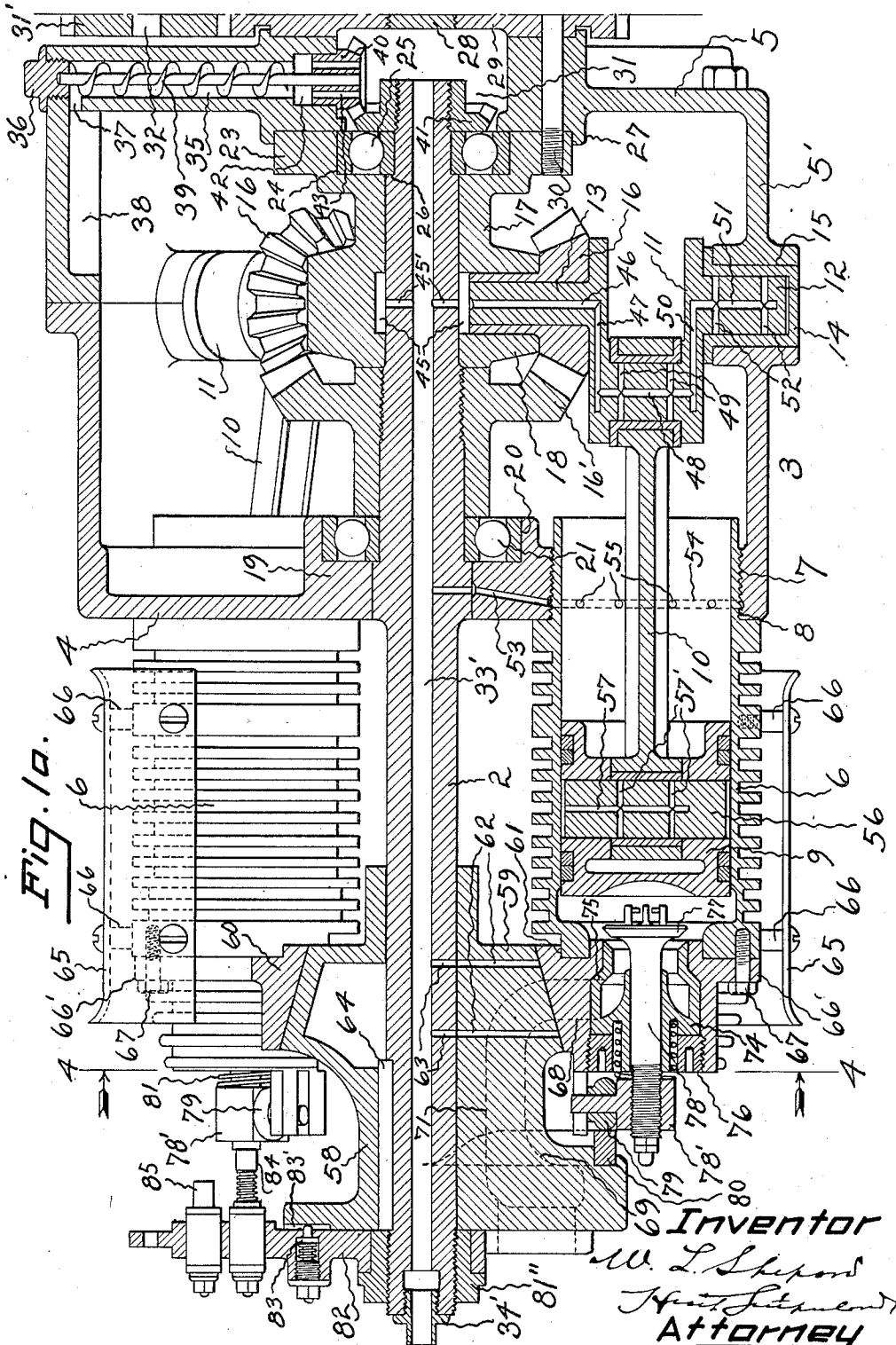


W. L. SHEPARD.
HYDROCARBON ENGINE.
APPLICATION FILED JUNE 20, 1919.

1,393,174.

Patented Oct. 11, 1921.

