H. W. SHONNARD.

SUBMARINE TORPEDO.

APPLICATION FILED FEB. 15, 1912.

1,077,311.

Patented Nov. 4, 1913.

3 SHEETS—SHEET 1.

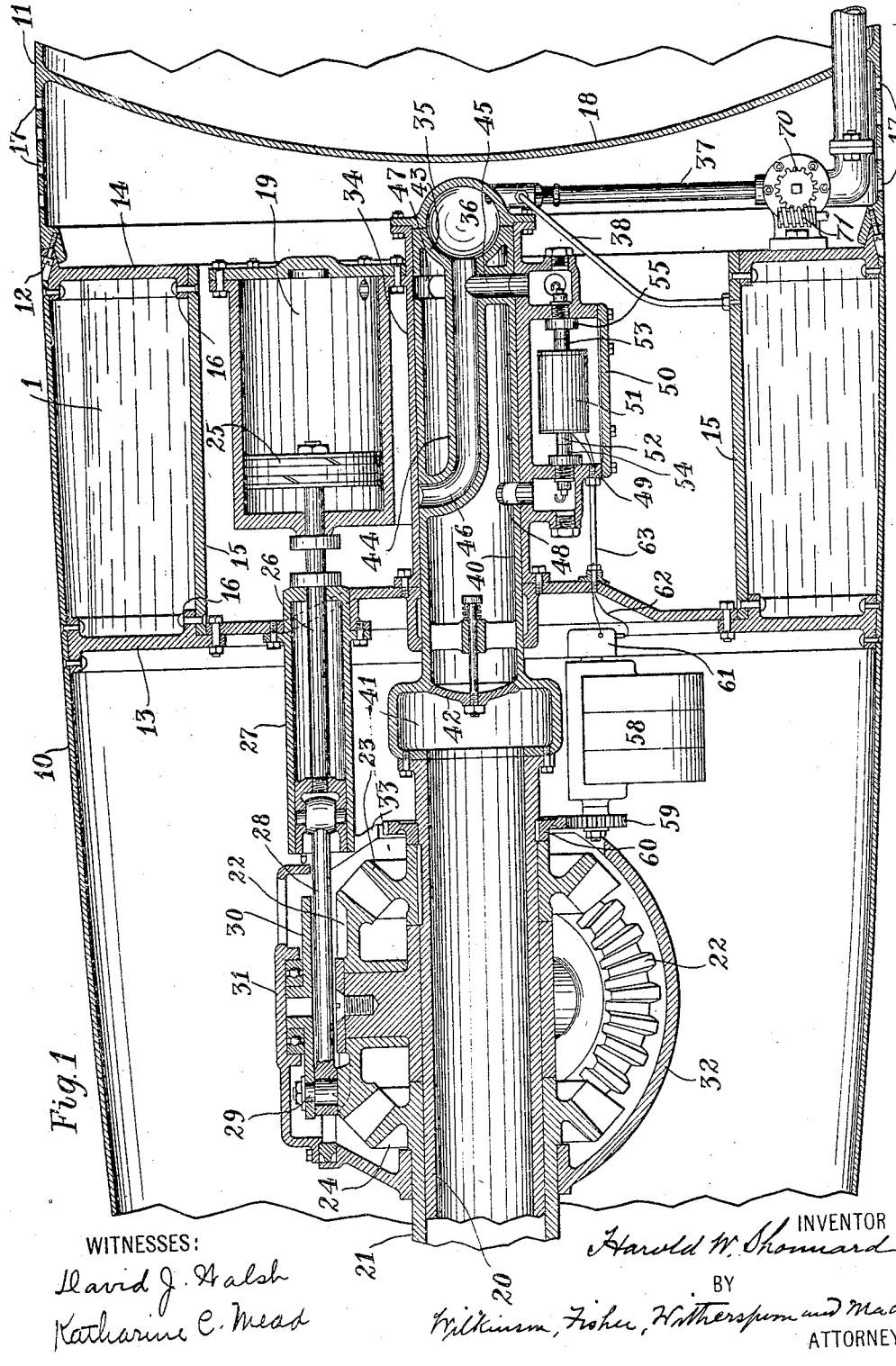


Fig. 1

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3 SHEETS—SHEET 2.

