A. JOHNSON.

ROTARY INTERNAL COMBUSTION ENGINE.

APPLICATION FILED APR. 12, 1916.

1,242,197.

Patented Oct. 9, 1917.

6 SHEETS—SHEET 1.

Fig. 1.

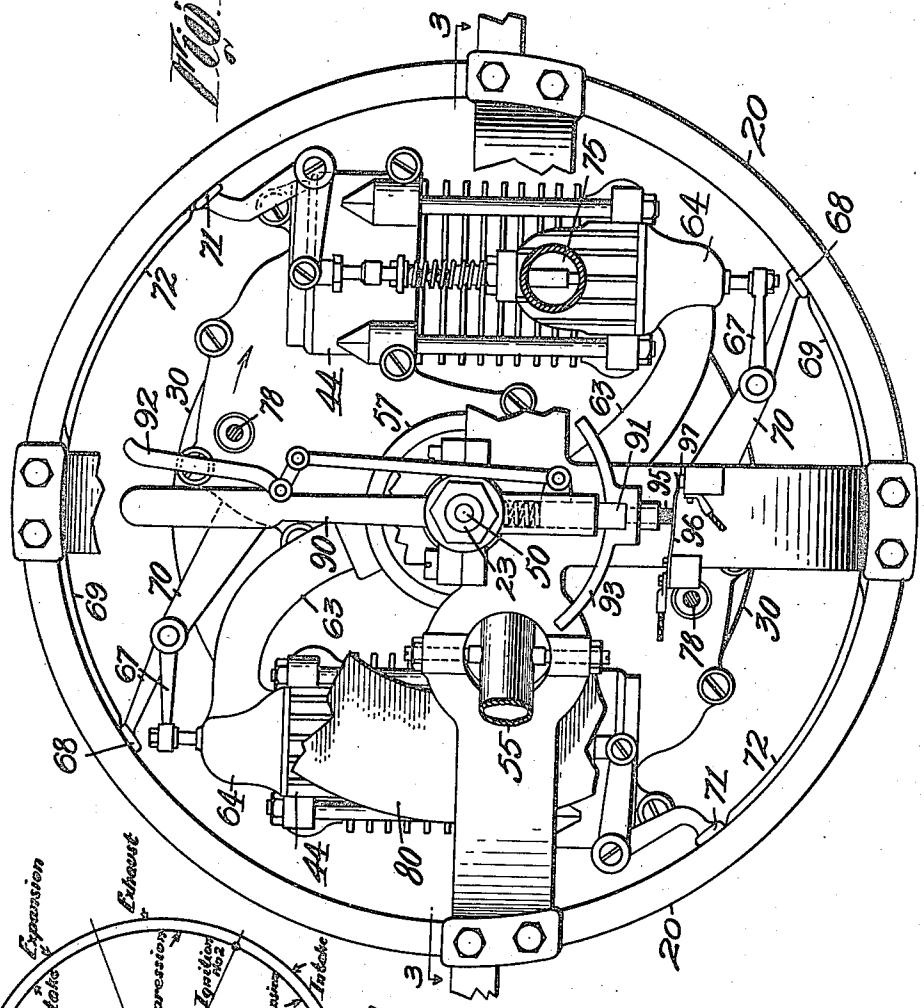
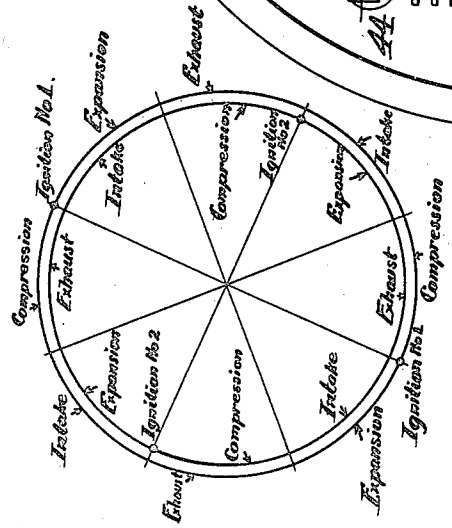


Fig. 1a.



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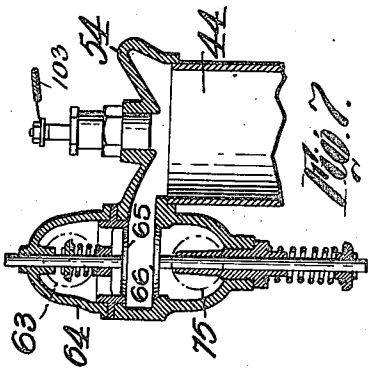


Fig. 1.

