A. N. STEWART.

HYDROCARBON ROTARY ENGINE.

APPLICATION FILED JUNE 30, 1914.

1,131,803.

Patented Mar. 16, 1915.

2 SHEETS—SHEET 1.

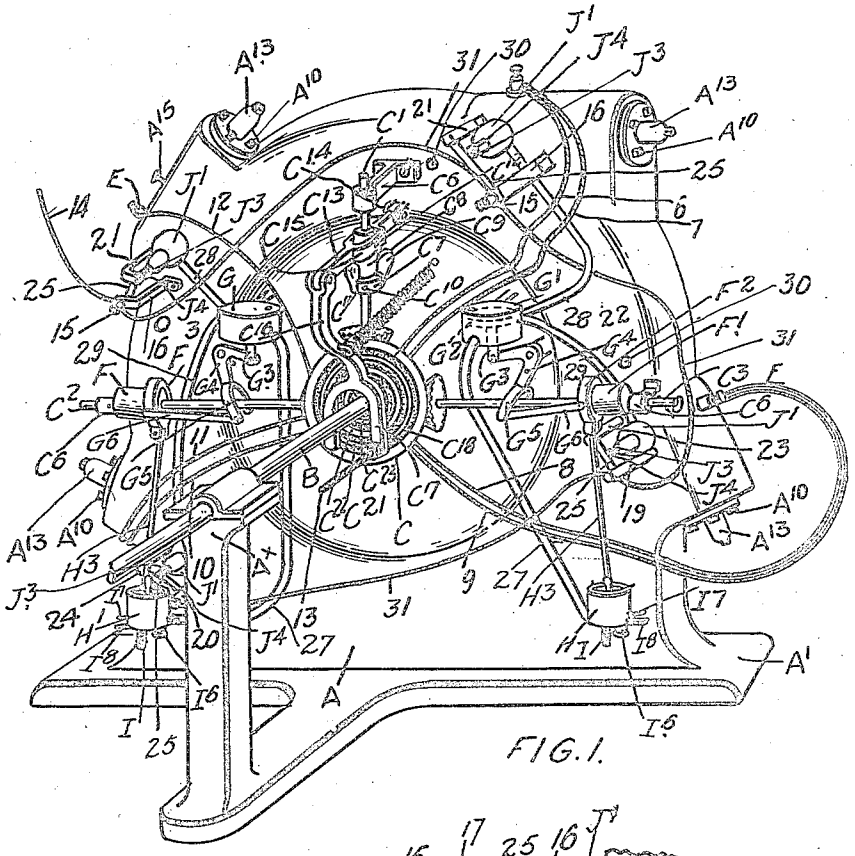


FIG. 1.

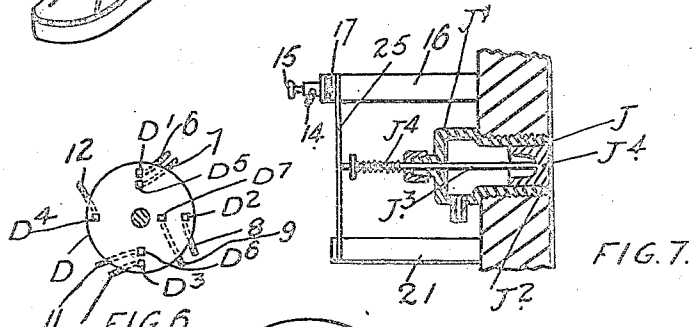


FIG. 7.

FIG. 6.

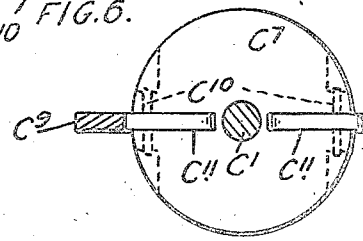


FIG. 8.

WITNESSES.

