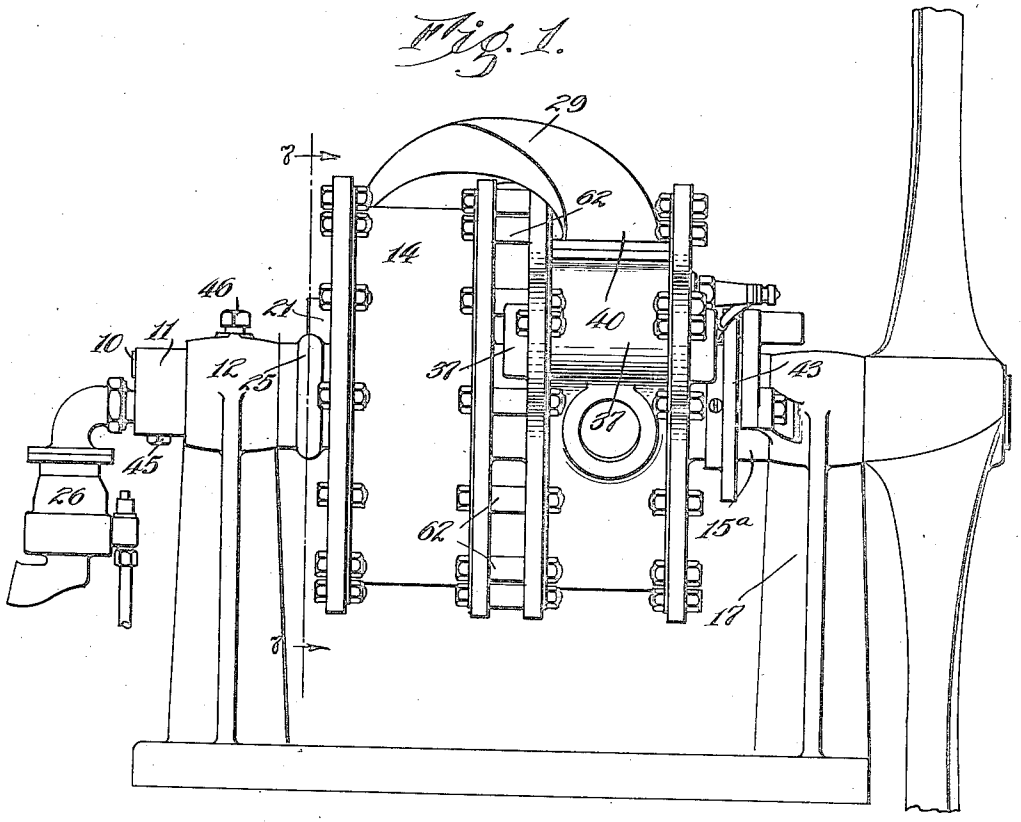
Nov. 13, 1923. 1,473,656

J. H. WAGENHORST

ROTARY INTERNAL COMBUSTION ENGINE

Original Filed Sept. 8, 1917 4 Sheets-Sheet 1

Fig. 1.



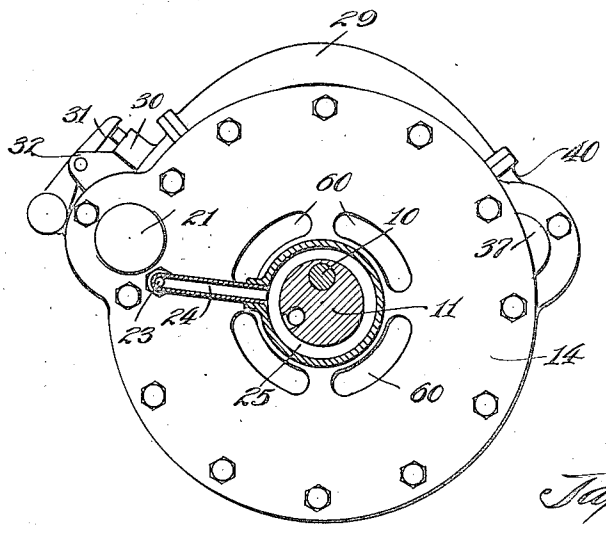


Fig. 7.

