

June 26, 1945.

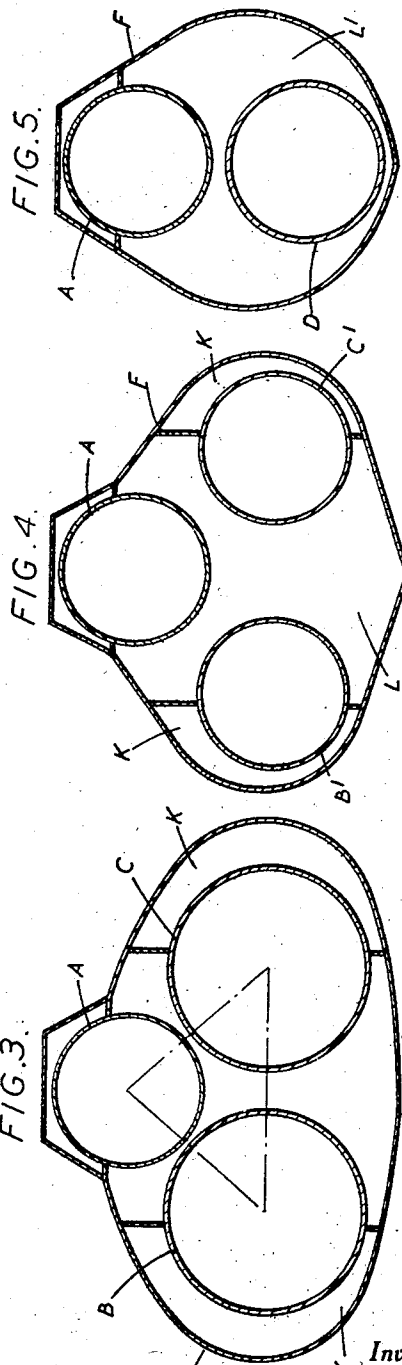
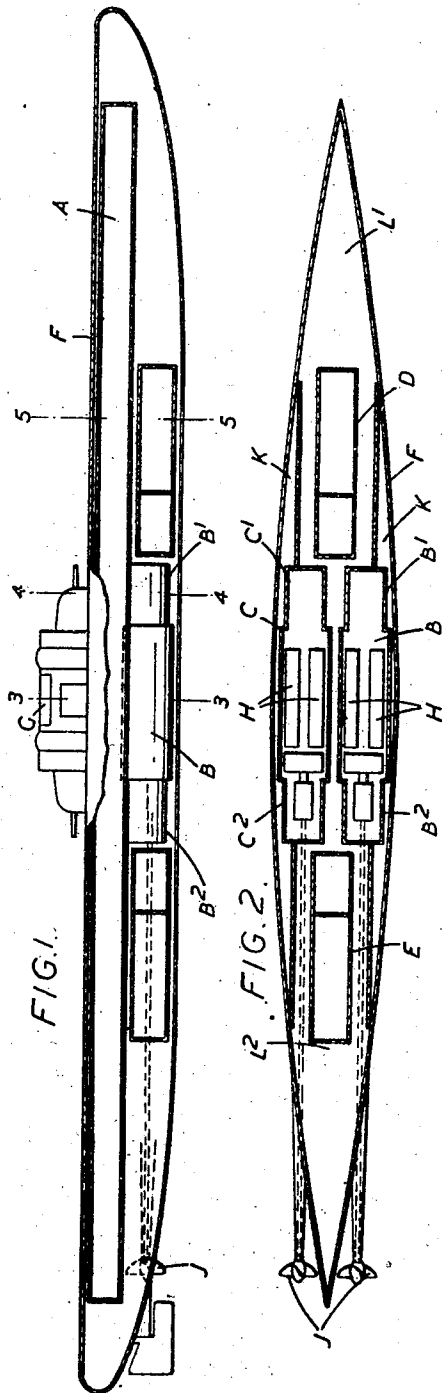
M. F. GUNNING

2,379,295

SHIP CONSTRUCTION

Filed Sept. 13, 1943

4 Sheets-Sheet 1



Inventor
M. F. GUNNING
By *Ernest C. Gunning*
Attorney

June 26, 1945.

