No. 803,772. PATENTED NOV. 7, 1905.

F. MARBURG, Jr.

ROTARY PUMP AND THE LIKE.

APPLICATION FILED MAR. 21, 1904.

4 SHEETS—SHEET 1.

Fig. 2.

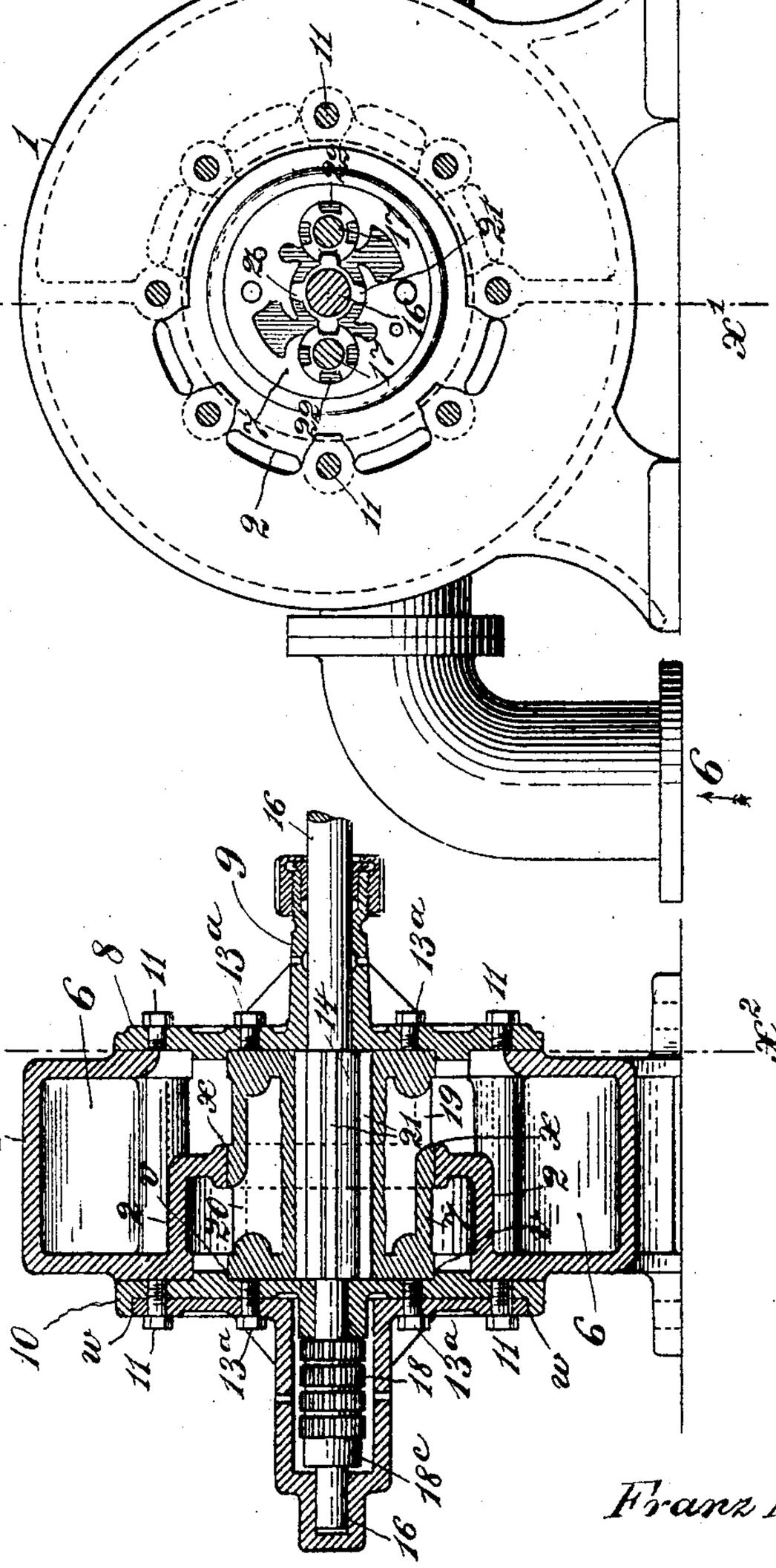

Fig. 1.

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4 SHEETS—SHEET 2.

Fig. 4.