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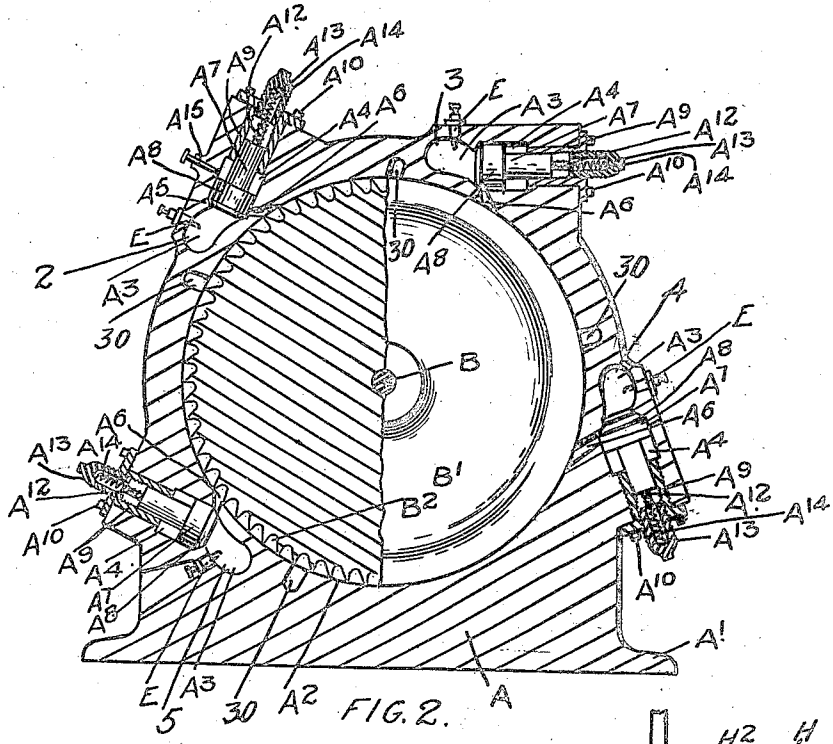


FIG. 2.

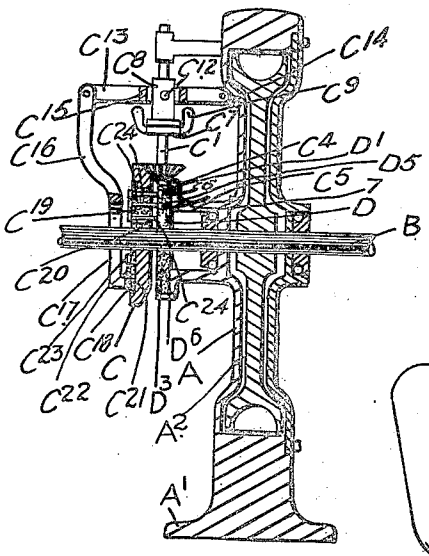


FIG. 3.

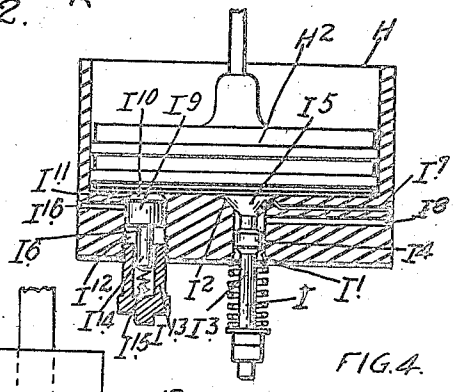


FIG. 4.

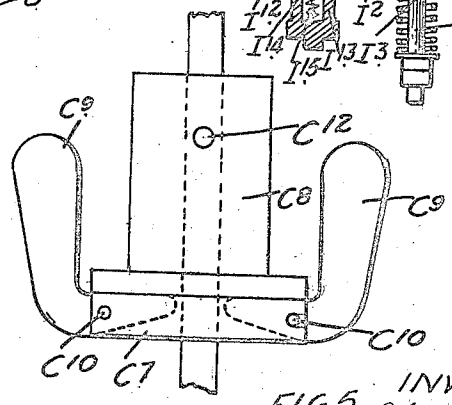


FIG. 5.

