

Underwater Transport Container for Combat Divers

The invention relates to an underwater transport container, which allows combat divers to bring equipment stored in the underwater transport container to the place of use undetected as far as possible. Combat divers are deployed for an undetected operation, for example, from a submerged submarine and usually take their equipment from a transport container, which can be mounted on the outside or stored in the weapon barrel. The disadvantage, however, is that the load must regularly be removed in situ and then the load is transported on the surface of the water, where the probability of detection is increased.

The object of the invention is to create an underwater transport container that can be safely transported by combat divers in the submerged state and can only be emptied above the water surface at the operation site.

This object is achieved by an underwater transport container with the characteristics specified in claim 1. Advantageous further developments result from the subordinate claims, the following description as well as the drawings.

The underwater transport container according to the invention comprises a front section, a central section and a rear section. The underwater transport container further comprises a cylindrical base shape for storing in a weapon barrel, and therefore has a diameter that is smaller than or equal to a diameter of an ejector body intended for ejection from a weapon barrel, preferably a diameter of less than or equal to 600 mm but greater than 100 mm. The central section comprises at least one storage area. The front section comprises at least one first buoyancy compensation element, the rear section comprises at least one second buoyancy compensation element. The first buoyancy compensation element and the second buoyancy compensation element are arranged inside the underwater transport container. The front section comprises at least one first surface buoyancy element, the rear section comprises at least one second surface buoyancy element. The first buoyancy compensation element and the second buoyancy compensation element are suitable for adapting the buoyancy to the ambient conditions. The first surface buoyancy element and the second surface buoyancy element can be switched between a compacted state in the interior of the underwater transport container and a buoyancy-generating state.

The underwater transport container may comprise a large storage area, which also allows the storage of a large piece of equipment. Alternatively, the underwater transport container may also comprise two or more separate storage areas. The advantage of this embodiment is that the buoyancy is only reduced to a lesser extent when water enters a single storage area.

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Buoyancy compensation elements are used for setting the buoyancy in a targeted and time-dependent manner. By means of the buoyancy compensation elements, the buoyancy can be adjusted, for example, to salinity and temperature, but also to the immersion depth. The latter can be particularly important in order to keep the load stable even at different decompression stages.

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The surface buoyancy elements are used to ensure safe and stable buoyancy for the rise to the surface and the removal of the load from the storage area. Particularly preferably, the surface buoyancy elements in the buoyancy-generating state are largely disposed outside the cylindrical base shape of the underwater transport container and thus ensure maximum stabilization at the water surface. In this case, the surface buoyancy elements should also be able to compensate for the ingress of water into the storage area during unloading. Particularly preferably, in the buoyancy-generating state the surface buoyancy elements are disposed horizontal to the water surface and transverse to the longitudinal direction of the underwater transport container. Particularly preferably, the at least two surface buoyancy elements are arranged at opposite ends in the longitudinal direction of the underwater transport container. This effectively results in stabilization at the four corners of the underwater transport container.

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The buoyancy compensation elements are preferably located in an area of the underwater transport container that is flushed by water. In a preferred embodiment, only the storage area is or only the storage areas are not flushed by water.

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In a further embodiment of the invention, the storage space of the underwater transport container is pressure-tight against a water pressure arising externally. In this way, penetration of water can be safely prevented even in the submerged state.

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In a further embodiment of the invention, the first surface buoyancy element is formed from a first first surface buoyancy part element and a second first surface buoyancy part element and the second surface buoyancy element is formed from a first second surface buoyancy part element and

a second second surface buoyancy part element. Here, the first first surface buoyancy part element and the second first surface buoyancy part element can be connected to each other or completely separated from each other. Likewise, the first second surface buoyancy part element and the second second surface buoyancy part element can be connected to each other or completely separated from each other.

In a further embodiment of the invention, the first first surface buoyancy part element and the second first surface buoyancy part element each have the same buoyancy in the buoyancy-generating state. Similarly, the first second surface buoyancy part element and the second second surface buoyancy part element each have the same buoyancy in the buoyancy-generating state. The first first surface buoyancy part element and the first second surface buoyancy part element are arranged on the starboard side and the second first surface buoyancy part element and the second second surface buoyancy part element are arranged on the port side. Preferably, the first and the second surface buoyancy part elements are arranged symmetrically to the longitudinal axis of the underwater transport container.