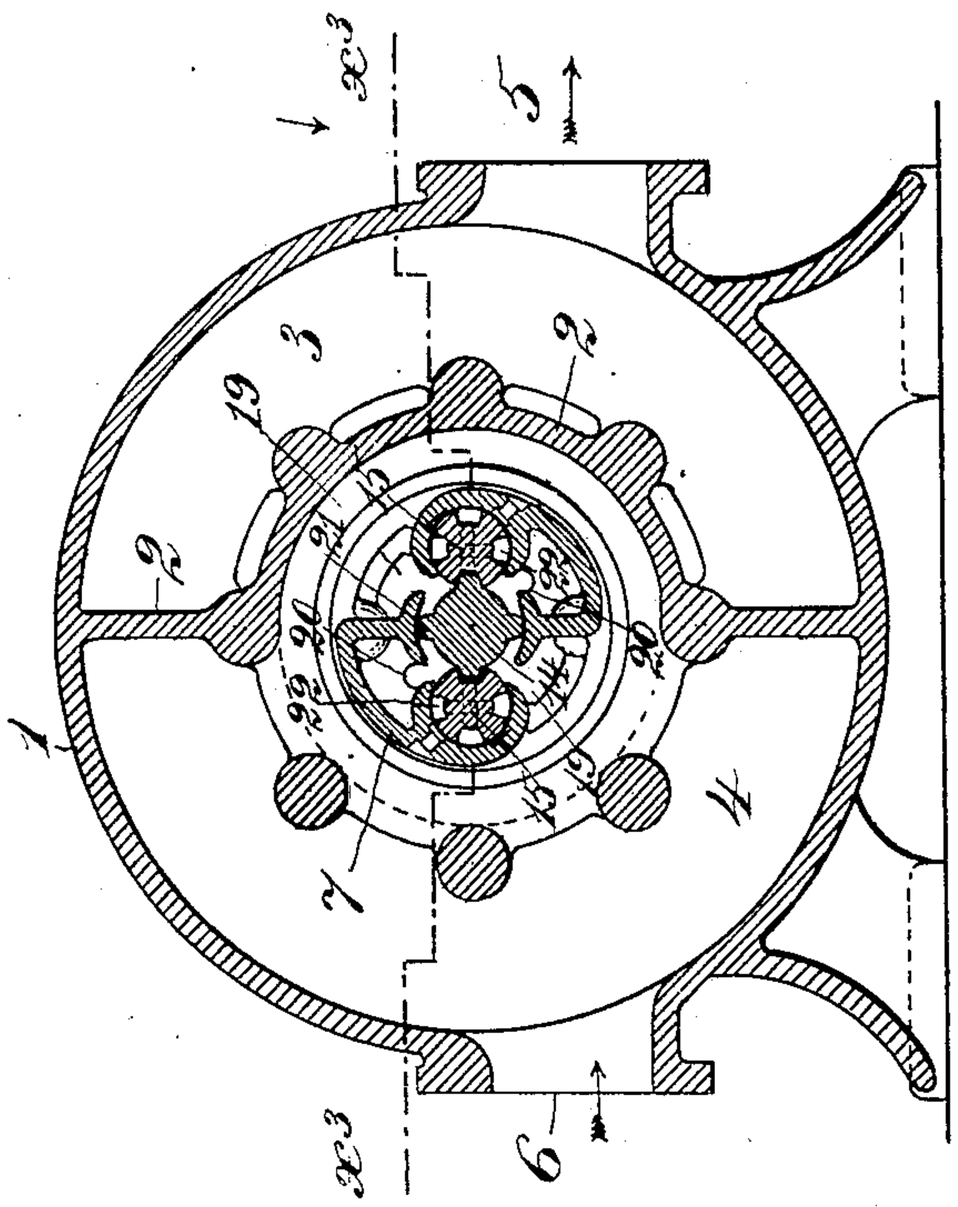
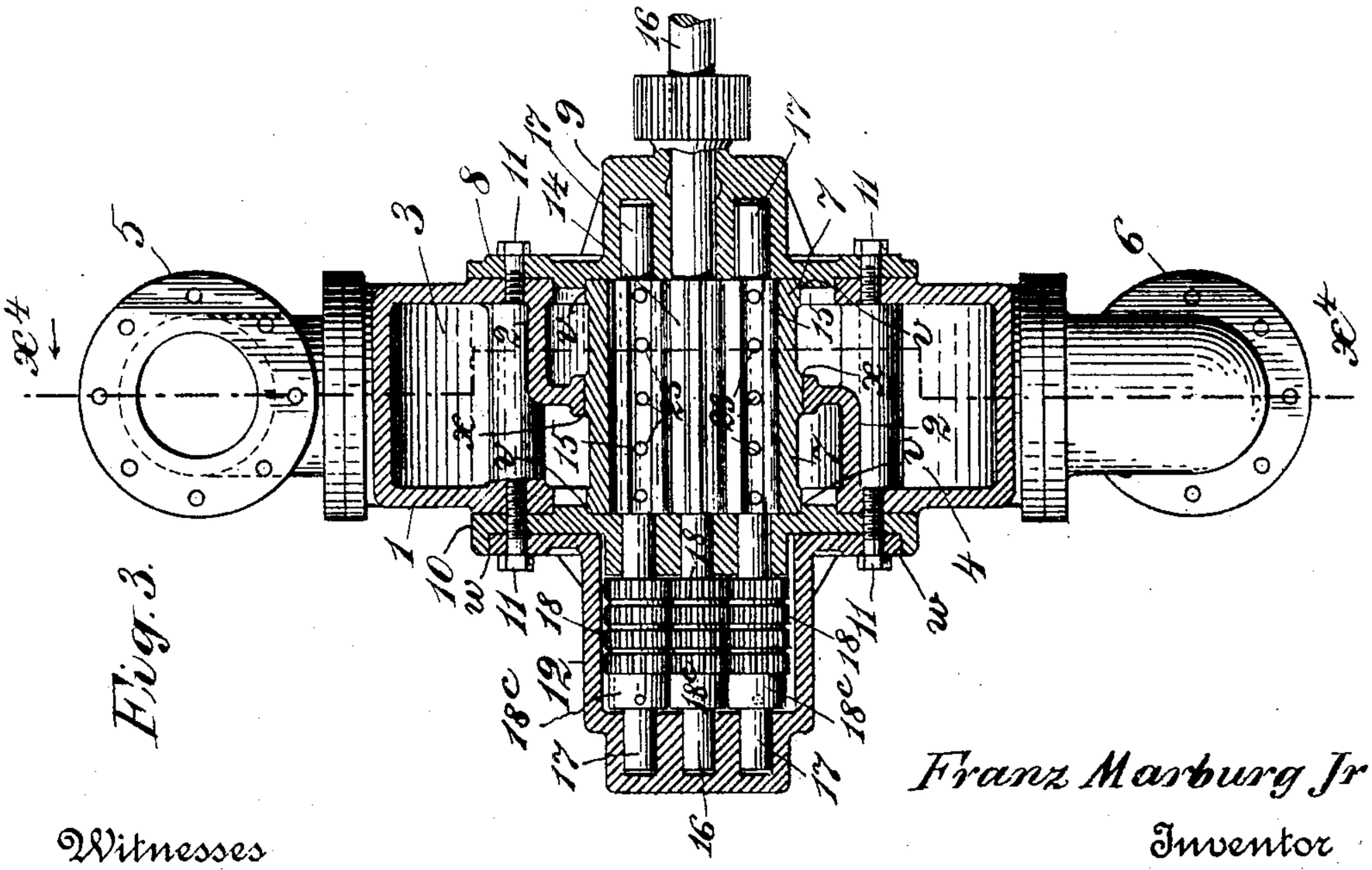


