Oct. 22, 1929. T. TSCHUDI 1,732,995

ROTARY ENGINE

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Fig. 1.

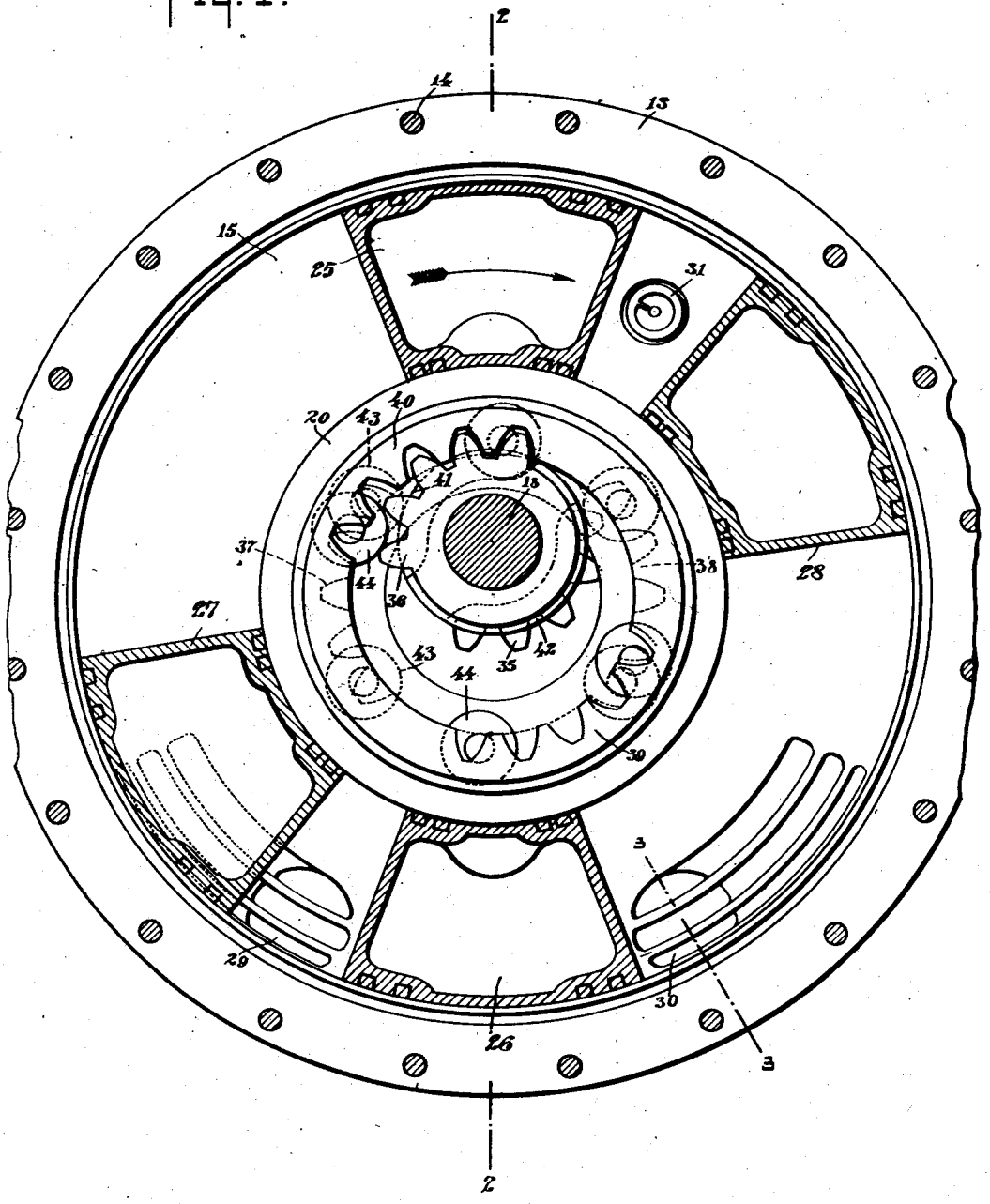

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Fig. 2.