In a further embodiment of the invention, in the buoyancy-generating state the first surface buoyancy element and the second surface buoyancy element are arranged substantially transversely to the longitudinal direction of the underwater transport container. By this arrangement, good stability can be achieved in the raised state at the water surface.

In this context, essentially transverse means on the one hand an alignment transverse, i.e. at a 90° angle, to the longitudinal axis. But embodiments in which the surface buoyancy elements take, for example, an X-shape are also conceivable. It is important that the surface buoyancy elements have a significant component in the transverse direction, i.e. an angle greater than 45° to the longitudinal axis.

In a further embodiment of the invention, the maximum buoyancy of the first buoyancy compensation element and the second buoyancy compensation element together amount to between 2% and 30%, preferably between 5% and 15% of the buoyancy of the entire underwater transport container with the first surface buoyancy element and the second surface buoyancy element in the compacted state. The underwater transport container is preferably balanced during loading in such a way that it has a slight downforce, i.e. slightly more mass than displacement.

Thus, with a comparatively low buoyancy volume of the buoyancy compensation elements, an adjustment to depth and environmental conditions can be made. In particular, it is possible to gradually adjust the depth of the dive between the application depth and the surface, thus giving divers at different depths the time for decompression. In addition, it is possible to adapt to the height profile, especially in the coastal or shore area, or even in rivers.

In a further embodiment of the invention, the maximum buoyancy of the first surface buoyancy element and the second surface buoyancy element together amounts to between 90% and 200%, preferably between 100% and 125% of the buoyancy of the entire underwater transport container with the first surface buoyancy element and the second surface buoyancy element in the buoyancy-generating state. The surface buoyancy elements must ensure a stable position at the water surface, which can be achieved by this dimensioning. The downforce corresponds to the total mass of the underwater transport container.

In a further embodiment of the invention, the underwater transport container, with the first surface buoyancy element and the second surface buoyancy element in the compacted state and minimal buoyancy of the first buoyancy compensation element and the second buoyancy compensation element, has a buoyancy that is between 1% and 15%, preferably between 2% and 8% less than the mass of the underwater transport container. Due to this design, the underwater transport container can be adjusted very well to depth and environmental conditions by means of the buoyancy compensation elements.

In a further embodiment of the invention, the central section below the storage area comprises at least one gas storage device. Preferably, the storage area and the area of the at least one gas storage device are separated by a floor. The floor is particularly preferably removable.

For example and in particular, gas pressure bottles can be used as a gas storage device, in particular commercially available breathing air bottles. Particularly preferably 2 to 20, more preferably 4 to 12 gas pressure bottles are used.

Alternatively or additionally, reactive gas storage devices can be used, for example sodium azide. These have the advantage of a very compact design and a very fast release speed.

In a further embodiment of the invention, in the buoyancy-generating state the first surface buoyancy element and the second surface buoyancy element have a greater volume than the storage area. This is used to ensure the ability to float even when the storage area is completely flooded. Particularly preferably, the volume of the surface buoyancy elements is selected to be so large that not only can penetrating water be compensated, but the load, which usually has a higher density than water, can also be compensated. Particularly preferably, in the buoyancy-generating state the first surface buoyancy element and the second surface buoyancy element have a greater volume than the storage area plus the volume that is required for compensation of the mass of the equipment stored in the storage area.

In a further embodiment of the invention, the outer skin of the underwater transport container consists of one or more materials selected from the group comprising aluminum and fiber-reinforced plastic, in particular carbon fiber-reinforced plastic and glass fiber-reinforced plastic.

In a further embodiment of the invention, the underwater transport container comprises at least one first gas distribution system, wherein the first gas distribution system is designed for the distribution of gas between at least one gas storage device and the first buoyancy compensation element, the second buoyancy compensation element, the first surface buoyancy element and the second surface buoyancy element, wherein the gas distribution system is manually operated from the back of the rear section. This allows a diver swimming behind the underwater transport container to easily change the buoyancy and thus the diving depth of the underwater transport container. The absence of electronic components results in a robust and fail-safe design.

In a further embodiment of the invention, the underwater transport container comprises at least one first gas distribution system, wherein the first gas distribution system is designed for the distribution of gas between at least one gas storage device and the first buoyancy compensation element, the second buoyancy compensation element, the first surface buoyancy element and the second surface buoyancy element, wherein the gas distribution system is automatically electronically controlled. In particular, this even allows adaptation to a pre-programmed diving profile.

