

June 11, 1957.

J. J. FOGARTY ET AL

2,795,201

PUMPJET TORPEDO STEERING CONTROL

Filed Feb. 12, 1954

3 Sheets-Sheet 1

Fig. 1.

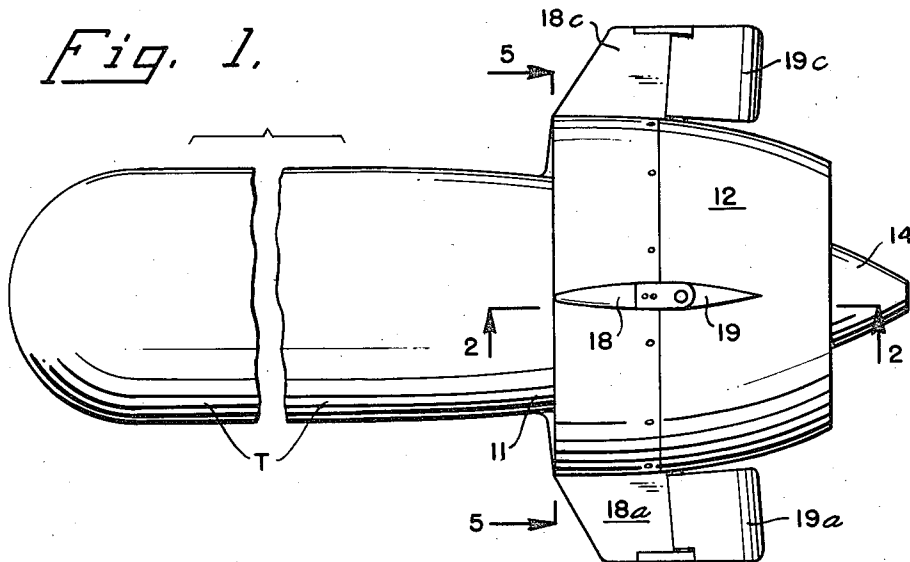
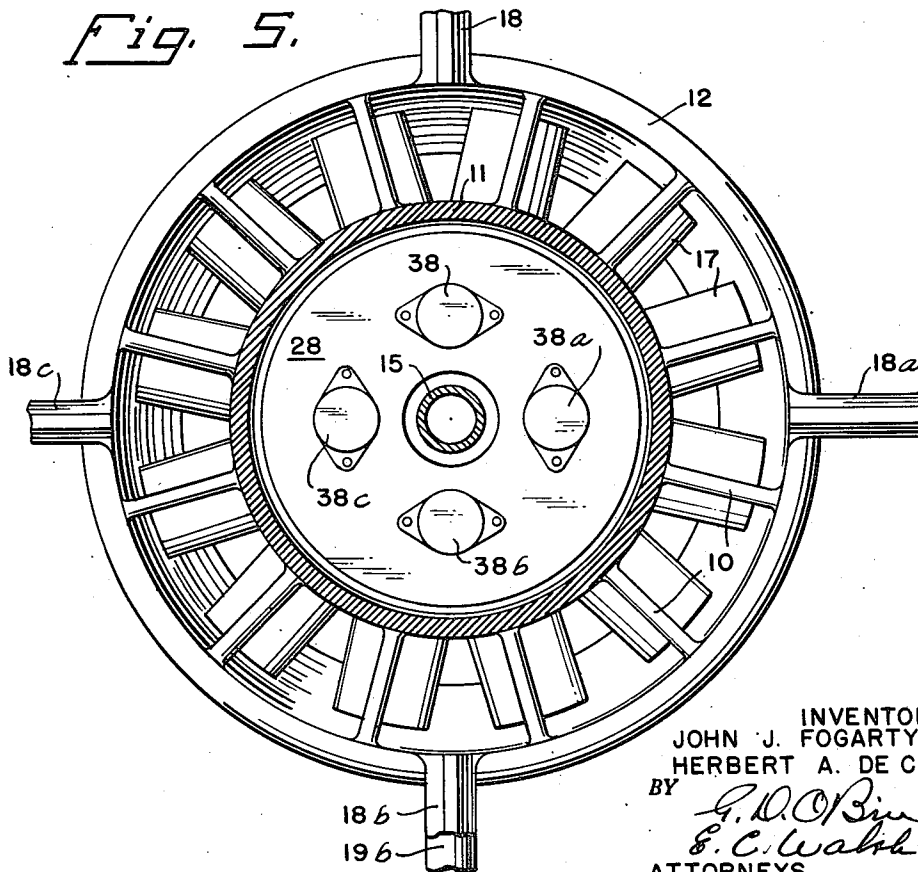


Fig. 5.



