July 12, 1938. C. J. HUBER 2,123,781

PUMP

Filed June 16, 1936 2 Sheets-Sheet 1

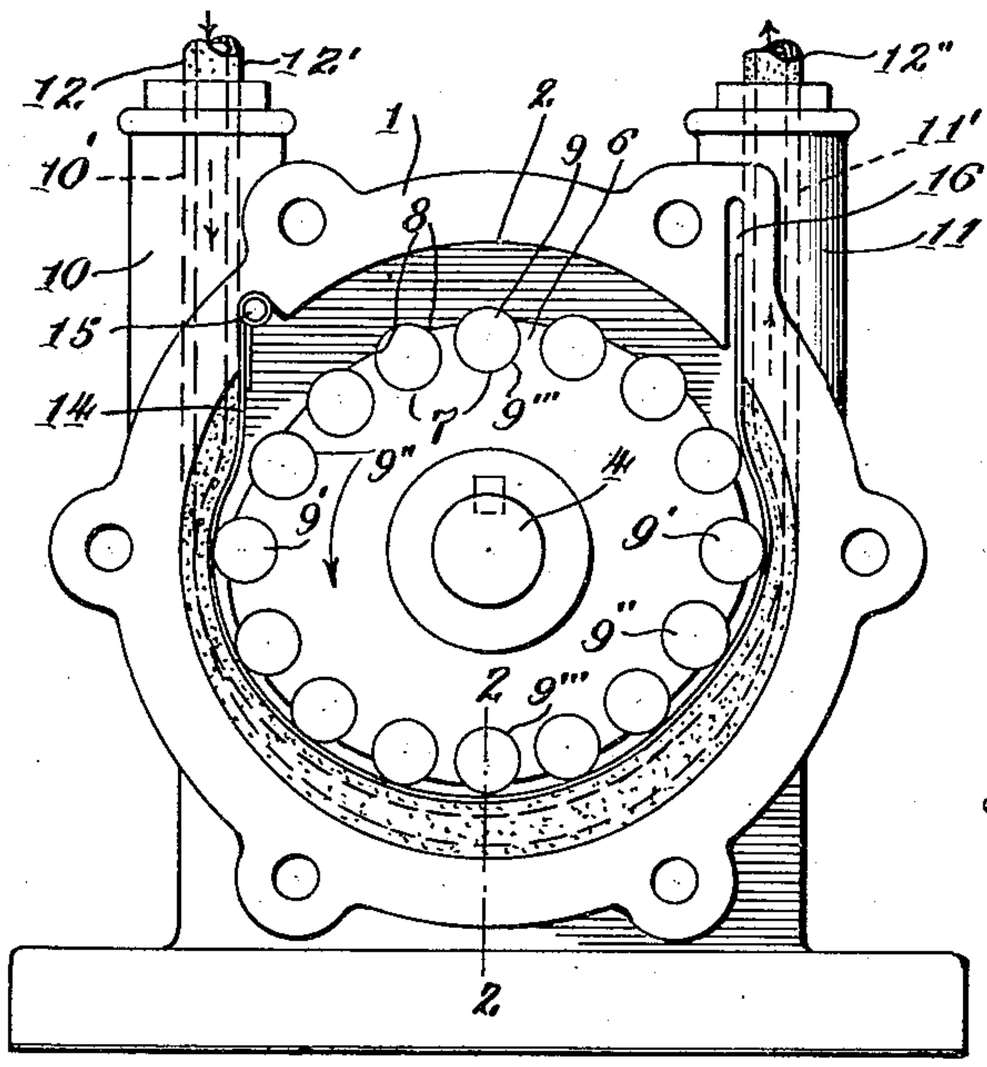

Fig. 1.

