G. E. ELIA.

SHIP OR VESSEL.

APPLICATION FILED MAR. 6, 1909.

966,813. **Patented Aug. 9, 1910.**

Fig. 1.

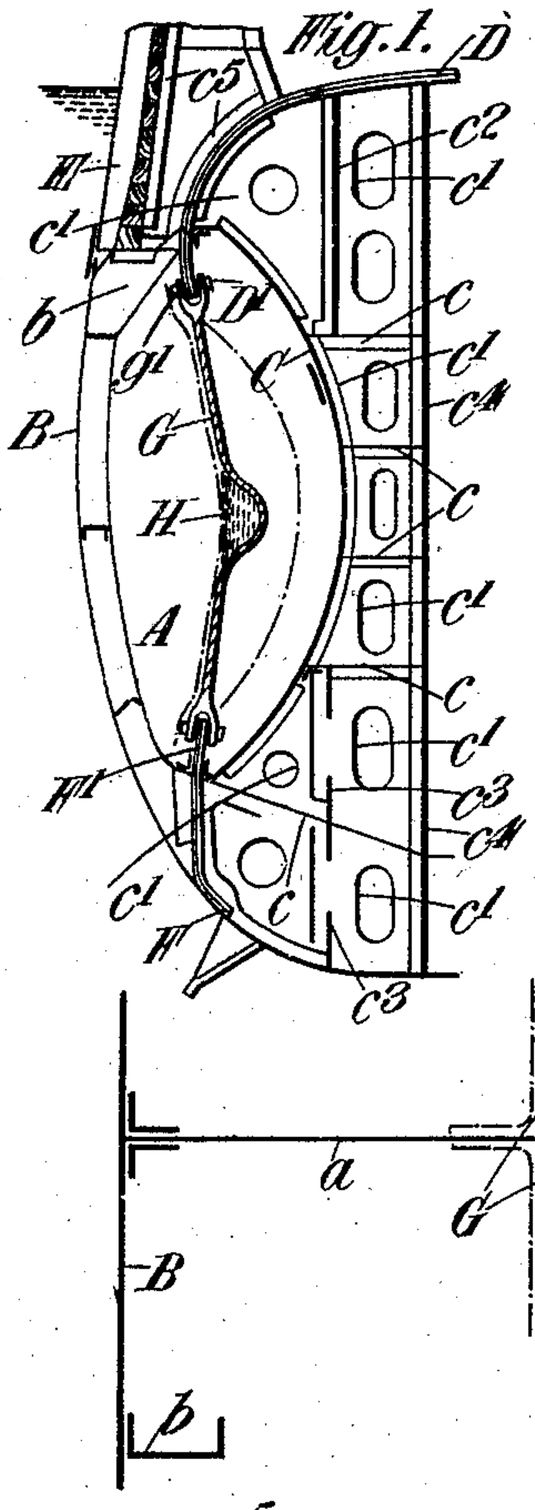


Fig. 2.

