C. L. AND L. F. RAGOT.

ROTARY ENGINE.

APPLICATION FILED SEPT. 13, 1918.

1,302,709.

Patented May 6, 1919.

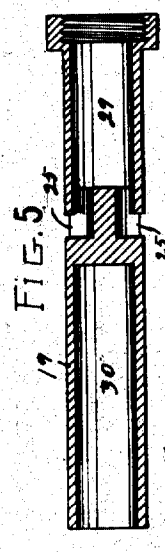


Fig. 5

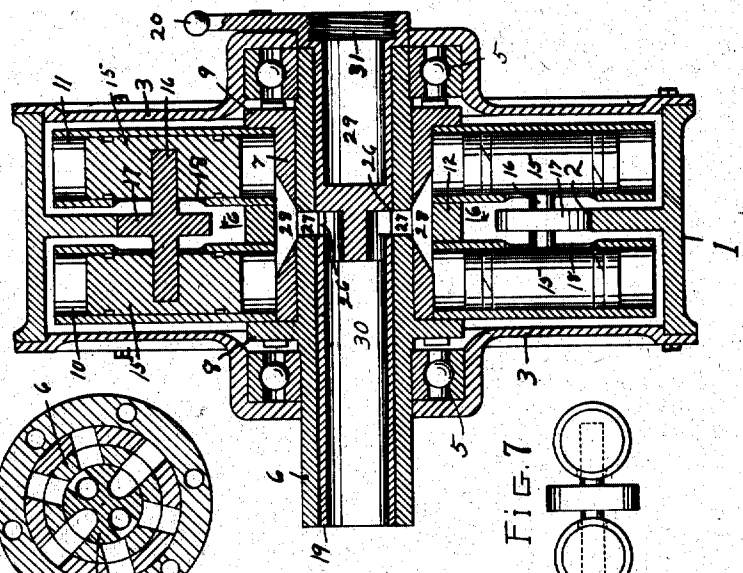


Fig. 2

Fig. 6

Fig. 7

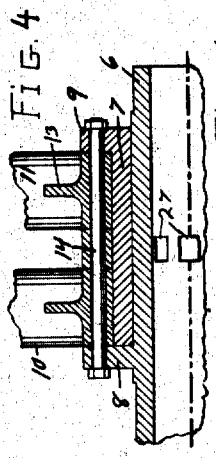


Fig. 4

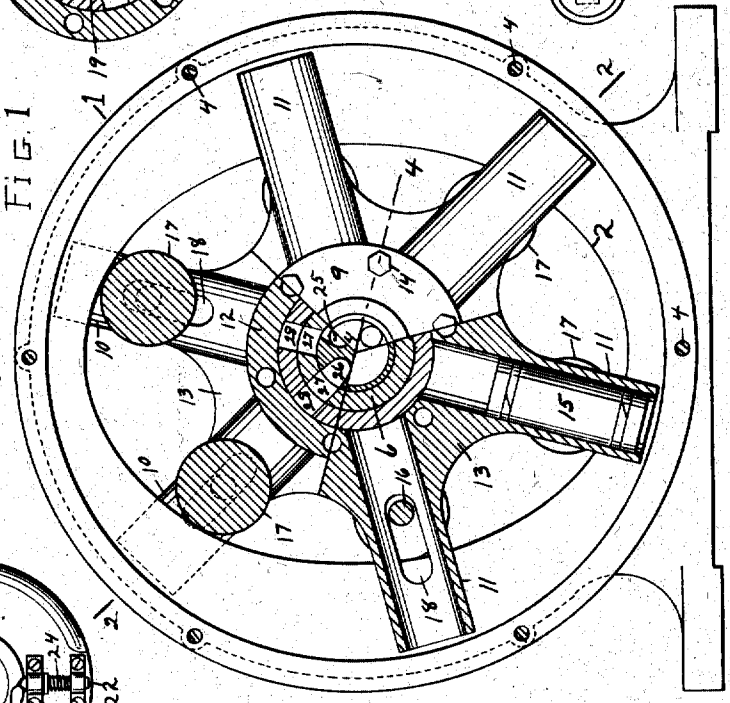


Fig. 1

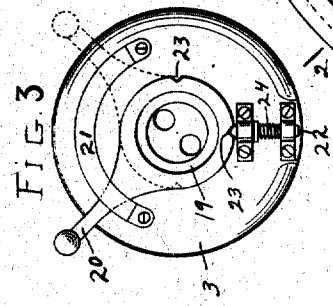


Fig. 3

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ROTARY ENGINE.

