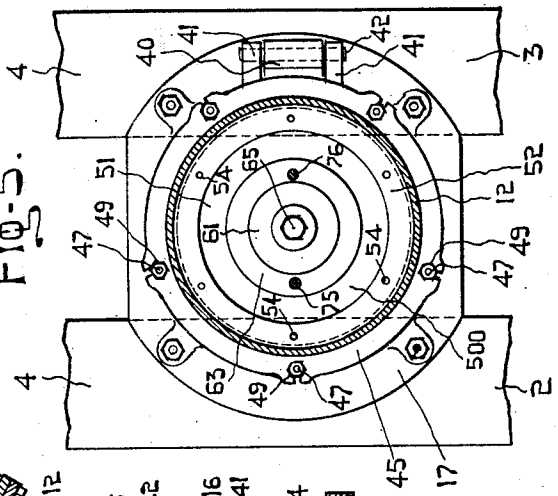


Fig-5.

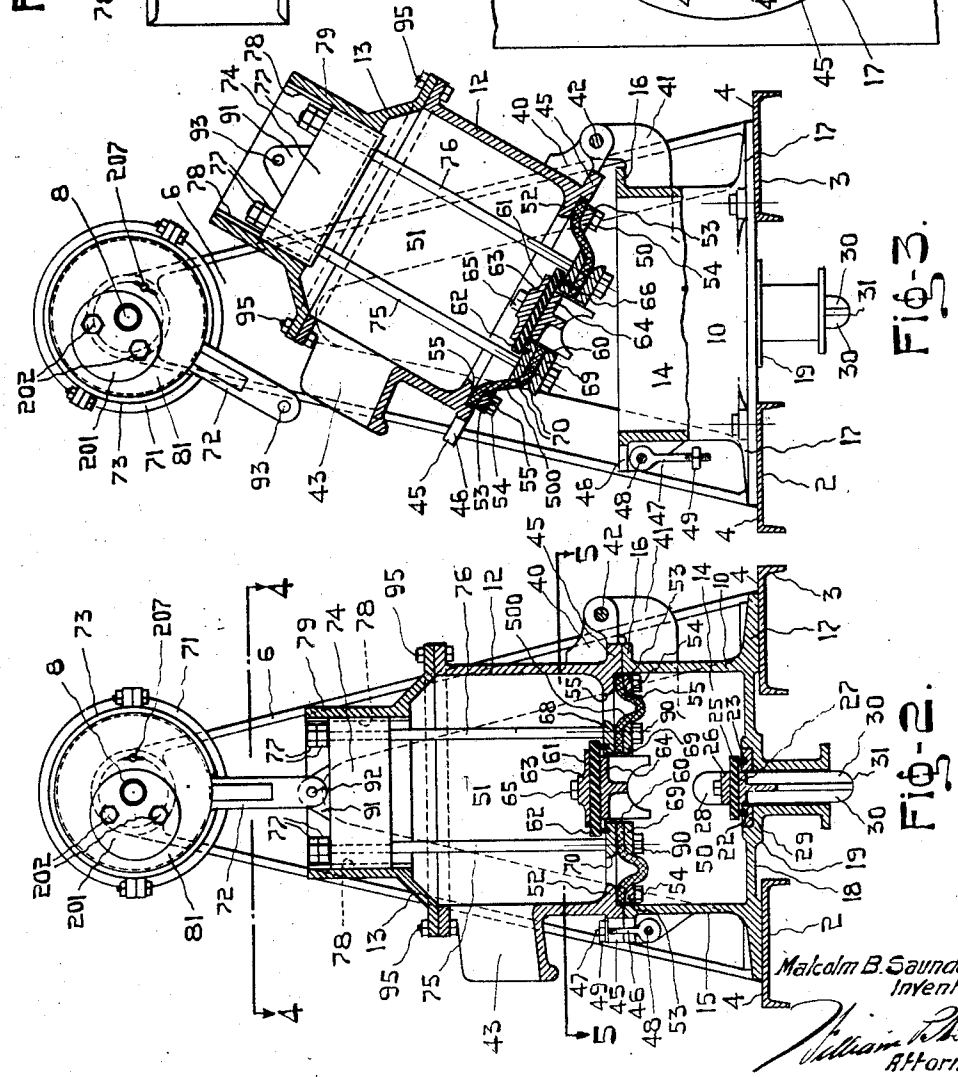


Fig-3.

