Aug. 30, 1966 M. KEMENCZKY 3,269,112

STEAM ACTUATED JET PROPULSION ENGINE

Filed May 12, 1964 2 Sheets-Sheet 1

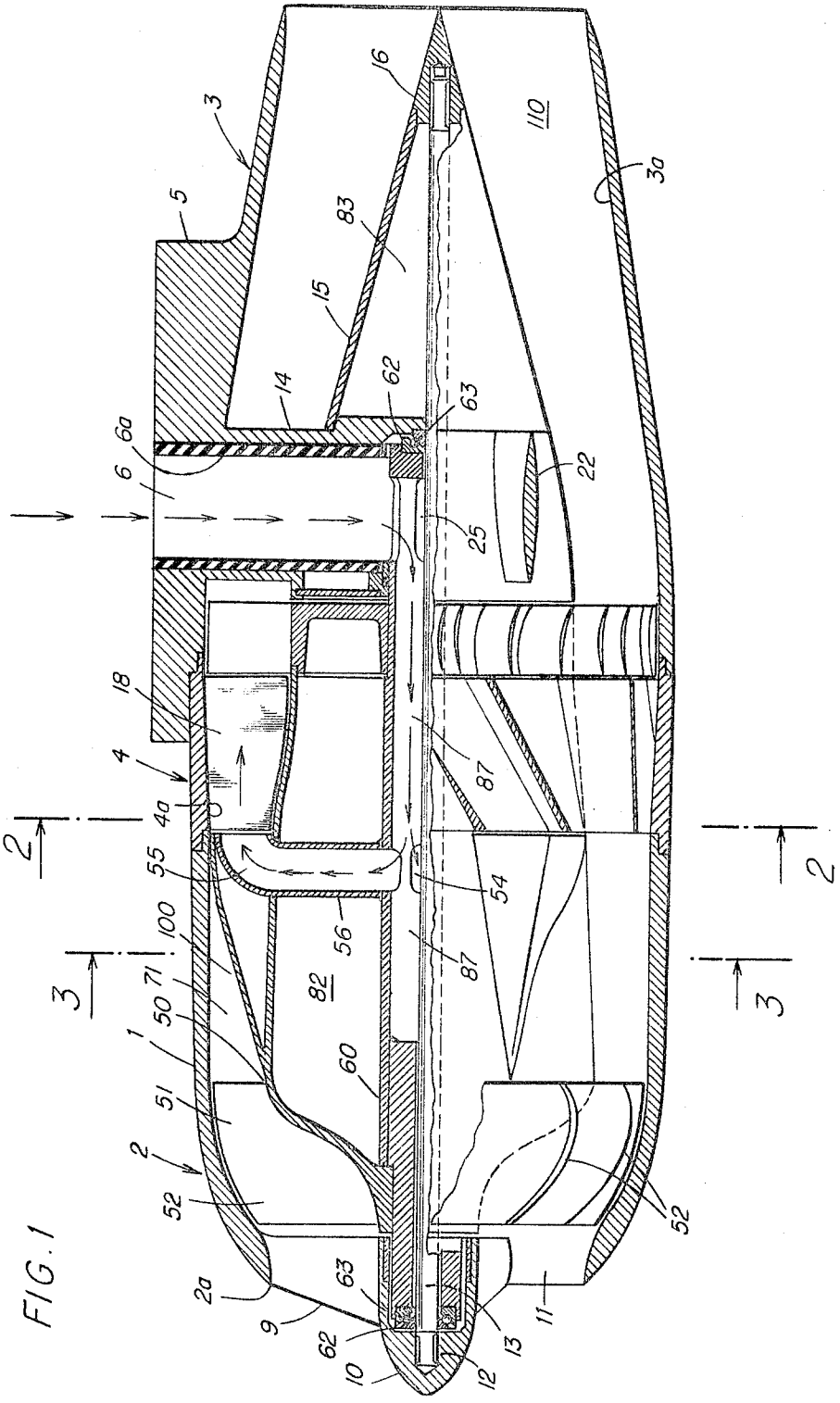


FIG. 1

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FIG. 2

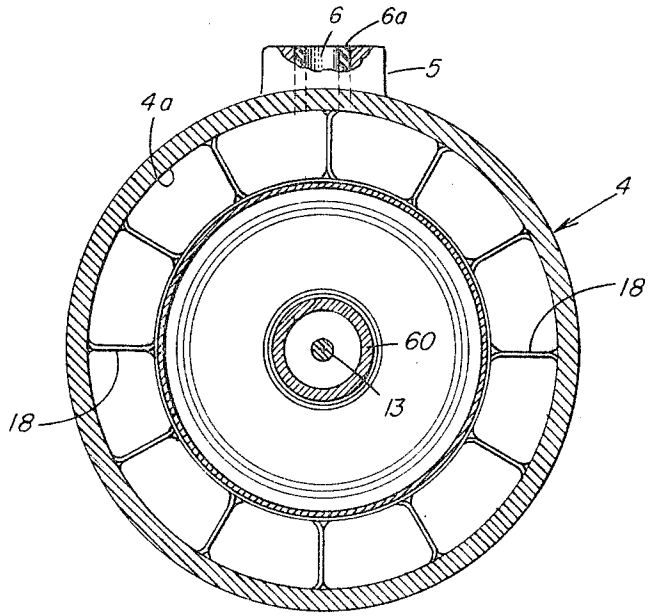
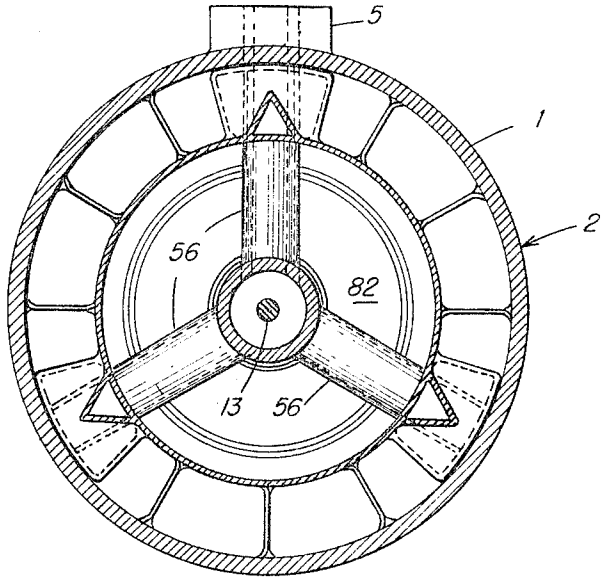


FIG. 3



United States Patent Office 3,269,112 Patented August 30, 1966

3,269,112

STEAM ACTUATED JET PROPULSION ENGINE

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The present invention relates to a jet propulsion engine for watercraft, and it is the primary object of the invention to provide an engine which is designed according to entirely new principles.

The engine according to the invention is a jet propulsion engine of the general type in which charges consisting of a mixture of air and an easily and quickly combustible fuel are drawn into a combustion chamber and are then ignited therein in successive explosions, and in which the combustion gases are employed to act upon a column of fluid within a thrust tube in a manner similar to a piston, whereby fluid is ejected from the thrust tube to produce a jet reaction. The jet reaction can then be used to pump the fluid or, in the case where the engine is attached to a watercraft, to propel the watercraft through the water.

The jet propulsion engines of this type which are presently known only develop a relatively low output because the compression attained by them is insufficient, and the starting of the engine and the ejection of the water from the thrust tube causes resistances of such a magnitude as to render the engines rather inefficient.

