

April 29, 1941.

H. A. LINCH ET AL

2,240,371

PUMP

Filed Dec. 14, 1939

7 Sheets-Sheet 1

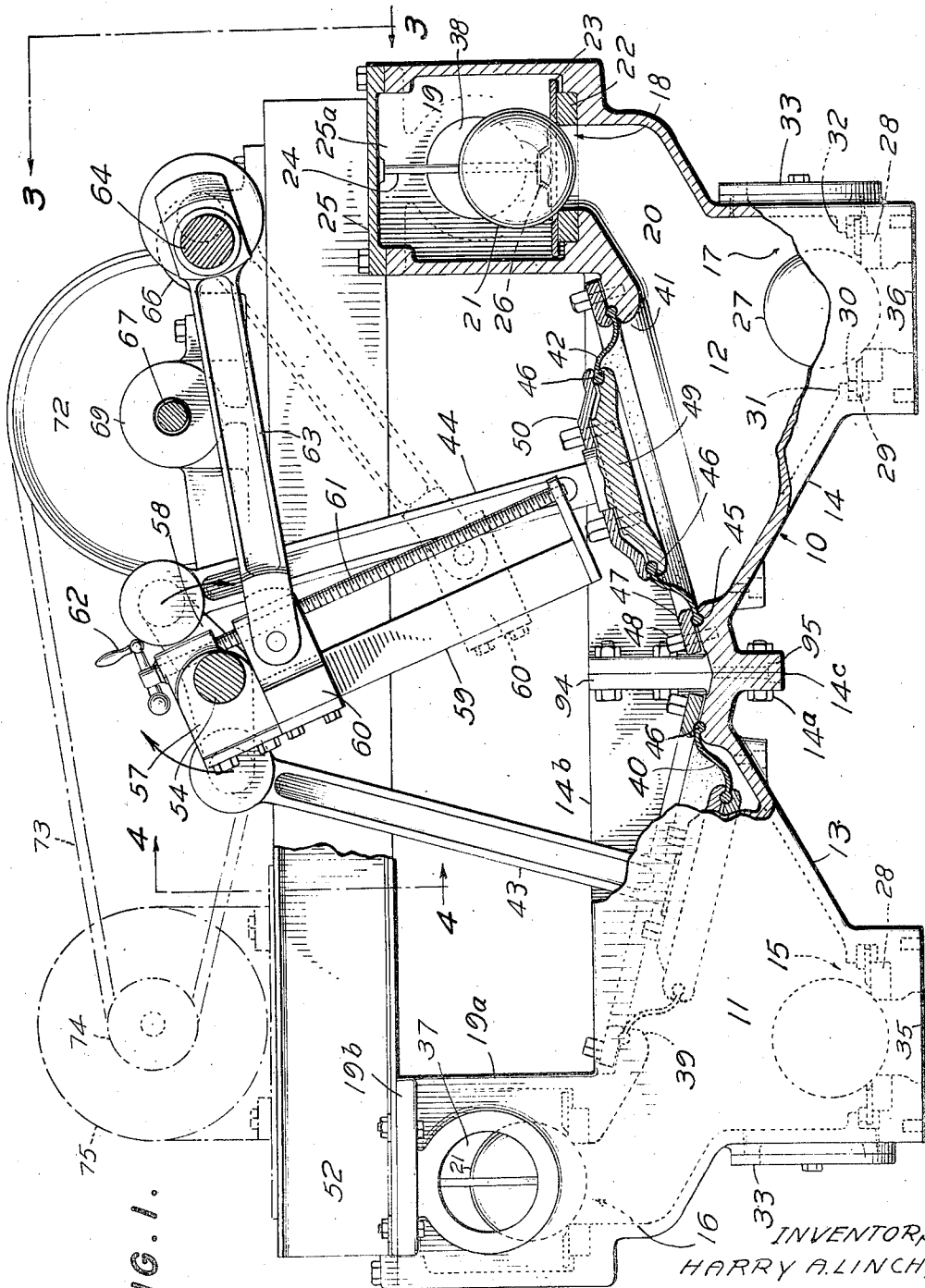


FIG. 1.

INVENTORS:
HARRY A. LINCH,
CHARLES H. SCOTT,

BY

Antoni Nicolosi

ATTORNEY.

April 29, 1941.

