A. A. GUERINI.

INTERNAL COMBUSTION ROTARY ENGINE.

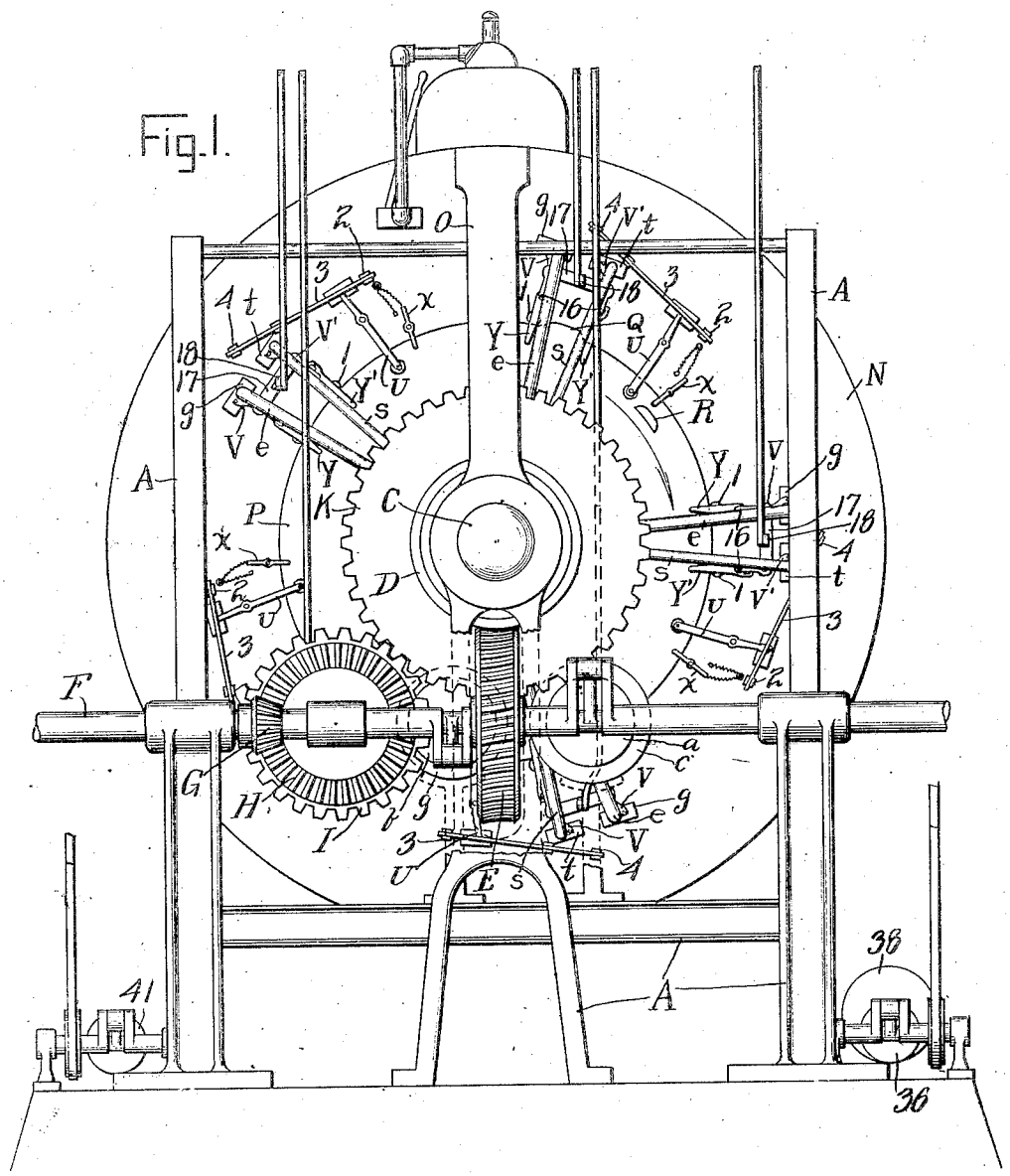
APPLICATION FILED OCT. 31, 1917.

1,381,872.

Patented June 14, 1921.

4 SHEETS—SHEET 1.

Fig. 1.