4 SHEETS—SHEET 1.

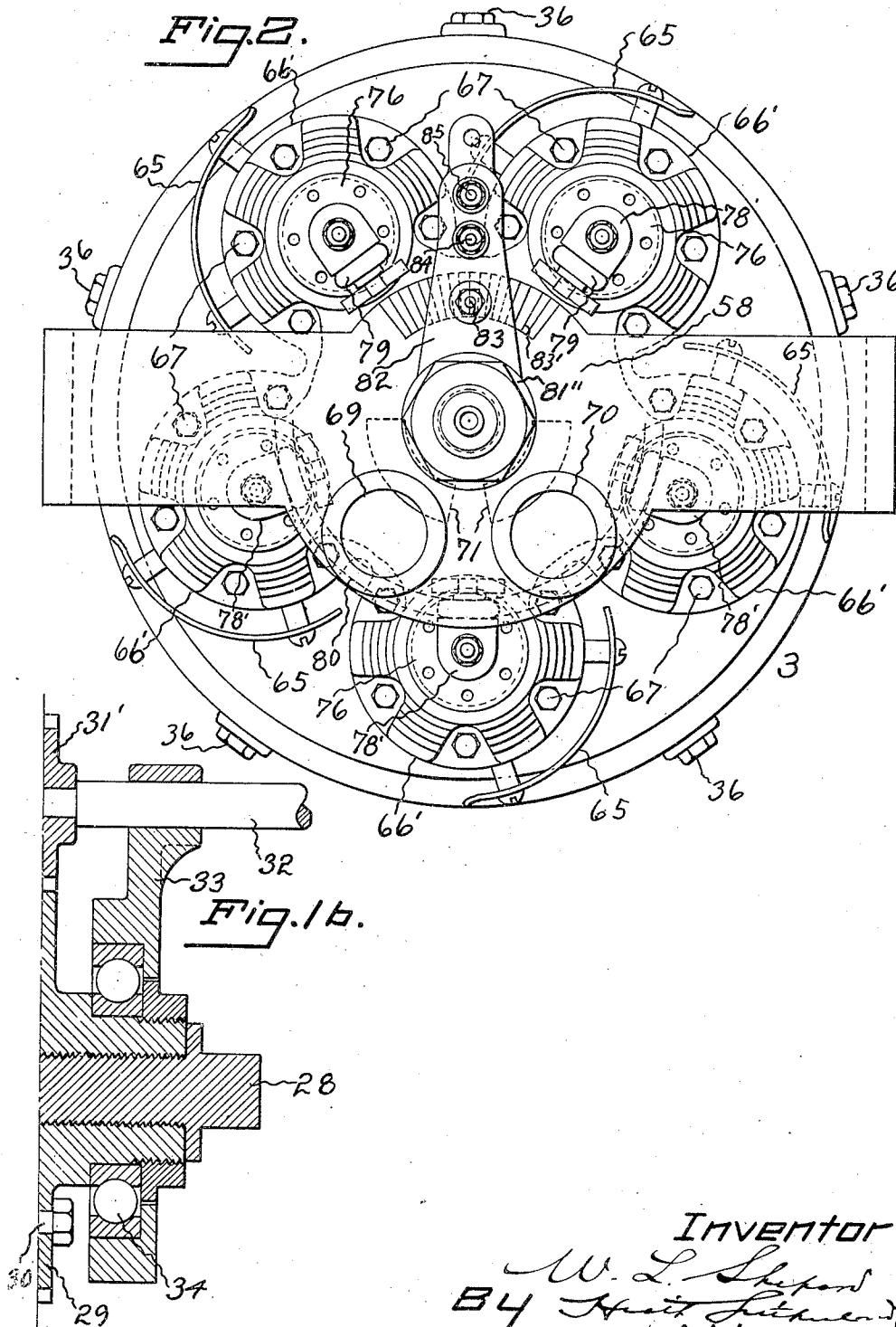


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