No. 710,510. Patented Oct. 7, 1902.

P. PHILIPPON & M. CHEVALIER.

ROTARY MOTOR.

(Application filed Mar. 21, 1902.)

(No Model.) 4 Sheets—Sheet 1.

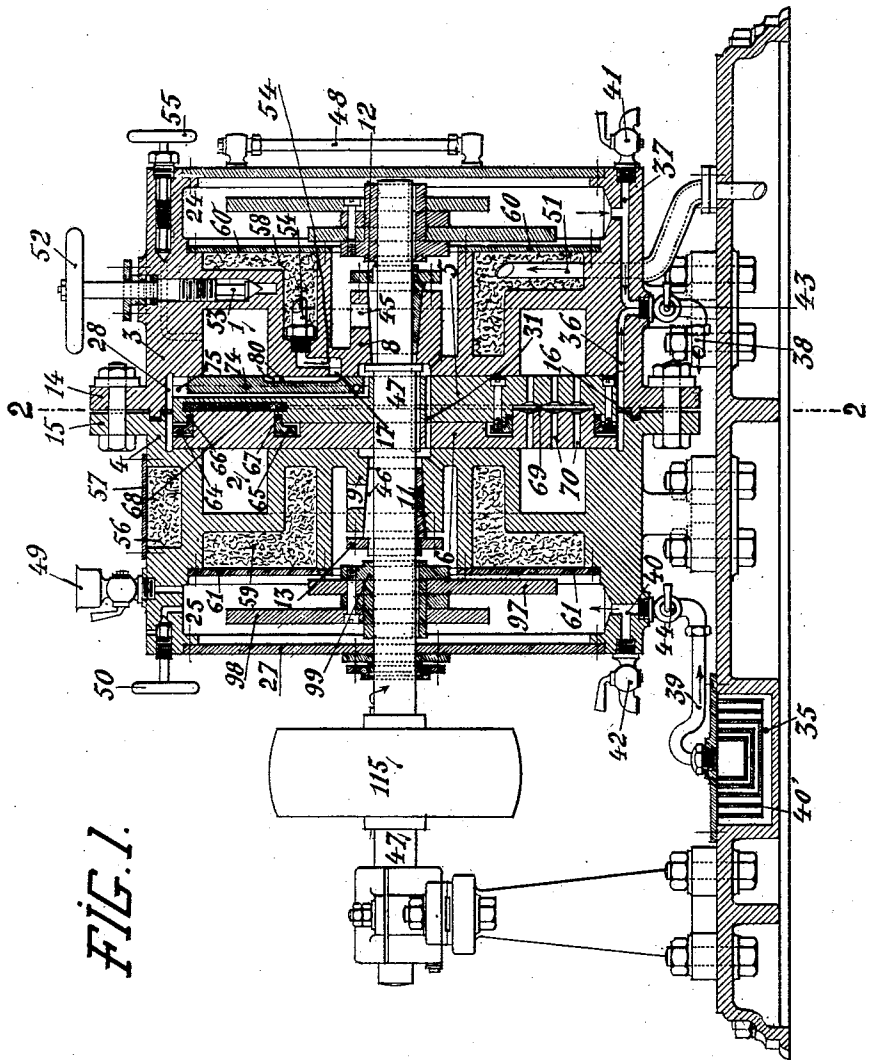

FIG. 1.