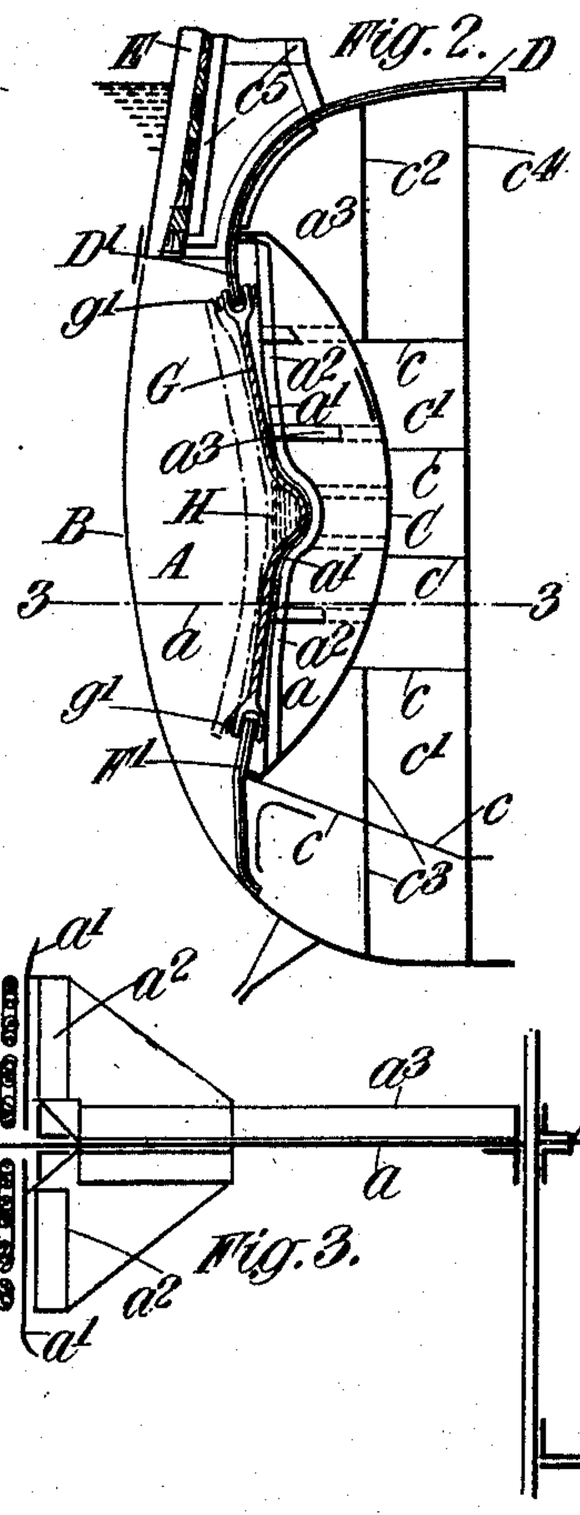


Fig. 4.

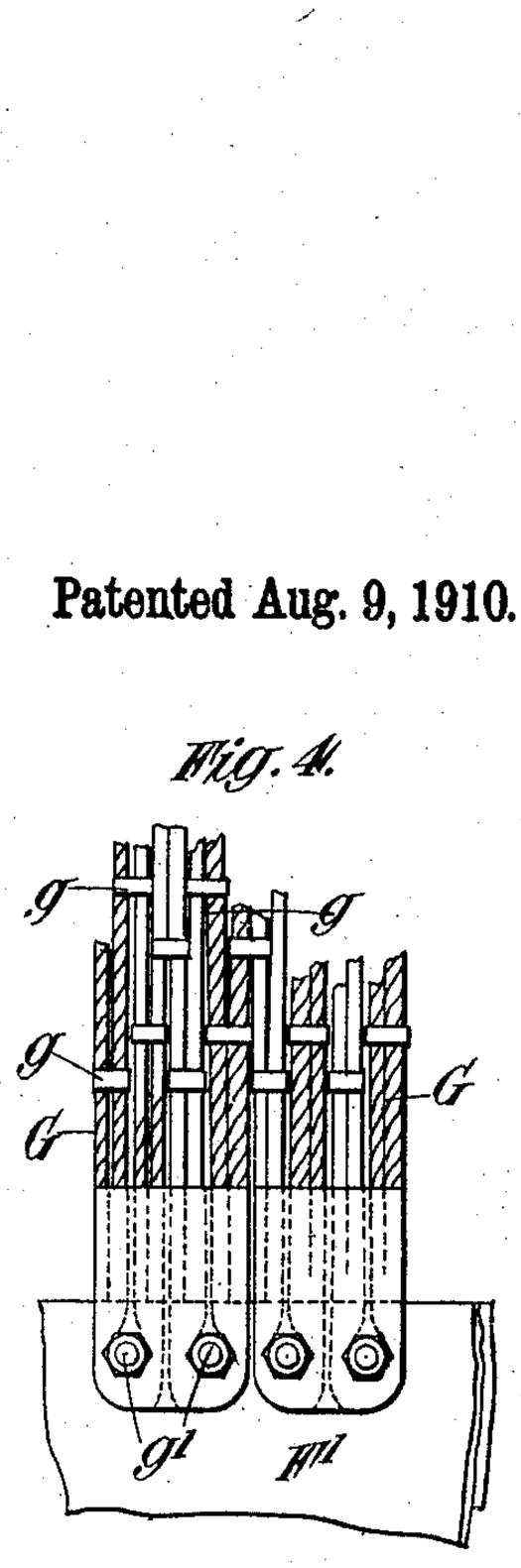


Fig. 3.

