E. J. BROWN.

ENGINE.

APPLICATION FILED FEB. 3, 1919.

1,319,752.

Patented Oct. 28, 1919.

3 SHEETS—SHEET 1.

Fig. 5.

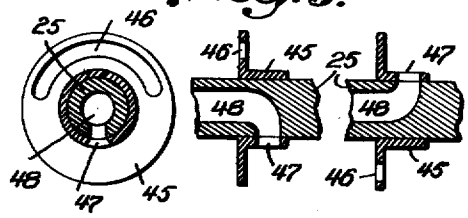
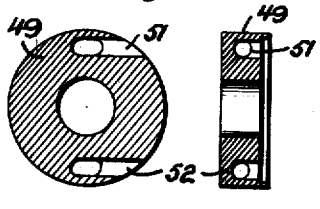


Fig. 1.

Fig. 6.

Fig. 7.



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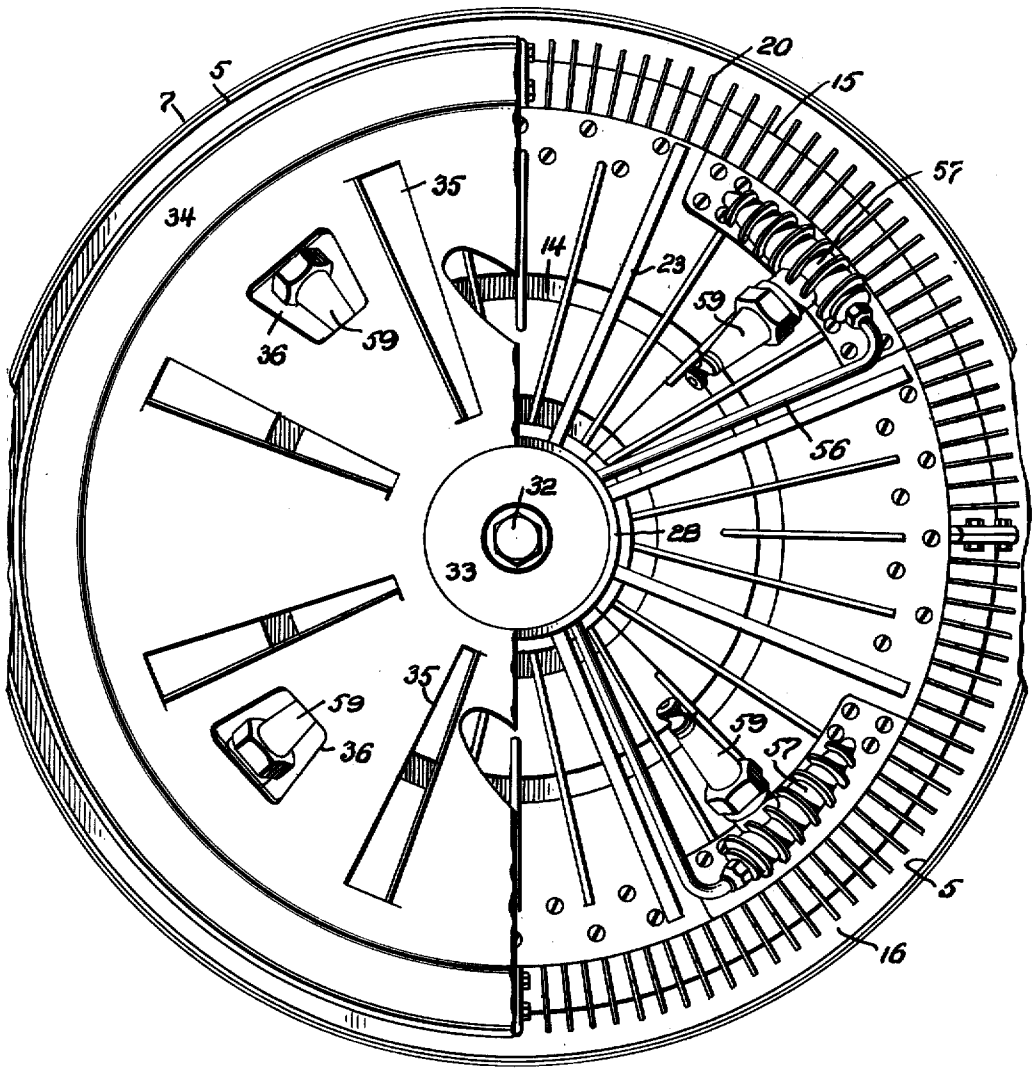
3 SHEETS—SHEET 2.

