E. L. PEASE.

PUMP FOR DELIVERING LIQUID.

APPLICATION FILED AUG. 23, 1920.

1,383,997.

Patented July 5, 1921.

2 SHEETS—SHEET 1.

Fig. 1.

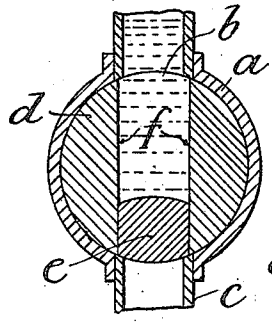


Fig. 2.

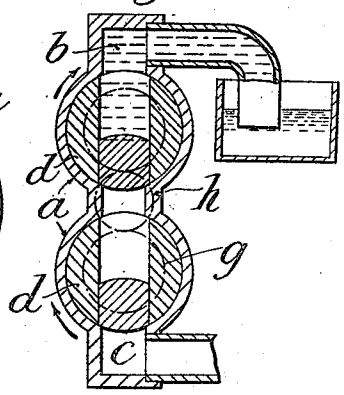


Fig. 3

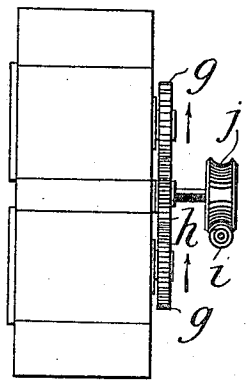


Fig. 4.

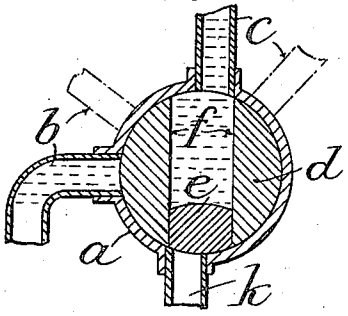


Fig. 5.

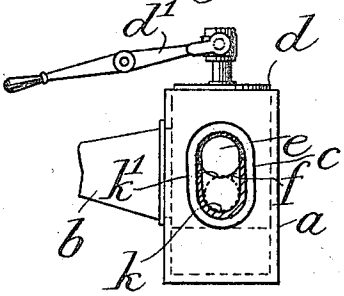


Fig. 6.

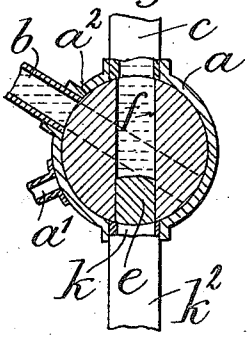


Fig. 11.

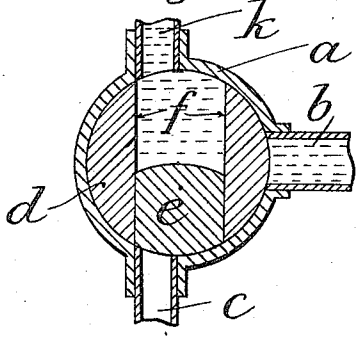
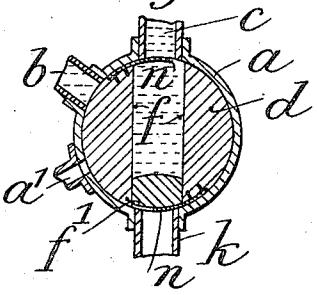


Fig. 7.



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2 SHEETS—SHEET 2.

Fig. 8.

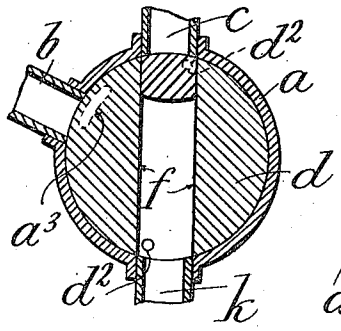


Fig. 9.

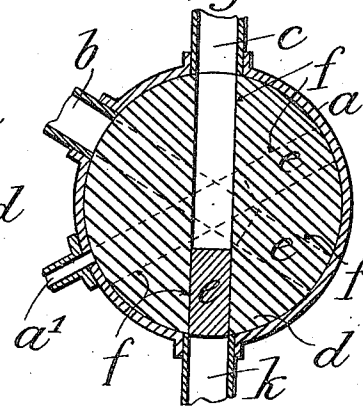


Fig. 12.

