March 14, 1944. L. MEEKS 2,344,159

ROTARY INTERNAL COMBUSTION ENGINE

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Fig. 1.

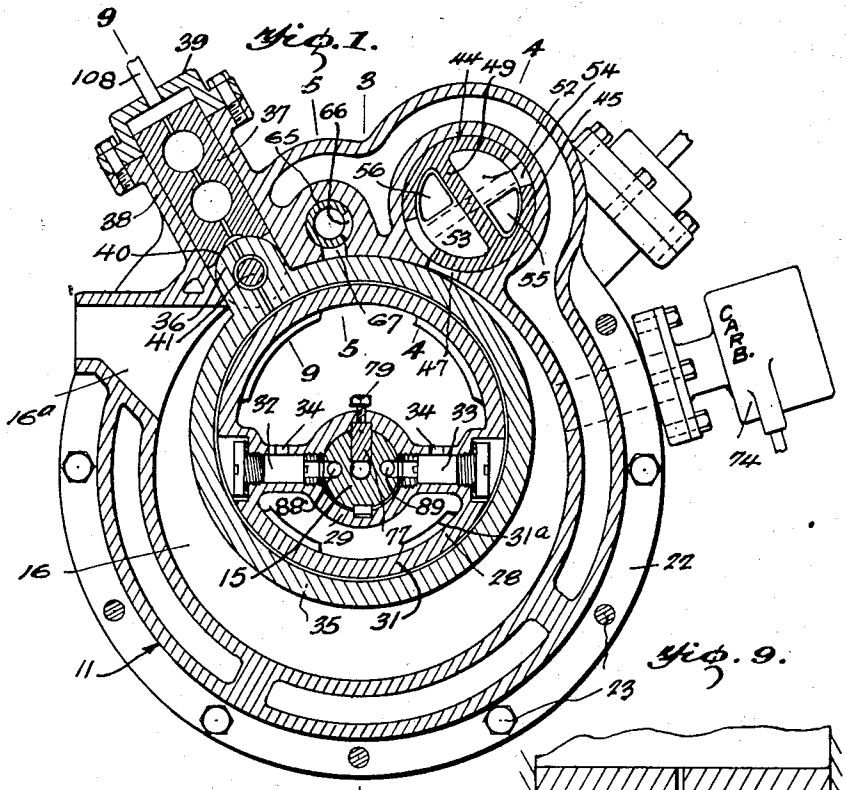


Fig. 9.

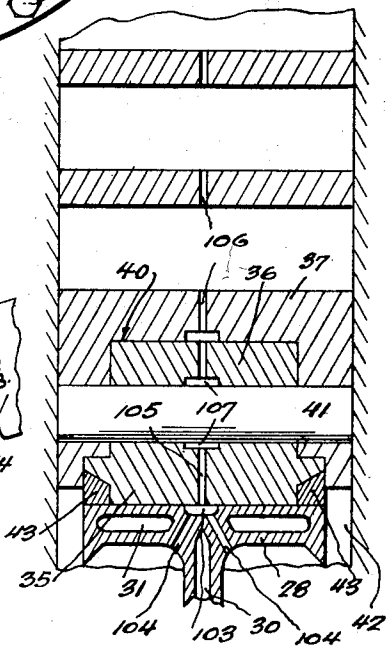
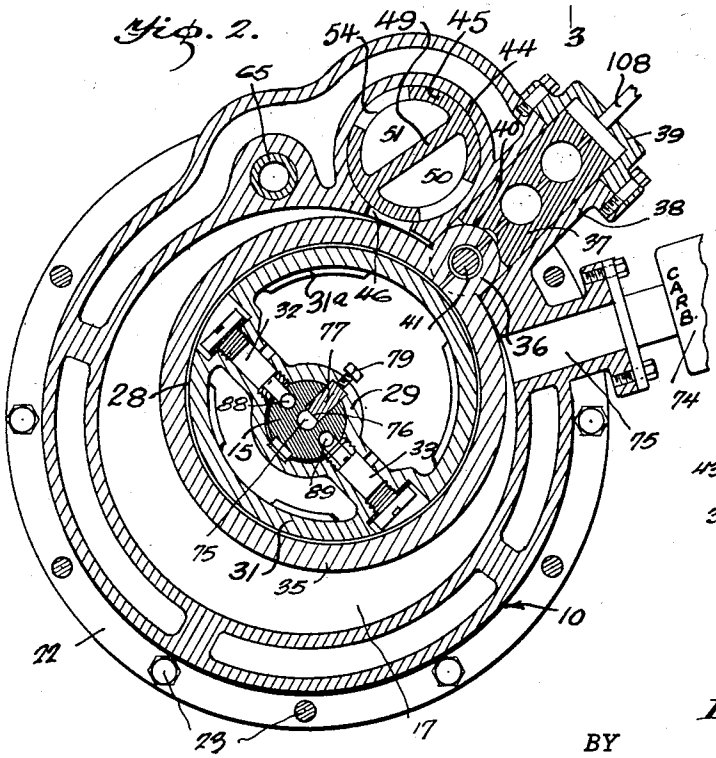


