

[54] **SYSTEM FOR JOINING THE LOCK CHAMBERS OF A SUBMARINE AND AN UNDERWATER ENCLOSURE**

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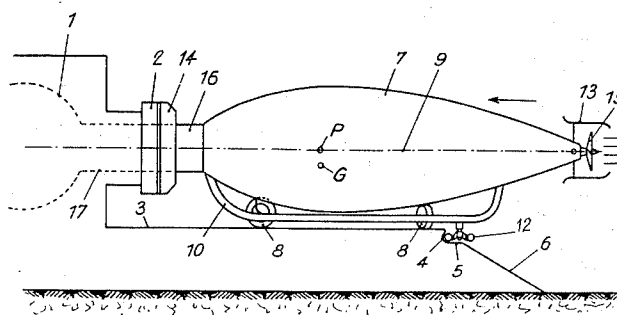
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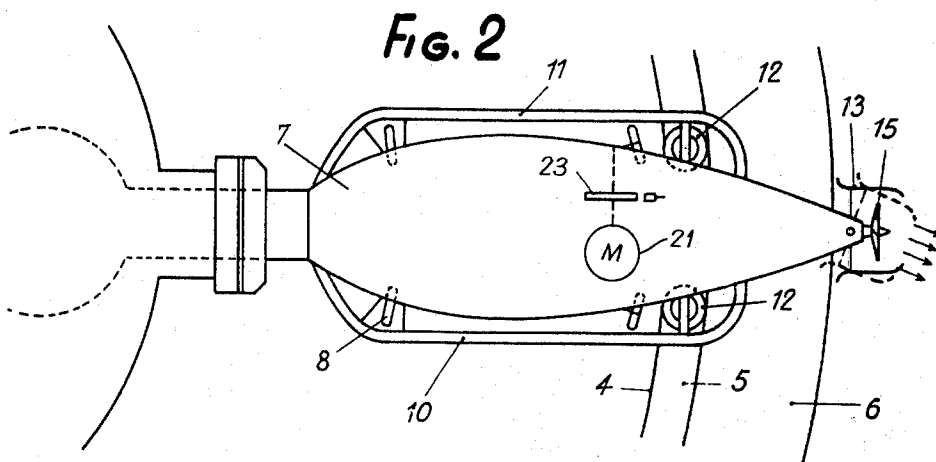
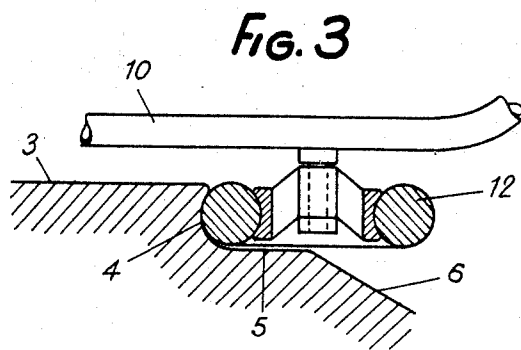
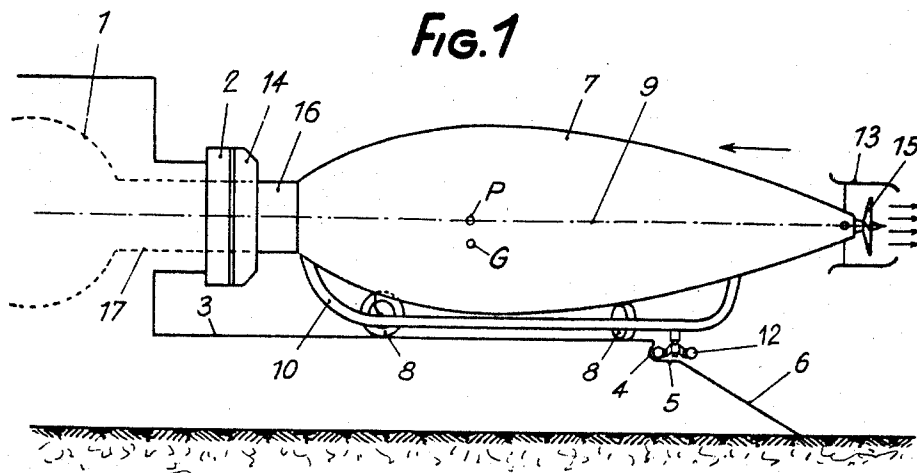
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**ABSTRACT**

An underwater enclosure on the sea bottom has an approach ramp leading to a horizontal submarine landing platform. The edge of the platform forms a circular, toric, lateral guide track, and a lock chamber for entering the enclosure is positioned above the platform. A submarine rides up the ramp on skis until vertical axle wheels in its stern engage the guide track. Wheels are then lowered from the skis and the submarine is maneuvered on the platform until its lock chamber is aligned with and joined to the lock chamber of the enclosure.