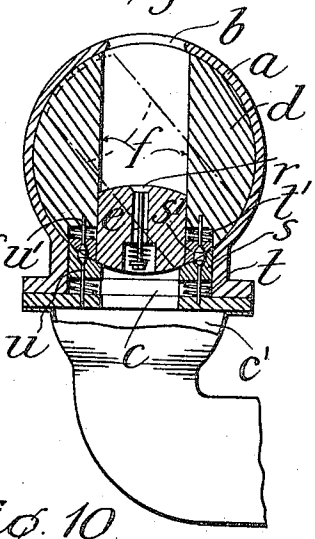


Fig. 14.

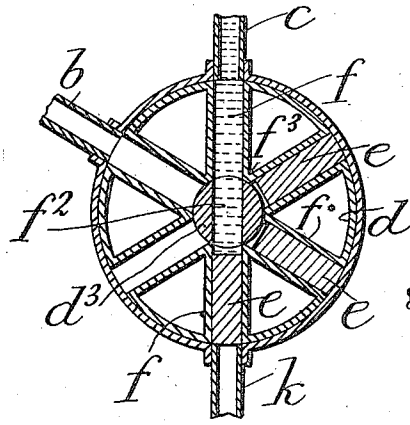


Fig. 10.

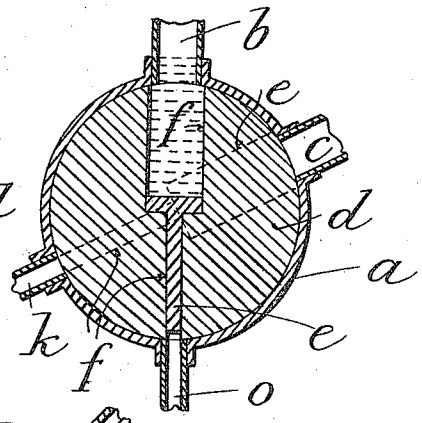
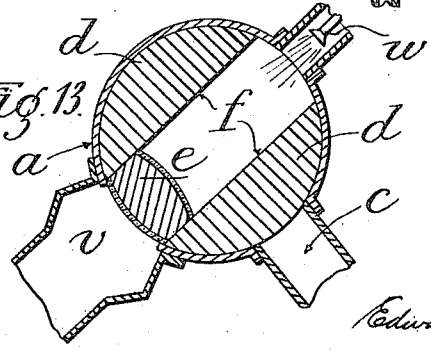


Fig. 13.



Edward Lloyd Pease

By Davis & Davis

Attys.

UNITED STATES PATENT OFFICE.

EDWARD LLOYD PEASE, OF DARLINGTON, ENGLAND.

PUMP FOR DELIVERING LIQUID.

1,383,997. Specification of Letters Patent. Patented July 5, 1921.

Application filed August 23, 1920. Serial No. 405,419.

To all whom it may concern:

Be it known that I, EDWARD LLOYD PEASE, a subject of the King of Great Britain and Ireland, residing at Darlington, Durham, England, have invented Improvements in or Relating to Pumps for Delivering Liquid, for which I have filed an application for patent in England, dated April 14, 1919, No. 9,466, and of which the following is a specification.

This invention has for its object to provide a rotary or oscillatory pump of simple construction.

To this end, a pump to be used in carrying out the invention comprises a rotary or oscillating body of circular cross section and preferably of cylindrical shape having a transverse passageway extending therethrough and fitted with a sliding plunger of less length than the passageway, and a stationary casing in which the body is mounted to turn or oscillate in a fluid tight manner and which is provided with openings for inlet and outlet of fluids, the improved pump differing from others of this general type in that the movement of the plunger to which displacement of fluid is due takes place without the aid of any mechanical contrivance during angular motion of the rotary or oscillating body.

The accompanying drawings illustrate several embodiments of the invention, Figure 1 being a semi-diagrammatic cross sectional view of one form of pump. Fig. 2 is a similar view of a tandem arrangement of pumps and Fig. 3 is a view of gearing therefor. Fig. 4 represents a pump having a plunger adapted to be moved by fluid under pressure. Fig. 5 is a plan of such a pump. Figs. 6, 7, 8, 9, 10, 11, 12, 13 and 14 are similar views to Fig. 1 showing modifications.

