April 29, 1969 J. G. STRADER 3,441,952

HAND HELD PROPULSION UNIT

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Fig. 1.

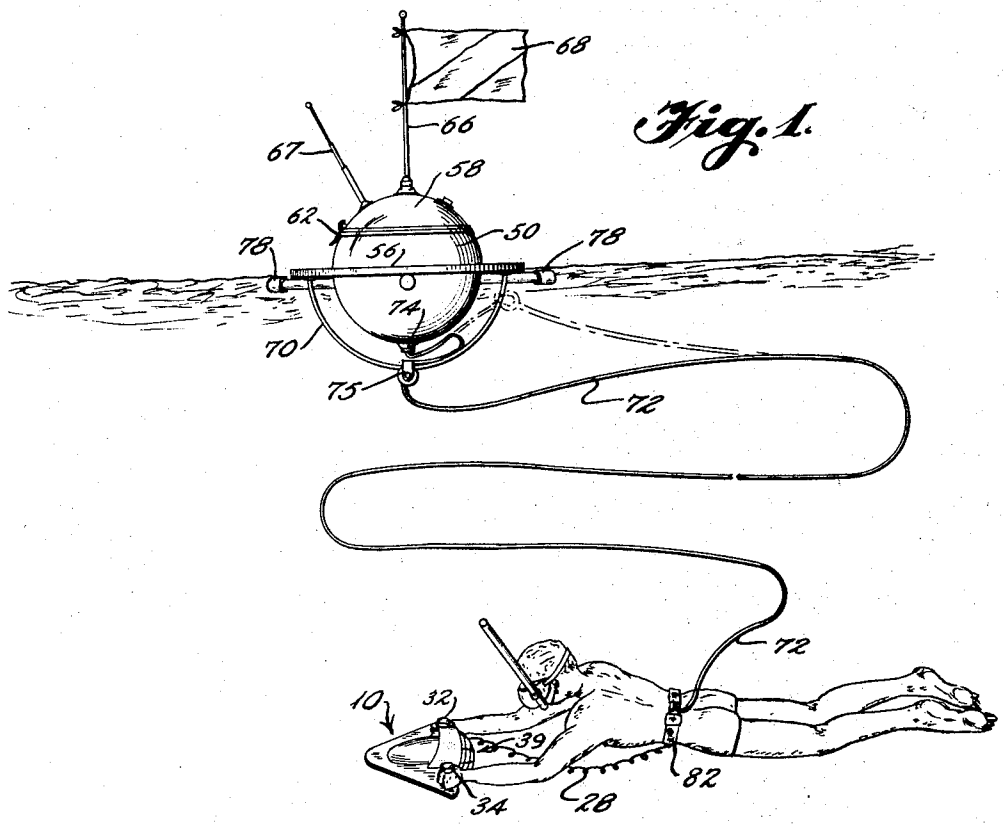

Fig. 2

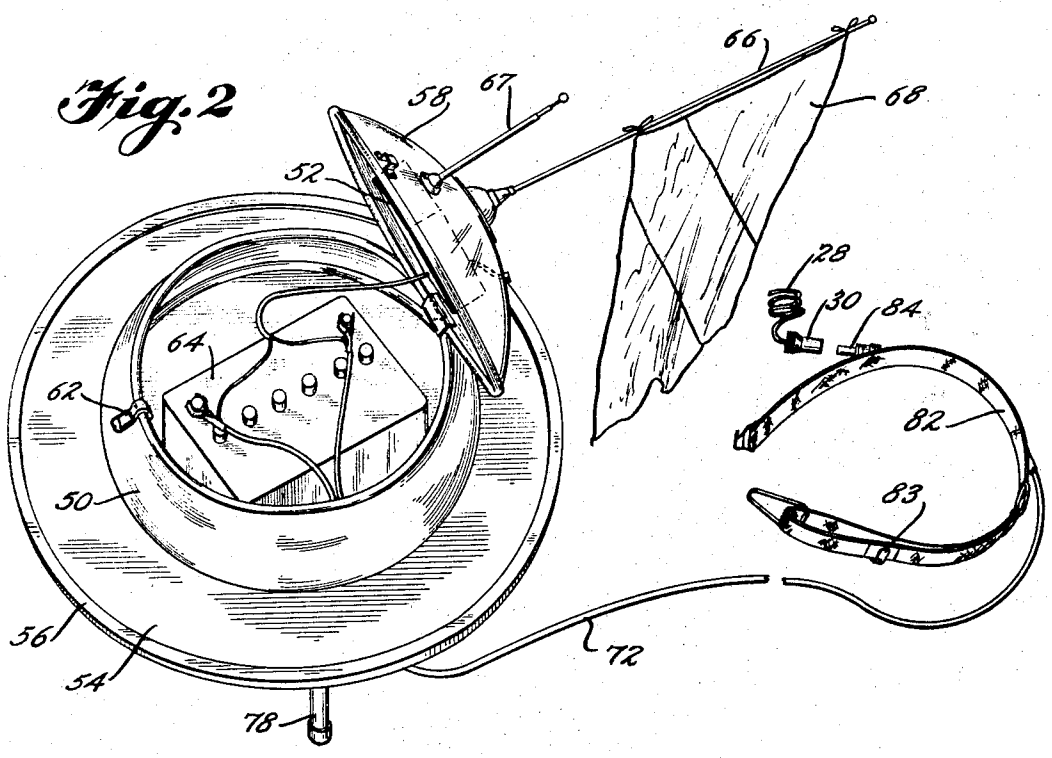

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Fig. 3

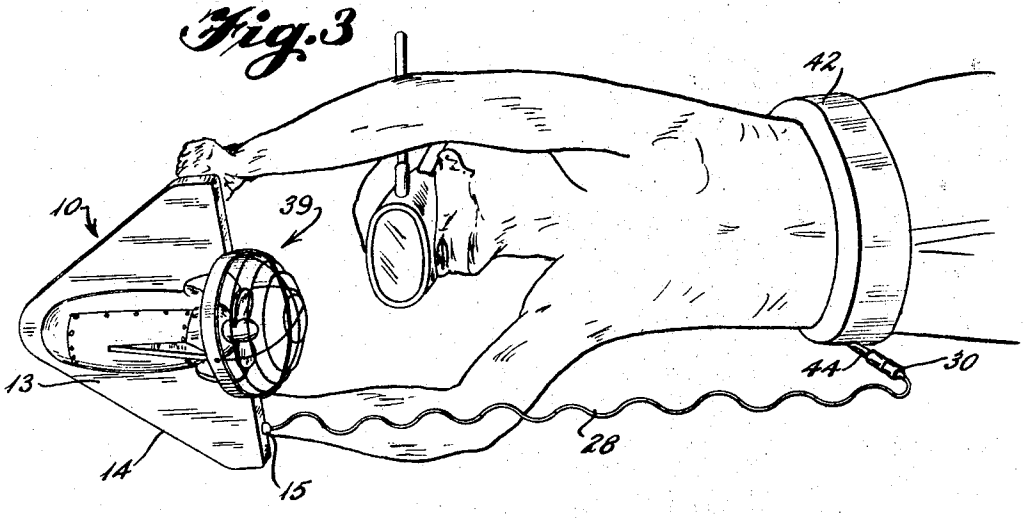

Fig. 4

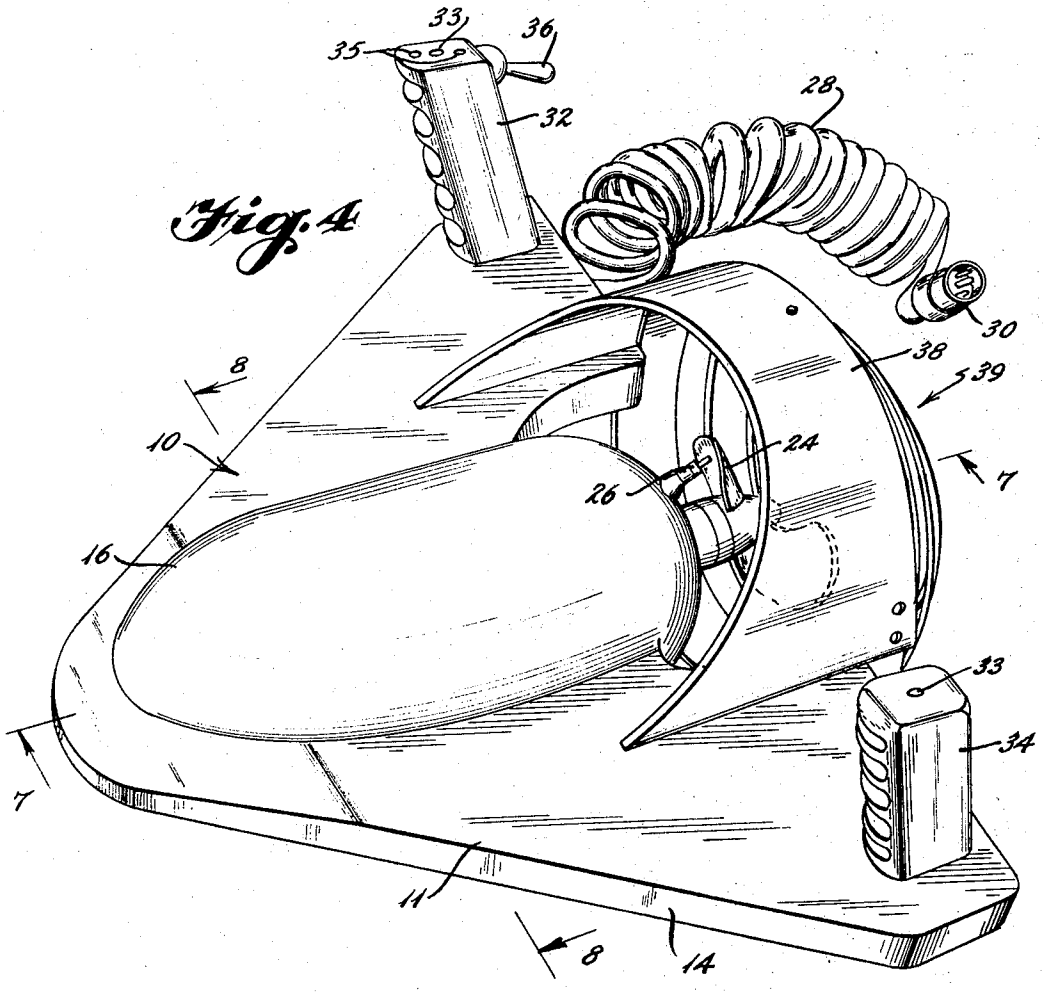

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Fig. 5

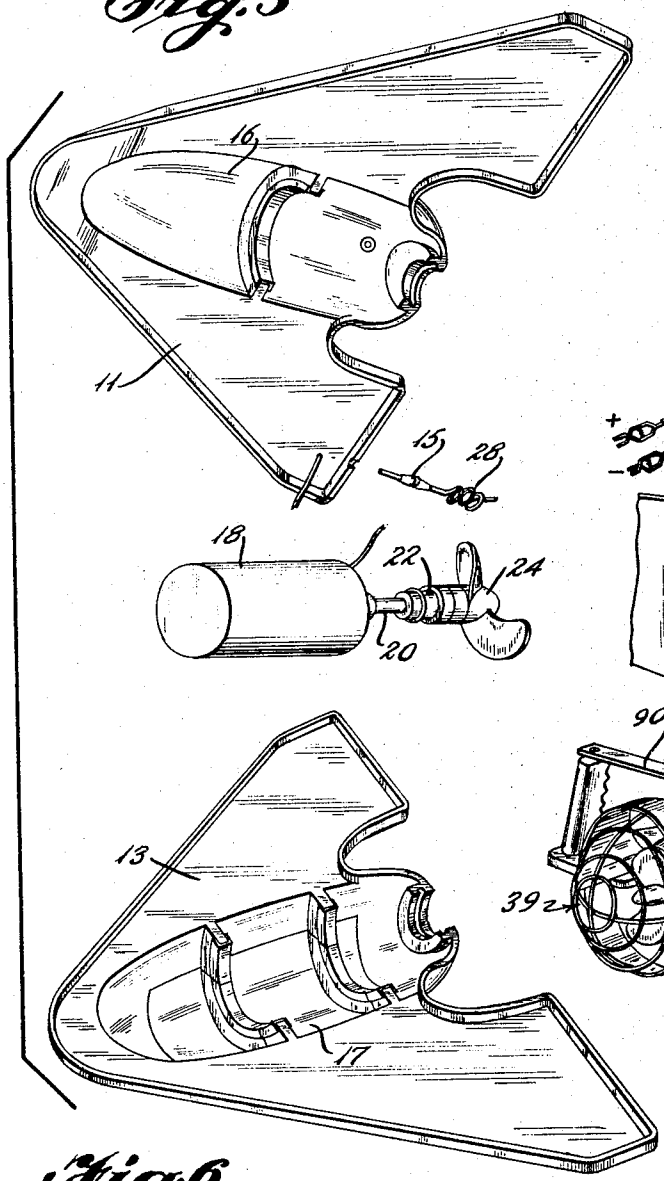

Fig. 12

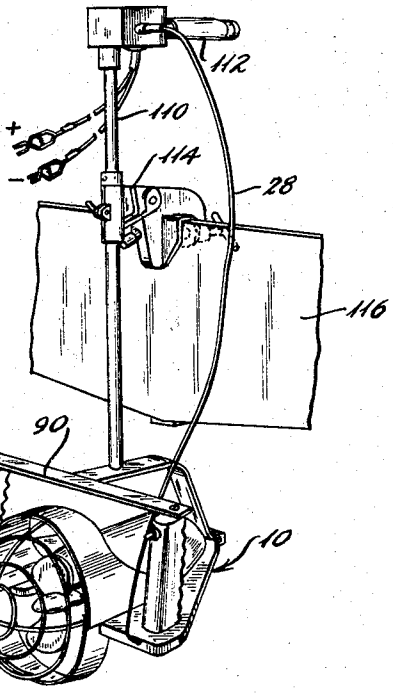

Fig. 6

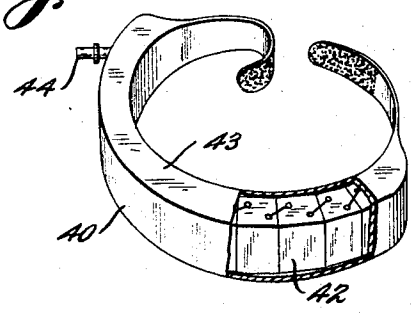

Fig. 11

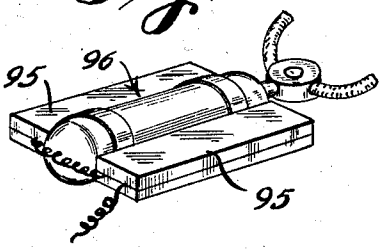

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Fig. 7

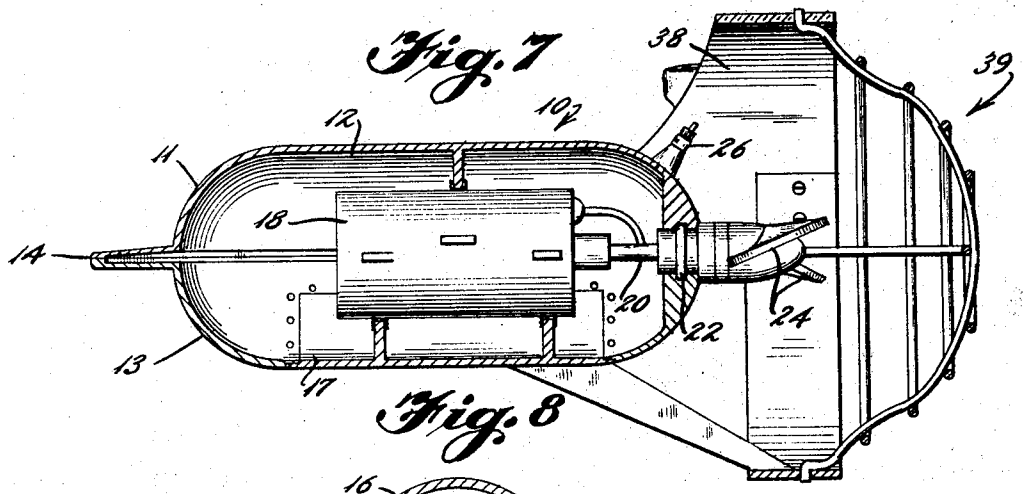


Fig. 8

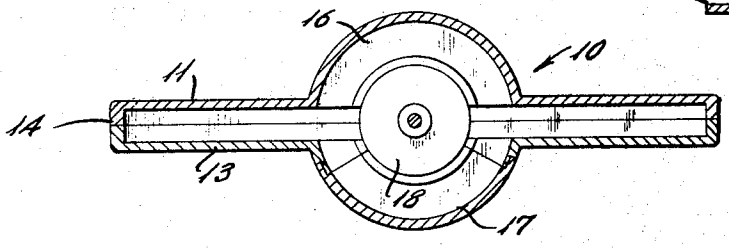


Fig. 9

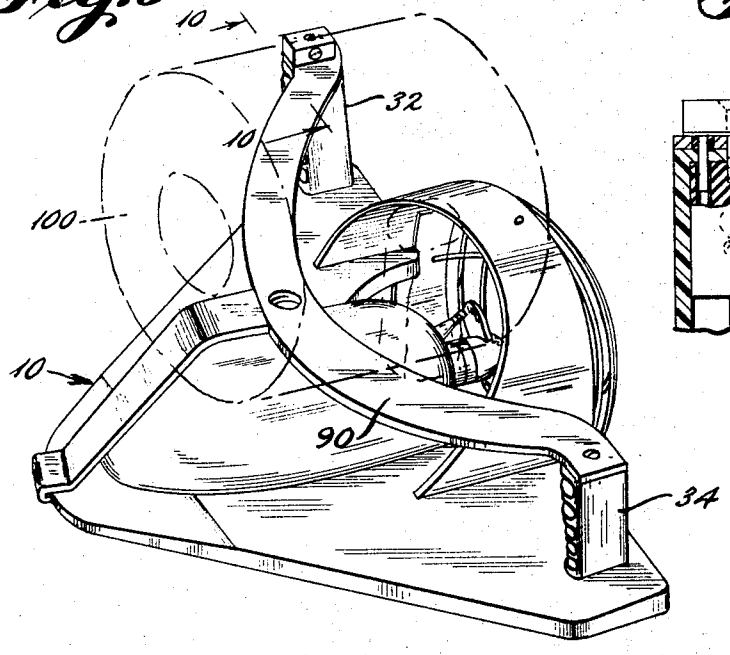
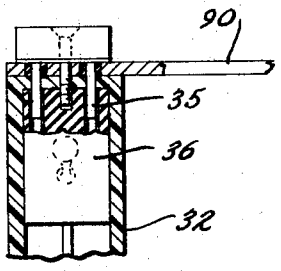


Fig. 10



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3,441,952

HAND HELD PROPULSION UNIT