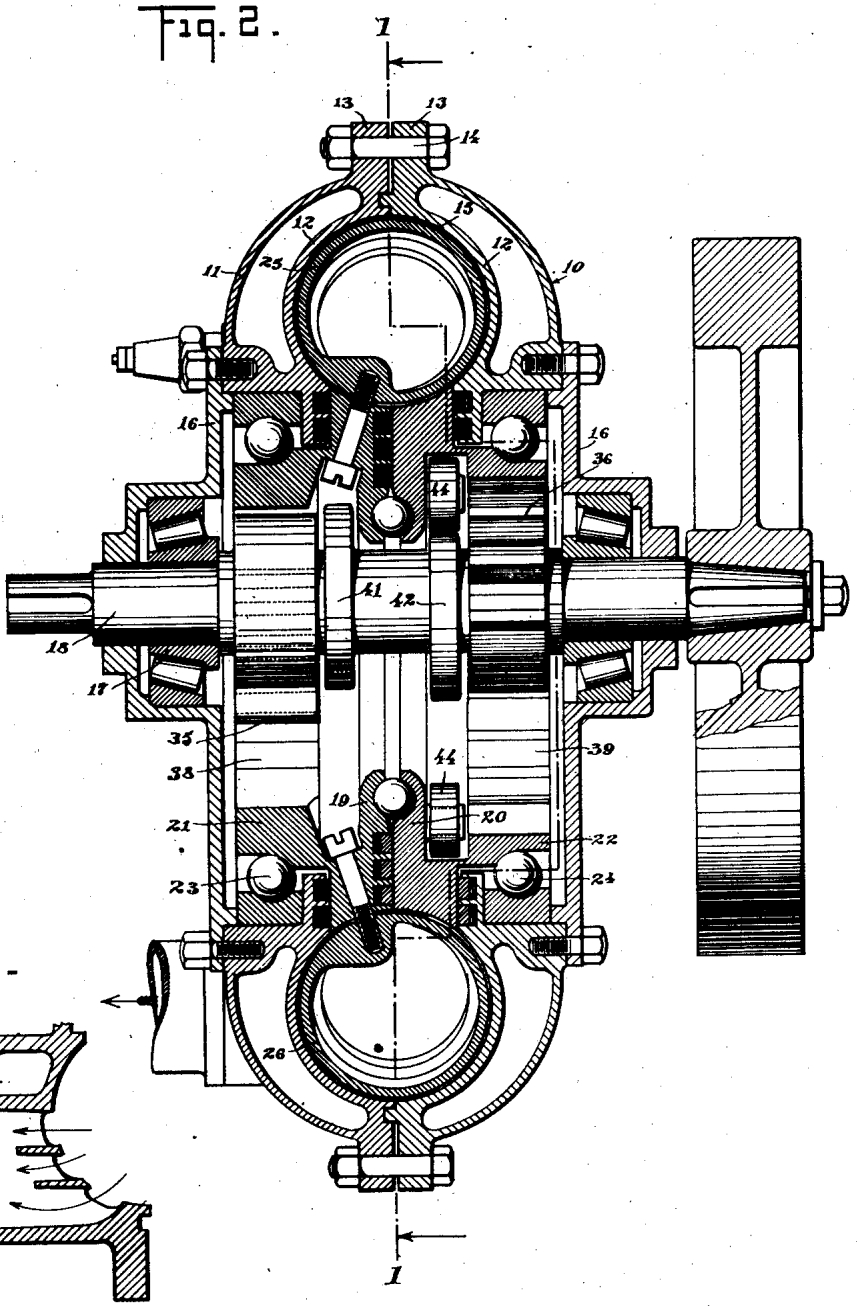

Fig. 3.

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Fig. 4.