In one of these prior jet propulsion engines as disclosed, for example, in the U.S. Patents Nos. 2,644,297 and 2,714,800, the combustion chamber extends from the ignition point directly to the opening into the thrust tube which is controlled by a flap valve, and the thrust tube is provided at its front end with a flap valve assembly which operates as a check valve. This valve assembly gives the thrust tube an extremely great front resistance since it consists of a large number of long lamellar blades which cause a considerable flow resistance along their entire length, and the structure of this assembly is also not adapted to comply with the requirements of operation of such a pulsating drive since these valve blades cannot open and close as rapidly as necessary.

Another known type of jet propulsion engine for watercraft as disclosed, for example, in the French Patent No. 1,043,920, requires a separate compressor and is already for this reason unsuitable to form a light propulsion unit which may be used independently of any additional driving means. The requirement of a jet propulsion engine for boats and similar watercraft of being easily manipulatable and very economic in operation is also not fulfilled by a type of engine as disclosed, for example, in the U.S. Patent No. 2,412,825, in which the discharge part of the thrust tube operates according to the venturi principle, while the inlet side of the thrust tube is not provided with any valve. Jet propulsion engines of this type, which also require separate driving means for starting the engine, operate very inefficiently. Because of the almost complete absence of a compression within the combustion chamber, this lack of efficiency also applies to another type of jet propulsion engine for watercraft as disclosed, for example, in the German Patent No. 841,552, in which the upper part of a tubular work chamber forms a combustion chamber, while the lower part thereof which forms a direct continuation of the upper part is provided with a water inlet opening which is controlled by a flap valve and an opening at its rear end for ejecting the water. This type of water inlet will only permit a very slow succession of explosions, and has been found entirely inadequate in actual practice. Similar disadvantages are inherent in a pump of the type as disclosed, for example, in the German Patent No. 878,599, which operates according to the jet propulsion principle and may also be used for propelling ships. In this apparatus, the combustion chamber which is provided with a baffle plate which covers only a part of this chamber terminates directly without any intermediate check valve into a thrust tube, the front end of which is provided with a flap valve for controlling the water inlet, and the rear end of which is likewise provided with a valve which is intended to close the discharge opening to prevent any water from entering the opposite direction. This rear valve, however, destroys almost the entire energy which is developed by the engine. Consequently, the efficiency of this pump, particularly where it is used as a propulsion unit for a boat, is very poor.

In accordance with the invention set forth in my Patent 3,060,682, many of the deficiencies of the known jet propulsion engines for watercraft and especially small boats are overcome by providing such an engine with a combustion chamber which is divided into at least two compartments which are separated from each other by check valves and the last compartment of which extends into the thrust tube, and by designing the valve which controls the water inlet opening of the thrust tube in the form of a low-inertia, quickly reacting check valve which operates in a manner similar to a turbine wheel and is provided with closing flaps in the form of blades which are pivotable about radial axes and are mounted on a freely rotatable wheel hub which is driven by the flow of water passing through this valve.

A jet propulsion engine which is designed in this manner will attain a high output even though it is not provided with a special compressor. However, such engines are still not completely satisfactory, especially when the horsepower requirements for such an engine are high.

The present invention is an improvement over all of the above described jet engines for watercraft.

In accordance with the present invention, the deficiencies of all of the above-described jet propulsion engines for watercraft are overcome by providing a jet engine which is constructed employing a principle which is completely different from that which is employed in jet engines of this type.

The jet engine of the present invention is simpler to construct than any such engine heretofore known and involves a minimum of moving parts. Furthermore, the engine can be made primarily of inexpensive materials, if desired, and can be constructed to generate power varying from a few horsepower, for a very small and lightweight engine, to power in the order of 20,000 to 30,000 horsepower or more. In addition, the present engines are so constructed that they are much more efficient than engines which have been heretofore suggested.

These and still further objects, features, and advantages of the present invention will become more apparent from the following detailed description thereof, particularly when the same is read with reference to the accompanying drawings, in which:

FIG. 1 shows a diagrammatic longitudinal partially cut away section of the jet propulsion engine of the present invention.

