Nov. 12, 1935. J. KONSTANTINOFF 2,020,788

TORPEDO WAKE REDUCING DEVICE

Filed March 17, 1934 3 Sheets-Sheet 1

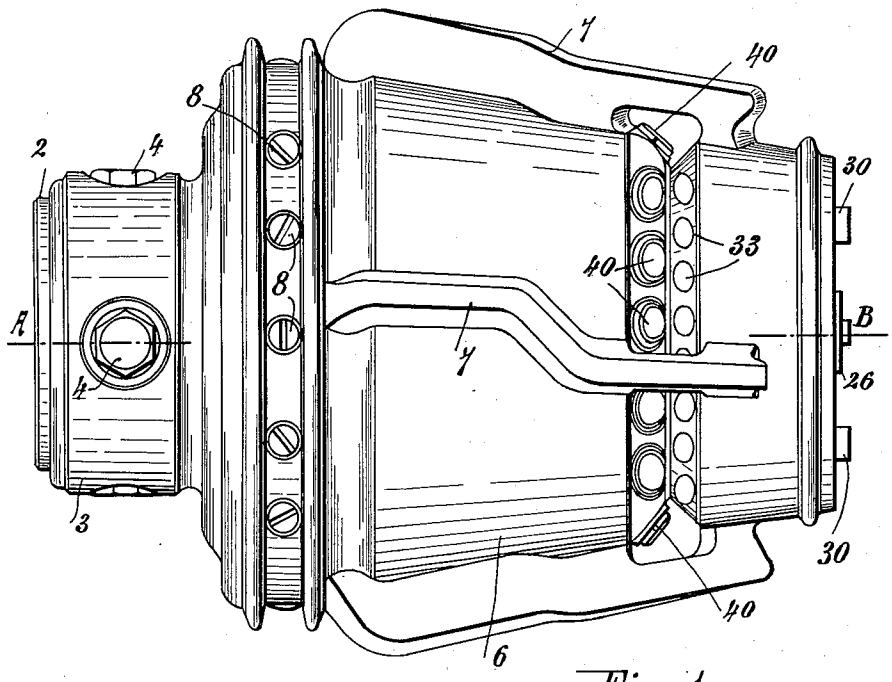


Fig. 1.

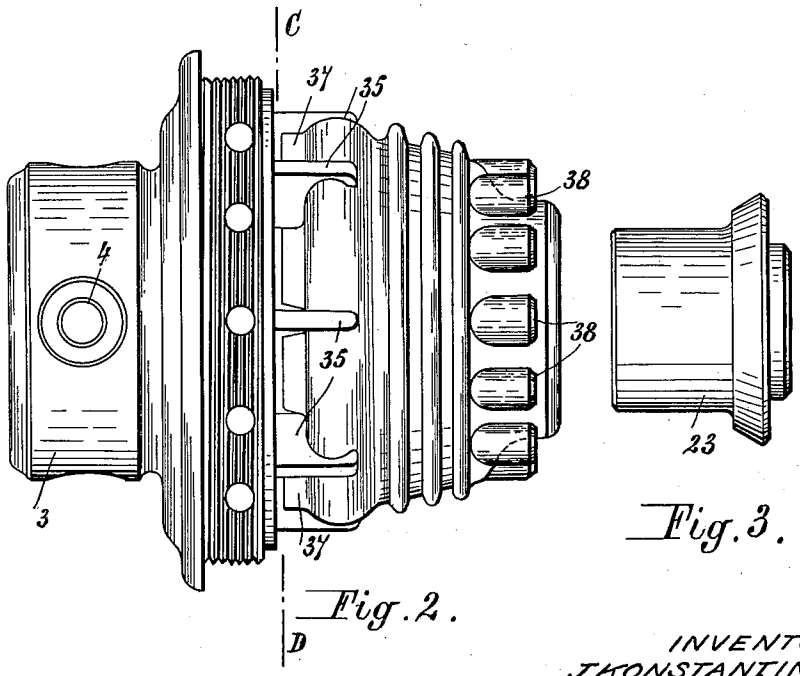


Fig. 3.

Fig. 2.

