E. HARTIG & C. A. LADWIG.

ROTARY MOTOR.

APPLICATION FILED NOV. 29, 1911.

**1,047,518.**

Patented Dec. 17, 1912.

4 SHEETS—SHEET 1.

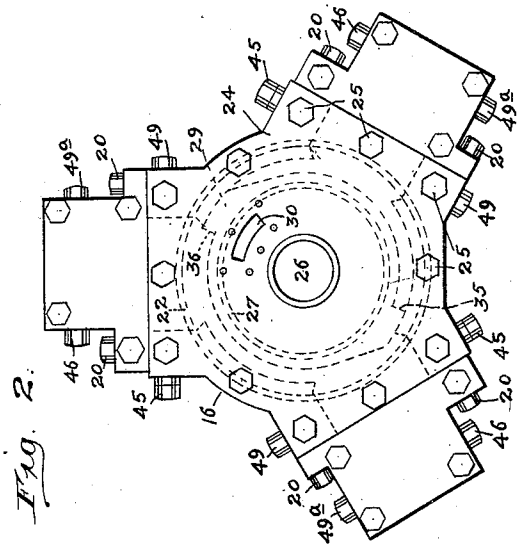

Fig. 2.

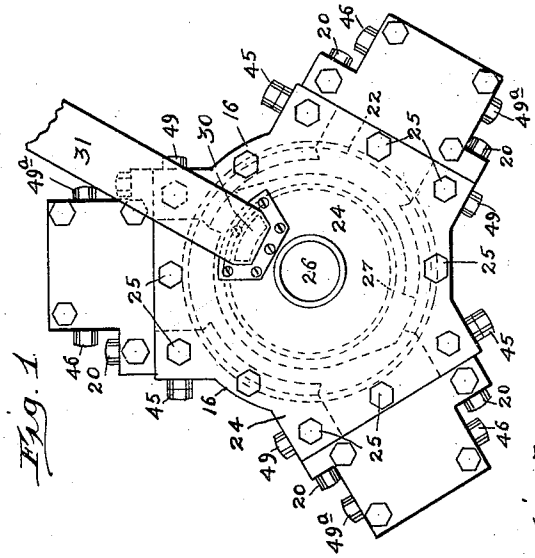

Fig. 1.

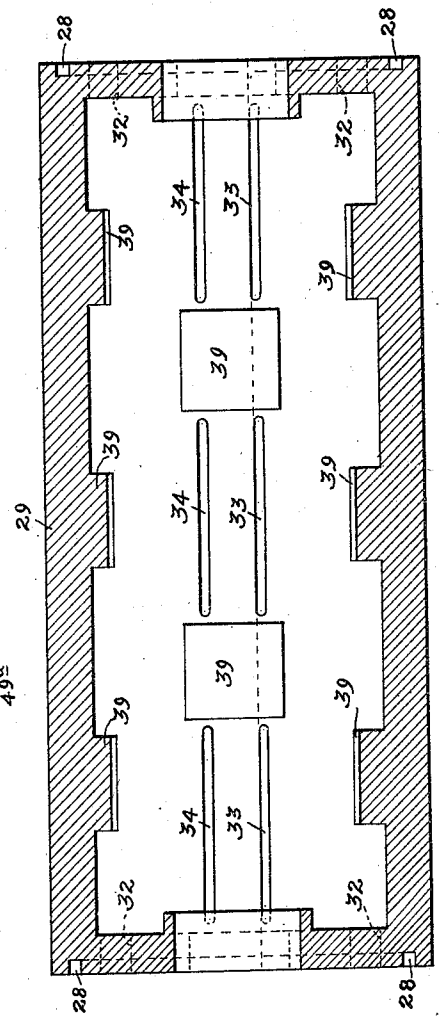

Fig. 3.