WITNESSES.

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HYDROCARBON ROTARY ENGINE.

1,131,803. Specification of Letters Patent. Patented Mar. 16, 1915.

Application filed June 30, 1914. Serial No. 848,203.

To all whom it may concern:

Be it known that I, ADAM NEIL STEWART, of the town of North Bay, in the District of Nipissing, in the Province of Ontario, Canada, have invented certain new and useful Improvements in Hydrocarbon Rotary Engines, of which the following is the specification.

My invention relates to improvements in hydrocarbon rotary engines and the object of the invention is to devise means for holding each separate charge of gas under compression in the firing chamber and free of the rotor so as to be freed by its sudden expansion when ignited and delivered so that the rotor receives the impact tangentially and to devise means for automatically maintaining the normal speed of the engine by regulating the number of ignitions per revolution and it consists essentially of a bucket wheel mounted on a suitable shaft and in a suitable casing having the open sides of the bucket fitting closely against the casing wall, a firing chamber having a port communicating with the wheel chamber against the open sides of the buckets, a closing valve for the port designed to be balanced by the compressed gas in the firing chamber, mechanism for automatically pumping gas charge into the firing chamber, an ignition mechanism and means for regulating the number of ignitions per revolution as hereinafter more particularly explained by the following specification.

Figure 1, is a general perspective view of my engine. Fig. 2, is a sectional elevation. Fig. 3, is a cross section through my engine. Fig. 4, is a sectional detail of the pumping mechanism. Fig. 5, is a detail elevation of the governor control. Fig. 6, is a detail view of the timing plate for the ignition mechanism. Fig. 7, is a sectional detail of the ground connection cut out. Fig. 8, is a plan sectional view of Fig. 5.

In the drawings like letters of reference indicate corresponding parts in each figure.

A is the engine casing resting upon a suitable portion A′ provided with a circular rotor chamber A^2.

A^3 are a series of firing chambers located in the wall of the casing and arranged in close proximity to the periphery of the rotor chamber.

A^4 are valve chambers leading into the firing chamber A^3 and each provided with an intervening valve seat A^5.

A^6 is a port extending from each valve chamber immediately above the valve seat and leading to the rotor chamber in a tangential direction.

A^7 is a piston valve provided with a head A^8 co-acting with the valve seat A^5 and normally closing the inner end of the port A^6.

A^9 is a guide sleeve held in the upper end of the valve chamber and in which the piston valve A^7 reciprocates. The valve sleeve A^9 is preferably flanged at its upper end and secured to the engine casing by suitable tap screws A^{10}. The upper end of the sleeve A^9 is internally threaded and the upper end of the piston valve A^7 is provided with an upward projection A^{12}.

A^{13} is a hollow cap screwed into the threaded portion of the sleeve A^9.

A^{14} is a compression spring extending between the inner end of the cap and surrounding the projection A^{12} at its opposite end.

A^{15} is a needle valve designed to control the air in the valve chamber between the valve head A^8 and the inner end of the sleeve A^8.

Although I have only shown one needle valve it will, of course, be understood that each valve chamber is provided with a similar needle valve.

B is the main shaft extending centrally through the rotor chamber A^2 and journaled in suitable bearings A^x.

B′ is the rotor provided with a circumferential series of buckets B^2, such buckets being preferably inclined in a direction opposite to the direction of the rotation of the rotor.

C is a gear mounted upon the main shaft.

C′, C^2 and C^3 are supplemental shafts extending radially from the gear wheel C, such shafts being held at their inner ends in step bearings C^4 supported by the main bearing C^5 of the rotor casing. The outer ends of the shafts C′, C^2 and C^3 are supported in bracket bearings C^6.