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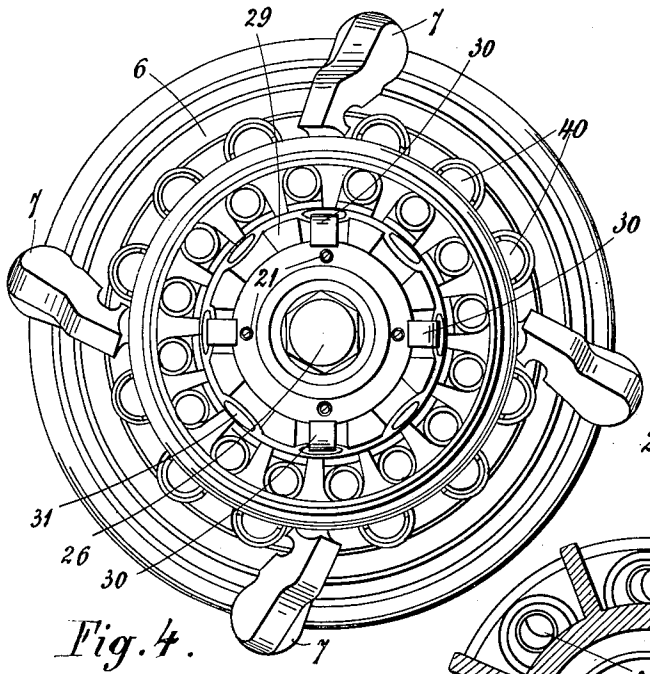


Fig. 4.

Fig. 5.

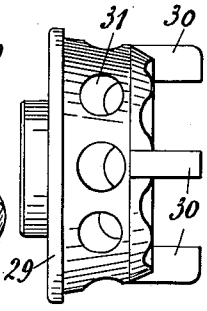


Fig. 7

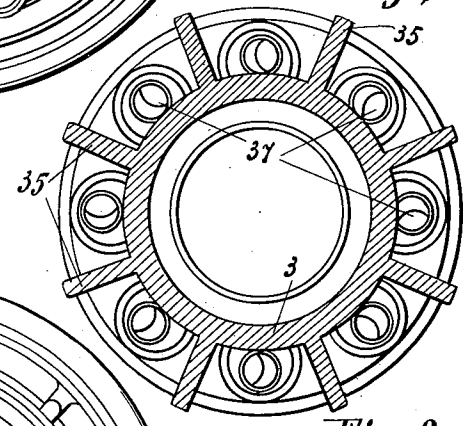


Fig. 6.

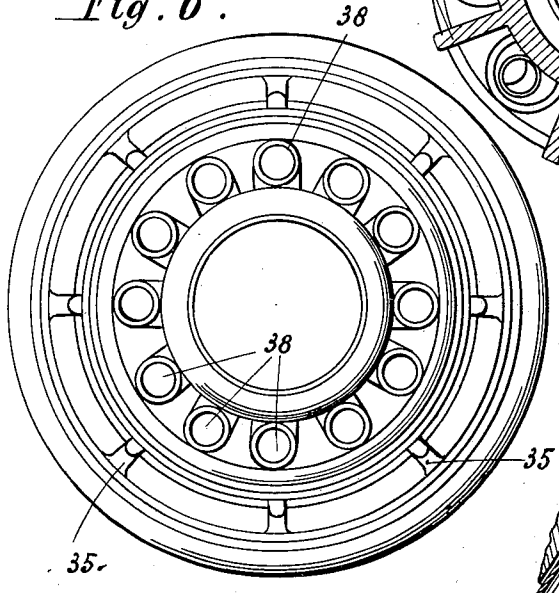


Fig. 8.

