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COASTAL AND LIKE DEFENSE UNIT

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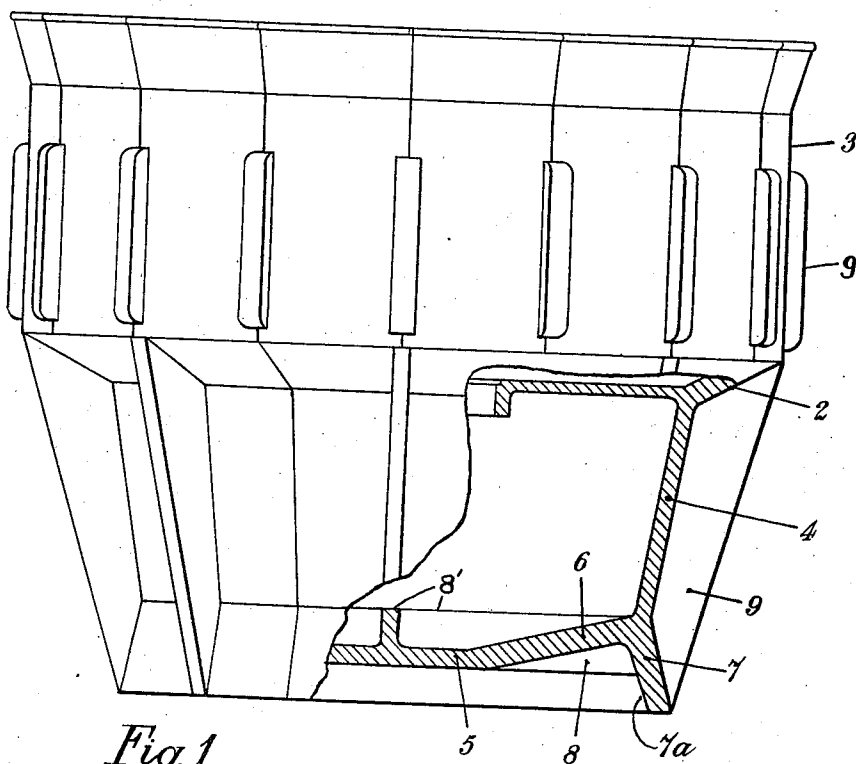


Fig. 1.

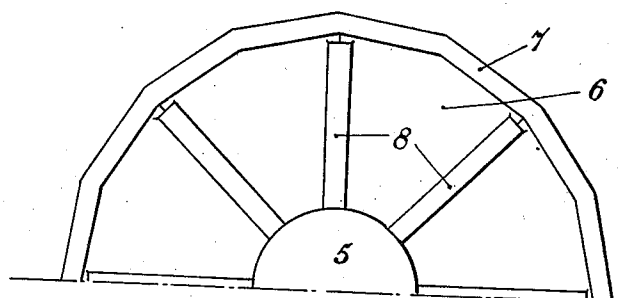


Fig. 2.

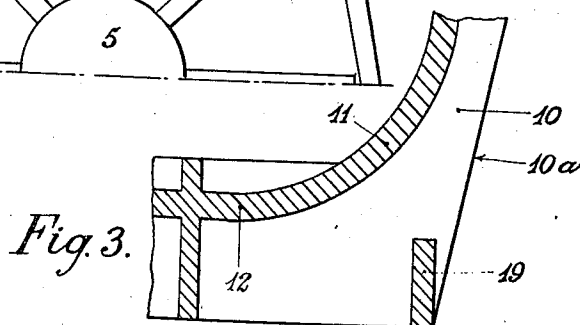


Fig. 3.

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## UNITED STATES PATENT OFFICE

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## COASTAL AND LIKE DEFENSE UNIT

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4 Claims. (Cl. 114—4)

This invention relates to coastal and like defense units and is particularly concerned with units of the general character described in the specification of British patent application No. 10,822 of 1940. Such units comprise floating hulls and are intended to be built of reinforced concrete or other suitable material. The shape and dimensions of the unit may embody considerable variations to obtain the necessary steadiness. Thus for example the structure may resemble a truncated cone with the apex downwards, or may be of stepped formation including two or more truncated cone sections or cylindrical sections of different size, or various combinations of these. The different sections may be cylindrical or polygonal in plan and certain sections, more particularly the uppermost section which lies at the water plane, may approximate to an oval shape in plan, i. e., the part or parts in question may be elongated in the horizontal direction.

An object of the present invention is to provide a unit of the above general character having an improved structural form giving the necessary stability, and steadiness. Another object is to provide a hull form which facilitates the building of the unit and subsequent launching.

According to the invention a floating unit or hull, of the character and for the purposes described, is provided with a flat, curved or dome bottom surrounded by a circular or annular keel. According to a further feature of the invention, the said keel may be of relatively heavy construction, i. e., its thickness in cross-section may be substantially greater than that of the contiguous wall of the structure of which the keel may form the lowermost part or a downward continuation. The provision of the keel has the dual effect of offering resistance to rolling or angular movement in all directions, and lowering the centre of gravity of the unit, thus improving its general behaviour particularly in disturbed water.

A further advantage of the annular keel is that it provides a footing upon which the unit may rest stably when grounded for any reason, as for example during construction or when in dry docking. Moreover if the unit should be grounded when in service, e. g., due to an unusually low tide, the keel will tend to assist the unit to hold firmly in its grounded position by suction.

In some circumstances, however, the suction effect afforded by the keel may not be desired and in order to meet this requirement, through-ways or passages are formed in the keel below the bot-

tom proper of the unit at or near its junction with the shell.