Fig-2.

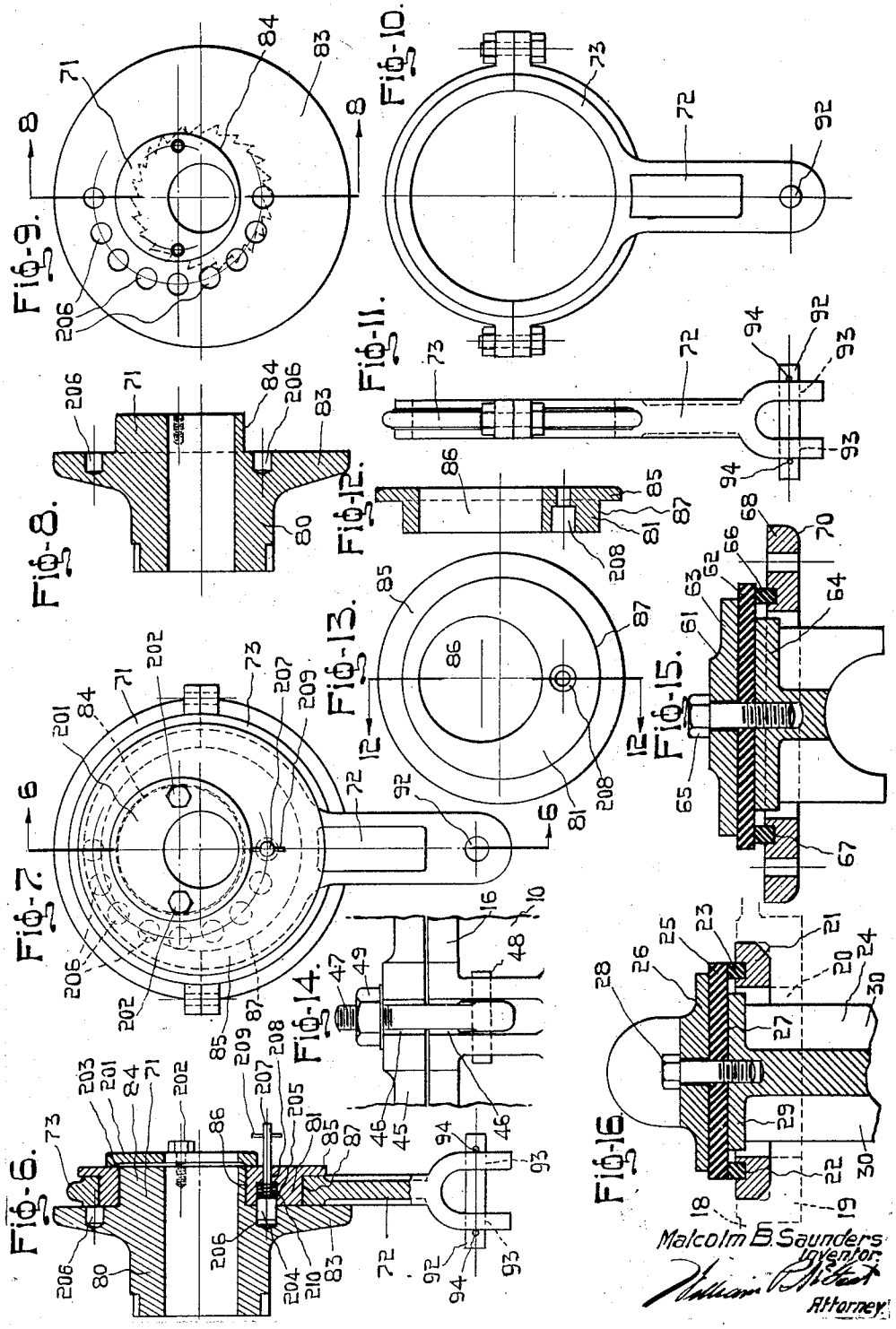
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Dec. 15, 1925. 1,565,819

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PUMP

Filed June 29, 1922 3 Sheets-Sheet 3



Patented Dec. 15, 1925. 1,565,819

UNITED STATES PATENT OFFICE.

