F. D. TICE.

PUMP.

APPLICATION FILED JULY 28, 1915.

1,229,676.

Patented June 12, 1917.

2 SHEETS—SHEET 1.

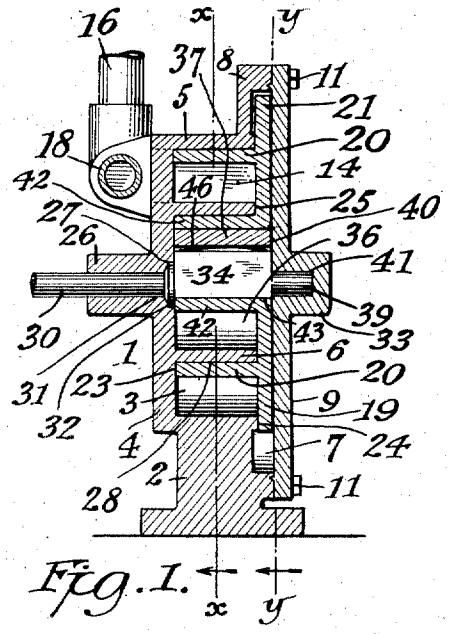


Fig. 1.

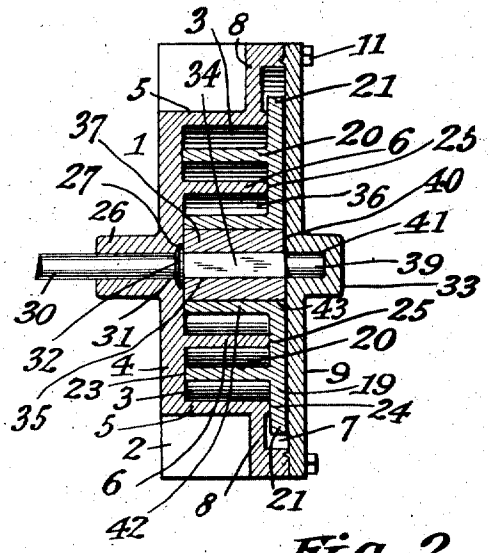


Fig. 2.

Fig. 3.

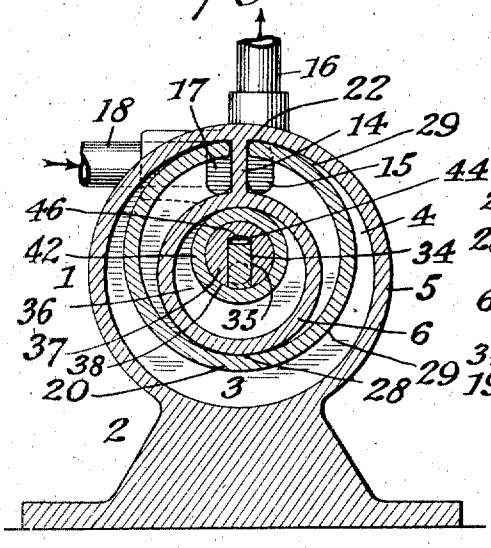
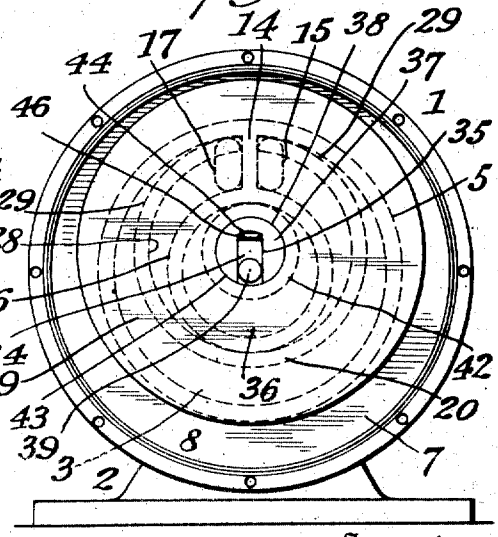


Fig. 4.



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2 SHEETS—SHEET 2.

Fig. 7.