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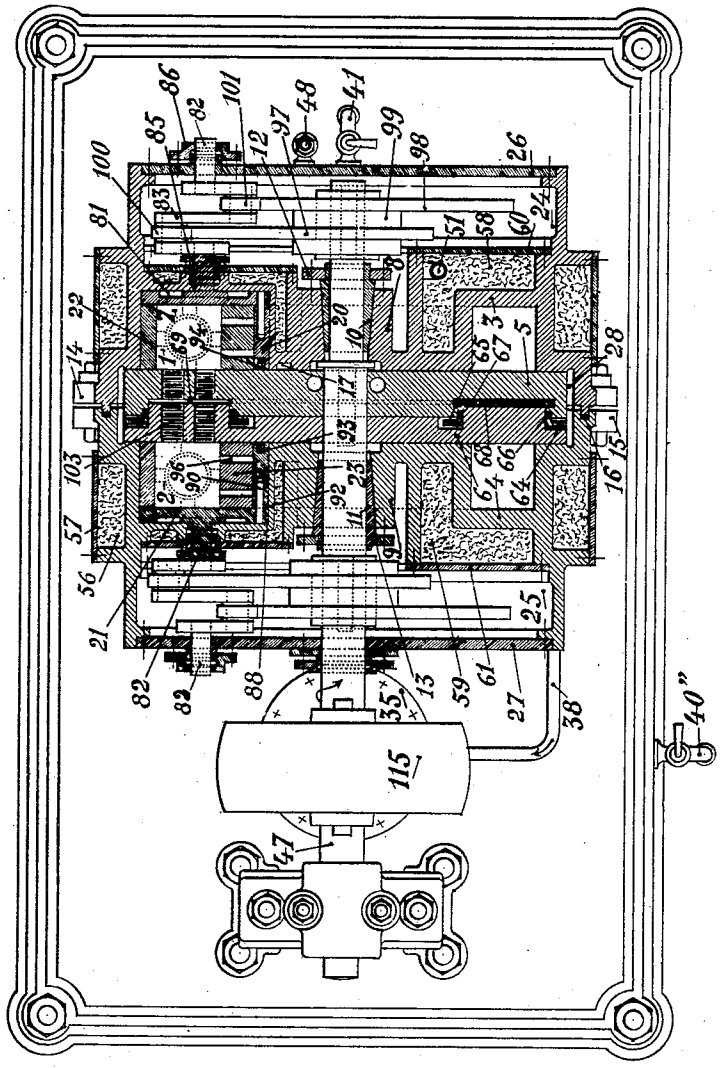
(No Model.) 4 Sheets—Sheet 2.

FIG. 2.



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(No Model.) 4 Sheets—Sheet 3.

FIG. 4.

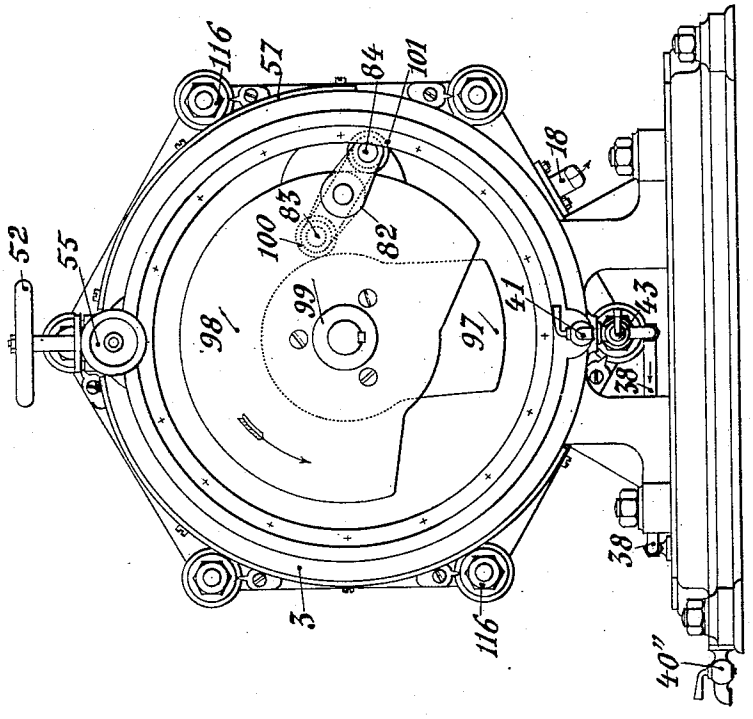
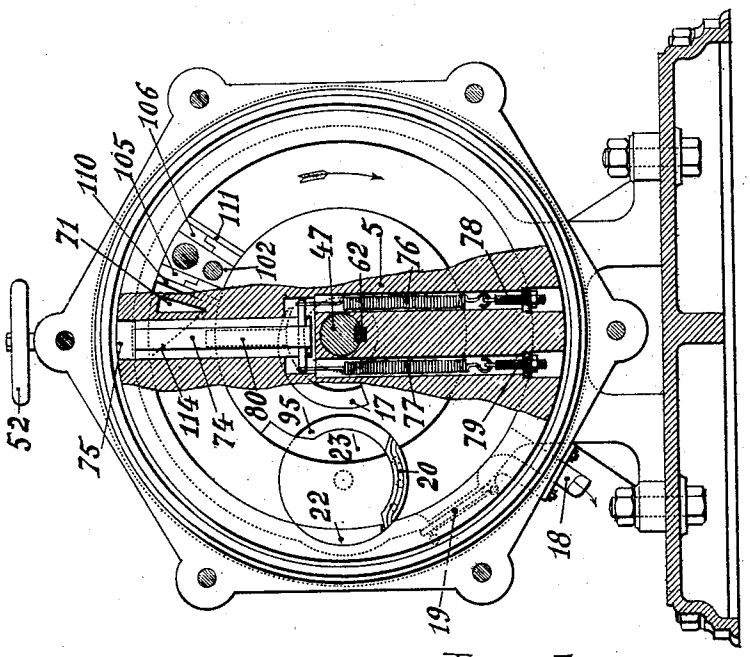