INVENTORS
JOHN J. FOGARTY
HERBERT A. DE CENZO
BY *G. D. O'Brien*
E. C. Walsh
ATTORNEYS

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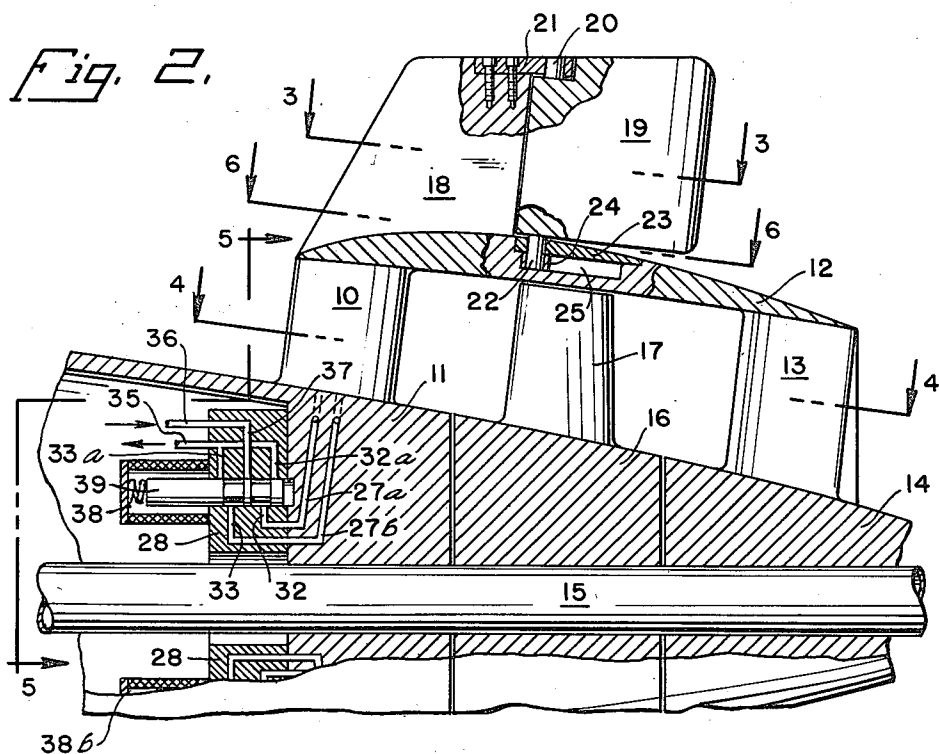
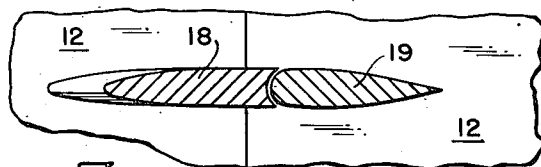


Fig. 3.

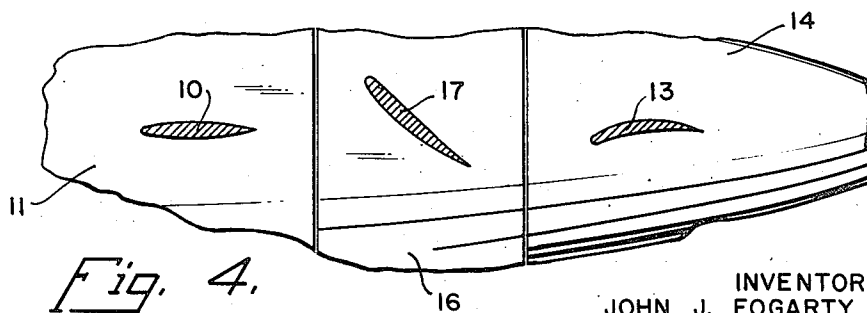


Fig. 4.