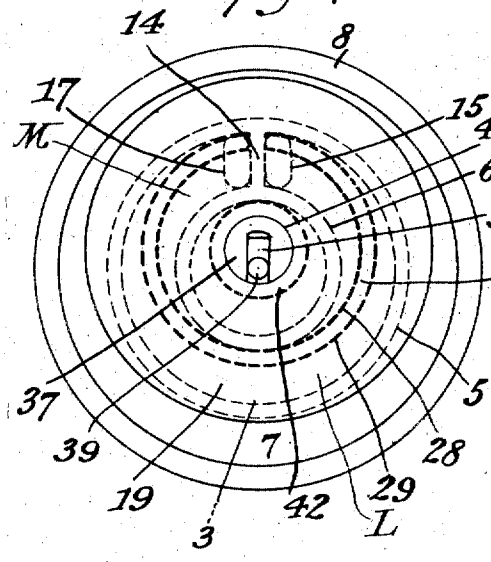


Fig. 8.

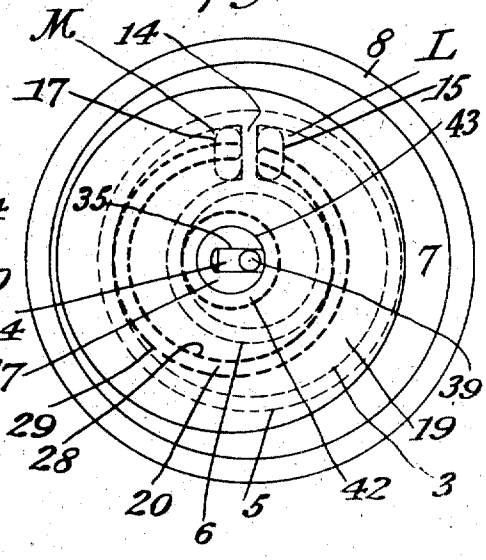


Fig. 5.

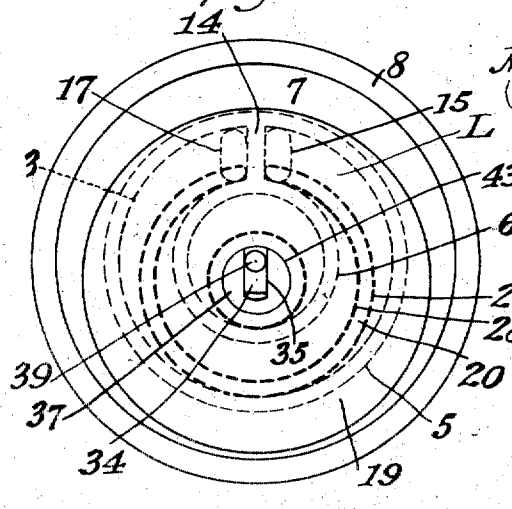
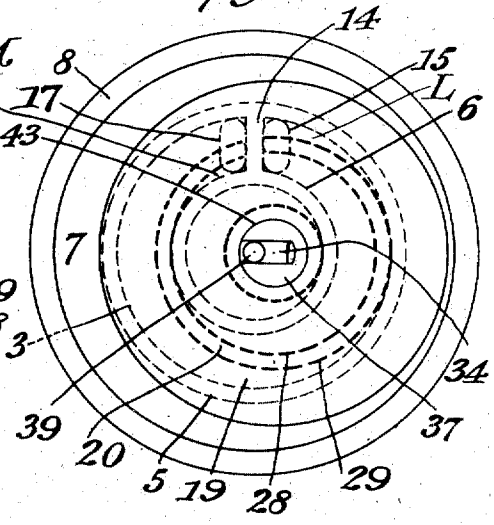


Fig. 6.



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UNITED STATES PATENT OFFICE.

FRANCIS D. TICE, OF NIANTIC, CONNECTICUT.

PUMP.

1,229,676. Specification of Letters Patent. Patented June 12, 1917.

Application filed July 28, 1915. Serial No. 42,246.

To all whom it may concern:

Be it known that I, FRANCIS D. TICE, a citizen of the United States, and resident of Niantic, in the county of New London and State of Connecticut, have invented certain new and useful Improvements in Pumps, of which the following is a specification.

This invention relates to pumps, and it has particular relation to an improved pump of a "cycloidal" or "gyratory" character.

