Sept. 29, 1959 F. H. SMITH 2,906,227

TORPEDO CONSTRUCTION

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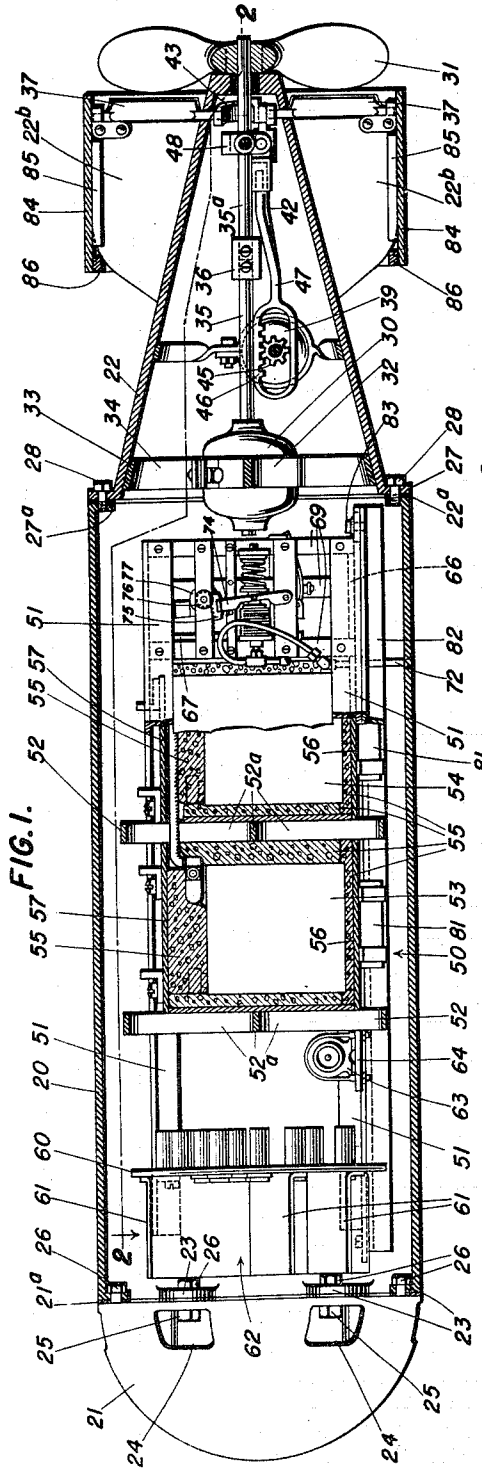


FIG. 1.

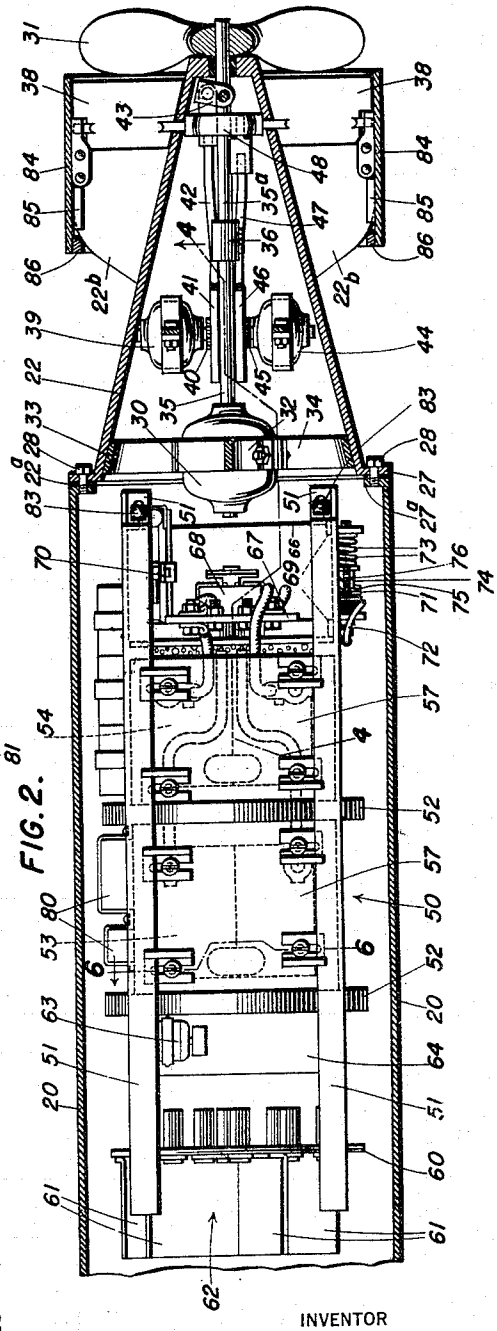


FIG. 2.