MALCOLM B. SAUNDERS, OF OWEN SOUND, ONTARIO, CANADA, ASSIGNOR TO THE IRON WORKS LIMITED, OF OWEN SOUND, ONTARIO, CANADA, A CORPORATION OF CANADA.

PUMP.

Application filed June 29, 1922. Serial No. 571,644.

To all whom it may concern:

Be it known that I, MALCOLM B. SAUNDERS, of the city of Owen Sound, Province of Ontario, Dominion of Canada, a subject of the King of Great Britain, have invented certain new and useful Improvements in Pumps; and I do hereby declare that the following is a full, clear, and exact description thereof.

Although certain features of my invention are applicable to pumps generally the invention is particularly adapted to pumps of the diaphragm type.

The invention has for its object to provide a pump of this type the vital parts of which may be readily exposed with minimum disassociation of the working parts, thereby expediting inspection and repair work and consequently reducing the time that the pump is idle.

Another object is to so construct and arrange the diaphragm and associated parts that in conjunction with the above feature it may be removed and replaced at a moment's notice.

A further object is to provide a simplified means for eliminating the rocking motion of the diaphragm so frequently experienced in pumps of this type.

Another object is to provide an assembly of pump units in simplex, duplex, triplex or other multiple arrangement having a common supporting structure and operating mechanism and which will enable each pump unit to be inspected or repaired without disturbing the other units in any way.

Other minor objects will be hereinafter set forth in the accompanying detail description.

For full comprehension, however, of my invention reference must be had to the accompanying drawings in which similar reference characters indicate the same parts and wherein:

Figure 1 is a front elevation of the "triplex" assembly of my improved pump unit;

Figure 2 is a vertical sectional view taken on line 2—2 Figure 1, illustrating the discharge section of the pump in operating position;

Figure 3 is a similar view to Figure 2 illustrating the discharge section thrown open;

Figure 4 is a transverse sectional view taken on line 4—4 Figure 2;

Figure 5 is a transverse sectional view taken on line 5—5 Figure 2;

Figure 6 is a detail sectional view of the adjustable eccentric means forming a part of the diaphragm actuating mechanism, the section being taken on line 6—6 Fig. 7;

Fig. 7 is an elevation thereof taken at right angles to Fig. 6;

Figure 8 is a sectional view of one part of the eccentric means, the section being taken on line 8—8 Fig. 9;

Figure 9 is an elevation thereof taken at right angles to Figure 8;

Figures 10 and 11 are detail elevations of the connecting rod forming a part diaphragm actuating mechanism;

Figure 12 is a sectional view taken on line 12—12 Figure 13;

Figure 13 is a detail elevation of another part of the eccentric means;

Figure 14 is a detail fragmentary view of one of the bolts for securing the sections of each pump unit together;

Figure 15 is a detail sectional view of the delivery valve; and

Figure 16 is a detail sectional view of the suction valve.

The accompanying drawings illustrate the preferred embodiment of my invention in triplex arrangement. This arrangement comprises three pump units, supporting structure and driving mechanism, the supporting structure and driving mechanism being common to all three units.

The supporting structure consists of a bed of concrete or timber upon which a pair of parallel spaced channel irons 2 and 3 are laid in horizontal alignment presenting flat floor surfaces 4 upon which the pump units are positioned, the space between the channel irons accommodating the suction connection of each unit. Standards 6 and 7 are mounted at opposite ends of the channel irons and having journalled in their upper ends a hollow steel shaft 8 constituting a part of the mechanism for actuating the diaphragms of the pump units. Before de-

scribing this mechanism, however, I shall describe in detail one of the pump units, all of which are constructed alike.