Fig. 2.

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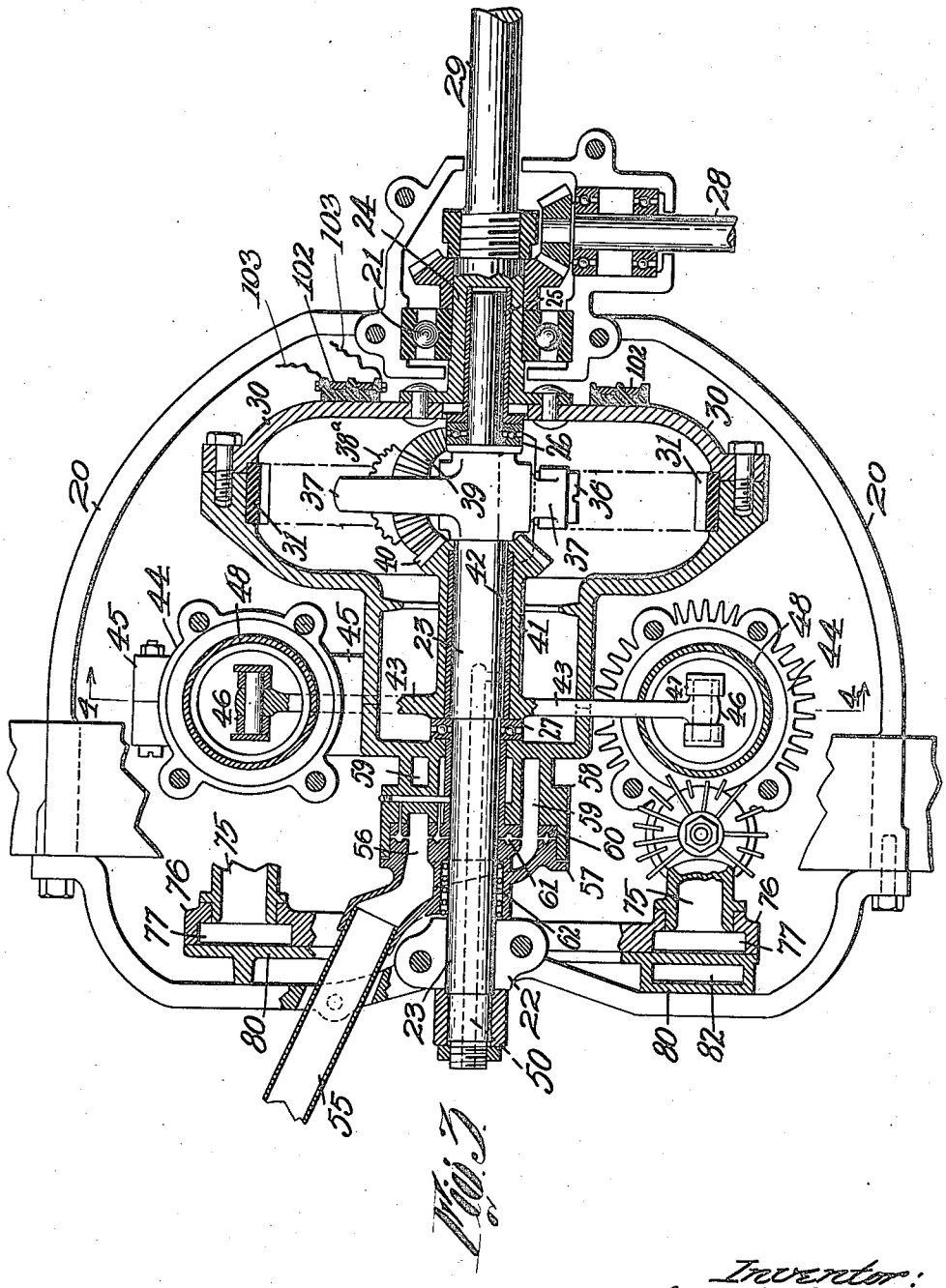


Fig. 3.

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Fig. 4.