Fig. 3.



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4 SHEETS—SHEET 3.

Fig. 7.

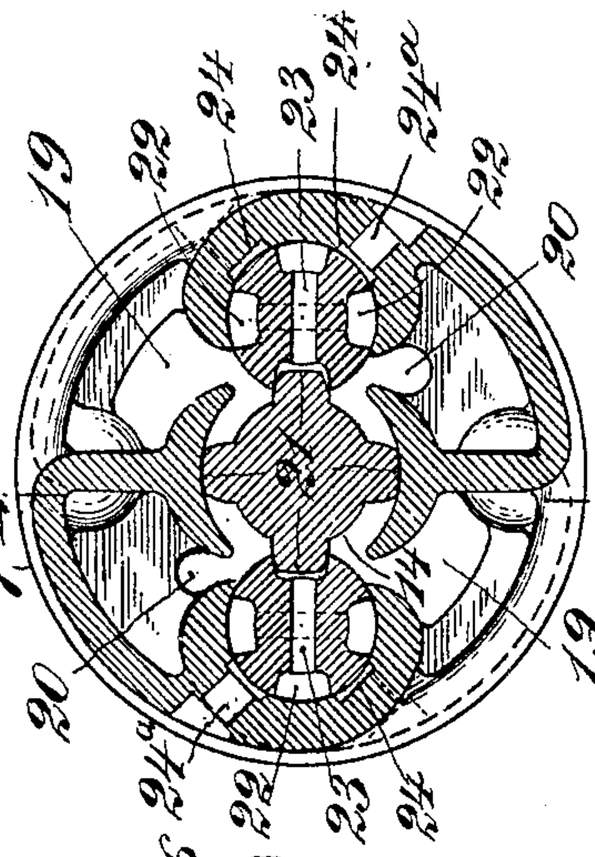


Fig. 10.

