H. G. BROWN.

INTERNAL COMBUSTION ENGINE.

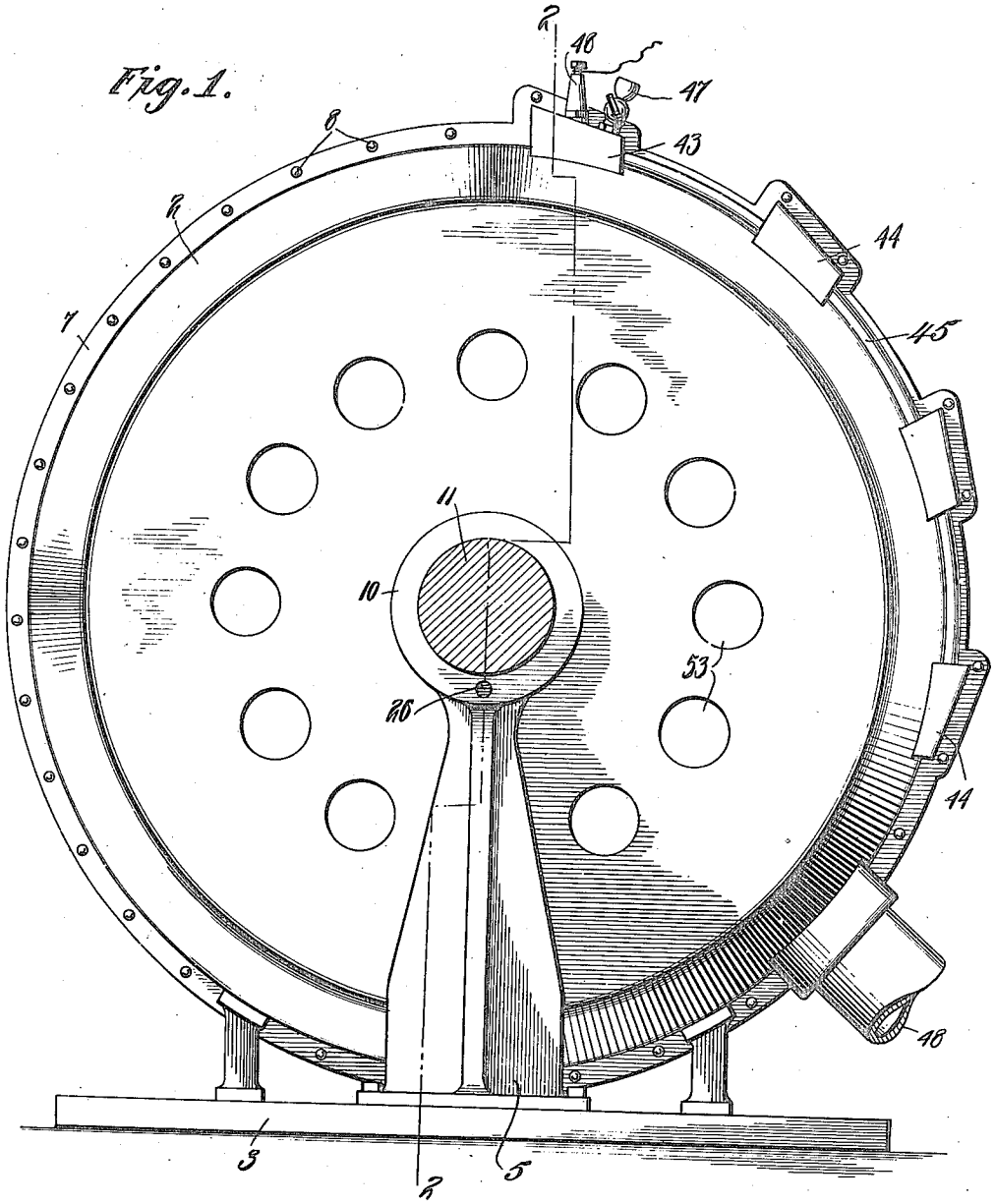
APPLICATION FILED OCT. 10, 1916.

1,282,745.

Patented Oct. 29, 1918.

7 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

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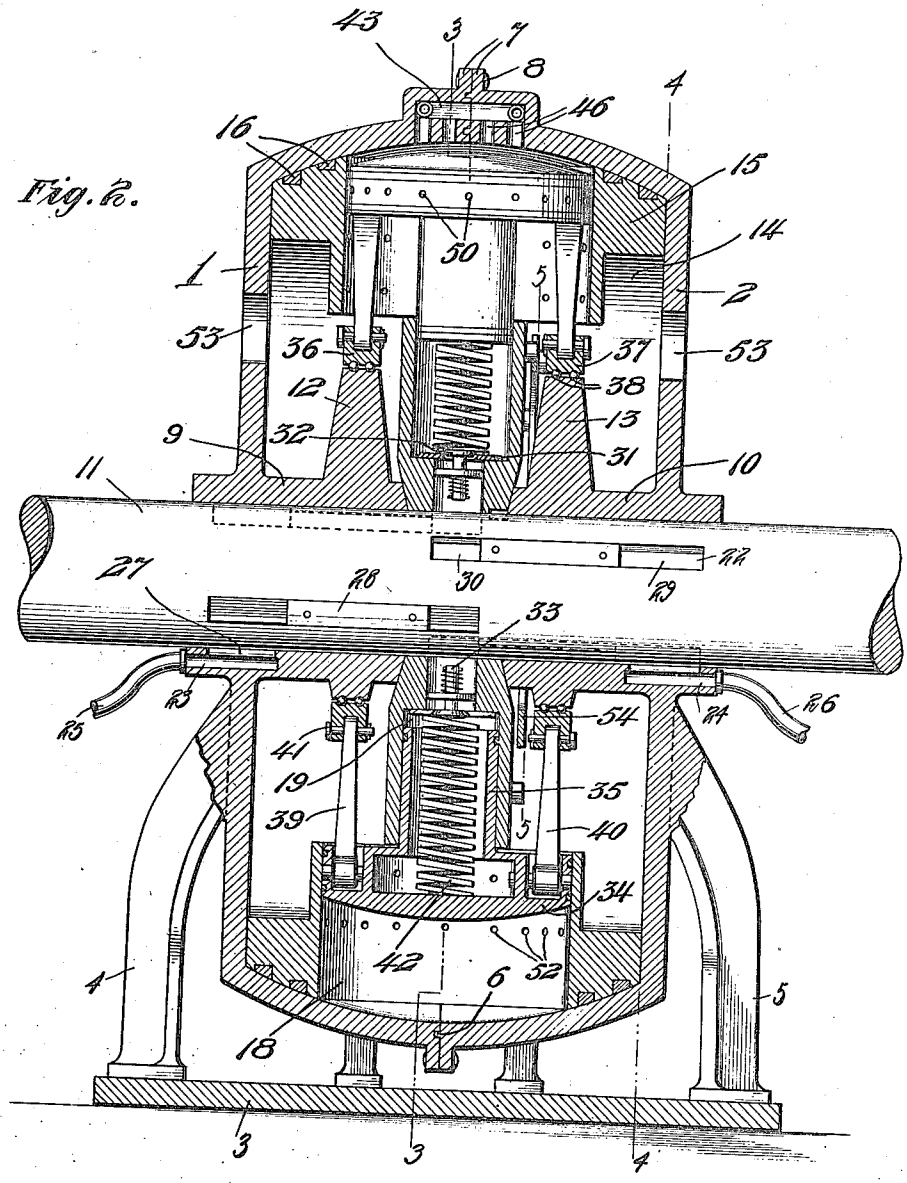
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7 SHEETS—SHEET 2.