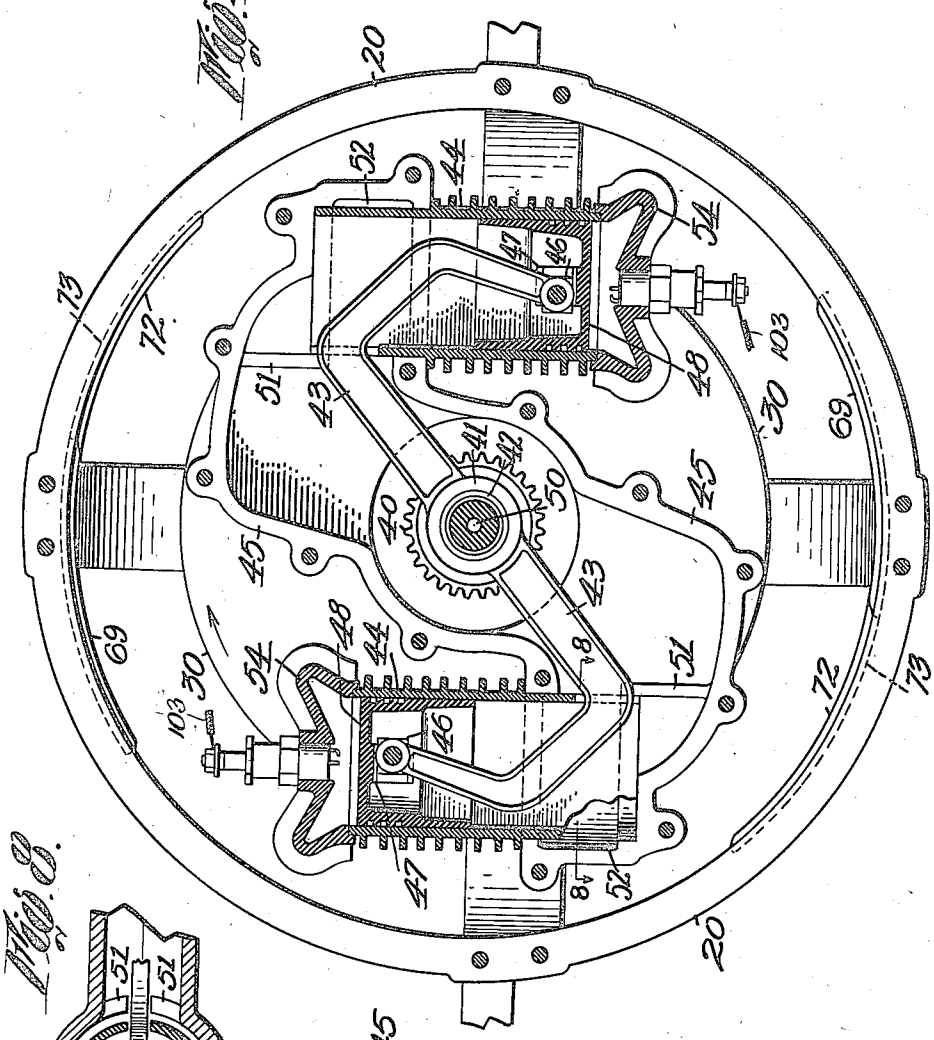


Fig. 8.

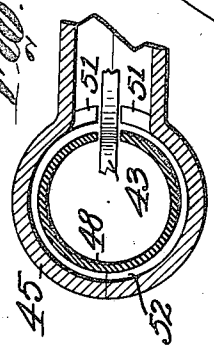
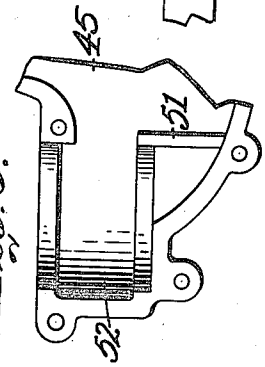


Fig. 9.



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6 SHEETS—SHEET 5.

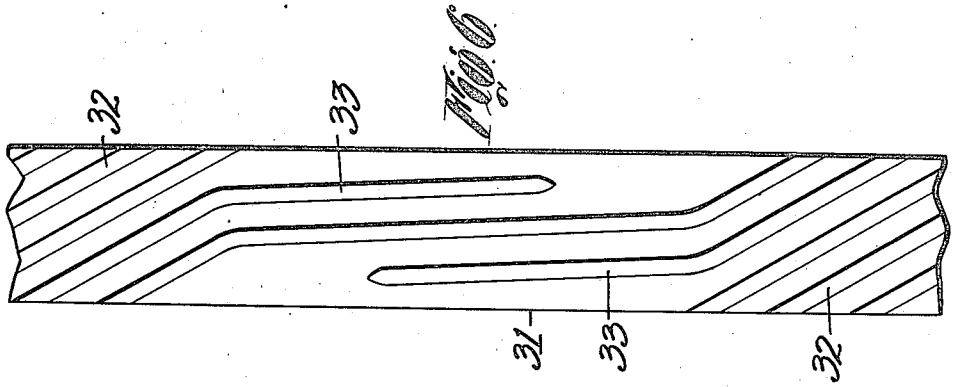


Fig. 6.