While my invention is particularly adapted for employment as a pump in which the gyratory motion of the piston is produced by a rotary motion of the shaft, it will be understood that the invention is equally adapted for employment as an engine, propelled by steam or gases or fluids, in which the gyratory motion of the piston will produce a rotary motion of the shaft.

The object of my invention is to produce a mechanism of the class described which will be extremely simple in construction, positive and effective in operation, and which will produce an enhanced or maximum degree of power with relation to the units of operative force employed.

A further object of my improvements is to provide a mechanism of the class described which will possess general advantages in point of simplicity, strength and durability, inexpensiveness in construction, minimum friction, economy, and efficiency.

In the drawings—

Figure 1 is a vertical transverse sectional view of the mechanism embodying my improvements.

Fig. 2 is a horizontal transverse sectional view thereof.

Fig. 3 is a vertical cross-section, taken on the line x—x, Fig. 1.

Fig. 4 is a vertical cross-section, taken on the line y—y, Fig. 1.

Figs. 5, 6, 7 and 8 are diagrammatic views, indicating different positions of the piston.

Corresponding parts in all the figures are denoted by the same reference characters.

Referring to the drawings, 1 designates the main body or casing of the mechanism, which is mounted or fixed in any suitable manner, preferably vertical (for instance, upon a base portion, 2), and is interiorly provided with an annular chamber, 3, which constitutes the cylinder. The body or casing 1 may be constructed in a single piece, comprising an end wall, 4, forming the closed side of the annular cylinder-chamber 3, a side wall, 5, forming the outer annular wall of the chamber 3, and a centrally-arranged interior wall, as at 6, projecting from the end wall 1 and forming the inner annular wall of the chamber 3. Beyond the cylinder-chamber 3, the main casing 1 is provided with a chamber or interior space, 7, extending across the chamber 3 and enlarged laterally with respect thereto, so that the full diameter of the chamber or space 7 is greater than the full diameter of the cylinder-chamber 3, which chamber or space 7 accommodates the head-plate of the piston in its operative movement. Said chamber or space 7 may be formed by a flange extension or enlargement of the side wall 5 of the casing 1, projecting from the same circumferentially, as shown at 8. The outer side of the chamber or space 7 is closed by a side wall, 9, oppositely located with relation to the end wall 4 of the casing 1, which wall 9 may consist of a cheek-plate, as shown, removably secured, by bolts, as at 11, to the face of the flange extension 8 which surrounds the chamber or space 7.

The cylinder-chamber 3 is divided by a fixed partition or head, 14, extending across the width of said chamber and preferably located at the top thereof. At one side of said partition, and immediately adjacent thereto, is located the exhaust port, 15, which is constituted by an opening in the end wall 4 which forms the closed side of the cylinder-chamber, from which opening may suitably extend an exhaust pipe, as shown at 16. At the opposite side of said partition 14, and immediately adjacent thereto, is located the inlet port, 17, which is constituted by an opening in the end wall 4 which forms the closed side of the cylinder-chamber, corresponding to the exhaust opening 15, and from the inlet port 17 may suitably extend a feed-pipe, as shown at 18.

The piston comprises a plate or head, 19, operative in the chamber or space 7 of the casing 1, having projecting from its inner face an annular or circular flange, 20, operative within the cylinder-chamber 3, beyond which flange the peripheral portion of said head or plate 19 circumferentially extends, as at 21. The flange 20 has a thickness or width area less than the width area of the cylinder-chamber, and it is trans-

versely recessed, as at 22, to receive the fixed partition or head 14 in the chamber 3. Said recess is of a width approximately corresponding to the width of said partition, so that the partition will approximately close the recess but a sliding movement of the piston-flange 20 will be permitted upon and with relation to the partition in the operation of the piston. The relative construction and arrangement is such that the annular flange 20 of the piston is received within the annular cylinder-chamber 3, and the edge, 23, of the flange at all times bears against the inner face of the end wall 4 which forms the closed side of the cylinder-chamber, while the inner face of the peripheral projecting portion 21 of the piston plate or head 19 at all times bears upon the inner edge, 24, of the outer side wall 5 of the chamber 3, and the inner face of the piston plate or head 19 at the portion immediately within the annular piston-flange 20 at all times bears upon the inner edge, 25, of the interior wall 6 of the chamber 3, a fluid-proof joint being thus formed at such edge-contacts during the gyratory operation of the piston. The edges 24 and 25 are preferably slightly raised or extended respectively beyond the plane of the inner wall of the chamber or space 7, which is constituted by the flange extension 8, so that they respectively form annular edge bearing-surfaces projecting with relation to the chamber or space 7 and facilitate the bearing contact of the inner faces of the head-plate 19 and peripheral plate portion 21 of the piston.