Fig. 2.



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Fig. 3.

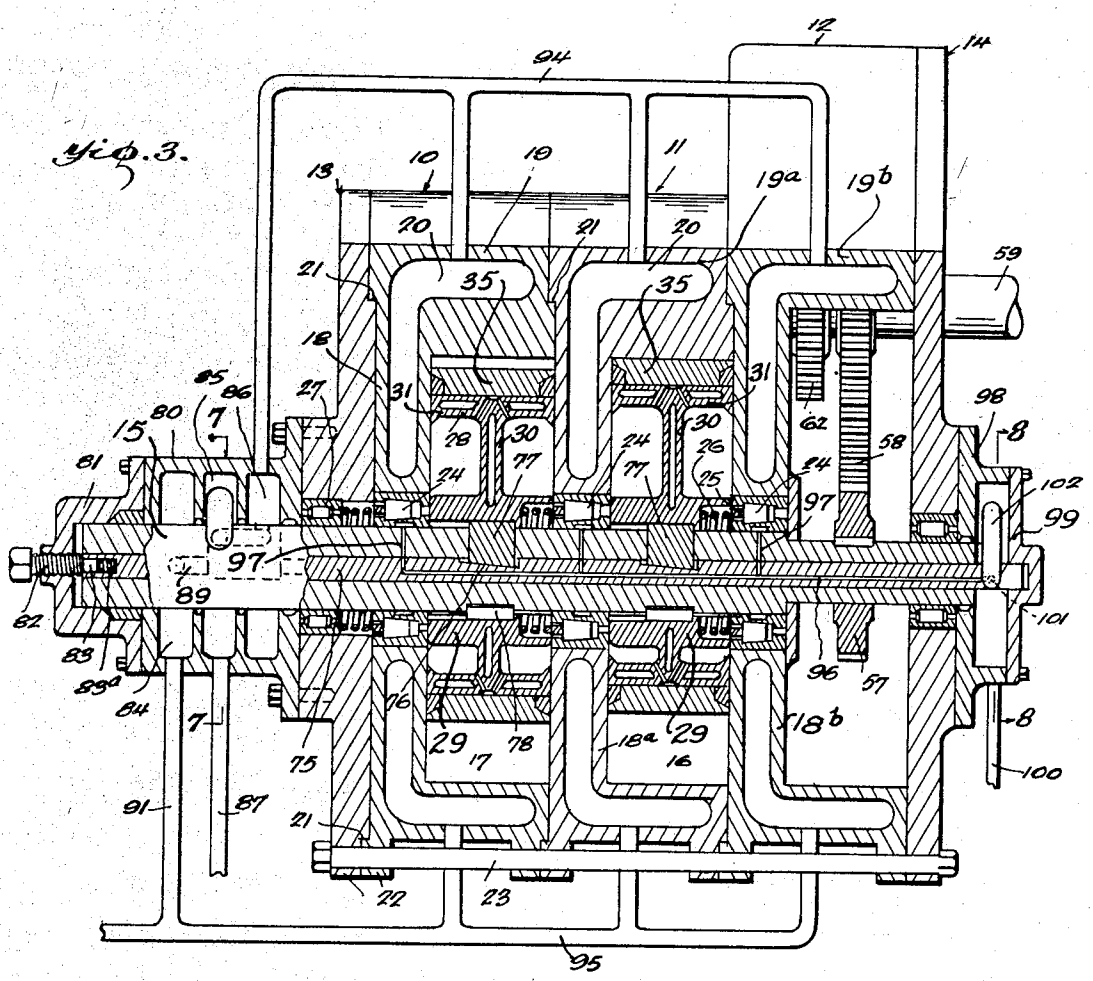
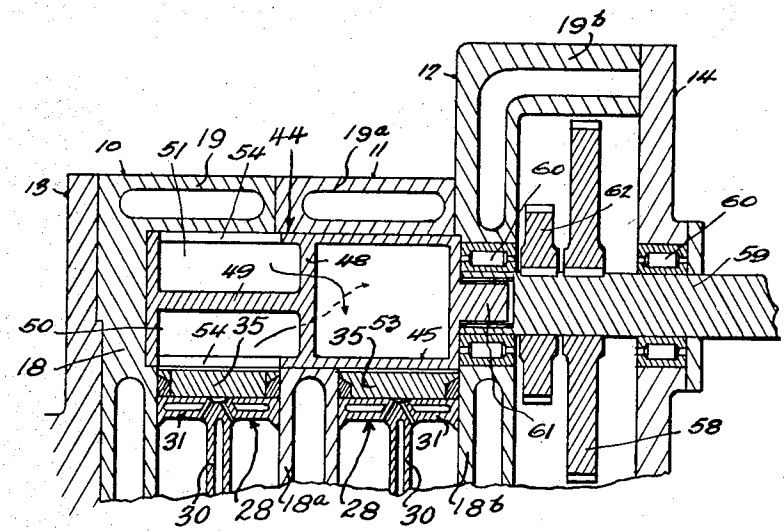