Fig. 2

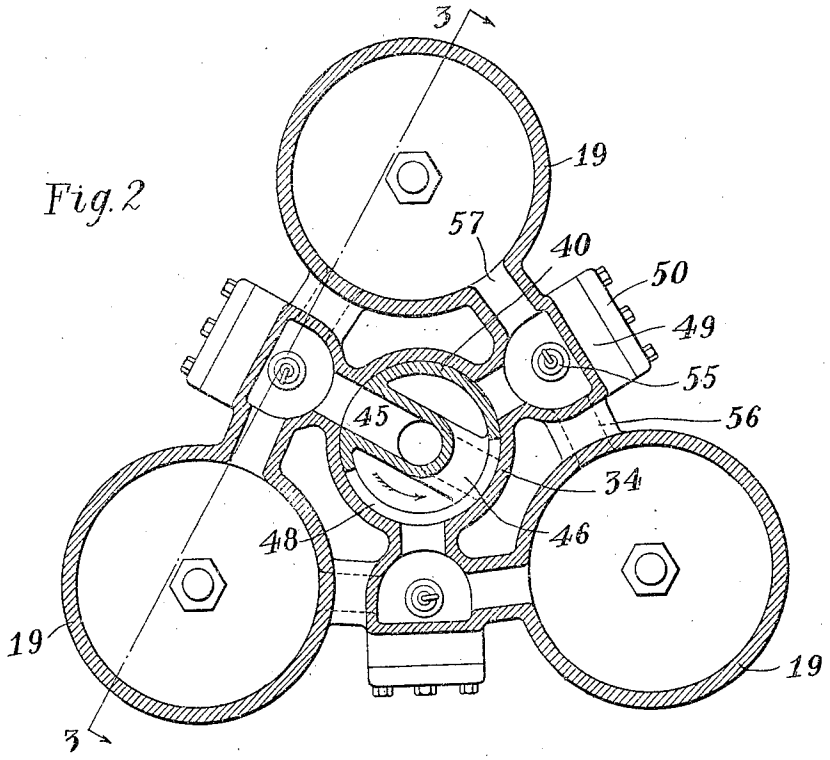
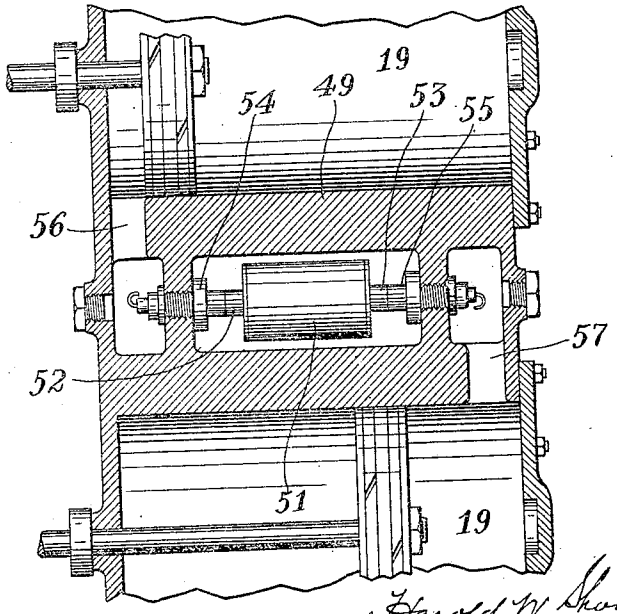