FIG. 3.



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(No Model.) 4 Sheets—Sheet 4.

FIG. 10.

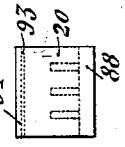


FIG. 9.

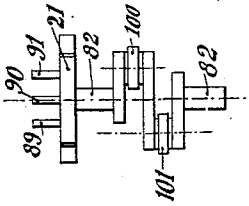


FIG. 12.

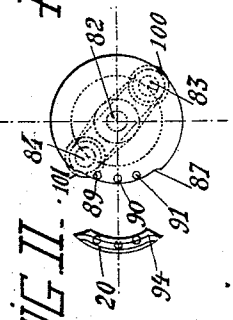


FIG. 14.

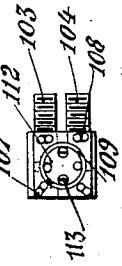


FIG. 13.

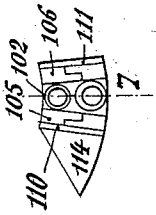


FIG. 7.

FIG. 8.

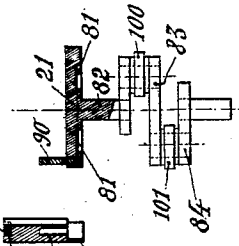


FIG. 11.

FIG. 5.

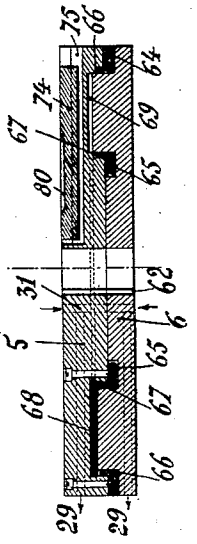
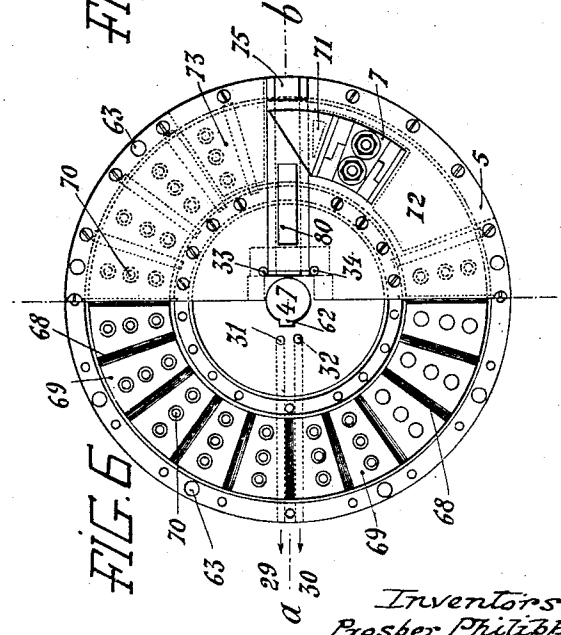


FIG. 6.