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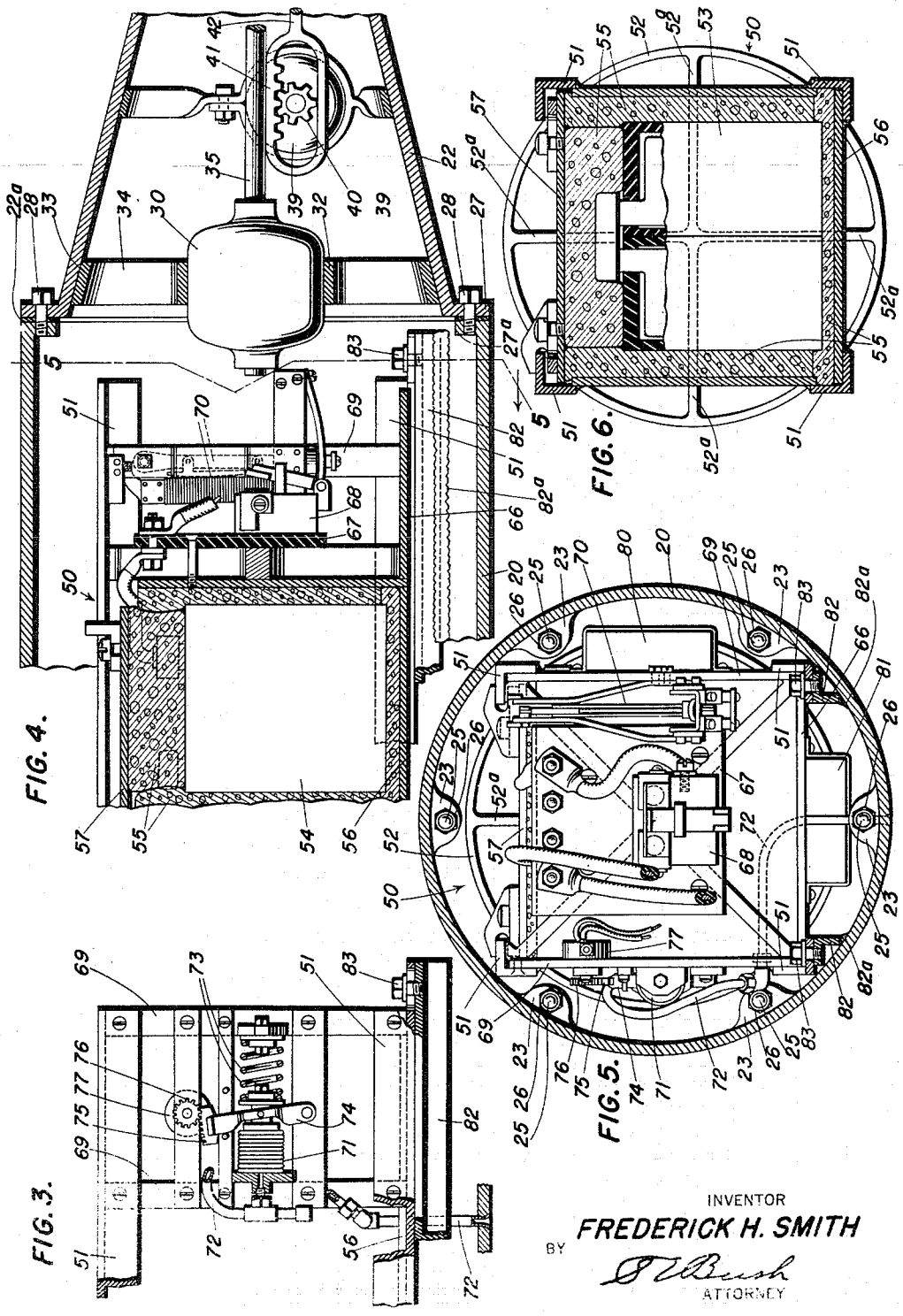


FIG. 4.

FIG. 6.

FIG. 5.

FIG. 3.