Fig. 4.



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Fig. 5.

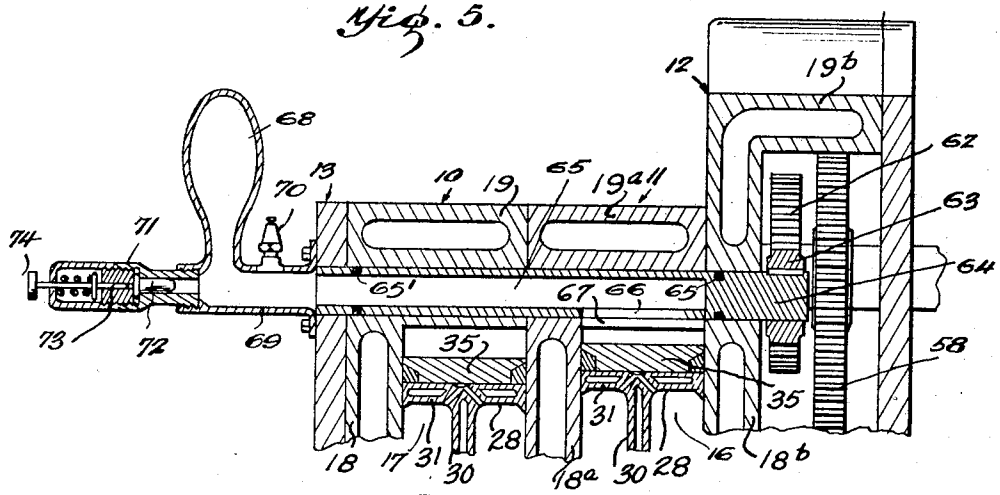


Fig. 6.