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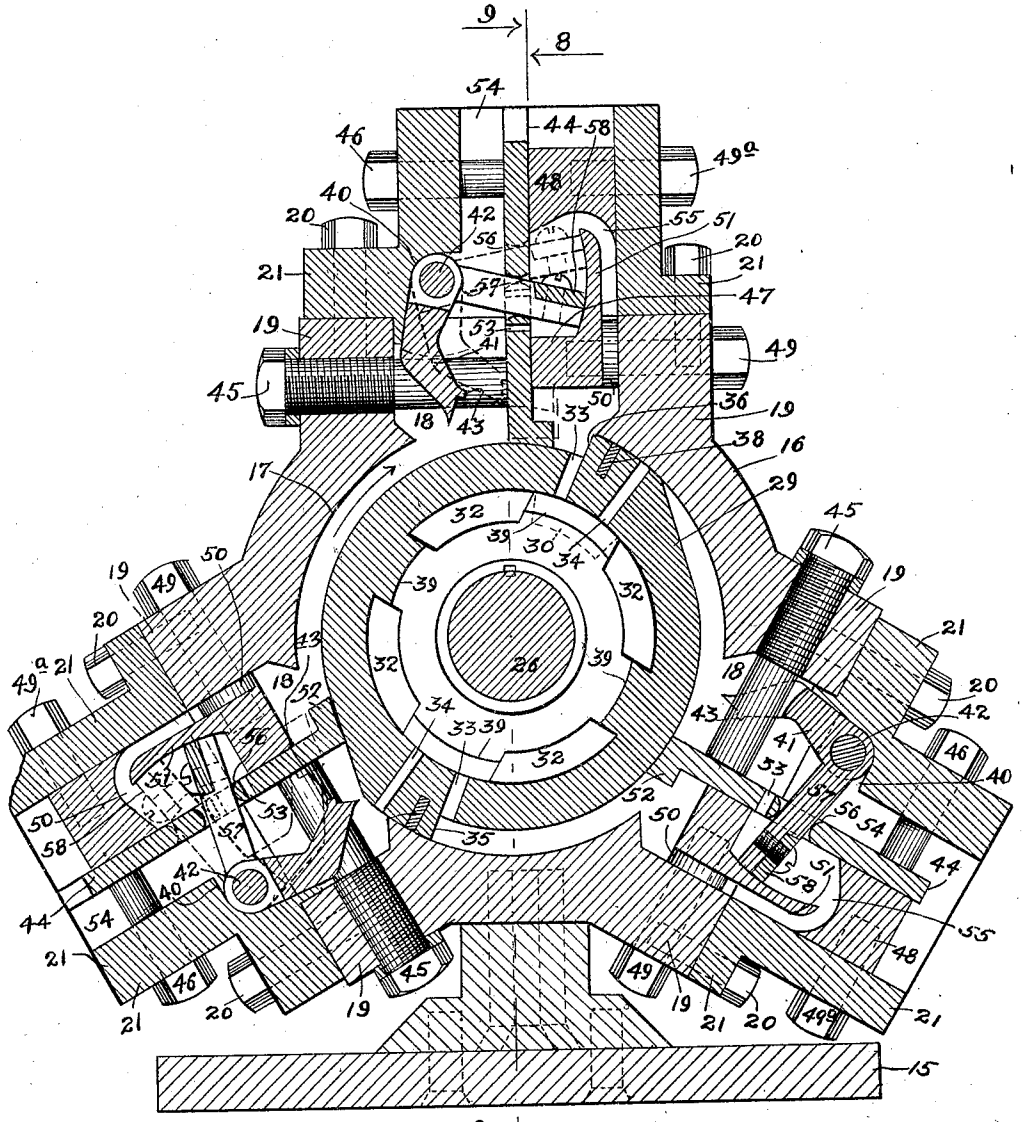
Fig. 4.

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4 SHEETS—SHEET 3.