It will be understood that the piston is retained against rotary movement by the fixed partition or head 14 in the cylinder-chamber 3, and that the piston head-plate 19—21 at all times closes or covers the side of the cylinder-chamber opposite from the wall 4. The piston head-plate is imperforate at all points which are operative with relation to the cylinder-chamber 3.

30 designates the shaft, which has an eccentric connection with the piston. In the preferred construction for effecting this connection, the shaft projects through the end wall 4 of the casing 1 and has a bearing, as at 31, therein and in a boss or extension or bearing-box, 26, projecting exteriorly from the wall 4, and at its bearing the shaft has a circumferential flange or enlargement, 32, received by a corresponding depression, 27, at the inner face of the end wall 4, whereby the shaft is positioned against outward movement with relation to the casing 1. The shaft extends across and axially of a central interior cylindrical chamber or space, 36, comprised within the interior wall 6 which forms the inner annular wall of the cylinder-chamber 3, and across the chamber or space 7, and its terminal end, 39, has a bearing in a bearing recess, 41, formed in the cheek-plate 9 which constitutes the outer side wall of the chamber or space 7, said bearing recess being preferably provided in an extension or boss, 33, projecting laterally from said cheek-plate. Upon that portion of the shaft which extends across the central chamber or space 36, it is provided with an enlargement, as at 34, of angular transverse contour and projective laterally with relation to the axis of the shaft. Said enlargement is received by a corresponding recess, 35, in a disk-piece or block, 37, the periphery of which is of cylindrical or circular contour, as at 38, the relative construction and arrangement being such that the block 37 is mounted upon the shaft-enlargement 34 eccentrically with relation to the axis of the shaft. The mounting of said block upon the shaft in the manner just described enables the removal of the block slidably with relation to the angular enlargement 34, when it is desired to disassemble the parts of the mechanism, after the removal of the cheek-plate 9 and the piston from their association with the casing 1.

The disk-piece or block 37 moves with the shaft 30, in its eccentric mounting thereon, and turns within a corresponding circular opening or bearing centrally provided in the piston. Said bearing is preferably constituted by an annular or circular flange, 42, projecting from the inner face of the piston head-plate 19 at the central portion thereof and concentric with the piston flange 20 which is operative within the cylinder-chamber 3, said flange 42 being operative within the central cylindrical chamber or space 36. In the preferred construction, the block 37 and the shaft-enlargement 34 preferably extend to the plane of the outer face of the head-plate 19 of the piston, as shown at 40, and said head-plate has a central cylindrical perforation, as at 43, receiving said extensions and forming a continuation of the bearing constituted by the annular flange 42.

In the preferred construction, a spring is interposed between the block 37 and the shaft-enlargement 34, and as herein shown consists of a plate spring, 46, seated longitudinally in a depression, 44, in the base of the recess 35 in the disk-piece or block and bearing against the shaft enlargement, it being understood that said recess 35 is sufficiently large to permit a slight play of said block upon said enlargement. The purpose of this spring mounting in the eccentric connection between the shaft and the piston is to take up any dead-center resistance at the instant of the initial starting of the rotary movement of the shaft and to facilitate the operative action between the shaft and the piston.

From the foregoing description, it will be understood that the disk-piece or block 37 is eccentrically keyed upon the shaft 30 and operates eccentrically with relation to the piston, and that the shaft is thus eccentrically mounted with relation to the operation of the piston in the reverse gyratory movements of the latter within the cylinder-chamber.

It will be noted that the cheek-plate 9 operates to hold the piston to its seat and to retain the disk-piece or block 37 in its eccentric mounting upon the shaft, and if desired a suitable spring control may be interposed with relation to this maintenance of the operative position of the piston and said block. It will be further noted that the exhaust and inlet ports 15—17 extend, in the preferred construction, across substantially the complete width area of the cylinder-chamber 3.