Fig. 2.



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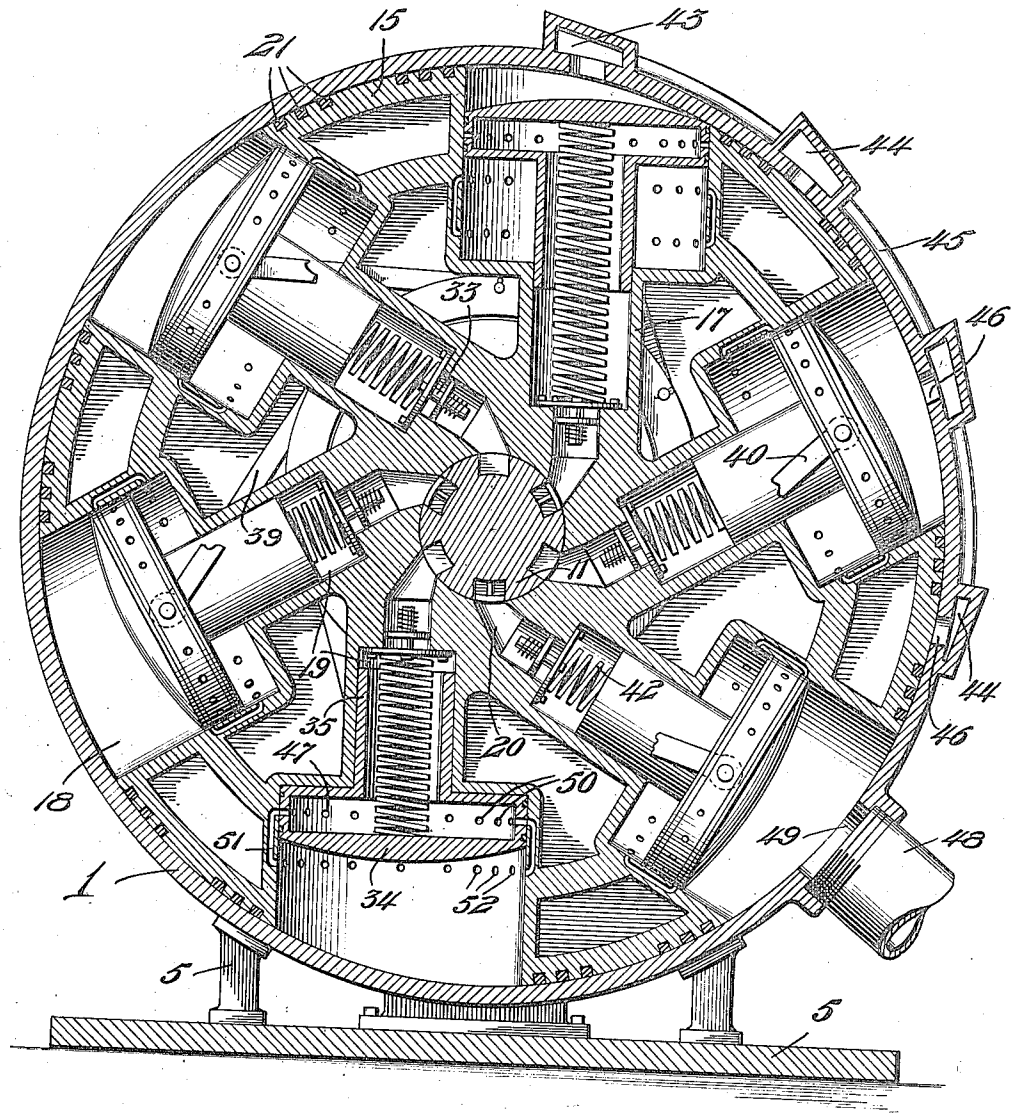
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7 SHEETS—SHEET 3.

Fig. 3.



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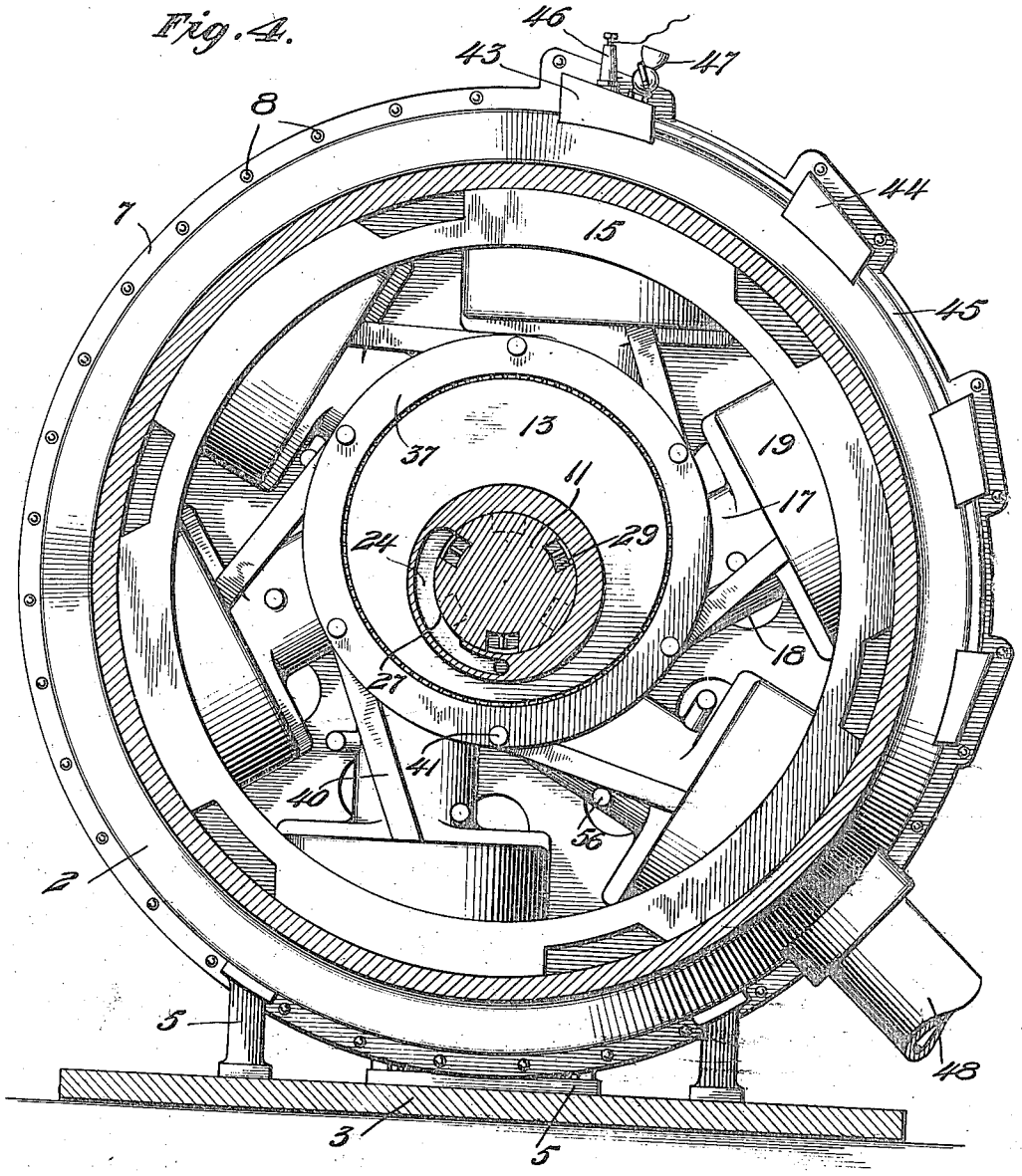
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7 SHEETS—SHEET 4.