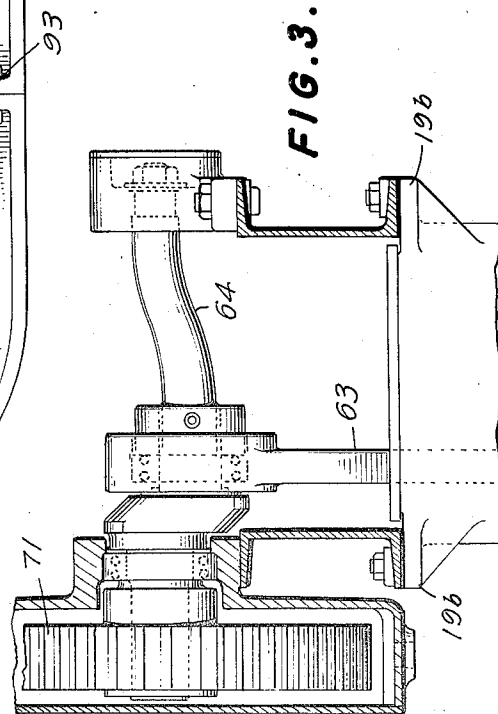
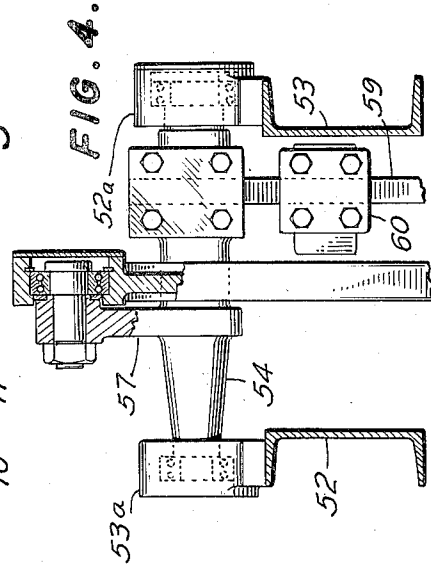
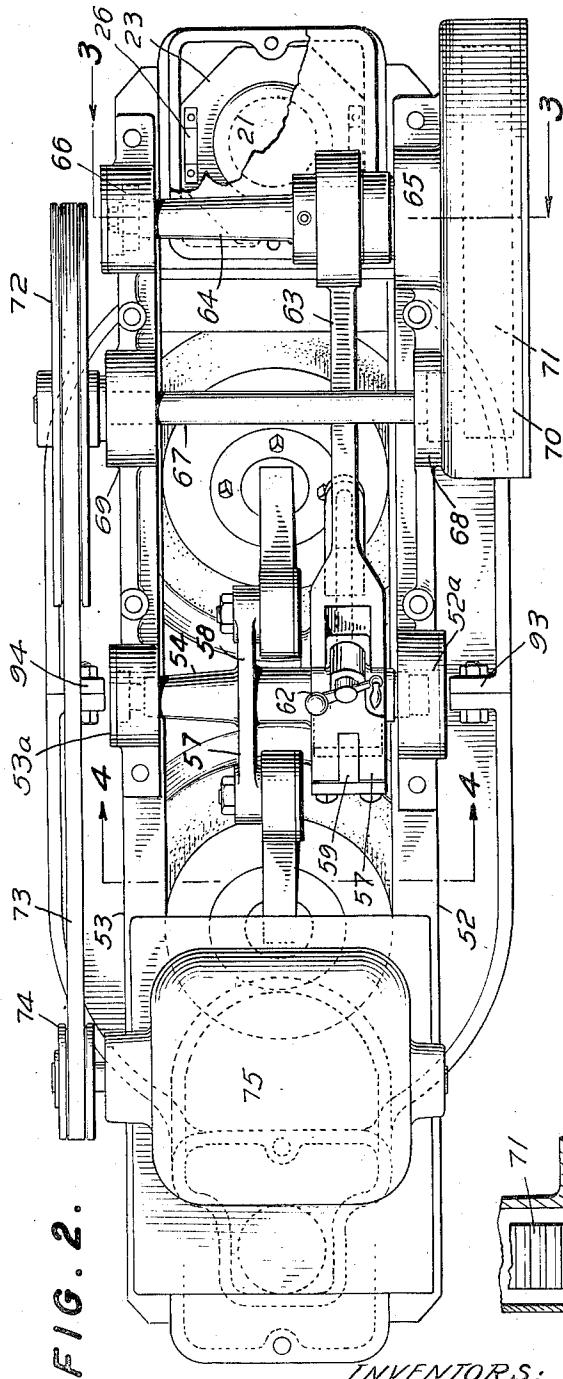
H. A. LINCH ET AL

2,240,371

PUMP

Filed Dec. 14, 1939

7 Sheets-Sheet 2



HARRY A. LINCH,
CHARLES H. SCOTT,
INVENTORS:
BY *Arthur M. Mason*
ATTORNEY.

2,240,371

Filed Dec. 14, 1939

7 Sheets-Sheet 3

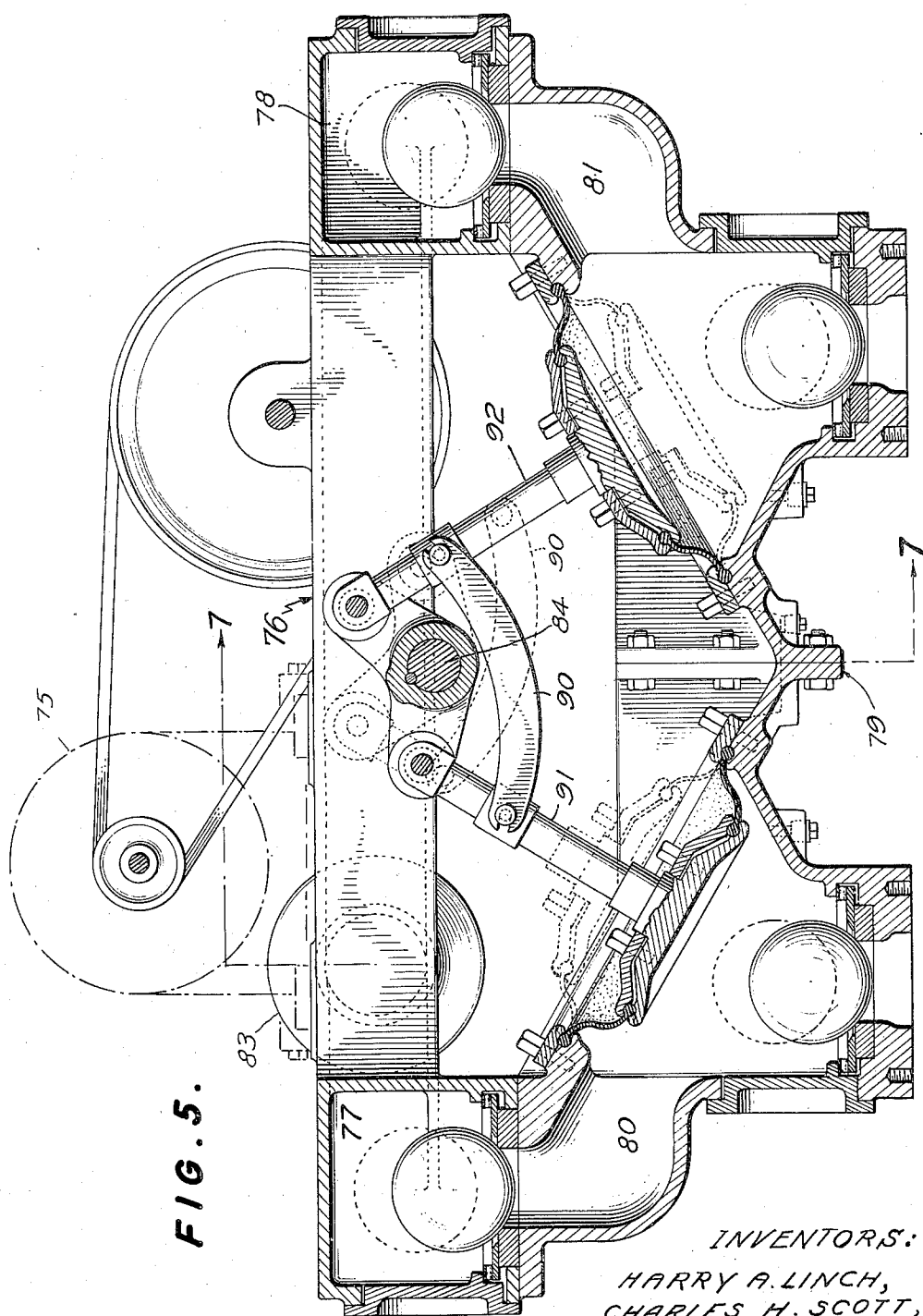


FIG. 5.