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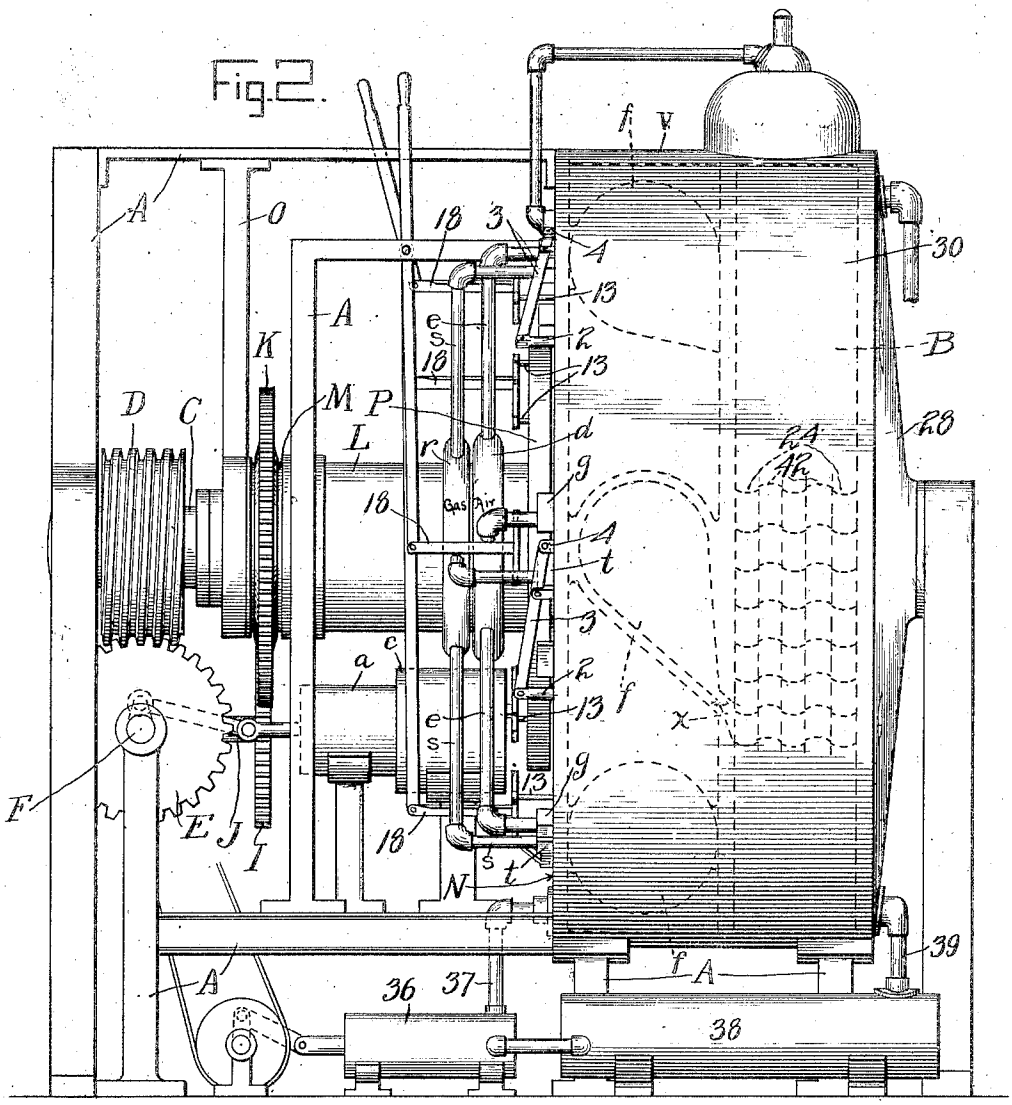
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4 SHEETS—SHEET 2.

Fig. 2.