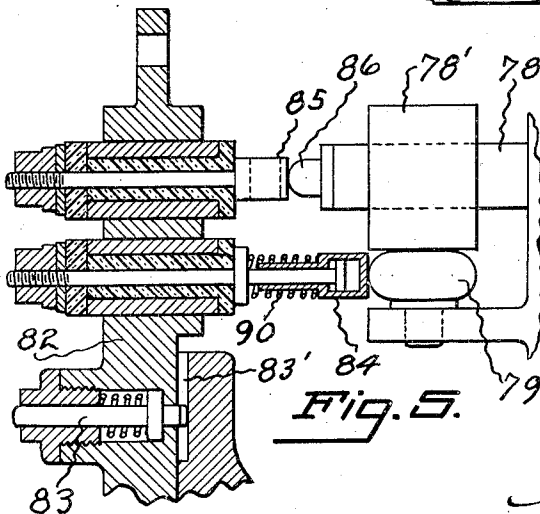
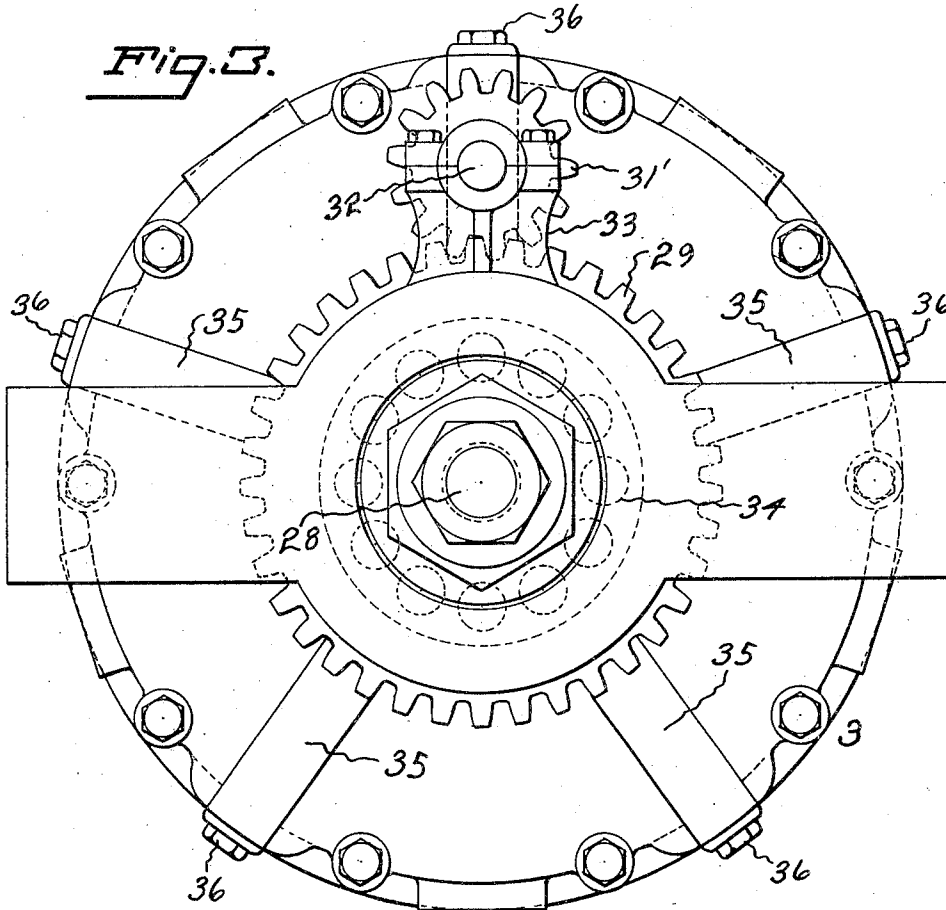