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UNITED STATES PATENT OFFICE.

PROSPER PHILIPPON AND MARIUS CHEVALIER, OF PARIS, FRANCE.

ROTARY MOTOR.

SPECIFICATION forming part of Letters Patent No. 710,510, dated October 7, 1902.

Application filed March 21, 1902. Serial No. 99,366. (No model.)

To all whom it may concern:

Be it known that we, PROSPER PHILIPPON and MARIUS CHEVALIER, citizens of the French Republic, residing and having our post-office address at 39 Rue de Richelieu, Paris, France, have invented certain new and useful Improvements in Rotary Motors, of which the following is a specification.

The present invention relates to a rotary motor with variable expansion. The disadvantages of all motors of this kind—that is to say, the vibrations caused by centrifugal force and the want of tightness of the parts—are overcome by this improved motor. All the parts in the present motor are balanced, and the tightness increases with the pressure. This effect is obtained by means of an arrangement which has, among others, the advantage of automatically taking up the play caused by the wear of the parts. Under these circumstances the present motor is as economical and less cumbersome than the best steam-engines.

In the annexed drawings, Figure 1 is a longitudinal central section with parts in elevation. Fig. 2 is a central horizontal section. Fig. 3 is a cross-section on line 2 2 of Fig. 1 with the parts in a different position to Fig. 2. Fig. 4 is an end view of the interior of one of the oil-chambers. Fig. 5 is a cross-section of the distributing-disk on line *a b* of Fig. 6. Fig. 6 shows in plan view on the right a half view of the outer surface of one of the plates of the disk and on the left a half view of the inner surface of the other plate of the disk. Figs. 7 to 12 are detail views, respectively, of each of the two parts constituting the closing plate or valve. Figs. 13 and 14 are elevation and side view, respectively, of the various parts constituting the piston.

The motor shown as an example comprises, essentially, two annular chambers or cylinders 1 and 2 of rectangular cross-section provided in the casing parts 3 and 4; but it may also comprise a larger number of concentric chambers or cylinders of any suitable section in order to render the motor compound, the fluid after partially expanding in one chamber completing its expansion in an adjacent chamber or cylinder.

The following description refers to a motor with a single chamber in each casing part; but it can also be applied to a motor having a number of such chambers. The chambers 1 and 2 are arranged opposite each other and are separated by a movable disk or partition, preferably made in two pieces 5 and 6. The said disk effects the distribution and carries on each of its surfaces two blocks 7 7 with extensible side surfaces, which form pistons and adapt themselves to the shape of the annular chambers 1 and 2, in which they slide with slight friction, these chambers constituting the cylinders for the said pistons. The casing parts 3 and 4 are provided with central sockets 8 and 9, carrying adjustable truncated conical bearings 10 and 11, adapted to take up the play produced by the wear of the shaft without changing the tightening-rings 12 and 13. The casing parts also carry the flanges 14 and 15, with an annular groove-and-tongue joint containing an elastic packing 16 permitting a micrometric tightening by means of suitably-divided nuts. A slot 17, Fig. 3, is provided in the casing part 3 and has the form of a horn. Its inner edge is concentric to the motor-shaft, while its outer edge is of such eccentricity that the said slot progressively narrows in the direction of the rotation of the shaft. At a point of the circumference of each casing part is provided a free outlet-aperture 18, Fig. 3, and in the wall of the cylinder an opening 19, closed by a glass plate, serves for observing the action of the motor. In the annular chambers 1 2 of each casing part is a cavity in which is arranged a closing-plate 20, driving-plate 21, and the two keys 22 and 23, Figs. 1, 2, and 3. At the back of the chambers 1 and 2 the casing parts are each hollowed out, so as to form oil-chambers 24 and 25, closed by covers 26 and 27, respectively, and communicating, by means of the passages 29 and 75, with the space 28 between the circumference of the disk 5 6 and casing parts 3 4. These oil-chambers also communicate with each other by means of the orifices 31, 32, 33, and 34, Fig. 6, and with the oil-purifier 35, Figs. 1 and 2, the one by the channels 36 and 37 and pipe 38, the other by the channel 40 and pipe 39.

