No. 815,911. PATENTED MAR. 20, 1906.

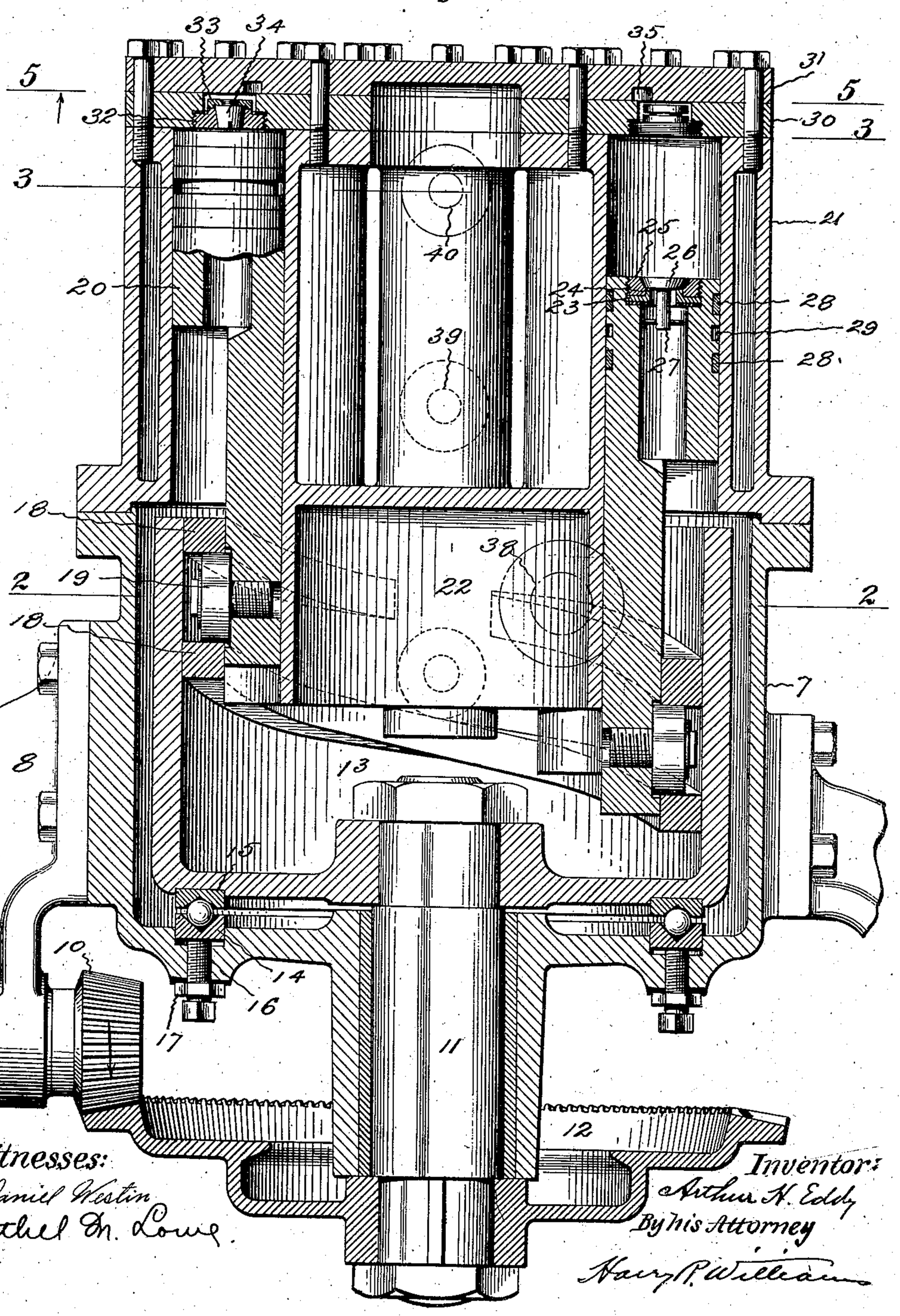
A. H. EDDY.

AMMONIA PUMP.