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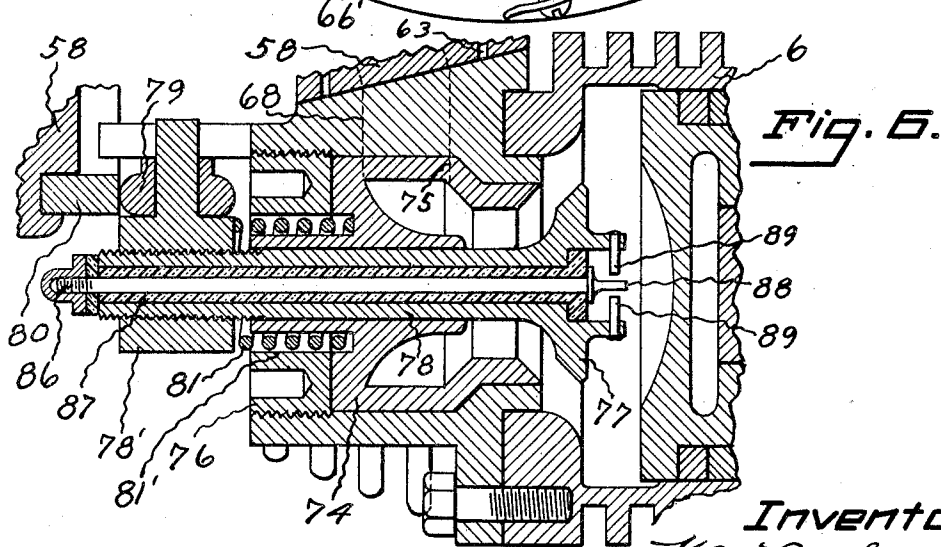
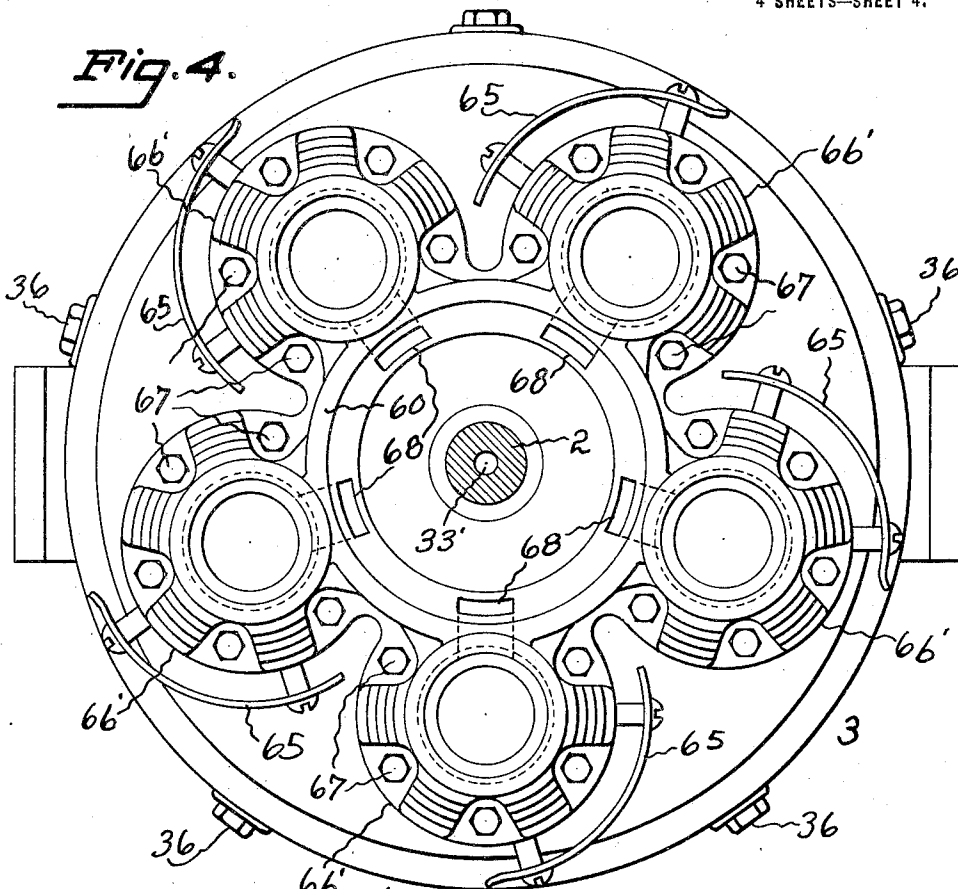


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4 SHEETS—SHEET 4.



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UNITED STATES PATENT OFFICE.

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HYDROCARBON-ENGINE.

1,393,174.

Specification of Letters Patent.

Patented Oct. 11, 1921.

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To all whom it may concern:

Be it known that I, WILBUR L. SHEPARD, a citizen of the United States, residing at Elmwood, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Hydrocarbon-Engines, of which the following is a specification.

This invention relates to what may be properly considered as "hydrocarbon engine." Obviously the title selected is a convenient one, as hydrocarbon is merely one agent of many, which can be properly utilized to secure the correct action of the machine. It is also possible that the "engine" so termed, may be utilized for functioning other than as an engine. When the apparatus is employed as an engine it can be utilized in various ways; for example for the propulsion of an aeroplane or an automobile. I have a number of important objects in view among them being the provision of a structure which is thoroughly compact and which is precisely balanced, and by which the necessary action is insured in a proper manner.

In the drawings accompanying and forming part of the present specification, I have shown somewhat fully one of the several form of embodiment of the invention, which will be fully set forth in the following description primarily to enable those skilled in the art to practice the invention. Clearly I am not restricted to this showing. I may in fact depart therefrom in a number of ways within the scope of the invention defined by the claims following said description.