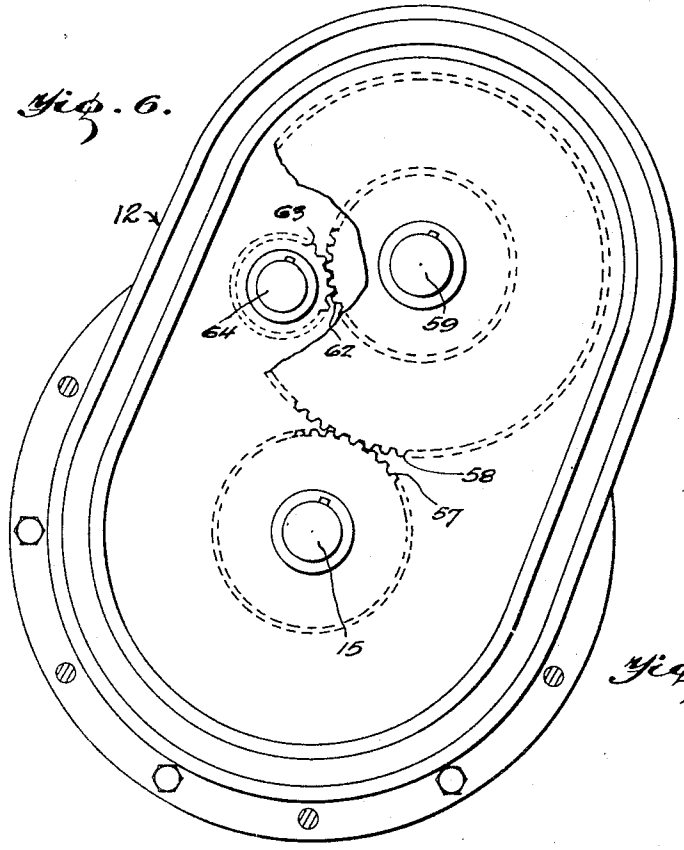


Fig. 7.

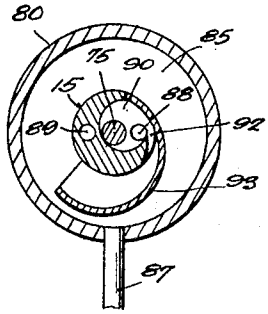
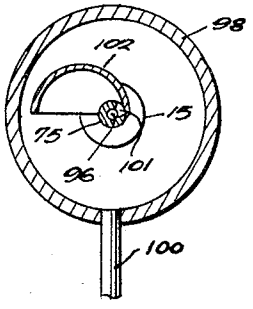


Fig. 8.



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UNITED STATES PATENT OFFICE

2,344,159

ROTARY INTERNAL COMBUSTION ENGINE

Lonnie Meeks, San Antonio, Tex.

Application August 24, 1942, Serial No. 455,835

6 Claims. (Cl. 123—8)

The present invention relates generally to rotary engines and more particularly to rotary engines of the internal combustion type, and involves refinements, improvements and additions over known engines of this type, with the primary object in view of rendering the same more practical both in construction and operation and of greater efficiency in use.

With these general purposes and objects in mind, other and more detailed aims, objects and advantages will be more readily understood and more thoroughly appreciated, in the course of the following detailed description of the construction, combination and arrangement of the several parts of the invention, and by reference by the accompanying drawings, forming a part of this specification, and illustrating the best mode so far devised for carrying the invention into practise.

In the drawings,

Figure 1 is a vertical transverse sectional view through the engine unit forming the combustion chamber.

Figure 2 is a similar view through the engine unit forming the compression chamber.

Figure 3 is a vertical longitudinal sectional view through both units taken substantially on line 3—3 of Figure 1.

Figure 4 is a radial sectional view taken substantially on line 4—4 of Figure 1, through the charge transfer valve.

Figure 5 is a view similar to Figure 4, taken substantially on line 5—5 of Figure 1, through the firing tube.

Figure 6 is a front elevation of the unit forming the gear case, with the front plate removed.

Figure 7 is a detail vertical transverse sectional view through the water circulating pump and its casing, taken substantially on line 7—7 of Figure 3.

Figure 8 is a similar view through the lubricating pump taken substantially on line 8—8 of Figure 3, and,

Figure 9 is a longitudinal sectional view through one of the sliding abutments, taken substantially on line 9—9 of Figure 1.

Referring now to the several figures above described, and particularly to Figure 3, the casing or stator of my improved engine, is shown of unit construction and assembly, there being a compression unit 10, a combustion unit 11, a gear unit 12, and back and front plates 13 and 14 in axial alignment upon a shaft 15 which extends axially through the combustion chamber 16 and the compression chamber 17.

For the above purpose, it will be noted that each of the units 10 and 11, as well as the gear unit 12, is formed with a wall having a surrounding flanged extension, the walls being respectively designated 18, 18a and 18b, and the extensions being respectively designated 19, 19a and 19b. Each of these walls and flanges has a water circulating chamber 20, for cooling purposes, as we shall presently see.

The above units 10, 11 and 12 are assembled with their extensions 18, 19a and 19b projecting in the same direction so that the wall 18a of combustion unit 11 is between the combustion chamber 16 within unit 11 and the compression chamber 17 within unit 10, these units and the back plate 13 being nested in their assembled contacting relation by virtue of annular offsets at 21, and having outstanding apertured flanges 22 for the reception of connecting bolts 23, some of which may extend along the entire series of units to unite the same as a stator casing, and some bolts being relatively short to connect only adjacent units as they are assembled.