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Int. Cl. B63c 11/00; B63h 1/14
U.S. Cl. 115—6.1 14 Claims

ABSTRACT OF THE DISCLOSURE

A small hand held propulsion unit is shaped in the form of a delta wing with a bulbous housing for an electric motor drive. The battery power source which is separated from the propulsion unit is connected thereto by way of the swimmer being in one mode directly mounted on the swimmer, e.g., in a belt, and in another mode in a floating buoy with a power line umbilical connected to the swimmer and thence to the propulsion unit.

The present invention relates to a battery operated propulsion unit for swimers and more particularly to a hand held, electrically powered propulsion unit combined with a remote battery power source.

Batteries generally available to underwater swimmers have been adapted for relatively extended use, e.g. five hours without exceeding the weight and volume limitations of portability. Certain battery types may even be mounted on the swimmer's torso. Reference is made to prior Patent 3,329,118 for some discussion of the battery power sources now available to underwater swimmers. Patent 3,329,118 shows a battery operated propulsion unit adapted for attachment to the swimmer's torso by a body harness which leaves arms and legs unhindered. While such an approach seems self-evidently highly desirable, in practice, the unhampered freedom of arms and legs is more apparent than real since little is done with the hands other than guiding the forward motion of the swimmer when the propulsion system is in operation.

A small hand-held propulsion unit loosely tethered to the swimmer may in fact be more advantageous than a torso mounted system. It can hamper the swimmer's activities less. A loosely tethered propulsion unit of zero buoyancy can be hooked to a belt or body harness or even laid aside when the swimmer wishes unhindered arms and hands, yet remains conveniently at hand when the swimmer wishes to travel. Moreover, a hand-held unit may have a shape