Referring to said drawings:

Figure 1^a is a longitudinal central section of a portion and the principal portion in fact, of an engine involving the invention.

Fig. 1^b is a similar view of the remainder of the engine, this view and the preceding one representing together the engine.

Fig. 2 is an end view as seen from the left in Fig. 1^a.

Fig. 3 is an end view as seen for instance from the right in Figs. 1^a and 1^b.

Fig. 4 is a cross section on the line 4—4 of Fig. 1^a looking in the direction of the arrows.

Fig. 5 is a sectional side view of ignition mechanism.

Fig. 6 is a horizontal sectional view of

a cylinder and certain adjunctive devices hereinafter more fully explained.

Like characters refer to like parts throughout the several views which are on different scales.

I have observed that the organization involving the invention is capable of general use, although it is of particular advantage when utilized as a propelling medium and I have mentioned at least two fields in which it can be employed. In the action of the apparatus there is utilized a suitable substance and what is known as "gasolene" meets my requirements in this regard.

The engine includes in its structure, a suitable shaft such as that denoted by 2. In the present instance this shaft is fixed or stationary although this may not always be necessary. In practice this central or main shaft will be sustained by bearings which I have not deemed it necessary to show in full. Surrounding the rear end of the shaft 2 is what I term a "carrier" such as that denoted in a general way by 3. This carrier is practically in the form of a cylindrical casing or housing the shaft extending through the walls 4 and 5 of the housing or casing which as will be inferred, turns upon the shaft 2. The front wall 4, the rear wall 5, and the circumferential portion 5' make up the carrier or casing 3.

Associated with the rotary carrier 3 is a set of cylinders as 6 of which there may be any desired number in the set, there being five as represented. These cylinders are parallel with each other and with the longitudinal axis of the main shaft 2, their rear end portions being fitted in openings in the wall 4. The cylinders as illustrated are externally threaded as at 7, the threads engaging threads in the walls of the openings 8. It is therefore clear that when necessary a cylinder may be removed. The cylinders in the following made, revolve with their carrier; they are symmetrically or equidistantly laterally disposed. Their front end portions extend a greater distance out of their carrier or casing 3 than their rear end portions do into it. They are virtually duplicates of each other and the same statement applies in effect to their adjuncts.

In the cylinders 6 are slidable pistons as 9, the rods or pitmans 10 of which are jointed to the rear sides of the respective pistons. Said rods 10 are jointed at their rear ends

to the transverse members of cranks as 11. The branches of the cranks have laterally-extending studs 12 and 13 ordinarily integral therewith. The outwardly extending studs 12 are rotatively fitted in cups as 14 disposed in openings 15 in the carrier or cylindrical casing 3. As shown these cups face inwardly, their closed sides being situated exteriorly of the casing 2, they being sustained as will be clear, by the cylindrical body 5' of said carrier as best shown in Fig. 1^a. The inwardly extending studs 13 extend through the hubs of pinions 16 of bevel or miter form. Said pinions are supported for rotation by the bearing 17 loose on the main shaft 2, the inner end portion of said bearing being enlarged somewhat as at 18 to receive said pinion hubs. The bearing 17 as I have noted rotates upon the shaft 2 and from this it will be evident that said pinions may revolve around said shaft. The teeth of said pinions 16 mesh with the master gear 16' obviously in the present case, of "bevel" type, and the hub of which is made rigid, as by a threaded joint, with the main shaft 2. It will be apparent that the master gear 16' does not rotate.

The front wall 4 it will be understood receives the main shaft 2 the hub 19, through which said shaft extends, having on its inner side the chamber 20 to receive the anti-friction bearing 21 which fits closely therein and surrounds the shaft 2, the said bearing being abutted by the back end of the master gear 16' as shown in said Fig. 1^a. The hub of the master gear as will be seen, engages one side of said anti-friction bearing the other side of the bearing fitting against the annular collar 22 of the shaft 2. The bearing 17 to which I have referred has at its outer end the head or enlargement 23, having on its outer side the cylindrical cavity 24 to receive the anti-friction bearing 25 engaged by the shaft 2 and said bearing 17, the shaft having an annular collar 26 which is engaged by the anti-friction bearing 25 as shown in said Fig. 1^a. Both of the anti-friction bearings to which I have referred, are shown as being of ball character although this is not essential. As represented the head or enlargement 23 fits closely a concavity in the hub 27 on the inner side of the central part of the outer wall 5' of the carrier. As I will later set forth there is starting mechanism of proper kind, a form of which I will describe, operatively associated with the bearing 17 or in fact with some other convenient member of the train of elements of which said bearing 17 is a part.

