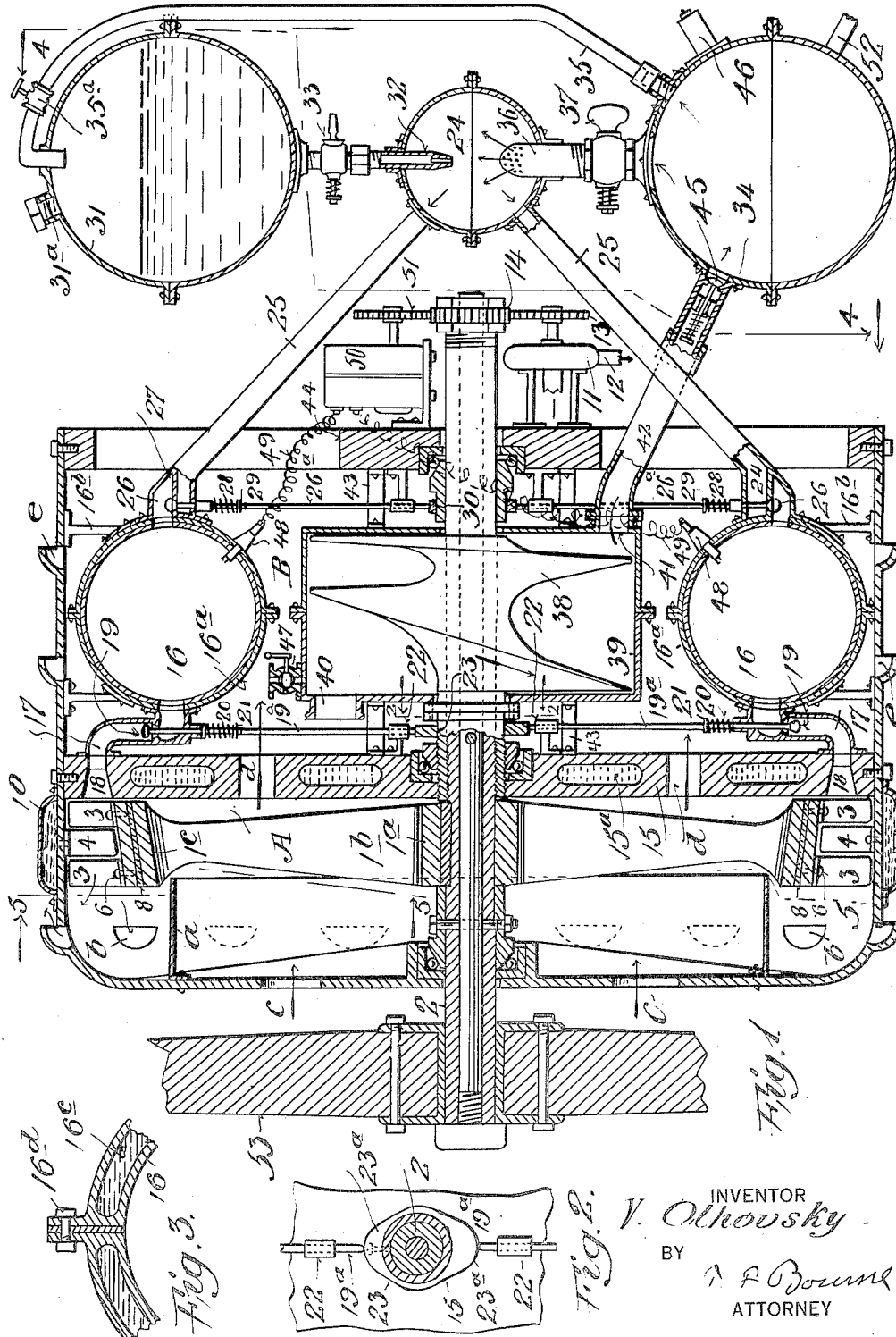


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EXPLOSION GAS TURBINE.
APPLICATION FILED SEPT. 14, 1918.

1,346,509.

Patented July 13, 1920.