Fig. 2.



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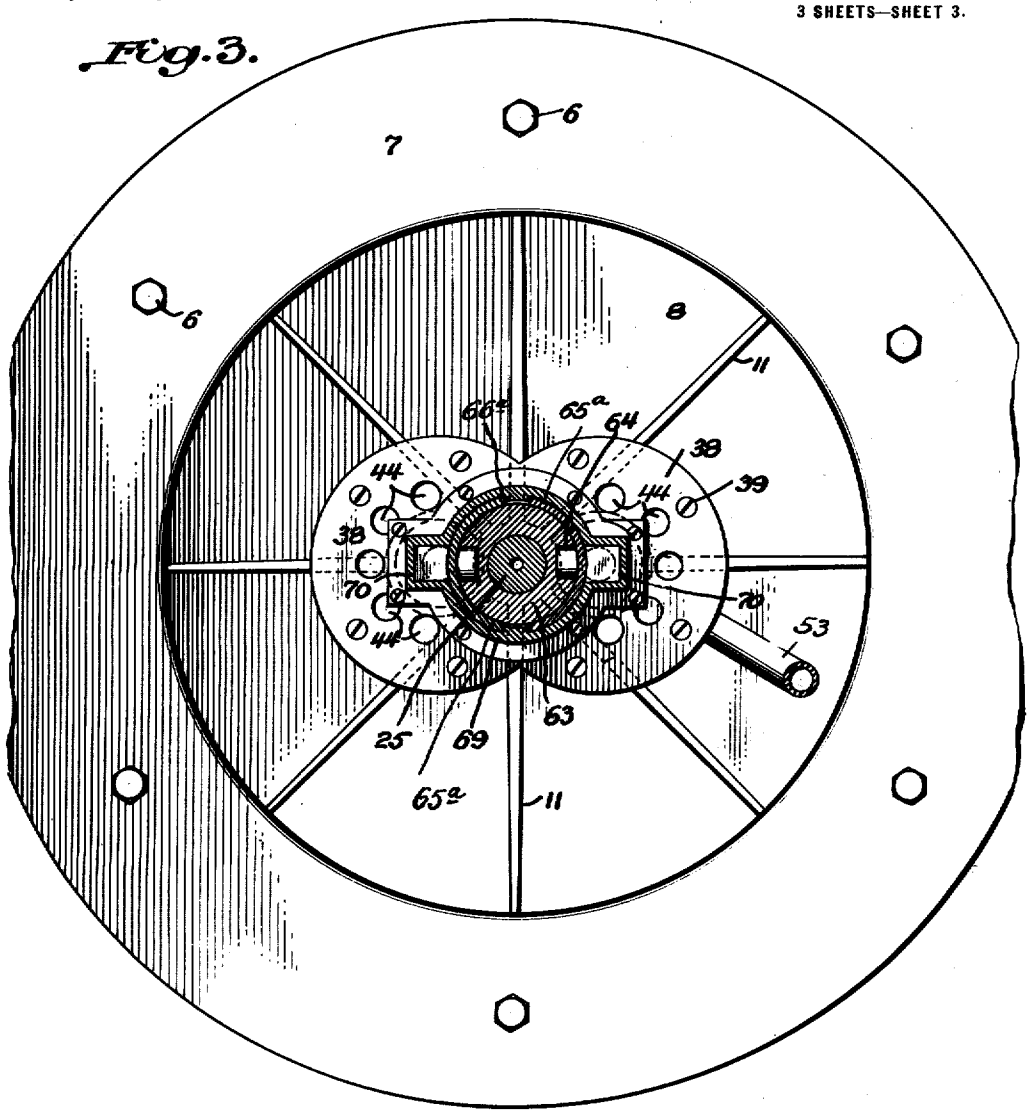
3 SHEETS—SHEET 3.