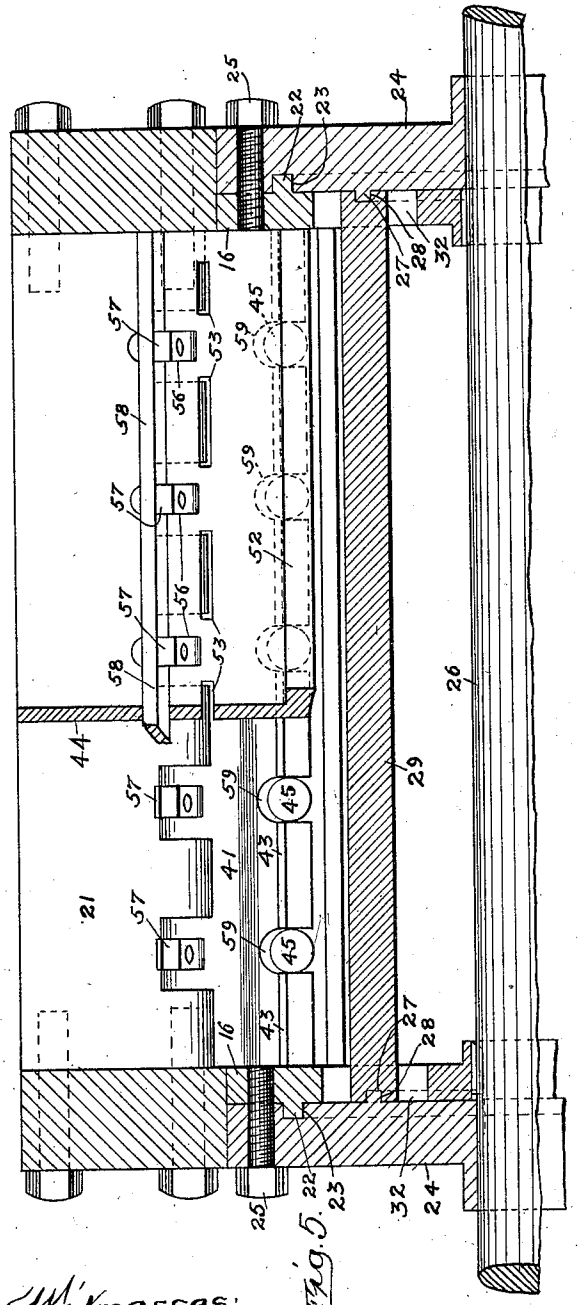

Fig. 5.

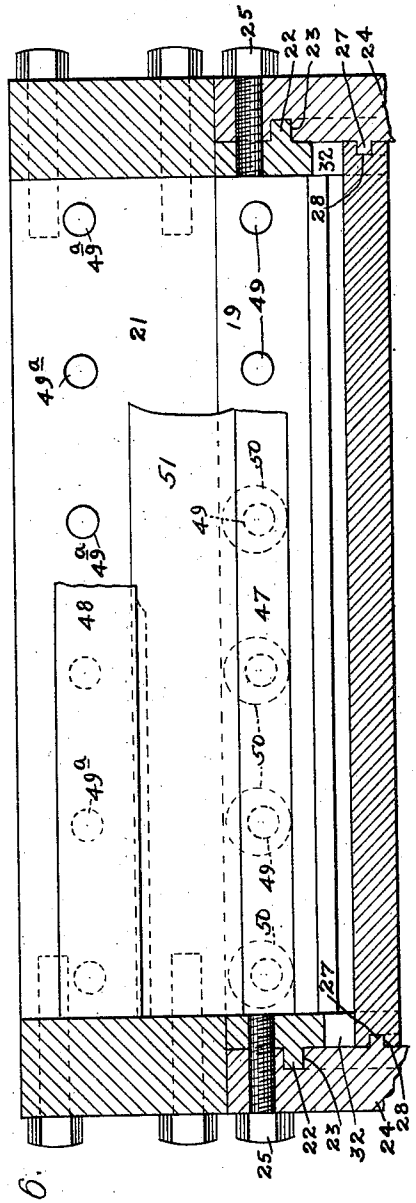

Fig. 6.

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4 SHEETS—SHEET 4.

Fig. 8.