41 and 42 are cocks for emptying the oil-chambers, and 43 and 44 are cocks for regulating the circulation of oil.

45 and 46 are passages for oil for lubricating the shaft 47, carrying the disk 5 6.

48 is a gage for indicating the oil-level; 49, an oil-feed cup; 50, an air-valve for outlet of air for facilitating the filling; 35, a purifier composed of a certain number of finely-perforated cylindrical tubes 40′, which are traversed by the oil before arriving in a central compartment into which the pipe 39 opens.

40″, Fig. 2, is a cock for emptying the purifier.

51 is a steam-supply pipe; 52, a valve for controlling the admittance of the motive fluid; 58, a chamber receiving steam; 54, the conduit through which the steam passes to the slot 17.

56 is a valve for controlling direct admittance of steam into the cylinder 1 for starting during the period of expansion.

The distributing-disk, Figs. 5 and 6, is composed of two plates 5 and 6, mounted on one another by an annular groove-and-tongue joint and provided with double adjustable pressure-rings 64 and 65, having elastic packings 66 and 67. The plates 5 and 6 may be brought toward or away from each other by sliding on the key 62 and guides 63. The plane surfaces of the two parts of the groove-and-tongue joint are provided with semicylindrical radial grooves arranged opposite each other, thus forming cylindrical conduits filled with flexible thread or the like, 66, forming joints and dividing this part of the disk into independent radial compartments 69, which communicate with the chambers or cylinders by means of the small holes 70. A triangular orifice 71 passes through the two parts of the disk between the regulator and piston and supplies the cylinder 2 with steam. Two hollowed-out portions 72 and 73 exactly balance the piston.

The play of the disk described above is automatically taken up by the motive fluid. However, the same result can be obtained by means of an arrangement utilizing centrifugal force. In this case the space between the two plates is obtained by means of several rods working during the period of compression placed at an equal distance from each other and arranged between the two plates. The said rods are smooth at one end and screw-threaded at the other. Their smooth end can freely pivot on one of the plates, while the other is screwed into the second plate. They carry in the center of their length a perpendicular arm provided with a counterweight arranged in such a manner that the centrifugal force acting on the said counterweights forces the latter by means of the arms to unscrew the rods by a fraction of a revolution, and consequently removes the plates from each other until the adherence of the rubbing-surfaces being sufficient the counterweights are stopped and maintained in that position by a system of pawls preventing their return. The play of the disk instead of being automatically taken up may have any suitable adjustment, in which case the two plates are joined together in the center. The plates may also be made in two parts with a central connection, radial grooves receiving slightly conical micrometrical pins which are prolonged by screw-threaded rods screwed into the joining-surface of the plate. By tightening or loosening the said pins the spacing of the plates is adjusted.

The regulator, Figs. 5 and 6, consists of a long block 74, adapted to move freely in a radial groove 75 in the plate 5 and fastened to two springs 76 and 77, Fig. 3, arranged opposite to each other, tending to bring the block nearer the shaft, and fixed to the adjustable screws 78 and 79. A passage 80 in the regulator allows the steam to pass into the cylinder 1 when it is in communication with the slot 17.

Figs. 7 to 12 refer to the parts composing the closing-plate. The driving-plate 21, hollowed out annularly at 81, is mounted on a double-cranked shaft 82, which carries two crank-pins 83 and 84 and traverses the oil-chamber 24, Figs. 1, 2, and 4. A notch 87 in its circumference receives the narrow circular flange 88 of the closing-plate 20, which is connected with the plate 21 by the pins 89 90 91, on which it can slide. The closing-plate 20 in the form of a portion of a cylinder is provided with a hollow 92, Figs. 1 and 2, for receiving the pressure of the fluid, which presses it strongly against the disk 5 6, its opposite end carrying in a groove an elastic packing 93, which constantly maintains a facing-piece 94 against the surface of the disk, with which it forms a tight joint. The keys 22 and 23, Figs. 1, 2, and 3, before referred to, fill the unoccupied space and guide the piston and plate 21. A space 95 for receiving the closing-plate 20 is left behind the key 23, and for the purpose of balancing the pressure on the latter it receives the fluid through the holes 96.