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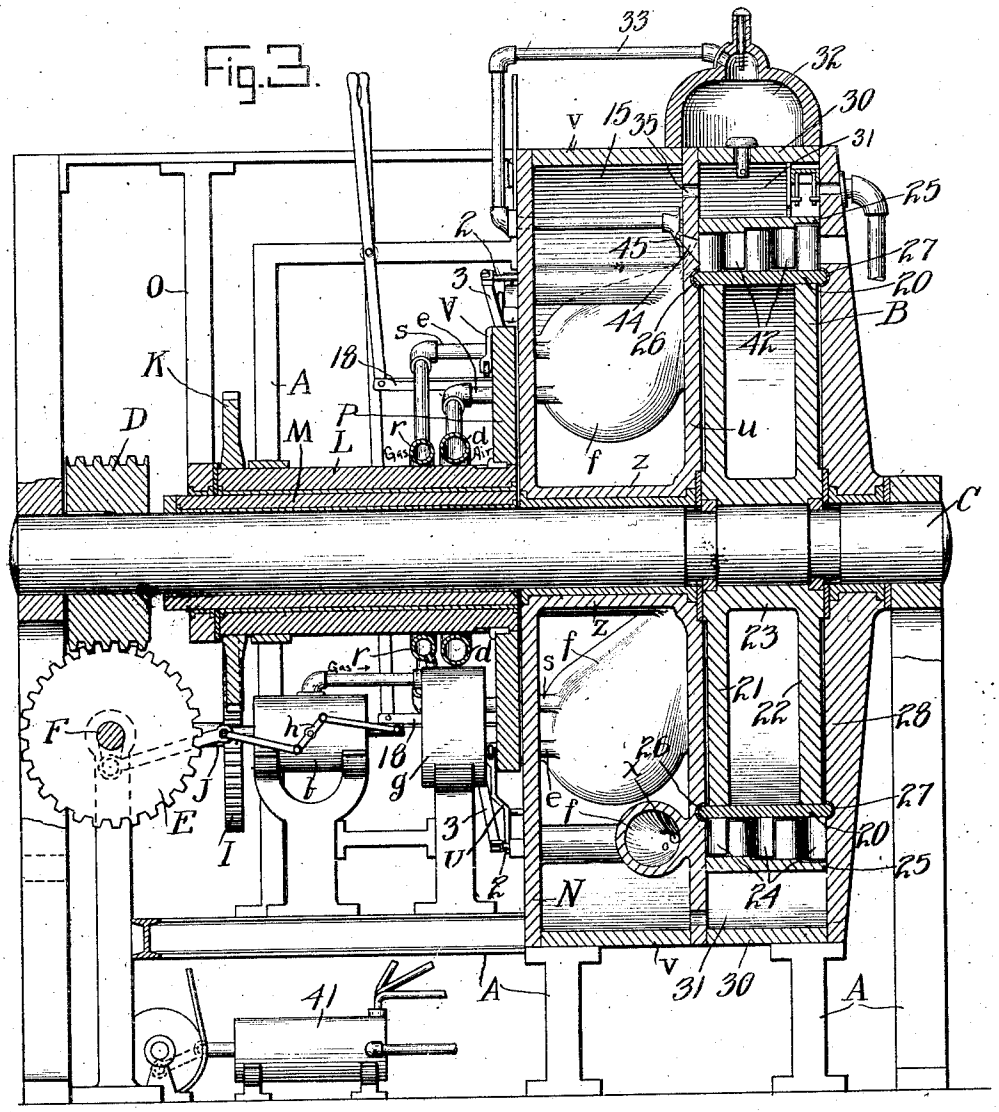
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4 SHEETS—SHEET 3.

Fig. 3.



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4 SHEETS—SHEET 4.

Fig. 4.

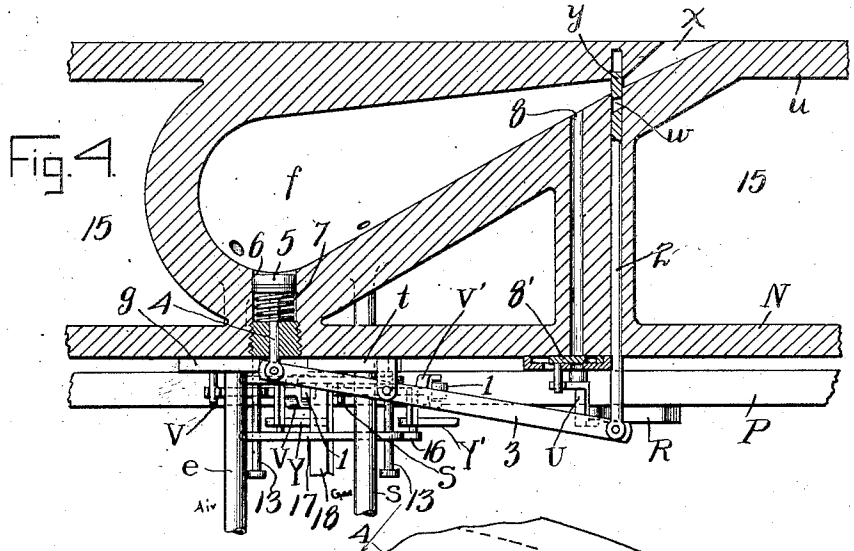


Fig. 5.