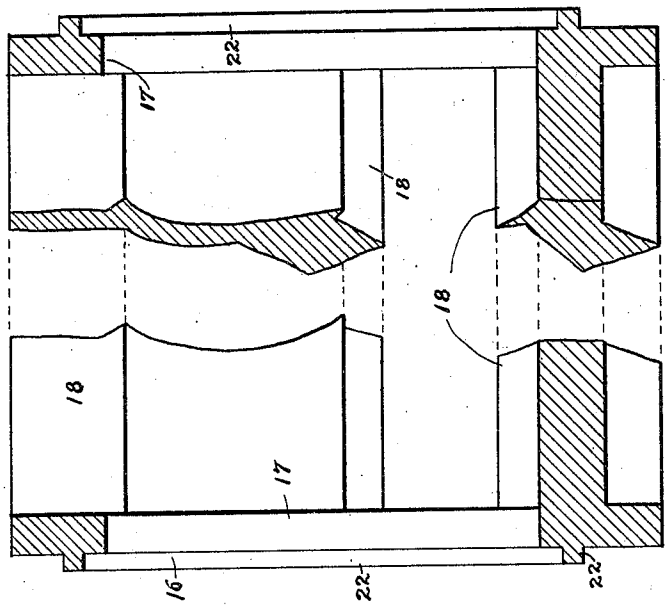
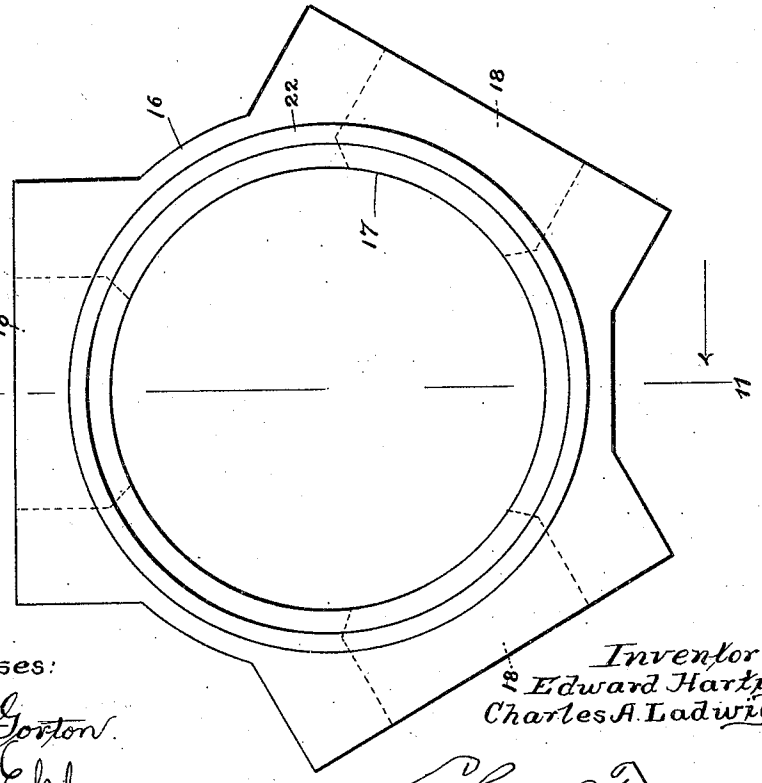



Fig. 7.

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# UNITED STATES PATENT OFFICE.

EDWARD HARTIG AND CHARLES A. LADWIG, OF CHICAGO, ILLINOIS.

## ROTARY MOTOR.

1,047,518. Specification of Letters Patent. Patented Dec. 17, 1912.

Application filed November 29, 1911. Serial No. 663,065.

*To all whom it may concern:*

Be it known that we, EDWARD HARTIG and CHARLES A. LADWIG, citizens of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Rotary Motors, of which the following is a specification.

This invention relates to improvements in a rotary motor to be used for various purposes and of a type in which any suitable motive fluid, such as steam, compressed air, or gas, may be employed for operating the same, and it consists in certain peculiarities of the construction, novel arrangement, and operation of the various parts thereof, as will be hereinafter more fully set forth and specifically claimed.