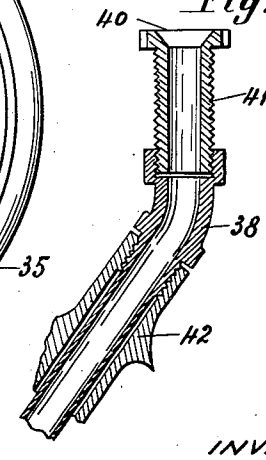


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Fig. 9

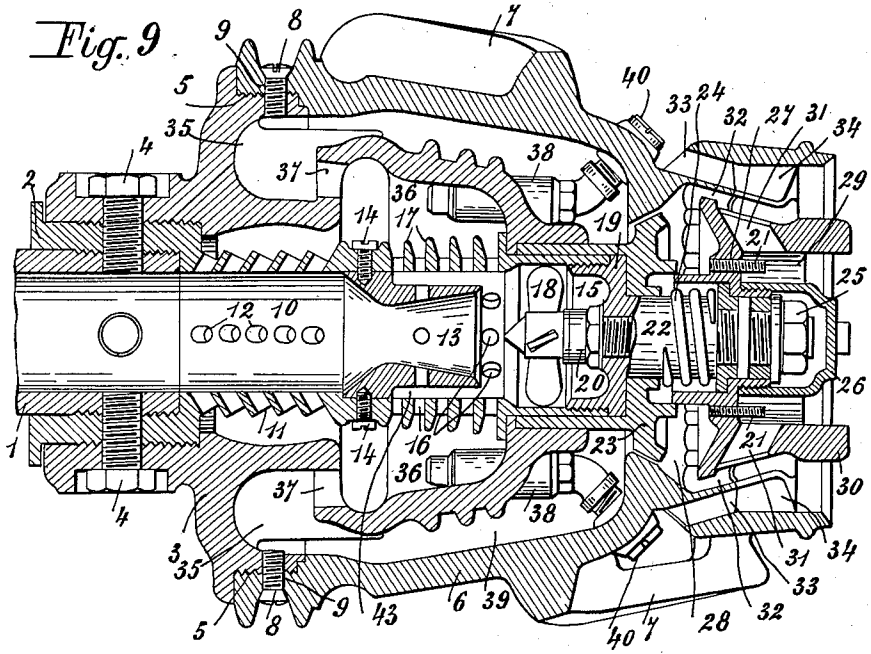



Fig. 10

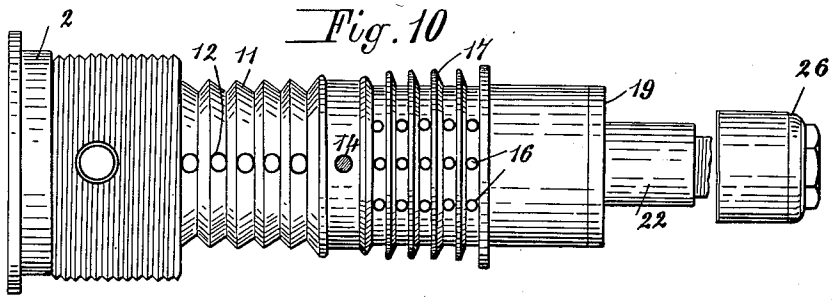



Fig. 11

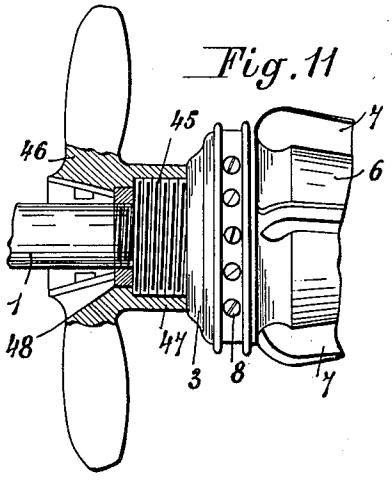
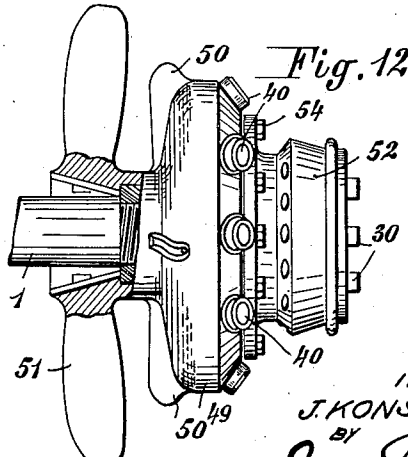



Fig. 12.

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2,020,788

# UNITED STATES PATENT OFFICE

2,020,788

## TORPEDO WAKE REDUCING DEVICE

Jean Konstantinoff, Paris, France

Application March 17, 1934, Serial No. 716,194
In France March 18, 1933

5 Claims. (Cl. 114—20)

It is known that torpedoes or submarine torpedoes are usually propelled by means of gases or of compressed air which escape in the water with such violence that they project, above the surface and all along the path followed by the torpedo, a continuous water jet visible at a great distance, this allowing the ship aimed at to exactly follow the path of the torpedo launched and to manoeuvre so as to swerve from the line followed by the latter.