INVENTORS
JOHN J. FOGARTY
HERBERT A. DE CENZO
BY *G. W. O'Brien*
E. C. Walsh
ATTORNEYS

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3 Sheets-Sheet 3

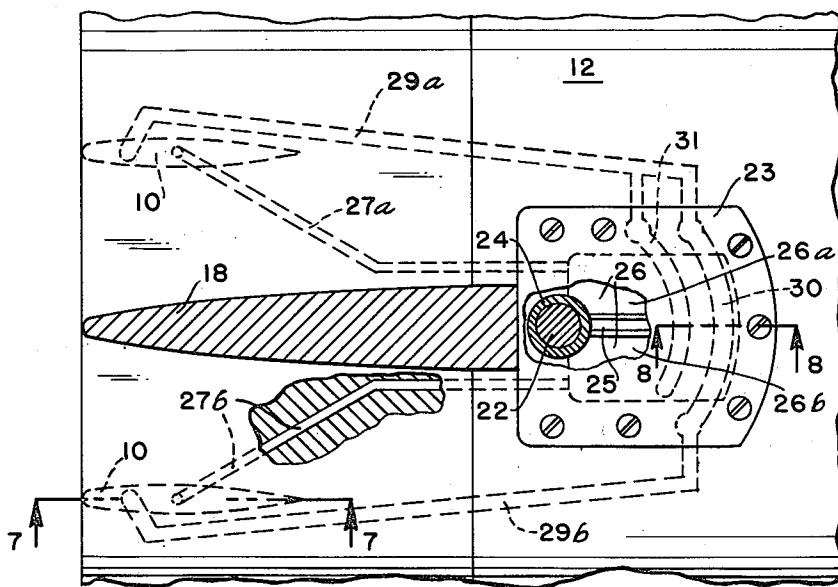


Fig. 6.

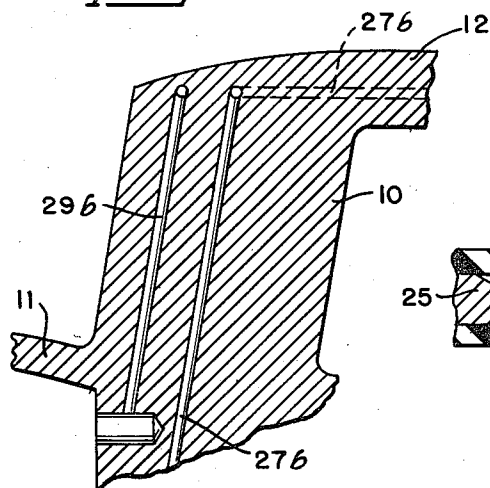


Fig. 7.

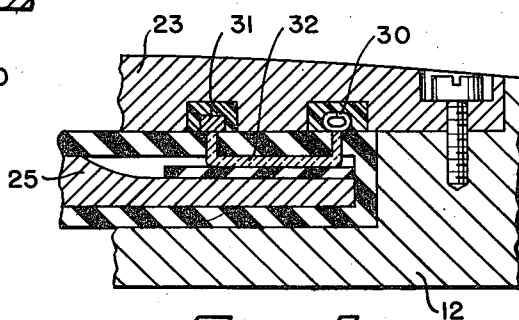


Fig. 2.

INVENTORS
JOHN J. FOGARTY
HERBERT A. DE CENZO
BY *J. H. O'Brien*
E. C. Walsh
ATTORNEYS

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2,795,201

PUMPJET TORPEDO STEERING CONTROL

John J. Fogarty, Glendale, and Herbert A. De Cenzo, Arcadia, Calif., assignors to the United States of America as represented by the Secretary of the Navy

Application February 12, 1954, Serial No. 410,057

7 Claims. (Cl. 114—23)

(Granted under Title 35, U. S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

This invention relates to torpedoes and more particularly to improvements in stabilizing and directional control surfaces for same.

In torpedoes of the pumpjet type, in which propulsive thrust is effected by a shrouded pump unit is has been proposed to dispose the stabilizing fins and the directional control rudders forwardly or rearwardly of the pump unit. When placed forwardly, undesirable water turbulence has resulted and also increase in self noise of the torpedo which is objectionable in torpedoes of the homing type. When placed rearwardly, undesirable structural assemblies have resulted together with loss of desired free water stream characteristics.

One of the objects of this invention is to provide a torpedo of the pumpjet type in which the stabilizing fins and rudders are disposed on the outside of the shroud ring.

Another object is to operate the rudders by hydraulic actuators disposed within the shroud ring.