Fig. 3



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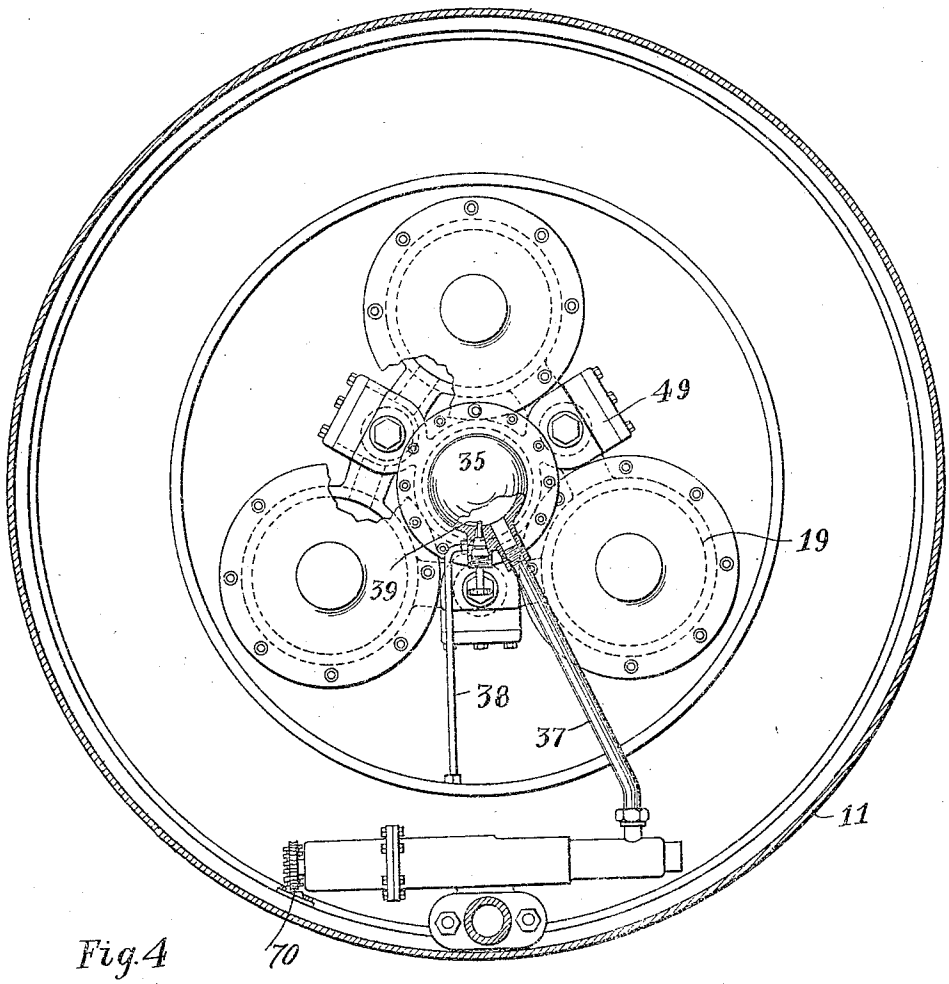


Fig. 4

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UNITED STATES PATENT OFFICE.

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SUBMARINE TORPEDO.

1,077,311. Specification of Letters Patent. Patented Nov. 4, 1913.

Application filed February 15, 1912. Serial No. 677,763.

To all whom it may concern:

Be it known that I, HAROLD W. SHONNARD, a citizen of the United States, residing at East Orange, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Submarine Torpedoes; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

In the construction of self-propelling and automatically directed submarine torpedoes, the rigid conditions of established practice, and complicated considerations of weight-distribution and compact arrangement of internal mechanisms are controlling factors which cannot be overlooked where any attempts are made at improvement.

The present invention has for its principal object the provision of means constructed and operating consistently with the exacting conditions of established practice, whereby a prime mover of great compactness and high power may be employed to propel the torpedo.

Among the various novel advantages resulting from use of my improvement are the following: I am able to use a double acting engine kept cool by submersion of all working parts and applied to the cluster gears immediately, and to save room and improve the conditions of balance and buoyancy by storing the liquid fuel used for running the engine in a reservoir or tank which surrounds the water-cooled space wherein the engine cylinders are located. I employ a single rotary valve having the same speed the propeller shaft, and preferably directly connected thereto. This greatly simplifies the construction of the valve and its associated parts; and in the preferred form great saving of room is accomplished by placing the engine cylinders in a parallel group around the valve as a center. By arranging the cylinders symmetrically and parallel to each other, I am able to place water-tight boxes between the cylinders wherein the sparking coils are removably deposited, in immediate juxtaposition to the sparking plugs at both ends. By this means no high tension wires are carried through the water and the utmost simplicity of arrangement is secured. The space between the cylinders being thus utilized, there is a corresponding economy of space effected in other portions of the torpedo body which would otherwise have to accommodate the sparking coils. The low tension generator (magneto) is placed behind a water tight bulkhead, and direct, simple and secure means are provided for conveying the low tension current to the sparking coils in the water space between the cylinders. By arranging the single rotary valve to supply the new mixture through the ignition chambers said mixture as it passes through these chambers acts to scavenge them, so that perfect certainty of action of the sparks is insured. The arrangement of the fuel tank in the same compartment as the engine proper, saves the necessity of connecting and disconnecting fuel supply pipes when the torpedo sections are connected and separated. The weight of a special casing is also saved and the displacement is improved. By transferring the reversing or "cluster" gears to the immediate vicinity of the engine so that they are directly connected to the engine pitmen, the tail of the torpedo (where these gears have been located heretofore) becomes available as a buoyancy chamber. By using three engine cylinders, I can place two below the center of displacement and one above, and so improve the stability of the torpedo, and also the direct connection with the cluster gears is made consistent with the use of gears of uniform size. This arrangement also gives room for the magneto on the line intermediate between the two lower engine cylinders. This arrangement, by permitting use of cluster gears all of the same size, permits the use of a single rotary valve for all cylinders, turning with the propeller shaft.