In a further embodiment of the invention, the underwater transport container comprises a first gas distribution system, wherein the first gas distribution system is designed for the distribution of gas

between at least one first gas storage device and the first buoyancy compensation element and the second buoyancy compensation element, wherein the first gas distribution system can be manually operated from the back of the rear section. Furthermore, the underwater transport container comprises a second gas distribution system, wherein the second gas distribution system is designed for the distribution of gas between a second gas storage device and the first surface buoyancy element and the second surface buoyancy element, wherein the second gas distribution system can be operated manually from the back of the rear section. In a preferred embodiment, the first gas distribution system and the second gas distribution system are separated, i.e. not connected to each other. This leads to the fact that even in the event of failure of a system or exhaustion of the gas supply, in particular for the buoyancy compensation elements, safe surfacing and thus removal of the transported load are possible.

In a further embodiment of the invention, the underwater transport container comprises a first gas distribution system, wherein the first gas distribution system is designed for the distribution of gas between at least one first gas storage device and the first gas buoyancy compensation element and the second buoyancy compensation element, wherein the first gas distribution system is automatically electronically controlled. Furthermore, the underwater transport container comprises a second gas distribution system, wherein the second gas distribution system is designed for the distribution of gas between a second gas storage device and the first surface buoyancy element and the second surface buoyancy element, wherein the second gas distribution system is automatically electronically controlled. In a preferred embodiment, the first gas distribution system and the second gas distribution system are separated, i.e. not connected to each other. This leads to the fact that even in the event of failure of a system or exhaustion of the gas supply, in particular for the buoyancy compensation elements, safe surfacing and thus removal of the transported load are possible. Due to the electronic control, it is in particular even possible to adapt to a pre-programmed diving profile.

In a further embodiment of the invention, the underwater transport container comprises at least one first closure element for the closure of the storage area of the central section, wherein the first closure element can be completely reversibly connected to the underwater transport container. The first closure element could be connected to the underwater transport container, for example, also in the form of a flap. However, this leads to the risk of the flap being closed by the swell during unloading and can lead to injury to persons who are removing the load at this very time. The first

closure element can also be prevented from floating away after being completely released, for example by means of a rope or wire.

5 In a further embodiment of the invention, the underwater transport container comprises at least one first closure element for the closure of the storage area of the central section, wherein the first closure element can be connected to the underwater transport container with a hinge.

10 In a further embodiment of the invention, the underwater transport container comprises a weapon coupling at the back of the rear section for deployment from a weapon barrel. Such weapon couplings are known, for example, from mines or torpedoes.

15 In a further embodiment of the invention, the underwater transport container comprises a coupling at the front of the front section for coupling to an underwater vehicle. Preferred examples of such an underwater vehicle are vehicles that are used as support by divers to overcome larger distances and that therefore comprise an energy supply and a propulsion system.

20 In a further embodiment of the invention, the underwater transport container comprises a respective coupling at the front of the front section and at the back of the rear section for coupling two underwater transport containers.

Of course, multiple underwater transport containers can also be coupled to an underwater vehicle.

For example, and in particular, the underwater transport container has a diameter of 533 mm.

25 The underwater transport container according to the invention is explained below in more detail on the basis of an exemplary embodiment shown in the drawings.

Fig. 1 shows a longitudinal section through an underwater transport container

Fig. 2 shows a top view of an underwater transport container

30 Fig. 3 shows a further top view of an underwater transport container

Fig. 4 shows a detailed view of the closure element

Fig. 5 shows a cross-section through an underwater transport container

Fig. 6 shows a weapon barrel with two underwater transport containers in cross-section

In fig. 1 through fig. 5 an underwater transport container 10 is shown from different perspectives.

In fig. 1 the front section 20, the central section 30 and the rear section 40 of the underwater transport container 10 can be recognized. The front section 20 comprises a first buoyancy compensation element 50 and a first surface buoyancy element 70, the rear section comprises a second buoyancy compensation element 60 and a second surface buoyancy element 80. The first surface buoyancy element 70 and the second surface buoyancy element 80 are arranged in the compacted state inside the underwater transport container 10. In the buoyancy-generating state, the first surface buoyancy element 70 and the second surface buoyancy element 80 protrude far out of the underwater transport container 10, as can be clearly seen in fig. 2. The storage area 90 and the gas storage devices 110 are arranged in the central section 30. In the rear section 40, a weapon coupling 100 is arranged in order to be able to eject the underwater transport container 10 from a weapon barrel 160.