Another object is to employ hydraulic actuators of the oscillatable vane type which are directly connected to the respective rudder shafts.

Further objects, advantages and salient features will become more apparent from the description to follow, the appended claims, and the accompanying drawing, in which:

Fig. 1 is a top plan of a torpedo, a central portion being broken out;

Fig. 2 is an enlarged section taken on line 2—2, Fig. 1, portions being broken away;

Fig. 3 is a section taken on line 3—3, Fig. 2;

Fig. 4 is a section taken on line 4—4, Fig. 2;

Fig. 5 is an enlarged section taken on line 5—5, Fig. 1, portions being broken away;

Fig. 6 is an enlarged section taken on line 6—6, Fig. 2, portions being broken away;

Fig. 7 is an enlarged section taken on line 7—7, Fig. 6; and

Fig. 8 is an enlarged section taken on line 8—8, Fig. 6.

Referring in detail to the drawing, torpedo T is of the pumpjet type having a forward set of angularly spaced stator blades 10, the inner ends of which are secured to the torpedo tail cone 11, and the outer ends of which are secured to a forward portion of a shroud ring 12 which surrounds the tail cone in spaced relation thereto. A second set of angularly spaced stator blades 13 connect a rear portion of the shroud ring with a stationary member 14 through which a hollow rotary shaft 15 extends. A hub 16 is affixed to shaft 15 and carries a plurality of rotor blades 17 which pump water through the annular space between the tail cone and shroud ring to provide a rearwardly discharging water jet which propels the torpedo forwardly. The conduit formed within the shaft

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serves as an exhaust for the torpedo engine. The construction so far described is, in general, conventional.

The shroud ring is provided with four equi-angularly spaced radially projecting stationary stabilizing fins 18, 18a, 18b, 18c and behind these are disposed, respectively, rudders 19, 19a, 19b, 19c. Since the four sets of stabilizing fins and rudders are identical, the subsequent description of one set will serve for all.

Referring to Fig. 2, rudder 19 is pivotally connected to fin 18 at its outer end by a shaft or pintle 20 which rotatably engages a bearing plate 21 secured to the outer edge of the fin. Its inner end is provided with a similar shaft or pintle 22 which extends through a removable plate 23, recessed into the shroud ring, and into a hub 24 of a vane actuator 25 which may swing within a chamber 26 in the shroud ring. Hub 24 and pintle 22 may be splined, keyed or otherwise secured together.

The vane separates the chamber into two expansible chambers 26a, 26b which are supplied with liquid under pressure through conduits 27a, 27b which extend forwardly through the shroud ring and radially inwardly through adjacent stator blades 10, terminating adjacent a manifold 28 disposed within the torpedo. Conduits 29a, 29b, similarly extend between the manifold and actuator which are adapted to contain electric wires (not shown). One wire extends through conduit 29b and is electrically connected to one end of an arcuate resistance coil 30. Another wire extends through conduit 29a and is electrically connected to the other end of coil 30. A third wire extends through conduit 29a and is electrically connected to one end of an arcuate contact 31. A bridging contact 32, carried by vane 25, and electrically insulated therefrom, contacts coil 30 and contact 31, the various electrical connections just described forming a feed back potentiometer for indicating a position to which a rudder has been moved by its actuator.

Referring to Fig. 2, conduits 27a, 27b communicate with ports 32, 33 in manifold 28. Ports 32a, 33a communicate with a common discharge conduit 35 which communicates with a sump or the like of a fluid supply system (not shown). A supply conduit 36 which carries fluid under pressure from the fluid supply communicates with port 37. A solenoid 38 controls the position of a plunger 39 formed as a piston type valve cooperating with the various ports. In the operation of the valve, in the position shown, port 37 is closed by the valve and there is no flow of fluid to chamber 26. Assuming that the valve is now moved to the right of the position shown, port 37 is opened permitting flow through port 33 and conduit 27b to chamber 26b, rotating vane 25 counterclockwise, as viewed in Fig. 6. Port 32a is also opened, permitting fluid trapped in chamber 26a to flow through conduit 27a, ports 32, 32a to conduit 35. As will be apparent, when the valve is moved to the left of the position shown, the direction of flow through conduits 27b, 27a is reversed from that just described, reconstruction of the type such as the "Nike" valve manufacturing vane 25 clockwise. The valve is of conventional factured by the Bell Telephone Laboratories, or the "Berteau" valve manufactured by the Berteau Co. of Pasadena, California. Valves 38a, 38b, 38c, of the same construction as valve 38, are provided to control the other three rudders in the same manner described.