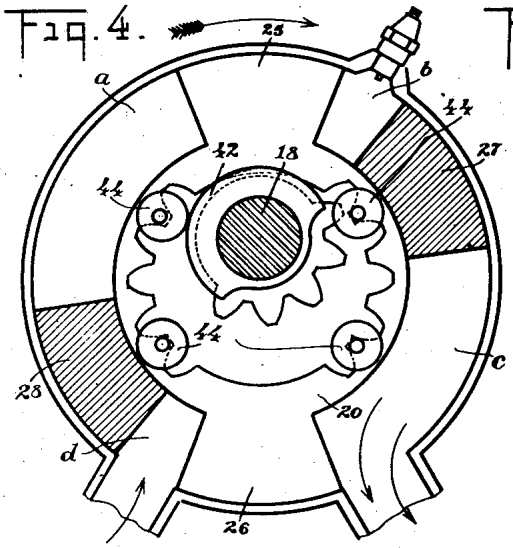


Fig. 5.

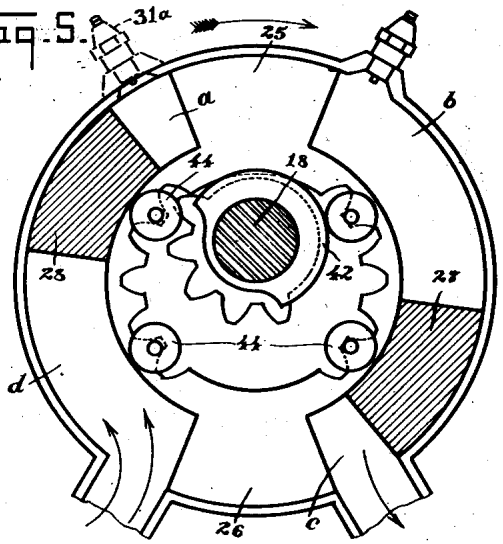


Fig. 6.

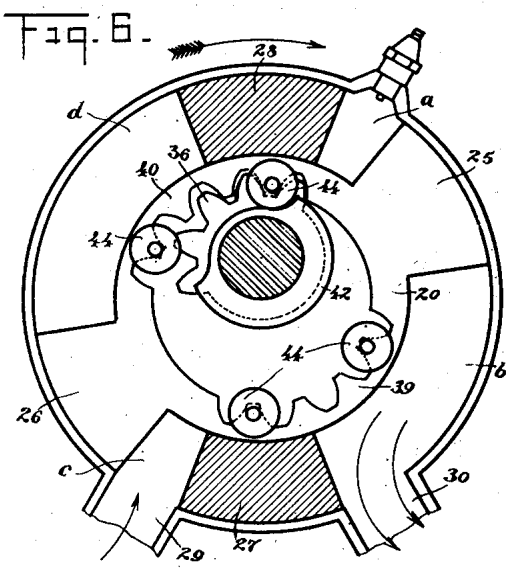
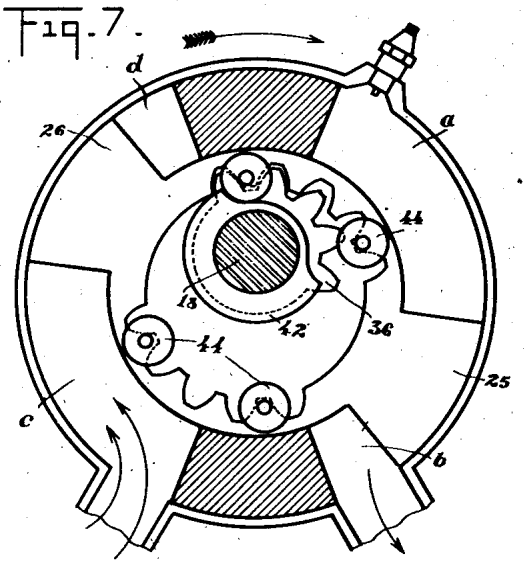


Fig. 7.



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UNITED STATES PATENT OFFICE

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ROTARY ENGINE

Application filed June 28, 1928. Serial No. 288,948.

This invention relates to rotary internal combustion motors, and is in the nature of an improvement over my prior United States Letters Patent No. 1,641,911, granted September 6, 1927.