INVENTORS:

HARRY A. LINCH,
CHARLES H. SCOTT,

BY

Arthur Nielsen

ATTORNEY.

April 29, 1941.

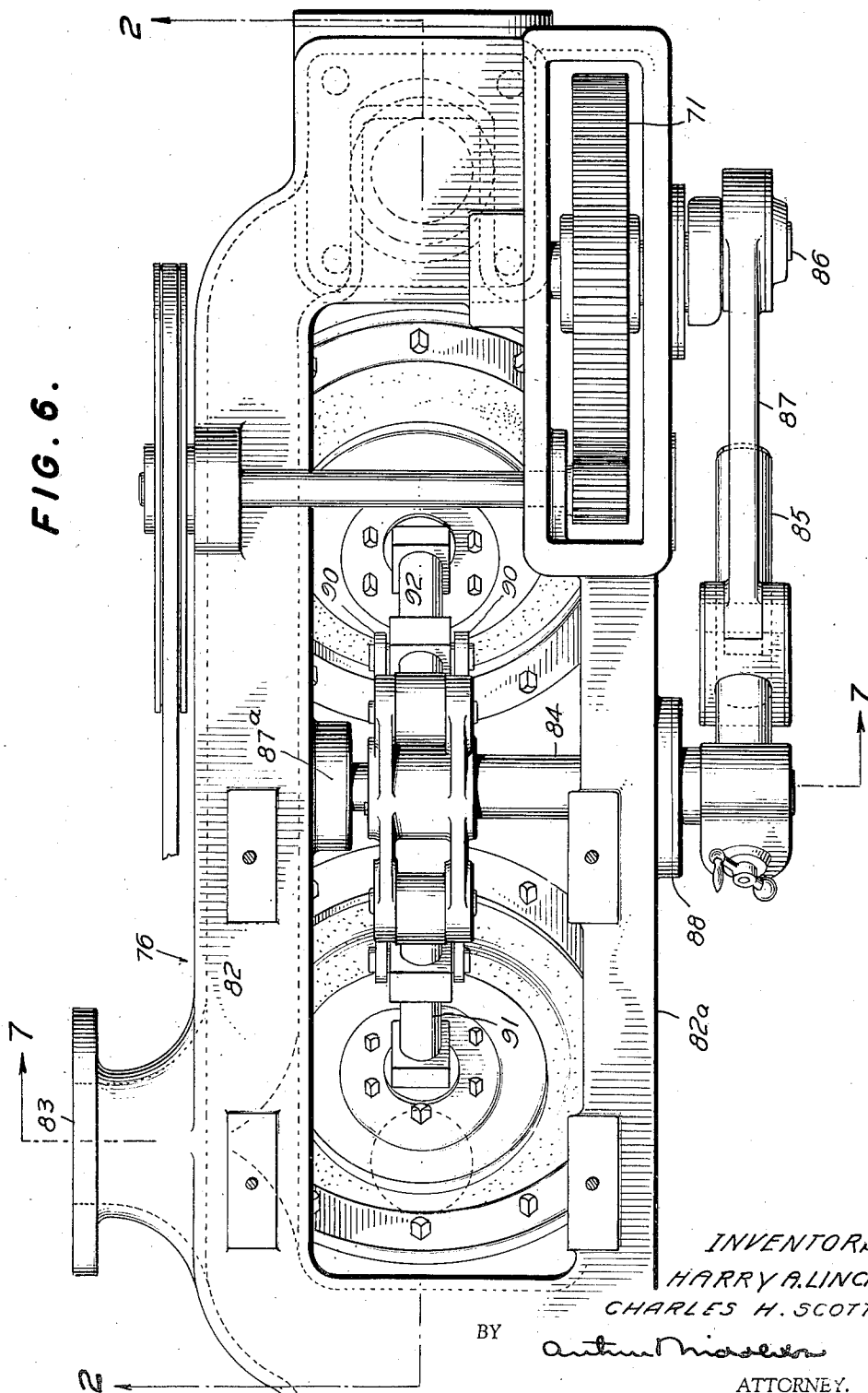
H. A. LINCH ET AL

2,240,371

PUMP

Filed Dec. 14, 1939

7 Sheets-Sheet 4



April 29, 1941.