M. F. GUNNING
SHIP CONSTRUCTION
Filed Sept. 13, 1943

2,379,295

4 Sheets-Sheet 2

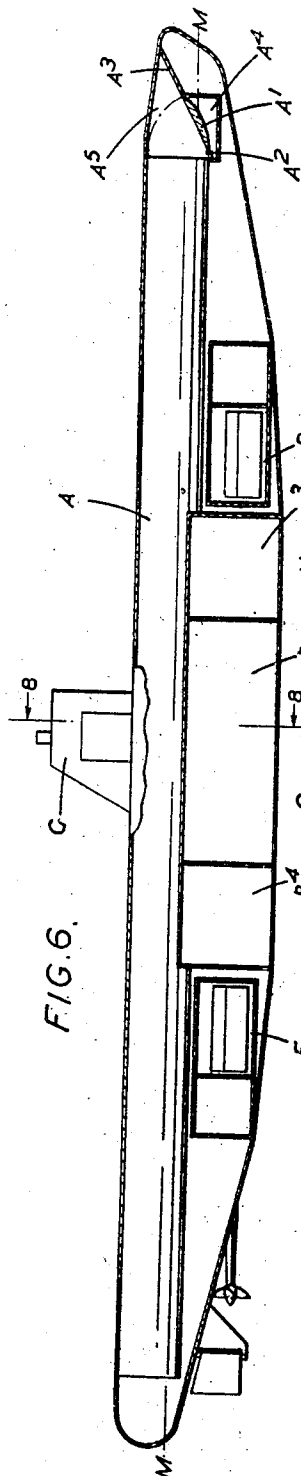


FIG. 6.

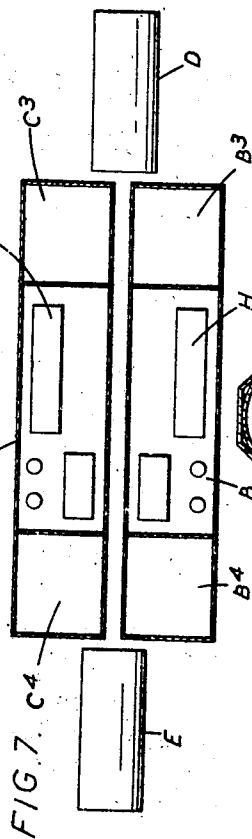


FIG. 7.

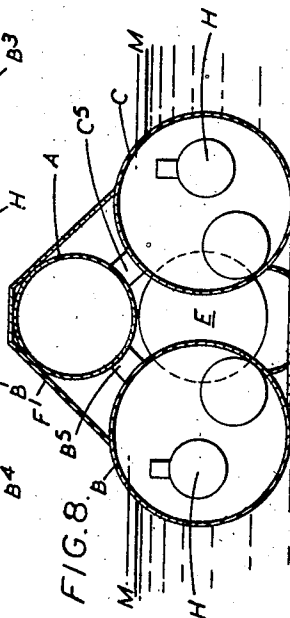


FIG. 8.

Inventor
M. F. GUNNING
By *Ernest Solomonson*
Attorneys

June 26, 1945.

M. F. GUNNING
SHIP CONSTRUCTION
Filed Sept. 13, 1943

2,379,295

4 Sheets-Sheet 4

FIG. 11.

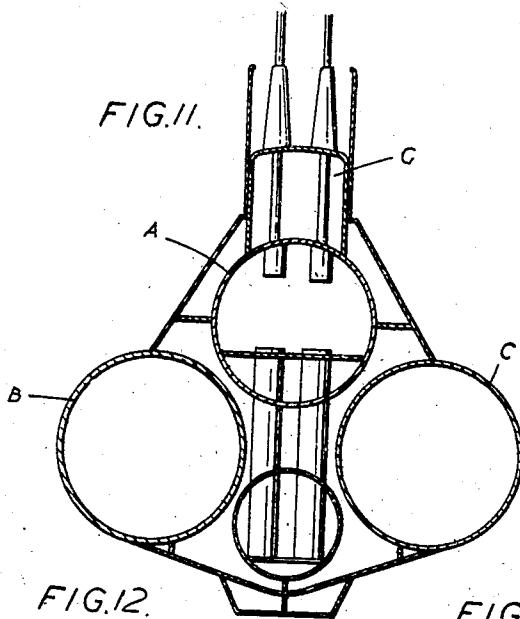


FIG. 12.