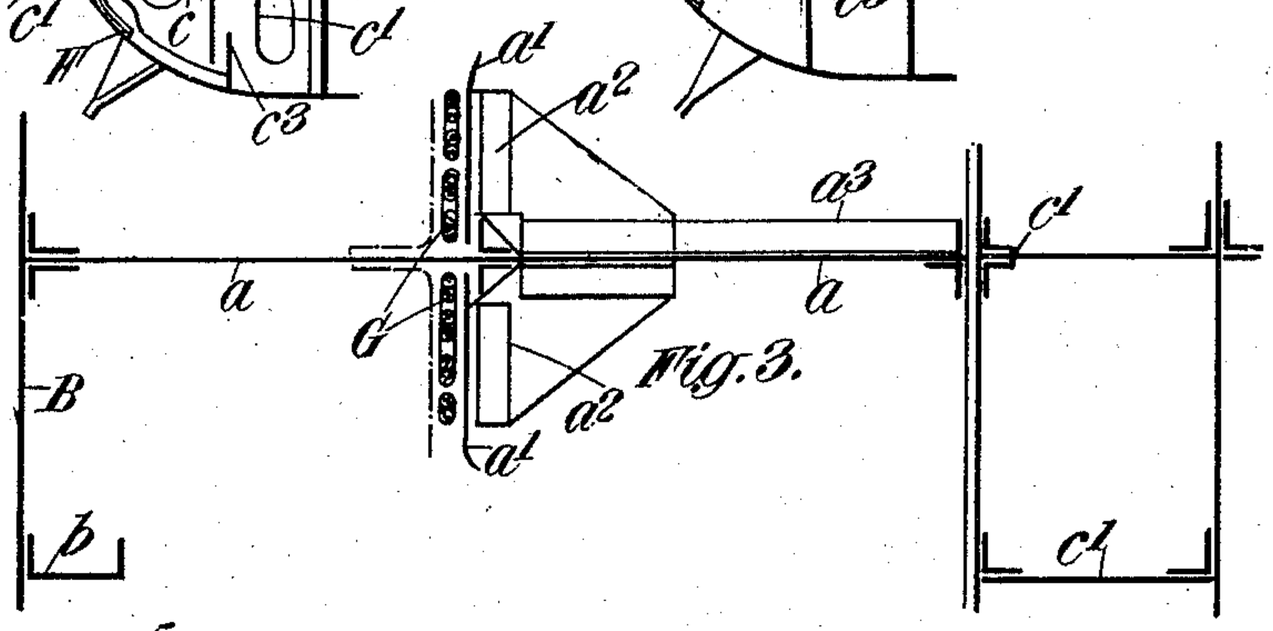


Fig. 5.