Fig. 4.



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7 SHEETS—SHEET 5.

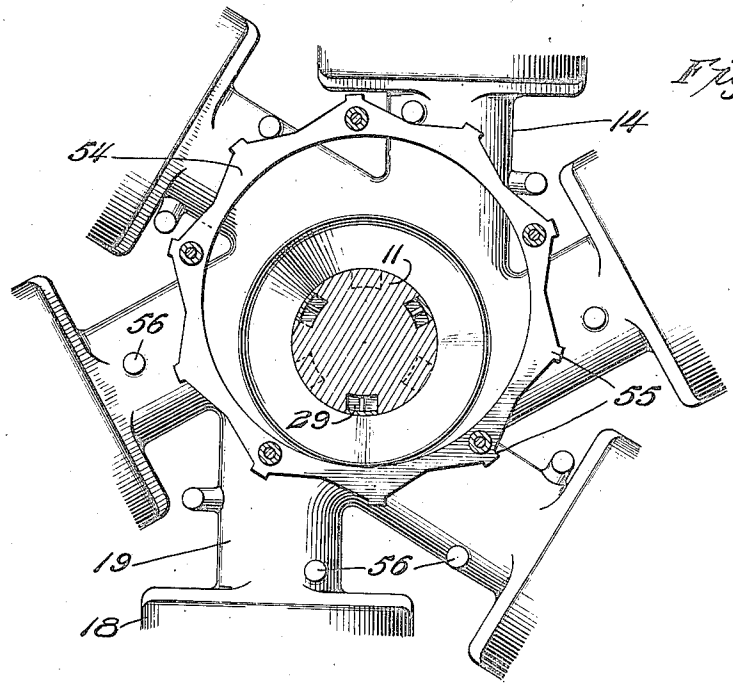


Fig. 5.

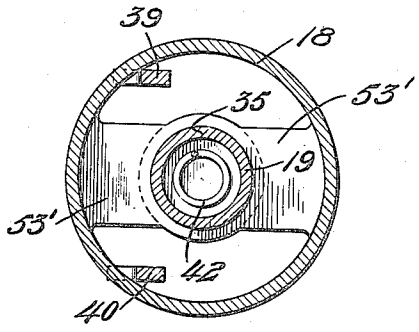


Fig. 6.

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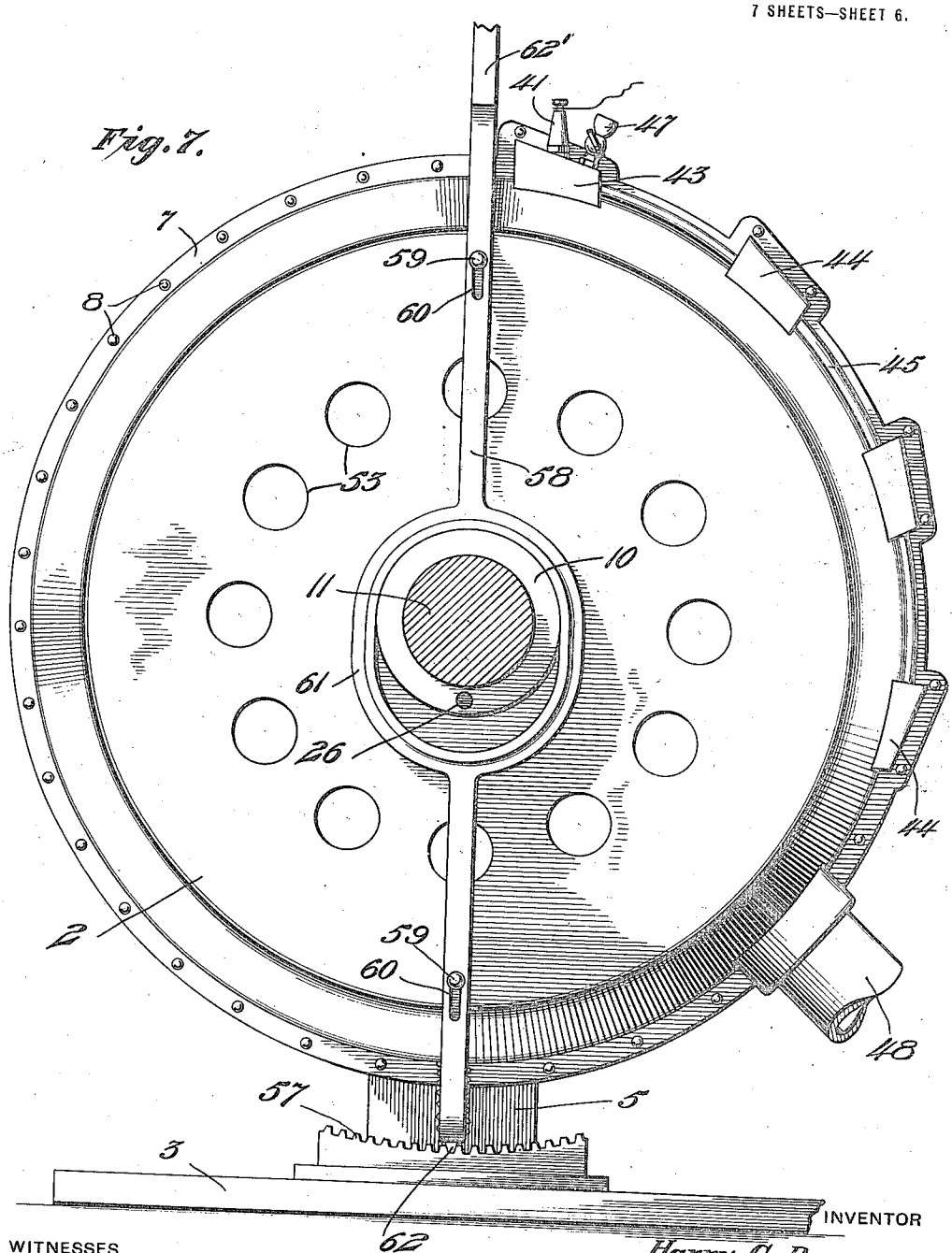
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7 SHEETS—SHEET 6.