H. A. LINCH ET AL

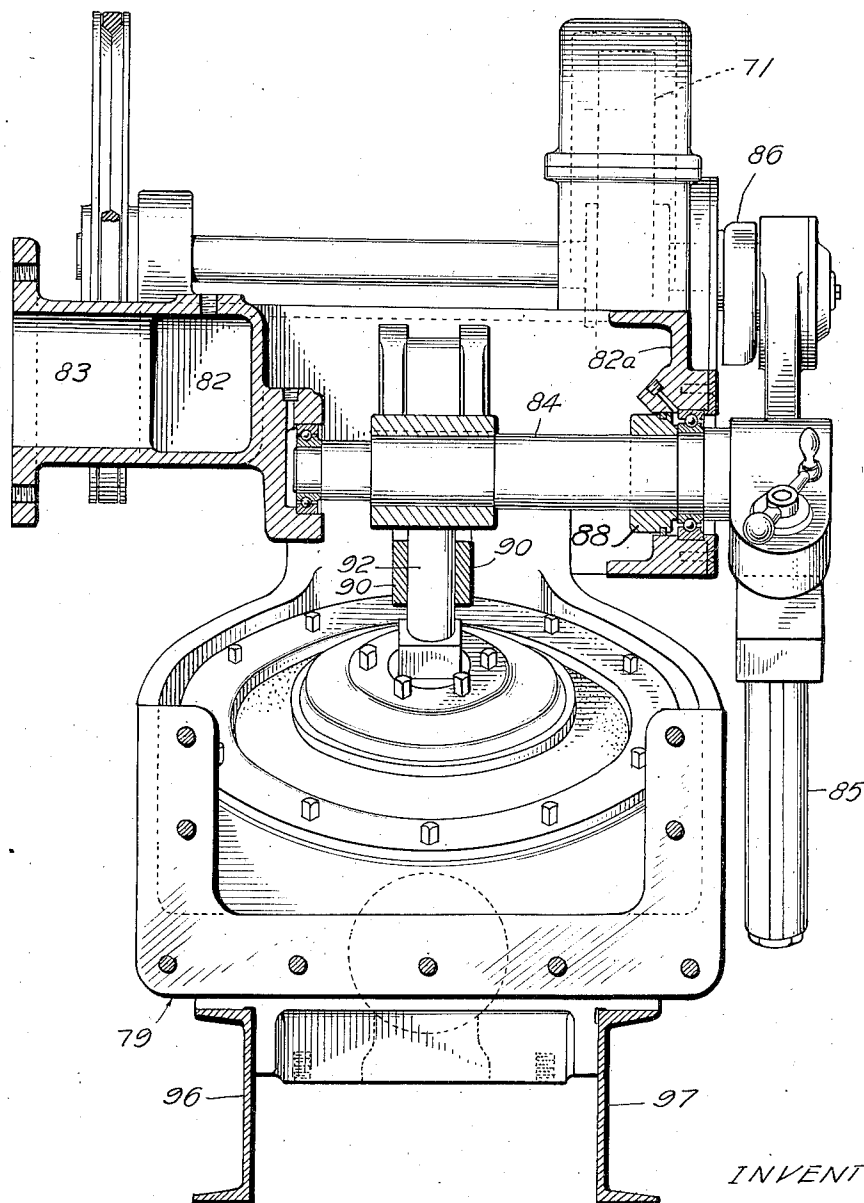
2,240,371

PUMP

Filed Dec. 14, 1939

7 Sheets-Sheet 5

FIG. 7



INVENTORS:
HARRY A. LINCH,
CHARLES H. SCOTT,
BY *Arthur Nielsen*
ATTORNEY.

April 29, 1941.

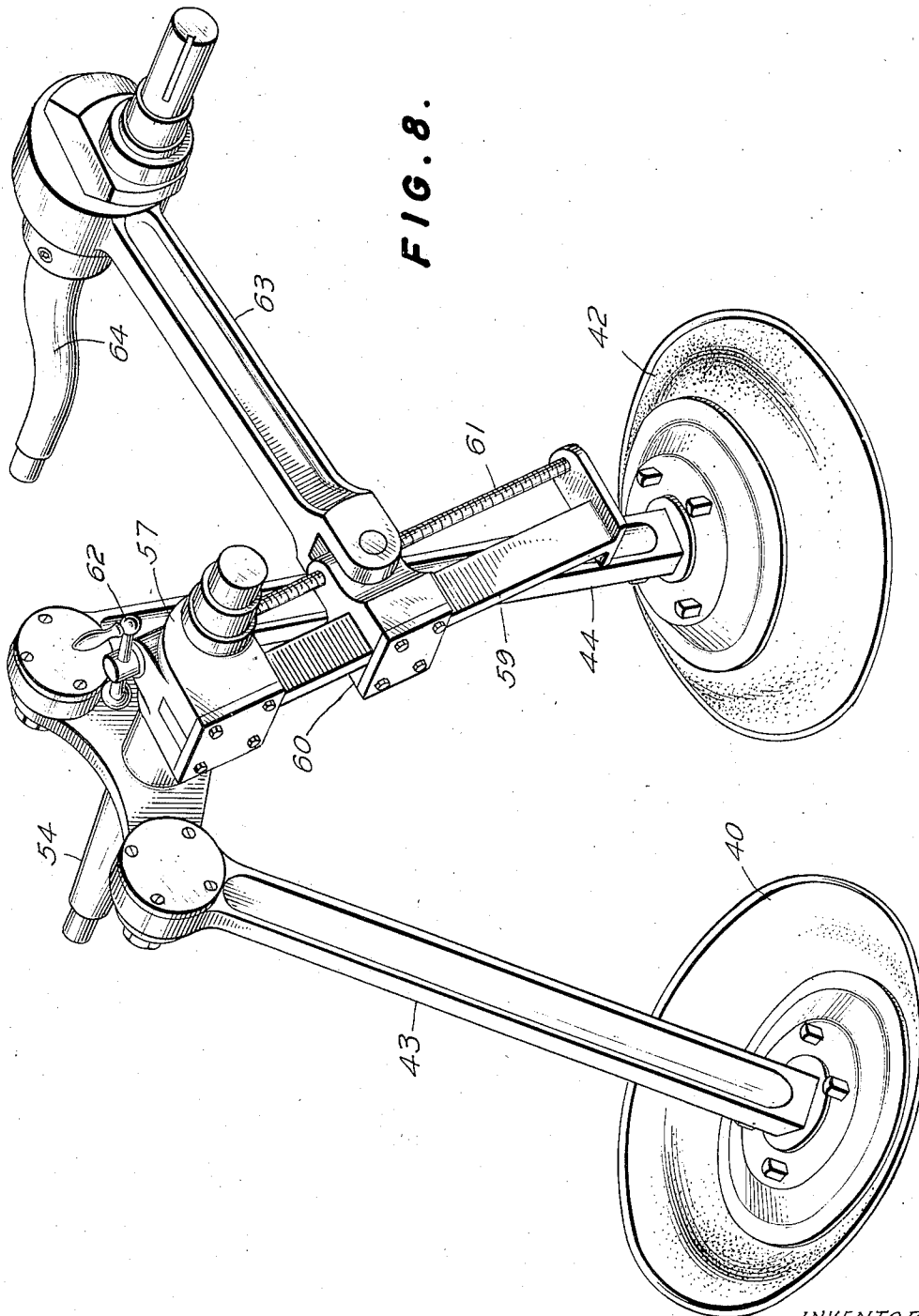
H. A. LINCH ET AL

2,240,371

PUMP

Filed Dec. 14, 1939

7 Sheets-Sheet 6



INVENTORS:
HARRY A. LINCH, CHARLES H. SCOTT,
By: *Arthur Nielsen*
ATTORNEY.