The casing of each unit which in the main is substantially cylindrical in form is divided into three parts, viz, a base section 10, an intermediate or discharge section 12 and a top section 13. The base section which contains the suction chamber 14 consists of a surrounding side wall 15 and a bottom 18, the side wall having external circumferential flanges 16 and 17 respectively located at its upper and lower ends, the lower flange 17 being comparatively heavy and bolted to the channel irons 2 and 3. The bottom 18 is provided with a downwardly offset central portion 19 having a suction opening 20, the offset constituting a socket in which a removable ring 21 is snugly mounted, the ring having an annular groove 22 in its top side in which a hard rubber gasket 23 is seated. This gasket projects above the top of the ring and forms a seat for the gravity valve 24 controlling the suction opening.

The suction valve comprises a comparatively hard rubber disc 25 which is clamped between two metal parts 26 and 27 by a bolt 28 and adapted when in position closing the suction opening to rest upon the gasket 23, its diameter being substantially the same as the outside diameter of the gasket. It may be found desirable, however, to eliminate the rubber disc 25 and allow the metal part 26 to rest upon the gasket 23.

In order to prevent complete displacement of the valve from the suction opening in its opening and closing movements and to ensure its proper seating the lower metal part 26, which is of disc-form as indicated at 29 is extended downwardly in the form of three radial ribs 30 tapered to a blunt point as at 31, the length of the ribs being sufficient to prevent complete displacement from the suction opening when the valve is at the extreme upper end of its opening movement.

To enable the casing to be thrown open at a moment's notice for the purpose of permitting easy accessibility to the diaphragm and other vital parts, the intermediate and top sections of the casing, the diaphragm and that part of the means for transmitting motion to the latter which is located within such sections compose a unit which is hinged upon the base section and which may be swung to the position indicated in Figure 3 with little or no disturbance of the relative positioning of the working parts.

To this end the lower end of the discharge section is provided with a radially projecting lug 40 which is hinged between a pair of upturned lugs 41 on the base section as at 42. The location of this hinge may be varied to meet conditions without departing from the spirit of the invention but the preferable location is diametrically opposite the discharge opening 43 and in a plane perpendicular to the shaft 8. When in closed position the discharge section rests upon the top of the base section, an external circumferential flange 45 being formed upon the lower end of the discharge section and adapted to bear upon and be clamped to the flange 16 on the base section, the two flanges having open-ended slots 46 equi-distantly spaced apart throughout their circumference such slots being adapted to receive clamping bolts 47. These bolts are hinged at their lower ends upon the base section as at 48 and are provided with nuts 49. When it is desired to throw open the pump the nuts 49 are loosened and the bolts dropped to position clear of the flanges. The flexible diaphragm 500 which divides the interior of the casing into suction and delivery chambers indicated at 50 and 51 respectively, is secured to and extends across the lower end of the discharge section and is movable in unison therewith where the pump is thrown open. It is secured adjacent its periphery upon an inwardly extending continuous flange 52 formed integrally with the lower end of the discharge section, by a clamping ring 53 bolted to the flange as at 54, the inner edges of the flange and ring being rounded off as at 55 to reduce, as far as possible, wear of the diaphragm at this point. Communication between the suction and delivery chambers 50 and 51 is effected through an opening 60, hereinafter referred to as a delivery opening, located at the centre of the diaphragm and controlled by a gravity valve 61. This opening 60 may be made of a diameter sufficiently large to permit of the withdrawal of the suction valve therethrough (see Figure 2) but while this is preferable it is not essential owing to the construction and arrangement of parts which enables the pump casing to be thrown open. The delivery valve with its seat is somewhat similar in construction to the suction valve and seat. The former valve consists of a hard rubber disc 62 interposed between metal parts 63 and 64, the whole being secured by a bolt 65. The disc 62 is of greater diameter than either of the metal parts and, when in position closing the delivery opening, is adapted to bear upon a hard rubber gasket ring 66 forming the valve seat. This gasket ring is mounted on an annular groove 67 in the top of a metal ring 68 surrounding the delivery opening in the diaphragm and cooperating with a second ring 69 located on the underside of the latter in reinforcing the portion of the diaphragm surrounding the opening. The peripheral edges of the rings are rounded off as at 70 to reduce wear on the diaphragm.