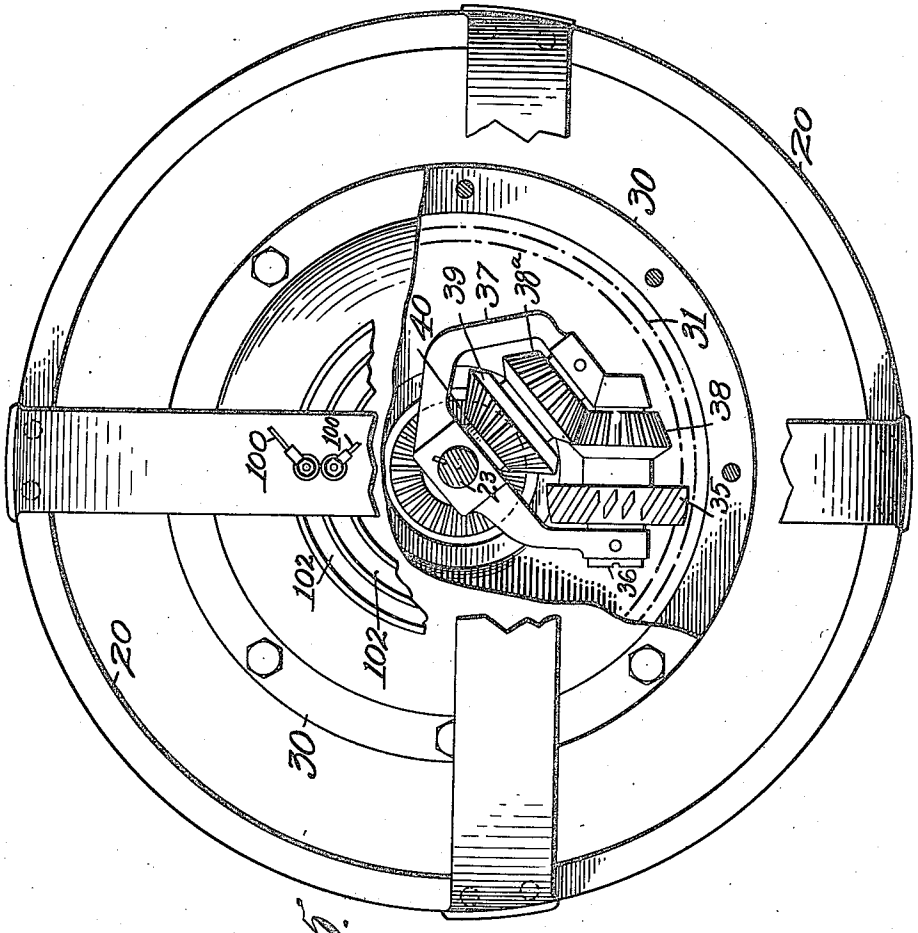


Fig. 5.

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6 SHEETS—SHEET 6.

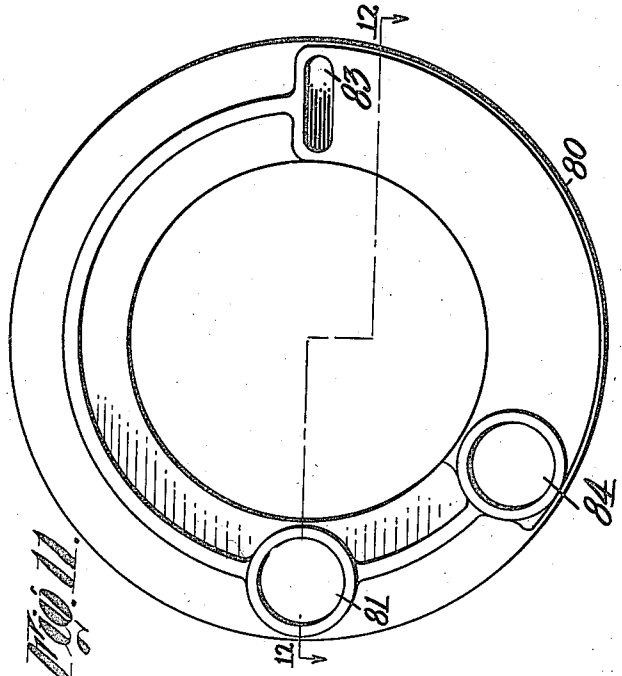


Fig. 11.