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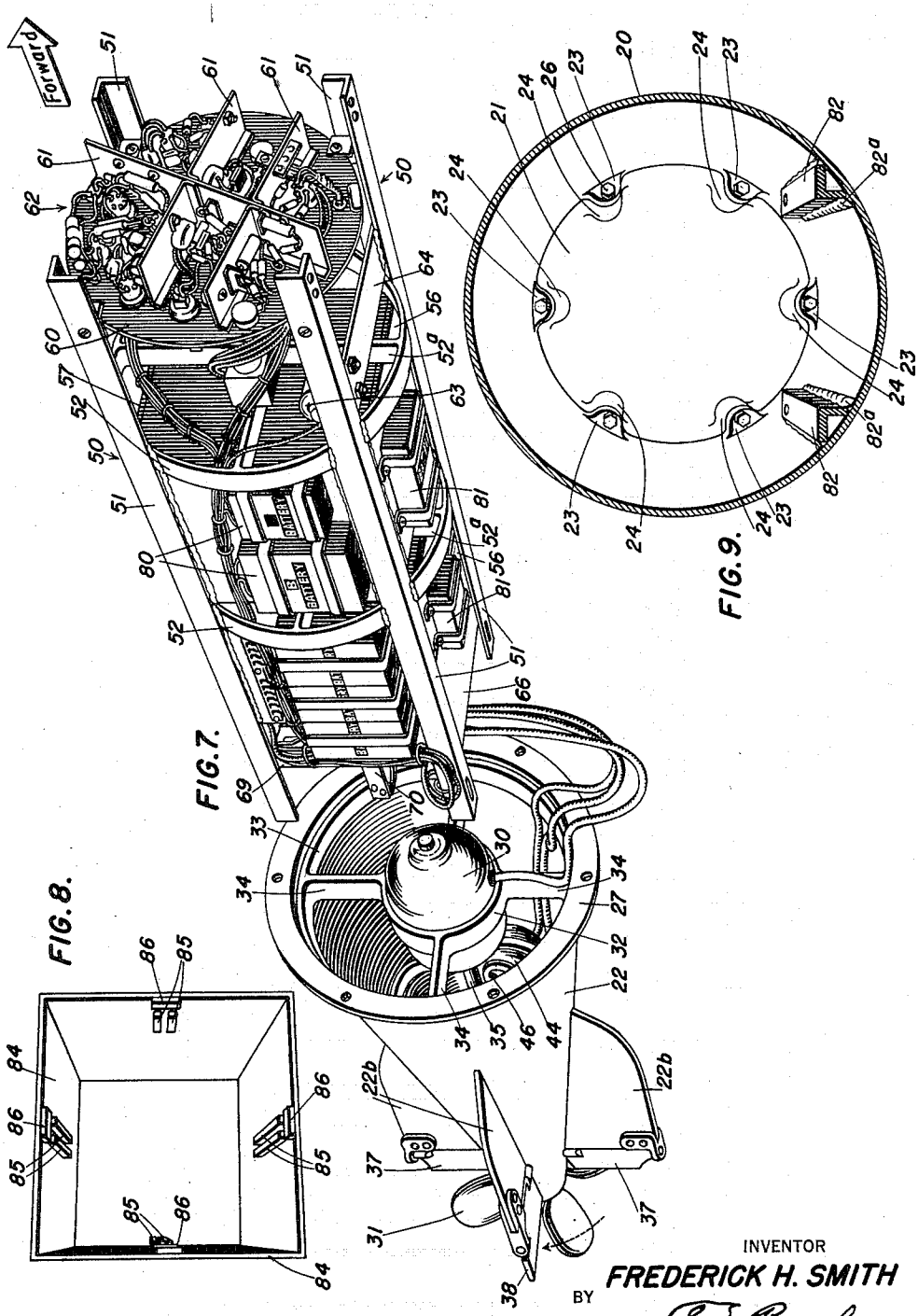


FIG. 7.

FIG. 9.

FIG. 8.