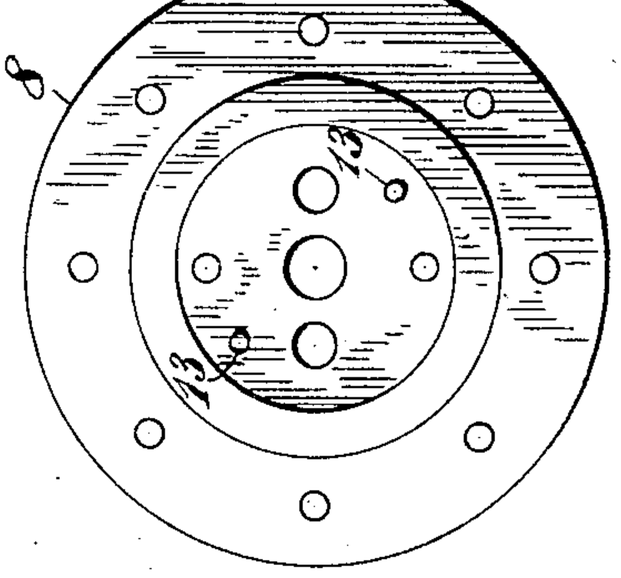


Fig. 6.

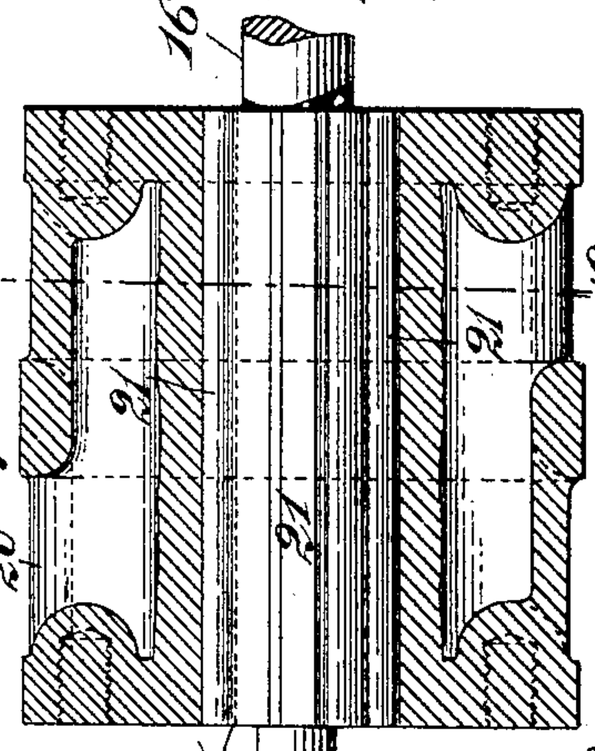


Fig. 8.

Fig. 8a.

Fig. 9.

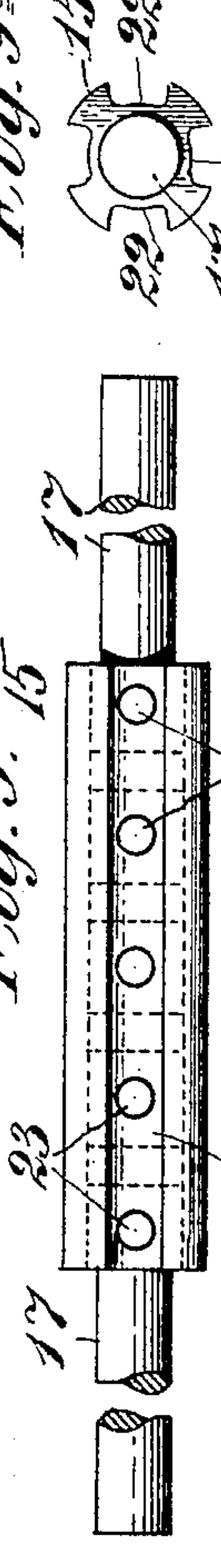


Fig. 9a.

Fig. 11.

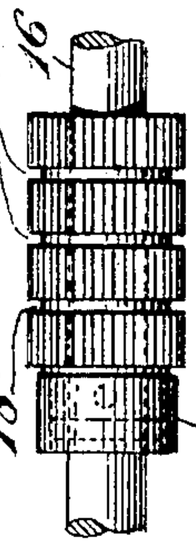
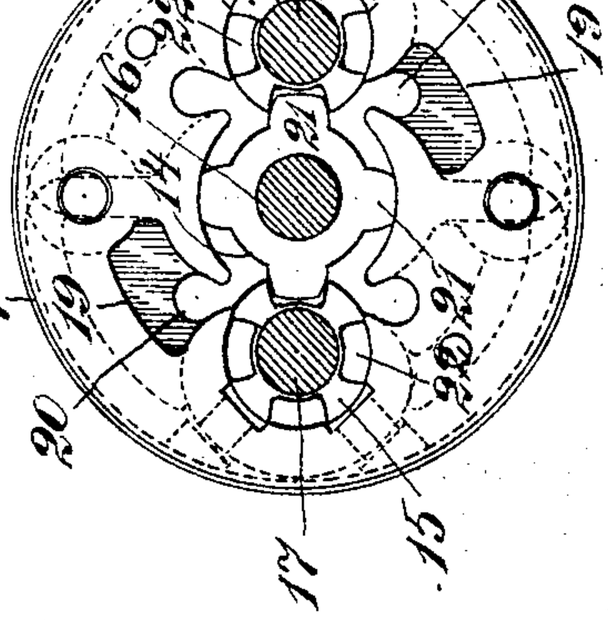


Fig. 11a

Fig. 5.