Referring first to the simplest construction of pump, shown in Fig. 1, the stationary casing *a* is provided with a liquid inlet passage *b* adapted to be placed in communication with a source of liquid supply and an outlet passage *c* through which liquid can be forced against a head or pressure, *d* being a cylindrical body mounted to turn in the stationary casing and having a diametrically arranged passageway *f* extending through it in which is a sliding plunger *e* of less length than the passageway. The arrangement is such that upon turning the body *d* about its center, the plunger *e* will be caused by gravity to slide endwise from one end portion of the passageway *f* to the other end portion thereof and then to slide in the opposite direction, so as to form a pocket in the body first on one side of the plunger and then on the other side thereof, the liquid entering one pocket from the inlet passage *b* and being afterward forced from the pocket into the outlet passage *c* against a head or pressure, by endwise movement of the plunger *e* the plunger at the same time forming at its opposite side another pocket which in turn receives liquid from the inlet passage *b*, such liquid being afterward forced through the outlet passage *c* by the movement of the plunger in the opposite direction. In this way, upon the turning of the body *d* in the casing *a*, liquid is fed into and discharged from the body *d* in an intermittent manner by the reciprocation of the plunger *e* in the body.

The body *d* may be provided with more than one transverse passage *f* and one sliding plunger *e*, and the casing *a* with more than one set of inlet and outlet passages, so angularly arranged that liquid can be delivered from the pump in a constant or nearly constant stream.

Also, two or more such pumps may be connected in tandem, the liquid delivered by one pump passing into the next and so on if desired, in order to obtain a cumulative effect. An example of this kind is shown in Fig. 2, the bodies *d* being driven in the same direction, as indicated by the arrows, by means such as shown in Fig. 3, comprising a wheel *g* for each body, a wheel *h* meshing with both the wheels *g* and a worm *i*, driven by a motor, for coöperating with a worm wheel *j* upon the shaft of the wheel *h*.

Pumps adapted to operate in the manner set forth can be constructed in various forms and the plunger be caused to reciprocate in different ways other than simply by turning the body, but without employing mechanical means.

Thus, the plunger may be caused to make its working or operative stroke in each direction by the action thereon of fluid under pressure. The motive fluid may be steam, or air or other uncondensable gas or gases, for instance gases produced by combustion of liquid or gaseous fuel, or a soluble gas,

for instance ammonia. Or, according to a second type of pump according to the invention, the plunger may be raised by rotation of the body assisted, it may be, by the action due to the production of a vacuum, and caused to make its working stroke by gravity, assisted, it may be, by motive fluid acting thereon.

In a pump of the type first mentioned in the preceding paragraph, the pump casing, in addition to being provided with a liquid inlet passage and a liquid outlet or discharge passage, is, as shown in Fig. 4, provided with an inlet passage k for connection to a source from which steam, compressed air or other vapor or gas under pressure can be obtained. The arrangement in this case is such that during one complete rotation of the body d one end of the passage way f therein will be brought into communication with the motive fluid supply passage k at a time when the plunger e will be at the same end of the passageway so that the plunger will be forced by motive fluid to the other end of the passage and discharge the liquid that will be in the pocket at its opposite side through the liquid discharge outlet c and at the same time form a pocket in the body that will be filled with motive fluid. Then, by further rotation of the body e, the pocket filled with motive fluid will be brought opposite the liquid supply passage b, so that if it be charged with steam as the motive fluid, the steam will be condensed by the water which will enter the pocket, or if the pocket be charged with a gas readily soluble in the liquid to be pumped, the gas will be dissolved in such liquid, the pocket in each case being finally filled with the liquid. Upon further rotation of the body, the pocket will be brought opposite the liquid discharge passage c at the same time that the opposite end of the passageway in the body, with the plunger at this end, is brought opposite the inlet k for motive fluid, whereupon the plunger will be caused to again move endwise in the passageway f but in the opposite direction to its first movement, and discharge the liquid from the pocket at its opposite side through the liquid discharge passage c. The above described operations will be repeated for each complete rotation of the rotary body d. This arrangement may be used as a lift and force pump when steam, or a readily absorbable gas, is used as the motive fluid. When compressed air or other gaseous fluid is used that will not be condensed or absorbed by liquid from the supply passage b, this passage should extend upward, as shown in dotted lines in Fig. 4, instead of downward as shown in full lines, to allow of such air or gas freely escaping, the discharge passage c being also shifted around to the position shown in dotted lines.