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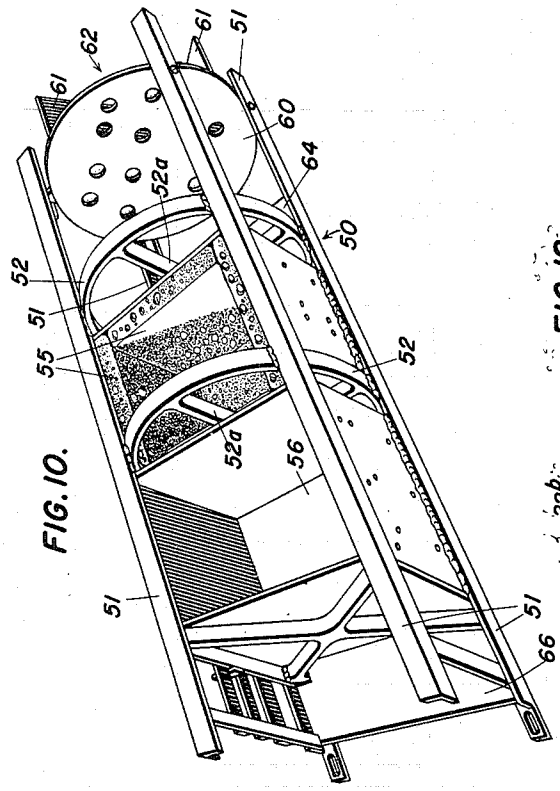


FIG. 10.

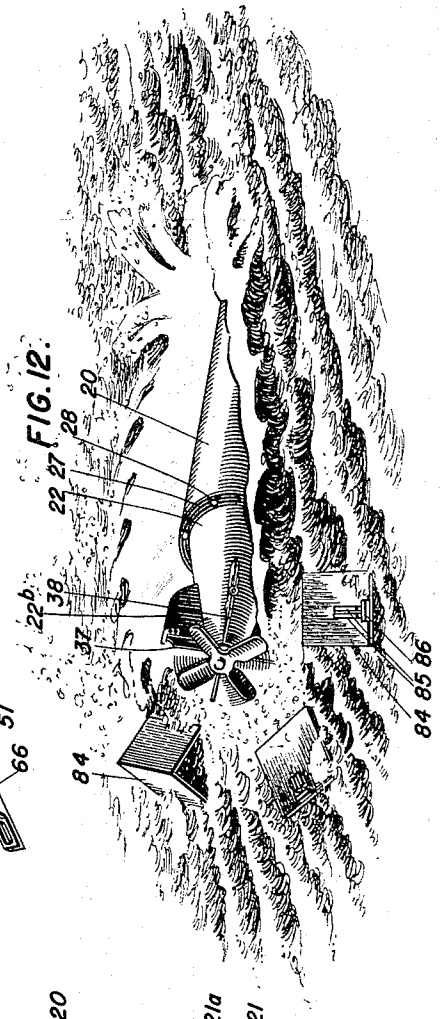


FIG. 12.

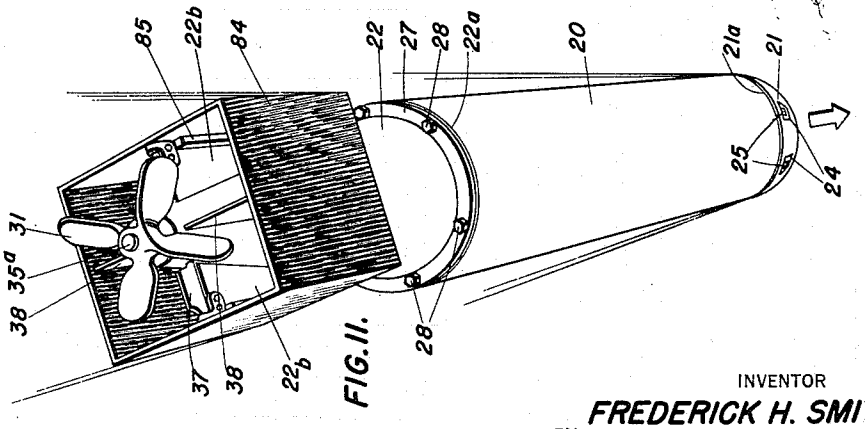


FIG. 11.

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United States Patent Office

2,906,227

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2,906,227

TORPEDO CONSTRUCTION

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Application September 11, 1943, Serial No. 502,074

3 Claims. (Cl. 114—20)

This invention relates to torpedoes and more particularly to a novel automatically controlled torpedo which is rugged and compact and may be readily assembled.

