E. R. ARMSTRONG.

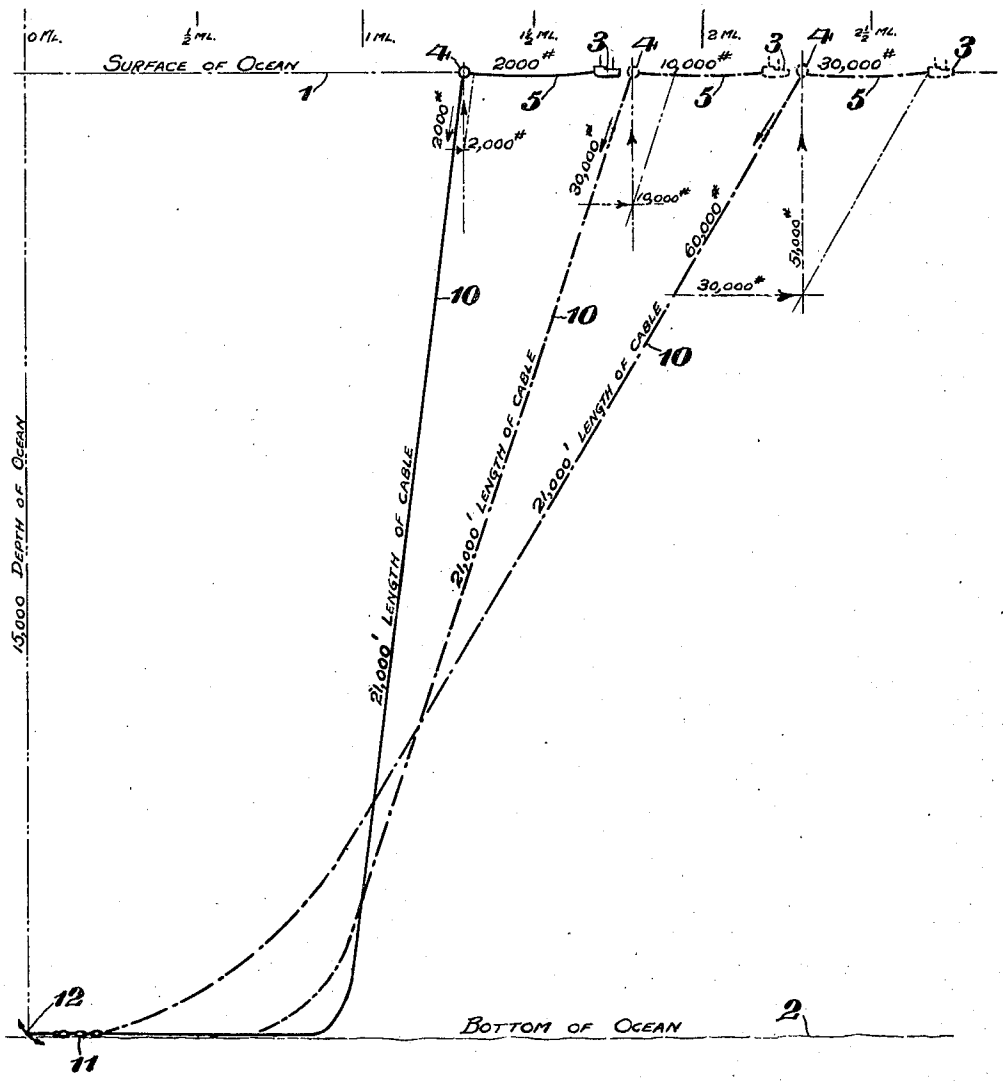
METHOD OF ANCHORING AEROPLANE, NAVIGATING, AND SUPPLY STATIONS AT ANY DEPTH OF THE OCEAN.

APPLICATION FILED JULY 25, 1919.

1,378,394. Patented May 17, 1921.

3 SHEETS—SHEET 1.

Fig. 1.



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3 SHEETS—SHEET 2.

Fig. 2.