The jet propulsion engine is shown in FIG. 1 with the upper portion completely sectioned along a center line and with the lower portion having jacket **1** removed from the side being viewed to reveal the inner components.

FIG. 2 shows a sectional view of the jet propulsion engine of FIG. 1, taken along the line **2—2**.

FIG. 3 shows a sectional view of the jet propulsion engine of FIG. 1, taken along the line **3—3** of FIG. 1.

Referring to FIGURES 1 to 3 of the drawings, which illustrate the preferred embodiment of the invention diagrammatically, the engine consists of a generally cigar-shaped outer jacket **1**, which in this embodiment consists

of forward section 2, aft section 3, and central section 4. These three sections may be joined together by suitable threading or may be welded or otherwise adhered to each other. Preferably, as will be discussed later in this specification, these sections are joined by a central shaft which is suitably threaded, so that they can be disassembled for cleaning and for repair, when necessary.

Aft section 3 is constructed with an extension 5 which can serve as a mounting for the engine or which can be connected to a suitable mounting for the engine. The actual mounting arrangement which may be employed is not shown in the figures. Suitable mountings may be of the type generally known for such engines, for example mountings of the type which are illustrated with regard to my earlier filed application Serial No. 40,452, which issued as United States Patent 3,060,682 on October 30, 1962.

Mounting 5 contains a passageway 6 through which steam or super-steam may pass. Passageway 6 contains within it a lining 6*a* made of insulating material.

Forward section 2 has a generally cylindrical shape, the rear or aft portion of which engages central section 4, which also has a generally cylindrical shape. The forward portion of forward section 2 forms three stream-lined shape wings or spiders 9 which terminate in generally conic shaped nose 10. The circular front edge 2*a* of forward section 2 and wings 9, together with nose 10, define three openings 11 through which water can pass through centrifugal pump 5 into chamber 71, which is defined generally by the inner surface of walls 2 and the outer surfaces of rotating unit 50, between pump 51 and work chambers 20. As shown, wings 9 are disposed at an angle of 120° to each other, but may be disposed at a different angle or may be employed in greater or fewer number, so long as they rigidly support nose 10 within forward section 2. Nose 10 has an opening 12 which is adapted to hold shaft 13. As shown, shaft 13 and opening 12 are threaded so that shaft 13 can be screwed into or otherwise be held by opening 12 in such a manner that it is concentrically mounted within forward section 2.

Aft section 3 has mounted on it, at its inner mounting 14, shaft supporting unit 15 which is in the form of a hollow truncated cone. Shaft supporting unit 15 can be mounted on inner mounting 14 by means of suitable threading or by welding or adhesives or, as is preferred, can be held in place by means of central shaft 13 and conic nut 16. Conic nut 16 is mounted on shaft supporting unit 15 by means of suitable threading or, less desirably, by welding or an adhesive. Conic nut 16 contains opening 17 which is adapted to hold the aft portion of shaft 13. The inner mounting 14, shaft supporting unit 15 and conic nut 16 are so positioned within aft section 3 and with relationship to central section 4 and forward section 2 that shaft 13 is mounted concentrically within forward section 2, central section 4 and aft section 3.

Central section 4 has mounted on its inner walls 4*a* a plurality of inwardly directed dividing walls 18 which form a plurality of work chambers 20. Work chambers 20 are mounted in such a manner that their front openings 19 form a radial array about the periphery of central section 4, as can best be seen from FIG. 2, and their dividing walls 18 extend at an angle from the central axis of the engine, i.e. at an angle from the axis of shaft 13, which can best be seen from the lower half of FIG. 1. Work chambers 20 terminate in rear openings 21.

Shaft supporting unit 15 is held in place within aft section 3 by means of two stream-lined shaped solid aft wings 22, which are mounted on the lower part of shaft supporting unit 15 and on the inner surface 3*a* of aft section 3 and by hollow aft wing 23. Hollow aft wing 23, having opening 24 through which steam can pass, is mounted on the upper surface of shaft supporting unit 15 and connects with passageway 25 by means of opening 24.