The oil-chambers 24 and 25, Fig. 4, contain the mechanisms for operating the closing-plates. The said mechanisms, which are similar, each comprise two cams 97 and 98, secured to the shaft 47. The pins 83 and 84 of the cranked shaft carry rollers 100 and 101, which are in continuous contact, the one, 100, with the circumference of the cam 97 and the other, 101, with the circumference of the cam 96.

Each piston 7, Figs. 13 and 14, consists, essentially, of a trapezoidal piece 102, fixed on the disk 5 or 6 by means of the pins 103 and 104. On each side of the piece 102 is arranged a segment 105 and 106, made in four parts projecting over each other and guided by means of the pins 107 sliding in the slots 108 in said piece 102. An inner elastic ring 109 exercises a continuous outward-pushing ac-

tion of the segments against the walls of the chambers 1 and 2, and their position is assured by the plates 110 and 111 each bearing on a ring 112, fixed to the piece 102 by means of screws 113. A triangular part 114, fixed on the plate 110 and so arranged as not to cover the aperture 71, lengthens the piston and reduces the unoccupied space.

The operation of the apparatus is as follows: The motive fluid under pressure controlled by the valve 52 passes successively into the chamber 58, conduit 54, hole 17, and channel 80 of the regulator and arrives behind the piston in the chamber or cylinder 1, wherefrom it passes through the aperture 71, Fig. 3, to behind the piston 7 in the chamber or cylinder 2. The plate 20 is in its closed position, Fig. 3. The outlet-aperture 18 being constantly open, the pressure is consequently simultaneously exercised on one side of each of the pistons 7, which revolve in the chambers 1 and 2, at the same time driving the disk 5 6, the shaft 47, and the pulley 115; but when the channel 80 of the regulator is no longer in communication with the slot 17 the admission of motive fluid ceases and expansion takes place until the piston has passed the orifice 18, when the fluid escapes either into the open air or to a condenser. (Not shown.) At this moment and simultaneously for the actuating mechanisms of both closing-plates the cam 97 strikes the roller 100 in order to cause the cranked shaft to vibrate, and consequently also the plate 21 and closing-plate 20. The chambers 1 and 2 are thus left free, each plate 20 being now in the space 95 behind the key 23, and the pistons continue their revolutions. However, as soon as the piston has passed beyond the locality of the plate the cams 97 and 98 act in the opposite direction and bring the plate back into its closing position, the motive fluid being again admitted to the disk 5 and 6 and shaft 47. As the speed increases the block 74 of the regulator moves away from the shaft 47, the channel 80 moves away from the center, and by reason of the shape of the slot 17 admission ceases sooner the greater the distance of the block 74 from the center—that is to say, the greater the speed. The fluid under pressure in the chambers 1 and 2 passes through the passages 70 into the chambers 69 between the two parts of the disk 5 and 6. The surface of the said chambers being larger than the corresponding surface of the annular opening of each chamber, the two parts of the disk 5 6 tend to move slightly away from each other in order to bear perfectly against the walls of each chamber. This arrangement maintains the tightness and assures the automatic taking up of play between the disks and casing.

When the disk 5 6 is made in a single piece, the tightness is obtained by tightening the rings 14 and 15, between which is placed the elastic packing 16, by means of micrometer-nuts 116, having very fine thread.

The arrangements described above assure perfect tightness.

Automatic lubrication is obtained in the following manner: The oil introduced through the oil-cup 49 passes into the oil-chambers 25 and 24 and purifier 35. The disk tends to suck in the oil in the center, since the centrifugal force forces it through the conduits 29 and 30 and groove 75, Fig. 6, to the circumferential space or channel 28, Figs. 1 and 2, by which it is forced back to the purifier through the conduits 36 and 37 and pipe 38, whereupon the oil is drawn through the pipe 39, cock 44, and passage 40 back into the oil-chambers, and so on, a continuous stream of purified oil, which can be regulated by the two cocks 43 and 44, being thus assured in the motor.