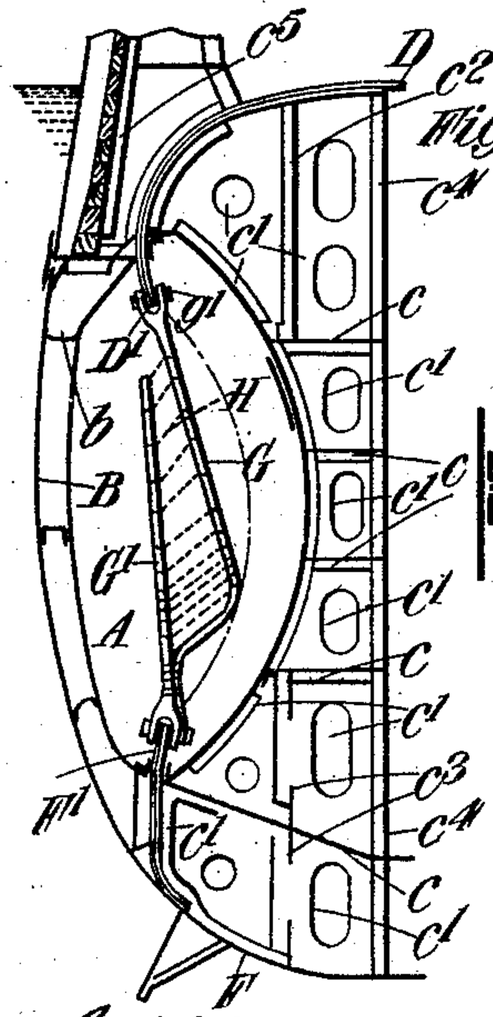
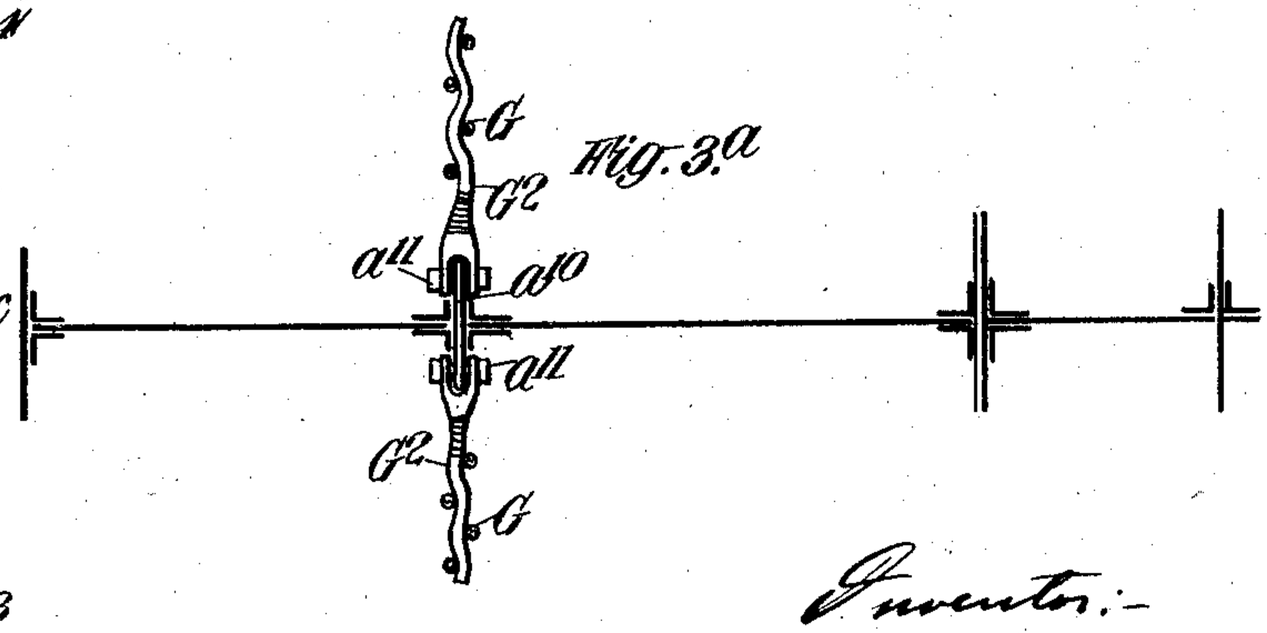


Fig. 3a.



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UNITED STATES PATENT OFFICE.

GIOVANNI EMANUELE ELIA, OF PARIS, FRANCE.

SHIP OR VESSEL.

966,813. Specification of Letters Patent. Patented Aug. 9, 1910.

Application filed March 6, 1909. Serial No. 481,573.

To all whom it may concern:

Be it known that I, GIOVANNI EMANUELE ELIA, a subject of the King of Italy, residing at Hotel Astoria, Avenue des Champs Elysees, Paris, in the Republic of France, have invented certain new and useful Improvements in Ships or Vessels, of which the following is a specification.

This invention relates to ships and vessels and is particularly applicable for use in connection with vessels employed in naval warfare, and has for its object to provide increased protection to those parts of the vessel which are liable to torpedo attack or to contact with submarine mines.

The invention consists mainly in neutralizing the destructive force resulting from the sudden generation of a large volume of hot gases on explosion of the torpedo or mine, by allowing the said gases to expand in a chamber or chambers situated around the ship for reducing the apparent density of charge at the moment of the ships contact with and consequent explosion of the torpedo or mine, and in opposing to the partly expanded gases a series of successive resistances extending in front of the part of the ship to be protected and particularly designed with a view to offering a large number of cooling surfaces to the explosive gases. By thus providing for the expansion of the explosive gases and the absorption of their kinetic energy as well as their heat, the said gases are rendered incapable of materially damaging the vital parts of the ship.