APPLICATION FILED MAY 4, 1904.

4 SHEETS—SHEET 1.

Fig. 1.



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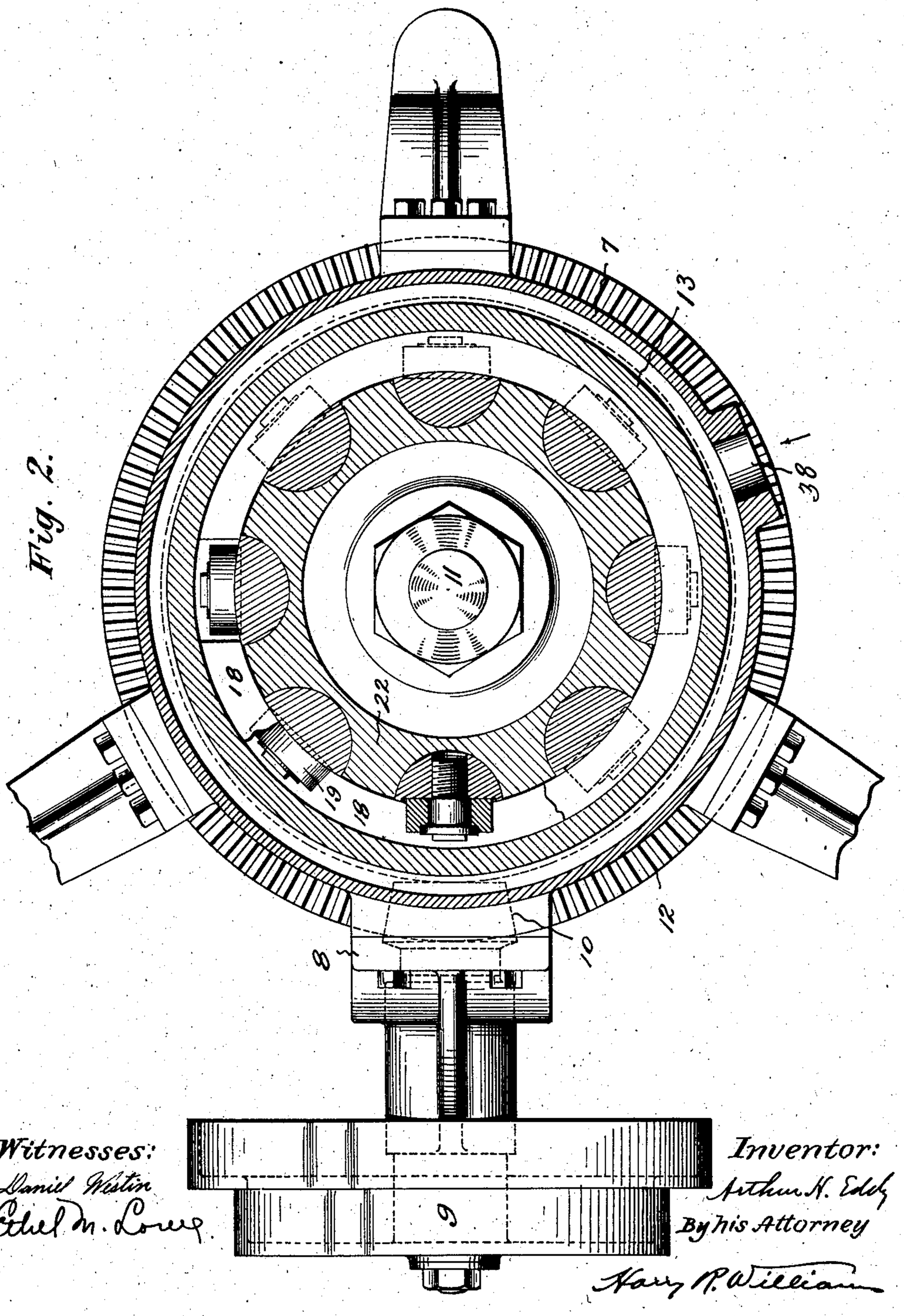
4 SHEETS—SHEET 2.