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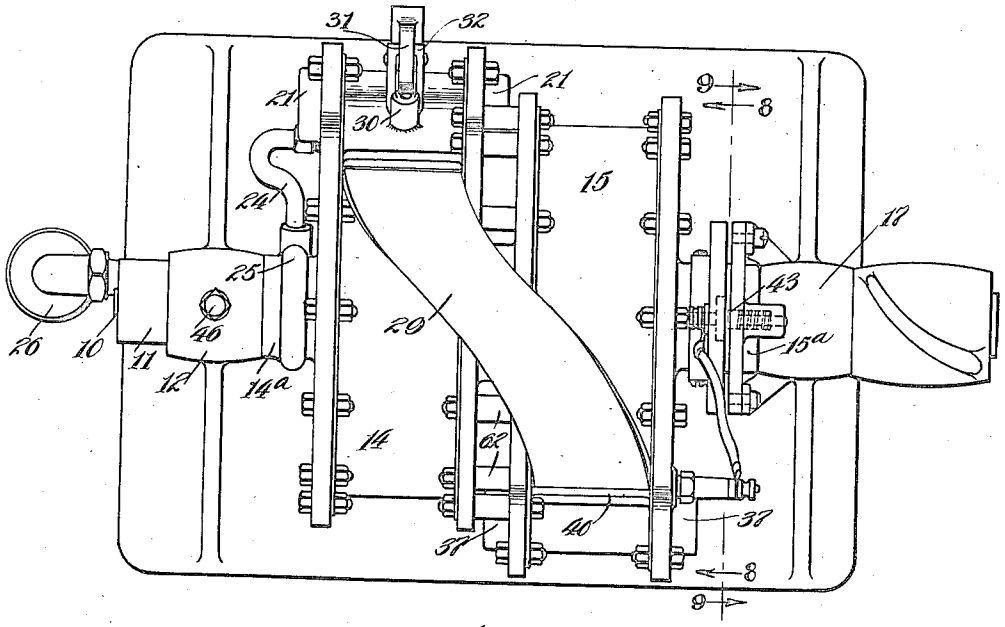


Fig. 2.

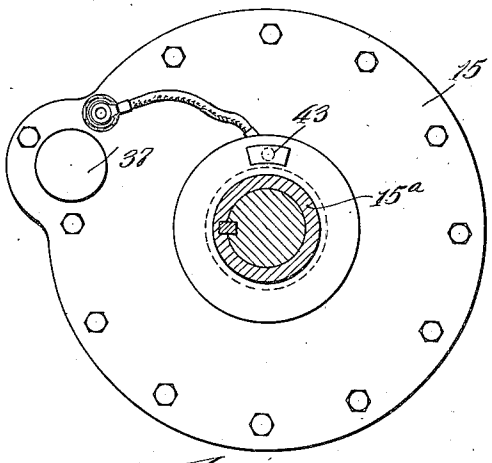
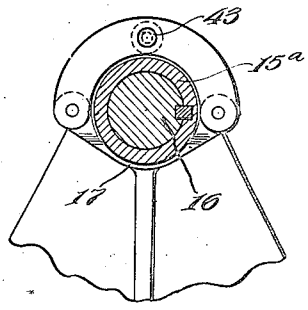


Fig. 3.

Fig. 9.



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ROTARY INTERNAL COMBUSTION ENGINE

Original Filed Sept. 8, 1917 4 Sheets-Sheet 3

Fig. 3.