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ROTARY PUMP AND THE LIKE.

APPLICATION FILED MAR. 21, 1904.

4 SHEETS—SHEET 4.

Fig. 14.

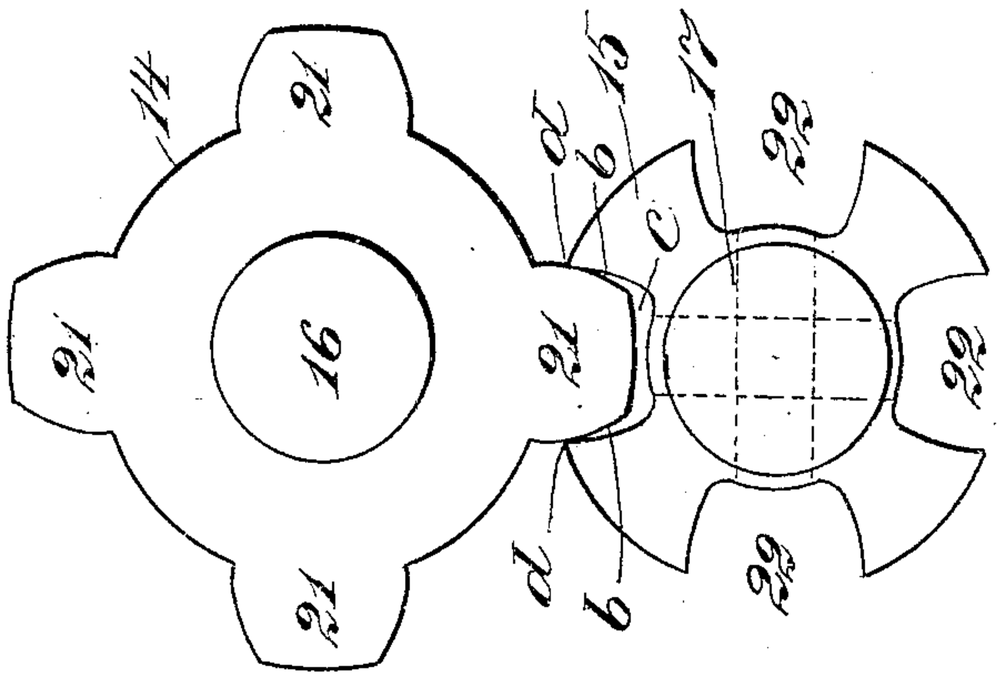


Fig. 13.