Fig. 3.



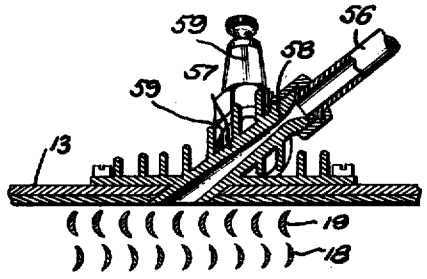


Fig. 4.

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UNITED STATES PATENT OFFICE.

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1,319,752. Specification of Letters Patent. Patented Oct. 28, 1919.

Application filed February 3, 1919. Serial No. 274,722.

To all whom it may concern:

Be it known that I, EMMETT J. BROWN, a citizen of the United States of America, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Engines, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to a turbine engine especially designed for air planes, hydro planes, and propeller driven or pulled crafts, and my invention includes novel structural features that may be characterized in the following particulars.

First, the engine includes compactly arranged turbine elements or blades, some of which are carried by a rotor and others by a stator, the rotor being disposed circumferentially of the stator and coupled directly to the propeller adapted to have movement imparted thereto by the engine. The turbine elements or blades are radially disposed relative to the axis of the engine and of such constructive arrangement that the explosive and expansive forces of fuel and air may be utilized to the fullest extent.

Second, provision is made for alternately subjecting the turbine elements or blades to the action of fuel and air. The fuel is supplied during the operation of the rotor and when ignited the burned gases impinge against the movable and stationary blades of the engine, the forces set up by detonation of the fuel being used until expended or exhausted at atmospheric pressure, thus obviating the necessity of using a muffler or similar device to deaden the exhaust of the engine, as is a desideratum when an air craft is used for war purposes.

Third, a novel reciprocatory pump is utilized for forcing fuel and air into the annular cylinder formed by the rotor and stator, the supply of air serving as a cooling agent and when heated its expansive force is converted into work by impinging against the turbine elements or blades of the engine. As with fuel, the air has its expansive force completely used before reduction to atmospheric pressure, and by injecting air between charges of fuel the air also serves as a scavenging agent.

Fourth, external cooling is accomplished by providing the rotor with heat disseminating elements, and with a centrifugal fan which during the operation of the rotor sets air in motion around the stator and thus prevents overheating of the engine due to excessive speed.

Fifth, the weight of the engine is materially reduced compared to ordinary air craft engines by constructing the greater part of the engine of an aluminum composition or a light and durable material. The engine may be relied upon to operate for an indefinite period without requiring any attention, and the novel construction, combination and arrangement of parts employed for accomplishing the above and other results will be hereinafter specifically described and then claimed.

Reference will now be had to the drawings, wherein—

Figure 1 is a longitudinal sectional view of an engine in accordance with my invention;

Fig. 2 is an end view of the same with the propeller removed;

Fig. 3 is a cross sectional view taken on the line III—III of Fig. 1;

Fig. 4 is a longitudinal sectional view of a nozzle associated with the rotor of the engine, and

Figs. 5, 6 and 7 are detail views of a rotary valve adapted to form part of the engine.

In describing my invention by aid of the views above referred to, I desire to point out that the same are intended as merely illustrative of the structural elements by which I may put my invention into practice, and I do not care to confine myself to the exact construction and arrangement of parts shown or hereinafter described, other than defined by the appended claims.

In the drawings, the reference numeral 1 denotes a stator shell having circumferential grooves 2 and a concentric bearing 3. The peripheral edges of the stator shell 1 are provided with an integral cylinder wall 4, and this cylinder wall has a peripheral flange 5 adapted to be connected at places indicated by 6, to the peripheral flange 7 of another stator shell 8. The shell 8, with the exception of its flange 7, is in spaced relation to the shell 1 and between said shells are radially disposed heat disseminating ribs 9. Centrally of the shell 8

are two parallel casings 10 somewhat cylindrical and communicating with each other, said casings being connected to the shell 8 and flange 7 thereof by radially disposed heat disseminating ribs 11.