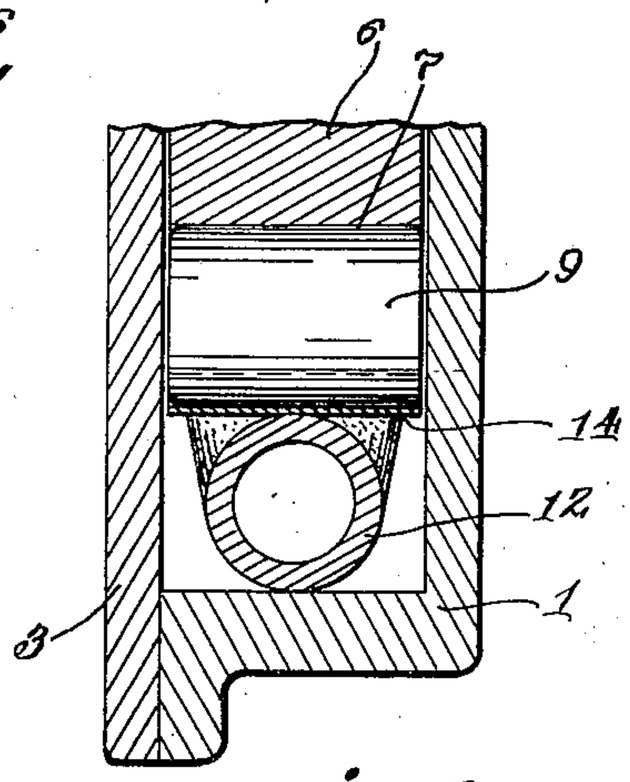

Fig. 2.

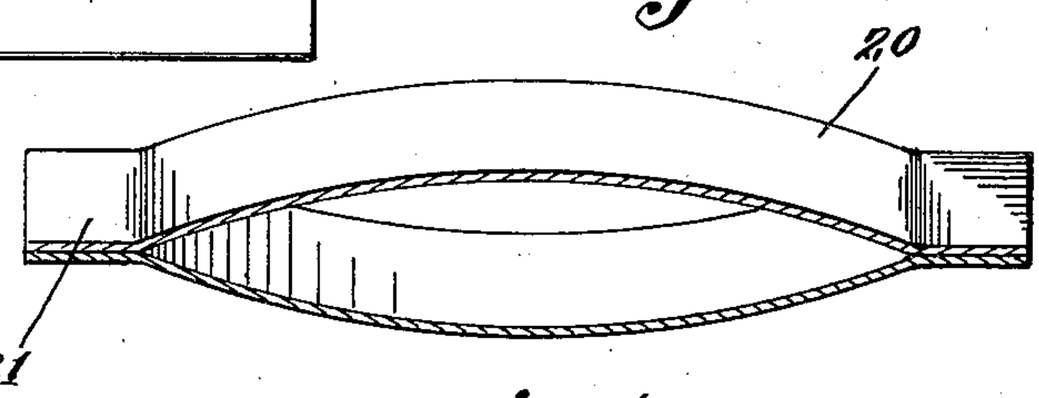

Fig. 4.