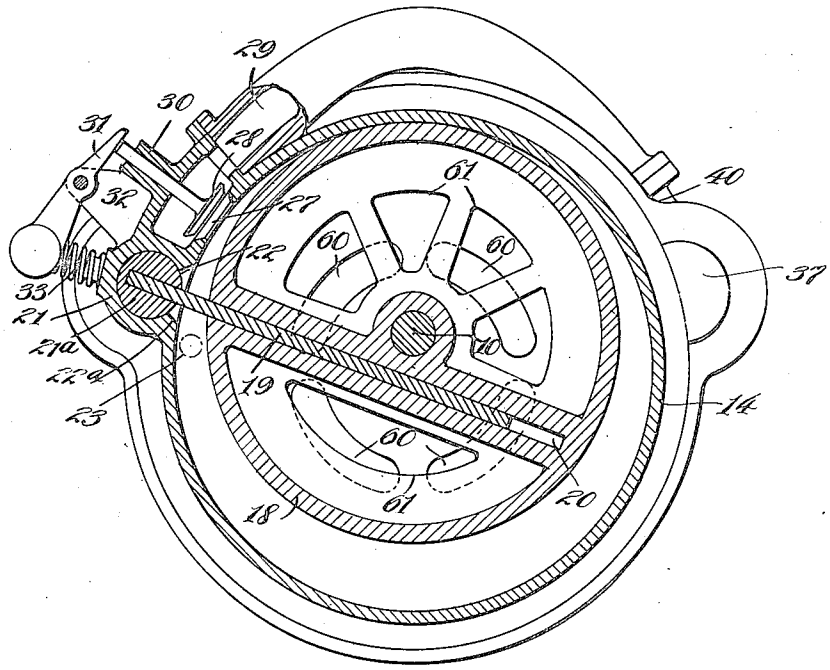
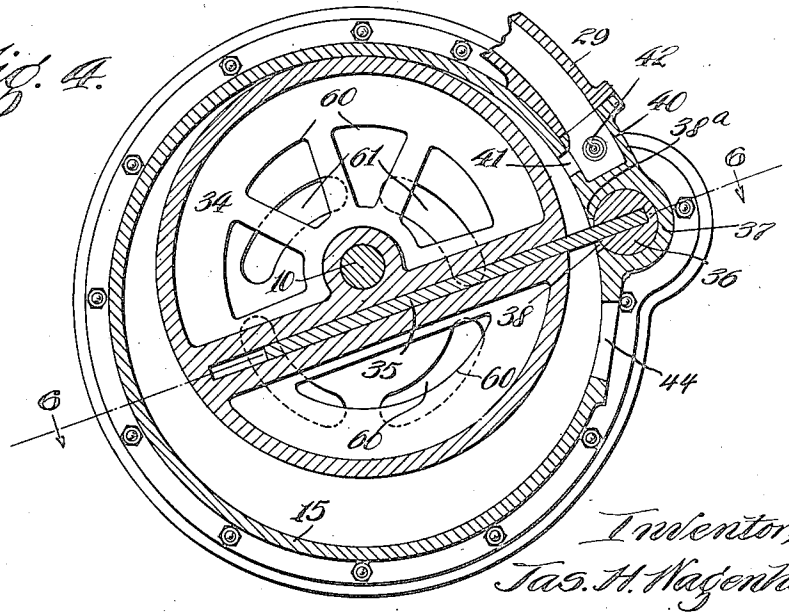


Fig. 4.



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ROTARY INTERNAL COMBUSTION ENGINE

