G. J. K. BEHRMANN & E. HURLBRINK.

CONNING TOWER FOR SUBMARINE AND DIVING VESSELS.

APPLICATION FILED DEC. 10, 1909.

1,011,012. Patented Dec. 5, 1911.

Fig. 1.

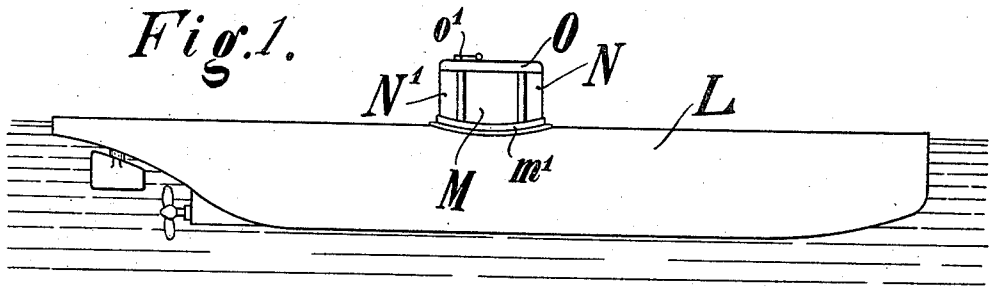


Fig. 2.

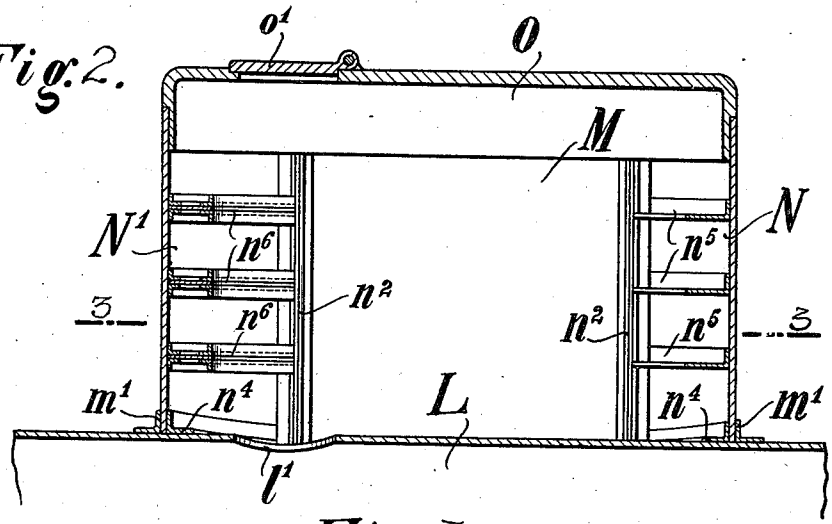
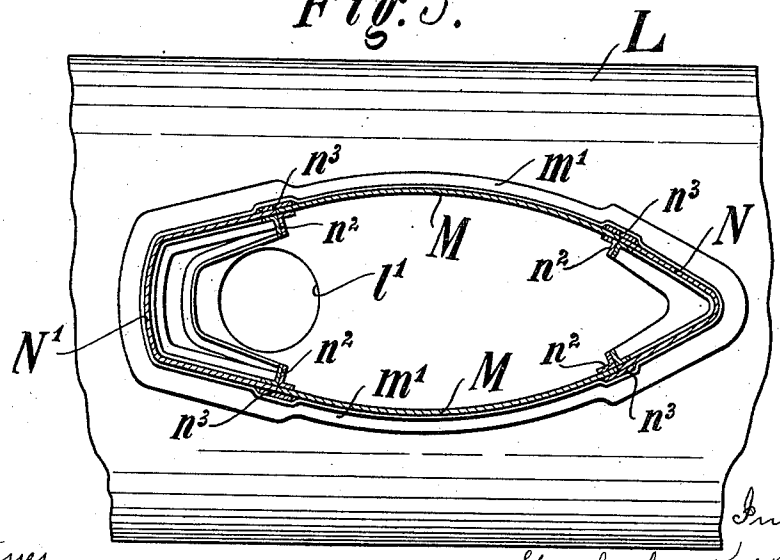


Fig. 3.



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CONNING-TOWER FOR SUBMARINE AND DIVING VESSELS.

1,011,012. Specification of Letters Patent. Patented Dec. 5, 1911.

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To all whom it may concern:

Be it known that we GEORG JOACHIM KARL BEHRMANN and ERNST HURLBRINK, both subjects of the Emperor of Germany, and residing at Kiel, Germany, have invented certain new and useful Improvements in Conning-Towers for Submarine and Diving Vessels, of which the following is a specification.

The present invention relates to conning towers for submarine and diving vessels. Heretofore conning towers of this description have been given a perfectly circular cross-section, or else an elliptical one. The circular shaped conning tower fulfils the highest claims as regards strength, but on the other hand, produces very great resistance to speed in the water, and must consequently be made comparatively small. Towers of elliptical section are very favorable as regards utilization of space, but lay very slight claim to resistance against outside water pressure and it is very difficult to compute their strength. In order, notwithstanding, to obtain enough safety when using elliptical tower construction, resource had to be taken either to allow to a certain extent deformations of the tower; or else to making the side walls thereof strong enough to be able to resist, under all conditions, the outside water pressure. In the latter case, the weight of the vessel was naturally unfavorably increased.