It is thus obvious that, although but one compression cylinder and one combustion cylinder have been shown, it becomes an easy matter to assemble greater numbers of units 10 and 11 in alternating relation to form multiple compression and combustion cylinders. Thus the engine may be easily expanded to bring into use a plurality of pairs of cylinders by reason of the separable units which also provide for ready and easy assembly and disassembly of the casing when repairs or substitution of parts becomes necessary.

For reasons which will presently appear, it is very important that the shaft 15 have firm, even rotatable supports in the walls 18 of the units 10, 11 and 12, and for this reason roller bearings 24 are disposed around the shaft in these walls, including lengthwise shiftable tapering rollers. Each series of rollers is engaged by a ring 25 against which bears a spring 26 whose tension is such as to constantly press the rollers in the direction of their smaller ends to take up any inequalities and uniformly compensate for wear, so as to assure firm, uniform and anti-friction support of the shaft 15 in the stator or casing.

The shaft 15 extends rearwardly of the rear plate or unit 13 in which it has a roller bearing 27, and this bearing and the hubs of the rotors in chambers 16 and 17 form abutments for the springs 26.

The rotors are in the form of eccentrics 28 within the combustion and compression cylinders

16 and 17, and each includes an inner hub 28, a central hollow web 30 and a hollow peripheral portion or rim 31. Each eccentric also has tubular radially projecting arms 32 and 33 as plainly seen in Figures 1 and 2, both arms having openings 34 into the hollow of the web 30 which latter communicates with the hollow of the peripheral portion or rim 31 as at 31a in Figures 1 and 2, for the circulation of cooling fluid in the hollows or water spaces of the web and rim portions to provide for the cooling of the moving parts within the compression and combusion chambers.

The eccentrics 28 are keyed to rotate with the shaft 15, and their rim portions 31 rotate within cylindrical sleeves 35, which latter are shifted eccentrically around and within the chambers, and are pressed into contact, at the high points of the eccentrics, with the annular cylinder walls. The shaft 15 and the eccentrics 28 of both cylinders 16 and 17 rotate in a clockwise direction as viewed in Figures 1 and 2, and the construction in both cylinders is the same.

Each eccentric sleeve 35 is prevented from rotation and has for this purpose a radially protuberant portion 36 which is rounded as plainly seen in Figures 1, 2 and 9, and laterally reduced to swingingly interfit a pocket in the inner end of an abutment 37. This abutment is confined to radial sliding movement into and out of its respective cylinder, within a cap-covered housing 38 forming a part of its respective casing unit. The closing cap 39 of this housing is preferably bolted thereto, and the abutment 37 therein has a concave surface 40 at its inner end within which the protuberant portion 36 of the eccentric sleeve swingably interfits. A pivot pin 41 connects the abutment and sleeve protuberance 36, extending through the latter and through side portions of the abutment, which portions slide in radial grooves 42 of the side walls of the cylinder as plainly seen in Figure 9.

The rim portions 31 of the eccentrics, as well as the sleeves 35 extend from one side wall to the other in each cylinder, the sleeves having side rings 43, so as to isolate the inner space within the eccentric rims 31 at opposite sides of the webs 30, and the compression or combustion space between the sleeves 35 and the annular walls of cylinders 16 and 17.

It will be noted that the abutments 37 of the compression and combustion cylinders are arranged at divergent angles radially with respect to the cylinders, and that the units 10 and 11 provide an axial cylindrical bore 44 within which is a hollow rotary transfer valve 45. The bore 44 communicates with the compression cylinder 17 through a port 46 opening into said cylinder rearwardly of its abutment 37 in respect to direction of rotation of the rotor, and communicates with combustion cylinder 16 through a port 47 opening into said cylinder forwardly of its abutment in respect to said direction of rotation, as seen by a comparison of Figures 1 and 2.