**9 Claims, 3 Drawing Figures**





# SYSTEM FOR JOINING THE LOCK CHAMBERS OF A SUBMARINE AND AN UNDERWATER ENCLOSURE

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention

This invention relates to a method and apparatus for joining the lock chamber of a submarine vessel with an enclosure of a submarine installation, particularly in deep or turbid waters preventing any visibility.

### 2. Description of the Prior Art

It is known to spot submarine objects by means of sonar, so that it is theoretically possible, by putting precision sonar on board a submarine, to perform approach maneuvers in order to reach a certain target. However, the cost of precision sonar, on the one hand, and the difficulty of getting a submarine to approach a given place, even in the absence of current, on the other hand, make such a method impractical.

## SUMMARY OF THE INVENTION

One object of the invention is therefore to provide a device for the economical and practical joining of a submarine installation and a lock chamber of a submarine vehicle. The submarine installation involves a platform parallel to the axis of the entry chamber and the submarine vehicle is provided with rolling means which enable it to move on the platform, the distance between the platform and the axis of the lock chamber of the installation being equal to that between the platform and the axis of the vessel, when the latter rests on its rolling means.

The platform can be easily spotted because of its size, and it therefore suffices to use a low-precision sonic spotting system in order to locate the target. The adherence of the platform may be easily increased by increasing the weight of the submarine so that the approach to the target is practically not influenced by the prevailing current. The energy required to move the vessel on the platform may be small, which is a very important advantage in small-dimension vessels.

Another object of the invention is to facilitate the handling of the submarine by controlling the rolling means with motors which move and brake the submarine on the platform or on the surrounding ocean bottom.

Even in the presence of a strong current it is thus easy and does not require any expenditure of energy to keep the submarine in a stationary position by blocking the wheels or by causing it to advance on the platform with a power consumption smaller than that of a conventional engine. For the control means, small hydraulic motor reduction gears are preferably used.

Another object of the invention is to increase the speed of the approach maneuver by using a junction device of the type indicated including a lateral guide track, while the submarine vessel itself is equipped with a thrust-block, cooperating with the guide track. This renders it possible to perform the maneuver in the absence of any visibility whatsoever.

Another object of the invention is to achieve a further increase in the speed and safety of the approach maneuver performed by the submarine vessel by employing, for the platform of the submarine installation, a horizontal platform whose guide track consists of a toric surface, bordering on said platform, and being connected to an access ramp leading to said platform by means of a horizontal circular crown.

The simple approximate location of the platform thus brings the submarine up to the access ramp which it clears to the point where it bumps, by means of its thrust-block, into the toric track. The submarine thus more easily reaches the level from which the junction will be performed. On the other hand, this guidance method at any moment permits the instantaneous release of the submarine since the latter is not connected to the guide track but only comes to rest against it.

Another object of the invention is to facilitate the orientation of the submarine while it clears the access ramp and returns to the horizontal position, by providing, below and toward the stern of the submarine, two wheels with vertical

axles, serving as thrust-blocks and rolling means in the toric guide track.

In this way, the support of the two wheels on the guide track easily aligns the axis of the submarine vessel in the direction of the center of the platform.

Another object of the invention is to provide a submarine vessel of the type indicated, involving carrying skis as well as rolling means and lateral guide means. Each of these means is retractable to protect them when the vessel is made to touch ocean bottom. Furthermore, the retraction of the wheels facilitates the movement of the vessel when it leaves the ocean bottom.

Another object is to increase the maneuverability of the vessel by equipping it with lateral movement means. Under these conditions, the submarine may very rapidly align its axis to coincide with that of the lock chamber of the installation and accomplish the junction.