appropriate for streamlined movement. Efficient use of available power is of more than passing importance for battery powered underwater propulsion systems.

The principal object of this invention, is to provide a small hand-held battery powered propulsion unit for underwater swimmers.

A further object of the invention is to provide an underwater propulsion unit of a miniaturized nature which does not block the swimmer's line of sight.

Another object of the present invention is to provide a hand-held battery powered propulsion unit and remote power source system for underwater swimmers.

Further objects and the advantages of the present invention will be apparent from the following description, wherein preferred embodiments thereof are described in detail, without limiting the scope of the invention set forth in the appended claims.

The present invention provides for separating the propulsion unit and power source. The power source, i.e. the battery, is attached to the swimmer's torso as for example by being made part of a belt structure, causing the swimmer or diver to be self-contained. The battery

may also be disposed in a floating structure (e.g. a buoy) tethered to the swimmer by a power line umbilical.

The propulsion unit is formed in an efficient shape for underwater movement, being in a preferred embodiment, a small hand-held unit shaped like a delta wing having a generally cylindrical, hollow center portion. An electric motor is disposed in the center portion with the motor drive shaft extending through a seal at the rear of the center portion to a propeller mounted thereon adjacent the rear edge of the center portion. A pair of hand grips are provided on the wing for the swimmer so that he may be drawn along behind the propulsion unit. A power line extends out from the motor of the propulsion unit to a plug connection on a belt or harness secured to the swimmer's torso. This power line, alone or with a tie line or cord, tethers the propulsion unit to the swimmer.