The arrangement may be such as to admit of varying the cross sectional area of the inlet for motive fluid to the passageway f and of the duration of opening of the inlet. For this purpose, the rotary body d may be so arranged that it can be moved endwise relatively to the inlet k for motive fluid, as by a lever d^1 (see Fig. 5) or cam. In this case, the area of the fluid inlet will correspond to the size of the segmental passageway k^1 formed by the overlapping of the two circles, namely that of the passageway f, in the rotary body and that of the fluid inlet k, and the period of fluid admission will be limited to the time such segmental passageway is left open. In this case the liquid inlet and delivery passages b and c may be of oval or elongated shape, to provide a free passage between each of them and the passageway f in the rotary body d at the required times. Or the fluid inlet k may be adjustably controlled, as by using in connection with the steam supply pipe k^2 leading to the said inlet k, a regulating valve. Or each end of the passageway f may, as shown in Fig. 7, be partly closed by an end wall n arranged to leave an opening f^1, or formed with an opening of sufficient size to admit of the free inlet of motive fluid and liquid into the pocket and of the free discharge of liquid from the pocket. The passageway f in the rotary body may, as in the example shown, be of greater cross sectional area than the inlets k and b for motive fluid and liquid and the outlet c for liquid.

In each case also, and as shown in Fig. 4, the inlet passages k and b for motive fluid and liquid respectively and the outlet passage c for liquid, may be arranged at opposite sides of a vertical plane passing through the longitudinal center of motion of the rotary body, as seen in end view.

The pump casing a may, as shown in Figs. 6 and 7, be provided with an exhaust port or passage a^1 located between the inlet k for motive fluid and the liquid inlet passage b so that after the motive fluid has acted to cause the plunger e to make its working stroke, excess of motive fluid may be exhausted from the pocket in the rotary body before such pocket is brought opposite the liquid inlet passage b. In this way, liquid will be enabled to enter and fill the pocket in a better and quicker manner than would otherwise be the case and permit the pump to be worked at a higher speed.

When the motive fluid used is steam, or a soluble gas, the pump may be used as a combined lift and force pump. When the motive fluid is compressed air or other uncondensable or insoluble gas or gases, an exhaust port or passage a^1 (Fig. 6) may, as hereinbefore mentioned, be provided for relieving the pressure in the pocket after the

pocket leaves the inlet k for motive fluid and before it reaches the liquid inlet passage b, it being understood that by the time the body d has moved to close the inlet k it has also closed the outlet c so that the pressure of the delivery liquid does not act to return the plunger e to initial position. Or the liquid inlet passage b may be made large in area and incline upward, as shown in dotted lines in Fig. 4, to admit of the ready escape of the air or other gas. Or one or more vents may be provided in the casing in such a position, for instance beyond the liquid inlet b, as shown at a^2 in Fig. 6, as to permit of air freely escaping from the pocket when water is entering the pocket. Or, as shown in dotted lines in Fig. 8, a vent a^3 may, for a like purpose, be formed in one or each end of the casing a arranged to register at the required times, with one or other of two exhaust passages d^2, extending through the body d from each outer end portion of the passage way f to the corresponding end of the body.

The rotary body may be rotated by any suitable driving means external to the pump casing. In some cases however by providing the rotary body with several passageways f, as shown in Fig. 9, arranged in staggered relationship along its length and fitting them with heavy plungers e, for instance of lead, or loaded with lead, the plungers on the descending or right hand side of the rotary body d may serve to render the body self driving or to assist external driving means to rotate the body, it being understood that the pistons are raised by the fluid pressure admitted by the pipe k.

The passageway in the body may, in some cases, be made of different cross sectional areas at different parts of its length and be fitted with a plunger of different cross sectional areas at different parts of its length to suit. An example of this kind is shown in Fig. 10. In such a case the body d may be caused to oscillate so as to bring the larger end of the passageway f alternately in communication with a liquid inlet b and a liquid outlet c in the casing a and to bring the smaller end of the passageway f in communication with an exhaust opening o when the larger portion of the passageway is in communication with the liquid inlet b so as to enable the plunger e to be moved inward by the liquid and form a pocket to be filled by the liquid, and afterward to bring the smaller end of the passageway opposite an inlet k for admission thereto of fluid under pressure when the larger portion of the passageway is opposite the liquid delivery outlet c so as to admit of the charge of liquid being forced out of the pocket. In this case, there is no admission of steam or other vapor or gas to the larger portion of the passageway. As an alternative, such a pump may be used in the reverse way, the passage end of smaller diameter dealing with the liquid and the larger end being supplied with the fluid under pressure, thus increasing the delivery pressure of the liquid.