April 29, 1941.

H. A. LINCH ET AL

2,240,371

PUMP

Filed Dec. 14, 1939

7 Sheets-Sheet 7

FIG. 9.

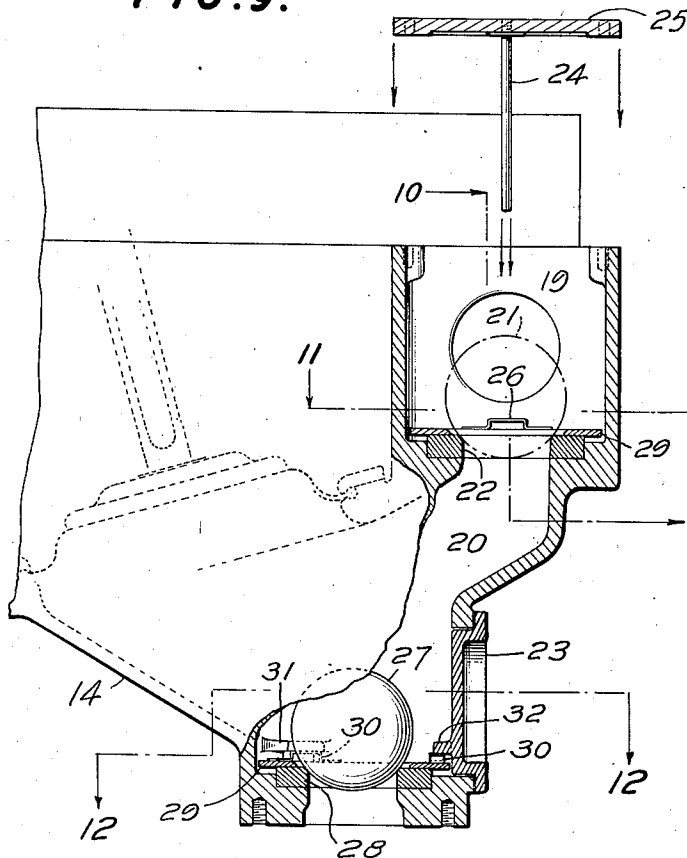


FIG. 10.

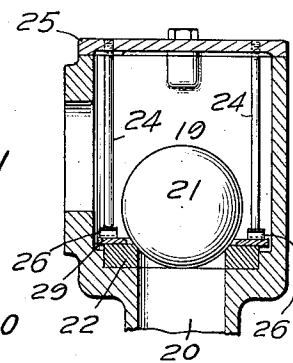


FIG. 11.

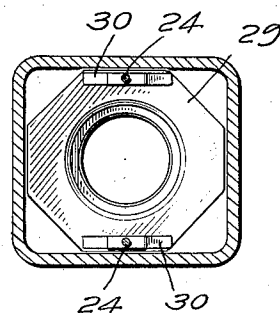
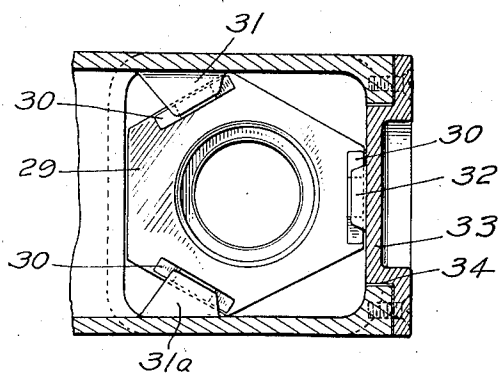


FIG. 12.



INVENTORS:
HARRY A. LINCH,
CHARLES H. SCOTT,

BY

Arthur M. Nelson

ATTORNEY.

UNITED STATES PATENT OFFICE

2,240,371

PUMP

Harry A. Linch and Charles H. Scott, Westport,
Conn., assignors to The Dorr Company, Inc.,
New York, N. Y., a corporation of Delaware

Application December 14, 1939, Serial No. 309,138

15 Claims. (Cl. 103—150)

This invention relates to single- or double-acting pumps and more particularly to diaphragm pumps.

Some of the broader objects are to produce a pump which is simple, compact, and yet accessible with respect to the renewal of parts that are subject to wear and require inspection, such as the diaphragms and the valves; which pump furthermore is volumetrically efficient.

More specific objects are to facilitate the maintenance of the valves, such as ball valves; and to provide pump diaphragms which are conveniently and expeditiously exchangeable.

The above mentioned more general objects are attained by having the power drive means and drive elements supported directly by the pump housing.

The more specific objects are realized in that there are provided valve seats which are exchangeable through a hand-hole in the pump housing; and in that the annular diaphragm elements are formed with special inner and outer marginal portions enabling them to be conveniently clamp-fastened in the pump substantially without necessitating the dismantling of parts of the pump.

According to one feature a double-acting pump housing has its two pump chambers arranged side by side in a unit, and above and supported by the housing extends a frame upon which are mounted the drive and the drive elements.

According to another feature, the membrane plungers or rods are disposed at an angle, that is to say, in V-arrangement with respect to one another, and hence in a manner to avoid the entrapment of air underneath the diaphragms, and to insure volumetric efficiency of the pump.

Other features reside in the construction of the pump housing per se, in that each pump chamber is represented by an individual casting, both castings being substantially identical and bolted together to form a symmetrical two-chamber housing construction. More specifically, the flanged portions whereby the two castings are bolted together, also form a pan for collecting any possible leak water from the diaphragms.

Still other features have to do with the arrangement of the drive elements.

According to another feature the annular pump diaphragms are formed with beaded inner and outer edge portions whereby they can be conveniently and expeditiously clamp-fastened to their respective portions of the pump substantially without dismantling of any parts thereof. Also

a diaphragm thus constructed represents a new article of manufacture per se.