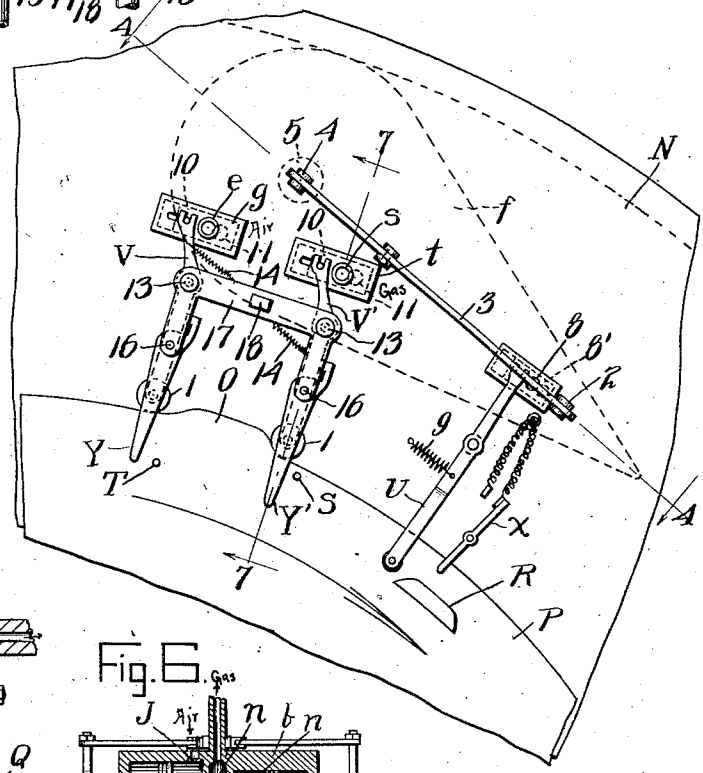


Fig. 7.

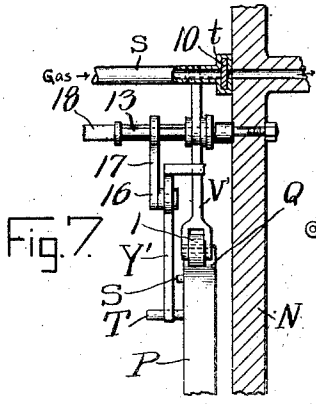
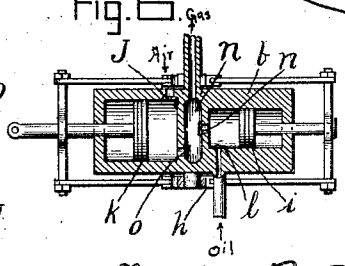


Fig. 6.



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UNITED STATES PATENT OFFICE.

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INTERNAL-COMBUSTION ROTARY ENGINE.

1,381,872. Specification of Letters Patent. Patented June 14, 1921.

Application filed October 31, 1917. Serial No. 199,560.

To all whom it may concern:

Be it known that I, ANNIBALE A. GUERINI, a citizen of the United States, residing at Middleboro, Plymouth county, and State of Massachusetts, have invented and discovered certain new and useful Improvements in Internal-Combustion Rotary Engines, of which the following is a specification.

The invention for which this is an application for Letters Patent, consists in improvements in internal combustion motors, driven by turbine action, in which the high temperature, produced by the combustion of the gases, is lowered and kept at a similar temperature to that of the steam, by using steam, produced by the motor itself, and the same steam will be used as a power for driving the turbine with the gases.

The primary object of my invention is to provide a turbine with one or several sets of rings of moving blades, and fixed blades, one next to another; one or several combustion chambers secured to a plate with nozzles for the gases and for the steam; and two compressors, one for compressing the air and the other for generating the gases. The compressors can be driven by the same or by different motors.