C^7 is a collar secured upon the shaft C′.

C^8 is a sleeve slidably mounted upon the shaft C′ and normally resting upon the collar C^7.

C^9 are L-shape governor arms pivoted on pins C^{10} extending through the slotted portion C^{11} of the collar C^7. The upwardly extending portions of the L-shape arms C^9 are weighted, the horizontal portion of the L-shape arm bearing against the lower face of the sleeve C^8.

C^{12} are trunnion pins extending from diametrically opposite sides of the sleeve C^8.

C^{13} is an arm pivoted at its inner end to a bearing lug C^{14} carried by the main casing. The arm C^{13} is provided with a looped enlargement C^{15} surrounding the sleeve C^8 and into which the trunnion pins C^{12} extend.

C^{16} is an arm pivotally connected at its upper end to the arm C^{13} and provided with a forked lower end C^{17} extending to each side of the main shaft.

C^{18} is a disk of insulating material inserted within the back of the gear wheel C and provided with an inward projection C^{19} extending through a slot C^{20} formed in the wheel C.

C^{21}, C^{22} and C^{23} are a concentric series of contact rings secured to the insulating disk C^{18}.

C^{24} is a projecting pin extending from each of the concentric contact rings C^{21}, C^{22} and C^{23} through the insulating projecting portion C^{19} so as to project beyond the inner face of the wheel C.

D is the timing disk of insulating material carried in a stationary position by the main bearing C^5.

D', D^2, D^3 and D^4 are an outer series of contact pieces arranged circumferentially on the timing disk D and in horizontal alinement with the outer concentric rings C^{21}. D^5 and D^6 are similar contacts arranged at diametrically opposite points in the timing disk D and in horizontal alinement with the intermediate contact ring C^{22}. D^7 is a contact piece also carried by the timing disk D and in horizontal alinement with the inner concentric contact ring C^{23}.

Each firing chamber A^3 is provided with a sparking plug E. In the engine as shown in the drawing the firing chambers are arranged in four positions, namely, 2, 3, 4 and 5 (see Fig. 2).

6 and 7 are wires leading from the contacts D' and D^5 to the sparking plug E of the firing chamber A^3 located at the position 3.

8 and 9 are wires leading from the contacts D^7 and D^2 to the sparking plug E of the firing chamber A^3 located at the position 4 and 10 and 11 are wires leading from the contacts D^3 and D^6 of the timing plate D to the spark plug E of the firing chamber A^3 located at the position 5.

12 is a wire leading from the contact D^4 of the timing plate D to the spark plug E of the firing chamber A^3 located at position 2.

13 and 14 are terminal wires of the main circuit. The wire 13 is connected to one of the arms of the fork C^{17} being insulated therefrom and contacting at its inner end with one of the contact rings C^{21}, C^{22} or C^{23}. The terminal wire 14 is connected to a suitable binding post 15 supported on the bracket 16. The binding post 15 is provided with a contact point 17 (see Fig. 7). 18, 19 and 20 are similar brackets and contacts supported thereby located in juxtaposition to the firing chamber A^3 at positions 3, 4, and 5.

21, 22, 23 and 24 are supplemental brackets each carrying a spring contact finger 25 held normally in contact with the binding post contact point 17.

F and F' are drums mounted upon the shafts C^2 and C^3, the inner end of each drum being concentric with the center of the shaft and the outer end eccentric with the center of the shaft thereby giving to the drums an upwardly inclined set in relation to the supporting shaft.

F^2 and F^3 are straps mounted upon the drums F and F'.

G and G' are cylinders carried by the main casing and provided with pistons G^2 provided with depending piston rods G^3.

G^4 is a bell crank lever mounted on a suitable bracket extending from the casing and pivotally connected at one end to the piston rod G^3 and provided at its opposite end with a forked portion G^5 extending to each side of the shaft C^2.