One object of the invention resides in the provision of a torpedo of novel construction which may be assembled quickly and easily by reason of its inclusion of a frame or cartridge supporting a control means for the torpedo and adapted to slide into position on rails or ways mounted in the torpedo hull. In its preferred construction, the torpedo hull is made up of head and tail sections and a main central section having a pair of rails on which the cartridge may be moved. In assembling the torpedo, the control means, which may include batteries, electronic devices, etc., for an automatic steering system, is mounted on the cartridge and the latter is moved on the rails into the main section of the hull, after which the necessary wiring connections may be made to the driving means, microphones, or other parts in the head or tail section, or both, before joining these sections to the main section.

Another object of the invention is to provide a torpedo of the character described in which at least part of the control means is mounted on a frame or cartridge adjustable longitudinally on rails in the torpdo hull, whereby the relative positions of the center of buoyance and the center of gravity of the hull may be varied to trim the torpedo.

A further object of the invention is to provide a novel torpedo having a control apparatus mounted on a frame or cartridge in the hull and including a battery, or the like, the center of gravity of which is disposed on one side of the vertical plane through the longitudinal axis of the torpedo, or to one side of the center of buoyancy so as to counteract the torque of the motor and propeller acting to rotate the hull in the water, whereby the hull is provided with the desired trim.

Still another object of the invention resides in the provision of a torpedo of the character described having a control apparatus so mounted and arranged as to be capable of withstanding the shock incident to dropping the torpedo from an aircraft.

These and other objects of the invention may be better understood by reference to the accompanying drawings and the following detailed description. In the drawings—

Fig. 1 is a vertical, longitudinal sectional view of one form of the new torpedo, parts of which are shown in side elevation;

Fig. 2 is a sectional view on the line 2—2 in Fig. 1;

Fig. 3 is a detail side view of a portion of the depth steering apparatus, partly in section;

Fig. 4 is a sectional view on the line 4—4 in Fig. 2;

Fig. 5 is a sectional view on the line 5—5 in Fig. 4;

Fig. 6 is a sectional view on the line 6—6 in Fig. 2;

Fig. 7 is a perspective view of the assembled cartridge and the adjacent tail section;

Fig. 8 is a perspective view of the aerodynamic stabilizer;

Fig. 9 is a transverse sectional view in perspective of the forward end portion of the hull before the cartridge is inserted, showing the guide rails for the cartridge;

Fig. 10 is a perspective view of the cartridge showing the battery compartments and the chassis for electronic components of the steering system;

Fig. 11 is a perspective view of the torpedo in flight after it is dropped from an aircraft and before it strikes the water, and

Fig. 12 is a perspective view of the torpedo as it strikes the water, showing the destruction of the aerodynamic stabilizer.

The torpedo, as shown, is of the type which is launched from an airplane and steered automatically in the water by the action of compressional waves transmitted through the water from a submarine or other target. The azimuth and depth steering system may be of any desired construction but is preferably of the form disclosed in a copending application of C. K. Stedman et. al., Serial No. 502,075, filed September 11, 1943.

The hull of the torpedo comprises a main section 20 of cylindrical form, a generally hemispherical head 21 on the front end of the main section, and a tail portion 22 on the rear end of the main section. At its front end, the main section 20 is provide with inwardly extending flanges 23 spaced circumferentially around the section in alignment with generally U-shaped recesses 24 in the head 21. The head is connected to the main section 20 by bolts 25 extending through the rear end walls of the recesses 24 and through the aligned flanges 23, the bolts being provided on their rear ends with nuts 26 which are tightened against the flanges. A suitable sealing gasket 21*a* may be inserted between the adjacent ends of the main section 20 and the head 21. The had 21 contains a suitable fuze (not shown) and a plurality of azimuth and depth steering microphones or ears (not shown), as illustrated, for example, in the above-identified application of C. K. Stedman et al., and the usual high explosive charge is packed around the microphones and the fuze.

The tail section 22, as shown, tapers from the main section 20 of the hull, although the tail section may be of hemispherical or other form. At its front ends, the tail section 22 has an outwardly extending peripheral flange 27 seated against an internal flange 27*a* on the main section 20, the flanges 27 and 27*a* being held together by bolts 28. A sealing gasket 22*a* may be interposed between the flanges 27 and 27*a* to make the hull watertight. If desired, the tail section 22 may be arranged so that its surface lies flush with the surface of the main section 20.