13 denotes a rotor in parallelism with the shell 1 of the stator, said rotor having circumferentially disposed ribs 14 extending into the grooves of the stator shell 1. Mounted on the peripheral edges of the rotor 13 is an inclined cylinder wall 15 cooperating with the cylinder wall 4 of the stator shell 1 in providing an annular cylinder that tapers outwardly from the rotor toward the peripheral flange 5 in the stator shell 1. The cylinder wall 15 is of less width than the cylinder wall 4 so that there will be an annular exhaust passage 16 adjacent the flange 5 and this exhaust passage communicates with the space between the stator shells 1 and 8 through the medium of openings 17 in the cylinder wall 4.

18 denotes a series of turbine elements or blades carried by the cylinder wall 15 of the rotor 13, said blades extending in proximity to the cylinder wall 4 and being circumferentially disposed around the cylinder wall 15. The blades are preferably arranged in rows and said blades gradually increase in depth toward the exhaust end of the cylinder, as shown in Fig. 1.

19 denotes similar blades or turbine elements carried by the cylinder wall 4 and by reference to Fig. 4 it will be noted that the blades are convexo-concave in cross section and that the blades of the rotor are disposed the reverse of the blades of the stator. This arrangement of blades permits of burned gases and air admitted to the inner end of the cylinder impinging against the blades and passing from one set of blades to the other until the burned gases and air finally exhaust at the exhaust passage 16 under atmospheric pressure. The shape of the blades is such that the burned gases and air will be deflected from one circumferential set of blades to another and since the blades 18 are carried by the rotor and the blades 19 by the stator, these blades can be conveniently referred to hereinafter as movable and stationary blades.

20 denotes heat disseminating ribs on the cylinder wall 15 of the rotor 13 and said rotor supports a fan 21 within the exhaust passage 16, said fan facilitating the exhaust of gases and air from the cylinder and also air utilized for cooling the space between the shells 1 and 8 of the stator, the air being drawn in at the ends of the casing 10, as will hereinafter appear.

22 denotes a hollow hub portion carried by the rotor 13 and braced relative thereto by radially disposed ribs 23 which also assist in the external cooling of the engine.

24 denotes a collar screwed or otherwise mounted in the hub portion 22 of the rotor and said collar is carried by an engine shaft 25 axially of the rotor and stator. The outer end of the shaft 25 terminates in a hollow spindle 26 and mounted on the hollow spindle 26 and fixed to rotate therewith by a key 27 or similar fastening means is the hub 28 of a propeller 29, said hub being preferably made in two parts to facilitate assembling the blades of the propeller, which blades may be two or more in number and constructed similar to propellers now used in connection with air planes. The hub 28 of the propeller may be connected to the collar 24 of the shaft 25 by a plurality of screw bolts 30 or other suitable fastening means.

31 denotes a plug mounted in the hollow spindle 26 and screwed into this plug is a screw bolt 32 engaging the nose 33 of a conical shaped casing 34, said casing inclosing the rotor 13 by extending into proximity of the centrifugal fan 21 carried by said rotor. The casing 34 serves as a hub for the greater portion of the engine, and besides having openings to provide clearance for the blades of the propeller 29, said casing has a plurality of ventilating openings 35 and spark plug openings 36, as best shown in Fig. 2.

37 denotes a set of pump cylinders having flanges 38 suitably connected at places, indicated by 39, to the ends of the casings 10, said pump cylinders extending into the casings and affording a bearing 40 for the shaft 25. At the inner ends of the pump cylinders 37 is a sleeve 41 abutting the central bearing portion of the stator 1, and in a portion of the sleeve 41 and extending into the stator bearing 3 is an anti-frictional ball bearing 42 which supports the engine shaft 25 relative to the stator. Suitable packing 43 is interposed between the engine shaft collar 24 and the bearing 3, between the bearing 3 and the anti-frictional bearing 42, and between the bearing 3 and shaft 25.