The invention is illustrated in one preferred embodiment in the accompanying drawings wherein,

Figure 1 is a central median section of that portion of a torpedo in which my engine is located, Fig. 2 is a cross section of the engine proper showing the valve in cross section, Fig. 3 is a partial section on the line 3—3 of Fig. 2, and Fig. 4 is an elevation (with partial section) of that compartment of a torpedo which contains my improved engine, the cap of the automatic valve being removed.

The torpedo is, as usual, constructed of sections, the shell of one section being shown at 10 and the shell of the contiguous section being shown at 11. The bolts 12, or equiva-

lent means are used to secure the sections together. A watertight bulkhead 13 extends across the rear section 10, and near the forward end of said section is bolted the annular supporting member 14. The bulkhead 13 and member 14 are joined by an inner shell 15 preferably cylindrical, which is shown fastened to each member by bolting to appropriate flanges 16. Within the inner shell 15 is located the engine proper, and the space between the inner and outer shells is preferably employed as a tank 1 for holding the gasolene or other fuel used. The engine space within the shell 15 is accessible to the sea water by means of apertures 17 in the shell 11, the interior of which shell is protected by the usual bulkhead 18.

The engine cylinders 19, preferably three in number, are arranged symmetrically around, and with their axes parallel to, the prolongation of the axis of the propeller shaft. This shaft comprises the usual inner tube 20 and outer sleeve 21, respectively connected to the two oppositely rotating propellers. It is one important advantage of my invention that the "cluster gears" for insuring the opposite rotation of these propellers are placed in immediate juxtaposition to the engine, thus relieving the tail of the torpedo of their weight, and producing other advantageous effects which will be obvious. These gears are arranged symmetrically around the shaft axis, and consist of three driving gears 22 placed 120 degrees apart, and all gearing with the beveled pinion 23 fixed to the tube 20 on one side, and with a similar pinion 24 fixed to the outer sleeve 21.

From each piston 25, sliding in its own cylinder 19, a piston rod 26 extends back through stuffing boxes into a water-tight casing or trunk 27 for each rod, and a pitman 28 connects each piston rod 26 with the wrist pin 29 upon the corresponding driving gear 22. I prefer to mount the pitmen between the gears 22 and the disks 30 provided with suitable ball bearings in the removable caps 31 bolted to the casing 32. The casing 32 with its caps and the driving gears are held fixed by ribs 33 extending to the casings or trunks 27, or other suitable provision may be made for this purpose.

In the prolongation of the direction of the propeller shaft, and surrounded by the cylinders 19, I place the fixed valve casing 34 bolted at the rear to the bulkhead 13 and provided at its forward end with a tight cap 35 forming part of a mixing chamber 36 to which air under pressure may be supplied by the pipe 37, and fuel by the pipe 38 through the valve 39 (see Fig. 4). It will be seen that I thus secure a mixing chamber common to all the cylinders located in the automatic distributing valve. I also use a single inlet and exhaust valve. The passage of air through the pipe 37 is commanded by any well known valve movable by means of the working gear 70, operated by the worm 71, which is turned in a well known manner for this purpose.

Within the casing 34 rotates the single rotary valve member 40, communicating at its rear end with the hollow propeller shaft 20, through the enlarged chamber 41, bolted to the shaft tube. A large check valve 42 permits the exhaust gases to escape, while preventing any entrance of water or gas from the rear.