These rings also serve to connect the means for actuating the diaphragm to the latter.

This actuating means consists of an eccentric 71 mounted upon the shaft 8 and rotatable therewith, a connecting rod 72 one end of which terminates in a collar 73 adapted to encircle the eccentric, and a yoke comprising a cross-head 74 and elongated bolts 75 and 76.

The opposite ends of the bolts are of reduced diameter and threaded, the lower ends being passed through the rings 68 and 69 and having nuts 90 clamping the latter and the diaphragm thereto. The upper ends of the bolts are extended through vertical openings in the cross-head at opposite ends thereof and are secured to the latter by nuts 77.

The cross-head is of substantially oblong form and its ends are slidably mounted in vertical guideways 78 in a cylindrical extension 79 of the casing top section 13 so that a straight up-and-down movement is translated to the diaphragm thereby eliminating the rocking action of diaphragm so frequently experienced in pumps of this type.

In order to provide a connection between the cross-head and connecting rod 72 which may be readily disconnected when it is desired to open the pump casing the top of the cross-head has an upwardly extending lug 91 the lower end of the connecting rod is forked and straddles this lug and a pin 92 is passed through aligned openings 93 in the lug and the arms of the fork, displacement of the pin being prevented by cotter pins 94 or other suitable means.

In view of the foregoing it will be seen that the preliminary steps necessary to the opening of the pump casing are few and simple, the bolts 47 securing the base and discharge sections together being removed and the pin withdrawn, after which the unit comprising the discharge section, top section, diaphragm and associated parts may be swung to the open position indicated in Figure 3.

The top section 13 is rigidly secured to the discharge section by bolts 95.

In order to permit of adjustment of the throw of the eccentric the latter is divided into two parts 80 and 81. The first part 80 consists of a sleeve encircling the shaft 8 and adapted to be connected thereto through a clutch 82 or other suitable means, such sleeve having a circumferential flange 83 adjacent its reduced end 84 and the periphery of the latter being eccentric to the axis of the shaft. The second part 81 is in the form of a collar having a flange 85 and an opening 86 eccentrically disposed relatively to its circumferential surface 87 the opening being slightly greater than the eccentric end 84 to permit of the mounting of the collar thereon. The collar 73 of the connecting rod is adapted to be interposed between the flanges 83 and 85 in position encircling the portion 87 of the eccentric collar 81, the parts being maintained in their respective positions by a plate 201 fastened to the hub 84 of the eccentric 80 by cap screws 202. This plate is larger in diameter than the hub to which it is secured and its face adjacent thereto is provided with a circumferential rib 203 which is adapted to press the eccentric part 81 into contact with eccentric part 80. This serves to prevent strain on the means for interlocking the eccentric parts so that they rotate in unison. This locking means is constructed and arranged to permit of adjustment of the throw of the eccentric by a turning movement of the eccentric part 81 upon the part 80. The locking means consists of a pin 204 mounted in a socket 205 in the eccentric 81 and adapted to register with any one pin having a reduced end 207 which is extended outwardly through an opening 208 and having a fingerhold 209 which enables the pin to be pulled completely out of a socket 206 in the part 80 when adjusting. A spring 210 encircling the reduced portion of the pin and located with the socket 205 yieldingly maintains the pin in position in the socket in the eccentric 80 in which it has been positioned.

To adjust the throw of the eccentric the cap screws 202 are loosened sufficiently to allow the eccentric part 81 to be turned. The pin 204 is then withdrawn from its socket in the eccentric part 80 and the part 81 turned until the desired eccentricity is obtained. Figures 6 and 7 illustrate the parts in a neutral position in which the eccentricity of one part relatively to the shaft 8 is neutralized by that of the other part. From this position by turning the part 81 in a clockwise direction the throw of the eccentric unit is increased commensurately with the extent of such movement.

Operation.

In the operation of each pump unit upward movement of the diaphragm produces a partial vacuum in chamber 50 which lifts the suction valve 24 off its seat and the solution is sucked into such chamber. On the downward movement of the diaphragm the solution which has been admitted to chamber 50 forces the valve controlling the delivery opening off its seat and passes through the opening into the delivery chamber 51 from when it is discharged through the discharge opening. Independent clutches for effecting connection between the driving shaft 8 and each of the pump units are provided so that operation of each may be stopped independently of the other.