The principal object of the invention is to provide a rotary motor, which shall be simple and inexpensive in construction, compact in form, strong, durable, powerful, and efficient in operation, and so made as to overcome dead centers in its operation.

Other objects and advantages of the invention will be disclosed in the subjoined description and explanation.

In order to enable others skilled in the art to which the invention pertains to make and use the same we will now proceed to describe it referring to the accompanying drawings in which—

Figure 1 is an end view of a motor embodying the invention. Fig. 2 is a similar view thereof with the supply pipe for the motive fluid omitted. Fig. 3 is a longitudinal sectional view of the rotor taken on line 3—3, of Fig. 5, looking in the direction indicated by the arrows. Fig. 4 is a cross sectional view through the rotor and cylinder or casing therefor showing the valve-chests in the latter and the means for operating the valves. Fig. 5 is a longitudinal sectional view through the upper portion of the machine taken on line 8—8, of Fig. 4, looking in the direction indicated by the arrows, and Fig. 6 is a similar view taken on line 9—9, of Fig. 4, of the upper part of the machine. Fig. 7 is an end view of the casing or cylinder for the rotor, and Fig. 8 is a longitudinal sectional view thereof, showing it shortened for the convenience of illustration, and taken on line 11—11, of Fig. 7.

Like numerals of reference refer to corresponding parts throughout the different views of the drawings.

The reference numeral 15, designates a base on which the cylinder or casing for the rotor may be mounted, which base may be of the ordinary or any preferred construction. The cylinder or rotor-casing is designated as a whole by the reference numeral 16, and has a cylindrical opening 17, extended longitudinally therein from one of its ends to the other, from which opening lead a plurality, in the present instance, three openings 18, which are located at equal distances apart, and also extend longitudinally with respect to the cylinder 16, but terminate inwardly a slight distance from each of its ends. On each side of each of the openings 18, the cylinder 16, is provided with an outwardly extended flange 19, which are located in parallelism with one another and each has secured on its outer surface by means of bolts 20, an angle iron 21, which together with the flanges 19, form the sides of the valve-chests which communicate through the openings 18, with the interior of the cylinder or rotor casing 16. Each end of the cylinder 16, is provided on its outer surface with an annular rib 22, which are fitted in similarly shaped grooves 23, formed on the inner surface of the heads 24, of the cylinder, which heads are secured to the latter by means of bolts 25, and have centrally journaled therein the power or driven shaft 26, of the motor. Each of the heads 24, of the cylinder, is provided on its inner surface and inwardly of the groove 23, with an annular rib 27, which fit in annular grooves 28, in the end of the rotor 29, which is hollow and mounted on the shaft 26, within the cylinder casing 16, so as to rotate with said shaft. Each of the heads 24, of the cylinder or rotor casing, is provided with an inlet port 30, see Figs. 1, and 2, of the drawings, which have communication through supply pipes 31, with a source of motive fluid (not shown) and said inlet ports 30, are also adapted to communicate intermittently with the cavity of the rotor 29, through ports 32, formed in each end of the rotor as will be clearly understood by reference to Figs. 3, 4, and 5, of the drawings. As shown in Figs. 3 and 4, of the drawings, the rotor 29, is provided with a series of longitudinally disposed ports 33, and 34, arranged in pairs and in parallelism