At the rear of the carrier 2 is a stub-shaft as 28 which has united with it as by screw threading, the spur-gear 29 (Fig. 1^b) connected as by one or more screws 30, with the hub 27 and also with the head or enlarge-

ment 23. The gear 29 and the supporting stub-shaft 28 thereof, jointly close the cavity or chamber 31 in the outer side of the hub 27 as shown best in Fig. 1^a. I might note in passing that this cavity or chamber 31 presents an oil-space or reservoir. In mesh with the spur gear 29 is the pinion 31' (Fig. 1^b) rigid with the shaft 32 sustained by the bearing 33, surrounding the hub or gear 29, the central portion of this bearing 33 having a cavity in which is fitted the anti-friction bearing 34 surrounding the elongated hub of said gear 29. This shaft 32 is intended to be started by power or by hand, and it acts as the initial element of a starter. When turned, it acts through the described parts to effect the rotation of the bearing 17 and the resultant revolution of the pinions 16, their rotation, as they revolve, starting of the engine, as will be hereinafter more particularly explained.

The main shaft 2 is shown as having a longitudinally extending bore or passage 33' the rear end of which opens into the cavity or chamber 31 and the front end of which is closed by plug means as that designated in a general way by 34'. Said shaft in addition to constituting a support also acts as a conduit for carrying lubricant, desirably oil, to certain parts which are to be lubricated. The back wall 5 as shown, has therein the radial passages or ways 35 (Figs. 1^a and 3) the outer ends thereof being closed by plugs as 36. Said passages or ways 35 open at their inner ends into the cavity or chamber 31. The passages also have at their outer ends transverse ports 37 which connect the interiors of the respect-passages with the longitudinally-extending channels 38 near the outer end of the wall or body portion 5' of the carrier or casing 2 as best shown in Fig. 1^a. There are as shown five of these radial passages or ways 35 they being equidistantly laterally disposed.

Said passages 35 respectively contains propellers or screws 39 the shafts of which at their outer ends, are stepped into the plugs 36 and the inner ends of which are provided with gears such as 40 fastened thereto, and in mesh, as shown, with bevel gear as 41 fastened to the extreme rear end of the main shaft 2. It is therefore clear that as the carrier 3 rotates the several screws or propellers will be rotated so as to effect the positive feed of the oil as I will later explain. I should note at this point that there is a space 42 between the ends of the passages 35 and the hubs of the gears 40 and also that said hubs have passages or ports 43 through them. These passages or ports 43 are intended for the flow of the oil. There is therefore an uninterrupted communication between the interior of the carrier or casing 3 and the chamber 31 and the reason for this will hereinafter appear.

I have mentioned the fact that there is a bore or passage as 33' which extends entirely through the main shaft 2 and that this communicates directly with the chamber 31 as shown clearly in Fig. 1^a. It will be perceived on inspection of this view that the inner ends of the journals or studs 13 are spaced or separated from the surface of the shaft 2 the space being designated by 45. Said journals or studs 13 have longitudinally-extending passages 46 which open or lead into passages 47 extending lengthwise of the inner branches or the cranks 11. These passages 47 in turn communicate with passages 48 having branches 49 leading to the journal portions of the cranks. The passages 48 open in turn into passages as 50 which communicate with passages as 51 in the journals 12, having in turn branches 52 leading to the exterior surface of the said journals 12. Ports 53 also lead from the passage 33' in said main shaft to annular grooves as 54 around the threaded portions of the several cylinders 6. The latter in addition to these exterior annular channels, have ports 55 leading from the respective channels to the interior of the respective cylinders. The ports 55 are traversed by the pistons 9 as the latter reciprocate. The ends of the pins 56 which unite the respective rods 10 with their pistons are spaced a short distance from the inner surfaces of the respective cylinders, and are furnished with longitudinally-extending ports or passages 57 open at their inner and closed at their outer ends and furnished in addition with branches 57' which open into the peripheries of the respective pins 56. The main shaft 2 as shown, is sustained at its forward or front end, by a bearing as 58 having at its inner end the frusto-conical enlargement 59 the conical exterior surface of which receives upon it the ring 60 having on its inner side the circular apertures 61 which fit around the forward end portions of the respective cylinders 6 as shown in Figs. 1^a and 2. This frusto-conical has radial oil conducting passages 62 which are in constant communication with radial passages 63 near the head end of the main shaft 2, and which of course lead from the oil passages 33' in said shaft. The key by which this stationary bearing 58 is united to the shaft 2 is designated by 64.