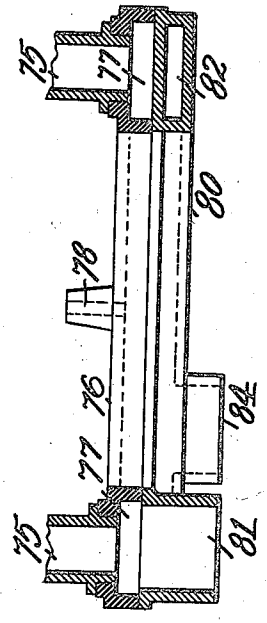


Fig. 12.

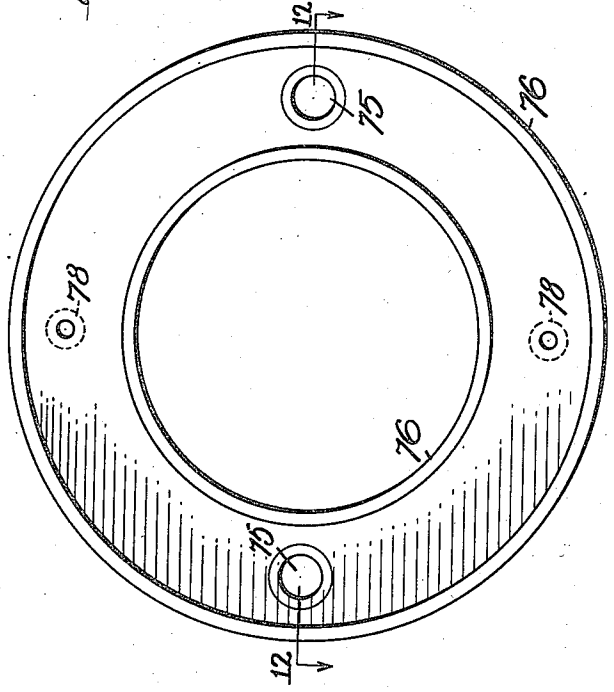


Fig. 10.

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UNITED STATES PATENT OFFICE.

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ROTARY INTERNAL-COMBUSTION ENGINE.

1,242,197. Specification of Letters Patent. Patented Oct. 9, 1917.

Application filed April 12, 1916. Serial No. 90,760.

To all whom it may concern:

Be it known that I, AUGUSTUS JOHNSON, a citizen of the United States, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented a new and useful Rotary Internal-Combustion Engine, of which the following is a specification.

This invention relates to an internal combustion engine of the type in which cylinders and pistons are employed rotating around a center and located laterally at a distance therefrom.

The principal objects of the invention are to so combine the parts that all the shock and vibration are received by the stationary frame which supports the parts, and in which there shall be no dead centers, thus permitting of operation at a high speed without injury to the operating parts; also to provide a construction in which the usual cam shaft is entirely done away with, together with al the difficulties which are attendant upon it in the ordinary practice; and to provide a construction of comparative simplicity. The invention also involves improved oiling features and means for cooling the exhaust gases and utilizing their heat, and other features of construction.

It will be understood that this engine is designed so as to have a shaft which is stationary during the operation of the engine, although it can be oscillated for starting purposes, and in which both cylinder and piston rotate around this shaft and always rotate in the same direction during the operation of the engine, the relative speeds of the cylinder and piston being varied to permit of the usual gas engine cycle of operations, but this variation preferably consists merely in slowing up the piston while the cylinder rotates at a constant speed.

Reference is to be had to the accompanying drawings, in which—

Figure 1 is an end view of an engine constructed in accordance with this invention, parts broken away to show interior construction;

Fig. 2 is a plan of the same with some of the outside frame sectioned away;

Fig. 3 is a central sectional view substantially on a horizontal plane;

Fig. 4 is a transverse sectional view on the line 4—4 of Fig. 3;

Fig. 5 is a view of the end opposite that shown in Fig. 1;

Fig. 6 is an inside view of part of the internal gear which controls the operation of the piston, developed into a plane;

Fig. 7 is a sectional view of one of the cylinder heads and valve casings on the line 7—7 of Fig. 2;

Fig. 8 is a sectional view of the cylinder and piston on the line 8—8 of Fig. 4;

Fig. 9 is an elevation of a portion of one of the two castings constituting a casing in which the cylinder is located, showing the oiling features;

Fig. 10 is an elevation of the rotary portion of the exhaust, cooling and air heating device;

Fig. 11 is a similar view of the stationary part;

Fig. 12 is a sectional view on the line 12—12 of Figs. 10 and 11 showing these two parts in their proper position with respect to each other, and

Fig. 13 is a diagrammatic figure showing the cycle of operations.