with each other and so that the ports 33, will be diametrically opposite each other while the ports 34, will occupy the same position with respect to one another. The rotor 29, has a cam-shaped periphery or outer surface, that is to say, it is provided at points diametrically opposite each other with abutments or enlargements 35, and 36, against the abrupt walls of which the pressure of the motive fluid will act. These enlargements or abutments 35, and 36, extend the entire length of the rotor and are gradually reduced as at 37, in corresponding directions as is clearly shown in Fig. 4, of the drawings, in which view, it will be seen that the rotor is of such size that the outer surfaces of its enlarged portions 35, and 36, will fit closely to the inner surface of the cylinder 16, yet in such a manner as to permit the rotor to turn therein. To make the juncture between the enlargements 35, and 36, of the rotor and the inner surface of the cylinder more tight, the said enlargements are provided with suitable packing strips 38, which are embedded therein. The ports 33, in the rotor 29, are preferably located at the abutments or abrupt walls of the enlargements 35, and 36, while the ports 34, are extended through said enlargements. For the purpose of strengthening the same the rotor 29, is provided on its inner surface with a series of thickened portions 39, some of which are located between the adjacent ends of the pairs of ports 33, and 34, as will be readily understood by reference to Fig. 3, of the drawings.

Each of the angle iron pieces 21, forming a portion of one of the side walls of each of the valve-chests is provided on its inner portion with a cutaway part 40, for the reception and operation of the outer portion of a leaf valve 41, with which each of the valve-chests is equipped, which valve is mounted on a pivot rod 42, journaled in the ends of the valve-chest. Each of the leaf valves 41, is of sufficient length to extend from one end of its valve-chest to the other and has its lower portion deflected from the wall of the valve chest on which it is mounted. The deflected end of each of the valves 41, is provided with a projection or rib 43, to contact with a sliding throttle valve 44, one of which is longitudinally located in each of the valve-chests between and in parallelism with the side walls thereof. These sliding throttle valves 44, are held for inward and outward movement by means of guide bolts 45, and 46, extended through the flanges 19, and angle iron pieces 21, on one side of each of the valve-chests and by means of guide plates or bars 47, and 48, which are located on the inner surfaces of the flanges 19, and angle iron pieces 21, on the opposite side of each of the valve-chests from the guide bolts 45, and 46. Each of the guide plates or bars 47, is secured to the inner surface of the flange 19, on the opposite side of the valve-chest from that on which the leaf valve is mounted by means of bolts 49, extended through suitable openings in said flange, which bolts are each surrounded between the inner surface of said flange and the outer surface of the bar 47, with a boss 50, which serve to hold the bar 47, at a distance from the said flange so as to form spaces between the boss 50, through which the motive fluid may pass. Each of the guide bars 47, is provided with an outwardly extended flange 51, which extends to near the inner surface of the guide bar 48, but terminates at a slight distance therefrom to afford a passageway for the motive fluid. The inner surface of each of the flanges 51, which flanges are co-extensive with their respective bars 47, and with their valve-chests, has its surface adjacent to the valve 44, curved, as shown. Each of the sliding valves 44, is provided on its inner edge with a foot flange 52, to rest against the rotor when said valve occupies its inmost position and to contact with the bar 47, when the valve is in its outermost position. Each of the valves 44, is also provided with a series of ports 53, to afford communication between the main exhaust ports or outlets 54, and the auxiliary exhaust chambers 55, with which each of the valve-chests is provided. Each of the valves 44, is also provided with a series of openings 56, through which are extended stems 57, for operating the sliding valves 44. It will be understood that each of the leaf valves 41, is provided with a series of stems 57, which are formed integrally with said leaf valves or connected thereto in such a manner as to move in unison with said valves, and it will also be understood that the stems 57, are projected from their respective valves 41, at angles thereto thus forming out of each valve 41, and its stems a series of bell crank levers, the stems forming one arm of each and as they are passed through the openings 56, in the valves 44, they will serve to raise and lower the same when the valves 41, are actuated by the motive fluid. Located on the upper surface of the stems 57, of each of the valves, and at their free ends is a bar 58, which extends the entire length of the valve-chest and as shown, closes the space between the valve 44, and the flange 51. The lower edge or deflected portion of each of the leaf valves 41, is provided with a series of recesses 59, to receive the guide bolts 45, when said valve occupies its inmost position.