By the construction set forth I can adequately and thoroughly and properly lubricate all parts which require such action. It will be clear that the necessary oil or its equivalent is supplied in the requisite quantity into the interior of the casing 3 and as the latter rotates, the oil is thrown centrifugally into the channels 38 and it is from them drawn through the respective ports 37 by the rotating screws or propellers 39, it being assumed of course that during this action the casing 3 is rotating. As the cas-

ing rotates the propellers or screws 39 are of course rotated through their described operative connections with the stationary main shaft 2. As the propellers or screws 39 rotate they feed the oil along the passages 35 and through the ports 43 of the gears 40 into the chamber or reservoir 31 whence the oil can pass under force, into the longitudinally-extending passage 33' where it is directed through the passage means to the parts already described, which require lubrication.

The ring or band 60 is of course keyed to the cylinders 6 and rotates with said cylinders as they turn with the carrier or casing 3. Fitted around the forward or projecting end portions of said cylinders are the fans 65 and connected respectively therewith as at 66. These fans suck up air and direct the same against the cylinders as they turn and thus tend to keep the same properly cool.

The member or ring 60 has portions 66' which act as heads for the forward ends of the cylinders 6, these head portions as will be clear, in the present case, constituting integral parts of the member or ring 60 which also functions as a valve, and being connected as by screws 67 with the bodies of the cylinders as shown for instance by Fig. 1^a, the screws extending through marginal flanges at the back ends of said head portions. As I have observed there is in the organization shown five of such cylinders each with its head, the head portions being obviously united so as to in effect present a continuous structure as shown in Fig. 4. Each said head portion is shown furnished with a port 68 which as will be hereinafter set forth, serves alternately for the supply of fuel and the discharge of the exhaust after the fuel has exercised its function. It will of course be understood that the part or ring 60 in which these ports 68 are formed, rotates and it acts a valve, a single main valve in fact to properly govern supply and exhaust.

In the bearing or fixed element 58 are openings 69 and 70 intended, the first for the supply of the explosive agent and the second for the exhaust. This opening 69 will therefore be in communication with some source of fuel supply, of whatever nature the same may be. The two openings to which I have referred are shown in elevation in Fig. 2 and the supply opening 69 also appears in Fig. 1^a. From these openings 69 and 70 passages as 71 extend, the two passages 71 being of curved formation and their rear ends opening into the wall of the conical chamber 72 into which the conical single valve part 73 fits, these parts respectively being rigid with the bearing 58 and ring 60. The two passages 71 are laterally widened as to permit the free flow of the fresh and

spent gases. As the member or ring 60 turns the ports 68 are brought into communication with the back ends of the passages 71 to effect the charging and discharging of the cylinders 6 as they revolve with their carrier.

In the head portions 66' are disposed cages as 74 having ports 75 circumferentially thereof, in constant register with the respective ports 68 and constituting in effect parts thereof. The cages 74 are held tightly in place by nuts as 76, and at their front ends have seats for valves as 77 which function as will be evident, alternately as intake or supply and exhaust or discharge valves, there being as will be clear one valve for each cylinder. The valves 77 are furnished with forwardly extending stems or shanks 78 and they are slidable through and centrally of the respective cages 74. Fastened as by screwthreading to the forward ends of the several valve stems are blocks as 78' provided with rollers or projections 79 to cooperate with the cam-track 80 rigid with the bearing. The rollers are adapted to travel upon the active portions of the cam-track and the latter is of such a character as to apply thrusts to the stems of the valves at the proper point to effect opening thereof either for supply or exhaust. The valves are closed when released from the influence of the cam-track 80 by springs 81 acting against the respective blocks 78, seated in annular grooves 81' in the respective nuts 76 and cages 74 as shown best in Fig. 1^a. It will be clear that as the carrier 3 rotates it carries the cylinders 6 therewith and that at the proper points the rollers 79 travel upon the cam-track 80 and the latter opens the valves 77 in proper sequence so that the necessary fluid passing through the opening 69 will enter the cylinders 6 as they turn, the pistons 9 in the cylinders being reciprocated through their operative described connection with the main shaft to compress the fluid which is subsequently fired as I will hereinafter set forth. As the carrier 3 and cylinders 6 continue their turning motion the valves 77 are again opened to permit the exhaust of the spent gases which are discharged to atmosphere by way of the opening or port 70 and described passage means. It will be clear that as the carrier or casing 3 rotates around the stationary or fixed shaft 2, the reciprocating pistons 9 will draw in the hydrocarbon or its equivalent, compress the hydrocarbon which is subsequently fired, as I will later describe, and then exhausted, all this as I note occurring while the carrier is rotating. Initially the starting mechanism must be mechanically or manually operated to effect an initiation of the operation which beyond such point is altogether automatic until the supply of the explosive agent is arrested.