It will, of course, be understood that the cylinder G' is also provided with similar pistons and piston rods and bell crank lever as above described in connection with the cylinder G. The lower end of the forked portion G^5 of the bell crank lever G^4 is connected by links G^6 to each side of the strap F^2.

H and H' are pumping cylinders each provided with a piston H^2 connected by a link H^3 to the straps F^2 or F^3.

I is a feed valve inserted in the orifice I' extending through the bottom of the cylinder H or H' and provided at its inner end with a tapered valve seat I^2. The valve comprises the valve stem I^3 having an enlargement I^4 fitting the orifice I' and a tapered head I^5 co-acting with the valve seat I^2.

I^7 is a channel through which the hydrocarbon fluid is fed, the inner end of such channel being closed by the valve head I^5 when in position on its seat.

I^8 is a channel for supplying air to the inner end of the channel extending into the orifice I' immediately below the valve head I^5.

I^6 is a discharge valve comprising the head I^9 having a tapered inner portion I^{10} fitting a corresponding valve seat I^{11} formed in the bottom of the orifice I^{12}. The orifice

I^{12} is provided with a hollow closing plug I^{13} in which fits the stem I^{14} of the valve I^9, such valve being held in place by means of a compression spring I^{15} extending between the base of the closing plug and the end of the stem.

I^{16} is a discharge port extending from the orifice I^6 below the valve seat I^4.

Each firing chamber A^3 is provided with an inlet port J into which is threaded a hollow valve plug J′ having a tapered valve seat J^2 at its inner end.

J^3 is a valve stem extending through the valve casing and provided at its inner end with a tapered valve head J^4 co-acting with the valve seat J^2 and bearing at its opposite end against the spring contact finger 25.

J^4 is a compression spring bearing at its outer end against a suitable projecting portion extending from the stem J^3 and designed to normally hold the valve J^4 closed and the spring contact finger 25 in contact with the contact point 17.

Having described the principal parts involved in my invention I will briefly describe the operation of the same.

Initially when the engine is starting the straps F^2 and F^3 are placed at the eccentric ends of the drums F and F′ thus operating the piston heads H^2 to draw in a charge of gas when the engine rotor is manually rotated by any suitable means. By the upward movement of the pistons H^2 the valves I^5 are drawn to the open position drawing in separate charges of gas and air through the ducts I^7 and I^8 which mix as they enter the cylinders H and H′. As the piston head H^2 performs its downward stroke a charge of gas is compressed forcing the valve I^9 open allowing the gas to discharge through the port I^{16} of the cylinders H or H′ which are connected by pipes 29 to the cylinders G and G′. As the gas enters the cylinders G and G′ it raises the pistons G^2 thereof. As the pistons G^2 rise to the top of the cylinders G and G′ they gradually draw the straps F^2 and F^3 toward the concentric ends of the drums F and F′, that is, into the position shown in the drawing thereby automatically throwing the pump piston H^2 out of operation thus preventing an over pumping of the mixture.

Normally when the engine is thrown out the pistons G^2 are in the position shown, that is to say, full of gas. As the pistons G^2 arrive at their extreme upper position the compressed gas is discharged through the pipes 28 and 29 leading to the valve casing J′ which forces the valve J^4 open thereby drawing the valve J^3 longitudinally away from the spring finger 25 allowing such spring finger to break away from the contact point 17 thus opening the ground circuit and preventing the passage of current through the ignition mechanism during the time that the gas is feeding into the firing chambers A^3 thus preventing any danger of back firing.

As hereinbefore described the inner end of the main contact wire 13 engages with the outer contact ring C^{21} and therefore as the gear revolves the outer contact pin C^{24} extending from such ring successively engages with the contact pieces D′, D^2, D^3 and D^4 thereby successively passing the current through the sparking plugs of the firing chambers A^3 into positions 2, 3, 4 and 5.