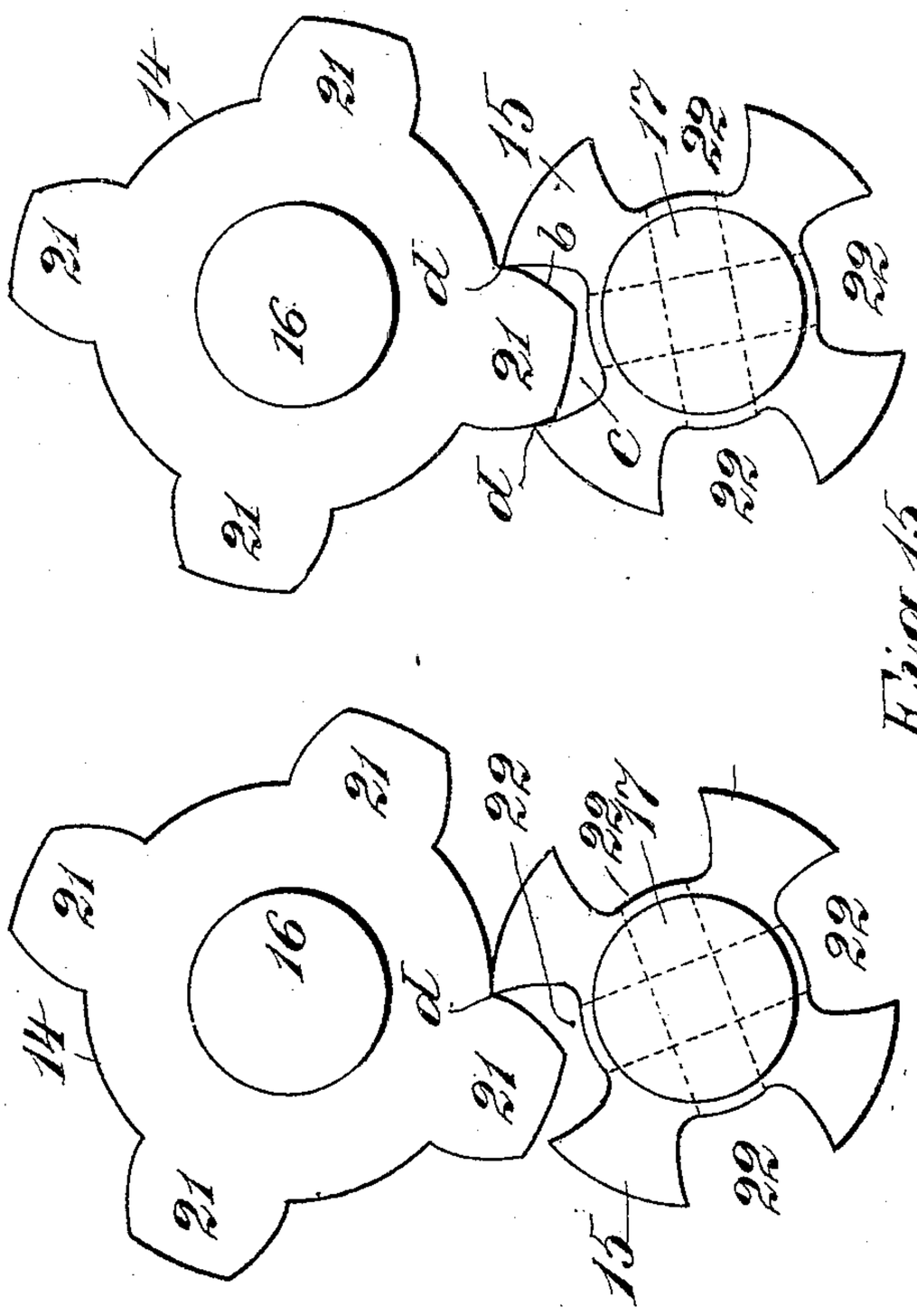
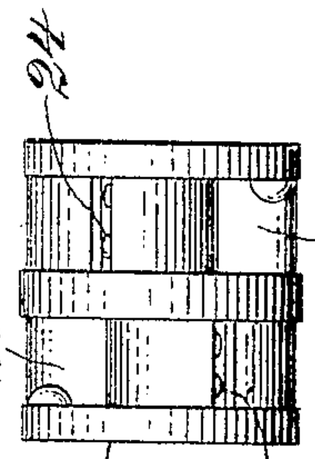


Fig. 12.

Fig. 15.



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UNITED STATES PATENT OFFICE.

FRANZ MARBURG, JR., OF NEW YORK, N. Y.

ROTARY PUMP AND THE LIKE.

No. 803,772. Specification of Letters Patent. Patented Nov. 7, 1905.

Application filed March 21, 1904. Serial No. 199,076.

To all whom it may concern:

Be it known that I, FRANZ MARBURG, Jr., a citizen of the United States, residing in the borough of Brooklyn, in the county of Kings, in the city and State of New York, have invented certain new and useful Improvements in Rotary Pumps and the Like, of which the following is a specification.

This invention relates to a rotary pump, engine, or blower having a rotating piston-body provided with radially-projecting pistons, which engage with corresponding piston-recesses in rotating abutments disposed at opposite sides of the piston-body in suitable chambers, wherein they fit snugly. The inclosing casing has a suitable inlet and outlet for the fluid.

It is important in a rotary pump, engine, or blower of this general character in order that it may be durable, be relatively inexpensive in repairs, and may do the proper duty that the rotating parts shall be carefully balanced and shall be free from shocks, undue wear, and friction, and it is also important that the parts shall be driven accurately and positively in unison by gearing and be driven wholly independent of the pistons engaging their recesses.

Having in view these essentials to the proper working of the pump, engine, or blower, it is the purpose of the present invention to provide means for balancing the pressures on the rotating parts, to insure smooth running by providing against shocks at the rotating parts, to provide an interchangeable cylinder in the casing, said cylinder having in it the chambers and ports, and to provide means for accurately centering said cylinder and securing it in position. The piston-body and abutments are geared together in a manner to insure accurate running in unison, this being effected by special gearing and lubricating means. The external casing is adapted when the device is employed as a pump for liquids to serve as a liquid-holder.