In order to remedy this inconvenience, use is made, according to the present invention, of a device secured to the rear part of the propeller shaft of the torpedo and allowing to discharge, in the water, without this being visible at the surface of the latter, the gases or the compressed air which have supplied the pressure necessary for actuating the engine of the torpedo. The method employed in order to deprive the gases or the compressed air of their vis viva, after they have fulfilled their function, does not affect in any way the proper working of the engine of the torpedo and allows to completely eliminate the wake produced by the discharge of said gases or compressed air at the surface of the water all along the path followed by said torpedo. This device can be used whenever it is necessary that the exhaust of an engine should directly take place in water and also when it is desirable to obtain a perfect invisibility of the wake due to the discharge of the gases or compressed air. The device can also be used for hot or cold gases, as well as for submarines in which the accumulators are charged by means of a Diesel engine for instance, and, in this case, it will not be necessary to rise to the surface for effecting this operation. This device, besides eliminating the wake caused by the exhaust, also allows of utilizing the latter in order to increase the speed of the torpedo, by means of a suitable turbine arranged within the device.

The main feature of the process according to the present invention particularly resides in the fact that the stream due to the exhaust of the engine is progressively deprived of all its vis viva and is saturated with water. For that purpose, it is caused to pass through a diffuser and eddies are created in reverse direction to the rotation of the device by producing negative back-pressures in reverse direction to the exhaust, in order to draw in sea water for mixing it with the gases or with the compressed air discharged by the engine, so that the latter is not subjected to any braking action during the discharge of the gases converted into a fine mist in an atomizing chamber from which it escapes, through a safety valve adjustable at will, and enters a stirring chamber.

The device allowing to carry this method into practice is essentially characterized by the fact that on the rear end of the propeller shaft of the torpedo is secured a diffusion shaft divided into three sections, the first of which forms the balance or differential chamber, the second the diffusion chamber, and the third the partial vacuum or turbulence chamber, which, at its rear part, is closed by means for a plug or obturator. The latter carries, on its outer face, an extension serving as a guide for an adjustable safety valve loaded by a resilient member, whilst it is provided, on its inner face with a small rod serving as a shaft for an air screw. The three sections indicated above are surrounded by a turbine provided with vanes and which forms, with the diffusion shaft, a negative back-pressure chamber provided with channels slightly inclined relatively to the diffusion shaft and communicating with another so-called atomizing chamber. In the direction of these channels are arranged injectors putting the back-pressure chamber in communication with sea water.

The resilient member loading the safety valve is held in position by means of a stay on which freely rotates a water fountain arranged in a stirring chamber also enclosing a second fountain. The function of both fountains is to intimately stir the mixture of air and water or the mist entering this chamber when the valve is lifted from its seat.

Other features of the invention will appear from the following description.

The invention is diagrammatically illustrated, by way of example only, in the accompanying drawings, in which:

Fig. 1 is an elevation of the device.

Fig. 2 is an elevation of the turbine in which is shown the negative back-pressure chamber.

Fig. 3 is an elevation of the safety valve.

Fig. 4 is a front view of the device.

Fig. 5 is an elevation of a water fountain of the free inlet type.

Fig. 6 is a front view of the turbine.

Fig. 7 is a section made according to line C—D of Fig. 2.

Fig. 8 is a longitudinal section of an injector.

Fig. 9 is a longitudinal section made according to line A—B of Fig. 1.

Fig. 10 is an elevation of the diffusion shaft.

Fig. 11 is an elevation of a modification in the

mode of securing the device in position on the rear propeller.

Fig. 12 is an elevation of a second modification applicable to short torpedo tubes.

As illustrated in the drawings, 1 designates the rear end of the propeller shaft of the torpedo, on which end is screwed a second shaft, so-called "diffusion shaft" 2 (Figs. 9 and 10) which serves, at the same time, to secure the turbine 3 described hereinafter.

The front end of this turbine as well as those of the shafts 2 and 1 are locked together by screw bolts 4. This turbine is moreover screw-threaded at 5 in order to secure thereto the shell or body 6 enclosing the inner members of the device; this turbine is externally provided with vanes 7 rigid with the shell 6. The latter can be further secured on the turbine 3 by screws 8 passing entirely through both these elements as indicated at 9.