2 SHEETS—SHEET 1.



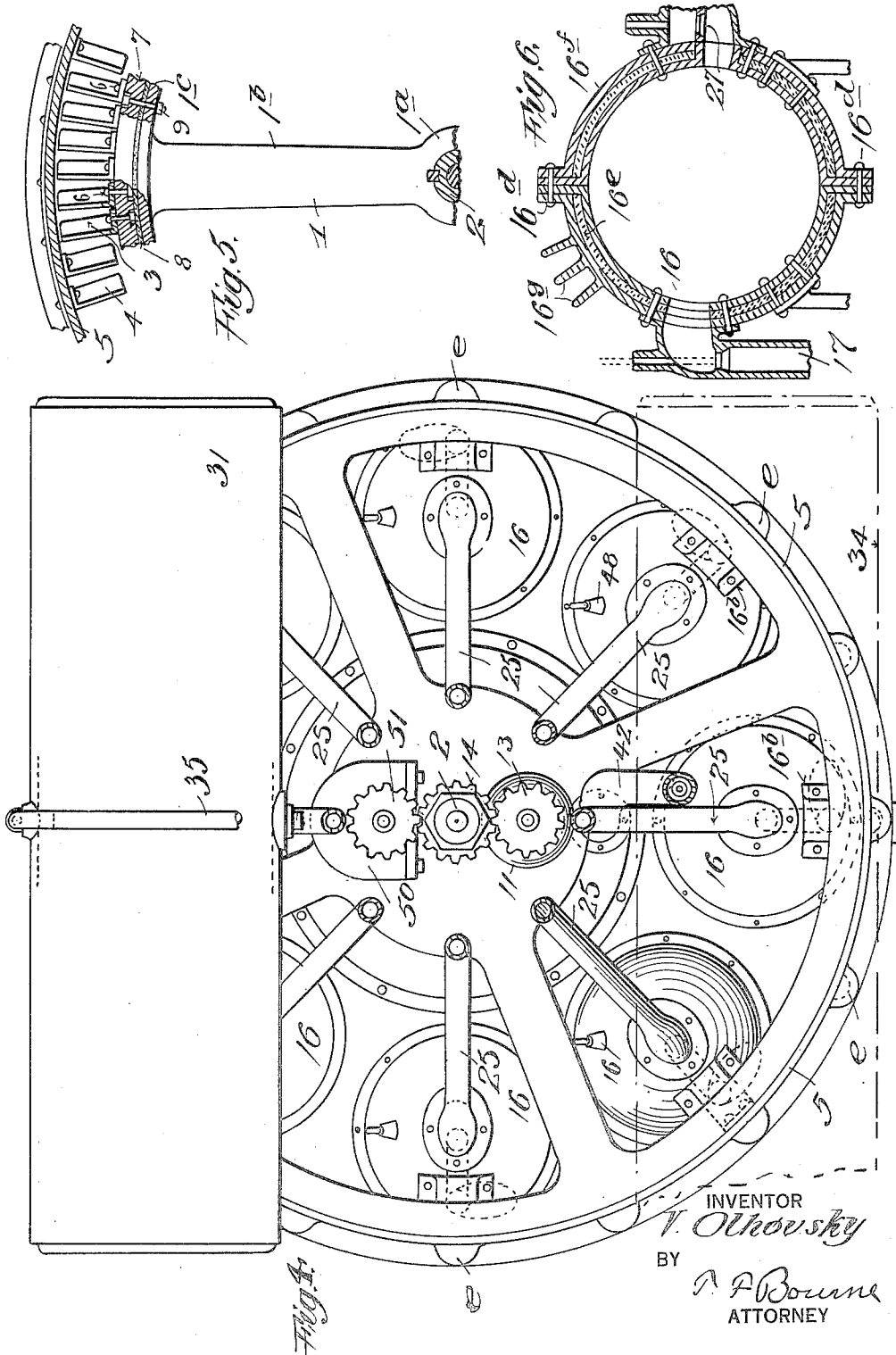
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UNITED STATES PATENT OFFICE.