The present invention comprehends an improved means for intermittently coupling the rotors with the drive shaft respectively for movement of said shaft by one rotor while the other rotor is at rest, and for movement of the other rotor by and in unison with the first mentioned rotor.

More specifically, the invention contemplates a rotor and shaft coupling means for a motor of the character set forth, including mutilated gearing on the rotors and motor drive shaft and including eccentric locking means provided respectively on the motor shaft and rotors which function to set up the intermittent coupling and driving of the shaft by the rotors without undue friction and wear on the parts.

The invention further contemplates in a rotary internal combustion motor, a stator having a toroidal cylinder with an eccentrically arranged drive shaft extending axially through the stator and in which a pair of axially spaced rotors, each provided with a pair of diametrically disposed arcuate pistons arranged in the cylinder for sub-dividing the same into a plurality of chambers, are adapted upon relative movement of the pistons to vary the size of the chambers for successively effecting the intake, compression, ignition and exhaust of fuel.

The invention further aims to provide in a motor of the character described an improved intermittent coupling between the rotors and drive shaft which admits of the operation of the motor in either a clockwise or counter clockwise direction by employing ignition devices at two points.

Other objects reside in the comparative simplicity of construction of the motor, the economy with which it may be produced and the general efficiency derived therefrom.

With the above recited and other objects in view, reference is had to the following description and accompanying drawings, in which there is exhibited one example or embodiment of the invention, while the claims define the actual scope of the same.

In the drawings:

Figure 1 is a vertical sectional view taken approximately on the line 1—1 of Figure 2.

Figure 2 is a transverse sectional view taken approximately on the line 2—2 of Figure 1.

Figure 3 is a detail fragmentary sectional view taken approximately on the line 3—3 of Figure 1 and illustrating the construction of the exhaust or intake ports.

Figures 4 to 7, inclusive, are diagrammatic views illustrating the various working positions of the pistons and rotors.

Referring to the drawings by characters of reference, the motor includes a casing comprising mating sections 10 and 11 of substantially identical construction and each including an annular wall 12 of substantially semi-cylindrical configuration in cross section formed with an outwardly projecting annular flange 13, which flanges are designed to be fastened together by bolts 14 for holding the sections in mated relation. The walls 12 of the sections when mated define an annular or toroidal chamber 15. The annular walls support side plates 16 which are formed with suitable bearings 17 disposed eccentrically to the axis of the annular chamber and receiving axially therethrough a drive shaft 18. A pair of annular rotors 19 and 20 are arranged within the casing in axially disposed side by side relation. The rotors are respectively provided with laterally projecting annular bearing flanges 21 and 22 mounted on suitable bearings 23 and 24 within the casing for rotation. The rotor 19 is provided with diametrically disposed arcuate pistons 25 and 26 which are arranged within the chamber 15 while the rotor 20 is provided with diametrically disposed arcuate pistons 27 and 28 arranged within the chamber 15. The casing section 11 is provided with circumferentially spaced intake and exhaust ports 29 and 30, between which an ignition device 31 is arranged to communicate with the chamber 15. Obviously, this arrangement subdivides the chamber into a plurality of compartments, one being disposed between each pair of pistons.

As illustrated in Figures 4 to 7, inclusive, the compartment *a* in Figure 4 is the compression compartment, the compartment *b* the ignition compartment, the compartment *c* the exhaust compartment, and the compartment *d* the intake compartment. When the ignition occurs, the pistons 27 and 28 in Figure 4 are driven in a clockwise direction to the position illustrated in Figure 5, while the pistons 25 and 26 are stationary. Obviously, this compresses the charge of fuel in the compartment *a*, forces out the perviously ignited charge in the compartment *c* and draws in a fresh charge of fuel in the compartment *d*, while the expansive forces of the gases or fuel in the compartment *b* have performed their function. The momentum now carries the pistons 25 and 26 with the pistons 27 and 28 to the position illustrated in Figure 6 so that the compressed charge in the chamber *a* is now in registry with the ignition device while the burned charge in the compartment *b* is in registry with the exhaust port 30. The scavenged compartment *c* is in registry with the intake port 29 while the previously in taken charge in the compartment *d* is moved around and trapped ready for compression when the next ignition occurs. Obviously, when the next ignition occurs, the pistons 27 and 28 remain stationary, while the pistons 25 and 26 are moved in a clockwise direction to the position illustrated in Figure 7, due to the fact that explosion of the fuel in the compartment *a* draws the pistons 25 and 26 in a clockwise direction, causing the trapped fuel charge in compartment *d* to be drawn into the compartment *c*, while the previously expanded and exploded charge in compartment *b* is exhausted.