44 denotes openings in the flanges 38 of the pump cylinders 37 and said openings communicate with the space between the casings 10 and said pump cylinders. On the pump cylinders within the casings 10 are ribs 45^a to assist in cooling the engine and the air admitted by the openings 44 is drawn between the casings 10 and the pump cylinders 37 into the space between the shells 1 and 8 of the stator, the centrifugal fan 21 maintaining the circulation of air for externally cooling the engine and also placing a supply of air at the sleeve 41 for a purpose that will hereinafter appear.

45 denotes an annular valve member mounted on the engine shaft 25 against the inner end of the bearing 40 and within the sleeve 41, said rotary valve member hav-

ing a segment shaped port 46 and a port 47, the latter being adapted to communicate with a longitudinal port 48 in the engine shaft 25. The rotary valve member 45 is associated with two other stationary valve members 49 and 50, the former being located between the bearing 42 and the valve member 45, and the latter held about the cylindrical portion of the valve member 45 at the ends of the pump cylinders 37. A stationary valve member 49 has opposed angular ports 51 and 52, the latter adapted to communicate with an opening in the sleeve 41, so as to receive air from between the casings 10 and the pump cylinders 37. The port 51 is adapted to communicate with the end of a manifold or fuel supply pipe 53 extending between the ribs 11 of the stator shell 8 and through the casings 10 and the sleeve 41 so that fuel may be admitted to the port 51. These ports are adapted to have the segment shaped port 46 of the rotary valve member 45 register therewith, and the segment shaped port 46 is also adapted to register with the ports 54 in the stationary valve member 50, said ports communicating with the pump cylinders 37, as shown in Fig. 1. The stationary valve member 50 is ported or recessed, as at 55 so as to establish communication between the pump cylinders 37 and the engine shaft port 48, as shown in Fig. 1.

56 denotes radially disposed tubes extending from the shaft collar 24, where they communicate with the shaft port 48, toward the periphery of the rotor 13, said tubes communicating with tangentially disposed nozzles 57 connected to the rotor, as best shown in Figs. 2 and 4. The nozzles 57 have restricted portions 58 adapted to increase the pressure of fuel emitted by the nozzles against the movable and stationary blades 18 and 19 within the engine cylinder, and associated with each nozzle is a conventional form of spark plug 59 suitably supported by the nozzles on the rotor. Access is had to the spark plug through the opening 36 of the engine casing or hood 34 and said spark plug has electrical connections 60 extending into the shaft collar 24 through the port 48, and on through the engine shaft 25 which is bored out to accommodate said electrical connections and thus permit of an ignition system being maintained in connection with the spark plugs. On a reduced portion 61 of the shaft 25 may be placed a conventional form of timer or interrupter 62 so that the fuel may be detonated in proper sequence during the operation of the engine.

63 denotes a cam member on the engine shaft 25 and said cam member is provided with a cam groove 64 into which extends anti-frictional rollers 65 carried by guide shoes or semi-circular plates 65^a and blocks 66 on the outer ends of piston rods 67, said piston rods extending into the pump cylinders 37 and having the inner ends thereof provided with piston heads 68 reciprocable in said cylinders.

69 denotes a housing suitably connected to the ends of the cylinders 37, said housing inclosing the cam member 63 and providing opposed slide ways 70 for the blocks 66 and ways 66^a for the shoes 65^a, so that said blocks can only reciprocate during rotation of the cam member 63. In the housing 69 may be placed an anti-frictional bearing 71 for the engine shaft 25, and said housing also supports a transmission casing 72 in proximity to a worm or spiral gear 73 on the reduced end 61 of said engine shaft, as shown in Fig. 1.