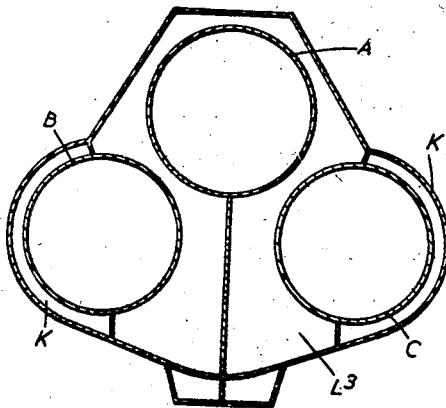


FIG. 13.

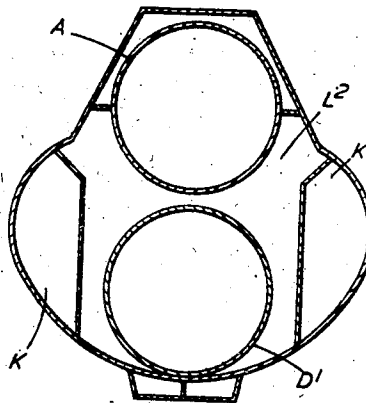


FIG. 14.

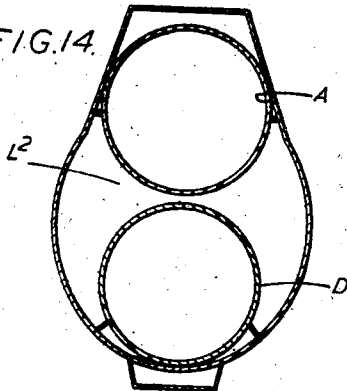
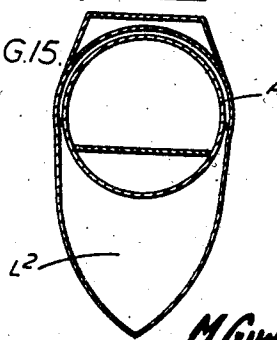


FIG. 15.



Inventor
M. F. GUNNING
By
E. M. GUNNING
Attorneys

UNITED STATES PATENT OFFICE

2,379,295

SHIP CONSTRUCTION

Maximiliaan Frederik Gunning, Petersfield,
EnglandApplication September 13, 1943, Serial No. 502,207
In Great Britain October 2, 1942

5 Claims. (Cl. 114-16)

This invention relates to ship construction and more particularly the construction of a submarine and has for its object to provide a construction which has certain features which adapt it more especially for carrying cargo, though the construction may also be used in a war vessel.

The present invention is an improvement on a known type of submarine ship in which the hull comprises several separate compartments or sub-hulls each constructed to withstand considerable external pressure as when submerged, each of these compartments being circular in cross-section over the greater part of its length and all of them being grouped so that two of the compartments lie side by side with the third compartment above them, passages being provided as a means of communication between these compartments. In such a known construction the spaces between and around the compartments were closed in by plating giving the whole a suitable ship form. In a ship of the above type as hitherto proposed the main part of the vessel was constituted by the two lower compartments since the single upper compartment was really of the nature of an enlarged conning tower or like structure, but providing quarters for the crew. In one such construction the upper compartment was even formed so that it could be detached in case of emergency.