Another object is to facilitate the rotation of the vessel around the center of the platform, using wheels with horizontal axles, the direction of each of these axles passing through the center of the platform, said axles remaining locked in this direction. A convenient means is thus provided for moving the vessel on the platform by rolling it on a circular track without having to use large lateral displacement forces.

Another object of the invention is to facilitate the junction of the lock chamber of the submarine vessel to the submarine installation by equipping said vessel with a thrust-block whose attachment axis may be moved from the side opposite the lock chamber when the axis of the submarine and the axis of the lock chamber of the installation are aligned. Thus, the moment the axes of the lock chambers coincide, the thrust-block, which keeps the vessel at a certain distance from the lock chamber of the submarine installation, may be withdrawn so that the simultaneous movement of the submarine vessel in a direction to maintain contact between the thrust-block and the guide track will bring about the junction of the lock chambers.

Another object of the invention is, again, the method thus applied, according to which the submarine, equipped with a thrust-block, establishes contact by means of said thrust-block with a guide surrounding the lock chamber of the submarine installation, moves with the aid of rolling means while remaining in contact with said guide, and advances in order to establish contact with the lock chamber of the installation the moment the lock chamber of the submarine vessel is opposite the lock chamber of the installation, the junction then being performed as a result of the movement of the thrust-block, remaining in contact with said guide means.

Other advantages and features will emerge from the following description given with reference to the attached drawing which, by way of nonrestrictive example, represents one way of implementing this invention.

## BRIEF DESCRIPTION OF THE DRAWINGS

In the drawing:

FIG. 1 represents a schematic elevation view of the lock chamber of the submarine installation according to the invention and of the lock chamber of the submarine vessel in junction positions;

FIG. 2 is a schematic plan view of the device shown in FIG. 1, and

FIG. 3 is the schematic elevation view of a guide wheel of the submarine vessel in its rolling track.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

The access 17, FIG. 1, to the enclosure 1, of the submarine installation is shown in dotted lines. This enclosure, which may have any shape whatsoever, opens up on the support crown 2 of the installation. The latter is surrounded by a horizontal platform 3 whose periphery consists of a toric surface 4 which is more visible in FIG. 3. This surface is connected to a horizontal circular crown 5 from which extends an access ramp 6.

The submarine vessel 7, FIGS. 1 and 2, is provided with retractable wheels 8 having horizontal axes. These wheels may be mounted on a pivot and equipped with a locking device that can be activated when their axes converge toward the center of the circular platform 3.

The height of the platform is such that, when the submarine vessel rests on its wheels 8, as shown in FIG. 1, the axis 9 of the submarine coincides with the axis of the support crown 2.

In the version shown here by way of example, the wheels 8 are mounted on skis 10 and 11 on which the submarine may rest after the retraction of the wheels. The details of the wheels, including their retraction, pivoting and locking means have not been illustrated in the interest of simplicity. Such features are old in the wheel art, and any suitable form may be used.

In addition to the wheels 8, each of the skis 10 and 11 has, in the rear, a wheel 12 with a vertical axle whose function is to serve as a thrust-block and as a rolling means when the submarine 7 comes alongside the platform 3 and moves laterally. The position of one wheel 12 on guide track 4 is shown more clearly in FIG. 3. The toric surface 4 receives the wheel 12 along a contact arc sufficient to provide an effective lateral rolling track, permitting the submarine to move on the platform while remaining at a specific distance from the center of the platform.

The submarine vessel carries, in its stern portion, an orientable nozzle 13, FIGS. 1 and 2, which surrounds screw 15. This nozzle, which provides great maneuverability, could be replaced by an orientable screw or by small transverse motors or jets.

When it is desired to join lock chamber 16 of the submarine vessel and access 17 of the installation, the submarine is made slightly heavier by taking on ballast. The center of thrust P and the center of gravity G of the submarine have been shown in FIG. 1. Using a low-precision sonic spotting system, the submarine is directed toward the installation at slow speed. The submarine runs into and up access ramp 6 on skis 10 and 11 and continues its advance until it rests on the horizontal platform 3. The retractable aft wheels 12 are then let down, as are the horizontal-axis wheels 8, when the latter are mounted on a pivot.