Fig. 7.



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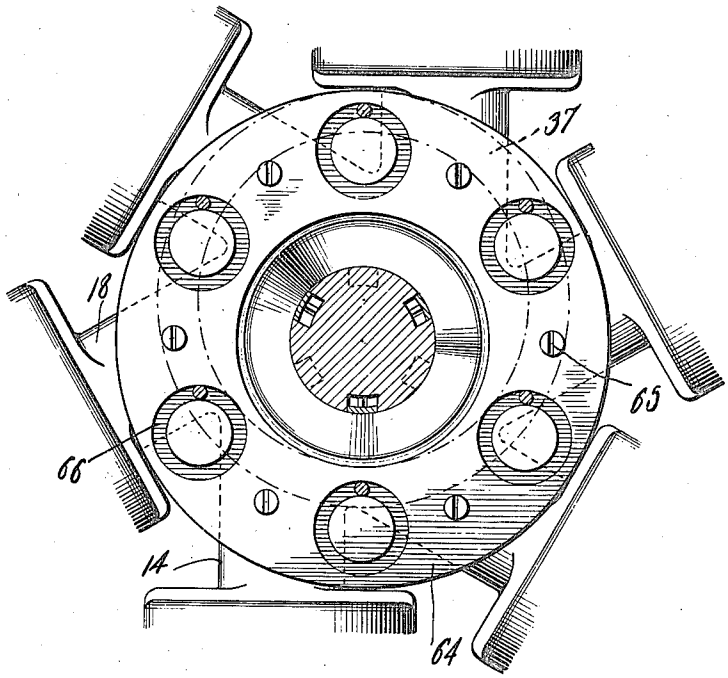
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7 SHEETS—SHEET 7.

Fig. 8.



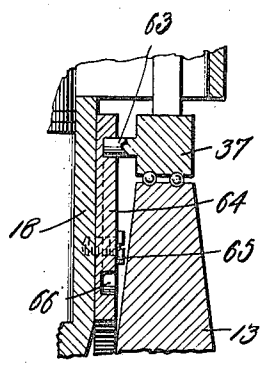


Fig. 9.

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UNITED STATES PATENT OFFICE.

HARRY G. BROWN, OF NORTH YAKIMA, WASHINGTON.

INTERNAL-COMBUSTION ENGINE.

1,282,745. Specification of Letters Patent. Patented Oct. 29, 1918.

Application filed October 10, 1916. Serial No. 124,851.

To all whom it may concern:

Be it known that I, HARRY G. BROWN, a citizen of the United States, residing at North Yakima, in the county of Yakima and State of Washington, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

This invention relates to an improvement in internal combustion engines, and more particularly to an engine of this character in which pistons are mounted to have reciprocatory movement and to then directly transfer this reciprocatory movement to rotate a power shaft without the use of cranks or crank arms.

The invention has for one of its objects, to provide a single casting in which a plurality of cylinders are formed around a common center to be disposed radially outwardly from the center, but with their axial line arranged to be angularly disposed from radial lines and to so mount said casting that it is directly connected with the power shaft of the engine and when rotated will cause turning movement of said power shaft.

Another object of the invention is to arrange pistons within said cylinders and to form the main shaft as a supply or distributing valve so that the explosive mixture will be supplied at the proper intervals to the inner ends of the cylinders and as the pistons move on the inward stroke the explosive mixture will be compressed to be subsequently discharged to the explosive chambers of the cylinders.

Still another object is to provide eccentric means with which the pistons are connected in such relation that upon firing of the explosive mixture in the chambers of the cylinders turning movement of the eccentric means will be accomplished, and in arranging a connection from said eccentric means to cause the motion thereof and the power generated thereto by the reciprocation of the pistons, to be directly applied to increase the turning action exerted by the cylinder casting upon the power shaft.

A further object lies in providing means whereby a portion of the explosive charge supplied to an explosive or combustion chamber of a cylinder is used in an ignited and flaming condition as the firing medium for firing the explosive charge as contained in other of the cylinders.

A still further object of the invention resides in constructing the gas distributing portion of the main drive shaft in such a manner that a full supply of gas will be given to each of the cylinders at the proper time, and when the gas supply opening or passage is cut off to thus absolutely preclude the possibility of accident through backfire, on the firing of the explosive charge in the cylinders.

Yet another object is to provide means by which the initial charge of explosive mixture may be ignited to start the engine and which means may be cut out of operation when the engine has attained proper operation and when the portions of the structure by which the flaming gas is conducted back from the cylinders to ignite subsequent charges has been brought into successful operation.

With the above and other objects in view, my invention consists in certain novel features of construction and combinations of parts which will be hereinafter set forth in connection with the drawings and then more particularly pointed out in the claims.

In the drawings:—

Figure 1, is a view in side elevation of an engine constructed after the manner of my invention.

Fig. 2, is a transverse sectional view taken on the line 2—2 of Fig. 1.

Fig. 3, is a sectional view taken on the line 3—3 of Fig. 2.

Fig. 4, is a sectional view taken at right-angles to the extent of the main shaft and on the line 4—4 of Fig. 2.

Fig. 5, is a fragmentary detail view of the means by which the cylinder casting and the piston actuating means are secured to operate in step or in unison.

Fig. 6, is a view taken transversely through one of the cylinders to better show the details of construction thereof.

Fig. 7, is a view similar to Fig. 1, showing a slightly modified form of the engine.

Fig. 8, is a detail view similar to Fig. 5 showing a somewhat modified form of means to hold the parts to operate in unison.

Fig. 9, is a fragmentary sectional view to better disclose the coöperative mounting of the cylinder casting, the piston actuated means, and the means for holding these parts in the proper relation.

The main casing comprises two half-shell members 1 and 2 which are mounted on the base member 3 through the medium of the

supporting standards or legs 4 and 5. These members 1 and 2 have tongue and groove connection at their joining edges, as is indicated at 6, and the outwardly extending securing flanges 7 have a rivet 8 or other fastening means passed therethrough to secure the shell members 1 and 2 connected together to form the completed casing, the tongue and groove on the edges of these members acting to form a fluid tight connection.