Fig. 2.



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4 SHEETS—SHEET 3.

Fig. 3.

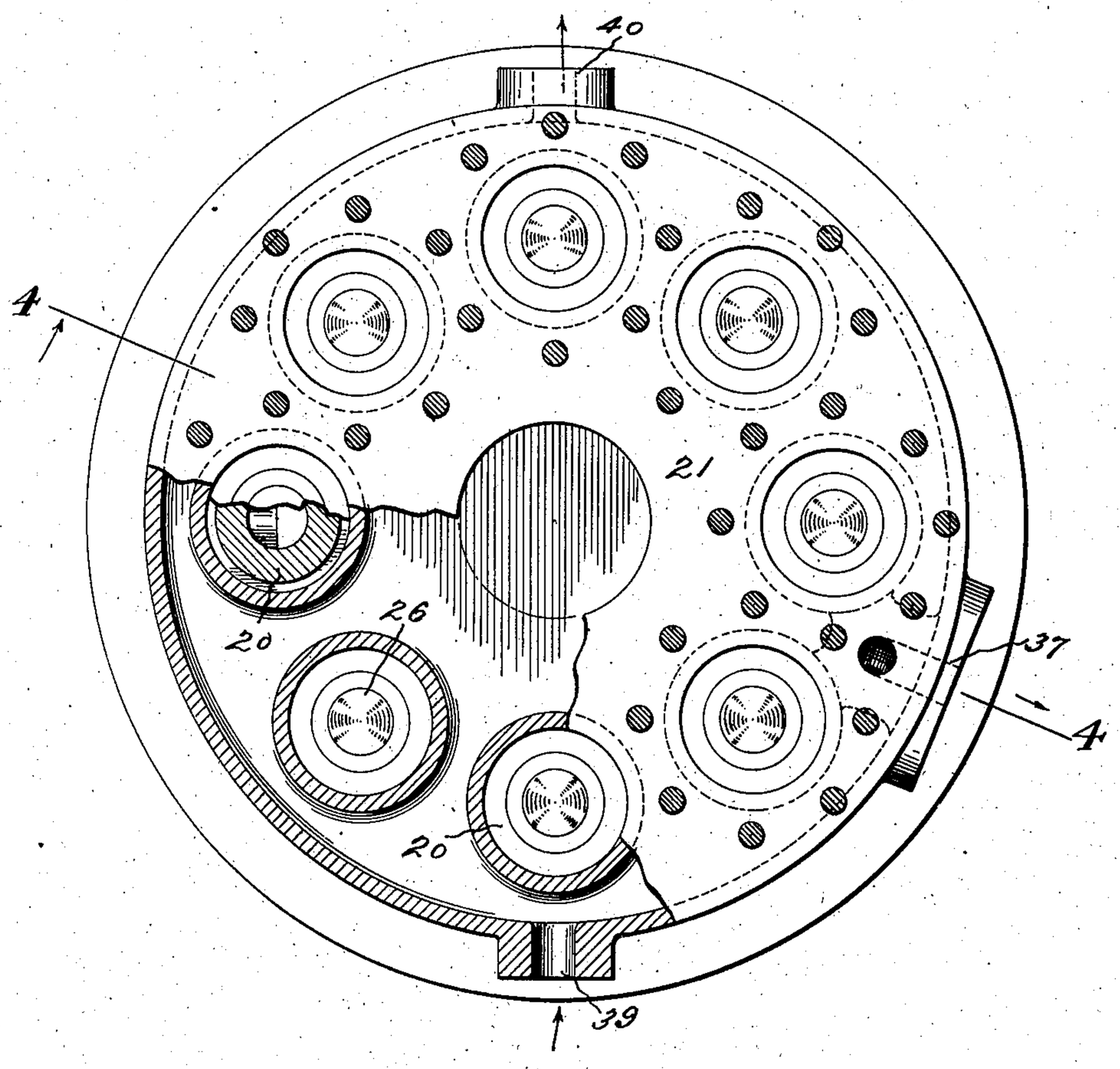
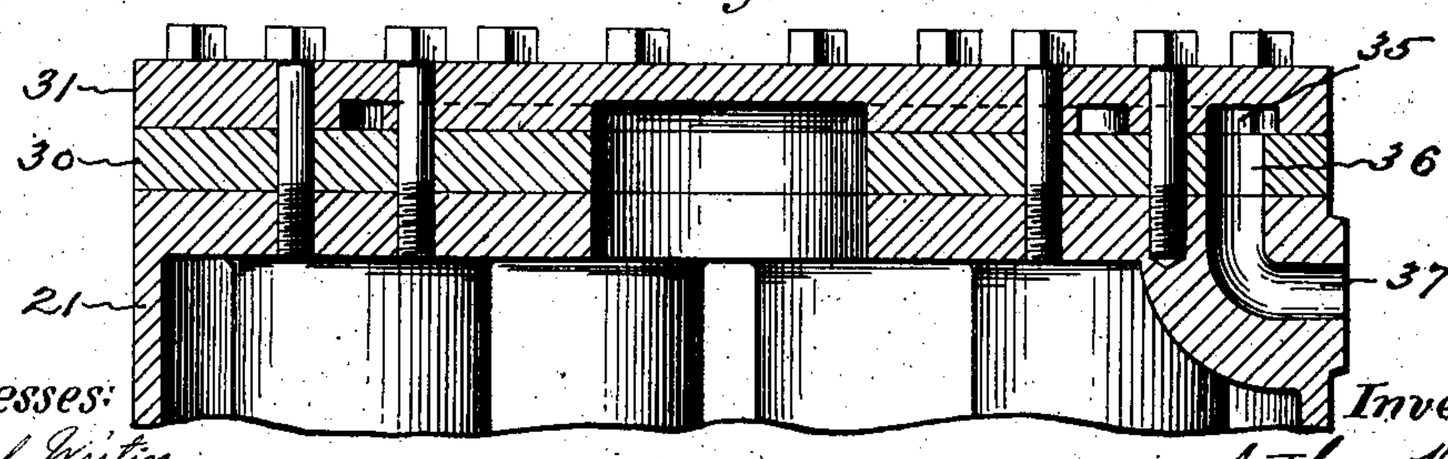