What I claim is as follows:

1. In a diaphragm pump a casing divided

into a pair of sections hingedly connected together, said sections having abutting edges, means for clamping the said sections together with their edges directly abutting each other; a diaphragm disposed across the casing adjacent the plane of said division with the circumferential edge of the diaphragm located within the inside diameter of the casing, and means for securing the diaphragm upon one of said sections independently of said abutting edges.

2. In a diaphragm pump the combination with diaphragm actuating means and a fixed casing section containing a suction chamber, of a unit hinged upon the top of said section and movable to position exposing the interior thereof, said unit consisting of a casing section containing a delivery chamber, a diaphragm mounted upon and extending across the lower end of said last mentioned casing section and having a central opening adapted to effect communication between the chambers when the unit is in position resting upon the top of the fixed casing section, a valve controlling said opening and means contained within the movable casing and adapted to transmit motion from the diaphragm actuating means to the diaphragm.

3. In a diaphragm pump the combination with a casing comprising a fixed section and a movable section hinged upon the fixed section, a diaphragm carried by said movable section, means for actuating said diaphragm, said means being located partially inside and partially outside of the movable section, and means effecting a detachable connection between the inside and outside portions of said actuating means for the purpose set forth.

4. In a diaphragm pump a cylindrical casing having a closed top with a central opening therein and guideways adjacent said opening, a diaphragm dividing the interior thereof into suction and delivery chambers, a rotary driving element, means for translating rotary movement of the element into reciprocatory movement of the diaphragm and a crosshead movable in said guideways for preventing rocking of the diaphragm, rings positioned on opposite sides of the diaphragm and elongated bolts having their opposite ends respectively connected to the cross-head and the rings, substantially as described.

5. In a diaphragm pump a cylindrical casing divided into two sections one being fixed and the other movable and hinged upon the fixed section, the movable section adjacent its lower end having an inwardly extending annular flange, a diaphragm, means securing the diaphragm to the underside of said flange and dividing the interior of the casing into two chambers, and means detachably securing the sections together.

6. In a diaphragm pump, a casing having oppositely disposed guideways at its upper end, a suction inlet at its lower end and a valve controlling said inlet, a flexible diaphragm mounted within the casing in position dividing the interior of the pump into suction and delivery chambers, said diaphragm having a central opening, a valve controlling said opening, and means for reciprocating said diaphragm, said means consisting of a yoke comprising a pair of elongated bolts having reduced ends, a pair of rings located on opposite sides of said diaphragm in position encircling the opening thereon, means securing the rings and diaphragm upon the lower ends of said bolts, a cross-head secured to the upper ends of said bolts and slidable in the guideways on the casing and means to impart reciprocatory movement to the said cross-head.

7. In a diaphragm pump the combination with a casing comprising a fixed section and a movable section hinged upon the fixed section, a diaphragm carried by one of said sections, means for actuating said diaphragm, said means being located partially inside and partially outside of the movable section, and a one point detachable connection between the inside and outside portions of said actuating means, said inside portion being movable as a unit in unison with the movable section when the latter is swung upon its hinge.

8. In a diaphragm pump, a casing having oppositely disposed guideways at its upper end, a suction inlet at its lower end and a valve controlling said inlet, a flexible diaphragm mounted within the casing in position dividing the interior of the pump into suction and delivery chambers, said diaphragm having a central opening, a valve controlling said opening, and means for reciprocating said diaphragm, said means consisting of a yoke comprising a pair of elongated bolts having reduced ends, a pair of rings located on opposite sides of said diaphragm in position encircling the opening therein, nuts securing the rings and diaphragm upon the lower ends of said bolts, a cross-head secured to the upper ends of said bolts and slidable in the guideways on the casing, a shaft, an eccentric on said shaft, and a connecting rod effecting an operative connection between the eccentric and cross-head, substantially as described.

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

MALCOLM B. SAUNDERS.