The operation and advantages of my invention will be readily understood by those skilled in the art to which it appertains. The piston has an eccentric movement with relation to the shaft and the piston-flange 20 has a reverse gyratory movement in the cylinder-chamber and with relation to the partition or head 14 as a fixed point, in which movement the true center or axis of the piston with relation to the annular flange 20 describes a movement in a segmental path with relation to the axis of the shaft. The relative construction and operation is such that at all times in the movement of the piston the inner face, 28, of the piston-flange 20 contacts at some point with the inner wall 6 of the cylinder-chamber 3 and the outer face, 29, of said flange 20 contacts at some point with the outer wall 5 of the cylinder-chamber. These contacts at all times during the movement of the piston cause the division, by the piston-flange 20, of the cylinder-chamber 3 into two chambers, respectively operative as inlet and exhaust chambers, during the movement and operation of the piston.

When the mechanism is operative as a pump, the shaft 30 is driven and rotated by any suitable source of power and its eccentric bearing connection with the piston causes the operation of the latter in the reverse gyratory movement whereby the water entering at the inlet port 17 will be discharged under pressure at the exhaust port 15. For an understanding of the operative movement and action of the piston, reference may be had to the diagrammatic illustrations in Figs. 5 to 8, inclusive. In Fig. 5, assuming the piston to be at its lowermost point of movement, the inner face 28 of the flange 20 is bearing against the inner wall 6 of the cylinder-chamber 3 at the top and the outer face 29 of said flange is bearing against the outer wall 5 of the cylinder-chamber at the bottom, and the inlet and exhaust ports are respectively open to the respective spaces or chambers which then exist within the cylinder-chamber, at opposite sides of the partition or head 14, between the piston-flange 20 and the outer wall 5 of the cylinder-chamber; now, as the shaft 30 is revolved and carries the piston toward the position shown in Fig. 6, the water in the chamber (indicated at L) then at the right-hand side of the partition 14 is driven by the piston-flange 20, in its eccentric movement in one direction within the cylinder-chamber, out at the exhaust port, and the space or chamber at the left-hand side of the partition 14 enlarges and fills with water from the inlet port. When the cylinder reaches the point shown in Fig. 6, the inner face 28 of the flange 20 is bearing against the inner wall 6 of the cylinder-chamber 3 at the left-hand side and the outer face 29 of said flange is bearing against the outer wall 5 of the cylinder-chamber at the right-hand side, and in this position water enters from the inlet port to the chamber (indicated at M) then beginning to form at the left-hand side of the partition 14 between the inner face 28 of the piston-flange 20 and the inner wall 6 of the cylinder-chamber; now, as the piston continues, under action of the shaft, in the same direction of its eccentric movement until it reaches its uppermost position, as shown in Fig. 7, the water in the chamber L is entirely exhausted at the exhaust port, a successive chamber L is formed at the lower portion of the cylinder-chamber between the outer face 29 of the piston-flange 20 and the outer wall 5 of the cylinder-chamber, and the chamber M enlarges and fills from the inlet port. When the piston has reached its uppermost position, as shown in Fig. 7, the outer face 29 of the flange 20 is bearing against the outer wall 5 of the cylinder-chamber 3 at the top and the inner face 28 of said flange is bearing against the inner wall 6 of the cylinder-chamber at the bottom; the continued rotation of the shaft in its operation of the piston then reverses the eccentric movement of the latter to a direction opposite to that it has described in moving from its lowermost to its uppermost position, which reverse eccentric movement carries the piston toward the position shown in Fig. 8, and the water in the chamber M is exhausted under pressure at the exhaust port. The reverse eccentric movement of the piston, as just described, continues until the piston again reaches the lowermost position, as shown in Fig. 5, when the continued rotation of the shaft again starts the piston in an eccentric movement in a reverse direction as hereinabove described. It will be noted that, during the reverse eccentric movements of the piston as just described, the true center

of the piston with relation to its annular flange 20 has described a complete movement in the path of a circle about the axis of the shaft, and that the piston has reciprocated up and down upon the fixed partition or head 14 at the top of the cylinder-chamber 3, the initial points of the respective reverse eccentric movements of the piston being when the latter is at its lowermost position (shown in Fig. 5) and at its uppermost position (shown in Fig. 7). It will further be noted that at all points in the movement of the piston and in the variable location of the respective chambers L and M into which the cylinder-chamber 3 is divided by the piston-flange 20, water is always entering the cylinder-chamber 3 at the inlet port at one side of the fixed partition or head 14 and being forced out at the exhaust port at the other side of said partition.