According to one of a number of embodiments, this is a self-contained power driven unit, each end of the two-chamber pump housing having an upwardly extending portion constituting the bowls for the respective outlet valves, and at the same time constituting supporting posts or the like for a horizontally extending frame construction to extend above the pump housing and upon which the drive is mounted. The pump plungers are arranged at an angle or in V-shape with respect to one another, and the planes of the respective membranes are correspondingly inclined toward one another and towards the center of the pump housing. A rocker shaft works the plungers in alternating fashion, and a power-driven crankshaft also mounted on the frame, through a connecting rod oscillates the rocker shaft, motor and reduction gearing, etc. also being placed on that frame, making this a self-contained power-driven unit.

The invention possesses other objects and features of advantage, some of which, with the foregoing, will be set forth in the following description. In the following description and in the claims, parts will be identified by specific names for convenience, but they are intended to be as generic in their application to similar parts as the art will permit. In the accompanying drawings there has been illustrated the best embodiment of the invention known to me, but such embodiment is to be regarded as typical only of many possible embodiments, and the invention is not to be limited thereto.

It should be understood that some of the features of this invention, such as the pump housing with its superposed drive supporting frame, are not limited to diaphragm pumps but may include other types of plunger displacement pumps.

The novel features considered characteristic of my invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of a specific embodiment when read in connection with the accompanying drawings in which:

Fig. 1 is a longitudinal part sectional view of the pump, with frame elements or beams supported directly by and fastened to the pump housing, for supporting the drive.

Fig. 2 is a plan view taken upon Fig. 1.

Fig. 3 is a partial end view taken along the line 3—3 on Figs. 1 and 2 respectively.

Fig. 4 is a partial cross-section along the line 4—4 in Figs. 1 and 2 respectively.

Fig. 5 is a view similar to that of Fig. 1, of a pump in which the supporting frame for the drive constitutes a manifold for common delivery from both discharge valves.

Fig. 6 is a plan view of the machine shown in Fig. 5.

Fig. 7 is a cross-section along the line 7—7 taken in Figs. 5 and 6 respectively.

Fig. 8 is an enlarged detailed perspective view of the plungers in V-arrangement taken from Fig. 1, and some of the driving elements therefor.

Fig. 9 is a sectional view taken from Fig. 1, showing details of the exchangeable valve seats.

Fig. 10 is a section taken along the line 10—10 in Fig. 9.

Fig. 11 is a section taken along the line 11—11 of Fig. 9.

Fig. 12 is a section taken along the line 12—12 of Fig. 9.

According to Figs. 1 and 2 the pump housing is collectively designated by numeral 10. It consists of two symmetrically arranged pump chambers 11 and 12 respectively, each in the form of a casting or housing portion 13 and 14 respectively, and each constituting one-half of the pump housing 10, both halves being bolted together at the center of the housing as indicated by flange and bolt connection 14a. Each half also has splash walls 14b, all splash walls in assembly constituting a splash trough and also serving as reinforcements to make this a rigid unit. The housing portions 13 and 14 are symmetrical to one another, each having an inlet and outlet valve comprising a loosely movable valve body in the form of a ball. The inlet or suction responsive valve in the lefthand housing portion 13 has the collective numeral 15, the outlet or pressure responsive valve in that housing portion having the numeral 16. In the righthand housing portion 14 the inlet valve is at 17 and the outlet valve at 18. Inasmuch as the respective valves for both halves of the double acting pump are identical it will suffice to describe those of the righthand half or housing portion 14. The outlet valve 18 is located upwardly of the pump chamber 12 in a valve chamber 19 here shown to be part of the casting or housing portion 14 and to connect and communicate through a neck 20 with the pump chamber 12. The valve 18 proper comprises a loosely movable valve body in the form of a ball 21, an annular valve seating element 22 for the ball, which seating element in turn is removably seated in the housing portion 14, an annular securing member 23 overlying the seating element 22 and held down and in place by a set of rods 24 rigidly connected with and extending downwardly from a hand hole cover 25 closing the hand hole 25a, provided in the top of the valve chamber 19 (see also Figs. 9 to 12). The annular securing element 23 has attached to its upper face resilient loop members 26 as of flat spring steel and representing slightly resilient footings upon which the rods 24 are designed to engage in order to hold the securing member and therefore the valve seating element 22 in place and under a desired amount of resilient pressure. Obviously, when the hand hole cover 25 is removed together with the rods 24 thereof, the securing member 23 and the valve seating element 22 are free to be manipulated by

way of the hand hole 25a for inspection or the like.

The parts in the valve 17 are substantially the same as the ones just described for the outlet valve 18, and accordingly the inlet valve comprises a loosely movable valve body or ball 27, a valve seating element 28 therefor, and an annular securing member 29 with its three springy loop elements 30 attached thereto. In the instance of this inlet valve, however, the securing member 29 along with the seating element 28 are held in place by means of lugs 31 and 31a extending from the interior of the wall of the pump housing, and by a third lug 32 extending from a hand hole cover 33 closing a hand hole 34 in the pump housing next to the valve 17. The three lugs 31, 31a, 32 normally engage each upon a corresponding resilient loop element 30, thus keeping under a certain resilient pressure the valve seating element 28.

The pump housing 10 as a whole has a pair of inlets 35 and 36, one for each of the pump chambers 11 and 12, and accordingly a pair of outlets 37 and 38 located above.

In the left-hand housing portion 13 an opening of the pump diaphragm is designated as 39 and the diaphragm itself as 40. Similarly in the right-hand housing portion 14 there is an opening 41 for a diaphragm 42. There is a pair of alternately reciprocal actuating or plunger rods 43 and 44, each of which is connected with a respective diaphragm 40 or 42 in a manner exemplified in the right-hand housing portion 14 and presently to be described.

The diaphragm 42, similar to diaphragm 40, is of annular construction and its outer and its inner margin is formed with a beaded portion 45 and 46 respectively. The housing 14 is formed with an annular depression, and so is an annular clamping member 47, the beaded portion 45 of the diaphragm thus being closed in between respective annular depressions and securely held when the clamp member 47 is screw bolted to the housing as indicated at 48. Similarly the inner beaded portion 46 of the diaphragm is held clamped between a disc-like portion 49 fixedly connected with the actuating rod 44, and an annular member 50 screw bolted as at 51 to the disc-like portion 49.