Fig. 2 shows the underwater transport container 10 in an oblique top view perspective. The first first surface buoyancy part element 72, the second first surface buoyancy part element 74, the first second surface buoyancy part element 82 and the second second surface buoyancy part element 84 can be recognized, each in the buoyancy-generating state. By the arrangement of the surface buoyancy element 70, 80 substantially transverse to the longitudinal direction of the underwater transport container 10, optimal stabilization of the underwater transport container 10 at the water surface is achieved.

In fig. 1 and fig. 2 it can be clearly recognized that the volume of the first buoyancy compensation element 50 and the second buoyancy compensation element 60 inside the underwater transport container 10 is used to change the buoyancy.

The first buoyancy compensation element 50, the second buoyancy compensation element 60, the first surface buoyancy element 70, the first first surface buoyancy part element 72, the second first surface buoyancy part element 74, the second surface buoyancy element 80, the first second surface buoyancy part element 82 and the second second surface buoyancy part element 84 are for example and preferably made of a plastic material, which is also suitable for the production of inflatable boats, for example.

In fig. 3, the first second surface buoyancy part element 82 is shown in the compacted state to show the difference from the buoyancy-generating state. In the compacted state, the first second surface buoyancy part element 82 is arranged entirely inside the underwater transport container 10. In addition, handles 120 can be recognized, onto which a diver can hold or with which a diver can push the underwater transport container 10. Preferably, the handles 120 are at least partially designed such that a crane hook for the recovery of the underwater transport container 10 can be arranged thereon. In addition, the underwater transport container 10 comprises a fire-fighting coupling 130, as is common in the submarine area. In the event of a fire, especially if the underwater transport container 10 is stored inside a submarine, a corresponding fire extinguisher can be connected via the coupling to extinguish a fire inside.

The closure element 140 is shown enlarged in fig. 4. In the example shown, the closure element 140 comprises a retaining boss 142 that allows the underwater transport container 10 to be fixed in a weapon barrel 160. The closure element 140 is fastened by means of ten lever clamping fasteners 144, five on each side. This allows the closure element 140 to be easily removed completely by divers. In order to prevent the penetration of water into the storage area 90, the underwater transport container 10 comprises a seal 146. The storage area 90 is closed at the bottom by a floor 150, under which gas storage devices 110 are arranged. This division can be clearly recognized in fig. 5 in cross section.

Fig. 6 shows schematically two underwater transport containers 10 in a weapon barrel 160. After opening the muzzle flap 162, the two underwater transport containers 10 can be ejected by means of an ejection device 164 and received by divers.

Reference characters

- 10 underwater transport container
- 20 front section
- 30 central section
- 40 rear section
- 50 first buoyancy compensation element
- 60 second buoyancy compensation element
- 70 first surface buoyancy element

	72	first first surface buoyancy part element
	74	second first surface buoyancy part element
	80	second surface buoyancy element
	82	first second surface buoyancy part element
5	84	second second surface buoyancy part element
	90	storage area
	100	weapon coupling
	110	gas storage device
	120	handle
10	130	fire-fighting coupling
	140	closure element
	142	retaining boss
	144	lever clamping fasteners
	146	seal
15	150	floor
	160	weapon barrel
	162	muzzle flap
	164	ejection device

Claims

1. An underwater transport container (10), wherein the underwater transport container (10) comprises a front section (20), a central section (30) and a rear section (40), wherein the underwater transport container (10) has a cylindrical base shape for storage in a weapon barrel (160), wherein the central section (30) comprises at least one storage area (90), wherein the front section (20) comprises at least one first buoyancy compensation element (50), wherein the rear section (40) comprises at least one second buoyancy compensation element (60), wherein the first buoyancy compensation element (50) and the second buoyancy compensation element (60) are arranged inside the underwater transport container (10), wherein the front section (20) comprises at least one first surface buoyancy element (70), wherein the rear section (40) comprises at least one second surface buoyancy element (80), wherein the first buoyancy compensation element (50) and the second buoyancy compensation element (60) are suitable for adapting the buoyancy to the ambient conditions, wherein the first surface buoyancy element (70) and the second surface buoyancy element (80) can be switched between a compacted state in the inner part of the underwater transport container (10) and a buoyancy-generating state.
2. The underwater transport container (10) as claimed in claim 1, **characterized in that** the first surface buoyancy element (70) is formed from a first first surface buoyancy part element (72) and a second first surface buoyancy part element (74) and the second surface buoyancy element (80) is formed from a first second surface buoyancy part element (82) and a second second surface buoyancy part element (84).
3. The underwater transport container (10) as claimed in claim 2, **characterized in that** the first first surface buoyancy part element (72) and the second first surface buoyancy part element (74) each have the same buoyancy in the buoyancy-generating state, wherein the first second surface buoyancy part element (82) and the second second surface buoyancy part element (84) each have the same buoyancy in the buoyancy-generating state, wherein the first first surface buoyancy part element (72) and the first second surface buoyancy part element (82) are arranged on the starboard side, wherein the second first surface buoyancy part element (74) and the second second surface buoyancy part element (84) are arranged on the port side.