The present invention relates to an improved means for exerting a continuous torque upon the drive shaft 18 from the particular piston which is being moved by the explosion of the fuel while at the same time employing on said shaft means cooperating with the inactive rotor and pistons for locking the same against movement so that one of the pistons acts as an abutment for the piston which is receiving the force of the explosion. The improved means consists of diametrically disposed circumferentially and axially spaced arcuate series of gear teeth 35 and 36 provided respectively on the drive shaft 18 and diametrically disposed circumferentially spaced arcuate series of gear teeth 37 and 38 and 39 and 40 formed on the rotors 19 and 20 respectively. This means further includes axially spaced arcuate ribs 41 and 42 formed on the drive shaft, which ribs are disposed at 180° with respect to each other and diametrically opposite to the respective arcuate series of gear teeth on the drive shaft. The arcuate ribs are in turn designed to cooperate with circumferentially spaced sets of rollers 43 and 44 provided on the rotors 19 and 20, it being obvious that the rollers turn on independent axes to which the drive shaft 18 is eccentric. The arrangement of the mutilated gearing and ribs and rollers is such that when the piston 27 in Figure 4 is receiving the force of the explosion, the drive shaft 18 is being turned therewith through the engagement of the gear teeth 39 of the rotor 19 with the gear teeth 35 of the drive shaft while the arcuate rib 42 of the drive shaft is locked between the rollers 44 of the rotor 20 to hold said rotor 20 and its pistons 25 and 26 stationary. When the rotors and pistons reach the position illustrated in Figure 5, the gear teeth 40 of the rotor 20 engage with the gear teeth 36 of the drive shaft before the gear teeth 37 of the rotor 19 discontinue to mesh with the gear teeth 35 of the drive shaft whereby both rotors and all pistons move in unison from the position illustrated in Figure 5 to the position illustrated in Figure 6. The gear teeth 37 are then moved out of mesh with the gear teeth 35 on the drive shaft while the arcuate rib 41 moves between an adjacent pair of rollers 43 to lock the rotor 19 and its pistons 27 and 28 in their positions illustrated in Figures 6 and 7, while the rotor 20, together with its pistons 25 and 26, is driven by the force of explosion to the position illustrated in Figure 7. This cycle of operation is repeated as long as the motor is in operation.

By providing an additional ignition device 31ª, as illustrated in dotted lines in Figure 5, and reversing the intake and exhaust ports, it is obvious that the motor may be driven in a counter clockwise direction in the same manner.

What is claimed is:

1. In a rotary internal combustion motor including an annular cylinder and a pair of rotors each having a pair of diametrically disposed pistons movable in the cylinder, an eccentrically arranged drive shaft extending axially through the motor and means for intermittently coupling the rotors with the drive shaft respectively for movement of said shaft by one of the rotors while the other rotor is at rest and for movement of the other rotor by and with the drive shaft and in unison with the first mentioned rotor.

2. In a rotary internal combustion motor including an annular cylinder and a pair of rotors each having a pair of diametrically disposed pistons movable in the cylinder, an eccentrically arranged drive shaft extending axially through the motor and means for intermittently coupling the rotors with the drive shaft respectively for movement of said shaft by one of the rotors while the other rotor is at rest and for movement of the other rotor by and with the drive shaft and in unison with the first mentioned rotor, said means

including mutilated gearing on the drive shaft and rotors.