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EXPLOSION GAS-TURBINE.

1,346,509.

Specification of Letters Patent.

Patented July 13, 1920.

Application filed September 14, 1918. Serial No. 254,028.

To all whom it may concern:

Be it known that I, VLADIMIR OLHOVSKY, a subject of Russia, and resident of New York city, borough of Manhattan, in the county of New York and State of New York, have invented certain new and useful Improvements in Explosion Gas-Turbines, of which the following is a specification.

My invention relates to the production of power from burning gases under pressure, and has particular reference to operating the rotor of a turbine or rotary motor by means of burning gases delivered to the vanes or pockets of the turbine from one or more chambers into which inflammable gases are periodically admitted under pressure and therein ignited to increase the pressure of the gases for operation of the rotor.

In carrying out my invention I provide a turbine or rotary motor having a rotor and vanes, one or more explosion chambers to receive inflammable gases and having outlets for delivering burning gases to the turbine for operating the rotor, a carbureting chamber for communication with the explosion chambers, and means to deliver liquid fuel and compressed air under the same pressure into the carbureting chamber for production therein of an inflammable mixture under pressure for delivery to the explosion chambers, means also being provided to control the flow of such mixture from the carbureting chamber to the explosion chambers and for controlling the flow from the explosion chambers to the turbine in proper timed relation, means also being provided to cause ignition of such compressed gases in the explosion chambers as required.

My invention also comprises novel details of improvement and combinations of parts that will be more fully hereinafter set forth and then pointed out in the claims.

Reference is to be had to the accompanying drawings forming part hereof, wherein,

Figure 1 is a vertical section through an apparatus adapted for carrying out my invention; Fig. 2 is a detail section on the line 2, 2, in Fig. 1; Fig. 3 is a sectional detail of a modification; Fig. 4 is an end elevation partly in section on the line 4, 4, in Fig. 1; Fig. 5 is an enlarged detail section substantially on the plane of the line 5, 5, in Fig. 1; and Fig. 6 is a sectional detail of a modification.

Similar numerals of reference indicate corresponding parts in the several views.

My invention may be carried out in connection with any suitable turbine or rotary motor having a rotor adapted to be rotated by means of burning gases operating against its vanes or pockets. The turbine illustrated in the accompanying drawings comprises mainly a rotor 1, which may be secured upon drive shaft 2, and which is provided upon its periphery with annular series of spaced vanes or blades 3 operative with relation to stationary vanes or blades 4 secured upon a suitable casing or housing 5. The vanes 3, 4, may be secured respectively to the rotor and housing by means of bolts 6 or in other suitable manner. The dimensions and pitch of the vanes 3, 4, may be arranged in any suitable manner and by preference the periphery or outer face of the rotor upon which vanes 3 are secured is arranged so as to converge in the direction of shaft 2, substantially as shown in Fig. 1, the annular series of vanes 3 being of suitable length radially to rotate within the housing or casing 5 sufficiently close thereto, the inner edges of the vanes 4 preferably being shaped corresponding to the inclination of the periphery of the rotor to fit sufficiently close thereto, whereby burning gases will be properly directed between the vanes, and will be permitted to expand.

To prevent conduction of heat from the vanes to the main portion of the rotor, which may comprise a hub 1^a, spokes 1^b and rim 1^c in the nature of a wheel, I preferably secure vanes 3, as by means of the bolts 6, to a ring 7 fitting around the rim 1^c and having heat insulating material, such as asbestos 8, located between the rim 1^c and ring 7, said parts being secured together by bolts 9 (see Fig. 5). The casing or housing 5 may be provided with a water jacket at 10 secured thereon in any suitable manner or made integral therewith in a wellknown way, to provide for cooling the housing and vanes 4 adjacent to the rotor. A pump 11 may be connected by a pipe 12 with said water jacket for maintaining circulation of water there-through, which pump may be driven by suitable gearing 13, 14 from shaft 2. At 15 is a wall or partition within the housing or casing adjacent to the rotor dividing the housing into a compartment A containing the

rotor and a compartment B containing one or more explosion chambers 16. At *a* is an annular wall in housing 5 adjacent to the vanes to direct gases therefrom through outlet openings *b*. The front of the housing is shown provided with openings *c* for the admission of air, and the wall 15 is shown provided with openings *d* whereby air may flow through the compartment A containing the rotor into the compartment B containing the chambers 16. The housing is also shown provided with openings *e* whereby air may enter the corresponding compartment. The wall or partition 15 may be water-jacketed as indicated at 15^a, and pump 11 may supply water to the jacket for cooling said wall.