The shell members 1 and 2 have the hub portions 9 and 10 formed at their approximate centers and the main or drive shaft 11 is revolubly mounted in bearings provided in the hubs 9 and 10. Flange portions 12 and 13 are formed around the inner ends of the hubs 9 and 10 in eccentric mounting so that the greatest width of extension of the flanges from the hubs is preferably upwardly, as is better shown in Figs. 4 and 5.

A rotor is mounted on the shaft 11 between the hubs 9 and 10, and is keyed or otherwise secured on this shaft to turn therewith, the hub portions of the rotor being shaped to have the proper fit between the hubs 9 and 10 of the casing shells so that this rotor will be held against side shifting movement or side play. The rotor has a ringlike rim 15 which is shaped to have a turning fit within the casing and against the rim walls of the side members 1 and 2, suitable packing rings 16 being provided to be disposed around the rim 15 adjacent the side edges thereof so that a packing is established between this rim and the interior wall of the casing at the edges of the rim. The rotor 14 has a plurality of substantially spoke-like portions which connect between the rim and the hub thereof, and these spoke-like portions 17 are formed on two diameters to form the working or explosion cylinder 18 and the compression cylinder 19, these bores formed to extend inwardly from the outer face of the rim 15 of the rotor 14, being angularly disposed so that they do not extend in true radial line from the center; this arrangement of the bores of the cylinder being better shown in Fig. 3. Fluid passages 20 are formed to establish communication from the inner ends of compression cylinder 19 through the wall of the bore or the hub of the rotor, and thus the working cylinder 18 occupies the position where it opens through the outer face of the rim 15, the cylinder 19 is disposed inwardly beyond this working cylinder 18 and the fluid passage 20 is formed still further within the rotor. The mounting of the packing ring 16 in the manner set forth so forms the structure that fluid leakage from the working cylinders 18 laterally and then outwardly between the rotor and the inner wall of the casing is not permitted, and to stop leakage from any one of the cylinders 18 to the adjacent cylinders on either side, the packing strips 21 are mounted in suitable recesses formed in the outer face of the rotor 14, these recesses being extended even into the innermost packing ring 16, so that the ring 16 and the strips 21 will isolate each of the cylinders 18 from the remaining cylinders when the rotor 14 is mounted in place in the casing. The shaft 11 has the grooves 22 cut or otherwise formed therein, these grooves being made to extend at their inner ends slightly past the longitudinal center of the hub of the rotor and at the outer ends being stopped sufficiently short that they will at all time be covered by the hubs 9 and 10. In the present instance I have shown six sets of working and compression cylinders, and in consequence six fluid passages 20 are led to communicate with the central bore of the hub of the rotor, and under these circumstances three of the grooves 22 will be formed to extend to each side from the approximate longitudinal center of the hub, and the passages of one set will have their outer ends inclosed within the hub 9 while the passages of the remaining set will have their ends confined within the hub 10, the mounting of the rotor 14 on the shaft 11 being such that the grooves 22 which are to act as fluid supply passages in a manner to be hereinafter described, communicate at their inner ends with the fluid passages 20 and by reason of the fact that the rotor is fixedly mounted on the shaft 11, six of the fluid passages 20 will be at all times in direct communication with six of the fluid supply passages or grooves 22, the first being secured in the relation shown in Fig. 3. The hubs 9 and 10 are cored or otherwise hollowed out to form the fluid chambers 23, and 24, which are open at their inner sides to communicate with the bores of the hubs 9 and 10, and to thus communicate with the grooves or fluid supply passages 22 as the shaft 11 turns. Explosive mixture supply pipes 25 and 26 are led from a carbureter or other suitable charge forming device and are connected with the chambers 23 and 24 so that a constant supply of explosive mixture may be maintained in these chambers. The chambers 23 and 24 open as at 27 into the fluid supply passages 22, and plates 28 are secured over portions of these grooves or passages 22. Intake openings are provided at 29 and outlet openings at 30, direct passages being thus accomplished from the chamber 24 through the fluid supply passages 22 and the fluid passages 20, to the compression cylinders 19 at intervals as the intake end 29 of the passages 22 register with the openings 27 of the chambers 23 and 24, during the rotation of the shaft 11.

Suitable valve seat members 31 are mounted at the inner ends of the compression cyl-

inders 19 so that the passages therethrough are positioned to establish direct connection from the passages 20, and these members 31 have valve seats therein to receive the valves 32 which are of the puppet type, and are designed to be normally held closed by the springs 33 which are mounted around the stems thereof. The valves 32 are so mounted that they close down over the passages 20, and thus these valves will at all times act against the passage of fluid from the compression cylinders 19 to the passages 20 and will be held by the springs 33 to preclude the passage of fluid from the passageways 20 to the cylinders 19 except that the same be taken thereinto under pressure or under suction created within the cylinder, the hollow pistons 34 are mounted within the cylinders 18 to be capable of reciprocatory movement and are provided with suitable rings, and the sleevelike or tubular extensions 35 are formed to project from the inner faces of the pistons 34 and are received in the cylinders 19, suitable packing being provided around the inner ends to establish fluid tight connections between the sleeves and the walls of the cylinders.

Eccentric rings 36 and 37 are mounted around the eccentrically disposed flanges 12 and 13, suitable bearings races being provided in the interior walls of the rings 36 and 37 and in the outer faces of the flanges 12 and 13, to receive the ball-bearings 38 so that friction will be relieved as the eccentric rings 36 and 37 are turned on the flanges 12 and 13. Piston rods 39 and 40 are connected by suitable pivot pins with the pistons 34, and at their free ends are connected with the eccentric rings 36 and 37 by means of the pins 41, or in any other suitable manner, this mounting of eccentric rings on the ball-bearings 38 and the connection of the rings with the pistons through the piston rods 39 and 40 forming a structure in which the eccentric rings will be given turning movement on the flanges as the pistons 34 are reciprocated in the cylinders 18. Coil springs 42 are mounted within the sleeves 35 to bear at the outer ends against the under side of head of the piston 34, and at their other ends to bear around the valves 32, however these springs 42 are of sufficiently large diameters that free working of the valves 32 is not interfered with in any way.