The same letters and numbers in these specifications, apply to the same letters and numbers in the accompanying drawings.

The drawings.

Figure 1—front elevation of the machine.

Fig. 2—side elevation of the machine.

Fig. 3—vertical section of the machine.

Fig. 4—section of a combustion chamber, showing the working of the valve.

Fig. 5—perspective view of a combustion chamber showing the valves.

Fig. 6—section of the compressor generating the gases.

Fig. 7—a section on the line 7—7 of Fig. 5.

A, is the frame having bearings for the different shafts. B, is the turbine secured to the shaft C, to which is fixed the worm D, driving the worm gear E. The worm gear E, is secured to the crank shaft F, to which is fixed the bevel gear G, which engages the bevel gear H. The bevel gear H, is secured to the pin J, to which is fixed the gear I, intermeshing with the gear K, secured to the drum L, which turns on the sleeve M, of the shaft C. One end of the sleeve M, is bolted to the plate N, and the opposite end is kept rigid by the braces O, which are bolted to the frame. On the drum L, is secured the cam wheel P; to this wheel are attached two cams Q and R, and two pins S and T. The cam Q on the circumference engages the rollers 1 of the lever V, and V′; the cam R fixed on the plane side of the wheel P engages the levers U; the pin S, inserted on the side of the wheel right below the circumference engages the levers X; the pin T, which is longer and farther from the circumference, engages the levers Y and Y′.

Of the two cranks of the crank shaft F, one drives the pump for the air compressor *a*, and the other drives the two pumps for the gas generator *b*. The air compressor can be built by using some pattern already in the market, provided this will be of the capacity suitable for the motor. The compressor can compress the air in the explosion chamber directly or as it is done in the accompanying drawing, the air is compressed in the accumulator *c*, and from the accumulator is discharged into the circular tube *d*, and from the circular tube into pipes *e*, and from the pipes into combustion chamber *f*. The flow of the air is shut off from the combustion chamber by the valve *g* operated by lever Y. The motor of the accompanying drawing has five combustion chambers, and as the five combustion chambers are provided with the same valves and the same machinery for their operation the description of one applies to the others.

The other crank sets in action the double pump *h*, for generating the gas (Fig. 6). The piston *k*, in its outward movement sucks the air through the valve *j*, at the same time that the piston *i*, in its outward movement sucks the oil through the valve *l*. On their return the piston *i*, will force the oil through the valve *m*, into the chamber *n*, and the piston *k*, forces the air through the valve *o*, and causes it to enter into the chamber *n*, at the same time as the oil; the air by mixing with the oil will volatilize the oil, thus transforming the oil into gas. The continuing inward movement of the piston will increase the pressure of the gas in the chamber *n*, the gas will force its way through the valve *p*, into accumulator *q* (Fig. 3) and from the accumulator into the circular tube *r*, and from this tube into the pipes *s*, and from the pipes *s*, by opening the valves *t* operated by levers Y′, will enter the combustion

chambers *f*. The size of the oil pump and the air pump should be so regulated that the quantity of the air must be enough to volatilize the oil but not enough to cause explosion.

The combustion chambers are spaced secured and inclosed in an annular housing composed of the plates N—*u*—*v* and *z* (Fig. 3) these four plates inclosing the combustion chambers and forming the water jacket 15 around the chambers.

The interior of each combustion chamber *f* is an elongated cone terminating in a nozzle *x*, in the form of a funnel (Fig. 4). At the point of junction of the nozzle with the combustion chamber, which is the narrowest part of the two, there is a casing for the valve *y*. This valve in its lowest part is composed of a flat solid piece of metal *y*, wide and long enough to close the neck of the combustion chamber (Fig. 4); above the neck the valve is perforated by a circular hole *w*, of the same diameter as the opening that connects the combustion chamber with the nozzle. This valve is pivoted by the rod 2, to the lever 3. On the other end of this lever is pivoted the rod 4 of the piston 5. This piston works in the chamber 6, which opens into the interior of the combustion chamber. At the moment of the explosion of the gases in the combustion chamber, the pressure of the gases force the piston 5 up by compressing the spring 7, inverted on the rod 4. By this operation the lever 3 forces down the circular opening *w*, of the valve *y*, and by so doing opens the communication between the combustion chamber and the nozzle. As soon as the gases have left the combustion chamber the spring 7 forces the valve to its normal position.