The explosion chambers 16 are shown within the housing and may be of any suitable construction and of any desired number, wherein gases will be exploded and burned for transmission under pressure to the vanes of the turbine. The explosion chambers 16 may be made in any suitable form, and may be cast in spherical form and inclosed within an outer shell 16^a, and secured within housing 5 by suitable supports 16^b. If preferred said castings may be made with water jackets indicated at 16^c forming sections at the side and bolted together as indicated at 16^d in Fig. 3. Another form for cooling explosion chamber 16 is shown in Fig. 6, wherein the inner shell is covered with asbestos, indicated at 16^e, inclosed within a metal inclosure 16^f, which parts may be secured together by bolts or rivets 16^d. Radiating fins 16^e may be provided upon inclosure 16^f to aid in cooling the chamber. The chambers 16 communicate through conduits or passages 17 with nozzles 18, shown in the wall or partition 15, and having their delivery orifices opposing the vanes of the turbine for directing burning gases thereto. The nozzles 18 preferably flare toward the delivery orifices adjacent to the vanes to permit gradual expansion of the gases flowing from the explosion chambers 16. At 19 are valves coöperative with seats in the outlet conduits or passages 17, for periodically controlling the discharge of burning gases from the explosion chambers 16 to the vanes. Said valves may be spring pressed to their seats by means of springs 20 operating upon stops 21 upon the valve stems 19^a which are shown guided near their free ends by guides 22 secured upon wall or partition 15, an eccentric or cam 23 secured upon shaft 2 coöperating with said valve stems for unseating the valves periodically during rotation of the rotor and shaft 2.

The eccentric or cam 23 may be suitably shaped to cause opening of said valves in desired order in proper timing according to the number of such chambers that may be utilized in a series around shaft 2. By preference, cam or eccentric 23 will be provided with two oppositely disposed valve-stem operating portions 23^a for operating two diametrically opposed valves 19 substantially simultaneously (Fig. 2) to cause the flow of burning gases under pressure to the vanes 3, 4, on diametrically opposite sides of the rotor substantially simultaneously for balancing the pressure of the gases upon the rotor on opposite sides thereof. The arrangement is such that when explosion chambers 16 are provided in pairs or multiples of two in opposed radial relation around shaft 2, and the valves 19 of corresponding pairs of chambers 16 open together and in successive order, the burning gases from pairs of explosion chambers will be delivered to the vanes 3, 4, successively, in accordance with the rotation of cam or eccentric 23.

At 24 is a carbureting chamber from which conduits or passages 25 lead to the corresponding explosion chambers 16. Valves 26 coöperative with seats 27 control the flow of mixture from carbureter 24 to the explosion chambers respectively. Said valves are normally pressed to their seats by springs 28 operative against stops 29 on the valve stems 26^a, a cam or eccentric 30 secured upon shaft 2 serving to operate said valves in proper timing. Cam or eccentric 30 may be arranged like cam or eccentric 23 for operating pairs of valves 26 in manner described with respect to valves 19. The arrangement of operation of valves 19 and 26 may be such that when valve 19 of chamber 16 is seated, the corresponding valve 26 will open to admit mixture to such chamber, and said valve 26 may close before valve 19 opens. When the explosion chambers 16 are arranged in pairs on opposite sides of shaft 2, as before described, the valves 19 will be seated, the corresponding valves 26 will open to admit mixture to said chambers, and said valves 26 may close before valves 19 open. At 31 is a fuel supply tank, such as for gasoline, kerosene or other hydrocarbon fuel, having jet or nozzle 32 to deliver liquid fuel into carbureting chamber 24, a valve 33 being adapted to control the flow of fuel from said carbureting chamber. The tank 31 is shown above the carbureting chamber 24 whereby the liquid fuel may flow thereto by gravity. At 34 is a tank or chamber for compressed air, and the same is in communication with the upper portion of tank 31, through a pipe or conduit 35, whereby pressure in tanks 31 and 34 will be constantly equal. Tank 34 is in communication with carbureting chamber 24 through a suitable nozzle 36, and the flow of compressed air through said nozzle from tank 34 may be controlled by a suitable valve 37. Any suitable means may be provided for maintaining air under pressure in tanks 31 and 34. For such purpose I have shown a