A main firing box 43 is disposed from one side of the casing and a plurality of auxiliary firing boxes 44 are disposed from the casing beyond said main firing box, connection being established between these several firing boxes by the conducting tubes 45. Slots 46 are provided through the wall of the casing so that communication is established between each of the firing boxes and the interior of the casing, and with the cylinders 18 when the same come into registry with these openings 46. A priming cup 47 is mounted on the main firing box 43 and a spark plug 48 is also connected therewith to have its spark terminals within the firing chamber 43. By providing the openings 26 through the wall from the firing boxes 43 and 44, free communication is had from these boxes to the cylinders and the reverse and also the connection of the pipe 45 between the several firing boxes arranges these boxes in such relation that they constitute a substantially continuous passage with the openings 46 at spaced apart points along the length thereof, and thus when an explosive charge is introduced through the priming cap or cup cock 47, and a spark passes between the points of the spark plug 48, the flaming gas will pass through the openings 46 from the firing box 43 and will also pass through the tubes 45 to the several remaining firing boxes, the flaming gas will also find its way through the opening 46 from the firing boxes 44 to ignite the explosive mixture contained in the cylinders 18 above the pistons 34 thereof.

Each cylinder, together with the piston mounted therein, is substantially a reciprocating internal combustion engine of the two cycle type. As the rotor 14 rotates with its shaft 11, the eccentrically arranged flanges will cause the pistons 34 to be moved toward the outer ends of the cylinders 18, as the cylinders near the top of the shell members 1 and 2. This movement will cause a considerably increased space to be provided within the cylinders 19 as the same are moved upwardly, thereby decreasing the pressure therein and permitting the valves 32 to open when pressure is brought to bear against the inner ends thereof. Suitable fuel will be admitted into the cylinders 18 as these valves 32 are lifted from their seats. When the passages 20 register with the openings 30 formed in the shaft 11, the valves 32 will be forced open, by the pressure of the fuel acting upon the same, thereby causing a charge of the explosive mixture to be taken into the compression cylinders 19. Upon the return stroke of the sleeve 35 and piston 34, this charge of explosive mixture will be compressed and forced through the apertures 47, through the passages or ducts 51 and into the outer end of the cylinders 18. The second outward stroke of the piston 34 will compress the fuel within the cylinder 18, and as the firing box 43 is reached, this explosive mixture will be ignited and cause the piston 34 to move inwardly, in consequence of which, a new charge of explosive mixture will be compressed in the cylinder 19. In this way the engine may continue its operation.

An exhaust pipe 48 is arranged beyond the firing boxes 44 and in such a position

that the pipe 48 will be passed by the various cylinders as the pistons 34 thereof have reached substantially the inner ends of the inward stroke. The gases will then move out through the exhaust pipe 48, and the cylinder 18 will be ready for another charge. After the gas or fuel has been supplied to the cylinder 18, the pistons are forced outwardly under the action of the eccentric, and this outward movement is continued until the full compression of the gas, and a full outward stroke of the piston has been attained, at which point the cylinder registers with the fire box 43 and the next firing stroke takes place. As each cylinder 18 passes the pipe 48, the exploded gas passes out through the pipe 48.

To prevent undue increase in the temperature of the casing, the air passages 53 are formed through the shell member 1 and 2, and a suitable fan mechanism might be carried by the rotor in any of the approved manners in which said fans are now carried, or the casting might have vanes or ribs on the exterior of the cylinders 18 to permit a better circulation of air. To connect the cylinders 18 and 19 together, it is preferable that the web portions 53′ be provided so that the piston rods 39 and 40 may have free working movement and no obstruction or impediment will be entered into their paths, this structure being better shown in Fig. 6.

While the engine as described hereinbefore will operate efficiently, it is preferable that some means be provided to hold the eccentric rings 36 and 37 and the rotor casting 14 in step, so that the eccentric rings will travel at the same rate of speed. The structure shown in Fig. 5 might be adopted although it will of course be understood that various other forms of mechanism to accomplish this same purpose might be used. A ring 54 has the substantially star shaped teeth as indicated at 55, and this ring is secured to one of the eccentric rings 36 or 37, or for that matter a pair of the rings 54 might be provided and might be secured in this instance to each of the eccentric rings 36 and 37. The teeth 55 are spaced equally apart on the periphery of the rings 54, and an equal number of pins 56 are carried on the rotor structure. These pins 56 are mounted on the spokelike portions 17 of the rotor 14, or substantially on the outer walls of the cylinders 19, and are arranged concentrically around the turning center of this rotor structure, the pins being mounted at such distances from the turning center that as the rings 54 guide up to the highest points of the eccentric flanges, the pins will be engaged in the spaces between the star teeth 55 and in consequence the rings 54 will be held to turn at the same speed as the speed of rotation of the rotor 14, in consequence of which the eccentric rings 36 and 37 will be held to turn in the same manner.

In the disclosure in Fig. 7, a modified form of the invention is illustrated which is adapted to permit control of the speed of operation of the machine through advancing and retarding the time of firing of the explosive charge in each of the cylinders, and with this structure the parts are substantially identical with the portions as disclosed in the remaining views of the drawings with the exception that the shell members 1 and 2 of the casing are mounted on the hub portions 9 and 10 to be capable of turning movement, these hubs 9 and 10 being carried by the supporting legs 4 and 5 and the shaft 11 being mounted to be capable of revoluble movement in the bearings.

An arcuated rack 57 is mounted on the base structure 3 beneath the casing structure made up of shells 1 and 2, and a yoke member 58 is fitted over the casing and is held thereon through the medium of the tubes 59 which are passed through the slots 60 so that this yoke is held against turning movement but is permitted to have sliding movement in the direction of line upon the casing, a substantially elliptical ring portion 61 is provided in the yoke, upon each side to permit turning of the same over the hubs 9 and 10 in such relation that the endwise sliding movement of the yoke will yet be permitted, and a handle 62′ is provided on the yoke member 58 to allow manual movement of the same in the sliding path and also to permit swinging of the yoke and consequently swinging of the casing. A tooth 62 is carried on the lower portion of the yoke 58 so that as the yoke is moved to its lowered position this tooth 62 will engage with the teeth of the rack member 57 and in consequence the casing comprising the shell members 1 and 2 will be held against swinging movement. The firing boxes 43 and 44 are carried by this casing structure and as the casing is swung in one direction or the other the disposition of the firing boxes will be changed without altering the mounting of the intakes for the various cylinders, or without changing the relative position of the eccentric flanges 12 and 13, in consequence of which the operation of the pistons within the cylinders will not in any wise be altered while the variation in the positioning of the firing boxes will cause the explosive charges within the cylinders to be fired when the gas is compressed to a predetermined degree so that the speed of operation of the engine will be varied accordingly.