As the speed of the engine increases the governor arms C^9 fly outwardly until the required maximum speed is reached. After the engine has passed this maximum speed the inner ends of the governor arm C^9 have carried the sleeve C^8 upwardly a sufficient distance to raise the arm C^{13} and the forked arm C^{16} sufficiently to carry the lower ends of the forked arm C^{16} out of engagement with the ring C^{21} and into engagement with the ring C^{22} provided with intermediate pin projections C^{24} which alternately engage with the contact pieces D^5 and D^6 alternately carrying the current through the wires 11 and 7 to the corresponding spark plugs E thereby providing for only two explosions in each revolution. If it is necessary to further reduce the rotor power to bring the engine down to normal running speed the forked end of the arm is still carried upwardly until it contacts with the ring C^{23} provided with the innermost pin projection C^{24} which contacts with the innermost contact piece D^7 of the timing disk D, the contact D^7 being connected by the wire 9 to the corresponding spark plug E, thus providing for only one explosion per revolution. If the engine running speed decreases below normal the reverse of this operation takes place.

As has been before described the compressed gas is fed into the firing chamber and the spring pressure of the valve A^7 is sufficient just to balance this pressure. As soon, however, as the firing takes place the valve A^7 is forced open by the sudden expansion of the gas which is discharged through the port A^6 in a tangential direction against the buckets B^2 of the wheel B′ thus rotating the wheel by the force of the impact of gas against such buckets. The burnt gas is exhausted through the exhaust ports 30. It will also be seen that as soon as the charge of gas is fed into the firing chamber that the valve J^4 closes thereby carrying the spring contact finger into engagement with the contact point 17. It will also be seen that each contact point 17 is successively connected to a wire 31 so that the ground circuit is broken by the operation of each inlet valve as it feeds the charge into the firing chamber.

From this description it will be seen that

I have devised a very simple form of hydrocarbon rotary engine in which the charge of gas is held in compression ready for ignition in the firing chamber free of the rotor and that when the charge is fired the firing chamber is automatically opened to deliver the fired charge into the rotor chamber against the buckets of the rotor, in which there is no danger of back firing, in which the pumping mechanism is automatically thrown out of gear at the completion of the delivery of each charge into the firing chamber so as to eliminate the danger of over pumping and in which the number of ignitions per revolution is regulated so as to maintain the rotary movement of the engine at normal speed.

What I claim as my invention is.

1. In a hydrocarbon engine, the combination with the main casing having a circular rotor chamber and a firing chamber located in proximity to the rotor chamber, a port designed to carry the fired charge from the firing chamber to the rotor chamber and a spring pressed valve balancing the normal pressure of the charge in the firing chamber, a pumping mechanism for feeding the gas into the firing chamber, means for automatically throwing the pumping mechanism out of gear after the delivery of each charge to the firing chamber, and a rotor member mounted on a suitable shaft and fitting within the rotor chamber and a circumferential series of buckets carried thereby, as and for the purpose specified.

2. In a hydrocarbon engine, the combination with the main casing having a circular rotor chamber and a firing chamber located in proximity to the rotor chamber, a port designed to carry the fired charge from the firing chamber to the rotor chamber and a spring pressed valve balancing the normal pressure of the charge in the firing chamber, a pumping mechanism for feeding the gas into the firing chamber, a charge receiving cylinder and piston, a pipe leading from the pumping mechanism into the cylinder beneath the piston, pump operating mechanism and throwing out gear operated by the rising of the piston in the cylinder for throwing the pump operating mechanism out of gear, as and for the purpose specified.

3. In a hydrocarbon rotary engine, the combination with the main casing having a circular rotor chamber therein, a firing chamber and a port designed to carry the fired charge from the firing chamber tangentially to the rotor chamber, a valve normally closing such port against the pressure of the charge in the firing chamber and designed to be opened by the fired charge, a force pump designed to force the hydrocarbon mixture into the firing chamber, an operating shaft for the pump, a drum carried on the shaft being eccentric to the shaft at one end and concentric to the shaft at the other end, a strap slidably mounted thereon, a link connection between the strap and piston rod of the pump, and means for drawing the strap to the concentric end of the drum after each charge has been pumped, as and for the purpose specified.