In a pump of the secondly hereinbefore mentioned type, in which the plunger is raised by rotation of the body and caused to make its descent by gravity aided by pressure of fluid and suitable for use as a combined lift and force pump, the inlet k for motive fluid is, as shown in Fig. 11, at the top of the casing a, the inlet b for liquid at one side thereof and the outlet c for liquid at the bottom. In this case, assuming the passageway f in the rotary body d to be vertical at starting, as shown, that the plunger e is at the bottom of its stroke and the body to be rotating, then motive fluid such as steam or soluble gas will have entered the pocket at the top, the supply thereof will then be cut off and the pocket brought opposite the liquid inlet b so that the steam will be condensed or the gas absorbed and the pocket filled with liquid and then cut off from the liquid inlet passage, the passageway and plunger being meanwhile rotated about the center of the body until the plunger reaches its highest position from which it then falls by gravity, aided by the pressure of the motive fluid admitted to the pocket at its upper side so as to force the liquid in the previously formed pocket through the lower outlet passage c and eliminating the said previously formed pocket and forming a pocket on its upper side into which the motive fluid passes, the above described operations being repeated on the continued rotation of the body.

An arrangement of this kind could be worked by the aid of exhaust steam or soluble gas at atmospheric or other low pressure, the plunger then descending under the action of gravity only and drawing a charge of exhaust steam or soluble gas into the pocket formed on its upper side.

In a pump of this kind, the passageway in the rotary body, or each of them if a number thereof be used, may be formed in a metal tube fixed diametrically in a hollow metal cylinder through which a cooling fluid, for example air is caused to flow, the arrangement forming a combined condenser and air pump. The outlet for cooling fluid from the cylinder may be controlled by a valve adapted to open each time the passageway in the rotary body registers with the steam inlet and then to close, so that cooling fluid will flow in an intermittent manner through the cylinder, in order to minimize the quantity thereof used.

Fig. 12 illustrates an arrangement in which a receiver c' common to a number of passageways f in the rotary body is connected to the outlet c, each plunger e which

acts by gravity, being, if desired, fitted with an adjustable relief valve at r. For the purpose of reducing friction, the casing a may be provided with a packing ring s surrounding the outlet c and adapted to bear against the body d by the action of a spring t. The body d may be provided with a similar packing ring s^1 surrounding the passageway f and arranged to bear against the casing under the action of a similar spring t^1. Outward movement of the packing rings and the degree of pressure exerted thereby, may be limited by headed pins u, u^1. The angle at which the plunger will begin to descend depends upon the relation its weight per square inch bears to the pressure per square inch of the fluid delivered that opposes its descent. Where the weight of the plunger is relatively large and the plunger can fall before the passageway is vertical, it will assist the turning movement of the body d, and since this condition is more marked the lower the pressure opposing the plunger, the power to be expended is more or less in direct proportion to the work to be done. The greatest work to be done upon the body d is during the time that the plunger e moves from the full line position in Fig. 12 to say that indicated in dotted lines, the weight of the plunger being supplemented by the centrifugal force acting upon it, thus increasing the pressure of the plunger upon the casing a. When the outlet c is closed, or when the pressure there rises to that for which the relief valve at r is set, then the plunger will be unable to complete its stroke and so long as these conditions remain, will be balanced near the center of the passageway f, whereby the force required to rotate the body d will be again proportioned to the work to be done. Or the relief valve may be so set, if desired, that the pressure at the delivery shall be less than that represented by the weight of the plunger.

Fig. 13 shows an arrangement comprising a casing a, a rotary body d and plunger e such as already described, applied to an exhaust steam chest v, w being a water spray inlet and c a discharge outlet, it being understood that the liquid to be delivered is derived by condensing steam while in the pump. The action of the steam upon the plunger e drives it to the opposite end of the passageway f so that its weight causes or assists the body d to turn, the movement being sufficient to carry the plunger past the lower vertical line into register with the steam chest v again. In so doing, the steam that was confined in the pocket formed by the rising of the plunger in the passageway, will be brought into position to be acted upon by the water spray at w and become condensed, forming a vacuum and assisting the ascent of the plunger, under the action of the steam, to produce a further partial rotation of the body d and a discharge of the condensed contents through the outlet c. In this arrangement a number of passageways f arranged in staggered relationship and each fitted with a piston may advantageously be used.

Fig. 14 shows another arrangement wherein a number of passages f, each fitted with a heavy plunger e is used. In this case the several passageways are arranged with their axes in a common transverse plane and each of them is formed partly by two tubes f^1 carried by the rotary body d and partly by a diametrically arranged passageway f^2 formed in a stationary hub d^3, the inner ends of the several tubes being connected to a sleeve f^3 that closely surrounds the hub d^3. The passageway f^2 in the latter is arranged to be in line with each pair of passages f when these come opposite the inlet passage for motive fluid and the outlet for the fluid being pumped. In other respects the arrangement is like Fig. 9.