In the operation of the engine, the initial or starting charge is entered in through the priming cup 47 into the firing box 43, and by reason of the fact that the pipe 45 connects the firing box 44 with this box 43, the

gas will flow into each of the firing boxes, and in consequence will flow into two of the cylinders 18 which will be in registry with the openings 46 from these firing boxes. The circuit to the spark plug 48 is then closed and in consequence the gas charge in the firing boxes is ignited, which causes the charge in the cylinders to likewise be fired and start rotation of the rotor 14 this rotation being sufficient to bring the shaft 11 to the proper position to supply gas to subsequent cylinders, and the eccentric rings in their connection with the pistons 34 acting to cause compression of the gases within the cylinders 18 so that as the firing box 43 is reached the charge in the cylinders will be under full compression, and as the cylinder which has fired passes the lowermost firing box 44, the burning gas will be discharged back through the pipes 45 and will ignite gas which might be supplied to the firing box 43 from the compressed charge within the cylinder registering with the opening 46 thereof, or the flames will be of sufficient intensity to flare back through the opening 46 of this firing box 43 and in consequence the compressed charge relative to the point of the greatest gas compression in the rotation of the engine cylinders within the registering cylinder will be fired and this operation will continue as long as the explosive mixture is supplied through the pipes 25 and 26 the exhaust being at the end of the instroke of the piston 34, and the new supply of gas being introduced under pressure as the piston reaches its extreme instroke. The rings 54 having the star teeth thereon will cause the rotor and the eccentric rings to move in unison so that the proper operation of the parts will continue at all times.

With the form of structure as shown in Fig. 7, the operation of the engine will be substantially the same with the exception that by moving the yoke 58 and bringing the tooth 62 into engagement with varied teeth of the rack 57, the relative positioning of the firing boxes 43 and 44 may be varied in consequence of which the firing of the compressed explosive charge within the cylinders 18 will be advanced or retarded as the case may be, thus increasing or decreasing the speed of operation of the motor, and as long as a predetermined setting of the tooth 62 in the rack 57 is maintained the speed or operation of the motor will remain constant. With this adaptation, the structure is perhaps more efficient as the setting of the engine may be more readily accomplished and also retarding or advancing of the spark will permit regulation of the engine to best handle the load under which it is working.

With the modified form of the construction as illustrated in Figs. 8 and 9, the eccentric rings 36 and 37 and the rotor casting 14 are positively coupled so that they will at all times be held in step to operate together, however, the eccentric rings are permitted to have movement in the proper path around the eccentric while the rotor casting turns upon the fixed center. The eccentric rings 36 and 37 each have the outstanding pins or lugs 63 placed at predetermined and preferably equal spacing around the inner faces thereof, the pins or lugs being shown in section in Fig. 8 and the relative positioning of the ring 37 being illustrated by the dot and dash line. The ring plates 64 are secured by the use of the screws 65, or other suitable fastening means, upon the rotor casting and these ring plates 64 have the circular grooves 66 formed in the faces thereof which lie adjacent to the eccentric rings 36 and 37. The ring grooves 66 are preferably made with diameters equal to the throw of the eccentrics on which the rings 36 and 37 work, and thus as the ring plates 64 are mounted in place and are secured to turn with the rotor casting 14, the pins or lugs 63 of the eccentric rings 36 and 37 if placed within these circular grooves 66 will be free to move in the proper path with the eccentrics, but at the same time the eccentric rings will be held to turn with the ring plates 64 and consequently will move with the rotor casting 14. As has been stated, the form of the structure as shown in Figs. 8 and 9 is an alternative construction for that which is shown in Fig. 5, and it will of course be understood that other forms of the structure might be used and that an equally efficient operation would be accomplished.

Under some circumstances, such as for instance when the engine is to be used for high speed work, the intake valves 32 might be removed entirely, and the fit of the hollow shaft within the rotor would then be depended upon to stop leakage or back flow of the explosive mixture. Even if there should be back flow of the explosive mixture, the loss of compression and gas would be only slight as the engine would be working at high speed and consequently the loss through this slight leakage would not be felt, however, should it be found desirable, some form of packing might be introduced to stop this leakage or to reduce the same to a minimum.

From the foregoing it will be seen that I have provided an internal combustion engine in which the full driving force of the burning gases is obtained through the fact that these expanding gases are working against a reciprocating piston, and in which this force is used for driving the rotating parts of the engine and also it will be noted that the engine is constructed of comparatively few parts which are simple in their construction and assembling, and while I have herein shown and described only the

specific forms of the structure, it will be understood that a number of modifications and changes might be resorted to in the form and arrangement of the several parts without departing from the spirit and scope of my invention, and hence I do not wish to be limited to the exact disclosure, but only to such points as may be set forth in the claims.

I claim:—

1. In a combustion engine, a supporting structure, a main shaft revolubly mounted on said supporting structure, a rotor fixed on said shaft and comprising a plurality of combustion chambers disposed angularly with respect to radial lines from the turning center of said shaft, a fire box extending circumferentially of said rotor and having spaced openings along the length thereof, means to supply explosive mixtures to said combustion chambers, means to initiate combustion in said fire box, and all of said parts so arranged that as the rotor is carried forward by the explosion of the gases a portion of the burning gas will fire back through the fire box to ignite the explosive charges in subsequent combustion chambers.

2. In a combustion engine, a plurality of combustion chambers mounted about a central axis to be capable of turning movement as a body, a plurality of communicating firing boxes to discharge fire and ignite the explosive charges in the combustion chambers in succession from the burning gas of the exploded charges.

3. In a multi-cylindered combustion engine, a plurality of combustion cylinders, and intercommunicating firing boxes arranged with respect to the combustion cylinders to ignite the explosive charges in the combustion cylinders in succession from the burning gas of the exploded charges.

4. In a multi-cylindered combustion engine, a plurality of cylinders rotatable as a unit about a common axis, a firing box with which the cylinders successively communicate, means for igniting a charge in the firing box to ignite the explosive mixture in one of the combustion cylinders, and means to subsequently receive the ignited mixture from the cylinders and return the same to the firing box for the ignition of the explosive charge in the successive cylinders.

5. In a multi-cylindered combustion engine, a plurality of cylinders rotatable as a unit about a common axis, a firing chamber to receive explosive mixture from one of said cylinders, means to ignite the mixture in said chamber, a fire receiving and conveying means to receive the ignited mixture from the cylinders and return the same to the firing chamber for the ignition of the explosive in the successive cylinders as they successively register with the firing chamber.

6. In a multi-cylindered combustion engine, a plurality of cylinders rotatable as a unit about a common axis, a plurality of relatively stationary intercommunicating firing chambers with which said cylinders successively communicate in the rotation thereof, means for firing an initial charge in one of said chambers whereby the explosive mixture in one of the cylinders is ignited to impel the rotation of the cylinders, the flame being subsequently delivered to another of the firing chambers and returned therefrom to the first chamber to ignite the explosive charges in succeeding cylinders.

7. In a multi-cylindered combustion engine, a plurality of cylinders rotatable as a unit about a common axis, a firing chamber with which the cylinders successively communicate, means to ignite a priming charge supplied to said chamber whereby the explosive mixture in one of the cylinders is ignited to impel the rotation of said cylinders, and means for receiving a portion of the burning mixture from each cylinder and returning the same to the firing chamber for the ignition of compressed charges in the cylinders as they successively communicate with said chamber.