The diffusion shaft 2 is divided, within the device, into three sections, the first one of which forms the balance chamber 10 provided, at its periphery, with grooves 11 and openings 12. The second section of this shaft 2 constitutes the diffuser 13 secured on the shaft by means of screws 14 or otherwise. The third section forms the partial vacuum chamber 15 having openings 16 and externally provided with gills 17. This chamber is moreover provided with an air screw 18 adapted to change the direction of the gases or of the compressed air, in order to cause them to flow in a direction reverse to the rotation of the device set in motion by the propeller shaft 1 of the torpedo. The entire structure is closed by a screw plug 19 screwed in the end of the wall of the chamber 15. Inwardly of this chamber, this plug 19 carries an extension 20 which serves as a shaft for the air screw 18. Externally, it terminates in a rod 22 which serves as a guide for the safety valve 23, illustrated in detail in Fig. 3. This valve is loosely arranged on this rod and is loaded by a spring 24 wound about the latter and the tension of which can be adjusted by means of a nut 25 protected against external water by a cap 26. The spring bears, on the one hand, against the valve 23 and, on the other hand, against the lower face of a stay 27 arranged on the rod 22.

On this stay freely rotates, in the chamber 28, a water fountain 29 provided with vanes 30 and with screws 21 allowing to adjust the valve 23. The admission of water in this fountain freely takes place and nearly at right angles to the exhaust, through channels 31. The chamber 28 is moreover provided with a second water fountain 32 in which water also freely enters, but horizontally to the exhaust, through channels 33. This chamber 28, which serves as a stirring chamber, is also provided with vanes 34 allowing to stir the air or the gases and water, or the mist when issuing from the device.

The three sections 10, 13 and 15 of the diffusion shaft 2 are surrounded by a frame which constitutes, with these various parts, the turbine 3 of the device. This frame, which is provided with vanes 35, forms, with the shaft 2, a negative back-pressure chamber 36 having channels 34 slightly inclined towards the vanes 35 and in the direction of which are arranged injectors 38, the construction of which is shown in Fig. 8. Half the number of these injectors is of the same construction as that shown in this figure, whilst those of the other half constitute an evaporator. These injectors which enter the chamber 36, pass through the atomizing chamber 39 and draw in sea water through the openings 40. As shown in Fig. 8, these injectors are composed of a screw-threaded member 41 on which is screwed a curved member 38 provided with a sleeve 42. The sea water which is admitted through these injectors is intended to be mixed with the gases or with the compressed air discharged from the engine, in order to convert them into a water mist capable of being evacuated in the sea without causing the least wake at the surface of the water. The number of these injectors solely depends on the saturation with water of the gases or of the compressed air which it is desired to obtain, that is to say on the percentage which is to be mixed with the exhaust gases or with the exhaust air.

The operation of the device thus constructed is as follows:

When the discharge of the gases or of the compressed air of the engine operating the torpedo takes place, these gases pass, through the shaft 1, in the balance chamber 10 which is so devised that it allows the gases or the compressed air to issue, through the openings 12 and according to the direction of the grooves 11, only just in the quantity necessary in order that the engine should not be subjected to any braking action owing to the discharge which opposes the admission of air in the diffuser 13. When entering the latter, the gases are throttled so as to double their exhaust speed, this having for result that said gases violently enter the chamber 15 and cause the air screw 18 to rotate in reverse direction to the rotation of the device. The whirling thus obtained further increases the speed of the air or gases, but as the continual evacuation in the diffuser 13 causes a back-pressure, they are compelled to enter, under a high pressure, the annular pocket 43 formed by the diffuser 13 and the walls of the shaft 2. From this fact, the exhaust stream is forced to pass through the openings 16 and, being guided by the gills 17, enters the chamber 36 to form therein a negative and violent back-pressure. From there, it escapes through the channels 37 by exerting on the injectors 38 a great suction by drawing in sea water through the openings 40. The number of these channels and their cross section are so computed as to allow a complete evacuation of the mixture of gases or of air saturated with water contained in the chamber 36.

The proportion of water in the gases or in the compressed air can be controlled at will, and up to 70% of water can be obtained in the atomizing chamber 39 where the mixture constituted by the gases or by air and water is converted into a real mist.

The latter, before reaching the safety valve 23, exerts a pressure on the vanes 35 of the turbine and thus supplies the engine actuating the entire apparatus, with additional driving power. After exerting this pressure on the vanes, the mist reaches the outlet of the chamber 39 where it lifts the valve 23 which can be adjusted at the required pressure by means of the spring 24 and of the nut 25. The mist thus enters the chamber 28 and passes between both fountains 32 and 29 where it is thoroughly stirred by means of the vanes 34 and mixes, from this fact, once again with the water drawn in by the passage of said mist through the openings 31, 33. The mist freely mixed in this portion of the apparatus is in direct communication with the sea water in

which it finally escapes, without causing, at the surface of the latter, the least wake.