Within bore 44, transfer valve 45 is divided by a transverse intermediate cross partition 48 into end compartments, each compartment being divided lengthwise by a diametrical partition 49 into separate chambers 50 and 51 opposite the compression cylinder 17 and similar chambers 52 and 53 opposite the combustion cylinder 16. These chambers are severally open to communication with the cylinder ports 46 and 47 through wall openings 54 of the valve 45 and by a comparison of Figures 1, 2 and 4, it will be noted that compression compartment 50 is in constant communication with combustion compartment 52 through a transfer opening 55 in the cross partition 48, while compression compartment 51 is in constant communication with combustion compartment 53 through a transfer opening 56 in said partition. Moreover the arrangement will be seen to be such that when one of the compression compartments is in communication with compression cylinder port 46, the respective combustion compartment will be closed to the combustion cylinder port 47 and vice versa.

The above arrangement necessitates that the transfer valve 45 rotate at one-half of the speed of the eccentric shaft 15 and for this reason the latter shaft has its forward portion, within the gearing unit 12 of the casing, provided with a small pinion 57, seen in Figures 3 and 6, in mesh with a pinion 58 of twice its size. The latter pinion is secured upon a shaft 59 journalled in bearings 60 in the wall of unit 12 and the front plate 14 and extending forwardly of the latter for suitable connection with any mechanism for utilization of the operation and power of the motor.

The shaft 59 preferably has an internally bored and splined inner end, and the transfer valve 45 has a forward externally splined stub shaft 61 interfitting said bored end, to be thus driven by shaft 59 at the required half speed relative to the eccentric shaft.

The above mentioned shaft 59 has fixed thereon another pinion 62 which is in mesh with a pinion 63 of one-half the size of pinion 62. Pinion 63 is fixed on a shaft 64, as seen best in Figure 5, which is a part of an axially disposed firing tube 65 mounted in aligned bores in the units 10 and 11 and in wall openings of unit 12 and rear plate 13 and preferably having piston rings 65'. This tube is thus driven at the same speed as eccentric shaft 15 and communicates only with combustion chamber 16 once every revolution through a wall opening 66 of the tube and a port 67 of the unit 11 at a point between the abutment 37 of the combustion chamber and the port 47 through which each charge is flowed into the combustion chamber from the transfer valve 45, as seen in Figures 1 and 5. It is contemplated that this tube 65 will extend rearwardly through the rear plate 13 for communication with an external casing 68 so that its capacity will be such as to retain burning gas between revolutions of the motor to supply ignition to each combustible charge as the latter flows into the combustion cylinder and as the firing tube opening 66 registers with the combustion cylinder port 67.

For starting purposes, the hollow fixture 69 supporting gas casing 68, may have a spark plug 70, and may also have an extension cartridge holder 71 provided with a bore for holding a blank cartridge 72 and with a spring actuated firing pin 73 having an external head for manually withdrawing the same to place its spring under tension.

It will be noted that the firing tube rotates not only at the same speed at the eccentric shaft 15, but also in the same direction and that as the parts are shown in Figure 2 a previous charge has been compressed in compartment 50 of the transfer valve and the next charge has been taken into the compression cylinder 17 from a carburetor 74 or other source through an inlet port 75. During further rotation of the rotor this latter charge will be gradually compressed for introduction into the valve compartment 51 as the latter opens to the port 46.

As seen in Figure 1, the combustion rotor is starting on a combustion stroke and both the transfer valve 45 and firing tube 65 are in position ready for communication with the combustion chamber. As the rotor advances and its point of contact with the annular cylinder wall proceeds beyond the port 47, valve compartment 53 opens to port 47 to let into the combustion space the charge contained in its compartments 53 and 51 while compression is being forced into compartments 50 and 52. In the meantime the firing tube has come into communicating position, its wall opening registering with port 67, and the charge is fired, forcing the rotor in an advancing clockwise rotation, until it reaches its exhaust port 16a seen in Figure 1.

Referring to Figures 1, 2 and 3, it will be noted that the eccentric shaft 15 of the motor has an axial bore entirely therethrough, in which is disposed a lengthwise shiftable adjusting rod 75 which also rotates with the shaft as presently appears. Opposite each of the eccentrics 28, rod 75 has an inclined seat 76 for the inner inclined end of an adjusting key 77 disposed and shiftable radially in a slotted way formed in the shaft 15 in radial alignment with the high point of the eccentric so that by shifting the rod 75 slightly in a forward direction at any time during operation, without disassembly of the motor, the eccentric may be adjusted to press the respective eccentric sleeve 35 more snugly in contact with the annular wall of the cylinder.