74 denotes a conventional form of centrifugal governor mounted on the casing 72 and adapted to be actuated by gearing generally denoted 75 within the casing 72. The governor 74 is connected by leverage devices 76 to the valve 77 of fuel supply pipe 78 that extends into the manifold or fuel supply pipe 53 adjacent a throttle 79 within said pipe, which controls the supply of air to said manifold. The pipe 78 is adapted to be connected to a source of fuel under pressure, and coöperate with the air supply in forming a carbureting device. When the speed of the engine exceeds a certain limit, then the governor 74 is actuated to regulate the valve 77 and reduce the quantity of fuel to the manifold 53.

To place the engine in operation, it may be started by whirling the propeller 29 or any suitable starting device may be employed. When a rotary movement is imparted to the engine shaft 25, the pumps are placed in operation and the construction of the rotary valve is such that while air is being drawn into one pump cylinder, the other pump cylinder is discharging fuel to be ignited in the cylinder of the engine.

It is thought unnecessary to rehearse the path of the fuel and air from the pump cylinders to the engine cylinder, and while in the drawings there is shown an arrangement by which the engine cylinder and pump cylinders are compactly arranged, it is to be understood that air and fuel, under pressure, may be supplied to the engine cylinder from a point remote relative thereto. It is also to be understood that any suitable means may be employed for supporting the engine relative to the fuselage of an air plane or other craft.

What I claim is:—

1. A turbine engine, comprising a rotor, a propeller fixed relative thereto, a stator cooperating with said rotor in providing an annular cylinder having an annular exhaust passage, alternately disposed sets of blades carried by said rotor and stator, means

adapted for alternately supplying fuel and air to said cylinder, and fuel ignition means carried by said rotor.

2. An engine as characterized in claim 1 and wherein the cylinder formed by said rotor and stator tapers outwardly to its exhaust passage and said ignition means is located at the inner end of the cylinder.

3. An engine as characterized in claim 1, and wherein pumps operated by said engine supply the fuel and air under pressure to the cylinder.

4. A turbine engine comprising a shaft, an annular cylinder about said shaft having an annular exhaust passage, turbine blades in said cylinder, pumps adapted to alternately supply said cylinder with fuel and air under pressure, and ignition means in said cylinder and having its connection through said shaft.

5. A turbine engine as characterized in claim 4, and wherein a portion of said cylinder revolves with said shaft and has a fan to facilitate exhaust from said cylinder.

6. A turbine engine as characterized in claim 4, and wherein the pumps are parallel with said shaft and include reciprocable pistons actuated by a cam member on said shaft.

7. A turbine engine as characterized in claim 4, and wherein a rotary valve about said shaft controls the supply of fuel and air to said pumps and the supply of fuel and air from said pumps to said cylinder.

8. A turbine engine comprising a rotor, a propeller carried by said rotor, a stator cooperating with said rotor in providing an annular cylinder, a shaft axially of said rotor and stator, blades carried by said rotor and stator in said cylinder, a pump operated by said shaft to force fuel into said cylinder against said blades, ignition means carried by said rotor for fuel in said cylinder, and means carried by said rotor adapted to maintain a circulation of air between said rotor and stator.

9. A turbine engine as characterized in claim 8, and wherein another pump is operated in unison with said fuel pump to force air into said cylinder while said fuel pump is receiving a charge of fuel.

10. A turbine engine as characterized in claim 8, and wherein a rotary valve controls the supply of fuel to said pump and from said pump to said cylinder.

11. An engine comprising a shaft, a turbine for operating said shaft, pumps adapted to alternately supply fuel and air to said turbine, and a rotary valve operated by said shaft adapted to control the supply of fuel and air to said turbine.

12. An engine as characterized in claim 11, and wherein the valve is constructively arranged to also control the supply of fuel and air to said pumps.

13. An engine as characterized in claim 11, and wherein the pumps are parallel with said shaft and include reciprocable pistons actuated from a cam member on said shaft.

14. An engine comprising a shaft, a turbine for operating said shaft, said turbine having an exhaust passage, means adapted to supply fuel through said shaft to said turbine, ignition means for said fuel movable with said shaft and means operated by said turbine adapted to cause a circulation of air external of said engine and in the exhaust passage of said turbine.

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

EMMETT J. BROWN.

Witnesses:

LEWIS E. FLANDERS,

ANNA M. DORR.