The battery power source attached to the plug connection may be a multiplicity of cells mounted on a belt or harness on the swimmer's torso, e.g., silver-cadmium or nickel-cadmium cells.

Alternatively, the power source may be more remote, being for example, a battery encased in a buoy structure from which a power line extends to a plug connection on belt or harness means mounted on the swimmer. The buoy power source is, of course, particularly adapted for swimming in shallow waters. However, construction of a buoy power source with essentially zero buoyancy permits the buoy to be towed behind the swimmer at depths.

For a description of the structure of the present invention, reference is now made to the attached drawings, wherein:

FIGURE 1 is a perspective view of a swimmer being propelled by a propelling unit being supplied with power from a buoy;

FIGURE 2 is a perspective view of the buoy with its source of power;

FIGURE 3 is a perspective view of the swimmer being propelled by a belt mounted power source;

FIGURE 4 is a perspective view of the propulsion unit;

FIGURE 5 is an exploded view showing component parts of the propulsion unit;

FIGURE 6 is a perspective view of a belt mounted battery power source with parts broken away;

FIGURE 7 is a section taken along 7—7 of FIGURE 4;

FIGURE 8 is a section taken along 8—8 of FIGURE 4;

FIGURE 9 diagrammatically shows a camera mount fastened to the propulsion unit, with the camera shown in broken lines;

FIGURE 10 is a fragmentary section taken along line 10—10 of FIGURE 9 showing the electrical connection between the propulsion unit and an accessory;

FIGURE 11 diagrammatically shows a battery pack compressed air cylinder assembly; and

FIGURE 12 diagrammatically shows the propulsion unit mounted to drive a small boat.

As may be seen in FIGURE 1, a swimmer **1** is drawn along under water by the forward movement of propulsion unit **10**. Power from a battery inside buoy **50** is transmitted via power line **72** to a location on the swimmer's torso, e.g. a belt **82**, from which a plug connection to the power line **28** of propulsion unit **10** provides the current from the electric motor inside propulsion unit **10**.

Alternatively, as is shown in FIGURE 3, the power line **28** of propulsion unit **10** can be plugged into cells or batteries **42** mounted in a belt **40** around the swimmer's torso, or on the swimmer's back as in the mode illustrated by FIGURE 11 where battery pack **95** is associated with the lung or compressed air supply tank **96**.

The shape and construction of propulsion unit **10** may best be appreciated by reference to FIGURES 4 through 8, which illustrate how propulsion unit **10** comprises a sealed housing **12** formed in the shape of a delta wing **14** having a bulbous, almost cylindrical center portion **16**. Housing **12** may be assembled by gluing together molded top half **11** and bottom half **13**, these housing members being for example high strength plastic materials, polyester fiberglass laminates being particularly suitable.

The bulbous hollow center portion **16** of housing **12** is adapted to contain an electric motor **18**. The motor shaft **20** extends axially out of housing **12** through a pressure and water tight seal structure **22** (of a conventional character) and a screw propeller **24** is mounted on the end of shaft **20**. A removable hatch **17** provides access to housing **12** for repair purposes.

The specific size and shape of the wing **14** is subject to wide variation yet be within the hydrodynamic considerations for high efficiency movement through water at the desired velocity. As illustrated the delta wing shape is preferred with a small wing span (e.g. 2 feet) provided in keeping with the hand-held propulsion concept. Advantageously, efficient shape and convenient size is consistent also with the buoyancy control obtainable through predetermining the amount of hollow space left inside housing **12**. Thus propulsion unit **10** can be made with negative, or positive, or even zero buoyancy through proper proportioning of the hollow space to the total weight (in water) for the buoyancy desired.

The interior of housing **12** is, of course, made pressure and water tight and in addition housing **12** is capable of withstanding substantial external and internal pressures. Desirably, valve **26** (which may for example be an ordinary tire valve) is provided so that the interior of housing **12** may be pressurized. Aside from whatever advantages an internal gas pressure offers against collapse of housing **12** at great depths, positive air pressure inside propulsion unit **10** permits the swimmer to test for leaks, e.g. at seal **22**, hand grips **32** and **34**, etc. A full shroud **38** and guard **39** protect the swimmer from propeller **24**.