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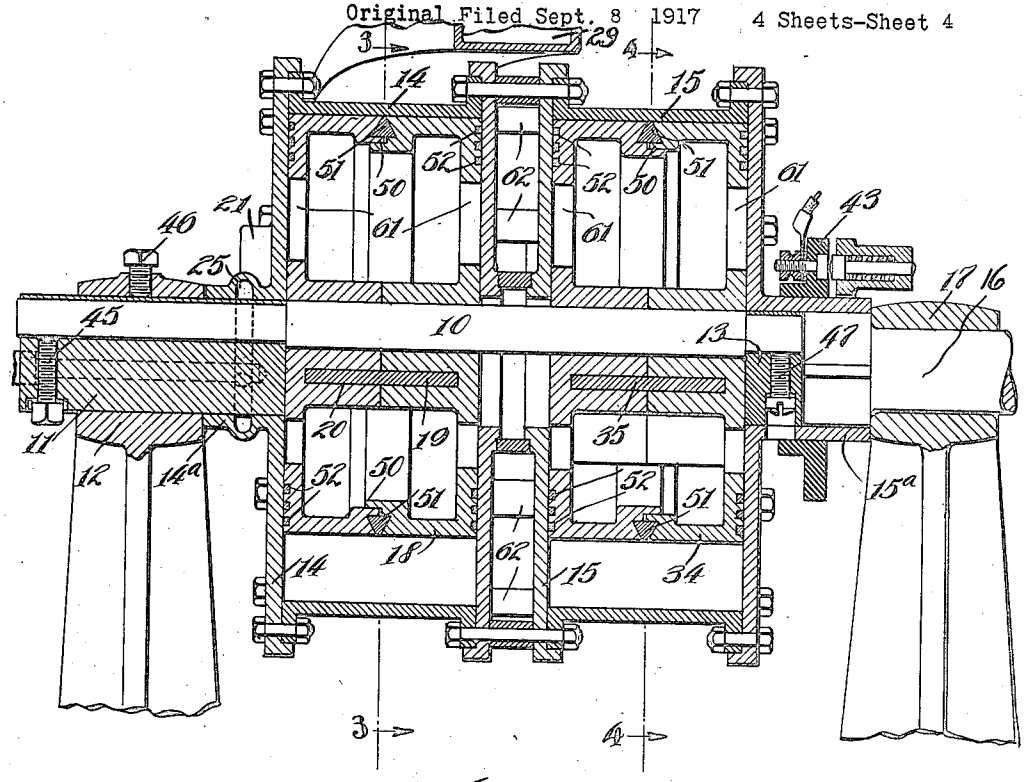

Fig. 5.

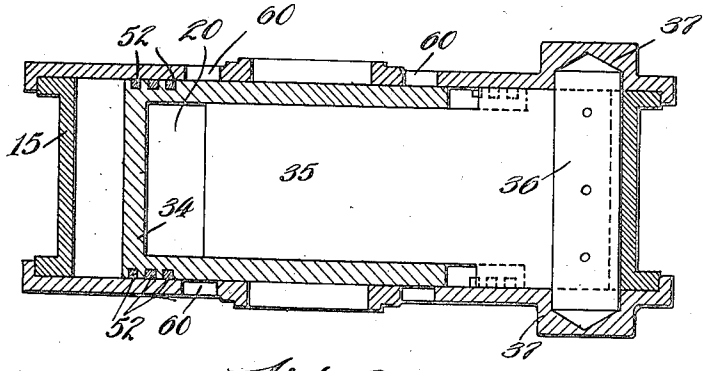

Fig. 6.

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UNITED STATES PATENT OFFICE.

JAMES H. WAGENHORST, OF JACKSON, MICHIGAN.

ROTARY INTERNAL-COMBUSTION ENGINE.

Application filed September 8, 1917, Serial No. 190,298. Renewed March 16, 1923.

To all whom it may concern:

Be it known that I, JAMES H. WAGENHORST, a citizen of the United States, residing at Jackson, in the county of Jackson and State of Michigan, have invented a certain new and useful Improvement in Rotary Internal-Combustion Engines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention relates generally to internal combustion engines and more particularly to an internal combustion engine of a rotary type.

The object of the invention is to provide a motor which is balanced and free from reciprocating parts, and one in which the piston friction is reduced to a minimum and the radiating surface about the explosion chamber increased to a maximum.

Another object is to provide a motor in which the compression chamber is independent of the explosion chamber thereby securing mixtures of greater density.

Another object is to provide a motor in which the compression and explosion chambers and their parts act as a fly wheel, and in which the weight of the engine per horse power output is reduced to a minimum and the revolutions per foot of piston speed increased to a maximum. The motor being of the rotary type eliminates vibration.