The extreme simplicity of the improved pump, under the construction constituting my invention as herein described, is indicated by the fact that the complete mechanism may consist in the main of but four parts, to wit: the body or casing 1 (in which is formed the cylinder-chamber 3), the piston, the shaft 30, and the movable wall forming the cheek-plate 9, which respective four parts may be practically of integral construction.

I do not desire to be understood as limiting myself to the detail construction and arrangement of parts as herein shown and described, as it is manifest that variations and modifications therein may be resorted to, in the adaptation of my invention to varying conditions of use, without departing from the spirit and scope of my invention and improvements. I therefore reserve the right to all such variations and modifications as properly fall within the scope of my invention and the terms of the following claims.

Having thus described my invention, I claim and desire to secure by Letters Patent:

1. In a mechanism of the class described, a casing comprising an interior annular cylinder-chamber having an end wall forming its closed side and an outer and inner annular wall and divided by a fixed partition or head extending across the width of the chamber, a piston comprising a plate or head closing the open side of said cylinder-chamber and having projecting from its inner face an annular flange provided with a recess receiving said partition or head, inlet and outlet ports entering said cylinder-chamber respectively at opposite sides of said partition or head, a rotary shaft extending transversely of said casing and axially with relation to the annulus of the cylinder-chamber and having a bearing in the end wall thereof, a cheek-plate closing side of the casing opposite said end wall and forming a bearing for the plate or head of the piston, said shaft having also a bearing in said cheek-plate, and a block or enlargement carried by and extending across the portion of said shaft which crosses the width plane of the cylinder-chamber between the end wall and said cheek-plate and having a cylindrical periphery eccentric to the axis of the shaft, whereby said block has a bearing between said end wall and cheek-plate, said piston having a central circular bearing projecting inwardly from its head plate and receiving and co-extensive with the width of said block or enlargement between said end wall and cheek-plate, whereby the piston has an eccentric mounting with relation to the cylinder-chamber and co-extensive with the entire width plane thereof intermediate of the shaft bearing to operate its annular flange in a gyratory movement.

2. In a mechanism of the class described, a casing comprising an interior annular cylinder-chamber having an end wall forming its closed side and an outer and inner annular wall and divided by a fixed partition or head extending across the width of the chamber, a piston comprising a plate or head closing the open side of said cylinder-chamber and having projecting from its inner face an annular flange provided with a recess receiving said partition or head, inlet and outlet ports entering said cylinder-chamber respectively at opposite sides of said partition or head, a rotary shaft extending transversely of said casing and axially with relation to the annulus of the cylinder-chamber and having a bearing in the end wall thereof, a cheek-plate closing the side of the casing opposite said end wall and forming a bearing for the plate or head of the piston, said shaft also having a bearing in said cheek-plate and having an angular enlargement projective laterally with relation to the axis of the shaft, and a disk-piece or block having a cylindrical periphery and a recess receiving said angular enlargement and having its cylindrical periphery extending across the width plane of the cylinder between the end wall thereof and said cheek-plate, whereby said block is mounted with its cylindrical periphery eccentric to the axis of the shaft and has a bearing between said end wall and cheek-plate, said piston having a central circular bearing concentric with the piston flange and receiving said disk-piece or block and co-extensive with the periphery thereof between said end wall and cheek-plate, whereby the piston has an eccentric mounting with relation to the cylinder-chamber and co-extensive with the entire width plane thereof intermediate of the shaft bearings to operate its annular flange in a gyratory movement.