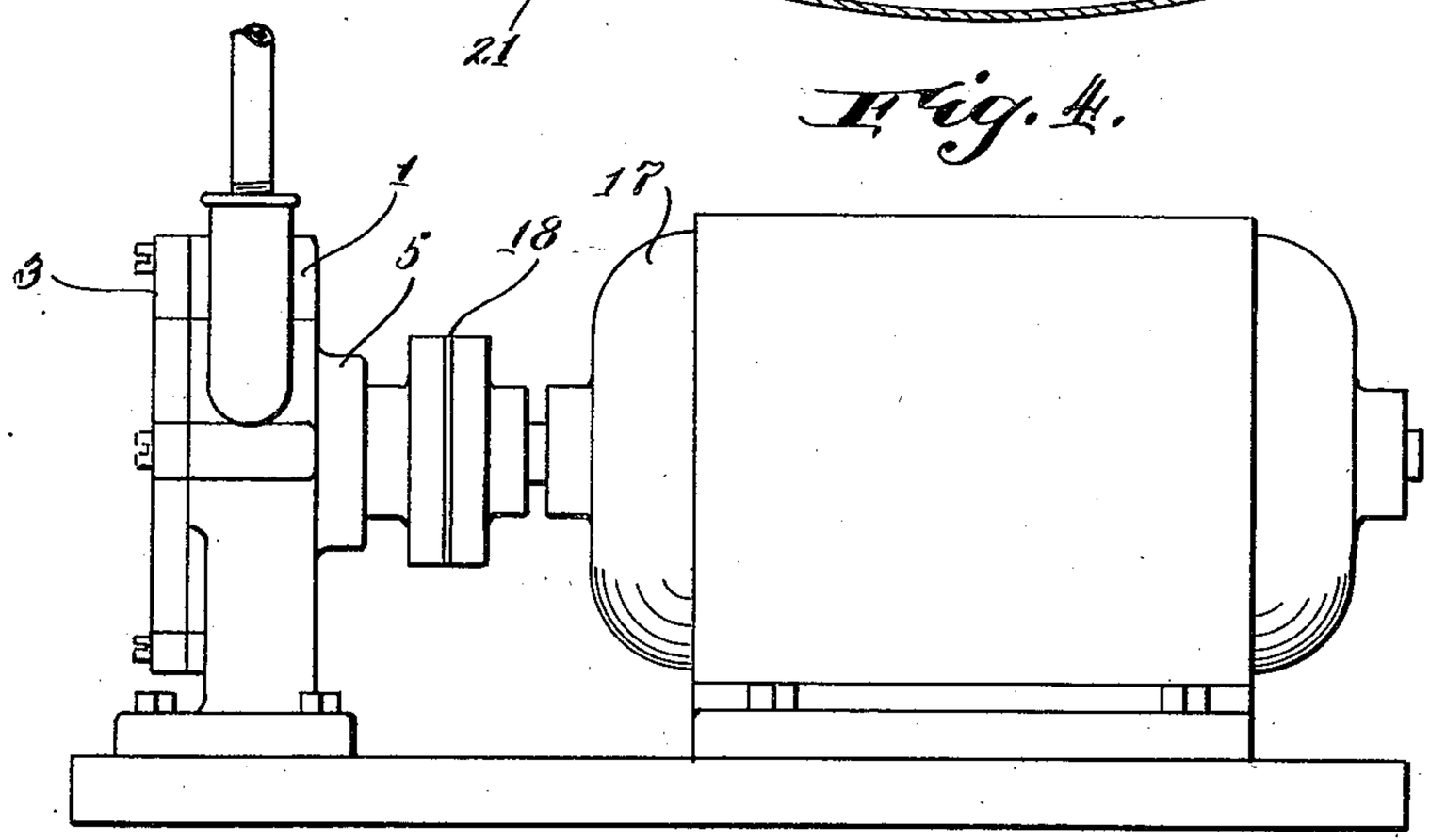

Fig. 3.

Witnesses

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July 12, 1938. C. J. HUBER 2,123,781

PUMP

Filed June 16, 1936 2 Sheets-Sheet 2

Fig. 5.