A motor of the kind hereinafter described is particularly adapted for the use of gasoline as a fuel in view of the fact that the motor revolves in the air which is a part of the explosive mixture, eliminating the difficulties attending packing, as both the intake and exhaust of the explosive can be easily accomplished while the motor is in motion.

Another object of the invention is to reduce the number of parts, no intake or exhaust valves being required, only a valve connection between the compression and explosion cylinders being set to determine initial mixture compression, this valve being interposed between the compression and explosion cylinders, and prevented from opening by either spring or mechanical means.

With these objects in view, and with other objects which will become apparent as the description proceeds, the invention may be said to consist broadly in providing two rotary cylinders or chambers rotating in unison, one of said cylinders or chambers being a compression chamber and the other a firing or ignition chamber, the compressed charge being transferred from one chamber to the other, the impact or motive force of the explosion being utilized to cause the chambers to rotate and perform all the necessary operations of intaking compressing, transferring and firing.

The invention consists also in providing an internal combustion engine of the rotary type in which the cylinder is caused to rotate and the rotary motion of this cylinder itself utilized for accomplishing the work to be performed.

An internal combustion engine of the character described is particularly adapted for aeroplane, automobile, motor boat and submarine engines, and in aeroplane engine structures the blades of the propeller can be connected directly with the hub of the rotating cylinder, and in the automobile, motor boat and submarine engine structures, the driven member can be directly connected with the hub of the cylinder.

The invention consists also in certain details of construction and novelties of combination all of which will be fully described hereinafter and pointed out in the appended claims.

In the drawings forming a part of this specification Fig. 1 is a side elevation; Fig. 2 is a plan view of the same, Fig. 3 is a central section through the compression cylinder, Fig. 4 is a central section through the explosion cylinder; Fig. 5 is a longitudinal sectional view; Fig. 6 is a detail on the line 6—6 of Fig. 4; Fig. 7 is a detail of the gas connection; Fig. 8 is a detail of the timer looking toward the engine; and Fig. 9 is a detail of the timer in the opposite direction.

In the practical embodiment of my invention I employ a shaft 10 which at one end is mounted eccentrically in a bushing 11 which is journaled in a bushing 12. At the opposite end the shaft 10 is eccentrically mounted in a bushing 13 which is arranged in the hub portion of a cylinder as hereinafter explained.

Cylinders 14 and 15 are mounted upon shaft 10 and rotate after the same, the hub portion 14^a of the cylinder 14 turning upon the bushing 11 while the hub portion 15^a of the cylinder 15 contains the bushing 13 heretofore referred to, the hub portion

15[a] being rigidly connected by a key or otherwise to a combined journal and support 16 mounted in a suitable bearing 17.

The cylinders 14 and 15 are rigidly connected together and moved in unison. The cylinder 14 may be designated the intake and compresssion cylinder and the cylinder 15 the firing and exhaust cylinder and within each cylinder is arranged what may be termed a piston or impeller, said piston or impeller in each instance consisting of a cylindrical shaped member 18 and a blade 19. The cylindrical member 18 mounted within the cylinder upon the shaft 10 turns loosely thereon in unison with the cylinder and the blade 19 is connected to the cylinder 14 and reciprocates in a slot or slide way 20 cut in the member 18, beyond the center of 18 and adjacent thereto. This blade has a limited vibratory movement with reference to the cylinder 14 and a limited reciprocating movement with reference to the member 18 due to the fact that the cylinder 14 turns upon the bushing 11 and the member 18 upon the shaft 10 which is eccentric with reference to said bushing. It is therefore obvious that as the cylinder 14 rotates the piston, consisting of the member 18 and blade 19, will be constantly changing their positions with reference to the interior of the cylinder; and the crescent shaped space between the said parts constantly shifting around the entire circumference of the cylinder.