rotary air compressor comprising a helically disposed member 38 secured upon shaft 2, and rotative within a casing 39 having an air inlet 40 and an outlet 41 communicating through a pipe or conduit 42 with tank 34. The casing 39 may be secured in place by supports 43 secured to wall 15 and to a wall or spider 44 of the casing. A check valve 45 prevents return flow of compressed air from tank 34 to the compressor. An automatic safety valve 46 may be applied upon tank 34 to limit the degree of compression of air therein. A manually controlled valve 47 may be provided upon the compressor, as upon the casing 39 thereof, whereby the degree of compression of air in the compressor may be controlled at will.

Each of the explosion chambers 16 may be provided with means for igniting the mixture therein periodically as required. For such purpose said chambers may be provided with spark plugs 48 connected by conductors 49 with a magneto or other electric generator 50, for the production of sparks in said chambers in any wellknown manner. Said magneto may be operated by means of a gear 51 upon its armature shaft in mesh with gear 14.

In the operation of my improvements tank 31 will be supplied with gasoline or other suitable liquid fuel, and tank 34 will be supplied with air compressed to a desired degree, as by means of a hand-pump attached to tank 34 as at 52 for initial air pressure, say to approximately two atmospheres. Valves 33 and 37 will be opened suitably, whereupon mixture of fuel and air under pressure will be produced in carbureting chamber 24 and will flow into one or more of the explosion chambers 16 whose valve 27 then may be open. The motor may be started by rotating shaft 2, whereupon mixture in one or more of the chambers 16 will be ignited, and the burning mixture will flow from such chamber or chambers through the outlets 17, 18, between the vanes 3, 4, causing rotation of the rotor. During rotation of shaft 2, the air compressor will maintain air under pressure in tank 34, and since the pressure in both tanks 31 and 34 is equalized through the pipe 35 a continuous supply of mixture for the explosion chambers 16 will be maintained under constant pressure. During operation a valve 19 will be closed and the companion valve 27 will open to admit compressed mixture into the corresponding chamber 16, and thereupon said valve 27 will close and the mixture will be ignited and will explode causing increase of its pressure in chamber 16 and thereupon valve 19 will open permitting flow of such burning mixture through outlets 17, 18, for operating the rotor, and so on successively in the various chambers, whereby a continual supply of

compressed mixture will be maintained for operation of the rotor. The speed of operation of the rotor shaft 2 may be governed by controlling the air pressure in the air compressor or tank 34, as well as by controlling the amount of liquid fuel admitted to the carbureting chamber 24. Since the supply of compressed air in tank 34 is maintained continually during operation, and since the explosions and increase of pressure of the gases are successive in the various explosion chambers 16, or pairs thereof, the operation of the rotor is maintained in manner analogous to the operation of a steam turbine with continuous pressure. The motor may be stopped by closing valve 33. To recharge tank 31 with liquid fuel the valve 33 may be closed and valve 35^a in pipe 35 also may be closed, the tank then being charged through a controllable inlet 31^a.

My improved motor is relatively light in weight and simple in construction, and is not liable to get out of order since there are few movable parts. My improved motor is particularly applicable for use in aeroplanes, dirigibles, seaplanes, and the like, as well as in automobiles and boats, and for stationary power purposes.