The forward end of the rotary member 40 is closed by a partition 43, forming, with the cap 35, the mixing chamber, and from this chamber there extends an inlet tube 44, provided with two branches 45, 46 at opposite ends of the cylinders 19, and intended to register respectively and successively with the forward and rear explosion chambers all the way around, as the valve revolves. Opposite each branch 45, 46 are elongated openings 47, 48, whereby the exhaust is admitted from the cylinders, through the explosion chambers, to the space within the rotary member 40.

Symmetrically placed between each pair of cylinders are the boxes 49, having watertight covers 50, and divided within into three compartments (see Figs. 1 and 3). Within each middle compartment is placed a removable sparking coil 51, having terminals 52, 53, which make contact, where the coil is placed in the box, with sparking plugs, 54, 55, arranged as clearly shown in Figs. 1 and 3 to form sparks within the end compartments of the boxes 49. These terminal compartments form the explosion chambers above referred to, and communicate by passages 56, 57, with opposite ends of adjacent cylinders 19. It is to be noted that the explosion chambers are so placed that both the live mixture and the exhaust gases pass (at different times) through said chambers. The advantage of this arrangement is that the live mixture, as it rushes through each explosion chamber sweeps out any exhaust gas remaining therein, thus insuring an explosion on the occurrence of each spark.

I prefer to employ a magneto 58, placed below the propeller shaft just behind the bulkhead 13, and within the space between the two lower connecting rod casings 27. The magneto is driven by a pinion 59 meshing with the larger spur wheel 60 on the hollow shaft 20. The low tension current generated by the magneto is conveyed by a proper directing and timing commutator 61, on the magneto shaft, and is conveyed thence by wires 62, through short watertight tubes 63, to the removable spark coils 51; there being a separate tube 63 and pair of low tension wires for each box 49. Conveyance of high tension current is thus made absolutely

directly to the sparking coils, and danger of all leakage is avoided. By this arrangement, also, the electrical generating and commutating elements of the torpedo are kept entirely away from the water, while the engine is nevertheless entirely immersed for cooling purposes. This cooling feature is very important, also, in connection with the single rotary valve.

The construction herein described makes it possible to increase greatly the power and efficiency of a given torpedo, since I can provide within a minimum of space a double acting three cylinder gas engine.

Various changes may be made in the construction and arrangement of my improvement without departing from the spirit and scope of my invention, and I do not limit myself to the details herein shown and described.

What I claim is—

1. In a self-propelled torpedo, a watertight bulkhead, a propeller shaft having its forward end near said bulkhead, a compartment accessible to the seat directly forward of said bulkhead, a heat engine in said compartment comprising cylinders and pistons grouped around the axis of and suitably connected with said shaft, a tight valve casing piercing said bulkhead in the line of said shaft, and a rotary valve for said cylinders within said valve casing, attached to said shaft, substantially as described.

2. In a self-propelled torpedo, a watertight bulkhead, a propeller shaft having its forward end near said bulkhead, a compartment accessible to the sea directly forward of said bulkhead, a heat engine in said compartment comprising cylinders and pistons arranged parallel to the axis of said shaft and suitably connected thereto, a tight valve casing piercing said bulkhead in the line of said shaft and a rotary valve for said cylinders within said valve casing attached to said shaft, substantially as described.

3. In a self-propelled torpedo, a watertight bulkhead, a propeller shaft having its forward end near said bulkhead, a compartment accessible to the sea directly forward of said bulkhead, a heat engine in said compartment comprising cylinders and pistons grouped around the axis of and suitably connected with said shaft, a tight valve casing piercing said bulkhead in the line of said shaft, and a rotary valve within said casing, attached to said shaft, and arranged to control inlet and outlet of gases at both ends of all of said cylinders, substantially as described.

4. In a self-propelled torpedo, a watertight bulkhead, a propeller shaft having its forward end near said bulkhead, a compartment accessible to the sea directly forward of said bulkhead, a heat engine in said compartment comprising cylinders and pistons arranged parallel to the axis of said shaft, tight casings piercing said bulkhead opposite said cylinders, connecting means between said pistons and said propeller passing through said casings, a tight valve casing piercing said bulkhead in the line of said shaft, and a rotary valve for said cylinders within said valve casing attached to said shaft, substantially as described.