According to a further feature of the invention, strengthening gussets or webs may be provided connecting the keel and bottom of the unit.

According to a further feature of the invention the keel may be spaced from the wall of the structure and connected thereto by gussets or webs that extend between the hull of the unit and the keel.

It is preferred to construct the keel of reinforced concrete integrally with the main portion of the hull structure. The keel reinforcement will be interconnected with the reinforcement of the walls and bottom of the unit, and/or with the reinforcement of the strengthening webs where these are provided.

It will be understood that while the preferred form of the keel is circular, i. e., comprising an annulus, this may be modified so that the keel is polygonal. The sides may be parallel or inclined to the vertical axis of the unit.

The hull may be of stepped form.

In the accompanying drawing:

Figure 1 is an elevation, partly in section, of a stepped unit having a keel according to the invention,

Figure 2 is an inverted plan view of the unit showing the bottom and keel, and

Figure 3 is a part section of a modified form in which the keel is separated from the unit and is connected thereto by webs or gussets.

In carrying the invention into effect, according to one convenient mode (see Figures 1 and 2) as applied by way of example to a reinforced concrete unit adapted to accommodate a crew of about six to twelve men, the structure comprises a stepped hull 1 having a maximum diameter of about twenty-three feet and a total height of about twenty feet. The hull is stepped at 2 and comprises a substantially cylindrical or prismatic upper portion 3 and a lower portion 4 of truncated conical form joined to the upper portion by the shoulder or step 2. It will be understood that this feature of stepping of the hull is in no sense necessary to the present invention.

The diameter at the base of the unit is about thirteen feet in the present example and the bottom 5 in shape may be convex downwards or substantially flat except for an inclined annular portion 6 where the bottom joins the sides. The average thickness of the hull shell and bottom may vary from about 5 inches upwards. The keel 7 is circular in plan and forms a downward, outwardly extending continuation of the side wall

of the unit. The keel 7 may be between two and three feet in depth, and of corresponding suitable thickness, and may be thicker than the hull shell. The keel may be of downwardly tapered shape in cross-section.

Any convenient number of strengthening webs, beams or gussets 8 may be provided extending between the inner wall 7a of the keel and the outer inclined portions 6 of the bottom.

The upper surface of the bottom is further strengthened by the provision of cross ribs 8<sup>1</sup>.

When required, through-ways or channels are provided extending from outside the keel at its junction with the bottom and the interior of the keel between the webs. These channels may be of any convenient size and number. Preferably they lie closely adjacent to the underside of the bottom.

Gussets or webs 9 are also provided in the space formed by the lower wall 4, the step 2 and the keel 7. These webs extend to the bottom of the keel and are of substantial depth to provide strength and resistance to angular movement of the unit about its axis. Vertical buffer bars 9<sup>1</sup> are also arranged about the outer cylindrical wall of the upper part 3.

It will be understood that while the invention has been described as applied to a particular form of hull, it may be applied with equal facility and advantage to other forms for example to forms approximating to that of the conventional buoy.

In the construction of a unit as above described, the mould for the lower part including the keel may be formed by a block secured to the erection floor or platform, and surrounded by shuttering. After the concreting has been completed and the unit is ready for removal, some difficulty may be experienced in separating the bottom from the moulding block due to suction effect. The provision of vent passages combined with a relieved or tapered form of the inner surface of the keel as previously described overcomes this difficulty, and if necessary water or compressed air may be introduced into one or more of the said passages to assist in the separation. Thus the invention not only provides an improved structure for use as a defense unit which possesses the advantages in service indicated in the foregoing, but one which is easier to build and handle.

According to a modified arrangement of keel, as applied more particularly to a unit in which the hull is not stepped (see Figure 3), the keel 19 is separated from the wall of the unit and comprises a circular concrete ring which may be reinforced by metal members extending into

gussets or webs 10. These gussets extend outwardly from the wall 11 of the unit and also downwardly from the bottom 12 of the unit. The diameter of the keel ring may vary but conveniently the edge 10a of the web is substantially parallel to the wall of the unit and extends downwardly to the outer surface of the keel ring. With this arrangement gussets of substantial height and depth are provided particularly at the lower part adjacent the keel ring which improve the stability of the unit and provide substantial resistance to rolling and/or angular movement. With the increased diameter afforded by the separated keel 19 the thickness may be considerably less than in the form first described above and may be less than the thickness of the wall of the hull.

I claim:

1. A floating coastal defense unit including a hull composed of an upper part, a lower part, a lateral shoulder joining the upper and lower parts together, the lower part being a downwardly decreasing area in cross section, an annular keel depending and flared outwardly from the bottom of the lower part, and bracing fins respectively on the outer surfaces of the side walls of the lower part between the shoulder and the keel and between the keel and the bottom.

2. A floating coastal defense unit including a hull comprising an upper part, a lower part of small diameter, a lateral shoulder portion joining the upper and lower parts, the lower part including a bottom having a central flat portion and an inclined outer portion, the walls of the lower part of the hull being tapered downwardly and joined with the inclined portion of the bottom thereof, an annular and outwardly flared keel depending from the bottom part of the hull, radially arranged gussets between the inner surface of the keel and the outer surfaces of the inclined portions of the bottom, and a series of laterally extending vertically arranged fins on the outer surface of the side walls of the lower part of the hull and joining the annularly inclined shoulder and the outwardly flared keel.

3. A floating unit as claimed in claim 2, in which all of the foregoing parts are formed of concrete and arranged so as to be cast in one piece.

4. A floating unit as claimed in claim 2, in which additional reinforcing bars are arranged in cross formation on the upper surface of the lower part and formed integrally therewith.

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