PLAN OF MAIN DECK

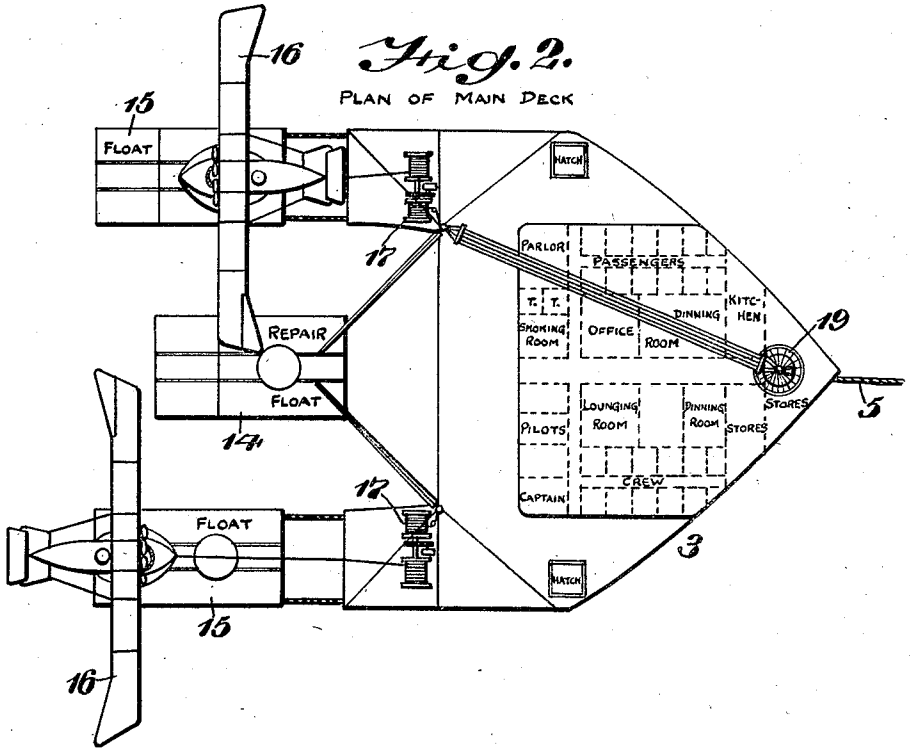
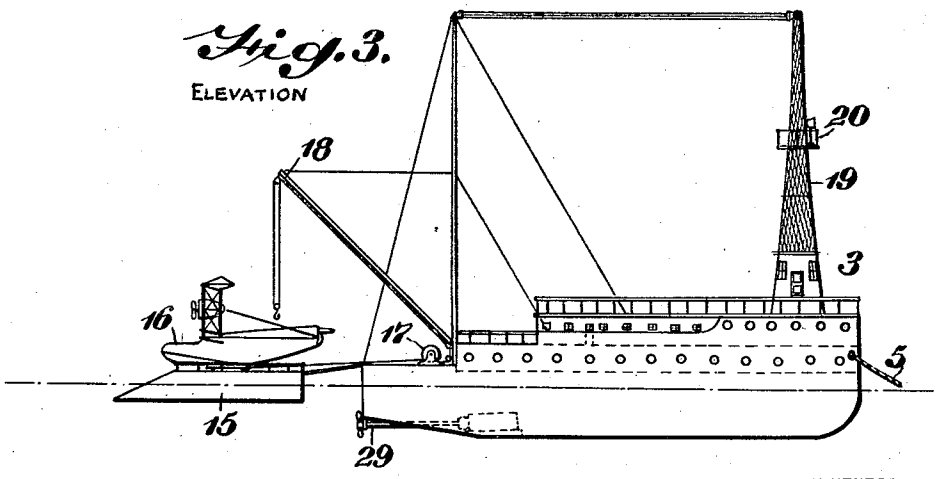


Fig. 3.

ELEVATION



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3 SHEETS—SHEET 3.

Fig. 4.

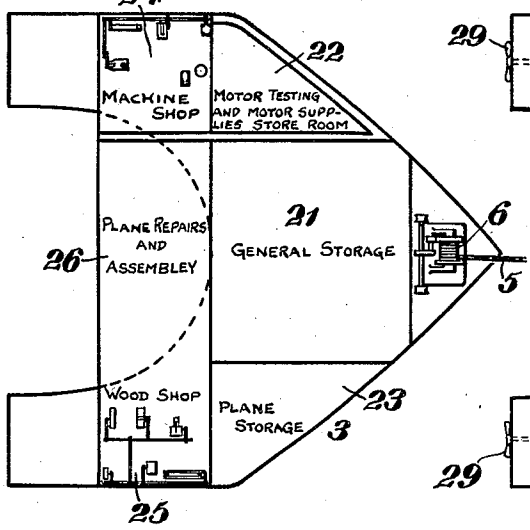


Fig. 5.