Rotating unit 50 consists of centrifugal pump 51 having blades 52, passageways 55 which are contained in pipes 56; turbine wheel 58 having blades 59; and a generally cylindrical core member 60 having inner wall 61 which defines a generally cylindrical passageway 87 which is coaxial with shaft 13.

Rotating unit 50 is rotatably mounted, by means of ball bearings 62 and bearing surfaces 63, on shaft 13. Centrifugal pump 51, pipe 56 and turbine wheel 58 are integral with core member 60 and capable of rotation therewith.

Core member 60, wall 57 and the inner surface 81 of turbine wheel 58 define chamber 82.

Shaft 13, aft section 3 and shaft supporting unit 15 define chamber 83.

Chambers 82 and 83 have no fluids passing therethrough and may be employed, if desired, for holding starting equipment, electrical equipment and the like.

Core member 60 contains at its aft end slots 86 which connect passageway 25 with passageway 87 and at its forward end slots 54 which connect passageway 87 with passageways 55.

Aft chamber 110, which is generally defined by walls 3*a* and shaft supporting unit 15 connects with turbine wheel 58 and with rear or aft opening 111.

In operation as a jet motor for watercraft, the entire motor will normally lie under water and only the mounting portion of aft section 3 will extend above the surface of the water.

To start the motor, rotating unit 50 can be rotated by a hand mechanism (not illustrated) which may be a crank connected to rotating unit 50 by suitable gearing devices or by a suitable starter of the type employed for outboard motors.

Such a hand rotating device will be suitable when the jet engines of the present invention are small. When the jet engines of the present invention are relatively large, for example 100 horsepower or more, it is preferable to start the motor by means of an electric motor (not shown) which can be mounted in chamber 83 or chamber 82 and suitably geared to cause rotating unit 50 to rotate with respect to shaft 13. Rotating unit 50 may also be caused to rotate by moving the entire motor through the water.

Once the rotating unit 50 has begun to rotate, centrifugal gump 51 pumps water, which enters through openings 11, through chamber 71. The angle of the blades of blades 52 of centrifugal pump 51 causes the incoming water to swirl spirally through chamber 71 to work chambers 20.

Simultaneously with the entry of water through openings 11, steam is drawn through passageway 6, passageway 25, slots 86, passageway 87, slots 54 and passageways 55 to work chambers 20.

The water which is introduced through the forward portion of chamber 71 is accelerated in a spiral direction by the rotation of the centrifugal pump 51.

During the rotation of the rotating unit 50, the solid mass of water 100 leaves chamber 71 and enters work chambers 20 through front openings 19. At any one instant when the three openings 56*b* of pipes 56 are aligned with front openings 19 of three work chambers 20, the hollow cylindrical water mass 100 will enter front openings 19 of the remaining nine work chambers 20, which are not covered by openings 56*a*.

The three work chambers 20 which have their front openings aligned with openings 56*b* of channels 56 receive the hot steam which is introduced through pipes 56.

Since rotating unit 50 rotates rapidly during the operation of the jet engine, pipes 56 are constantly being moved with reference to the fixed work chambers 20 so that successive work chambers 20 are successively filled with the hot steam passing through channels 56. The pressure of the steam from channels 56 forces the water in work chambers 20 through said chambers and greatly increases the speed of flow of the water to work

chambers **20**. As soon as channels **56** have passed any particular work chamber **20**, the work chamber **20** is again filled with water from the mass of water **100** which is passing through chamber **71**.

It can thus be seen that channels **56***a* serve as distributors of the steam which is introduced to the engine and which can be generated by any suitable device such as a boiler (not shown). The steam is preferably at a pressure of from about 150 p.s.i.g. to about 3,000 p.s.i.g. or more. Channels **56***a* thus provide steam under high pressure to push the water through work chambers **20** and result in a progression through each of the work chambers **20** of alternating units or plugs of water and steam.