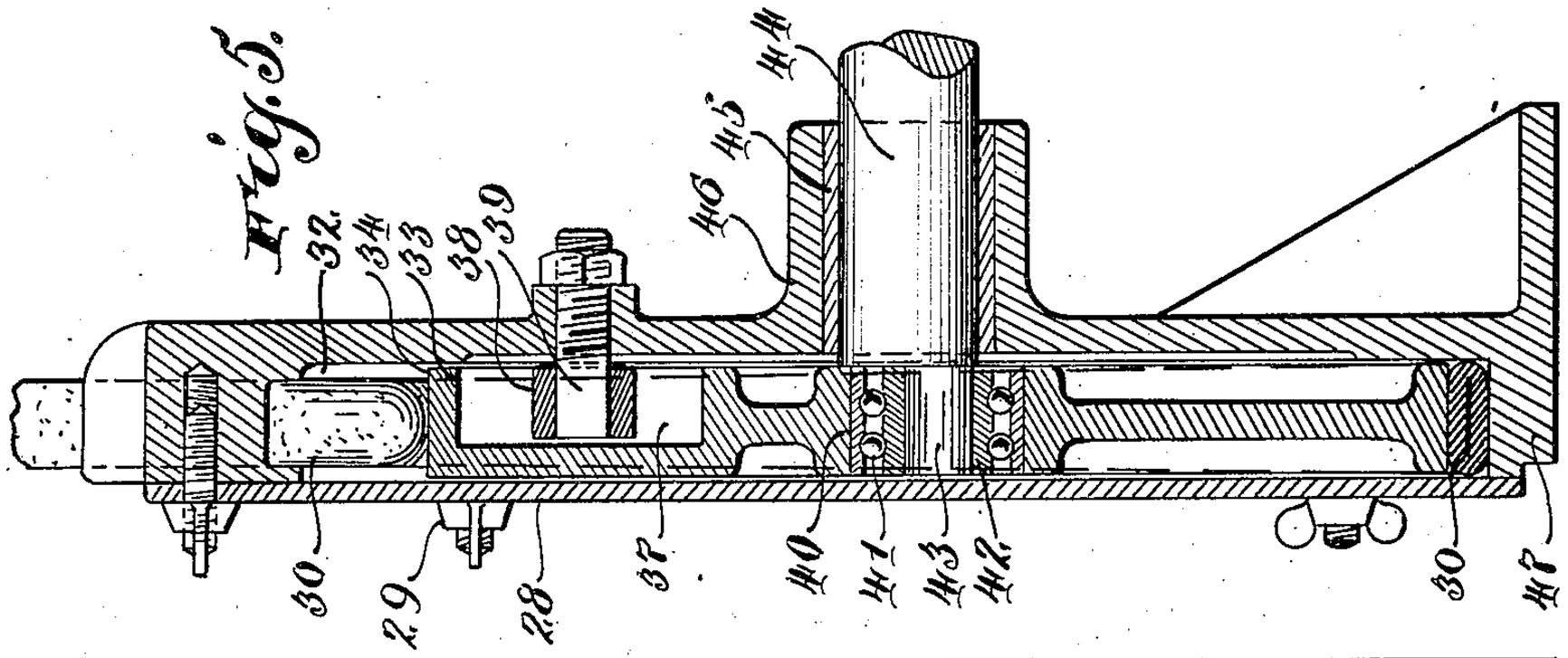
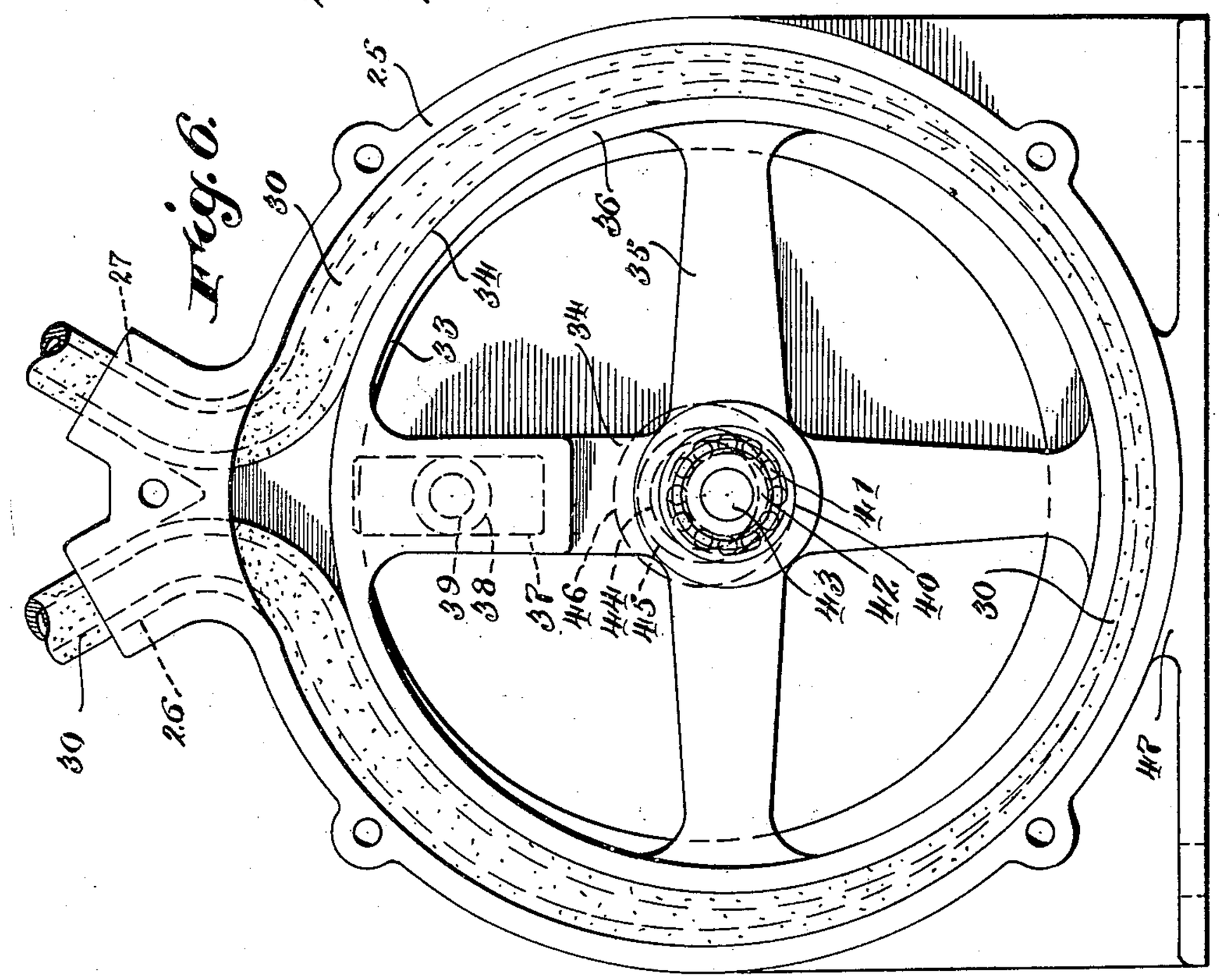