An objection to a construction of the above type as hitherto proposed is that it would appear that insufficient consideration had been given to the longitudinal strength of the vessel as a whole especially with respect to the upper compartment. While it would be possible to regard the upper cylindrical compartment in these earlier vessels of this type as resembling the bridge superstructure in an ordinary vessel, it would have been necessary to provide additional longitudinal strengthening members both forward and aft and this would involve a not inconsiderable weight of material. The strengthening members would also have to be connected to the upper compartment. A further objection to such a proposed construction is that it would be difficult to design a form of vessel which would be suitable for high speed. Further a difficulty would arise if it was desired to arrange torpedo tubes in such a vessel and make provision for handling the torpedoes.

According to the present invention a ship having a hull of the general type indicated is provided with two lower compartments placed side by side which are similar as to length and diameter and a central upper compartment of such greater length as to extend considerably in both

the fore and aft directions beyond the ends of the lower compartments. It will then be found that in order to obtain sufficient submerged stability without excessive use of ballast the cubic capacity of the upper compartment can conveniently be made at least approximately equal to and may be considerably in excess of the cubic content of the two lower lateral compartments taken together. A vessel thus constructed may be said to be a reversal of structures of the type in question as hitherto proposed since in the present invention the main part of the vessel is constituted by the single upper and central compartment with a length much in excess of the length of the lower compartments. This structure also overcomes the difficulty with respect to longitudinal strength in that this upper compartment itself serves as the upper strength member of the whole ship. This upper and longer compartment or sub-hull may be made with at least one opening at one or at each end through which material such as cargo can be loaded and discharged, if the compartment is designed to have accommodation for such cargo. In addition to the three main compartments or sub-hulls there are preferably one or more other compartments of substantially similar construction which are disposed below the main upper compartment and between the lower main compartments and/or beyond one or each end of these lower main compartments.

Ballast tanks are disposed in the space below the upper compartment and between it and the two lower compartments and other ballast tanks may be provided in the forward and after parts of the vessel within the external plating. Fuel tanks also are suitably disposed and the longitudinal fuel bulkheads are situated so as to reduce the free water surface in the main ballast tanks.

Since cargo objects or packages and other articles of large dimensions can be inserted and removed through openings in the ends of the upper hull, there is no need to provide large hatchways elsewhere which tend to weaken the structure of a hull which is to withstand considerable external pressure. The closure required for an opening in the end of a hull of circular cross-section is a simple matter.

With the improved construction it is possible to use propellers of large diameter and to arrange good clearance for them by reason of the shape which may be given to the complete hull and the position of the shafts.

The design of the whole ship may be such that its water-line in surface trim will bring the ends

of the upper compartment or sub-hull wholly or mainly above the surface of the water so that material such as cargo may be loaded into the vessel or discharged from it through an opening in one or in both ends of the compartment. By making the two lower compartments of the same length and appreciably shorter than the upper and central compartment it becomes possible to carry up the keel at each end of the ship and thereby reduce the draft forward and aft.

The necessary ballast tanks can be arranged so that in effect they lie between the pressure hulls and thus their construction need not add much to the weight except at the bottom of the vessel where the plating will act as ballast which is required in any case.

The heavier equipment such as engines and batteries will naturally be placed in the two lower pressure hulls leaving the upper hull for living accommodation and lighter equipment and in this way good conditions for stability can be obtained when the vessel is submerged or at the surface. With respect to stability the desired conditions can be determined by suitable design in which the spacing apart of the lower hulls is a feature.

The accompanying drawings illustrate diagrammatically and by way of example constructions of vessels which may be used in carrying the invention into practice. In these drawings:

Figure 1 is a longitudinal sectional elevation of a submersible vessel embodying the features of this invention.

Figure 2 is a sectional plan of this vessel in a plane in the neighborhood of the waterline.

Figure 3 is a transverse section on the line 3—3 in Figure 1.

Figure 4 is a similar section on the line 4—4 in Figure 1.

Figure 5 is again a similar section on the line 5—5 in Figure 1.

Figure 6 is a longitudinal sectional elevation of a modified construction.

Figure 7 is a plan showing the two lower main compartments or sub-hulls and adjacent parts.

Figure 8 is a transverse section on the line 8—8 in Figure 6.

Figure 9 is a longitudinal sectional elevation of a further modified construction designed for use at least partly as a war vessel.