8. In a multi-cylindered combustion engine, a plurality of cylinders rotatable as a unit about a common axis, said cylinders being open at their outer ends, a casing within which the cylinders are inclosed, said casing having circumferentially spaced chambers thereon opening into the casing and with which the cylinders successively communicate, and means for simultaneously igniting a priming charge in each of said chambers whereby the compressed explosive mixture in a number of the cylinders will be ignited.

9. In a multi-cylindered combustion engine, a plurality of cylinders rotatable as a unit about a common axis, a casing inclosing the engine cylinders, a piston reciprocating in each cylinder, fuel supply means for said cylinders, means for actuating said pistons, and means on said casing for igniting the compressed fuel charges in the successive cylinders by the flame from the exploded charge in a preceding cylinder.

10. In a multi-cylindered combustion engine, a plurality of cylinders rotatable as a unit about a common axis, a piston to reciprocate in each cylinder, means operatively connecting the pistons to each other and radially shiftable with relation to the axis of rotation of said cylinders, relatively stationary means coacting with said first named means to radially shift the same, and means to prevent rotation of the first named means relative to the engine cylinders.

11. In a combustion engine of the class described, a plurality of combustion chambers, of a piston working within each chamber, said piston provided with a tubular extension projecting inwardly, a cylinder, said

tubular extension working within said cylinder, a valve for controlling the entrance of fuel into said cylinder, and means formed in said piston having parts therein for delivering fuel from said inner cylinder to said combustion chamber.

12. In a combustion engine, a cylinder having a working chamber and a charge receiving chamber, a hollow piston reciprocating within the working chamber and having a plurality of radially disposed fuel ports, said piston having a tubular extension disposed in the charge receiving chamber, a valve for admitting the fuel charge into said chamber and through the extension into the hollow piston, the wall of the cylinder having passages therein with which the ports in the piston are adapted to register at the end of the piston stroke in one direction to admit the fuel charge in the working chamber at the opposite side of the piston.

13. In a combustion engine, a cylinder having a working chamber and a charge receiving chamber, a valve controlling the admission of the fuel charge to the latter chamber and preventing back pressure through said chamber, a piston reciprocating in the working chamber and having a plurality of fuel conducting ports therein, an axially extending spring yieldingly urging the piston outwardly in the cylinder, means to move the piston inwardly against the action of said spring and compress the fuel charge in the charge receiving chamber, the wall of the working chamber having a plurality of cavities therein with which the ports in the piston are adapted to register to admit the compressed charge to the working chamber for compression in the outward stroke of the piston.

14. In a combustion engine of the class described, a plurality of combustion chambers, a piston working within each chamber and provided with an enlarged outer end, said piston terminating in a reduced inner tubular extension, a cylinder receiving said reduced extension, a valve carried by said cylinder and adapted to control the passage of fuel into said cylinder, means for supplying fuel to said cylinder, and means positioned within said piston and extending through said tubular extension for normally and yieldably exerting an outward pressure upon said piston.

15. In a combustion engine, a plurality of combustion chambers, a piston slidably mounted within each chamber, a reduced extension carried by each piston, said reduced extension provided with a longitudinally extending bore, a cylinder adapted to receive said reduced extension of said piston, a coil spring extending through said reduced extensions for exerting a yieldable outward pressure upon said piston, each inner cylinder provided with an aperture formed within the inner end thereof, a valve yieldably held in a closed position within said aperture and adapted to admit fuel through said aperture, and said valve being adapted to prevent the backward flow of fuel from said inner cylinder after fuel has been admitted into said combustion chamber.

16. In a combustion engine, a plurality of cylinders mounted for movement in an orbital path, means for compressing an explosive charge in each cylinder, a common firing means for the exploded charges, and means for adjustably positioning the firing means relative to the point of greatest compression of the charge in the movement of the engine cylinders.

17. In a combustion engine, a plurality of combustion chambers mounted for movement in a rotary path, a casing member mounted to move to a limited extent, firing means carried by said casing member, a stationary rack arranged adjacent said casing, an operating lever engaging said rack and adapted to hold said casing in an adjusted position relative to said rack, and means for holding said lever upon said casing and permitting longitudinal movement of said lever thereon.

18. In a combustion engine, a plurality of combustion chambers, a plurality of firing boxes arranged in spaced relation, means for forming a communication between said firing boxes, one of said firing boxes adapted to receive an initial explosive charge, means for exploding the initial charge within said box, and said communicating means adapted to convey the exploded charge to the communicating boxes whereby the exploded charge will ignite combustible material supplied to said combustion chambers.

19. In a combustion engine, a plurality of cylinders rotatable as a unit about a common axis, a firing chamber with which the cylinders successively communicate, means for firing a priming charge in said chamber, and means for adjusting the firing chamber circumferentially relative to the axis of rotation.

20. In a combustion engine, a plurality of cylinders rotatable as a unit about a common axis, a plurality of firing chambers arranged in concentric relation to the axis and with which said cylinders successively communicate, means to ignite a priming charge supplied to said chambers to explode the gaseous mixture in a number of the cylinders, and means for circumferentially adjusting the firing chambers as a unit relative to the axis of rotation.

21. In a combustion engine, a plurality of cylinders rotatable as a unit about a common axis, a casing within which said cylinders are arranged, firing means on said casing to successively ignite the explosive

charges in the cylinders, and means for imparting a rotary movement to the casing relative to the axis of rotation of the cylinders to adjustably position the firing means.

22. In a combustion engine, a plurality of cylinders rotatable as a unit about a common axis, a casing for said cylinders, firing means on the casing to successively ignite the explosive charges in the cylinders, and means for rotating the casing relative to the axis of rotation of the cylinders to adjustably position the firing means, said casing rotating means including a member slidably mounted on the casing, and a relatively stationary part for engagement by said member to lock the casing against rotary movement.

23. In a combustion engine, a plurality of cylinders rotatable as a unit about a common axis, a piston reciprocating in each cylinder, a radially movable member operatively connected to the pistons, and means on the cylinders coacting with said member to effect the rotation of the member as a unit with said cylinders.

24. In a combustion engine, a plurality of cylinders rotatable as a unit about a common axis, a piston reciprocating in each of said cylinders, an eccentric operatively connected to said pistons, and means carried by the rotating cylinders adapted to coact with spaced parts of the eccentric at one point in the rotation of the cylinders to effect a positive rotation of the eccentric as a unit with the cylinders.

25. In a combustion engine, a plurality of cylinders rotatable as a unit about a common axis, a piston reciprocating in each of said cylinders, an eccentric operatively connected to the pistons, a plate fixed to the cylinders, and a plurality of spaced studs on the eccentric, said plate having means with which the respective studs are operatively engaged to effect the rotation of the eccentric as a unit with the engine cylinders.

In testimony whereof I affix my signature in presence of two witnesses.

HARRY G. BROWN.

Witnesses:
THOMAS H. WILSON,
WALTER HESSE.