For the above purpose the bore of the hub portion of each eccentric is made slightly larger than shaft 15 and a second key 78 connects the hub and shaft at a point diametrically opposite to the adjusting key 77 to avoid any wobbling action. In the initial assembly of the parts a set screw 79 in each eccentric hub, bearing against the outer ends of the adjusting key 77, serves to initially set the eccentric sleeve 35 firmly against the cylinder wall and thereafter any adjustment required to be made by the lengthwise shifting of adjusting rod 75 will be slight, since the rolling and sliding contact of the eccentric sleeves minimizes wear.

As best seen in Figure 3, the rear end of shaft 15 extends rearwardly beyond its bearing 27 in the rear plate 13, through a water casing 80 and into a bearing cover 81 bolted to said casing, the water casing being likewise bolted to the said rear plate 13. The bearing cover supports an axially disposed threaded adjusting screw 82 whose inner reduced end 83 seats rotatably and against a spring 83a in a socket in the rear end of adjusting rod 75, to thus provide for manual adjustment of said rod whenever necessary or desirable.

The water casing is divided by partitions around the shaft 15 into annular compartments 84, 85 and 86, water being supplied to the central compartment 85 through a pipe 87 which may lead from any suitable cooling device, as for example, a radiator (not shown). Along opposite sides of the adjusting rod 75, the shaft 15 has lengthwise water channels 88 and 89 which are in communication in the course of their lengths with the hollow arms 32 and 33 of each eccentric and provide for a circulation of water for cooling purposes through the water spaces of the eccentric hubs and rims.

Channel 88 is the feed channel, the rear end of which opens into a water chamber 90 formed in shaft 15 as best seen in Figure 7, and channel 89 is the return channel, the rear end of which opens laterally into the rear compartment 84 of the water casing 80, as seen in dotted lines in Figure 3. From compartment 84 a drain pipe 91 may lead to the cooling radiator above referred to. The chamber 90, is in open communication with feed channel 88 and also with the forward compartment 86 of the water casing 80, and has an inlet opening 92 within compartment 85 at the inner end of an arcuate tapering water scoop 93 fixed on shaft 15 in said compartment with its larger end opening into said compartment in the direction of rotation of the shaft with which it revolves.

The chamber 90 being thus supplied with water by reason of the scoop pump 93, in turn supplies cooling water to the feed channel 88 and also to compartment 86 of the water casing from which water flows through a pipe 94 having branches leading into the upper portions of the water spaces of the walls of motor casing units 10, 11 and 12. From the lower portions of these water spaces lead the branches of a return circulation pipe 95 which may, as seen in Figure 3, join the return pipe 91 before mentioned for return of water to the radiator.

For the supply of lubricating oil, the adjusting rod 75 has an oil feed channel 96 lengthwise thereof, there being branch channels 97 leading as seen in Figure 3, from said feed channel to the several adjustable bearings 24 from which oil finds its way into the cylinders 16 and 17 within the spaces at opposite sides of the webs 30 of the rotor eccentrics 28. For supplying oil through the feed channel 96, the forward end of adjusting rod 75 is extended beyond the forward end of shaft 15 within a lubricant casing 98 having a detachable cover plate 99 and a lubricant feed pipe 100. In this casing 98 the channel 96 has a laterally opening oil inlet 101, as best seen in Figure 8, at the inner end of a tapering oil scoop pump 102. During the rotation of the rod 75 with the shaft 15 oil is forced by the rotating pump 102 into the feed channel 96 for distribution to the several branches 97.

By reference to Figure 9, in particular, it will be noted that each eccentric 28 has an external median oil groove 103 to receive oil from the spaces at opposite sides of its web 30 around its hub 29 through oil channels 104 through its rim portion 31. The protuberant abutment connecting portion 36 of its sleeve 35 has oil channels 105 and 106 and an oil groove 107 around the pivotal connecting pin 41. Oil channel 105 communicates between oil grooves 103 and 107 and oil channel 106 extends throughout the length of the abutment 37 to finally deliver oil above the upper end of the abutment for escape from the housing cap 39 through an outflow pipe 108 which may lead to a suitable oil filter if the oil is to be reused.