Within the tail section 22 is an electric motor 30 for driving a propeller 31 adjacent the rear end of the hull. The motor 30 is mounted in a hub 32 connected to a ring 33 by radial arms 34, the ring having a slight taper and being fitted closely in the front end portion of the tail 22. The driving motor is connected to the propeller through a pair of aligned shafts 35 and 35*a* releasably connected by an adaptor 36. In order to steer the torpedo in azimuth, I provide a pair of vertical rudders 37 adjacent the top and bottom surfaces, respectively, of the tail section 22, the rudders being mounted in any suitable manner so that they may swing on a vertical axis. Similarly, the torpedo is steered vertically by a pair of horizontal rudders 38 mounted on the opposite sides of the tail portion and adapted to swing on a horizontal axis. The azimuth rudders 37 are actuated by a reversible electric steering motor 39 in the tail section, the driving shaft of the motor having a gear 40 (Fig. 4) engaging a rack 41 which is connected through a rod 42 to a lever 43 for swinging the azimuth rudders. A similar steering motor 44 has on its driving shaft a gear 45 engaging a rack 46 which operates the depth steering rudders 38 through a shaft 47 and a lever 48. The steering motors 39 and 44 are mounted in any suitable manner near the opposite sides of the tail

portion 22 with the driving shafts of the motors in alignment.

The main section 20 of the hull contains an open frame or cartridge 50 comprising four longitudinal beams 51 and a pair of circular bulkheads 52 to which the beams may be welded or otherwise secured. The bulkheads 52 are spaced apart a substantial distance and are disposed inwardly from the ends of the beams 51, each bulkhead being preferably provided with radial cross-braces 52*a* for strengthening it. Mounted in the central portion of the cartridge 50 are two main batteries 53 and 54 which may be encased in suitable padding 55. As shown, the batteries rest on a plate 56 extending transversely between the two lower beams 51, and the batteries are covered by a similar plate 57 connected between the two upper beams. The batteries 53 and 54 serve to supply current to the driving and steering motors 30, 39 and 44 and to electrical components of the azimuth and depth steering system, as disclosed in the above-identified application of C. K. Stedman et al.

Near the front end of the cartridge 50 is a generally circular chassis 60 connected to the beams 51 and extending transversely thereof. On the front face of the chassis 60 are partitions 61 dividing the chassis into several compartments which contain azimuth and depth steering amplifiers, shown generally at 62. In assembling the amplifiers on the chassis 60, the usual vacuum tubes are mounted so that they are base down when the torpedo strikes the water, whereby the tubes are better able to withstand the shock incident to launching the torpedo. The chassis 60 is disposed a substantial distance in front of the forward bulkhead 52, and the space between the bulkhead and the chassis contains a commutator 63 mounted on a transverse support 64 extending between the two lower beams 51. The purpose of the commutator 63 is to switch one or more stages of the azimuth amplifying means alternately between the left and right azimuth microphones, as shown in said application of Stedman et al.

A horizontal plate 66 is mounted on the two lower beams 51 near the rear end of cartridge 50 and is adapted to support steering amplifiers (not shown) electrically coupled to the amplifying means 62, the output of the steering amplifiers being operable to control the steering motors 39 and 44, respectively. Above the plate 66 is an insulating panel 67 disposed within the cartridge and supporting main power relay 68 for switching on the propulsion motor 30 after the torpedo is launched from the airplane. Secured to the beams 51 on opposite sides of panel 67 are supporting members 69, one of which carries a pendulum potentiometer 70 for use in controlling the depth steering system. Mounted on the supporting members 69 on the other side of the cartridge is a pressure type bellows 71 operable hydrostatically through a tube 72 in accordance with changes in the depth of the torpedo. The bellows 71 is biased by a compression spring 73 and is operatively connected through an arm 74, a rack 75 and a pinion 76 to a potentiometer 77. The pendulum potentiometer 70 and the hydrostatically operated potentiometer 77 are used in controlling the depth steering system, as disclosed in said application of Stedman et al. A second bellows (not shown) may be mounted on the cartridge to operate a snap switch for shutting off the main power motor 30 when the torpedo reaches a predetermined depth.

It will be apparent that the torque incident to driving the single propeller 31 would tend to rotate the torpedo hull in the water unless suitable provision were made for counteracting the effect of the torque. In order to counteract the torque incident to driving the propeller, I mount one or more "B" batteries 80 on one side of the cartridge 50. Thus, if the torpedo hull were stationary in the water with the propeller idle, it would be rotated through a considerable angle from its intended position, due to the eccentric mounting of the batteries 80, but when the propeller is driven, the resulting torque overcomes the torque due to the eccentric mounting of the batteries and causes the hull to assume its intended position. The batteries serve to supply current to components of the azimuth and depth steering system, as disclosed in said application of Stedman et al., and may be supplemented by additional batteries 81 secured to the bottom portion of the cartridge.