Since the rudders are operated by individual actuators, it will be apparent that various types of rudder control may be attained by the manner in which signals are transmitted to the electric solenoid valve operators. If no roll control is desired, the signals may be such that the pair of azimuthal rudders 19, 19b operate conjointly in both directions of movement from their normal central positions and the pair of elevational rudders or elevators

18a, 18 operate similarly. If a roll correction is desired, either or both pairs may be operated differentially.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

We claim:

1. In a torpedo of the type having a shroud ring encircling its rear end and supported in spaced relation therefrom by a plurality of angularly spaced stator blades, the shroud ring forming an annular channel between it and the rear end of the torpedo in which blades of a pumpjet rotor are adapted to rotate to produce a rearward flow of water through said channel, the improvements in combination comprising; a plurality of angularly spaced stabilizing fins rigidly affixed to forward portions of said shroud ring and projecting outwardly therefrom, and a directional control rudder associated with each stabilizer fin projecting outwardly from the shroud ring in a position rearwardly of its associated stabilizing fin, and means pivotally connecting each rudder for swinging movement about an axis adjacent its forward edge.

2. Apparatus in accordance with claim 1 including a hydraulic actuator for each rudder, the actuators being disposed within the shroud ring.

3. Apparatus in accordance with claim 2 wherein each actuator includes a vane swingably disposed within a chamber and adapted to receive fluid on opposite sides thereof, and conduits within the stator blades and the shroud ring communicating the actuators with control valves and a source of liquid under pressure disposed within the torpedo.

4. In a torpedo of the type having a shroud ring encircling its rear end and supported in spaced relation therefrom by a plurality of angularly spaced stator blades, the shroud ring forming an annular channel between it and the rear end of the torpedo in which blades of a pumpjet rotor are adapted to rotate to produce a rearward flow of water through said channel, the improvements in combination comprising; a plurality of angularly spaced stabilizing fins rigidly affixed to said shroud ring and projecting outwardly therefrom, and a plurality of directional control rudders carried by the torpedo for steering same.

5. In a torpedo of the type having a shroud ring encircling its rear end and supported in spaced relation therefrom by a plurality of angularly spaced stator blades, the shroud ring forming an annular channel between it and the rear end of the torpedo in which blades of a pumpjet rotor are adapted to rotate to produce a rearward flow of water through said channel, the improve-

ments in combination comprising; a plurality of angularly spaced movable directional control rudders projecting outwardly from the shroud ring for steering the torpedo, and a hydraulic actuator for each rudder disposed within the shroud ring and operatively connected to an associated rudder for moving same.

6. In a torpedo of the type having a shroud ring encircling its rear end and supported in spaced relation therefrom by a plurality of angularly spaced stator blades, the shroud ring forming an annular channel between it and the rear end of the torpedo in which blades of a pumpjet rotor are adapted to rotate to produce a rearward flow of water through said channel, the improvements in combination comprising; a plurality of angularly spaced hydraulic actuators disposed within the shroud ring, each actuator adapted to move a directional control rudder projecting outwardly from the shroud ring.

7. In a torpedo of the type having a shroud ring encircling its rear end and supported in spaced relation therefrom by a plurality of angularly spaced stator blades, the shroud ring forming an annular channel between it and the rear end of the torpedo in which blades of a pumpjet rotor are adapted to rotate to produce a rearward flow of water through said channel, the improvements in combination comprising; a plurality of angularly spaced stabilizing fins rigidly affixed to forward portions of said shroud ring and projecting outwardly therefrom, a swingable directional control rudder associated with each stabilizer fin projecting outwardly from the shroud ring in a position rearwardly of its associated stabilizing fin, a hydraulic vane type actuator for each rudder, the actuators being angularly spaced and disposed within the shroud ring, a potentiometer associated with each actuator having an electrical bridging contact carried by its vane, conduits extending within the shroud ring and stator vanes adapted to contain electrical conductors for electrically connecting the potentiometers with electric apparatus within the torpedo, and conduit means extending within the stator blades and shroud ring communicating the actuators with control valves and a source of liquid under pressure disposed within the torpedo.

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