The hole 8, which puts into communication the interior of the combustion chamber with the atmosphere is opened and closed by a valve 8′ operated by the lever U (Fig. 5). This valve is opened mechanically by the engagement of the lever U with the cam R properly timed after the explosion to permit the scavenging of the vitiated gases, and is closed by the spring 9. Simultaneously with the engagement of the cam R and the lever U, segment Q engages the roller I of the lever Y to displace the lever V and open the valve *g* thereby admitting air from pipe *e* into the combustion chamber to effect the scavenging, the vitiated gases passing from the chamber through the valve 8′ as described. More detailed explanation of the operation of the valve *g* is had from the following description. The compressed gases are admitted by the vlave which is opened by the lever V′ and closed by Y′. The parts which enter into the construction of these valves are the same for both and their way of working is the same also; so I will describe one and the description of this will apply to the other (Fig. 5). The valve proper is a flat rectangular piece of metal of which half is solid 10, and the other half is perforated by a cylindrical hole 11. The diameter of the hole is equal to that of the pipe *e*. A stem 12, is bolted below the solid part 10, which has a casing in form of a U. In this casing is inserted the upper part of the lever V; this lever has its fulcrum on the pin 13, and in its lower end carries the wheel 1 which, when it strikes the segment Q, compels the upper end of the lever, and also the valve, to swing from right to left. By this operation communication is established between the interior of the pipe *e*, and the interior of the combustion chamber. As soon as the wheel leaves the segment Q the spring 14 forces the valve and its lever to its normal position which is to shut off the communication of the combustion chamber with the pipe *e*. In this operation the spring 14 is assisted by the lever Y. This lever has two elbows, one bends from the right to the left and in its turn is located the fulcrum 16, and the other projects from the front so the lower part of the lever will not be in contact with the circumference of the wheel P, but will be operated by the pin T. The pins 16, which are fixed to the ears of the transverse bar 17, pass through a hole of the lateral ear of the lever Y, and in order to prevent this lever from slipping out from the pin, a head is inserted on the end of the pin. As is seen, this pin acts as a fulcrum for the lever Y and will not interfere with the movement of the lever V. As soon as the lever V leaves the segment Q, the lower end of the lever Y is engaged by the pin W and throws the levers Y and V with the valve to its normal position. The transverse bar 17, connects the levers V and Y with the levers V′ and Y′; in this transverse bar are two holes for the pins 13; the extremity of the transverse bar ends with two ears to which are fixed the pins 16; at the height of the top of the lever V and V′, but below the point where this lever V catches the stems of the valves, this transverse bar has a casing wide enough to permit the levers V and V′ to swing from right to left and vice versa. In the center of the bar is bolted the arm 18; this projects in front of the motor and at its end is hinged the lever 19, which extends upward, and by proper bending, meets (with the other levers marked with the same number) in the center and in front of the motor. By pushing the upper end of the lever toward the motor the transverse bar 17, will be pulled back and will carry with it the levers V—V′—Y—Y′, by so doing the valves will be disconnected and the result will be that the working of the combustion chamber will be stopped. The wheel P, continuing its run, will cause the pin S to strike the lever X; this will

cause an electric spark in the combustion chamber.

The turbine B, is composed of a drum 20, set in the frame composed of the plates 21—22 and a tube 23, in which is inserted the shaft C and to this shaft is secured the turbine. On top of the drum are secured the moving blades 24. The turbine is covered by a double casing; in the inner casing 25, are secured the fixed blades 42. The moving and the fixed palettes are disposed in alternate rows, first row will be the moving blades, the second row of fixed blades, etc. The inner casing will be as near as possible to the top of the moving blades and the lower part of the fixed blades will be as near as possible to the drum.

Each side of the drum terminates in two ribs 26—27. These ribs run in annular grooves in plates *u* and 28. The ribs should be made to fit in the annular groove as perfectly as possible.