The object of the present invention, is to produce a conning tower for submarine and diving vessels, which, on the one hand, gives little speed resistance and permits of good use of space, and, on the other hand, possesses such a cross-section, that the strain on the tower from outside water pressure may be computed exactly enough, so that the tower may possess the greatest safety against undue changes in shape with the use of least material.

One embodiment of our invention is represented in the drawing, wherein:—

Figure 1 shows in elevation a diving vessel provided with conning tower; Fig. 2, the conning tower with part of the vessel in a vertical, longitudinal section and in larger scale than Fig. 1, and Fig. 3, a section on line 3—3 of Fig. 2.

The conning tower consists principally of two side walls M, bent to circular arches, and two abutments N, N^1, bent V-shaped and U-shaped, respectively, and firmly and tightly connected to the side walls M, by means of angles n^2 and straps n^3 all riveted together, the plates at the joints running tangentially to the side walls M. The tower further consists of a roof O provided with an entrance-hatch o^1. The roof is also firmly and tightly riveted to the walls M, N and N^1 of the tower. The entire tower is riveted to the hull L of the boat through the medium of a ring m^1 of L-shaped cross-section and two angle-plates n^4 arranged within the abutments N and N^1. The ring m^1 is greatly enlarged at those places where it lies against the abutments N and N^1. On their inside the abutments N and N^1 are provided with strong angular braces n^5 and n^6 which extend horizontally and which are of L-shaped cross-section and I-shaped cross-section respectively. When a diving boat provided with such a conning tower dives the exterior pressure of the water tends to press the side-walls M toward each other. However as the side walls are suspended in an arch-like manner between their abutments N and N^1 their arch-thrust is transmitted to the straight parts of the tangentially running abutments N and N^1. The straight sides of the abutments will then be strained as evenly loaded beams, raised on edge, and rigidly supported at both ends (at the tower-roof O, and the hull L). They will therefore be subjected to an easily computed stress, and, having a sufficiently high cross-section in horizontal direction, will transfer the arch-thrust completely to the firm tower-roof O, and the hull L. The braces n^5, n^6 have only to prevent any possible buckling of the abutments N, N^1 from outside water pressure and to retain the straight walls in the tangential position to the side walls M, this being the most favorable position, for taking up the arch-thrust.

As the kind of the stress on the different parts of the conning tower described in the foregoing is completely capable of inspection and as the dimension of the parts can thus be exactly calculated, a collapse of the tower due to the exterior water-pressure can be avoided with certainty without unnecessary expenditure of material. This is not the case with the conning towers having elliptical cross-section. Furthermore the

conning tower shown in the drawings permits of almost the same utilization of space as a conning tower of elliptical cross-section.

Instead of making one abutment V-shaped and the other U-shaped, both abutments N, N^1 might be made V-shaped, or both U-shaped. And furthermore instead of making the wall of four parts, as described in the foregoing, the wall might be divided into two longitudinal halves and the halves, which may be pressed, may be connected together by rivets. The rigid connection between the several parts of the tower might of course also be obtained by welding. Finally, the entire tower with the cover O and the reinforcing ribs may be formed as an integral casting (steel-casting or bronze-casting). However, in all instances, to obtain the desired effect the basic form of the tower as shown in Fig. 3 must be retained, as the side walls M, must be bent as circular arches, on the one hand, and on the other hand the abutments N, N^1, being V-shaped or U-shaped and having straight sides, must run tangentially to the sides M.

The side walls M of the above described conning tower may be built on the principle of a cone instead of a circular cylinder. Without deviation from the object of the invention, the arching of the side-walls M may furthermore be slightly out of a true circular section, as the then appearing bending-moments will be very small as compared with the considerably larger stresses obtained by computing the walls against buckling.

Having thus described our invention, what we now claim as new and desire to secure by Letters Patent, is:—

1. A conning tower for submarine or diving vessels, the side-walls of which are curved as circular arcs, and terminate in straight abutments, continuing from the arcs in directions substantially tangential thereto.

2. A conning tower for submarine or diving vessels, the side-walls of which are curved as circular arcs, and terminate in straight abutments, continuing from the arcs in directions substantially tangential thereto; said abutments being respectively V-shaped and U-shaped, in cross-section, and forming the bow and stern parts of the tower.

3. A conning tower for submarine or diving vessels, the side-walls of which are curved as circular arcs, and terminate in straight abutments, continuing from the arcs in directions substantially tangential thereto; said abutments being respectively V-shaped and U-shaped, in cross-section, and forming the bow and stern parts of the tower, and a plurality of horizontal braces being provided for said abutments to prevent buckling.

The foregoing specification signed at Kiel, Germany, this 24th day of November, 1909.

GEORG JOACHIM KARL BEHRMANN.
ERNST HURLBRINK.

In presence of—
JULIUS RÖPKE,
KURT BUNDE.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."