The engine is shown as mounted on a fixed base or frame 20 which supports all the parts, and of course receives all the vibration and shock. This frame carries a ball-bearing 21 and a hub 22 which support the main shaft 23. This shaft is what I call a stationary shaft because it is stationary during the operation of the engine, although it is intended to be oscillated for starting purposes. The ball-bearing 21 does not directly support the end of the shaft 23, but carries a hub 24 which is rotatable independently of the shaft 23 and in which the end of the main shaft 23 is supported. Between the hub 24 and the end of the shaft 23 is a bushing 25 and I have shown additional ball bearings 26 and 27 along the shaft 23. It may as well be stated at this time that this hub 24 is connected with a rotating gear casing 30 so as to be rotated directly thereby and is a part of the transmission shaft 29, so that the power is transmitted from the engine through this shaft. It is also geared to the magneto shaft 28 as will be understood.

This gear casing 30 is provided with an internal gear 31 of peculiar construction. This gear is provided with two kinds of teeth, "quick-pitch" teeth 32 and teeth 33 of a comparatively slow pitch. These teeth, however, are continuous with each other after the manner indicated in Fig. 6 and constitute the equivalent of a spiral gear having teeth of two different pitches thereon. This gear meshes with a gear 35 mounted on a stud 36 which is supported by a frame 37 fixedly carried by the main stationary shaft 23. This gear 35 has teeth all of the same pitch but some of them are cut off to enable them to enter the spaces between the teeth on the gear 31. On this stud 36 is also a bevel gear 38 meshing with a bevel gear 38a which is relatively fixed to a bevel gear 39 meshing in turn with a bevel gear 40. This gear 40 is fixed on a hub 41 rotatably mounted on the shaft 23, a bushing 42 being shown between them for an obvious purpose.

It will be seen that the turning of the gear 35 caused by its moving relatively to the gear 31 will turn this train of gears and consequently turn the hub 41. This hub is shown in the present instance as provided with two arms 43. These two arms extend in opposite directions directly from the hub so as to enter the end of cylinders 44. In this case two of these cylinders are shown located parallel with each other tangentially in a plane transverse to the shaft and on opposite sides of the center of the machine. These cylinders are fixed with respect to a casing 45 formed of two castings in which the arms 43 are located. Each of the arms is bent at a comparatively sharp angle so as to enter the cylinder and be capable of moving relatively to it longitudinally as will appear. At the end of each arm is a cross head 46 sliding in a transverse guide 47 on a piston 48 which is mounted in the cylinder.

From what has been said so far it will be seen that the piston and cylinder are capable of a relative reciprocating motion, the arms 43 having plenty of space in the casing 45 which really constitutes a pair of projections from the casing 30. It is to be borne in mind, however, that both the piston and cylinder always move forward and that it is only a relative motion that is provided, that is, the piston is slowed up during certain parts of the cycle, while the cylinder continues to rotate at normal speed, but even in that case the piston is always moved forward.

It will be noted that the shaft 23 is shown as provided with an oil passage 50 extending longitudinally, and furthermore that the casing 45 is specially constructed for oiling purposes. The oil entering this casing from the ends of the bushing 42 will naturally have a tendency to move outwardly by centrifugal force into the ends of the cylinders. This is prevented by partitions 51 and the oil, or most of it, kept from flowing inwardly toward the centers of the pistons and forced to move into two annular reservoirs 52.

The course of the gases through the engine will now be described. From the carbureter gas is drawn in through a stationary pipe 55 into an annular chamber 56 in a stationary member 57 located concentrically with the shaft 23. Secured to or integral with the hub of the casing 45 is a projection 58 also having an annular passage 59 which communicates with the passage 56 so that the gases can freely enter this passage 59 from the carbureter. It will be seen that the joint between the stationary and rotating parts 57 and 58 is provided with double conical rings 60 lubricated by oiling passages 61. A spring 62 is employed to hold them in close contact.