In order that my said invention may be clearly understood and readily carried into effect I will describe the same with reference to the accompanying drawings in which:—

Figure 1 is a transverse section of a portion of a battleship constructed in accordance with this invention. Fig. 2 is a similar view taken at a transverse bulkhead. Fig. 3 is a horizontal section on line 3, 3 of Fig. 2. Fig. 3^A is a similar view to Fig. 3 showing a modification. Fig. 4 is a detached view drawn to a larger scale showing a method of connecting the ends of the elements of the protecting device to a portion of the ship. Fig. 5 is a similar view to Fig. 1 showing a slightly modified arrangement of protecting device.

In the arrangement shown in Figs. 1 and 2, the outer wall of the chamber A comprises thin plating B supported by light framings *b* suitably connected at their upper and lower ends to the adjacent portions of the ship. The inner wall of the chamber A comprises a strong concave bulkhead C supported by longitudinal framings *c* and lateral framings *c'* which also support intermediate bulkheads or division plates c^2, c^3 and an inner watertight bulkhead c^4. The above mentioned framings and bulkheads support the protective deck D and also the framings c^5 which carry the armor E. The protective deck D terminates in a double plate which extends into the chamber A. The outer plating F of the bottom of the ship also carries or terminates in a double plate which extends into the chamber A. This arrangement constitutes two strong points of attachment for the aforesaid device used for resisting the pressure and absorbing the kinetic energy of the explosion gases, said device being hereinafter referred to as the protecting device. The said arrangement also provides a ready means for enabling the said protecting device to be caused to occupy a position closer to or further away from the ship's side according to requirements. The protecting device shown by these figures comprises an arrangement of flexible steel wire cables G situated within the chamber A and extending from the top to the bottom thereof. These cables may conveniently be double and be connected together by bindings *g* as shown in Fig. 4 and be secured to the double plates at D' and F' by being looped around strong bolts *g'* which pass through the said double plates. The cables G are formed with a bend or pocket which is normally maintained by means of a number of small steel wire cables H connected to the main cables G. The cables H individually possess a comparatively small breaking resistance and extend one in front of the other across the aforesaid bend and are separated from each other by intervening spaces which may be gradually reduced toward the apex of the bend or pocket. A thin metal plate extending over the front surface of the cables G and H completes the protecting device, and prevents the explosion gases from prematurely passing between the cables.

The chamber A is divided into a number of watertight compartments by transverse bulkheads *a* (Fig. 3) and the wire cables are conveniently arranged in sections, one of which is situated within each compart-

ment. In order to prevent the explosion gases from passing between any two of such sections into the watertight compartments behind the same a baffle plate a' corresponding to the shape normally assumed by the cables G is supported on each side of the bulkheads a by suitable framings such as a^2, a^3. Another arrangement for effecting this purpose may consist in providing between two contiguous compartments vertical plates a^{10}, Fig. 3A, corresponding to the shape normally assumed by the cables G and in intermeshing with the said cables horizontal cables G^2 the adjacent ends of which are connected to the plates a^{10} by being looped around the bolts a^{11}.

When a submarine explosion occurs, the thin outer plating and framings are first ruptured and the explosion gases expand in the chamber A and successively rupture the small cables H. These cables offer a large number of cooling surfaces to the explosion gases and virtually act in the capacity of condensers for reducing the expansion of the said gases. During the time that the cables H are being successively ruptured the cables G are forced backward by the pressure of the explosion gases and are caused to assume a position approximating to that indicated by the dotted line in Fig. 1, the thin metal sheet preventing the said gases from entering the watertight compartments behind the strong cables until the latter become ruptured. When this occurs, the explosion gases are permitted to further expand in the said compartments whereby their pressure is sufficiently reduced to prevent any serious damage from being inflicted upon the strong or essential framing of the ship.