The turbine is inclosed by the plates *u* and 28; the plate *u* separates the turbine from the box holding the combustion chambers and in this plate are bored the nozzles 43 for the combustion chamber and for the steam 44. To these plates are bolted the casing 25 and the exterior casing 30, which, with the inner casing and the two side plates form the water jacket 31 for the turbine. On the top of the water jacket is secured the steam chest 32, from which departs the steam pipe 33. This steam pipe passes through the water jacket of the combustion chamber, and is connected to the circular pipe 45, which is incased on the plate *u*. From this circular pipe depart the steam nozzles 44; the steam ejected by these nozzles strikes the moving palettes of the turbine at the same angle as the gases which are ejected by the nozzles of the explosion chambers.

The water jackets 15 and 31 are in communication with each other through openings 35 of the plate *u*. The water is injected into the water jackets by the pump 36, through the pipe 37, and the condensed steam returns to the condenser 38 through the pipe 39. The pump 41 is used to lubricate the different parts of the motor.

To start the motor, disconnect first the feeding valves *g* and *t*; next, by some means turn the shaft C so as to start the pumps for the air compressor and the gas generator, until the accumulators *b* and *e*, and the tubular rings *d* and *r*, and the pipes *e* and *s*, are filled to the proper pressure with air and gas. When the pressure is reached, open the valves *g* and *t* of one combustion chamber, turn the shaft C again until the first explosion occurs, next open the valves of all combustion chambers. To reduce the speed, shut off one or more combustion chambers from the feed. As soon as there is some steam accumulated in the steam chest (the water jacket will produce steam in a few minutes after the motor is started) open the steam valve by moving the lever 40 from right to left. The steam in the turbine has a double function; first, it prevents the heat produced by the explosions, from reaching a high temperature in the turbine which would otherwise be red hot in about fifteen minutes and the consequence would be to put out of commission the motor; second, the steam adds power to the motor. To stop the motor, shut off all the feeding valves.

For the motor of which these are the specifications, any style of turbine can be used according to the purpose to which it is to be put.

The motor above described has the advantage that no power is lost, as almost all the heat energy is transformed into kinetic energy, and by so doing it is possible to secure a motor which is lighter than any other motor, per H. P. which will develop. Another advantage is: that an indefinite number of motors can be operated with a single supply of feed.

Having described and illustrated in full my invention, I ask that Letter of Patent be conceded to me for the following claims:

1. In an internal combustion engine a rotor, a plurality of explosion chambers spaced concentrically about the rotor, a nozzle communicating with the explosion chambers and directed toward the rotor, a cylinder communicating with each chamber, a piston slidable in the cylinder, means to admit and discharge the scavenging air under pressure, a spring carried by the piston having sufficient tension to resist the pressure of scavenging air, a nozzle valve controlled by the piston and held normal yieldingly closed, means to admit gas to the chamber, means to ignite the contained gas, the tension of the ignited gas actuating upon the piston to open the nozzle valve, and means carried by the rotor to actuate the scavenging valves, the gas admission valves and the igniter in timed relation and progressively for the several chambers.

2. In an explosive engine a rotor, a plurality of explosion chambers spaced concentrically about the rotor and provided with means for discharging expanded gases upon and to actuate the rotor, valved inlet ports for air and gas respectively, a valve actuating mechanism, means carried by the rotor for moving the valve actuating mechanism, and manual means for moving the valve actuating mechanism out of the path of control of the rotor.

3. In an explosive engine a rotor, a plurality of explosion chambers spaced concentrically about the rotor and provided with discharge ports directed to actuate the rotor, a valved air inlet port and a valved gas inlet

port for each chamber, valve actuating mechanism, means carried by the rotor for moving the valve actuating mechanism in timed relation, and a manually controlled means for moving any of the valve actuating mechanisms selectively out of the path of control of the rotor.

4. In an explosive engine a rotor, a plurality of explosion chambers spaced concentrically about the rotor and provided with orifices properly positioned to discharge expanded gases from the chamber to actuate the rotor, scavenging air inlet and exhaust ports for each chamber, a valved gas inlet port for each chamber, an igniter for each chamber, means carried by the rotor for actuating the valve controlled mechanisms in timed relations and for the several chambers progressively, and means to manually move the valve controlled mechanism of the air inlet and gas inlet ports out of the path of control of the rotor.

In witness whereof, I have hereunto set my hand and seal at Washington, District of Columbia, this thirty-first day of October, A. D. nineteen hundred and seventeen.

ANNIBALE A. GUERINI. [L. S.]

Witnesses:

H. H. BYRNE,

C. K. REICHENBACH.