3. In a rotary internal combustion motor including an annular cylinder and a pair of rotors each having a pair of diametrically disposed pistons movable in the cylinder, an eccentrically arranged drive shaft extending axially through the motor and means for intermittently coupling the rotors with the drive shaft respectively for movement of said shaft by one of the rotors while the other rotor is at rest and for movement of the other rotor by and with the drive shaft and in unison with the first mentioned rotor, said means including mutilated gearing on the drive shaft and rotors, and said means further including rotor locking means consisting of arcuate ribs on the eccentric drive shaft and concentric rollers on the rotors.

4. In a rotary internal combustion motor including an annular cylinder and a pair of rotors each having a pair of diametrically disposed pistons movable in the cylinder, an eccentrically arranged drive shaft extending axially through the motor and means for intermittently coupling the rotors with the drive shaft respectively for movement of said shaft by one of the rotors while the other rotor is at rest and for movement of the other rotor by and with the drive shaft and in unison with the first mentioned rotor, said means comprising diametrically disposed circumferentially and axially spaced arcuate series of gear teeth on the drive shaft and diametrically disposed circumferentially spaced arcuate series of gear teeth on each rotor, axially spaced arcuate ribs on the drive shaft and circumferentially spaced sets of rollers on each rotor adapted to coact with one of the arcuate ribs to arrest movement of one rotor while the other is in motion.

5. In a rotary internal combustion motor, a stator having a toroidal cylinder, an eccentrically arranged drive shaft extending axially through the stator, a pair of axially spaced rotors each having a pair of diametrically disposed arcuate pistons arranged within the cylinder for subdividing the same into a plurality of chambers adapted upon relative movement of the pistons to vary in size, said cylinder having circumferentially spaced fuel intake and exhaust ports, an ignition device communicating therewith between the intake and exhaust ports, and means for intermittently coupling the rotors with the drive shaft respectively for relative movement thereof and for movement of the same in unison.

6. In a rotary internal combustion motor, a stator having a toroidal cylinder, an eccentrically arranged drive shaft extending axially through the stator, a pair of axially spaced rotors each having a pair of diametrically disposed arcuate pistons arranged within the cylinder for subdividing the same into a plurality of chambers adapted upon relative movement of the pistons to vary in size, said cylinder having circumferentially spaced fuel intake and exhaust ports, an ignition device communicating therewith between the intake and exhaust ports, and means for intermittently coupling the rotors with the drive shaft respectively for relative movement thereof and for movement of the same in unison, said means comprising diametrically disposed circumferentially spaced arcuate series of gear teeth on the drive shaft and on each rotor, axially spaced arcuate ribs on the drive shaft and circumferentially spaced sets of concentric rollers on each rotor adapted to coact with one of the arcuate ribs to arrest the movement of one roller while the other is in motion.

7. In a rotary internal combustion motor including an annular cylinder and a pair of rotors each having a pair of diametrically disposed pistons movable in the cylinder, an eccentrically arranged drive shaft extending axially through the motor and means for intermittently coupling the rotors with the drive shaft respectively for movement of said shaft by one of the rotors while the other rotor is at rest and for movement of the other rotor by and with the drive shaft and in unison with the first mentioned rotor, said means comprising diametrically disposed axially and circumferentially spaced series of gear teeth on the drive shaft, diametrically disposed circumferentially spaced series of gear teeth on each rotor, axially spaced arcuate ribs on the drive shaft and circumferentially spaced sets of rollers on each rotor adapted to coact with the corresponding rib of the drive shaft to arrest movement of said rotor while its teeth are disengaged from the gear teeth of the shaft and during the time that the gear teeth of the other rotor are in mesh with the gear teeth of the drive shaft for exerting a torque thereon.

8. In a rotary internal combustion engine of the character set forth having a pair of axially disposed annular rotors and an eccentrically arranged drive shaft extending axially through the rotors, mutilated gearing means for intermittently connecting the rotors with the drive shaft respectively for movement of the rotors in unison with each other and with the drive shaft for movement of one of said rotors with the drive shaft while the other rotor is at rest, eccentric locking means on the drive shaft and means on the rotors cooperating therewith.

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