Fig. 4.



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4 SHEETS—SHEET 4.

Fig. 5.

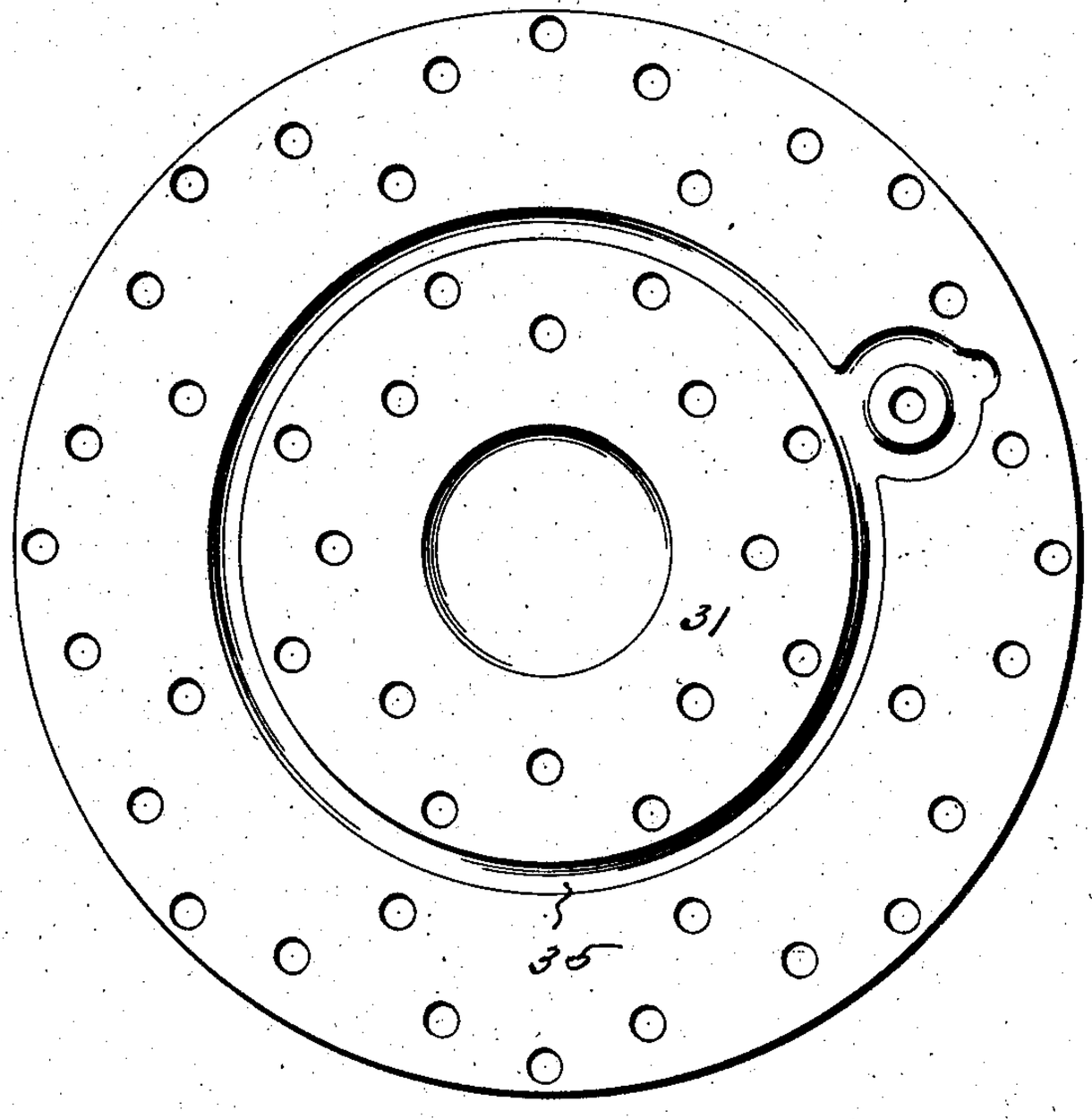
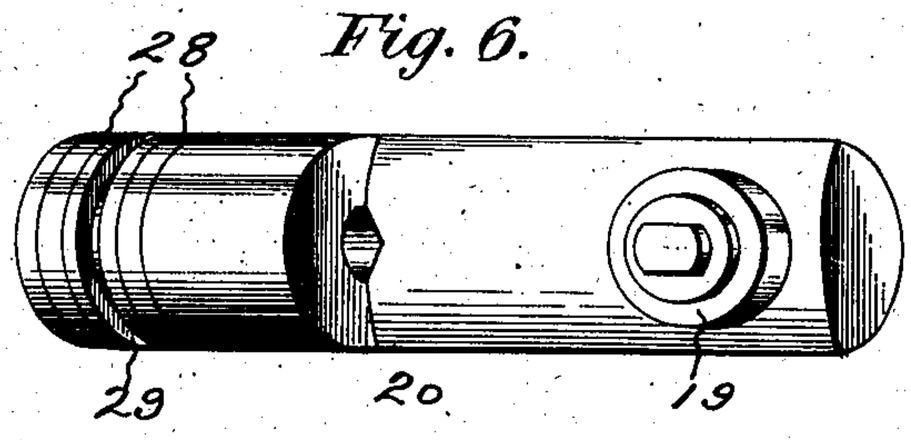


Fig. 6.



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UNITED STATES PATENT OFFICE.

ARTHUR H. EDDY, OF WINDSOR, CONNECTICUT.

AMMONIA-PUMP.

No. 815,911. Specification of Letters Patent. Patented March 20, 1906.

Application filed May 4, 1904. Serial No. 206,288.

To all whom it may concern:

Be it known that I, ARTHUR H. EDDY, a citizen of the United States, residing at Windsor, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Ammonia-Pumps, of which the following is a specification.