As an alternate embodiment, the wheels 8 may be driven by small hydraulic motors 21 through reduction gears. This facilitates the moving of the submarine on the platform while expending a considerably smaller amount of energy than would be used employing the main propulsion engine. Even in the presence of a strong current, the submarine can furthermore remain motionless on the platform by simply locking the brakes 23 of the wheels 8.

The main engine thus advances the submarine until wheels 12 run into toric guide track 4. The submarine thereby assumes a direction converging toward the center of the platform. If the horizontal-axis wheels have not yet been let down, it then suffices to activate their automatic placement device. This solution is suitable when the directions of the axles are locked so as to converge toward the center of the platform.

A simple, low-power transverse thrust from the nozzle 13 causes the vessel to turn around the center of the platform until the axis 9 of the submarine and the axis of the support crown 2 coincide.

When this point is reached, the vertical-axis wheels 12 are unlocked and due to the thrust exerted by the main engine, slide aft until support crown 14 of the vessel performs its junction with support crown 2 of the enclosure.

It is clear that numerous modifications could be made in the various elements involved in the device shown here, without going beyond the framework of this invention. Thus, for example, the guide track could include two spaced depressions to accommodate the wheels 12 when axis 9 of the vessel coincides with the axis of crown 2.

Similarly, platform 3 may involve two grooves or two small gutters parallel to the axis of support crown 2 and set apart from each other the same distance as the skis, their depth then being such that the axis of the entry chamber will coincide with the axis of support crown 14 when the skis are at the bottom of the grooves. In this manner we thus prevent any transverse movement of the submarine.

What is claimed is:

1. A system for joining an entry lock chamber of an underwater enclosure to a lock chamber of a submarine vessel, comprising in combination:
  - a. a platform on the underwater enclosure parallel to the axis of the entry lock chamber;
  - b. a lateral guide track on the platform;
  - c. wheel means on the submarine to enable it to move on the platform including at least one thrust absorbing wheel on the submarine having a vertical axle and adapted to cooperate with the guide track, and
  - d. the perpendicular distance between the platform and the axis of the entry lock chamber being equal to the perpendicular distance between the platform and the axis of the submarine lock chamber when the submarine rests on its wheel means on the platform.
2. A system as defined in claim 1 wherein:
  - a. the platform is horizontal,
  - b. the guide track is a toric channel lying along the edge of the platform, and further comprising,
  - c. a sloped access ramp leading up to the platform and joined to the track by a horizontal crown.
3. A system as defined in claim 2 wherein the guide track and crown are circular and the ramp is conical.
4. A system as defined in claim 1 further comprising a pair of parallel skis on the submarine to which the wheel means are mounted, the skis, the wheel means and the vertical axle wheel being retractable.
5. A system as defined in claim 1 further comprising lateral drive means for the submarine.
6. A system as defined in claim 3 wherein the wheel means have horizontal axes and are vertically pivotable, and further comprising means for locking the wheel means from pivoting in a position such that the axes of the wheel means point in the direction of the center of curvature of the platform.
7. A system as defined in claim 1 further comprising means for moving the thrust absorbing wheel further aft on the submarine when the axes of the entry lock chamber of the enclosure and the lock chamber of the submarine are aligned.
8. A system as defined in claim 4 further comprising two parallel guide tracks on the platform parallel to the axis of the entry lock chamber and spaced apart the same distance as the submarine skis.
9. A system for joining an entry lock chamber of an underwater enclosure to a lock chamber of a submarine vessel, comprising in combination:
  - a. a fixed platform on the underwater enclosure parallel to the axis of the entry lock chamber,
  - b. wheel means on the submarine to enable it to move both along the longitudinal axis of the submarine and transversely to the longitudinal axis while on the fixed platform,
  - c. alignment means on the platform for maintaining the submarine lock chamber at a set radial distance from the entry lock chamber while permitting traverse movement of the submarine to its longitudinal axis,
  - d. the perpendicular distance between the platform and the axis of the entry lock chamber being equal to the perpendicular distance between the platform and the axis of the submarine lock chamber when the submarine rests on its wheel means on the platform, and
  - e. means for driving and braking the wheel means on the submarine, the axis of the submarine lock chamber coinciding with the longitudinal axis of the submarine.

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