There follows now the description of the frame construction supported upon and by the pump housing 10, and in turn supporting the drive means mounted on the frame:

The frame construction comprises a pair of parallel beams here shown to be channel irons 52 and 53 placed symmetrically over both chambers of the pump housing 10 (see Figs. 1 and 2), in that the beams at one end are mounted upon the valve housing 19 and at the other end are mounted similarly upon the opposite valve housing 19a, each of the valve housings having lateral flange portions for that purpose, one of which being more clearly shown at 19b in Fig. 1.

A rocker shaft 54 is mounted centrally upon and extends transversely of the beams 52 and 53 in journals 52a and 53a, and it has a pair of oppositely arranged arms 57 and 58 rockable therewith and pivotally connected with the actuating rods 43 and 44 to reciprocate the same when the rocker shaft 54 is rocked. The rocker shaft 54 has fixed to it an arm 59 having thereon a slide block 60 positionable for pump stroke adjustment, the position of the slide block being controllably fixed by a spindle 61. The rotation of the spindle by manipulation of the crank han-

die 62 will position the sliding block 60 anywhere along the arm 59 depending upon what length pump stroke is desired.

The sliding block 60 is pivotally connected with a connecting rod 63 to oscillate the arm 59 due to the rotation of a crank shaft 64 horizontally spaced from the rocker shaft 54 and journaled in bearings 65 and 66 upon the beams 52 and 53 of the frame construction.

In between the rocker shaft 54 and the crank shaft 64 there is a countershaft 67 mounted upon the beams 52 and 53 by way of journal bearings 68 and 69, and having fixed at one of its free ends a pinion 70 meshing with a companion spur gear 71. The other free end of the countershaft 67 has fixed thereto a sheave 72 driven by a belt 73 from the pulley 74 of a motor 75 which motor again is mounted upon the beams 52 and 53 and horizontally spaced from the rocker shaft 54 in a direction opposite to the spacing therefrom of the countershaft 67 and of the crank shaft 64.

It will be noted that the actuating rods 43 and 44 are in V-arrangement with respect to one another, and that the planes of the two diaphragms 40 and 42 are inclined towards one another accordingly, that is to say inclined downwardly towards the center of the pump housing and towards one another, the angle of inclination depending, among other factors, upon the elevation of the rocker shaft 54.

The construction of a double acting pump according to Figs. 5 and 6 differs from the construction of Figs. 1, 2, 3, 4 and 8 mainly by the design of the frame construction that supports the driving elements.

In the embodiment of Figs. 5, 6 and 7, a horizontally extending frame construction 76 is shown to be in the way of a casting integral with a valve housing 77 at one end and a valve housing 78 at the other end, the frame as a whole being placed upon a two chamber pump housing 79, thereby connecting the one valve housing 77 of the frame with an upwardly extending neck portion 80 of the pump housing, and correspondingly connecting the other valve housing 78 with an upwardly extending neck portion 81 of the pump housing.

The frame or casting 76 has a hollow conduit portion 82 (see Figs. 6 and 7) serving as a manifold interconnecting both outlet valve housings 77 and 78 to lead their respective discharges into a common outlet 83, and a solid portion 82a, the portions 82 and 82a otherwise serving as beam elements for the support of the drive elements, similar to the drive supporting functions of the beams 52 and 53 in Figs. 1 and 2.

Another modification of parts over the arrangement of Figs. 1 and 2 is found in the arrangement of some of the drive elements in Fig. 6, namely, in that a rocker shaft 84 has an oscillator arm 85 disposed outside the frame construction 76 rather than inside, and accordingly has a crank shaft 86 provided with a crank at its free end from which to actuate the oscillator arm 85 through a connecting rod 87. The rocker shaft 84 is shown to be journaled directly in the frame or casting 76, an end bearing 87a being part of the inner wall of the manifold portion 82, a journal 88 being part of the frame portion 82a opposite to the manifold portion 82 of the frame.

Numeral 90 designates a guide member (see Fig. 5), having lost motion connection with a pair of actuating rods 91 and 92, and intended to maintain these actuating rods in their operat-

ing plane and aligned with respect to one another. 96 and 97 in Fig. 7 designate beams upon which the pump as a whole is mounted.

It is a common feature of both embodiments of this double acting pump, namely, that of Fig. 1 and that of Fig. 5, for the pump housing to be formed with extra wall portions enabling the housing to act as an interceptor or catch for liquid that may leak out due to a defect of the diaphragm. In Fig. 1 such wall portions are designated by the numeral 14b, and there is also shown a drain opening 14c through which leak water may escape. Similar provisions for leak water interception and drainage are made in the embodiment of Fig. 5.

In Figs. 1 and 2 it will be further noted that there are lateral flange portions 93 and 94 respectively extending inwardly from the wall portions 14b, and whereby the housing portions 13 and 14 are bolted together. Another flange portion, however, located at the center of the flange connection is shown at 95 to extend outwardly and downwardly rather than inwardly, for convenience and so that the clamping rings 47 may be cleared. A similar connecting flange arrangement is shown in embodiment of Fig. 5.

The operation of this double acting pump as such is thought to be self-explanatory from the foregoing detailed description thereof. Otherwise, it will be seen that the machine as a whole is self-contained, and compact, and of low headroom requirements, and yet with all parts well accessible. The valve seats are accessible and exchangeable.

The pump diaphragms are capable of being exchanged without necessity of dismantling the machine. For example the diaphragm 42 in Fig. 1 can be removed and exchanged by simply loosening up on the bolts 48 and thereby releasing the annular clamping member 47 sufficiently to permit the beaded portion 45 to slip out of its seat in the annular depressions. Similarly the inner beaded portion 46 can be released from between the portion 49 and the annular clamping ring 50. The material of the diaphragm as such has sufficient stretch to permit it to be slipped downward and out over the portion 49.

It will be further noted, for instance from Fig. 1, that castings 13 and 14 of the pump housing are identical and symmetrically arranged and connected with one another by means of the bolt connection 14b. Hence the form required for casting will be but one-half of the entire pump-housing, and the housing can be shipped in halves to be bolted together in assembly.