Fig. 6.



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UNITED STATES PATENT OFFICE

2,123,781

PUMP

Charles J. Huber, Baltimore, Md.

Application June 16, 1936, Serial No. 85,503

4 Claims. (Cl. 103—149)

The invention relates to a pump which operates with the maximum of efficiency and the minimum of upkeep and which is at the same time positive and continuous in its operation. In its positive operation it has obvious advantages over the rotary types of pump and as compared to the reciprocating piston pump it avoids the loss of power incident to leakage by the piston and also the loss due to the friction of the piston and the expense of upkeep incident to providing and maintaining piston packing or rings, and over both types of pump, it has the advantage that it eliminates the necessity for shaft packings or packing boxes.

Described in general terms the pump of the invention comprises a resilient or otherwise compressible and expansible and flexible tube connected at one end to the suction and at the other end to the discharge and means for compressing the tube at intervals and progressively from the suction toward the discharge.

In the operation of the pump the tube is closed or nearly closed by compression at one point and the point of closure or compression is progressed in the direction of discharge ejecting the fluid being pumped. Following each compression of the tube in this way it expands likewise progressively in the same direction, admitting a new content of fluid which is discharged by the next progressive compression of the tubes.

In the accompanying drawings I have illustrated a pump embodying the features of the invention in the preferred form.

In the drawings:

Figure 1 is an elevation of the pump with the front plate or cover plate removed.

Figure 2 is a section on the line 2—2 in Figure 1.

Figure 3 is an elevation at right angles to Figure 1 showing a pump and an electric motor by which it may be operated.

Figure 4 is a section near the end of a tube showing a modified form of resilient tube for use in this connection.