From the annular chamber 59 are shown two pipes 63 which conduct the gases freely to the valve casings 64 of the respective cylinders. Each valve casing is provided with two puppet valves 65 and 66, one for admission and the other for exhaust. Each admission valve is controlled by a two armed lever 67 having a shoe 68 thereon adapted to engage a cam 69 which is placed on the inner circumference of the stationary casing 20. This two-armed lever 67 is supported on a bracket 70 rotatable, of course, with the cylinder. A similar construction is shown for the exhaust valve, the shoe 71 of which is controlled by a cam 72. These cams 69 and 72 are adjustable in slots 73 on the frame. They are of course secured positively in their adjusted positions and entirely do away with the necessity for a cam shaft. It will be understood that there are separate cams for the different cylinders, two cylinders in the present case being shown, there are two admission and two exhaust cams for each cylinder. This is to provide, as shown in the diagram Fig. 13, for two complete cycles for each cylinder during each rotation.

The spent gases are exhausted from the cylinders, controlled by the puppet valve 66, through tubes 75, which tubes extend to a revolving circular member 76. This has an annular channel 77 on its plane face for receiving the exhaust gases from the exhaust pipes 75. This member 76 is held by the casing 45 by means of bolts extending into bosses 78. It will be seen that the gases are forced to circulate in the channel 77 while they are still hot, because this is located substantially in contact with the plane face of a stationary circular member 80 carried by the frame 20. This stationary member 80 is provided with a passage 81 which is open clear through to the channel 77 and takes the exhaust gases to

the muffler. It is also provided with an air channel 82 having a cold air intake 83 and with an outlet 84 which is connected with the carbureter by means not herein shown. This is for the purpose of causing the air taken to the carbureter to flow through this channel and substantially in contact with the heated gases from the exhaust so as to warm the air before it goes to the carbureter.

For the purpose of starting the engine the stationary shaft 23 is oscillated by the following mechanism. Fixed on this shaft is a starting lever 90. This is provided with a spring-pressed detent 91 and with a link and lever connection 92 for operating it. This detent normally enters a notch in a curved plate 93 which is fixed in stationary position on the frame. Under ordinary circumstances the shaft 23 consequently is held in fixed position thereby. When it is desired to start the engine, however, the lever 92 is pressed against the starting lever 90 to withdraw the detent 91 and then the lever 90, together with the shaft 23 can be oscillated. The oscillation of this shaft results of course in the oscillation of the frame 37 which is fixed thereto. This carries the train of gears 35, 38, 38[a] and 39 back and forth so that the gear 35 is oscillated on its shaft by its engagement with the gear 31 which at that time is stationary. Consequently the bevel gear 40 which is fixed with respect to the hub 41 is oscillated and that hub is turned with it. This causes the two pistons to reciprocate in their cylinders for the purpose of drawing in a charge in one cylinder or the other and compressing it. This is rendered possible because the admission valve springs are made weak enough to yield and permit admission of a charge when the piston is drawn back.

At the same time that the detent 91 is raised a projecting end 95 thereon of insulating material is withdrawn to allow a spring 96 to break its contact with a conductor 97 which breaks the spark circuit, as the parts 96 and 97 are connected in series with the primary of the magneto. Now with the gas compressed in the cylinder the lever 90 is brought back to normal position and the lever 92 released which locks the shaft 23 in stationary position and reconnects the spark circuit. The high tension circuit involves two wires 100 from the two point magneto, each of which is directly connected with a spring brush 101 mounted on the stationary frame 20. These brushes are pressed by their springs against conducting rings 102 carried by the casing 30. One brush and ring is provided for each spark plug. Each ring has a wire 103 connected with a terminal of one spark plug, the other terminals being grounded on the frame. The high tension induction coil circuit is also connected with the wires 100. The spark being produced manually not automatically in the cylinder which has the gas therein under compression, explosion takes place and the engine starts, and thereafter the ignition is provided for in this manner.

The operation of the engine is very simple. One of the cylinders, as has been stated, being provided with its charge under compression, the explosion will obviously tend to cause the piston and cylinder to separate. The effect of this is to force the cylinder forward, the piston acting merely as an abutment. The power secured by this action is transmitted directly to the casing 30 by the cylinder, and to the transmission shaft 29. At the same time the other cylinder is taking in a charge and getting ready for assisting the operation of rotating the casing 30, and, of course, the casings or projections 45 with it.