4. The underwater transport container (10) as claimed in any one of the preceding claims, **characterized in that** the first surface buoyancy element (70) and the second surface buoyancy element (80) in the buoyancy-generating state are arranged essentially transversely to the longitudinal direction of the underwater transport container (10).
5. The underwater transport container (10) as claimed in any one of the preceding claims, **characterized in that** the maximum buoyancy of the first buoyancy compensation element (50) and the second buoyancy compensation element (60) together amounts to between 2% and 30%, preferably between 5% and 15% of the buoyancy of the entire underwater transport container (10) with the first surface buoyancy element (70) and the second surface buoyancy element (80) in the compacted state.
6. The underwater transport container (10) as claimed in any one of the preceding claims, **characterized in that** the maximum buoyancy of the first surface buoyancy element (70) and the second surface buoyancy element (80) together amounts to between 90% and 200 %, preferably between 100% and 125% of the downforce of the entire underwater transport container with the first surface buoyancy element (70) and the second surface buoyancy element (80) in the buoyancy-generating state.
7. The underwater transport container (10) as claimed in any one of the preceding claims, **characterized in that** with the first surface buoyancy element (70) and the second surface buoyancy element (80) in the compacted state and with the minimum buoyancy of the first buoyancy compensation element (50) and the second buoyancy compensation element (60), the underwater transport container (10) has a buoyancy between 1% and 15 %, preferably between 2% and 8% less than the mass of the underwater transport container (10).
8. The underwater transport container (10) as claimed in any one of the preceding claims, **characterized in that** the central section (30) comprises at least one gas storage device (110) below the storage area (90).
9. The underwater transport container (10) as claimed in any one of the preceding claims, **characterized in that** in the buoyancy-generating state, the first surface buoyancy element (70) and the second surface buoyancy element (80) have a larger volume than the storage area (90).

10. The underwater transport container (10) as claimed in any one of the preceding claims, **characterized in that** an outer skin of the underwater transport container (10) consists of one or more materials selected from the group including aluminum, fiber-reinforced plastic, in particular carbon fiber-reinforced plastic and glass fiber-reinforced plastic.
11. The underwater transport container (10) as claimed in any one of the preceding claims, **characterized in that** the underwater transport container (10) comprises at least one first gas distribution system, wherein the first gas distribution system is designed for the distribution of gas between at least one gas storage device (110) and the first buoyancy compensation element (50), the second buoyancy compensation element (60), the first surface buoyancy element (70) and the second surface buoyancy element (80), wherein the gas distribution system can be operated manually from the back of the rear section (40).
12. The underwater transport container (10) as claimed in any one of the preceding claims, **characterized in that** the underwater transport container (10) comprises a first gas distribution system, wherein the first gas distribution system is designed for the distribution of gas between at least one first gas storage device (110) and the first buoyancy compensation element (50) and the second buoyancy compensation element (60), wherein the first gas distribution system can be manually operated from the back of the rear section (40), wherein the underwater transport container (10) comprises a second gas distribution system, wherein the second gas distribution system is designed for the distribution of gas between a second gas storage device (110) and the first surface buoyancy element (70) and the second surface buoyancy element (80), wherein the second gas distribution system can be manually operated from the back of the rear section (40).
13. The underwater transport container (10) as claimed in any one of the preceding claims, **characterized in that** the underwater transport container (10) comprises at least one first closure element (140) for the closure of the storage area (90) of the central section (30), wherein the first closure element (140) can be completely reversibly connected to the underwater transport container (10).

14. The underwater transport container (10) as claimed in any one of the preceding claims,
characterized in that the underwater transport container (10) comprises a weapon coupling (100) at the back of the rear section (40) for deployment from a weapon barrel (160).
15. The underwater transport container (10) as claimed in any one of the preceding claims,
characterized in that the underwater transport container (10) comprises a coupling at the front of the front section (20) for coupling to an underwater vehicle.