Figure 5 is a section taken in the vertical plane of the axis showing a second form of pump embodying the invention.

Figure 6 is an elevation with the front lateral removed looking from the left in Figure 5.

Referring to the drawings by numerals, each of which is used to indicate the same or similar parts in the different figures, the construction shown comprises a casing or housing 1 enclosing a pump chamber 2, which is preferably of short cylindrical shape, the axis of the cylinder being shown as horizontal and open at one end, the opening being closed by the cover plate or front plate 3. The pump shaft 4 is mounted coaxially with the casing in a suitable bearing shown externally at 5 which is formed in the rear side of the casing and this shaft carries secured thereto within the casing the rotary compressor plate or carrier 6. This plate is preferably of irregular shape as hereinafter described and in the preferred form shown it is provided with arcuate sockets 7 of cylindrical curvature with their axes parallel to shaft 4 and open at the peripheral edge of the plate as to relatively small arcs 8. These sockets 7 carry cylindrical pins 9 which serve as rollers or followers. These in the form shown project as to a portion of their cylindrical sides outwardly beyond the periphery of the plate through the openings 8. The casing 1 is provided at suitably spaced points with tubular projections 10 and 11, connected to the chamber 2 as to the passages 10′ and 11′ therein. The passage 10′ according to the arrangement shown is utilized as a suction passage and the passage 11′ as a discharge passage. The pump tube 12, already referred to as a resilient or otherwise collapsible tube, extends through the passages 10 and 11, being passed from one to the other about the wall of the pump chamber 2 upon and against which it is supported for the purposes hereinafter described. This tube 12 is connected at one end to the suction and at the other end to the discharge or at its respective ends 12′ and 12″ it may serve as the suction and/or discharge connections.

In the preferred form of the invention shown there is a thin flat strip of flexible metal 14 secured at one end adjacent the suction passage 10′ in any suitable manner as by means of a pin 15 about which it is looped. This strip 14 is passed about the chamber from the suction to the exhaust overlying the tube 12, between the pressure rollers or followers 9 and the tube, the other end of the tube adjacent the discharge as shown rests freely in a slot 16 in the casing, so that this end is free to move in the direction of the length of the tube.

The pressure rollers or pins 9 are arranged to give a gradually increasing compression of the tube from the first contact until substantially complete compression is attained. In this connection it may be noted that in the arrangement shown the rotary pressure plate 6 rotates contra-clockwise as indicated by the arrow. In order to give progressive compression of the tube described, the master followers or rollers 9′ of the set of rollers 9, preferably at diametrically op-

posite points, are spaced outwardly by the maximum radius from the center of the shaft 4, and, to give gradually applied compression, each successive roller continuing in left handed rotation from each of the master rollers or followers 9' is spaced inwardly toward the center as compared to the master roller 9' to a slightly greater degree up to the roller 9'' which in each instance is spaced inwardly to the greatest extent having the least radius from the shaft 4.

In the operation of the pump as shown, the shaft of the motor 17 or any suitable source of power, manual or mechanical, being connected in any suitable manner as by means of a coupling 18 to the shaft 4, and the pump tube 12 being connected at the suction end 12' to a supply of fluid to be pumped and at the other or discharge end 12'' to the desired point of discharge, the pressure plate or carrier 6 is rotated in left-handed rotation or counterclockwise, the direction of rotation being merely a matter of arrangement. As the plate 6 rotates, it will be assumed that one of the pressure rollers or pins 9 indicated at 9'' but slightly contacts the tube 12 immediately adjacent the suction passage box and progresses in counterclockwise rotation. The next roller 9 to the right i. e. in right handed rotation, comes in a little closer contact with the tube, applying a slight degree of pressure and this pressure increases as the rollers to the right are brought progressively in contact with the tube till the master roller 9' which is spaced outwardly at the greatest radius from the shaft 4 comes in contact with the tube and closes it or substantially closes it. As the plate or carrier 6 continues to rotate, the master roller 9' which has just come in contact with the tube moves downwardly to the left and then upwardly to the right in contraclockwise rotation forcing the liquid contained in the tube forwardly in contraclockwise direction through the tube and out at the discharge end at 12''. As the roller 9' passes along the tube, the tube again expands back of said roller and sucks in or receives a full quota of fluid which is advanced along the tube as it is again progressively compressed by the action of the next roller 9' preceded by the roller 9'', etc. which effect the gradual closing of the tube as already described, this gradual closing feature being mainly to avoid too sudden compression and too great strain on the tube which would tend to affect its length of life.