In the accompanying drawings, which illustrate an embodiment of the invention especially adapted for pumping liquids, Figure 1 is a vertical section taken substantially at line x' in Fig. 2. Fig. 2 is a section at line x^2 in Fig. 1, the head 8 at that end being removed and the shafts being in section. Fig. 3 is a horizontal section substantially at line x^3 in Fig. 4. Fig. 4 is a vertical section substantially at line x^4 in Fig. 3. Fig. 5 is an end view of the cylinder, together with the piston-body and the abutments in place therein. Fig. 6 is a longitudinal section of the cylinder at line x^6 in Fig. 7. Fig. 7 is a cross-section of the cylinder, piston-body, and abutments, taken at line x^7 in Fig. 6. Fig. 8 is a side view, and Fig. 8^a an end view, of the piston-body detached. Fig. 9 is a side view, and Fig. 9^a an end view, of one of the abutments detached. Fig. 10 is a face view of one of the casing-heads. Fig. 11 is a side view, and Fig. 11^a an end view, of one of the gears. Figs. 12, 13, and 14 are views, on a large scale, of the piston-body and an abutment, illustrating the forms of the pistons and piston-recesses and the manner of their engagement. Fig. 15 is a side elevation of the cylinder on the same scale as Figs. 1 to 4.

1 designates the exterior casing of the pump, which may have a circular drum-like form, as seen in Fig. 4, and be provided with feet. This casing is divided by a partition 2 into an eduction-chamber 3 and an induction-chamber 4. The former has an outlet 5 and the latter an inlet 6.

In each end of the cylindrical casing is an aperture, one of which is closed by a head 8 and the other by a head 10. These heads are secured to the casing by screws 11 and are turned out on their inner faces to fit concentrically into the apertures turned out in the ends of the casing. The cylinder 7 is turned to fit at its ends into bearings at v in the respective heads 8 and 10, and it has at its middle a bearing x in the partition 2. The cylinder is secured in place by screws 13^a, (seen in Fig. 1;) but it is accurately positioned as to adjustment about its axis by steel pins 13, Fig. 10, which pass through and may be fixed in the head 8 and enter holes in the end of the cylinder. This feature is important, as it secures with great accuracy the positioning of the cylinder in the casing. In chambers carefully bored out in the cylinder 7 are mounted the piston-body 14 and the two rotatable abutments 15. The former has a shaft 16 and the latter have shafts 17.

On the head 8 and integral therewith is a bearing 9 for the shafts 16 and 17 at that side, (see Fig. 3,) and on the other head 10 is mounted a flanged box 12, the flange of which is circular and fits within a circular shoulder at w on the head 10. The box 12 provides bearings for the shafts and provides also a casing for the gears 18, by which the shaft 16 drives the shafts 17. One of these gears is seen detached in Figs. 11 and 11^a, and when they are

in place their teeth intermesh, so that the piston-body and abutments will be driven positively in unison. These gears are cut to fit very accurately, so that there may be no looseness, and to prevent wear by abrasion, as well as to reduce the friction, the gears are made long and have circumferential grooves 18[a] in them to receive and deliver oil with which the inclosing box 12 is charged. In order to fix the gears accurately on their respective shafts and so that they cannot shift, each is secured by cross-pins 18[b], driven through a boss at one end of the gear and through the shaft, the boss being then covered with a sleeve or ferrule 18[c].

19 represents the inlet-ports to the pistons, and 20 the outlet-ports. The former connect with the induction side and the latter with the eduction side of the pump.

The piston-body 14 is provided with radially-projecting pistons 21 (four as herein shown) and the abutments 15 have each a like number of piston-recesses 22 to be engaged by the pistons 21. The construction of these features is important and is best illustrated in Figs. 12, 13, and 14. In these enlarged detail views, Fig. 12 shows the piston entering, Fig. 14 shows it fully entered, and Fig. 13 shows it in an intermediate position. Referring particularly to Fig. 14 for illustration, it will be seen that piston 21 has a truncated end and curved convex sides *b* and that the piston does not extend to the bottom of the piston-recess 22, but leaves a space or clearance *c*, which extends up the sides of the piston when the latter is fully entered, the only contact-points being at *d d*, where the piston is thickest.

It will be observed as a further characteristic of the piston that it is thickest near its base and tapers by curves toward its truncated end and of the abutment that the solid parts between the piston-recesses are widest at their outer ends, while the recesses have a substantially uniform width. The effect of this construction, as seen in Figs. 12, 13, and 14, is to provide the recess with relatively sharp bearing edges, which bear on the curved sides of the piston during the entire engagement of the latter with the recess and prevent leakage. At the same time the piston-body and abutment are rotated in unison by gears, and consequently there is no undue wear of the parts, which would arise if one element were driven by the other, as in some forms of rotary pumps.

To secure a perfect balancing of the working parts of the pump, means are provided for balancing the pressures on the abutments. As these abutments are herein shown they are each subjected to pressure of two kinds, which act in different directions crosswise of each other—namely, induction-pressure from two of the ports and eduction-pressure from the other two ports. As such pressures may have a tendency to induce friction, they are equalized or counterbalanced by channels 24, formed in the walls of the chambers and having the same length as the abutments and equal in width to the surface exposed to pressure. These channels are connected by ports 24[a] with the respective induction and eduction chambers. For a fuller understanding of this balancing feature reference may be had to my United States Patent No. 578,938, dated March 16, 1897, which relates to a pump of this general character.