Current from the electric motor **18** in propulsion unit **10** is provided from the remote battery source by way of power line **28**, which extends from a pressure tight sealed opening **15** (see FIGURES 3 and 5) on the rear of wing **14** to a terminal jack **30** which jack is adapted to plug into a matching jack **44** on the swimmer's belt **40** (or alternatively on a body harness).

A pair of hand grips **32** and **34** are disposed adjacent the rear corners of wing **14** and in a preferred embodiment, as is shown in FIGURE 4 of the drawing, grips **32, 34** upstand obliquely from wing **14**. They could as well extend out directly in line with the wing or be at some convenient angle thereto. A waterproof switch **36** (e.g. a toggle switch) on hand grip **32** controls propulsion unit **10**, the switch **36** being adapted for operation by the thumb of swimmer **1** or by movement of the palm of his hand.

The tops of hand grips **32, 34** have threaded fittings **33** therein for removably attaching accessories to propulsion unit **10**, as for example the camera **100** shown in FIGURE 9. Suitably, camera **100** is mounted on a yoke **91** which attaches to hand grips **32, 34** and to the nose of wing **14**. An electrical plug (waterproof) connection **35** on grip **32** (see FIGURE 10) serves to provide power to the accessories. The camera thereby rests at a convenient location relative both to propulsion unit **10** and to the line of sight of swimmer **1**.

It may be noted that the same or a similar yoke **90** may be employed to connect propulsion unit **10** to a small craft (e.g. row boat) **116** by way of a shaft **110** and bearing bracket **114**. The steering rod **112** may be provided with a control switch. Since skin and scuba diving is frequently done from small craft, the possibilities for operating propulsion unit **10** (off a boat battery) offers the swimmer a desirable safety feature against the event of motor failure.

Allusion has already been made that separating the battery power source from propulsion unit **10** is desirable. Separation permits construction of a small, self-contained, propulsion unit. Desirably the power line of the propulsion unit is tethered to the swimmer's torso. In one mode of the invention, the battery source of power is mounted directly on the swimmer's torso by a belt or harness. FIGURE 6 illustrates a belt member **40** holding a series of miniature batteries **42** (in series connection) inside a waterproof shroud **43**. A belt jack **44** is adapted to plug into the jack **30** on the power line **28** of propulsion unit **10**.

FIGURE 11 shows another mode where battery pack **95** is associated with the self-contained underwater breathing apparatus **96**.

An alternative power source, or a supplemental source of power, is the buoy mounted battery illustrated in FIGURES 1 and 2 of the drawings. The buoy **50** comprises an enclosed body, e.g. spherical **52** with an annular skirt **54** medially therearound (at about the water line). Optionally, a rubber bumper fringe **56** may be on the peripheral edge of skirt **54**. The top half of sphere **52** contains a port **58**, which, in a preferred embodiment, opens on hinge **60** and secures by latch **62** into watertight sealing engagement. The battery **64** is, or course, inside the hollow sphere or chamber **52**. Suitably, battery **64** may be a conventional heavy duty 12-volt lead-acid battery. If desired, the buoy **50** may be incorporated into a catamaran or trimaran.

Extending up from sphere or chamber **52**, suitably from the top side of port **58**, is a post **66** for a diver down flag or pennant **68**. Pennant post **66** may serve as a receiving antenna; thus it may be noted that the buoy **50** serves both as power source and as carrier for the diver down flag. A transmitting antenna **67** may be provided on buoy **50** along with a radio inside buoy **50** so that the swimmer may communicate with other divers or with any boat equipped with a receiver of the same frequency.

At the underwater side of sphere or chamber **52** is a half moon runner **70** (of stainless steel) extending from one side of the periphery of skirt **54** around to the other side. Runner **70** passes closely adjacent where the power line **72** passes from the under side of sphere **52** by way of a watertight juncture **74** therewith. A pulley **75** is attached to runner **70**. The purpose of pulley **75** is to stabilize buoy **50** while under tow and to prevent stress at water tight juncture **74**. A separate line may be provided for tethering purposes, and/or alternatively for communication if the swimmer is provided with a radio.

Desirably, the underside of buoy **50** is provided with three legs **78** so that buoy **50** may be set upright on the legs **78** when out of water for recharging battery **64**. When buoy **50** is in the water, legs **78**, which are hingedly mounted, are placed into an up position generally parallel to skirt **54**, as is shown in FIGURE 1. The skirt **54** acts generally to maintain buoy stability, preventing capsize when forward motion by swimmer **1** tugs at the pulley connection **75** of power line **72**. The botttom of buoy **50** need not be restricted to a sphere shape. The bottom can be squared off for seating on shore without the need of legs or any sort of tripod.