The pump thus operates with rapidly repeated successive periods of progressive compression of the tube from the suction toward the discharge, and intervening periods of expansion in the same direction, effecting, as a result, a continuous transfer of the liquid from the suction to and through the discharge. This is effected without loss of power due to leakage or friction and without the need of packing, or replacement of packing, thus avoiding all of the various sources of loss and inefficiency in the existing types of pump. At the same time the action of the pump is, as already pointed out, both continuous and positive and the pump so constructed is capable of generating a head and lift greater than that of any pump of similar size and power consumption, and it is adapted for production at a cost which is insignificant in comparison to any other type of pump.

In place of the round tube 12, which may be of rubber or metal or any suitably resilient material, a tube 20 has been devised which may be of resilient sheet metal with a seam at 21 at each side where the material is joined by welding, clinching or soldering. This tube can be substituted for the round tube shown in Figures 1 and 2 without any important change in the construction.

Referring now to the construction shown in Figure 6, the drawings show a casing 25 which is similar to the casing or housing 1 in Figures 1, 2 and 3, except as to the particular arrangement of the intake and discharge passages 26 and 27, the function of which is interchangeable by reversing the direction of rotation. The arrangement of the front plate is similar to the arrangement of the plate 3 in Figure 3, except for the use of wing nuts 29 which are not essential, but are found most convenient for quick operation in opening the casing for any purpose.

The construction Figures 5 and 6 includes a resilient or otherwise collapsible tube 30 which extends around the periphery of the casing 25 on the inside from one of the openings 26, 27 to the other, being inserted and secured in or extended through the said openings. Referring to Figure 5, it will be noted that the casing or housing 25 provides an arcuate peripheral supporting chamber at support 32 which, with the outer peripheral surface 34 of the compressor member 33 provides an enclosure for the tube which limits its expansion to or substantially to its normal cross-sectional area preventing undue expansion and the tendency to failure due to the generation of excess back pressure as in case of vibration of the column of liquid constituting the head or due merely to the necessity for supporting this head, the extent of which has no definite limit or to delivery against other pressures.

Compressor member 33 in the form shown comprises a circular disc which may be cut away to reduce the weight providing spokes 35. These spokes in the form shown are connected at their outer ends to a circular rim 36 which is of slightly less width than the chamber 33 and presents an outwardly disposed flat peripheral surface 34 and is preferably circular or substantially circular in the direction of its length and shown as flat transversely, i. e., parallel to the axis. One of the spokes 35 is slotted at 37, the slot being shown as radial and this slot is engaged by a roller 38, mounted on a stud 39 seated in the wall of the casing 25 and arranged in parallel with the axis of the pump.

The member 33 is centrally apertured, providing an inwardly disposed bearing surface 40 which engaged anti-friction balls 41 providing an external anti-friction bearing for operating eccentric 42 which rotates on an eccentric pin 43 located eccentrically of the pump shaft 44 which is mounted in bearings 45 in a boss 46 formed on the back side of the housing 25. This housing also has a base 47.

In operation the shaft 44 is driven in any suitable manner as by means of the motor 17 shown in Figure 3 or it may be operated by hand power transmitted through and by way of a multiplying gear train or a belt or any suitable type of multiplying gearing.