When dealing with incompressible liquids, the liquid incarcerated in the piston-recess will produce a shock unless means are provided to prevent it, and in the present construction the clearances *c* at the bottoms of the recesses are connected at intervals by cross-ports 23 in the abutments, and these are open through the recesses 22 to the channels 24 while the piston is entering the piston-recess.

The pistons and abutments extend the entire length of the cylinder. Fig. 9 shows the arrangement of the cross parts in the abutment.

Having thus described my invention, I claim—

1. A device or apparatus of the character specified, having a rotating piston-body in a chamber and provided with radially-projecting pistons each being thickest near its base and having truncated ends, an abutment in a chamber adjacent to that of the piston-body and provided with piston-recesses engaged by said pistons, the piston-recesses being each of substantially uniform width and of such depth as to leave clearances *c* not occupied by the engaging pistons and being connected by diametrically disposed ports, and gears connecting the piston-body and abutment for driving.

2. A device or apparatus of the character specified, having a chambered cylinder, a rotating piston-body in one of the chambers and provided with radially-projecting pistons, rotating abutments in the other chambers and driven positively from the piston-body, said abutments having in them piston-recesses each of substantially uniform width, engaged by said pistons, each thickest near its base, with convex-curved sides and truncated ends, the abutments having ports 23 extending from a clearance *c* in one recess to a similar clearance *c* in the opposite recess, and said cylinder having ducts 24 in its walls into which open successively said ports.

3. A device or apparatus of the character specified, comprising an outer casing, having in it an induction-chamber and inlet and an eduction-chamber and outlet, a cylinder mounted in bearings at its middle and ends in said casing, said cylinder having in it chambers and induction and eduction ports thereto, heads on the casing providing bearings for the ends of said cylinder, a piston-body with radial pistons rotatably mounted in one of the said chambers, abutments rotatably mounted in the

adjacent chambers, and having piston-recesses to engage said pistons, and bearings in the said heads for the rotating parts.

4. A device or apparatus for the purpose specified, having a hollow outer casing provided with an inlet and an outlet for a fluid, and a partition dividing its interior into induction and eduction chambers, heads fitted and secured on said casing, a chambered cylinder mounted in bearings in said casing, means for positioning said cylinder accurately in the casing, a rotating piston-body with pistons, and a rotating abutment with piston-recesses, mounted in the respective chambers in said cylinder.

5. A rotary pump, comprising a casing 1, having induction and eduction chambers, an inlet and an outlet for the liquid, heads 8 and 10 secured to the ends of said casing, a chambered cylinder 7, having bearings at its middle and ends in said casing and recessed bearings at its respective ends in the said heads, positioning-pins 13 in the heads and engaging holes in the cylinder, a rotating piston-body in the cylinder and provided with a shaft, rotating abutments in the cylinder and provided with shafts, gears 18 on said shafts through which the piston-body drives the abutments, and a flanged box 12, secured to the head 10, said box providing bearings for the shafts and housing said gearing.

6. A rotary pump, provided with chambers for the rotating parts and having in its walls ducts 24, said pump having a rotating piston-body in one of said chambers provided with radially-projecting, truncated pistons 21, with convex sides and widest near their bases, and having in another chamber a rotating abutment with piston-recesses 22 each with nearly parallel non-radial sides and having clearance-spaces *c*, the said spaces being connected by cross-ports 23, substantially as set forth.

7. A rotary pump or the like, having a rotating piston-body provided with a truncated piston 21, widest near its base with convex sides, a rotating abutment having in it a recess 22 to be engaged by the piston, said recess having a substantially uniform width throughout its depth, and gears connecting the said piston-body and abutment for driving.

8. A rotary pump or the like, having a rotating piston-body provided with pistons 21, each being widest near its base and with a truncated end, a rotating abutment having in it recesses 22 to be engaged by the said pistons the solid parts between the recesses being widest at their outer ends and gears connecting the said piston-body and abutment for driving.

9. A device or apparatus of the character specified, having a chambered cylinder, a rotating piston-body in one of the chambers and provided with radially-projecting pistons, each piston being thickest near its base with truncated ends, and rotating abutments in the other chambers and driven positively from the piston-body, said abutments having in them piston-recesses engaged by said pistons, the solid parts between the recesses being widest at their outer ends the abutments having ports 23 extending from a clearance *c* in one recess to a similar clearance *c* in the opposite recess, and said cylinder having ducts 24 in its walls which open successively into the said ports 23, and ports 24ª, leading from said ducts 24 substantially as and for the purpose set forth.

In witness whereof I have hereunto signed my name, this 17th day of March, 1904, in the presence of two subscribing witnesses.

FRANZ MARBURG, JR.

Witnesses:
HENRY CONNETT,
HENRY G. HOSE.