In the modification shown in Fig. 5 two screens G G′ of the strong steel wire cables are employed, the cables G being connected to the top and bottom double plates in the manner above described with reference to Figs. 1 and 2. The cables G′ however are connected to one of such plates only, and are attached to the cables G by comparatively weak cables H which gradually increase in length from the free ends of the cables G′ so that the cables G are caused to assume the bent position approximating to that shown in the drawing. By this arrangement when the cables G G′ are subjected to the pressure caused by a submarine explosion the cables H are successively ruptured from the shortest to the longest of such cables, and the gases in passing between the same meet with a large number of cooling surfaces with the result that their expansion is materially diminished. During this action the cables G G′ approximately assume the curved position indicated by the dotted line and by reducing the distance between the cables H as they increase in length, their resistance is gradually increased and the impact of the explosion gases upon the cables G G′ when the cables H have all been ruptured is reduced. It will be understood that in this arrangement the cables G′ are covered by a thin metal sheet to prevent the explosion gases from passing between such cables into the watertight compartments behind the same until the cables are ruptured.

What I claim and desire to secure by Letters Patent of the United States is:—

1. A device for protecting ships from the effects of submarine explosions, comprising a chamber extending around the portion of the ship to be protected, a plurality of strong cables arranged within the said chamber, and rows of weaker cables connected to the aforesaid cables in such manner as to retain the latter in a partly contracted condition.

2. A device for protecting ships from the effects of submarine explosions, comprising a strong inner bulkhead extending around the portion of the ship to be protected, a thin outer bulkhead incasing the strong bulkhead and arranged at a considerable distance therefrom, a plurality of strong cables interposed between the said bulkheads, and rows of weaker cables connected to the aforesaid cables in such manner as to retain the latter in a partly contracted condition.

3. A device for protecting ships from the effects of submarine explosions, comprising a strong inner bulkhead extending around the portion of the ship to be protected, a thin outer bulkhead, incasing the strong bulkhead and arranged at a considerable distance therefrom, a plurality of transverse bulkheads dividing the space between the inner and outer bulkheads into a plurality of compartments, a series of strong cables arranged within the said compartments, and rows of weaker cables connected to the aforesaid cables in such a manner as to retain the latter in a partly contracted condition.

4. A device for protecting ships from the effects of submarine explosions, comprising a strong inner bulkhead extending around the portion of the ship to be protected, a thin outer bulkhead incasing the strong bulkhead and arranged at a considerable distance therefrom, a plurality of transverse bulkheads dividing the space between the inner and outer bulkheads into a plurality of compartments, and a plurality of flexible resisting members arranged longitudinally one in front of the other within the said compartments and separated from each other by intervening spaces.

5. A device for protecting ships from the effects of submarine explosions, comprising a strong inner bulkhead extending around the portion of the ship to be protected, a thin outer bulkhead incasing the strong bulkhead and arranged at a considerable distance therefrom, a plurality of transverse bulk-

heads dividing the space between the inner and outer bulkheads into a plurality of compartments, a plurality of flexible resisting members arranged longitudinally one in front of the other within the said compartments, the said members being separated from each other by intervening spaces and arranged to completely cover the strong bulkhead, expansion chambers intervening between the outermost of the flexible members and the thin outer bulkhead.

6. A device for protecting ships from the effects of submarine explosions, comprising a strong inner bulkhead extending around the portion of the ship to be protected, a thin outer bulkhead incasing the strong bulkhead and arranged at a considerable distance therefrom, a plurality of transverse bulkheads dividing the space between the inner and outer bulkheads into a plurality of compartments, rows of cables arranged longitudinally between the inner and outer bulkheads, the said rows being separated from each other by intervening spaces and from the thin outer bulkhead by expansion chambers.

7. A device for protecting ships from the effects of submarine explosions, comprising a strong inner bulkhead extending around the portion of the ship to be protected, a thin outer bulkhead incasing the strong bulkhead and arranged at a considerable distance therefrom, a plurality of transverse bulkheads dividing the space between the inner and outer bulkheads into a series of compartments, a flexible member dividing each compartment into an inner and outer compartment, and a series of flexible members connected to the aforesaid member in such a manner as to retain the latter in a partly contracted condition.