The spiral shape of work chambers **20** not only serve to continue the centrifugal action of the steam and water passing therethrough but also serve to effect an intimate contact between the adjacent faces or interfaces of succeeding plugs of water and steam.

The alternating plugs of water and steam passing through work chambers **20** leave work chambers **20** through rear openings **21** and enter turbine wheel **58** having blades **59**.

The alternating plugs of water and steam give up some of their energy to drive the blades **59** of turbine wheel **58**. The rotation of turbine wheel **58** resulting from the driving of blades **59** is employed as power to drive rotating unit **50**, of which turbine wheel **58** is an integral part.

The plugs of steam and water passing through turbine wheel **58** begin to mix in turbine wheel **58** to form a water-steam mixture which leaves turbine wheel **58** and enters aft chamber **110**, which is formed by the walls of aft section **3**, shaft supporting unit **15**, conic nut **16**, and which is penetrated by aft wings **22** and **23**, said aft wings **22** and **23** serving to hold shaft supporting unit **15** in place within aft section **3**.

In aft chamber **110**, the steam-water mixture rapidly cools and results in a reduction in pressure and the resulting mixture, which still has a swirling motion, pushes out of rear opening **111** of aft chamber **110**. The resulting force can be employed to drive a watercraft at high speed in a silent and vibration-free manner.

The jet propulsion engine of the present invention employs only a fraction of the parts which are required for conventional propeller-type engines. In addition, the engine of the present invention can be constructed primarily of light-weight and inexpensive materials. Only the walls **6***a*, core **60** and pipes **56** need be made of heat-resistant material, for example heat-resistant stainless steel. All other parts of the engine are water-cooled and thereby protected from the heat of the steam and can be made of such plastic materials as melamine and the like.

The jet propulsion engine of the present invention may be made to be extremely light in weight and can be made to give a weight per horsepower ratio which is lower than ratios which have heretofore been obtained.

Obviously, the design and construction of the jet engine of the present invention can vary considerably from that shown in the figures. For example, any number of work chambers may be employed, so long as there are a plurality of work chambers and any number of distributing channels may be employed, so long as there are fewer distributing channels than work chambers and so long as the configuration of distributing channels is such that they will be properly aligned with selected work chambers during their rotation. For example, four pipes **56** could be employed spaced 90 degrees apart to operate with a total of, for example, 8 or 16 work chambers so that at any one time when the rear openings **56***b* of any one pipe **56** is aligned with the front opening **19** of any one work chamber **20**, the remainder of said channels are properly aligned with corresponding work chambers, leaving the remainder of the work chambers open for the introduction of fluid. In addition, different arrangements of fuel injection and ignition may be employed in the combustion chamber and various starting mechanisms and pumps may be employed without departing from the spirit of the present invention. Furthermore, while the invention is described with regard to water, and is particularly well adapted to propel an aqueous vehicle, it can also be used as a pump, not only for water but also for other fluids, such as oil. Thus, because of its simplicity and capacity it could be employed for high speed pumping of heavy oils.

Therefore, although my invention has been illustrated and described with regard to the preferred embodiments thereof, it is to be understood that it is in no way limited to the details of said embodiments but is capable of numerous modifications within the scope of the appended claims.

I claim.

1. A jet propulsion engine comprising a thrust tube having a fluid inlet opening and a fluid discharge opening, a plurality of work chambers arranged about the periphery of the inner surface of a central portion of said thrust tube and having inlet openings and outlet openings, a rotating unit comprising a centrifugal pump, a steam pipe rigidly attached at one end to said centrifugal pump and having a steam outlet opening at the other end from said centrifugal pump, said steam outlet opening being of substantially the same size as the inlet opening of each of said work chambers, and a turbine wheel rigidly connected to said rotating unit and located downstream of and receiving steam and fluid from said work chambers, said centrifugal pump being adapted to direct said fluid into said engine with a spiral motion, said pipe being adapted to carry steam, whereby during rotation of said pipe, said work chambers are alternately fed by said fluid and by steam to form alternating plugs of steam and fluid, each steam plug propelling each fluid plug rapidly through said work chambers to said turbine wheel and said discharge opening positioned to receive steam and fluid from said turbine wheel.