It is to be noted that the vanes **30** prevent the fountain **29**, which is not secured on the shaft **22** from participating in the rotation of the device, and it remains stationary owing to the pressure exerted by the sea water on said vanes. This arrangement ensures most intimate stirring of the water and of the air or gases. It is to be noted that the fountain **29**, by eliminating the vanes **30**, might be also actuated by the shaft of the small air screw **18**, in a direction reverse to the rotation of the apparatus and thus ensure a still better stirring action.

The solubility of air in water being taken into account, the apparatus described above allows to convert the compressed air or gases into water in a proportion of about 90%.

The remaining portion of the air or gases which is composed of quite small bubbles arising from the first mixing which is more or less perfect, does not produce, in a minimum depth of two meters, any effect capable of being perceived at the surface of the water and, consequently, the passage of the torpedo remains perfectly invisible, with the exception however of a small artificial surging produced by the vanes **7** and which is moreover rapidly absorbed in totality by the eddies caused by the propellers of the torpedo.

Fig. 11 of the drawing shows a modification in the mode of securing the device in position.

According to this modification, the device is provided with a screw-threaded end **45** screwed in the propeller **46** of the torpedo and which, for that purpose, has a sleeve **47**. As usual, the propeller is held on the shaft **1** by a nut **48**. This mode of securing the device in position is more simple than that shown in Fig. 9 and, consequently, less costly.

Fig. 12 shows a modification of the device of Fig. 9. This modification is of oval shape and the shell or casing **49** is provided with blades **50** which can be cast with the propeller **51**. The bell **52** of this apparatus which forms an exhaust chamber is secured on the shell or casing **49** by means of screw bolts **54**. This apparatus is very short and can be conveniently used for short torpedo tubes. However, in case the propeller should be forged, it would be necessary to provide the same mode of assemblage as in Fig. 11.

I claim:

1. A means for the discharge of exhaust gases without surface visibility from under-water torpedoes and like submarine engines of the type having a hollow propeller shaft forming an exhaust gas outlet, including a hollow diffuser shaft secured to the rear end of said hollow propeller shaft, a diffuser mounted in said diffuser shaft, a closure member mounted at the rear end of said diffuser shaft, a turbine casing secured to said diffuser shaft and forming a depression chamber surrounding said diffuser shaft, said diffuser shaft being formed with openings arranged in rear of said diffuser and connecting the interior of the shaft to said depression chamber, water injectors mounted in said depression chamber and connected to the exterior, said turbine casing having outlet channels in front of said injectors, vanes adjacent to said channels, a shell surrounding said turbine casing and forming an atomizing chamber therewith, and a spring loaded valve closing a discharge opening formed at the rear end of said atomizing chamber.

2. A means for the discharge of exhaust gases without surface visibility from under-water torpedoes and like submarine engines of the type having a hollow propeller shaft forming an exhaust gas outlet, including a hollow diffuser shaft secured to the hollow propeller shaft, a diffuser in said diffuser shaft, a closure member at the rear end of the diffuser shaft, an air screw rotatably mounted in the diffuser shaft between the diffuser and end closure, a turbine casing secured to the diffuser shaft and forming a depression chamber surrounding the diffuser shaft, the diffuser shaft having openings formed in rear of said diffuser and connecting the interior thereof to said depression chamber, water injectors mounted in said depression chamber and connected to the exterior, said turbine casing having outlet channels in advance of said injectors, vanes adjacent to said channels, a shell surrounding said turbine casing and forming an atomizing chamber therewith, a spring loaded valve closing a discharge opening formed at the rear end of said atomizing chamber, and rotatable stirring means mounted in rear of said discharge opening.

3. A device as claimed in claim 1, wherein the forward portion of said diffuser shaft between its forward end and said diffuser is formed with openings communicating with said depression chamber.

4. A device as claimed in claim 1, having at its forward end a screw-threaded portion to be screwed into the hub of the propeller of the torpedo or like submarine engine.

5. A device as claimed in claim 1, wherein the shell is formed integral with the propeller of the torpedo or like submarine engine.

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