3. In a mechanism of the class described, a casing comprising an interior annular cylinder-chamber having an end wall forming its closed side and an outer and inner annular wall and divided by a fixed partition or head extending across the width of the chamber, a piston comprising a plate or head closing the open side of said cylinder-chamber and having projecting from its inner face an annular flange provided with a recess receiving said partition or head, inlet and outlet ports entering said cylinder-chamber respectively at opposite sides of said partition or head, a rotary shaft extending transversely of said casing and axially with relation to the annulus of the cylinder-chamber and having a bearing in the end wall thereof, a cheek-plate closing the side of the casing opposite said end wall and forming a bearing for the plate or head of the piston, said shaft also having a bearing in said cheek-plate and having an angular enlargement projective laterally with relation to the axis of the shaft and extending entirely across the portion of the shaft which crosses the width plane of the cylinder-chamber between the end wall thereof and the cheek-plate, and a disk-piece or block co-extensive with the length of said angular enlargement and having a cylindrical periphery and a recess receiving said angular enlargement, whereby said block is mounted with its cylindrical periphery eccentric to the axis of the shaft and said block and angular enlargement have a bearing between said end wall of the cylinder-chamber and the cheek-plate, said piston having a central circular bearing projecting inwardly from its head plate and receiving and co-extensive with the width of said disk-piece or block, whereby the piston has an eccentric mounting with relation to the cylinder-chamber and co-extensive with the entire width plane thereof intermediate of the shaft bearings to operate its annular flange in a gyratory movement.

4. In a mechanism of the class described, a casing comprising an interior annular cylinder-chamber having an end wall forming its closed side and an outer and inner annular wall and divided by a fixed partition or head extending across the width of the chamber, a piston comprising a plate or head closing the open side of said cylinder-chamber and having projecting from its inner face an annular flange provided with a recess receiving said partition or head, inlet and outlet ports entering said cylinder-chamber respectively and directly at opposite sides of said partition or head and co-extensive with the width of the cylinder-chamber, a rotary shaft extending transversely of said casing and axially with relation to the annulus of the cylinder-chamber and having a bearing in the end wall thereof, said shaft having an angular enlargement projective laterally with relation to the axis of the shaft and extending across the portion of the shaft which crosses the width plane of the cylinder-chamber, a disk-piece or block co-extensive with the length of said angular enlargement and bearing against the end wall of the cylinder chamber and having a cylindrical periphery and a recess slidably receiving said angular enlargement, whereby said block is removably mounted with its cylindrical periphery eccentric to the axis of the shaft, said piston having a central circular bearing projecting inwardly and extended from a cylindrical perforation in the head-plate of the piston and receiving and co-extensive with the width of said disk-piece or block, whereby the piston has an eccentric mounting with relation to the cylinder-chamber to operate its annular flange in a gyratory movement therein, and a removable side wall oppositely located with relation to said end wall of the casing and constituting a cheek-plate at the outer side of the head-plate of the piston and forming a bearing therefor and for the end of said disk-piece or block and for the shaft.

5. In a mechanism of the class described, a casing comprising an end wall forming the closed side of an annular cylinder-chamber and a side wall forming the outer annular wall of said chamber and an interior wall forming the inner annular wall of said chamber and a fixed partition or head dividing said annular cylinder-chamber, a piston comprising a plate or head closing the open side of said cylinder-chamber and having projecting from its inner face an annular flange provided with a recess receiving said partition or head, an inlet port provided in the end wall of said casing at one side of said partition or head and immediately adjacent thereto, an outlet port provided in the end wall of said casing at the opposite side of said partition or head and immediately adjacent thereto, said ports extending substantially across the complete width area of the cylinder-chamber between its outer and inner annular walls and at right angles to said piston-flange, a rotary shaft extending transversely of said casing and axially with relation to the annulus of the cylinder-chamber and having a bearing in the end wall thereof, said shaft having an angular enlargement projective laterally with relation to the axis of the shaft, a disk-piece or block having a cylindrical periphery and a recess slidably receiving said angular enlargement, whereby said block is mounted with its cylindrical periphery eccentric to the axis of the shaft, said piston having a central circular bearing projecting inwardly from its head plate and receiving said disk-piece or block, whereby the piston

has an eccentric mounting with relation to the cylinder-chamber to operate its annular flange in a gyratory movement therein, and a side wall oppositely located with relation to said end wall of the casing and constituting a cheek-plate at the outer side of the head-plate of the piston, said cheek-plate forming a bearing for the head-plate of the piston and the disk-piece or block and also for the shaft.

In testimony whereof I have signed the foregoing specifications.

FRANCIS D. TICE.