2. A jet propulsion engine for watercraft comprising a thrust tube having a fluid inlet opening and a fluid discharge opening, a plurality of work chambers arranged about the periphery of the inner surface of a central portion of said thrust tube and having inlet openings and outlet openings, a rotating unit comprising a centrifugal pump, a steam pipe rigidly attached at one end to said centrifugal pump and having a steam outlet opening at the other end from said centrifugal pump, said steam outlet opening being of substantially the same size as the inlet opening of each of said work chambers, and a turbine wheel rigidly connected to said rotating unit and located downstream of and receiving steam and fluid from said work chambers, said centrifugal pump being adapted to direct said fluid into said engine with a spiral motion, said pipe being adapted to carry steam, whereby during rotation of said pipe, said work chambers are alternately fed by said fluid and by steam to form alternating plugs of steam and fluid, each steam plug propelling each fluid plug rapidly through said work chambers to said turbine wheel and said discharge opening positioned to receive steam and fluid from said turbine wheel.

3. A jet propulsion pump comprising a thrust tube having a fluid inlet opening and a fluid discharge opening, a plurality of work chambers arranged about the periphery of the inner surface of a central portion of said thrust tube and having inlet openings and outlet openings, a rotating unit comprising a centrifugal pump, a steam pipe rigidly attached at one end to said centrifugal pump and having a steam outlet opening at the other end from said centrifugal pump, said steam outlet opening being of substantially the same size as the inlet opening of each of said work chambers, and a turbine wheel rigidly connected to said rotating unit and located downstream of and receiving steam and fluid from said work chambers, said centrifugal pump being adapted to direct said fluid into said engine with a spiral motion, said pipe being

adapted to carry steam, whereby during rotation of said pipe, said work chambers are alternately fed by said fluid and by steam to form alternating plugs of steam and fluid, each steam plug propelling each fluid plug rapidly through said work chambers to said turbine wheel and said discharge opening positioned to receive steam and fluid from said turbine wheel.

4. A jet propulsion engine comprising a thrust tube having a water inlet opening and a water discharge opening, a plurality of work chambers arranged about the periphery of the inner surface of a central portion of said thrust tube and having inlet openings and outlet openings, a rotating unit comprising a centrifugal pump, a steam pipe rigidly attached at one end to said centrifugal pump and having a steam outlet opening at the other end from said centrifugal pump, said steam outlet opening being of substantially the same size as the inlet opening of each of said work chambers, and a turbine wheel rigidly connected to said rotating unit and located downstream of and receiving steam and fluid from said work chambers, said centrifugal pump being adapted to direct said water into said engine with a spiral motion, said pipe being adapted to carry steam, whereby during rotation of said pipe, said work chambers are alternately fed by said water and by steam to form alternating plugs of steam and water, each steam plug propelling each water plug rapidly through said work chambers to said turbine wheel and said discharge opening positioned to receive steam and fluid from said turbine wheel.

5. The engine of claim 1 wherein said centrifugal pump is mounted concentrically within said thrust tube.

6. The engine of claim 2 wherein said centrifugal pump is mounted concentrically within said thrust tube.

7. The engine of claim 1 wherein said rotating unit is mounted on a hollow core which provides passageway for steam from said steam intake means through said engine and to said steam pipe.

8. The engine of claim 2 wherein said rotating unit is mounted on a hollow core which provides passageway for steam from said steam intake means through said engine and to said steam pipe.

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