In this way it will be seen that the usual cam shaft is entirely done away with, that the actual stopping of the piston and cylinder is entirely avoided so that there is nothing to correspond to the usual dead centers, at the same time adequate provision is made for oiling the parts, the sparking circuit is of the simplest character, and the exhaust gases are employed for warming the air going to the carbureter. At the same time these advantages are secured by comparatively simple mechanism which on account of the peculiar operation of the engine is not subjected to the usual violent shocks usually met with in this class of machines.

Although I have illustrated and described only a single embodiment of the invention and shown only two cylinders and pistons I am aware of the fact that the same principle can be carried out with a different number of cylinders and pistons and with modifications in various other features without departing from the scope of the invention as expressed in the claims. Therefore I do not wish to be limited to these or the other details of construction herein shown and described, but what I do claim is:—

1. In an internal combustion engine, the combination of a stationary shaft, a casing rotatably mounted on the shaft and having hollow projections extending outwardly therefrom, cylindrical shells supported by said projections constituting cylinders, a hub rotatable on the shaft independently and having arms extending outwardly therefrom in said hollow projections, pistons in the cylinders connected with said arms, and means for controlling the motion of said arms around the shaft and moving them constantly in the same direction but at varying speeds.

2. In an internal combustion engine, the combination of a stationary shaft, a hub thereon having arms extending therefrom, a

piston connected with each of said arms and rotatable therewith, a casing rotatable about said shaft independently of said hub, a cylinder for each of said pistons carried by said casing, means carried partly by said shaft for rotating said hub as the casing rotates, and means for varying the speed of rotation of said hub while the casing rotates at constant speed.

3. In an internal combustion engine, the combination of a stationary shaft, a casing rotatable about said shaft, cylinders fixedly carried by said casing and rotatable with it around the shaft, a piston located in each cylinder, a hub rotatable about the shaft, connections from the hub to said pistons for operating the pistons, a gear mounted on said casing and rotatable therewith and having two sets of gear teeth thereon, quick pitch and slow pitch teeth, a train of gearing connected with said hub for operating it and comprising a gear meshing with said gear on the casing whereby during a part of the rotation of said casing one set of teeth will drive said hub at a rapid rate and during another part of the rotation of the casing the other set of teeth will drive the hub at a slower speed to permit the pistons to be relatively retracted in the cylinders.

4. In an internal combustion engine, the combination of a stationary shaft, a casing rotatable about said shaft, cylinders fixedly carried by said casing and rotatable with it around the shaft, a piston located in each cylinder, a hub rotatable about the shaft, connections from the hub to said pistons for operating the pistons, a gear mounted on said casing and rotatable therewith and having two sets of gear teeth thereon, quick pitch and slow pitch teeth, a train of bevel gearing connected with said hub for operating it and comprising a gear meshing with said gear on the casing whereby during a part of the rotation of said casing the quick pitch teeth will drive said hub at a rapid rate and during another part of the rotation of the casing the other teeth will drive the hub at a slower speed, and a frame for supporting said train of bevel gearing, said frame being fixed to the stationary shaft.

5. In an internal combustion engine, the combination of a shaft, a rotatable casing thereon, cylinders fixedly carried by said casing and rotatable with it, a piston located in each cylinder, a gear rotatable with said casing and having two sets of teeth, quick pitch and slow pitch teeth, a train of gearing connected with said pistons for operating them and comprising a gear meshing with said quick and slow pitch gear whereby during a part of the rotation of said casing the pistons will be rotated at a rapid rate and during another part will be rotated at a slower speed to permit them to be relatively retracted in the cylinders.

6. In an internal combustion engine, the combination of a stationary shaft, a casing rotatably mounted on the shaft and having hollow projections extending outwardly therefrom, cylinders supported by said projections, a hub rotatable on the shaft independently and having arms extending outwardly therefrom in said hollow projections, pistons in the cylinders connected with said arms, means for controlling the motion of said arms around the shaft, an oil reservoir around each cylinder, and means in said hollow projections for directing oil into the reservoirs.

7. In an internal combustion engine, the combination with a rotary set of cylinders and pistons, of exhaust pipes from the cylinders, a member rotatable with said cylinders having a face provided with an annular channel therein into which said exhaust pipes discharge, a stationary member located in contact with said rotary member and having a passage adapted to be connected to a muffler and open to said channel, said stationary member also having a circular air passage adapted to be connected with a carbureter and extending along the course of said channel and registering therewith throughout a part of its circumference.

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