This invention relates to a pump which is particularly designed for compressing ammonia for refrigerating purposes.

The object of the invention is to produce a simple and efficient pump which can be cheaply manufactured and which when in use requires but little attention.

The pump illustrated has a case containing a cam which is adapted to be rotated from the exterior and which when rotated reciprocates a number of individual pistons that are provided with suitable valves and are movable in a case which is bolted to the cam-case and which is provided with a valve-plate and a head-plate.

Figure 1 of the accompanying drawings shows a central vertical section of this pump. Fig. 2 shows a horizontal section on the plane indicated by 2 2 on Fig. 1. Fig. 3 shows a plan of the piston-case with a portion broken away, as indicated by 3 3 on Fig. 1. Fig. 4 is a vertical section on the plane indicated by 4 4 of Fig. 3, taken through the head-plate, valve-plate, and upper end of the piston-case. Fig. 5 is a plan of the under side of the head-plate. Fig. 6 is a view of one of the pistons.

The cam-case 7 is preferably cast to shape, of iron, and is supported on any desired form of legs. Secured to one side of the cam-case is a bracket 8, with a bearing which supports a shaft having a pulley 9 on the outer end and a small bevel-gear 10 on the inner end. A long vertical bearing is formed at the bottom of the cam-case. This bearing is ground and polished, so as to closely fit the ground and polished arbor 11. On the lower end of the arbor outside of the cam-case is a large bevel-gear 12, that is in mesh with the bevel-gear on the pulley-shaft. On the upper end of the arbor in the cam-case is the cam-cylinder 13. On the bottom of the cam-case is a grooved ring 14, and on the bottom of the cam-cylinder is a grooved ring 15. Between these rings are antifriction-balls. Set-screws 16 are screwed through the bottom of the cam-case against the under side of the lower ring for the purpose of changing its level and adjusting the cam-cylinder vertically in the cam-case. These screws are provided with nuts 17, which are used to lock the screws in position and prevent leakage.

Around the interior of the cam-cylinder are the cam-ribs 18. Between these ribs are the rolls 19, which are mounted on studs projecting from the shanks of the pistons 20. As the cam-cylinder rotates the lower rib forces the pistons upwardly and the upper rib draws the pistons downwardly. These ribs are preferably so shaped that the pistons are forced up rapidly and drawn down slowly. A short section of the upper rib is cut away, so that the rolls may be inserted into the opening between the ribs. The upper section of each piston is cylindrical, and the lower or shank section is approximately semicylindrical, the outer face of each shank being shaped to conform to the inner walls of the cam-ribs.

The piston-case 21, which contains the cylinders in which the pistons move, is preferably cast to shape, of iron, and has its lower face ground so as to closely fit the ground upper face of the cam-case to which it is bolted. A hollow hub 22 extends downwardly from the center of the piston-case into the cam-cylinder, the diameter of this hub being but slightly smaller than the interior diameter of the cam-ribs. The cylinder-bores are continued in this hub and contain the semicylindrical shanks of the pistons, which are held against rotation by the engagement of their wide outer surfaces with the inner surfaces of the cam-ribs. Each piston is tubular, and in the upper end of the bore of each piston is a hardened annular plate 23, that has a ground and polished valve-seat 24 on its upper side. This plate is held in the bore of the piston by a threaded nut 25, the interior wall of which is preferably tapered. The valve-disk 26 has its lower face ground and polished, so as to make close contact with the valve-seat, and has its edge beveled, so that it will be guided to its seat by the beveled interior wall of the nut. A stem 27 extends downwardly from the valve-disk into the piston and is provided with a pin which prevents the dislocation of the valve. Each piston is preferably provided with two grooves containing split packing-rings 28, that are ground so as to make tight joints with the wall of the cylinder. Between the grooves containing the packing-rings may be a vacant groove 29, which will provide an oil-packing for the piston.