8. A device for protecting ships from the effects of submarine explosions, comprising a strong inner bulkhead extending around the portion of the ship to be protected, a thin outer bulkhead incasing the strong bulkhead and arranged at a considerable distance therefrom, a plurality of transverse bulkheads dividing the space between the inner and outer bulkheads into a series of compartments, flexible members dividing the said compartments into inner and outer compartments, and a series of flexible members connected to the aforesaid members in such a manner as to retain the latter in a partly contracted condition.

9. A device for protecting ships from the effects of submarine explosions, comprising a strong inner bulkhead extending around the portion of the ship to be protected, a thin outer bulkhead incasing the strong bulkhead and arranged at a considerable distance therefrom, a plurality of transverse bulkheads dividing the space between the inner and outer bulkheads into a series of compartments, a plurality of strong cables dividing the said compartments into inner and outer compartments, and rows of weaker cables connected to the aforesaid cables in such a manner as to retain the latter in a partly contracted condition.

10. A device for protecting ships from the effects of submarine explosions, comprising a strong inner bulkhead extending around the portion of the ship to be protected, a thin outer bulkhead incasing the strong bulkhead and arranged at a considerable distance therefrom, a plurality of transverse bulkheads dividing the space between the inner and outer bulkheads into a series of compartments, a plurality of strong cables dividing the said compartments into inner and outer compartments, rows of weaker cables connected to the aforesaid cables in such a manner as to retain the latter in a partly contracted condition and a covering plate extending in front of the combined cables and having an area approximating to the longitudinal area of each compartment.

11. A device for protecting ships from the effects of submarine explosions, comprising a strong inner bulkhead extending around the portion of the ship to be protected, a thin outer bulkhead incasing the strong bulkhead and arranged at a considerable distance therefrom, a plurality of transverse bulkheads dividing the space between the inner and outer bulkheads into a series of compartments, a plurality of strong cables dividing the said compartments into inner and outer compartments, rows of weaker cables of unequal lengths connected to the aforesaid cables in such a manner as to retain the latter in a partly contracted condition, a covering plate extending in front of the combined cables and having an area approximating to the longitudinal area of each compartment, and means for preventing the premature escape of the explosion gases between the adjacent ends of the covering plates.

12. A device for protecting ships from the effects of submarine explosions, comprising a strong inner bulkhead extending around the portion of the ship to be protected, a thin outer bulkhead incasing the strong bulkhead and arranged at a considerable distance therefrom, a plurality of transverse bulkheads dividing the space between the inner and outer bulkheads into a series of compartments, a plurality of strong approximately vertical cables dividing the said compartments into inner and outer compartments, plates extending into the upper and lower parts of the said compartments and connected with suitable parts of the ship's structure, means for connecting the said cables with the said plates, rows of weaker cables of unequal lengths connected

with the strong cables in such a manner as to retain the latter in a partly contracted condition, transverse framings situated behind the strong cables and corresponding in shape to the curvature assumed by the latter in their contracted condition, a covering plate extending in front of the combined cables and having an area approximating to the longitudinal area of each compartment, and means for preventing the premature escape of the explosion gases between the adjacent ends of the covering plates.

13. A device for protecting ships from the effects of submarine explosions, comprising a strong inner bulkhead extending around the portion of the ship to be protected, a thin outer bulkhead incasing the strong bulkhead and arranged at a considerable distance therefrom, a plurality of transverse bulkheads dividing the space between the inner and outer bulkheads into a series of compartments, a plurality of strong approximately vertical cables intermeshing with strong approximately horizontal cables and dividing the said compartments into inner and outer compartments, plates extending into the upper and lower parts of the said compartments and connected with suitable parts of the ship's structure, means for connecting the approximately vertical cables with the said plates, rows of weaker cables of unequal lengths connected with the approximately vertical cables in such a manner as to retain the latter in a partly contracted condition, transverse framings situated behind the strong cables and approximating in shape to the curvature assumed by the approximately vertical cables in their contracted condition, means for connecting the adjacent ends of the approximately horizontal cables together, a covering plate extending in front of the combined cables and having an area approximating to the longitudinal area of each compartment, and means for preventing the premature escape of the explosion gases between the adjacent ends of the said covering plates.

In testimony whereof I affix my signature in presence of two witnesses.

GIOVANNI EMANUELE ELIA.

Witnesses:

T. SELBY WARDLE,

WALTER J. SKERTEN.