The cartridge 50 is mounted on a pair of longitudinal rails 82 secured to the bottom portion of the main section 20 of the hull as by means of welding 82*a*. The rails 82 are spaced apart a distance corresponding to the spacing between the two lower beams 51 of the cartridge, so that these beams normally rest upon the rails, and the cartridge is adapted to slide longitudinally in the hull. Thus, in assembling the torpedo, the batteries and other electrical components are mounted on the cartridge 50 before the latter is inserted in the main section 20 of the hull. In this way, the mounting and wiring of the parts on the cartridge is greatly facilitated for the reason that the cartridge is fully exposed and the parts thereon are readily accessible. After the parts have been mounted on the cartridge and wired, the lower beams 51 at one end of the cartridge are placed upon the rails 82 at one end of the main section 20 of the hull, and the cartridge is slid into position on the rails. If desired, the cartridge may be locked in its final position by bolts 83 extending through the lower beams 51 and the corresponding rails. When the cartridge has been positioned in the hull section 20 on the rails, the necessary wiring connections are made from the parts on the cartridge to the motors 30, 39 and 44 in the tail section and to the microphones (not shown) in the head, and then the head and tail portions are bolted to the main section 20.

In order to stabilize the torpedo in its flight before it strikes the water, I provide an aerodynamic stabilizer in the form of a rectangular member having side walls 84 made of wood or other frangible material. The stabilizer 84 is supported by tail fins 22*b* which also support the rudders, and each of the side walls 84 of the stabilizer has a pair of spaced ribs 85 adapted to lie on opposite sides of one of the fins. Near the inner ends of each pair of ribs 85 is a transverse rib 86 engageable with the leading edge of the adjacent fin to prevent the stabilizer from sliding off the fins. When the torpedo strikes the water, the stabilizer 84 is shattered by the impact, as shown in Fig. 12, so that it is released and does not impose a drag on the hull. It has been found that a stabilizer of the form described serves to dampen the usual pitching-angle oscillations during the aerial flight of the torpedo and prevents the torpedo from tumbling in its aerial flight so as to insure its striking the water nose first at the proper angle.

By mounting the main components of the control means for the torpedo on the cartridge 50, the relative positions of the center of buoyancy and the center of gravity of the hull may be readily varied by sliding the cartridge longitudinally on the rails 82. This is a feature of particular advantage, because, when the torpedo is arranged for a test run, the trim would normally differ considerably from the trim when the torpedo is loaded with high explosive for use against a target, and by adjusting the position of the cartridge on the rails, the torpedo may be trimmed in the desired manner regardless of its loading.

I claim:

1. A torpedo comprising a generally cylindrical shell, a pair of rails secured to the inner wall of the shell, a cartridge having an open framework comprising a pair of longitudinal beams engageable with the rails and on which the cartridge is adjustable longitudinally on the rails, means for adjustably securing the beams to the rails, and control apparatus mounted on the cartridge and including means for displacing the center of gravity of the cartridge on one side of the center of buoyancy of the torpedo to counteract the torque incident to driving the torpedo.

2. A torpedo comprising a generally cylindrical shell, a pair of rails secured to the inner wall of the shell, a car-

tridge having an open frame comprising a pair of longitudinal beams engageable with the rails and on which the cartridge is adjustable longitudinally on the rails, means for adjustably securing the beams to the rails, and control apparatus mounted on the cartridge and including a battery having its center of gravity located to one side of the vertical plane through the longitudinal axis of the cartridge for displacing the center of gravity of the cartridge on one side of the center of buoyancy of the torpedo to counteract the torque incident to driving the torpedo.

3. A torpedo having a head section, a main section and a tail section, the three sections being removably secured together, the main section comprising a generally cylindrical shell, a pair of longitudinally extending rails secured to the inner walls of the shell, an open frame adapted to be removably mounted in the shell, said frame comprising a plurality of beams and bulkheads secured

together, two of the beams being slidably mounted on the rails in the shell, means for removably securing the frame to the rails, and control apparatus and means constituting a power source secured to said frame, whereby when the frame is removed from the shell, easy access may be had to the control apparatus and power source, and whereby the center of gravity of the torpedo may be located within the proper limits by adjustment of the location of the frame relative to the central shell.

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