As previously stated the member 18 is slotted to receive the blade 19, the outer end of this blade being rigidly secured to a cylindrical pin 21[a] which fits in a suitably recessed boss 21 formed in the wall of the cylinder, there being an opening 22 made in the wall of the cylinder and communicating with the recess of the boss and through which the blade extends, the walls of this opening being inclined as shown at 22[a] in order to permit of the vibration of the blade. An intake opening 23 is made in one side of the cylinder and to which leads the intake pipe 24 extending from the intake manifold 25 which is in communication with any suitable form of carbureter 26.

The mixture entering the cylinder through the opening 23, which is upon one side of the piston is caused to travel around to the opposite side thereof by the shifting or changing movement of said piston and during such movement the charge becomes compressed. Adjacent to the recessed boss 21, but upon the side of the blade opposite to the inlet opening 23, is an outlet opening 27 which is closed by means of a valve 28 until the pressure within the cylinder 14 reaches a predetermined limit, say eighty pounds, at which time the valve 28 is unseated and the compressd charge is forced cut through the outlet opening 27 into a passageway or conductor 29 which leads to the cylinder 15 and delivers the compressed charge thereto.

There may be various ways of maintaining the valve 28 seated until the proper pressure has been obtained and in the drawing I have shown one form in which the stem of the valve is projected through a suitable boss 30 formed upon the cylinder, and bearing upon said stem is one end of a lever 31 pivoted to a boss 32, the end of said lever being somewhat enlarged and bearing upon a coil spring 33 arranged between a boss of the cylinder and the end of lever; and the centrifugal force acting upon the weighted end of the lever 31 will aid materially in maintaining the valve 28 seated and by the employment of a properly tensioned spring the valve can be so regulated as to open immediately the predetermined pressure has been obtained, but not before. The cylinder 15 is constructed exactly the same as the cylinder 14 and it has therein a piston or impeller comprising a cylindrical member 34 and a blade 35, this cylindrical member being slotted to receive the blade and permit sliding movement of the same therein and the outer end of this blade is fitted into a cylindrical pin or bushing 36 exactly the same as previously described and which fits in the recessed boss 37 and there is an opening 38 corresponding with the opening 22 previously described and the walls are beveled as shown at 38[a].

In all respects the construction and arrangement of the pistons are the same in both cylinders except that it will be noted that they are arranged at oblique angles to each other, that is their pivotal ends are approximately 140°–150° apart. It will also be noted that each blade works back and forth in its respective circular member close to the center of said circular member.

The conductor or passage 29 leads into a manifold or chambered boss 40 formed upon the exterior of the cylinder and an intake opening 41 is provided through which the compressed charge is delivered into the cylinder upon one side of the blade 35, and comparatively close thereto, and in the side of the cylinder but not projecting therethrough is a spark plug 42 having electrical connection with a suitable distributing contact 43 mounted upon the hub of the cylinder and adapted to deliver the spark at the proper time to ignite the charge when the same has been delivered in sufficient quantity into the space 43, and when the ignition occurs the impact of the explosion is exerted against the walls of the cylinder and impeller including the blade and the cylinder is caused to rotate and this rotation of the cylinder causes the shifting of

the parts as previously described and the spent gases pass from one side of the impeller or piston to the opposite side and passes out through the exhaust opening 44.

The shaft 10 is made stationary by securing the same to the bushing 11 by means of a set screw 45 or any other suitable means, and the bushing 11 is made fast in the bearing 12 by means of a set screw 46 or otherwise. At the opposite end the shaft is made fast to the bushing 13 by means of a set screw 47 and it will be noted that this set screw passes through an opening in the hub 15^a of the cylinder so that the said hub is free to rotate about said bushing. Whenever it is desired to adjust the relative positions of the moving parts with reference to one another it can be accomplished by releasing the set screws and either turning the shaft 10 slightly in the proper direction or holding the shaft stationary and turning the cylinders to the proper extent and then retightening all of the parts.