As the shaft 44 rotates the compression member 33 receives a slight reciprocating motion which is, however, in the form shown not quite rectilinear. The member 33 in the form shown moves vertically for substantially the full amount of the eccentricity of the pin 43 and it also rocks laterally about the stationary guide pin 39. It will be noted that the compressor member 33 bears against the tube 30 oppositely to the inner peripheral surface of the casing which is the

outer wall of chamber 32, and by this motion, tube 30 is compressed initially near the opening 27 which at present will be treated as at the intake or suction end of the path of compression, the direction of rotation being right-handed, as seen in Figure 6. The tube may be considered as first compressed adjacent to the intake or suction passage, the tube 30 being thus collapsed or nearly so, as shown at the bottom in Figure 5. The degree of compression is gradually reduced on each side of the point of extreme compression, the tube being gradually opened on each side of what may be termed the centre of compression.

As the point of compression progresses about the casing, it travels away from the intake 27 toward the discharge. This results in the creation of a vacuum back of the point of greatest compression, so that the liquid is drawn in and carried around the casing, and discharged under pressure at 26. This operation being continuous so long as the shaft is rotated, creates a suction head which, under proper conditions will closely approach 29 ft. and a pressure head which depends on the desired lift or on the height of any lift pipe to which the pump may be attached or the extent of any pressure head against which the liquid is pumped.

It is of importance to note that in the manner illustrated and described of anchoring the member 33 it does not rotate, but merely moves backwardly and forwardly, applying progressive compression about substantially the entire length of the tube 30 so long as the shaft is rotated, so that there is no friction and no pulling of the tube which would be harmful, due to the tendency to stretch the tube so that the tube would otherwise be of very short life. With the construction shown, the life of the tube is greatly prolonged, being an important element in the production of a practical operative pump of this nature.

It is also of importance that the chamber 32 closely approximates in cross-section the cross-section of the tube as determined by its external determination so that any tendency of the tube to collapse due to back pressure is overcome.

I have thus described a pump embodying my invention in the preferred form, the description being specific and in detail, in order that the manner of constructing, applying, operating and using the same may be fully understood, however, the specific terms herein are used descriptively rather than in a limiting sense, the scope of the invention being described in the claims.

What I claim as new and desire to secure by Letters Patent is:

1. A fluid pump comprising a housing having a substantially circular arcuate support, a resilient tube resting on said support and adapted to be connected at one end to suction and at the other end to discharge, a rotary carrier having means thereon arranged along the periphery of the same engaging the tube and compressing and substantially closing it periodically and progressively from the suction toward the discharge, the tube being permitted to expand progressively in the same direction between said periods of compression, said compressing means being arranged at different radii decreasing from two points of greatest compression in the direction of rotation to give a gradually increasing compression of the tube up to said points of greatest compression, said points of greatest compression being points of equal radii exceeding the radius of said periphery at all other points, said periphery between said points of greatest compression serving to support the walls of the tube preventing undue expansion thereof.

2. A pump comprising a compressible and expansible tube connected at one end to the suction and at the other end to the discharge, an arcuate support for said tube, a rotary carrier having rollers thereon arranged about the entire circumference of said carrier and spaced from the center of rotation by radii which decrease slightly from two opposite points, the rollers being adapted to compress the tube progressively against the support substantially closing it as the carrier rotates, the tube being permitted to expand progressively in the same direction due to its resiliency following each compression, the rollers between the points of greatest radii being adapted to support the tube against excessive back pressure.

3. In a pump of the type described, a collapsible tube with suction and pressure connections at its opposite ends, a substantially arcuate support for the tube, a pressure member shaped in substantial conformance with the support, a rotary eccentric actuating member and a guide for the pressure member adapted to prevent rotation but permitting oscillation thereof, the pressure member being supported in pressure applying relation to the tube in opposition to said support, the rotation of the eccentric serving to oscillate the pressure member applying pressure to the tube compressing and collapsing it progressively, the progression being in the direction of the length and from the suction toward the pressure end.

4. A pump, as in claim 3, in which the pressure member and the support form an elongated chamber which substantially encloses the tube, preventing undue expansion and consequent failure of the same.

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