Power line **72** terminates at a plug-in jack **84** on the swimmer's belt **82** (or harness) which may of course be the battery containing belt **40** constructed with jack **84** and an associated separate jack for attachment to jack **30** of the propulsion unit **10** power line **28**. Thus, the connection between the propulsion unit **10** and the buoy power supply **50** is by way of means on the swimmer's torso, which means form then an important link between the power source and the propulsion unit.

Interposing the swimmer between the buoy **50** (or whatever remote power source such as the boat itself) and propulsion unit **10** maintains the swimmer as a vital part of the connection, providing thereby a significant safety measure against loss of the gear in a moment of panic or excitement. The belt **82** may have thereon a clip

83 on which propulsion unit 10 can be hung when not in use.

While the buoy 50 has been described in terms of a floating unit, it should be understood that weight and volume of buoy and battery may be predetermined to provide a near zero buoyancy, making the buoy power supply amenable to submergence should the swimmer wish to go deeper than the length of power line 72. Indeed, the buoy may be towed behind swimmer 1 at considerable depths.

Although the invention has been set forth in conjunction with exemplary preferred tethering and power supply embodiments thereof, other tethering and power supply embodiments are contemplated. Thus, for example, the swimmer and propulsion unit may be tethered to and powered by a submarine, or from an undersea installation like a sea-lab.

What is claimed is:

1. An electrically operated hand held propulsion unit for underwater swimmers comprising a sealed housing formed into a winged shape with a bulbous hollow center portion; an electric motor mounted inside said center portion at least partially filling the hollow space in said housing, the drive shaft of said motor extending out the rear of said housing; shaft sealing means on said housing adapted to maintain a watertight seal at the juncture of said motor shaft and housing; a propeller mounted on said shaft for propelling the propulsion unit when said motor is energized; a pair of spaced apart hand grips mounted on the wing area of said unit, one of said grips being provided with switch means for energizing said motor; and a power line for said motor extending through said housing for supplying current from a remote source.

2. The apparatus of claim 1 wherein said wing shape is a delta wing whose rear edge is about in line with said propeller.

3. The apparatus of claim 1 wherein said hand grips are mounted adjacent the rear of said wing area and upstand therefrom.

4. The apparatus of claim 1 wherein valve means are provided for pressurizing the interior of said sealed housing.

5. The apparatus of claim 3 wherein a shroud and propeller guard extend around the propeller.

6. The apparatus of claim 1 wherein said hand grips contain screw hole mounting means, whereby an accessor may be secured to said unit.

7. The apparatus of claim 6 wherein an electric outlet means is provided on said unit.

8. The apparatus of claim 1 including a battery power source attachable to the swimmer.

9. The apparatus of claim 8 wherein said battery power source is mounted on a belt intended to go around the swimmer's torso.

10. The apparatus of claim 8 wherein said power source is mounted in a floating structure and said floating structure is tethered to means adapted for attachment to the swimmer.

11. An electrically operated propulsion system for underwater swimmers comprising a hand held electric motor driven propulsion unit; a battery power source; and power connections therebetween attachable to the swimmer, said power source further comprising a buoy adapted to contain the battery therein, said buoy being in the form of a spherical body with an annular skirt horizontally thereabout at a mid region thereof, a runner extending from one side of the disc to the other at the underside of said buoy, the connection from said buoy to the swimmer extending from a bottom location on said buoy adjacent said runner, whereby said runner acts to prevent buoy capsize when motion of said swimmer tugs on the buoy connection.

12. The apparatus of claim 11 wherein said buoy further contains an access port on the top side half thereof to provide access to said battery.

13. The apparatus of claim 11 wherein legs are provided on the underwater side of said buoy whereby said buoy may stand upright on dry land.

14. An electrically operated propulsion system for underwater swimmers comprising a motor driven propulsion unit with hand grip operating members thereon; a battery power source separate therefrom; and a power connection therebetween attachable to the swimmer, said power source further comprising means adapted for attachment to the torso of a swimmer, a waterproofed battery forming a part of said means, said power connection serving also to tether said propulsion unit to the swimmer.

References Cited

UNITED STATES PATENTS

2,918,889	12/1959	Rebikoff.	
3,014,448	12/1961	Fogarty et al.	115—6.1
3,039,415	6/1962	Foster.	

FOREIGN PATENTS

92,265	8/1958	Norway.

TRYGVE, M. BLIX, *Primary Examiner.*