In each case the movable body d may be made hollow and the passageway f, or each such passageway, therein, be constituted by a metal cross tube fixed therein.

The details of constructon of pumps according to the invention can be variously modified.

What I claim is:—

1. A pump comprising a stationary casing having a peripheral inlet and a peripheral outlet, a body adapted to be turned in said casing and having a diametrical passageway adapted to communicate with said inlet and outlet and a plunger, adapted to travel along the passageway and of less than half the length of such passageway so that during such passage it passes bodily well beyond the center of rotation of the rotary body, thereby forming a pocket for the reception of liquid that has a capacity greater than the volume represented by the plunger, substantially as described.

2. A pump comprising a stationary casing having a peripheral inlet for an elastic fluid, a peripheral inlet for liquid and a peripheral outlet for liquid, a body adapted to turn in said casing and having a diametrical passageway adapted to register with the inlets and outlet aforesaid by turning of the body about its axis and a plunger fitting within and adapted to slide along such passageway under the action of elastic fluid admitted to said passageway and to then force liquid through said outlet.

3. A pump comprising a stationary casing having a peripheral inlet for elastic fluid, a peripheral inlet for liquid and a peripheral outlet for liquid, a body adapted to turn in said casing and having a diametrical passageway each end of which successively registers with the inlets and outlet afore-

said when the body is turned about its axis and a plunger fitting within and adapted to slide along such passageway.

4. A pump comprising a stationary casing having a peripheral inlet for a liquid, a peripheral outlet for liquid and a third peripheral inlet for an elastic fluid, a body adapted to turn in said casing and having a diametrical passageway each end of which successively registers with the inlets and outlet aforesaid and a plunger fitting within and adapted to slide along such passageway, the said plunger being acted upon periodically by an elastic fluid and then caused to move along its passageway when the latter registers with the elastic fluid inlet and the plunger is at the end adjacent thereto, for the purpose specified.

5. A pump comprising a stationary casing having a peripheral inlet for a liquid, a peripheral inlet at a lower level for an elastic fluid and a peripheral outlet for liquid disposed opposite the inlet for elastic fluid, a body adapted to turn in said casing and having a diametrical passageway each end of which successively registers with the inlets and outlet aforesaid and a plunger fitting within and adapted to slide along such passageway, the said plunger being forced upward along its passageway by the elastic fluid when the passageway registers with the elastic fluid inlet and returning under the control of the said body to a position adjacent to the inlet for elastic fluid when the said body has turned through a certain angle and while the passageway registers with the liquid outlet.

6. A pump comprising a stationary casing having a peripheral inlet for elastic fluid under pressure, a peripheral inlet for liquid, a peripheral outlet for liquid arranged opposite said inlet for elastic fluid, and a vent for elastic fluid, a body mounted to rotate in said casing and having a diametrical passageway and a plunger fitted within and adapted to slide along said passageway under the action of fluid under pressure admitted thereto, the inlet for liquid being arranged between the inlet for elastic fluid and the outlet for liquid, considered in relation to the direction of turning of the said body.

7. A pump comprising a stationary casing having a peripheral inlet for elastic fluid under pressure, a peripheral inlet for liquid, a peripheral outlet for liquid arranged opposite said inlet for elastic fluid and a vent for elastic fluid, a body mounted to rotate in said casing and having a diametrical passageway and a plunger fitted within and adapted to slide along said passageway under the action of fluid under pressure admitted thereto, the inlet for liquid being arranged between the inlet for elastic fluid and the outlet for liquid and the vent being arranged between the inlet for elastic fluid and the inlet for liquid, considered in relation to the direction of turning of such body.

8. A pump comprising a stationary casing having a number or peripheral fluid inlets and a corresponding number of fluid outlets, a cylindrical body adapted to turn in said casing and having passages therein corresponding in number to the inlets and outlets which passages are angularly displaced in relation to one another, and a plunger in each passageway adapted to slide therein, substantially as described.

9. A pump comprising a stationary casing having peripheral inlets for elastic fluid and liquid and an outlet for liquid, a body mounted to rotate in said casing and having a plurality of radially arranged passageways therein and a plunger fitted to slide endwise in each passageway.

Signed at Newcastle-on-Tyne, England, this 29th day of July, 1920.

EDWARD LLOYD PEASE.