One operating feature is particularly indicated in Figure 5, namely the feature which is inherent to the inclined planes of the pump diaphragms. In Figure 5 are indicated the extreme operating positions of the diaphragms, in full and dotted lines respectively. These are the end positions of the suction—and of the pressure stroke respectively of the pump. The drawing makes it clear that due to the inclined position of the diaphragms the pump will automatically displace whatever air may be trapped underneath the diaphragm, causing the same to escape upwardly to the pump outlet. This makes for volumetric efficiency of the pump.

It should further be understood that some of the features of the construction herein described for a double action or Duplex pump can be embodied with equal advantage in a single action or Simplex pump.

For instance, the feature of the inclined pump

diaphragm may be visualized as being embodied in a single acting—or single chamber pump. Therefore the construction of Figure 1 may be interpreted as representing a single-acting pump chamber 12, while the other pump chamber 11 may then be considered as a structural extension of the chamber 12, adapted to help supporting the frame structure 52, 53 above.

According to Figure 1, outlet openings 37 and 38 respectively may be provided at either side of the valve chambers 19a and 19 respectively. One pair of openings on one side may be closed, while the other pair of openings may be connected by a manifold (not shown). In this way it is optional which side of the pump to arrange for discharge. Also due to symmetry the same pattern can be used for both pump chamber castings, the same as with the symmetrical pump chambers in the construction of Figure 5.

We claim:

1. A double acting pump comprising a two-chamber pump housing having a pair of individual pump chambers side by side, a substantially horizontally extending frame disposed above and supported upon said pump housing at points represented by the respective outer end portions of the two pump chambers and which points are opposed to one another, a pair of reciprocable liquid displacing elements operable in alternation in the respective pump chambers, drive means mounted upon said frame, for actuating said liquid-displacing elements.

2. A pump according to claim 1, in which each pump chamber has at its outer end an outlet valve chamber, in which the outlet valve chamber for one pump chamber supports one end of the frame, and the outlet valve chamber for the other pump chamber supports the other end of said frame.

3. A pump according to claim 1, in which each of the liquid displacing elements comprises a diaphragm and a plunger rod connected substantially at right angles therewith, the plunger rods being disposed in the way of an inverted V with respect to one another, the planes of the diaphragm being correspondingly downwardly inclined towards one another and towards the middle of the pump housing, and in which said drive means comprise a rocker shaft having a pair of oppositely directed arms each of which is connected with a corresponding plunger rod, an actuating arm fixed to said rocker shaft, a crank shaft parallel to and horizontally spaced from said rocker shaft and a connecting rod driven by the crank of said crank shaft and connected with said actuating arm for rocking the rocker shaft.

4. Pump according to claim 1, in which said frame comprises a pair of beam elements extending substantially parallel to and spaced from one another and attached to said housing.

5. Pump according to claim 1, in which said frame comprises a pair of beam elements extending parallel to and spaced from one another and adapted to support the drive means, in which further each of the liquid displacing elements comprises a diaphragm and a plunger rod connected substantially at right angles therewith, the plunger rods being disposed in the way of an inverted V, the planes of the diaphragms being correspondingly downwardly inclined towards one another and towards the middle of the pump housing, and in which said drive means comprise a rocker shaft journaled on said beam elements and having a pair of oppositely directed arms

each of which is connected with a corresponding plunger rod, an actuating arm fixed to said rocker shaft and extending downwardly between the said beam elements and directly towards said housing, a connecting rod pivotally connected with said actuating arm, a crank shaft operatively connected with said connecting rod for driving the same, which crank shaft is horizontally spaced from and parallel to said rocker shaft and also journaled on said beam elements, and means comprising a threaded spindle for adjusting the connecting rod to various positions along the actuating arm for varying the pump stroke.

6. A pump according to claim 1, in which the pump housing comprises a pair of symmetrically disposed castings each of which represents a pump chamber, both castings having at their inner ends a flange connection whereby they are bolted together.

7. A pump according to claim 1, in which each pump chamber has a discharge outlet portion at the outer upper end thereof, and in which the frame itself constitutes a common manifold for the discharge outlets of both pump chambers.

8. A pump according to claim 1, in which each pump chamber has an outlet portion, and in which said frame is a unitary casting each end of which is supported upon a respective outlet portion, said frame representing a common manifold for said discharge outlet portions, which frame has each of its end portions formed in the way of a discharge valve chamber adapted to connect and communicate with a respective pump outlet portion on the associated pump chamber.

9. In a double acting pump a two chamber pump housing comprising a pair of symmetrically disposed castings each of which represents a pump chamber, both castings having at their inner ends between them a flange connection whereby they are bolted together, each casting having a diaphragm opening, the planes of which openings are inclined downwardly towards one another and towards the central portion of the housing, and a pump diaphragm associated with each opening.

10. A pump housing according to claim 9, in which said castings are formed with flanged together wall portions forming a liquid collecting pan having its greatest depth substantially at the central portion of the housing.

11. A pump housing according to claim 9, in which each chamber has an inlet portion at the bottom and an outlet neck portion extending outwardly and upwardly at the free end thereof.

12. A pump housing according to claim 9, in which each chamber has an outwardly and upwardly extending outlet portion formed as a valve housing.

13. In a diaphragm pump, a housing representing a pump chamber having an inlet and an outlet, and in which the diaphragm is disposed intermediate said inlet and said outlet, characterized by the fact that the plane of the diaphragm is inclined relative to the horizontal and thereby adapted to displace air trapped under the diaphragm, that the inlet portion is provided at the bottom of the housing, the outlet portion provided at the top of the housing and extending upwardly from adjacent to the upper edge portion of the diaphragm, and that the housing has a structural extension comprising a vertical flange portion disposed thereon opposite to said outlet portion.

14. A diaphragm pump comprising a housing having a pump chamber, a pump diaphragm connected with said housing and disposed at an angle relative to the horizontal, said housing having an upwardly directed outlet portion, an extension part extending rigidly from said housing opposite to said outlet portion, a frame construction extending above said housing and having its respective ends supported by said outlet portion and said extension part respectively, an

5 actuating element for reciprocating said diaphragm, and drive means disposed upon and supported by said frame, for actuating said diaphragm.

15. A diaphragm pump according to claim 14, in which the extension part has a vertical flange connection with the housing.

HARRY A. LINCH.
CHARLES H. SCOTT.