1,302,709. Specification of Letters Patent. Patented May 6, 1919.

Application filed September 13, 1918. Serial No. 253,856.

To all whom it may concern:

Be it known that we, CHARLES L. RAGOT, a citizen of the United States, and a resident of Keyport, in the county of Monmouth and State of New Jersey, and LOUIS F. RAGOT, also a citizen of the United States, and a resident of Milford, in the county of Pike and State of Pennsylvania, have invented certain new and useful Improvements in Rotary Engines, of which the following is a specification.

Our invention relates to engines operated by fluid pressure and of that type in which there are a plurality of radially disposed cylinders, rotatably mounted in respect to a stationary track annular in form (preferably elliptical) and in the same plane, the pistons receiving their pressure or motive impulses to force them against and along said track. In an engine of this type, power is obtained by utilizing the reaction caused by the side pressure of the piston against the cylinder walls resulting from the piston being caused to exert a radial pressure against the elliptical track at a point where said track recedes from the center. The resulting tangential pressure is translated into a rotary one by the bodily movement of the cylinders around the central axis. An engine of this type is disclosed in our prior Patent 1,088,623 issued February 24th, 1914.

So far as certain broad features of our present invention are concerned, any motive fluid may be employed, as for instance, a combustible gas, steam, compressed air, or water or other liquid or gas under pressure. Also the mechanism may be positively rotated from an outside source of power and used as a pump or compressor for liquids or gases.

Other features of our invention particularly adapt it for use as a steam or compressed air engine. The axis of the rotor being concentric with the elliptical track, it will be readily understood that four strokes of each piston are obtained in each revolution, thereby permitting opposed cylinders to perform the same part of the cycle at the same time.

One of the main objects of our invention is to provide an improved mechanical construction whereby the maximum amount of power and service is obtainable in a minimum amount of space and weight and a minimum number of simple, easily and inexpensively manufactured parts. In order to accomplish this we provide two sets of radially disposed cylinders, the cylinders of one set being disposed adjacent to and parallel with the corresponding cylinders of the other set. The two pistons of each pair of cylinders are connected intermediate of their ends to an interposed roller for engagement with the elliptical track. This permits the use of a smaller track and larger rollers with a corresponding decrease in the number of revolutions of the roller and balanced lateral pressure of each piston in its cylinder. By placing the axis of the roller opposite the center of the length of the piston, the side pressure is distributed throughout the length of the piston and binding effects prevented The number of rollers compared to the number of cylinders is reduced.

A further object of our invention is to provide positive means for distributing the motive fluid to the various cylinders in their consecutive order and at the proper time, and thereby causing the two pistons of each pair to receive their power impulses simultaneously with the pistons of the opposed pair thereby insuring a perfect running balance, said means also affecting the exhaust in a corresponding manner.

A further object of our invention is to provide improved means whereby the reversal of the direction of rotation of the engine is efficiently, easily, and quickly accomplished.

In the accompanying drawings we have illustrated one embodiment of our invention but we wish it understood that this is to be considered in an illustrative rather than in a limiting sense as various details of construction may be varied within wide limits without departing from the spirit or scope of our invention as defined in the appended claims.

In these drawings:

Figure 1 is a transverse elevation of the rotary engine with housings removed showing the rotor in place, different parts being in section on different planes.

Fig. 2 is a sectional longitudinal view on line 2—2 of Fig. 1.

Fig. 3 is an end elevation of the central portion of intake end of the engine showing one form of reversing mechanism.

Fig. 4 is a sectional view of rotor on line 4—4 of Fig. 1.

Fig. 5 is a longitudinal section of the distributer at 90° from the section shown in Fig. 2.

Fig. 6 is a sectional view through center of rotor on line 6—6 of Fig. 2.

Fig. 7 is an end view of a pair of cylinders with their pistons and roller in place.

In the form illustrated there is provided a stator frame 1 of any desired form but preferably circular and having any suitable form of base or fastening members for mounting the same. This is provided with an elliptical track 2 which may be attached to or integral with the stator frame intermediate of the opposite ends of the latter. The opposite ends may be closed with circular end plates or housings 3 if desired, although these may be of skeleton form and serve merely to connect the stator and its elliptical frame with the bearings of the rotating parts. These end plates are illustrated as having shoulders seated within the frame 1 and rigidly secured to the latter by bolts 4. The end plates at their centers carry anti-friction bearings 5 within which a sleeve 6 rotates. Around this sleeve is mounted another sleeve 7. These sleeves have each a flange member 8 and 9 Fig. 4 between which two sets of radially disposed cylinders 10 and 11 and spacing collar 12 are rigidly secured. The cylinders of each set are illustrated as being held together at their bases by an annular member 13, there being the same even number of cylinders in each set, these being here illustrated as six in number. Fig. 4 shows flange members 8 and 9, spacing collar 12, and annular members 13 of the two sets of cylinders 10 and 11, rigidly held together by bolts 14, the whole constituting the body of the rotor.