I have shown the cylindrical portions of the impellers or pistons as composed of two longitudinal sections provided with lap joints 50, there being a packing ring 51 between said sections, and in the faces of the cylindrical portions of the pistons where they contact with the ends or heads of the cylindrical casing there are grooves 52 which may be supplied with packing if desired, but in practice I have found that an air pocket will be provided and which will serve practically the same purpose.

Openings 60 are made in the sides of the cylinders, and openings 61 in the walls of the cylindrical portion of the impeller in order that the engine may be air cooled, the air being drawn through as the cylinders rotate.

The cylinders are spaced apart a short distance, by spacing blocks 62 arranged between the same and the sides of the cylinders and said blocks being rigidly bolted together. These details of construction with reference to the cylinders may be varied or changed without departing from the broad principle of the invention and instead of having the engine air cooled it may be water cooled, water being introduced through the central shaft and directed to the interior of the impellers.

The shaft 10 is firmly supported at each end and the cylinders turning upon their bushings which are properly held relieve the shaft of all strain or torque.

In operation the motor is started by rotating the cylinders and an explosive charge is drawn in through the opening 23 as the impeller uncovers said opening and this charge is forced around to the opposite side of the impeller or piston and forced out through the opening 27 when the proper pressure or degree of compression has been obtained. As the valve 28 is unseated the charge rushes through the passage or conductor 29 into the manifold 40 and out through the opening 41 into the space 43 where ignition occurs through the spark 42. The impact operates upon the blade and this being pivotally connected to the outer cylinder or case, carries the same around and, inasmuch as the cylindrical portion of the impeller and the outer cylinder or case are eccentric with reference to each other the contacting walls of these parts will be constantly shifting their position with relation to each other so that the exploded charge will be carried around to the opposite side of the blade and forced out through the exhaust opening.

The cylinders 14 and 15 being rigidly connected together move in unison, and the blades being connected to the outer cylinders or casings and reciprocating in the inner or cylindrical portions of the impellers or pistons cause all of said parts to move in unison and the blades of the cylinders being arranged in opposed relation the continued rotation of the cylinders causes the successive charges to be sucked in, compressed, trapped between the two pistons and fired, the motive force of the explosion continuing the rotation of the cylinders and consequently the movements of all the parts necessary to effect the complete operation of the device.

By the construction herein shown and described I am able to produce a motor consisting of an exceedingly small number of parts so arranged as to eliminate wear and friction to a very large extent and furthermore it will be noted that the relative arrangement of the moving parts is such that the engine as a whole is practically balanced and furthermore I am enabled to connect the working parts direct to the cylinder receiving the initial impact and by having the shaft supported at each end, and the cylinder rotating between fixed bearing points, all troque strains are eliminated. Furthermore in an engine of this kind all negative work is avoided.

Having thus described my invention, what I claim is:—

1. The combination with a shaft, of a plurality of cylinders mounted upon said shaft and moving in unison, said cylinders communicating with each other, means for compressing a charge in the first mentioned cylinder, means for releasing said charge at a predetermined pressure and delivering the same to the second cylinder, means for igniting said charge in the second cylinder, and means contained within said second cylinder for receiving the force of the explosion.

2. The combination with a shaft, of a plurality of cylinders arranged thereon and moving in unison upon said shaft, communicating means between said cylinders, a

movable member within the first cylinder for effecting the intake and compression of a charge, means for delivering the charge from the first mentioned cylinder to the second cylinder at a predetermined pressure, means for igniting the charge at the entrance of the second cylinder, and a movable member contained within said second cylinder, and receiving the impact of the explosion.

3. In an internal combustion engine of the kind described, the combination with a pair of cylinders adapted to rotate in unison about a shaft, each cylinder having a piston mounted upon said shaft and having connection with its respective cylinder, each piston having a blade member, the blade members being arranged at oblique angles to each other, each cylinder having inlet and outlet openings, communicating means extending from the outlet opening of one cylinder to the inlet opening of the other cylinder, means for supplying an explosive charge to one cylinder and means for igniting the charge in the other cylinder.