Figure 10 is a sectional plan in a plane in the neighbourhood of the water line of the vessel shown in Figure 9.

Figures 11, 12, 13, 14 and 15 are transverse sections respectively on the lines 11—11, 12—12, 13—13, 14—14 and 15—15 in Figure 9.

Referring first to the construction shown diagrammatically in Figures 1 to 5 which illustrate a fast war vessel, there are here seen clearly the three main compartments or pressure hulls A, B and C. Of these the upper one A is the longer extending throughout almost the entire length of the vessel while the two lower compartments are much shorter extending over only the midship portion of the vessel. All three pressure hulls are cylindrical and the upper one A has the same diameter throughout its length, but each of the lower ones B and C is made conveniently with its forward and after parts of less diameter than the centre parts. These smaller parts B¹, B² and C¹, C² may be regarded as extensions of the main parts B and C of these compartments. Beyond the ends of the lower compartments B and C are other compartments D and E which are also formed cylindrical as smaller

pressure hulls. Plating F encloses the several pressure hulls and enables a suitable ship form to be given to the whole vessel. Passages, not indicated in the drawings, provide a means of communication between the several compartments, while the spaces between the compartments and those between them and the outer plating are utilised for tanks or otherwise as found convenient.

In the construction here shown the upper pressure hull A provides living accommodation and contains the control room and there is communication with the conning tower G. The two lower main compartments B and C contain the engines H and propelling machinery for the twin propellers J. In the auxiliary compartments D and E are placed the batteries and parts of these compartments may be used for stores or other purposes. Extending over all the midship part of the length of the vessel and outside of the lower pressure hulls B and C and between them and the plating are fuel tanks K, and in the space L between these hulls and in the spaces L¹ and L² forward and aft of the auxiliary compartments D and E are arranged ballast tanks which may also be disposed at the sides of these compartments.

It may be seen in Figure 3 how the three pressure hulls A, B and C of circular cross-section are arranged so that their axes are placed relatively as at the angles of an isosceles triangle such as is indicated in chain lines in that figure.

Turning to the construction shown in Figures 6, 7 and 8, this is more particularly designed as a cargo vessel. The three main pressure hulls A, B and C are arranged as before with the engines H and propelling machinery in the two lower hulls B and C with the batteries in auxiliary compartments D and E. In this case the forward and after parts B³, B⁴ and C³, C⁴ of the lower hulls have the same diameter as the centre or main portions B and C of these hulls. These end parts may serve respectively as compartments for cargo. There is here shown how the upper pressure hull A may be provided, at least at one end, with means for loading and discharging cargo through the end of the hull. The vessel may be so designed that when in normal surface trim the end of the upper hull will come wholly or mostly above the water line M—M. The end of the cylindrical hull A is closed by a cap A¹ hinged at A² and when this cap is lowered into the position in which it is shown in Figure 6 it may form a part of a ramp A³ along which goods can be conveyed for the loading or discharging of the vessel. In the arrangement shown since a part of the end of the pressure hull A lies below the water line M—M, it is necessary to prevent water entering the hull when the closure A¹ at its end is removed. In some cases it may be possible to effect this by suitably trimming the vessel down by the stern. Alternatively and as shown in Figure 6 a well A⁴ with sides like coamings may be formed in the bow of the vessel outside the end of the pressure hull A. The part A⁵ above this well and the ramp A³ is open, but any water which may have accumulated there can be removed before the cap A¹ is lowered when a passage clear of the water will be provided for the goods. In Figure 8 there are indicated communicating passages B⁵ and C⁵ between the upper pressure hull A and the lower ones B and C. It will be noticed that in this construction it is arranged that parts of the lower pressure hulls B

and C form portions of the outer wall of the vessel over its midship part.