One of the advantages of my invention is that air may be maintained in tanks 31 and 34 at any desired degree of pressure at varying elevations of a flying machine containing my improvements, whereby the desired pressure of the mixture may be obtained for explosion in the chambers 16 to maintain high speed of rotation of the rotor regardless of the rarity of the air.

In the drawings I have illustrated a propeller 53, secured to shaft 2 in front of housing 5 for operation of the motor in a flying machine, it being understood, however, that the propeller or other part to be operated may be driven from shaft 2 directly or through any wellknown interposed transmission mechanism.

While I have illustrated and described a practical embodiment of means adapted to carry out my invention, it will be understood that the relative arrangement of parts and details of construction set forth may be varied, within the scope of the appended claims, without departing from the spirit of my invention.

Having now described my invention what I claim is:

1. The combination of a motor having a rotor, an explosion chamber, means to deliver burning gases therefrom to the rotor, a carbureting chamber, a conduit providing communication between the carbureting chamber and explosion chamber, means to periodically open and close communication between said chambers, a tank for liquid fuel for communication with the carbureting

chamber, means to supply air under pressure to the carbureting chamber and to the fuel tank for production of an inflammable mixture, and means to ignite such mixture
5 in the explosion chamber periodically.

2. The combination of a motor having a rotor, a plurality of explosion chambers, means to deliver burning gases from said chambers to the rotor, a carbureting chamber for communication with the explosion
10 chambers, means to produce an inflammable mixture under pressure in the carbureting chamber, means to ignite mixture in each of the explosion chambers, and means to admit
15 burning mixture simultaneously from two explosion chambers to opposite sides of the rotor.

3. The combination of a motor having a rotor, a plurality of explosion chambers,
20 means to deliver burning gases from said chambers to the rotor, a carbureting chamber for communication with the explosion chambers, means to produce an inflammable mixture under pressure in the carbureting
25 chamber, means to periodically control admission of said mixture to the explosion chambers, means to ignite mixture in each of the explosion chambers, and means to admit
30 burning mixture simultaneously from two explosion chambers to opposite sides of the rotor.

4. The combination of a motor having a shaft provided with a rotor, a plurality of explosion chambers located around said
35 shaft, conduits providing communication between said explosion chambers and the rotor at distances apart, valves to control the flow of burning mixture from the explosion chambers through said conduits,
40 means to successively operate the valves of different explosion chambers, a carbureting chamber, conduits providing communication from said chamber to each of said explosion chambers, means to supply said car-
45 bureting chamber with liquid fuel and air under pressure, means to periodically con-

trol the flow of mixture from the carbureting chamber to the explosion chambers, and means to ignite the mixture in the last named chambers.

5. The combination of a motor having a shaft and a rotor carried thereby, a plurality of explosion chambers around said shaft, conduits providing communication from said explosion chambers to spaced portions
55 of the rotor, valves for controlling the outlet of burning mixture from said chambers to the rotor, means to operate a pair of said valves substantially simultaneously, a carbureting chamber, conduits providing com-
60 munication from said chamber to the explosion chambers, valves to control the flow of mixture from the carbureting chamber to the explosion chambers, means to operate a
65 pair of the last named valves substantially simultaneously to admit mixture to said explosion chambers before operation of the corresponding pair of outlet valves, means to ignite mixture in said chambers sub-
70 stantially simultaneously, and means to produce inflammable mixture in said carbureting chamber.

6. The combination of a motor having a rotor, an explosion chamber, means to deliver burning gases therefrom to the rotor,
75 a carbureting chamber, a conduit providing communication between the carbureting chamber and the explosion chamber, a tank for liquid fuel for communication with the carbureting chamber, a tank for compressed
80 air, means providing communication between said tank and the carbureting chamber, means providing communication between said fuel tank and the compressed air tank to maintain equal pressure therein,
85 means to maintain air pressure in said air tank, and means to ignite mixture in said explosion chamber.

Signed at New York city, in the county of New York, and State of New York, this 11th day of September, A. D. 1918.

VLADIMIR OLHOVSKY.