The cylinders of the two sets are arranged in pairs, the two cylinders of each pair being parallel and spaced apart by the collar 12 mounted on the sleeve 7. Within each cylinder is mounted a piston 15 and the two pistons of each pair are connected by some suitable form of spindle 16 for supporting a roller 17. The spindles extend through longitudinal slots 18 in the cylinder walls. These rollers are shown as being rigid or integral with their corresponding spindles and the spindles are mounted in bearings fashioned into the pistons but various other means for connecting each roller to its pair of pistons might be employed, as for instance, the spindles might be rigid with the pistons and the rollers have anti-friction bearings on the spindles.

The cylinders are of such length in respect to the size of the elliptical track 2 that they project outwardly beyond the track upon oposite sides of the latter. In other words, the track extends inwardly between the two sets of cylinders and there engages with the several rollers and provides a continuous path for the latter whereby they are guided in and out and effect four strokes of each piston during each revolution of the engine. Although mechanical means might be employed for maintaining the rollers in contact with the track, in practice, such mechanism may be omitted as the pressure behind the pistons and the action of centrifugal force on them will maintain them in proper engagement with the track when the engine is running.

For distributing the motive fluid to and from the various cylinders, we provide a distributer 19 within the sleeve 6 and adapted to be normally held against rotation with the latter. This distributer is shown in the form of a tube or sleeve provided at one end with a radially extending arm or lever 20, Fig. 3. This may be retained by any suitable means, as for instance, by a strap 21 fastened against one of the end plates or housings 3. A pin 22, normally pressed into notches 23 by the spring 24, prevents the free rotation of the distributer but permits of an oscillation through 90° to effect the reversals of rotation of the engine when desired. The distributer has a pair of inlet ports 25 and a pair of outlet ports 26 in the same transverse plane with a series of radially extending passages 27 in the sleeves 6 and 7. These last mentioned passages correspond in number to the number of pairs of cylinders and each passage is disposed between the two cylinders of each pair and has a flared opening 28 communicating with its corresponding cylinders at their inner or base ends. The distributer has its opposite end portions constituting supply and exhaust passages 29 and 30, the former being connected to inlet ports 25 and the latter to the outlet ports 26. The supply passage 29 may be connected in any suitable manner to a source of motive fluid. This is shown at 31 as being internally threaded to receive a supply pipe. The ports 25 and 26 as well as the registering passages 27 may be of any suitable size or shape depending upon the character of the motive fluid and the portion of the stroke during which it is desired to admit motive fluid. The ports also have a predetermined relationship to the pin 22 and the notches 23 so that they may be located halfway between inner and outer dead center represented by the ends of the minor and major axes of the ellipse. The 90° rotation of the distributer will carry each of the ports 25 and 26 to an equal distance on the opposite side of the adjacent dead center point for reverse rotation.

In the drawings we have made no attempt to illustrate details of packings, pipe connections, oiling systems, throttle, or various other details desirable or essential in connection with a complete machine as they may be provided according to the size and pro-

portion of the parts, the contemplated speed of rotation, and the character of the motive fluid to be employed. Such details form no portion of our present invention.

It is thought that the operation of the engine will be clear from the foregoing description, although briefly, such operation is as follows:

Assuming that the distributer 19 is in the position illustrated in Fig. 3, that is, with the lever 20 in the position shown in full lines, the motor is set to rotate in an anti-clockwise direction. If motive fluid is admitted through the supply passage 29 it will pass in equal quantities through the branch passages 31 and inlet ports 25 and opposed radial passages 27 to two of the opposed pairs of cylinders and exert a pressure against the pistons therein. With the axis of the elliptical track vertical and with the ports 25 facing in opposite directions at an angle of 45° to the horizontal, the ports 25 will come into registry with two opposed passages 27 the instant the cylinders pass the horizontal or minor axis of the ellipse and will come out of registry at the instant the cylinders reach the vertical or major axis. Thus pressure is exerted continuously through one quarter of the revolution. During the next quarter these two opposed passages 27 will come into registry with the exhaust ports 26 and the pistons will be free to move inwardly and clear the cylinders of the expended motive fluid during the next successive one quarter revolution. Thus during each complete rotation of each opposed pair of cylinders about the axis of the rotor, pressure is directed to give two opposed power strokes to the pistons. It will be noted that during each power stroke the leverage tending to rotate the cylinders by the pressure of the rollers on the elliptical track, will increase throughout the entire stroke. By rotating the distributer through 90° and bringing it to the position shown by the dotted lines in Fig. 3, the pressure will be applied to the pistons during the other two quarters of the elliptical track and reverse rotation will be secured. As previously indicated, the relative widths of the ports 25 and 26 and the passages 27 may be varied to apply motive fluid to the pistons during less than the complete stroke or beginning and ending at different points in the cycle.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is:

1. In combination, a pair of parallel cylinders extending radially from and axially spaced along an axis of rotation, pistons therein, connections between said pistons intermediate of their ends, and a non-circular pathway encircling said axis and engaging with said connections for effecting a reciprocation of said pistons during a relative rotation of said cylinders and said pathway about said axis of rotation.

2. In combination, an annular stator casing presenting a single inwardly facing elliptical track, a sleeve rotatable within said stator, bearings for said sleeve rigidly connected to the opposite ends of said annular casing, two sets of radially disposed cylinders within said casing at opposite sides of said track and secured to said sleeve, pistons within said cylinders, each of said cylinders having a slot in the side thereof, and each of said pistons having means projecting through the slot of its cylinder for engaging with said track.

3. In combination, an even number of pairs of parallel cylinders radially extending from an axis of rotation, the cylinders of each pair being spaced axially along said axis, each pair being caused to perform the same cycle of operation simultaneously with the pair diametrically opposed to it, pistons within said cylinders, spindles connecting the pistons of each pair intermediate of their ends, a roller on each spindle, an elliptical track between said pairs of cylinders and engaging with said roller as said cylinders rotate about said axis.

4. In combination, two sets of cylinders, all of said cylinders extending radially in respect to the same axis of rotation, the cylinders of one set being spaced axially along said axis from those of the other set, the cylinders of the two sets arranged in parallel pairs, pistons within said cylinders, rigid connections between the two pistons of each pair intermediate of their ends, and a non-circular pathway encircling said axis of rotation between the two sets of cylinders and engaging with said connections.

5. In combination, a plurality of pairs of parallel cylinders extending radially from and equally spaced around an axis of rotation, the two cylinders of each pair being spaced apart axially along said axis, pistons within said cylinders, connections between the pistons of each pair, and an elliptical pathway encircling said axis between the cylinders of each pair and having the extremities of its major axis between the outer ends of said cylinders and said axis, and engaging said connections to effect a reciprocation of said pistons during a relative rotation of said cylinders and said pathway about said axis of rotation.

6. A rotary engine including an annular stator casing, presenting a single inwardly facing elliptical track, a rotatable sleeve concentric therewith, two sets of radially disposed cylinders carried by the sleeve, the cylinders of the two sets being arranged in pairs upon opposite sides of said elliptical track, each of said cylinders having a slot in the side thereof, pistons within said cylin-

ders, spindles extending through said slots and connecting the pistons together in pairs, a roller on each spindle for engagement with said track, a normally stationary tubular member extending through said sleeve and having one end thereof constituting a supply passage and the opposite end constituting an exhaust passage, an annular series of ports in the same transverse plane, each alternate port communicating with said supply passage and the remaining portion communicating with said exhaust passage, and an annular series of passages in said sleeve adapted to register with said first mentioned ports during the rotation of said sleeve, each of said passages communicating with both of the cylinders of the corresponding pair at the inner end thereof, and means for oscillating said tubular member through a limited distance to bring each supply port thereof to either side of the minor axis of said elliptical track.

7. A rotary engine including an annular stator casing, presenting an elliptical track, a rotatable sleeve concentric therewith, radially disposed cylinders carried by the sleeve alongside of but in a separate transverse plane from said track, each of said cylinders having a longitudinal slot in the side thereof toward said track, pistons within said cylinders, spindles extending through said slots from said pistons, rollers on said spindles for engagement with said track, a normally stationary member extending through said sleeve and having supply and exhaust passages and an annular series of ports in the same transverse plane, each alternate port communicating with the supply and the remaining ports communicating with the exhaust passages, and said sleeve having an annular series of passages adapted to register with said ports during the rotation of said sleeve, whereby said supply and exhaust passages communicate with the cylinders of the diametrically opposite pair simultaneously.

Signed at New York, in the county of New York and State of New York, this 12th day of September, A. D. 1918.

CHAS. L. RAGOT.
LOUIS F. RAGOT.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."