From the foregoing and by reference to the drawings, it will be readily seen and clearly understood that steam or motive fluid, is supplied to the cylinder or rotor-casing 16, by means of the supply pipes 31,

through the inlet ports 30, in the heads of the cylinder. From the inlet ports 30, steam or motive fluid will pass into the rotor 29, through the ports 32, at each end thereof and will pass out of the rotor and into the space between the latter and the cylinder through the ports 33, and 34, of the rotor in which operation it is evident that the same will be caused to turn and to rotate therewith the shaft 26, by reason of the action of the steam or motive power against the abrupt walls or abutments of the enlargements 35, and 36, in which action, assuming that the parts have reached or assumed the positions shown in Fig. 4, of the drawings, it is manifest that the sliding valve 44, in the uppermost valve-chest will have been moved to its outward limit by reason of the action of the cam surface or inclined part 37, of the enlargement 36, of the rotor, as well as, by reason of the pressure of the motive fluid on the leaf valve 41, in said chest, and held in such position by said instrumentalities until the abrupt wall of the enlargement 36, shall have passed out of contact with said valve 44, when the same and the said leaf valve 41, will be forced inwardly against the surface of the rotor, rearwardly of the abutment 36, by reason of the pressure of motive fluid discharged through the ports 33, passing between the bosses 50, in the upper valve chest and through the chamber 55, and exerting itself on the bar 58, thereby depressing the arms 57, and leaf valve 41, to about the position shown, thus allowing the fluid to exhaust through the port 54, of said upper valve chest. When the said parts are in the positions named, the parts in the valve chest of the lower left hand portion of Fig. 4, will occupy the positions shown by full lines in said figure, which parts in the revolution of the rotor, will be raised by means of the cam or inclined part 37, of the enlargement 35, and the pressure of the motive fluid on the leaf valve 41, in the last named chest, to about the positions shown by dotted lines, until the abrupt wall of the enlargement 35, shall have passed out of contact with the valve 44, in the last named chest, when the same and the said leaf valve will be forced inwardly against the surface of the rotor, rearwardly of the abutment 35, by reason of the pressure of the motive fluid discharged through the ports 33, at the abutment 35, which will act on the similar parts in said chest, to those above named, and in a like manner to that just above described.

By the above described construction and operation of the parts, it is apparent that so long as the ports 34, of the rotor are closed by the cylinder 16, the motive fluid will be confined betwen the abrupt walls of the enlargements 35, and 36, and the valves 44, at the rear of each of said walls, thus utilizing the expansive force of the motive fluid which will be supplied through the ports 33, to drive the rotor and through it to rotate the shaft on which it is mounted.

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

1. In a rotary motor, the combination with a suitably mounted cylinder having communication with a supply of motive fluid, a rotatable shaft extended longitudinally through the cylinder, a series of valve-chests on the cylinder in communication with its cavity and each having an exhaust port, a valve mounted for radial and slidable movement in each of said chests to open and close its port, and a hollow rotor mounted on said shaft within the cylinder to rotate with the shaft and having inlet ports in one of its ends and outlet ports between its ends.

2. In a rotary motor, the combination with a suitably mounted cylinder having communication with a supply of motive fluid, a rotatable shaft extended longitudinally through the cylinder, a series of valve-chests on the cylinder in communication with its cavity and each having an exhaust port, a valve mounted for radial and slidable movement in each of said chests to open and close its port, and a hollow rotor mounted on said shaft within the cylinder to rotate with the shaft and having inlet ports in one of its ends and outlet ports between its ends, the said outlet ports being arranged in diametrically disposed relation to one another.

3. In a rotary motor, the combination with a suitably mounted cylinder having communication with a supply of motive fluid at each of its ends, a rotatable shaft extended longitudinally through the cylinder, a series of valve-chests on the cylinder in communication with its cavity and each having an exhaust port, a valve mounted for radial and slidable movement in each of said chests to open and close its port, and a hollow rotor mounted on said shaft within the cylinder to rotate with the shaft and having inlet ports in each of its ends and outlet ports between its ends.