4. In a hydrocarbon rotary engine, the combination with the main casing having a circular rotor chamber therein, a firing chamber and a port designed to carry the fired charge from the firing chamber tangentially to the rotor chamber, a valve normally closing such port against the pressure of the charge in the firing chamber and designed to be opened by the fired charge, a force pump designed to force the hydrocarbon mixture into the firing chamber, an operating shaft for the pump, a drum carried on the shaft being eccentric to the shaft at one end and concentric to the shaft at the other end, a strap slidably mounted thereon, a link connection between the strap and piston rod of the pump, a cylinder interposed in the duct leading from the pump cylinder to the firing chamber, a piston therein designed to be raised by the gas fed from the aforesaid bucket into the bottom of the cylinder, a bell crank connected to the piston and a link connection between the opposite end of the bell crank and the drum strap, as and for the purpose specified.

5. In a hydrocarbon engine, the combination with the main casing having a circular rotor chamber therein, and a series of firing chambers arranged circumferentially around the rotor chamber and ports designed to carry a charge from the firing chamber in a tangential direction into the rotor chamber, of a rotor provided with a circumferential series of buckets into which the charge is delivered from said ports, an ignition plug for each firing chamber, means for feeding a charge of gas into each of the firing chambers, a valve for closing the port leading from the firing chamber to the rotor chamber and for holding said port closed normally against the pressure of the charge in the firing chamber, and automatic means operated by the varying speed of the engine for cutting out one or more of the sparking plugs, as and for the purpose specified.

6. In a hydrocarbon engine, the combination with the main casing having a circular rotor chamber therein, and a series of firing chambers arranged circumferentially around the rotor chamber and ports designed to carry a charge from the firing chamber in a tangential direction into the rotor chamber, of a rotor provided with a circumferential series of buckets into which the charge is delivered from said ports, an ignition plug for each firing chamber, means for feeding a charge of gas into each of the firing cham-

bers, a valve for closing the port leading from the firing chamber to the rotor chamber and for holding said port closed normally against the pressure of the charge in the firing chamber, a governor shaft driven from the rotor, governor arms carried thereby, an upwardly movable contact designed to be raised by the outward movement of the governor arms, and a stationary contact plate having a series of contacts supported thereby leading to the igniters, as and for the purpose specified.

7. In a hydrocarbon engine, the combination with the main casing having a circular rotor chamber therein, and a series of firing chambers arranged circumferentially around the rotor chamber and ports designed to carry a charge from the firing chamber in a tangential direction into the rotor chamber, of a rotor provided with a circumferential series of buckets into which the charge is delivered from said ports, an ignition plug for each firing chamber, means for feeding a charge of gas into each of the firing chambers, a valve for closing the port leading from the firing chamber to the rotor chamber holding said port closed normally against the pressure of the charge in the firing chamber, a governor shaft driven from the rotor, governor arms carried thereby, an upwardly movable contact designed to be raised by the outward movement of the governor arms, a stationary contact plate, and a plurality of co-acting contacts carried by said plate and designed to travel in concentric paths, as and for the purpose specified.

8. In a hydrocarbon engine, the combination with the main casing having a rotor chamber and a firing chamber adjacent to the rotor chamber, of a pump, a duct leading from the pump to the firing chamber designed to carry the hydocarbon mixture thereinto, an igniter for the firing chamber, a circuit leading through the igniter, a valve casing communicating with the firing chamber and into which the duct leading from the pump extends, a circuit breaker provided with spring contacts against which the valve stem bears to hold the contacts closed and which are designed to open when the valve stem bears to hold the contacts closed and purpose specified.

ADAM NEIL STEWART.

Witnesses:

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