Referring now to the construction shown in Figures 9 to 15, this is a vessel designed mainly for war purposes, but having some accommodation for cargo. As in the constructions previously described, there are three main pressure hulls, an upper one A and two lower ones B and C and there are also auxiliary compartments D¹ and E¹ disposed fore and aft beyond the ends of the shorter lower hulls B and C and below the upper hull A. The midship and after parts B, B² and C, C² of the lower hulls contain the propelling machinery and in the fore parts B¹ and C¹ of these hulls the batteries are conveniently arranged. The auxiliary compartments D¹ and E¹ may be used for the stowage of mines if the vessel is intended for mine-laying.

In the upper pressure hull A there is provided the accommodation for officers and crew, and the control room with access to the conning tower and passages leading to the lower hulls. At each end of this upper hull are groups of torpedo tubes N. It will be seen that these lie about or above the waterline M when the vessel is in surface trim with the effect that the resistance which these tubes usually offer to propulsion when a vessel is on the surface will be obviated or materially reduced. Also the position of these tubes is such that the torpedoes may be loaded into the vessel through the tubes thus avoiding the need for a long hatchway in the hull to enable the torpedoes to be taken into the vessel. Such a hatch is usually a serious point of weakness in the ordinary pressure hull. With the control room in the upper hull it will be in a conveniently raised position. It is an advantage to have the living accommodation in the upper hull since it is there removed from the noise of the engines in the lower hulls.

As is usual in submarines part of the outside tanks K may be used as main or auxiliary fuel oil tanks. The bulkheads of such main oil tanks may be arranged so as to minimise the free surface of the ballast water while the ballast tanks are being filled or emptied. Ballast tanks are provided at L³ and L⁴.

In a submarine of ordinary construction the diameter of the pressure hull is usually more or less fixed by the displacement and the overall length and any variations at the ends are determined by the necessity of obtaining a ship-shape form. The problem in designing such a vessel is to utilise the space available to the greatest possible extent by proper placing of the motor, batteries and so forth. On the other hand in a submarine structure as now proposed it is possible to choose a different diameter for each separate hull and to vary the diameter of the hull along its length. Thus the diameter can be adapted to the space requirements of the particular gear to be fitted in each hull. Great

economy in space results which is of the utmost importance in submarine design.

What I claim as my invention and desire to secure by Letters Patent is:

1. A ship the hull of which comprises in combination at least three compartments constituting sub-hulls and each constructed to withstand considerable external pressure, each sub-hull being circular in cross-section over the greater part of its length, the sub-hulls being grouped together so that two of them lie side by side in the horizontal direction with a third sub-hull compartment above them the two lower compartments being similar as to length and diameter while the single and central upper compartment is of greater length and extends considerably in both the fore and aft directions beyond the ends of the lower compartments, communicating passages between these sub-hulls, and plating enclosing the sub-hulls and closing in the spaces between them and giving the whole structure a ship form.

2. A ship the hull of which comprises in combination at least three compartments constituting sub-hulls which are circular in cross-section over the greater part of their length, the sub-hulls being grouped together so that two of them lie side by side in the horizontal direction with a third sub-hull compartment above them the two lower compartments being similar as to length and diameter while the single and central upper compartment is of greater length and extends considerably in both the fore and aft directions beyond the ends of the lower compartments, communicating passages between these sub-hulls, an opening in at least one end in the uppermost of the three sub-hulls through which cargo can be loaded and discharged, a water-tight closure for such opening, and plating enclosing the sub-hulls and closing in the spaces between them and giving the whole structure a ship form.

3. A ship having in combination the features as set out in claim 1, and at least one other compartment which is substantially similar to the said sub-hull compartments and is disposed below the said upper sub-hull and between the said two lower sub-hulls.

4. A ship having in combination the features as set out in claim 1, wherein the two lower sub-hulls have diameters that vary along the lengths of said sub-hulls, and said diameters are equal at corresponding points along said lengths.

5. A ship having in combination the features as set out in claim 1, wherein the two lower sub-hulls have maximum diameters at least as great as that of the upper sub-hull over a substantial part of the midship portion of the length of said lower sub-hulls, the diameters of the said sub-hulls vary along the lengths of said sub-hulls, and the diameters of said sub-hulls are equal at corresponding points along said lengths.

MAXIMILIAAN FREDERIK GUNNING.