4. In a rotary motor, the combination with a suitably mounted cylinder having communication with a supply of motive fluid at each of its ends, a rotatable shaft extended longitudinally through the cylinder, a series of valve-chests on the cylinder in communication with its cavity and each having an exhaust port, a valve in each of said chests to open and close its port, and a hollow rotor mounted on said shaft within the cylinder to rotate with the shaft and having inlet ports in each of its ends and outlet ports between its ends, said outlet ports being arranged in pairs diametrically disposed in relation to one another.

5. In a rotary motor, the combination with a suitably mounted cylinder having communication with a supply of motive fluid, a rotatable shaft extended longitudinally through the cylinder, a plurality of valve-chests on the cylinder in communication with its cavity and each having an exhaust port, valve means subjected to the motive fluid pressure in each of said chests to open and close the port thereof, and a hollow rotor mounted on said shaft within the cylinder to rotate with the shaft and having inlet ports in one of its ends and outlet ports between its ends.

6. In a rotary motor, the combination with a suitably mounted cylinder having communication with a supply of motive fluid, a rotatable shaft extended longitudinally through the cylinder, a plurality of valve-chests on the cylinder in communication with its cavity and each having an exhaust port, valve means subjected to the motive fluid pressure in each of said chests to open and close the port thereof, and a hollow rotor mounted on said shaft within the cylinder to rotate with the shaft and having inlet ports in one of its ends and outlet ports between its ends, the said outlet ports being arranged in pairs disposed in diametrical relation to one another.

7. In a rotary motor, the combination with a suitably mounted cylinder having communication with a supply of motive fluid, a rotatable shaft extended longitudinally through the cylinder, a plurality of valve-chests on the cylinder in communication with its cavity and each having an exhaust port, a sliding valve mounted in each of said chests, a leaf valve pivotally mounted at one of its edges within each of said chests and having its inner portion deflected toward the sliding valve of said chest, one or more stems mounted at one of their ends to be moved in unison with and by the leaf valve and extended through the sliding valve and a hollow rotor mounted on said shaft within the cylinder to rotate with the shaft and having inlet ports in one of its ends and outlet ports between its ends, the said outlet ports being arranged in diametrically disposed relation to one another.

8. In a rotary motor, the combination with a suitably mounted cylinder having communication with a supply of motive fluid, of a rotatable shaft extended longitudinally through the cylinder, a plurality of valve-chests on the cylinder in communication with its cavity and each having an exhaust port, a valve mounted in each of said chests to slide inwardly and outwardly, a leaf valve pivotally mounted at one of its edges within each of said chests at one side of the slidable valve and having its inner portion deflected toward said valve, a plurality of stems mounted at one of their ends to be moved in unison with and by the leaf valve and extended through the sliding valve, a bar secured on the upper portions of said stems at their free ends, a guide plate located in each of the valve-chests on the opposite side of the slidable valve from the leaf valve and having an outwardly extended flange to contact with the free ends of said stems and spaced from the adjacent wall of the valve, and a hollow rotor mounted on said shaft within the cylinder to rotate with the shaft and having inlet ports in one of its ends and outlet ports between its ends.

9. In a rotary motor, the combination with a suitably mounted cylinder having communication with a supply of motive fluid, of a rotatable shaft extended longitudinally through the cylinder, a plurality of valve-chests on the cylinder in communication with its cavity and each having an exhaust port, a valve mounted in each of said chests to slide inwardly and outwardly, a leaf valve pivotally mounted at one of its edges within each of said chests at one side of the slidable valve, a plurality of stems mounted at one of their ends to be moved in unison with and by the leaf valve and extended through the sliding valve of each chest, a bar secured on the outer portions of said stems at their free ends, a guide plate located in each of the valve chests on the opposite side of the slidable valve from the leaf valve and having an outwardly extended flange to contact with the free ends of said stems and spaced from the adjacent wall of the valve, and a hollow circular rotor mounted on said shaft within the cylinder to rotate with the shaft and having inlet ports to communicate with the supply ports of the cylinder and outlet ports between its ends, said rotor having diametrically disposed cam faced enlargements on its outer surface.

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