5. In a self-propelled torpedo, a watertight bulkhead, a propeller shaft having its forward end near said bulkhead, a compartment accessible to the sea directly forward of said bulkhead, an internal explosion engine comprising sparking means and three parallel cylinders and pistons grouped around the axis of and suitably connected with said shaft, two of said cylinders being located below said axis and one above it, a magneto located below the axis of said shaft behind said bulkhead and electrically connected with said sparking means, and means connected with said shaft for driving said magneto, substantially as described.

6. In a self-propelled torpedo, a watertight bulkhead, a compound propeller shaft having the usual two oppositely rotating elements, gearing for driving the same comprising a cluster gear of beveled pinions placed just behind said bulkhead, a compartment forward of said bulkhead accessible to the sea, a heat engine in said compartment comprising a cylinder and piston for each pinion in said cluster gear, a watertight casing piercing said bulkhead opposite each cylinder, and suitable mechanical connecting means between each piston and one pinion in said cluster gear, said connecting means passing through said casings respectively, substantially as described.

7. In a self-propelled torpedo, a compartment accessible to the sea closed aft by a watertight bulkhead, a tight valve casing piercing said bulkhead, a heat engine having cylinders and pistons grouped around said valve casing, a hollow propeller shaft adapted to be driven by said engine, and a rotary valve within said valve casing common to all of said cylinders and adapted to direct the exhaust from said cylinders into said hollow shaft, substantially as described.

8. In a self-propelled torpedo, a compartment accessible to the sea closed aft by a watertight bulkhead, a compound propeller shaft, a cluster gear placed just aft of said bulkhead for driving said shaft, a heat engine cylinder and piston located within said compartment forward of said bulkhead, a watertight casing piercing said bulkhead and having a stuffing box, a connecting rod extending from said piston through said stuffing box and into said casing and means connecting said connecting rod and cluster gear for driving the shaft, substantially as described.

9. In a self-propelled torpedo, a propeller shaft, a heat engine comprising cylinders and pistons grouped around the axis thereof and operatively connected therewith, and a reservoir for liquid fuel surrounding said engine, substantially as described.

10. In a self-propelled torpedo, a compartment accessible to the sea closed aft by a watertight bulkhead, a reservoir for liquid fuel surrounding said compartment, a propeller shaft behind said bulkhead, and a heat engine within said compartment comprising cylinders and pistons operatively connected with said shaft, substantially as described.

11. In a self-propelled torpedo, a compartment accessible to the sea closed aft by a watertight bulkhead, a propeller shaft behind said bulkhead, a high tension generator also behind said bulkhead, an explosion engine within said compartment for driving said shaft comprising a number of cylinders grouped symmetrically around the axis of said shaft, suitable boxes grouped between said cylinders around said axis, spark coils in said boxes for converting high tension current into low tension current, electric connections between said generator and said spark coils, and water tight conduits for protecting said electric connections, substantially as described.

12. In a self-propelled torpedo, a compartment accessible to the sea closed aft by a watertight bulkhead, a heat engine in said compartment comprising a single rotary valve having a mixing chamber at one end thereof and a number of cylinders and pistons grouped around the same, a reservoir for liquid fuel surrounding said compartment, and a pipe connecting said reservoir and said mixing chamber on said valve, substantially as described.

13. In a self-propelled torpedo, and in combination, a transverse watertight bulkhead, a propelling internal combustion engine having cylinders, pistons and valves within a space accessible to the surrounding water on one side of said bulkhead, exploding means operated by said engine on the opposite side of said bulkhead and out of reach of the surrounding water, means for storing air and fuel within the torpedo and means for supplying the same to said engine, substantially as described.

14. In a self-propelled torpedo, and in combination, two transverse watertight bulkheads having a chamber between them, a perforated shell surrounding said chamber, an internal combustion engine for propelling the torpedo having cylinders, pistons and valves located within said chamber, automatic exploding means located out of said chamber and behind one of said bulkheads, means for storing air and fuel within the torpedo, and means for supplying the same to said engine, substantially as described.

15. In a self-propelled torpedo, a transverse watertight bulkhead, a propelling internal combustion engine having cylinders, pistons and valves within a space accessible to the surrounding water forward of said bulkhead, exhaust pipes leading through said water space and said bulkhead and discharging aft of said bulkhead, automatic exploding means for the engine aft of said bulkhead, means for storing air and fuel within the torpedo and means for supplying the same to said engine, substantially as described.

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

HAROLD W. SHONNARD.

Witnesses:
H. S. MacKaye,
Katharine C. Mead.