The valve-plate 30 is placed upon the top

of the piston-case, and the head-plate 31 is placed on top of the valve-plate. The under surface of the valve-plate is ground to fit the ground upper end of the piston-case, and the upper face of the valve-plate and lower face of the head-plate are ground so that they will fit tightly together. Screws are passed through the head-plate and valve-plate into the upper end of the piston-case about each cylinder for holding the parts together.

Above each cylinder in the valve-plate is an opening containing a threaded nut 32, having a valve-seat that is very hard on its upper face. This valve-seat is ground and polished so as to be very smooth. Above the valve-seat in each opening is a valve-disk 33, that has its under face ground and polished so as to closely fit the valve-seat. A tapered stem 34 is fastened to this disk, so as to extend into the tapered opening through the nut for the purpose of guiding the valve to its seat.

In the under face of the head-plate above the valves is an annular groove 35, which on one side communicates with an opening 36 through the valve-plate and an outlet 37 in the upper end of the piston-case, which is adapted to be connected with the pipe which leads to the gas-receiver. Ammonia is received into the cam-case through the opening 38 on one side and is pumped by the pistons past the valves to the outlet as the cam is rotated.

The cam-case is preferably filled with oil nearly to the level of the ammonia-inlet. This oil prevents any possibility of the leakage of gas about the cam-arbor through the opening in the bottom of the cam-case, which opening is the only one from the interior to the exterior of the pump which contains a moving part. On account of the closeness of the joint and length of the bearing, also the use of oil, which not only lubricates the arbor, but packs the joint, there is no possible chance for gas to leak.

The web of the bevel-gear below the cam-case is preferably made dish-shaped, so as to hold any oil that might possibly leak from the interior about the cam-arbor.

The piston-case around the cylinders is chambered, and water or other cooling medium is caused to enter the space about the cylinders through the opening 39 at the bottom on one side of the piston-case and after circulating about the cylinders to flow out through the opening 40 at the top on the other side.

The parts of this pump are strong and durable. They are simple to make and are easily assembled. There is but one opening containing a moving part, and that is so arranged that it does not require a packing to prevent leakage, although a packing can be used, if desired. The valves are very simple and require no springs to assist their operation. The pistons are effective and are so adjusted by raising or lowering the rotary cam that they move upwardly close to the under face of the valve-plate. In practice the pistons are preferably adjusted so that there will be no clearance between their upper ends and the under side of the valve-plate when they are at the limit of their upward movement, thus insuring great efficiency. The pistons and the cams work easily and have such broad bearing-faces that the wear amounts to nothing. The cam-cylinder can be adjusted while the pump is running, and after being properly adjusted the pump will run for a long time without further attention.

The invention claimed is—

1. A pump having a tight case containing concentrically-arranged cylinders, each cylinder having an inlet-opening at one end and an outlet-opening at the other end, a rotatable cam located near one end of and inclosed in the case, the axis of the cam extending parallel with the axes of the cylinders, means for rotating the cam, pistons with fluid-passages through them located in the cylinders and adapted to be positively reciprocated by the rotation of the cam, valves controlling the passages through the pistons carried by the pistons and valves controlling the openings at one end of the cylinders held by the case, substantially as specified.

2. A pump having a case, a rotatable cam in the case, means for rotating the cam, pistons located in cylinders in the case and adapted to be positively reciprocated by the rotation of the cam, inlet-valves carried by the pistons, discharge-valves held by the case, and a cooling-chamber surrounding the cylinders in the case, substantially as specified.

3. A pump having a case, a rotatable cam in the case, means for rotating the cam, a ball-ring at the bottom of the case, balls located between the ring and the cam, pistons located in cylinders in the case and adapted to be positively reciprocated by the rotation of the cam, inlet-valves carried by the pistons, and discharge-valves held by the case, substantially as specified.

4. A pump having a case, a rotatable cam in the case, means for rotating the cam, a ball-ring at the bottom of the case, means for adjusting the ball-ring axially of the cam, balls located between the ring and the cam, pistons located in cylinders in the case and adapted to be positively reciprocated by the rotation of the cam, inlet-valves carried by the pistons, and discharge-valves held by the case, substantially as specified.