The general arrangement of the present motor as described above comprises two casing parts arranged face to face, the chambers opposite each other and the pistons mounted on a single disk placed between the two casing parts. It should, however, be remarked that the present invention can also be carried out by arranging the casing parts back to back with the chambers directed outward; the pistons are in that case carried by two disks each in a single piece, one of which is fixed on the motor-shaft and may constitute the driving-pulley and the other may slide slightly on a suitable key on the said motor-shaft, in such a manner as to allow by means of a micrometer-nut, and exactly regulating the distance of the two disks, and also taking up the wear of the parts in contact and completely assuring the tightness. This arrangement comprises the same parts as those already described, said parts being disposed suitably to the said arrangement; the two closing-plates especially will in this case be operated by a single cam mechanism, said mechanism being arranged in the central part of the two casing parts. This kind of motor similarly to that described may be provided with a single chamber or cylinder or with a number of such chambers for the purpose of rendering the motor compound.

What we claim is—

1. A rotary motor comprising in combination two casing parts one of which contains admission conduits and ports for the motive fluid, said parts being connected with each other and provided with annular chambers open each on one side, a rotary disk mounted in relation to each said annular chamber to close the open sides thereof, said disks containing passages for the motive fluid coöperating with the ports of the casing and leading to the annular chambers, two pistons mounted on said disks respectively, and adapted to move in the said chambers, closing-plates adapted to move across the said chambers and away from the same at the passage of the piston, cam mechanism operated by the motor-shaft for moving said closing-plates, a regu-

lator movable in the interior of the disks under centrifugal force, and springs for regulating the movement of said regulator, said regulator being adapted to coöperate with the ports of the casing to cut off the admission of motive fluid to the disk sooner or later in proportion to the speed of revolution.

2. A rotary motor comprising in combination two casing parts, one of which contains admission conduits and ports for the motive fluid, said parts being connected with each other and provided with annular chambers open each on one side, a rotary disk mounted in relation to each said annular chamber to close the open sides thereof, said disks containing passages for the motive fluid coöperating with the ports of the casing and leading to the annular chambers, two pistons mounted on said disks respectively and adapted to move in the said chambers, closing-plates adapted to move across the said chambers and away from the same at the passage of the piston, cam mechanism operated by the motor-shaft for moving said closing-plates, a circuit of passages for permitting a circulation of oil through the motor induced by the centrifugal force exercised by the rotary disks and an oil-cleanser in said circuit.

3. In a rotary motor, the combination of two casing parts provided respectively with annular chambers open each on the side adjacent to the other and a distributing-disk adapted to occupy the space between said chambers, and to severally close the same, this distributing-disk being formed of two plates mounted on the motor-shaft in such a manner as to move longitudinally thereon and mounted on each other by means of a groove-and-tongue joint with interposed packings, the interior surfaces of said plates being provided with radial coincident grooves with elastic packings in said grooves dividing said plates into independent radial compartments having means of communicating with the aforesaid annular chambers, and means for admitting pressure of the motive fluid to cause each of the plates of the disk to be pressed against the friction-surfaces of the corresponding casing part.

4. A rotary motor comprising in combination, two casing parts one of which contains admission conduits and ports for the motive fluid, said parts being connected with each other and provided with annular chambers open each on one side, a rotary disk mounted in relation to each said annular chamber to close the open sides thereof, said disks containing passages for the motive fluid coöperating with the parts of the casing and leading to the annular chambers two pistons mounted on said disks respectively and adapted to move in the said chambers, closing-plates mounted each on a plate, a double-cranked axle provided with rollers and carrying said plate, two cams mounted on the motor-shaft and adapted to coöperate with said cranked axle, to vibrate the same and to move the closing-plate in an arc of a circle intersecting the respective annular chamber.

In witness whereof we have signed this specification in the presence of two witnesses.

PROSPER PHILIPPON.
MARIUS CHEVALIER.

Witnesses:
LOUIS PARENT,
EDWARD P. MACLEAN.