The various features of the motor as thus fully set forth and described carrying out the objects first above stated in a practical, efficient manner which is of great advantage in the initial assembly thereof as well as throughout lengthy useful life of the motor in operation.

Having thus fully described the invention, what is claimed is:

1. A rotary internal combustion engine including a casing forming therein cylinders in axial alignment, a shaft journalled in said casing axially through said cylinders, eccentrics fixed on said shaft within the cylinders, cylinder-engaging sleeves on said eccentrics, abutments slidably disposed in the casing and pivotally connected to

said sleeves, means for initially, individually adjusting each eccentric with respect to the shaft, and means in operative association with the shaft for simultaneously adjusting the eccentrics with respect to the shaft.

2. A rotary internal combustion engine including a casing forming therein cylinders in axial alignment, a shaft journalled in said casing axially through said cylinders, eccentrics fixed on said shaft within the cylinders, cylinder-engaging sleeves on said eccentrics, abutments slidably disposed in the casing and pivotally connected to said sleeves, a lengthwise shiftable eccentric adjusting rod axially of the shaft, having inclined seats opposite to the eccentrics, and keys connecting the eccentrics to the shaft, said keys extending partially through the shaft and having inclined inner ends abutting the inclined seats of the adjusting rod.

3. A rotary internal combustion engine including a casing forming therein compression and combustion cylinders, the former having a charge intake and the latter having an exhaust port, a shaft journalled through the casing axially of the cylinders, eccentrics fixed on said shaft within the cylinders, sleeves on said eccentrics in contact with the cylinder walls, abutments sliding in the casing and pivotally connected to said eccentric sleeves, means for transferring compressed charges from the compression cylinder to the combustion cylinder, and means for forcing lubricating oil into the eccentrics, the said sleeves abutments having oil receiving channels communicating with the interior of the eccentric by way of the pivotal connections between the sleeves and abutments.

4. A rotary internal combustion engine including a casing forming therein compression and combustion cylinders, the former having a charge intake and the latter having an exhaust port, a shaft journalled through the casing axially of the cylinders, eccentrics fixed on said shaft within the cylinders, sleeves on said eccentrics in contact with the cylinder walls, abutments sliding in the casing and pivotally connected to said eccentric sleeves, means for transferring compressed charges from the compression cylinder to the combustion cylinder, and means for firing charges in the combustion cylinder, said eccentrics including web and rim portions, and having water spaces in the said webs and rims thereof and inlet and outlet ports in communication with said water spaces, the shaft having inlet and outlet channels communicating with said ports, and means actuated by the eccentric shaft for causing circulation of water through said channels thereof and said ports of the eccentrics.

5. A rotary internal combustion engine including a casing comprising axially aligned and connected units, each unit having an upright wall and a surrounding flanged portion around the upright wall, the flanged portion of each unit engaging the upright wall of an adjacent unit in abutting relation to thus form adjacent compression and combustion cylinders within the units and separated by said upright walls, a shaft extending axially through said units, eccentrics fixed on said shaft within the cylinders, cylinder engaging sleeves on said eccentrics, abutments slidable in portions of the casing and pivotally connected to said sleeves, said abutments and said sleeves having oil flow channels in communication by way of the said pivotal connection thereof, the casing having oil outlets in communication with the outer ends of said oil flow channels, means for transferring compressed charges from the compression to the combustion cylinder, means for firing charges in the combustion cylinder, and means for forcing oil into the inner ends of said oil flow channels of the sleeves.

6. A rotary internal combustion engine including a casing comprising axially aligned and connected units, each unit having an upright wall and a surrounding flanged portion around the upright wall, the flanged portion of each unit engaging the upright wall of an adjacent unit in abutting relation to thus form adjacent compression and combustion cylinders within the units and separated by said upright wall, a shaft extending axially through said units, eccentrics fixed on said shaft within the cylinders, cylinder engaging sleeves on said eccentrics, abutments slidable in portions of the casing and pivotally connected to said sleeves, means for transferring compressed charges from the compression to the combustion cylinder, means for firing charges in the combustion cylinder, means forming oil flow channels through the abutments and sleeves for communication at the inner ends thereof with the eccentrics, the casing having oil outlet means in communication with the outer ends of said channels, and oil pumping means on, and actuated by, the shaft, for forcing oil into the inner ends of said channels.

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