5. A pump having a case, a rotatable cam in the case, means for rotating the cam, pistons located in cylinders in the case and having shanks that are adapted to be reciprocated by but held against rotation by the cam, inlet-valves carried by the pistons, and

discharge-valves held by the case, substantially as specified.

6. A pump having a case, a rotatable cam in the case, means for rotating the cam, pistons located in cylinders in the case and adapted to be reciprocated by the rotation of the cam, a flat inlet-valve seat in each piston, a flat disk carried by each piston and adapted to open from and close against the inlet-valve seat, and opposite each piston a flat discharge-valve seat and a flat valve-disk adapted to open from and close against the flat discharge-valve seat, substantially as specified.

7. A pump having a cam-case, a rotatable cam in the cam-case, means for rotating the cam, a piston-case secured to the cam-case, pistons located in cylinders in the piston-case and adapted to be reciprocated by the rotation of the cam, inlet-valves carried by the pistons, a valve-plate secured to the piston-case, discharge-valves located in openings in the valve-plate and a head-plate secured to the valve-plate, substantially as specified.

8. A pump having a cam-case, a rotatable cam in the cam-case, an arbor extending from the cam through the bottom of the cam-case, a gear on the arbor below the cam-case, a pulley and gear for driving the cam-gear, a piston-case secured to the cam-case, pistons located in cylinders in the piston-case and adapted to be reciprocated by the rotation of the cam, inlet-valves carried by the pistons, a valve-plate secured to the piston-case, discharge-valves located in openings in the valve-plate, and a head secured to the valve-plate, substantially as specified.

9. A pump having a cam-case, a rotatable cam in the cam-case, means for rotating the cam, a piston-case having a hub that fits the interior of the rotatable cam, pistons located in cylinders in the piston-case, the shanks of said pistons on the inside fitting grooves in the hub and on the outside fitting the interior of the cam and having rollers engaged by the cam, inlet-valves carried by the pistons, a valve-plate secured to the piston-case, discharge-valves located in openings in the valve-plate, and a head-plate secured to the valve-plate, substantially as specified.

10. A pump having a cam-case, a bearing at the bottom of the cam-case, an arbor extending through the bearing, a gear attached to the lower end of the arbor outside of the cam-case, a cylindrical cam attached to the upper end of the arbor inside of the cam-case, a piston-case secured to the cam-case and containing cylinders, pistons located in the cylinders and adapted to be reciprocated by the rotation of the cam, inlet-valves carried by the pistons, a valve-plate secured to the piston-case, discharge-valves located in openings in the valve-plate, and a head secured to the valve-plate, substantially as specified.

11. A pump having a case, a rotatable cylinder in the case, cams secured to the interior of the rotatable cylinder, pistons located in cylinders in the case and provided with rolls engaging the cams, inlet-valves carried by the pistons, and discharge-valves held by the case, substantially as specified.

12. A pump having a case, a rotatable cam in the case, means for rotating the cam, pistons having cylindrical heads and semi-cylindrical shanks located in cylinders in the case, rolls mounted on the piston-shanks and adapted to engage the cam, inlet-valves carried by the pistons, and discharge-valves held by the case, substantially as specified.

13. A pump having a case, a rotatable cylinder in the case, means for rotating the cylinder, cam-ribs secured to the interior of the rotatable cylinder, pistons located in cylinders in the case, the shanks of the pistons having rolls lying between the cam-ribs and having their outer faces fitting the interior walls of the cam-ribs, inlet-valves carried by the pistons, and discharge-valves held by the case, substantially as specified.

14. A pump having a tight case containing concentrically-arranged cylinders, a rotatable cam located near one end of and inclosed in the case, the axis of the cam extending parallel with the axes of the cylinders, means for rotating the cam, pistons with fluid-passages through them arranged in the cylinders in the case on one side of the cam and adapted to be positively reciprocated by the rotation of the cam, valves controlling the passages through the pistons carried by the pistons, and valves controlling openings from the cylinders held by the case, substantially as specified.

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