The means for exploding the compressed charge like other features of the engine may vary although those shown for the purpose will now be set forth. Around the extreme forward end of the main shaft 2 is fitted a bushing 81" which supports the hub at the inner end of the laterally adjustable arm 82 see for instance Figs. 1^a and 2. This arm 82 is equipped with a spring-actuated detent 83 cooperative with the teeth of a segment 83' rising from and ordinarily integral with the bearing 58, the dog or detent 83 holding positively the adjustable arm 82 in a normally fixed position.

On this arm 82 are disposed the terminals or electrodes 84 and 85 the terminal or electrode 85 being in electrical connection with a source of high tension current supply while the electrode or terminal 84 is in connection with a source of low tension current supply. The electrode or terminal 85 it will be seen is wider or longer than the terminal 84. The terminals 85 and 84 are successively engaged by the outer ends or tips of the rods 86 and the rolls 79 as the carrier 3 with its set of cylinders, rotates. Each of the rods 86 extends entirely through its cooperating stem 78 and valve 77 being insulated therefrom as by the non-conducting sleeves 87 which extend through the respective stems and valves as best shown in Fig. 6. The current carrying rods 86 have at their inner ends terminals as 88 cooperative with terminals as 89 carried upon the respective valves. The terminals 89 are ordinarily arranged in pairs and they are intended to coact with a terminal 88 at the inner end of its pin 86, the space between the pair of pins and single pin presenting a spark gap in which is created a spark to fire the compressed mixture in the cylinder associated therewith. I should state at this point that the terminal 84 is in communication with some source of electrical energy such as a primary battery, and that the voltage developed therein is not necessarily high. The circuit of this terminal 84 might be properly considered as the primary circuit. The secondary circuit includes the terminal 85. Each of the circuits has a coil, that of the secondary circuit which includes the terminal 85, surrounding the coil of the primary circuit which has as I have noted a source of electrical energy. The current of the secondary circuit is therefore an induced one. By this induced current, I can obtain a very high voltage in the secondary circuit or that involving the terminal 85 which is engaged by the outer end tip of the current carrying rod 86 before the roller 76 associated therewith strikes the terminal 84. This I believe to be entirely novel. The terminal is yieldingly advanced as by springs 90. It is believed that the action of the engine will be

clearly apparent. Notwithstanding this I deem it proper to briefly set it forth. The engine will be started for instance in one of the ways to which I have referred. This
5 starting of the engine obviously effects the rotation of the carrier 3 and the consequent reciprocation of the pistons 9 in their co-operating cylinders 6. As the pistons reciprocate they of course draw in charges of
10 the fluid which is to be fired, and then compress such fluid which is fired after compression and then exhausted all in the manner I have pointed out.

What I claim is:

15 An engine of the class described comprising a rotary carrier, a plurality of cylinders supported by the carrier, pistons in the respective cylinders, cages set in the outer heads of the respective cylinders, a valve
20 extending through each cage and seated when closed against the inner end thereof,

means for operating the valves as the carrier rotates, to effect supply to and exhaust from the respective cylinders, a fixed bearing having a conical surface, the carrier having
25 a similar conical surface to engage and turn on the surface of the bearing, passages extending through the bearing one for supply and the other for exhaust and adapted alternately to communicate with the re-
30 spective cages as the carrier turns, spark means including an electrode extending through each valve, the bearing having means to cause the operative action of the
35 electrodes as the carrier turns.

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

WILBUR L. SHEPARD.

Witnesses:

HEATH SUTHERLAND,
GERTRUDE NITKIN.