4. In an internal combustion engine of the kind described, the combination with a pair of cylinders mounted upon a shaft adapted to rotate in unison, each cylinder having inlet and outlet openings, communicating means between the outlet opening of one cylinder with the inlet opening of the other cylinder, means for delivering an explosive charge to one cylinder and means for firing a charge in the other cylinder, a piston in each cylinder mounted upon the shaft, connected with the cylinder and movable therewith, the piston of one cylinder effecting compression of the charge delivered to the said cylinder, the piston of the other cylinder receiving the impact of the explosion within said cylinder and affecting the rotation of said cylinder and the exhaustion of the spent gases.

5. In an internal combustion engine of the kind described, the combination with a pair of cylinders mounted upon a shaft and adapted to rotate in unison, of pistons arranged in each cylinder, mounted upon the shaft, and connected with their respective cylinders, the piston of one cylinder effecting compression and the piston of the other cylinder receiving the impact of explosion, each cylinder having inlet and outlet openings, communicating means between the outlet opening of one cylinder with the inlet opening of the other cylinder, and means for maintaining a definite pressure within the compression cylinder before permitting the transfer of the compression charge together with means for supplying and igniting the charge.

6. In an engine of the kind described, the combination with a fixed shaft, of a pair of cylinders mounted to rotate thereon in unison, a piston in each cylinder comprising a cylinder portion and a blade, each blade having a pivotal connection with its respective cylinder and a reciprocating movement with its cylindrical member, each cylinder having an inlet and outlet opening communicating means between said cylinders, means for supplying an explosive charge and means for firing the same.

7. In an engine of the kind described, the combination with a fixed shaft supported at each end by eccentric bushings upon the ends of said shaft, cylinders connected together and rotatable upon said bushings, a piston in each cylinder comprising a cylindrical portion mounted upon the shaft and a blade portion having pivotal connection with the cylinder and reciprocative connection with the cylindrical member, each cylinder having inlet and outlet openings, communicating means between the cylinders, means for supplying a charge to one cylinder and means for exploding a charge in the other cylinder.

8. In an engine of the kind described, the combination with a fixed shaft of the eccentric bushings upon the ends of said shaft, a pair of cylinders connected together and adapted to rotate in unison upon the said bushings, each of said cylinders having inlet and outlet openings, communicating means between said cylinders, means within one cylinder for effecting compression of a charge, means connected with said cylinder for supplying a charge, means within the other cylinder for receiving the impact of the explosion and means connected with said cylinder for firing a charge, said cylinders having the working parts connected directly therewith.

9. In an internal combustion engine of the rotary type, the combination with a fixed shaft, of chambers rotatable about said shaft, means contained within one chamber for effecting compression, means within another chamber for receiving the impact of an explosion, together with means for conveying a compressed charge from one chamber to the other, the impact receiving means being connected with the chamber whereby said chamber is caused to rotate.

10. In a device of the kind described, the combination with a stationary shaft, of a plurality of cylinders rotatable thereon, each cylinder having inlet and outlet openings, means for supplying an explosive charge to the first cylinder, a piston within said cylinder, said piston and shaft being adapted to receive a cooling fluid, means for conveying the compressed charge from the first cylinder to the second cylinder, means for firing the compressed charge, and a piston arranged in the second cylinder adapted to receive the impact of said explosion, said impact receiving piston being connected with

said second cylinder, said piston being adapted to receive a cooling fluid.

11. In an internal combustion engine of the rotary type, the combination with a stationary shaft, of cylinders rotatable about the same, each cylinder having inlet and outlet openings, means for supplying an explosive charge to the first named cylinder, means within said cylinder for effecting compression, means for conveying the compressed charge from the first cylinder to the second, together with means for retaining the compressed charge within the first named cylinder until a predetermined limit of compression is obtained, means for firing the compressed charge in the second cylinder, means contained within said cylinder for receiving impact and effecting exhaustion, the said impact receiving means being connected with the cylinder whereby rotation is effected.

In testimony whereof, I hereunto affix my signature.

JAMES H. WAGENHORST.