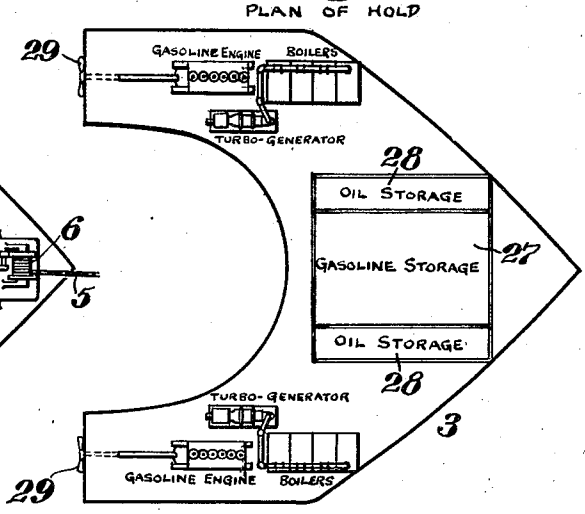


Fig. 6.

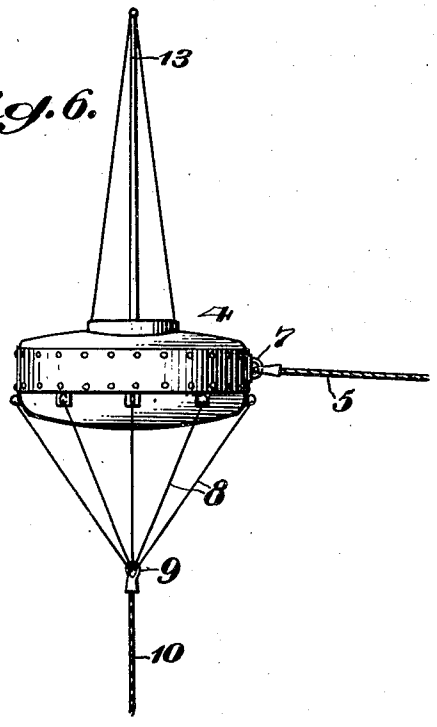
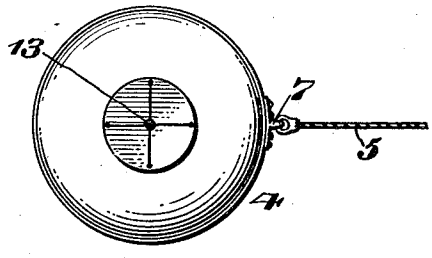


Fig. 7.



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UNITED STATES PATENT OFFICE.

EDWARD R. ARMSTRONG, OF WILMINGTON, DELAWARE.

METHOD OF ANCHORING AEROPLANE, NAVIGATING, AND SUPPLY STATIONS AT ANY DEPTH OF THE OCEAN.

1,378,394. Specification of Letters Patent. Patented May 17, 1921.

Application filed July 25, 1919. Serial No. 313,172.

To all whom it may concern:

Be it known that I, EDWARD R. ARMSTRONG, a citizen of the Dominion of Canada, residing at Wilmington, in the county of New Castle, State of Delaware, have invented a new and useful Method of Anchoring Aeroplane, Navigating, and Supply Stations at Any Depth of the Ocean, of which the following is a specification.

The commercial use of the aeroplane, hydro-aeroplane, or aerial vessels of the lighter or heavier than air type for oversea transportation is at present restricted or very limited because of the great distance between landing points at which the fuel supply can be replenished or repairs made, it being obvious that an aeroplane flying from New York to London, or back, without stop, must carry sufficient fuel, oil and other supplies for the entire trip, and it is well known that in the present day state of the art, the necessary amount of fuel and supplies for a trip of this character leaves very little or no carrying capacity available for passengers, mail, or express. Assuming that the average depth of the Atlantic Ocean for a great portion of the distance between Newfoundland and Ireland or England or the Azores, averages about three miles, if it were attempted at intervals throughout this distance at such a depth to make an anchorage for a sea station or supply station in the customary manner by attaching the anchor or cable directly to the sea station or floating vessel constituting the sea station, the great weight of the anchor chain or cable would be supported by the same and would so seriously hamper the movement of the ship constituting the sea station under the force of the wind and waves under storm conditions, that an attempted anchorage made in this manner would be liable to result in disaster.

To remedy this condition, I have invented a new method of anchoring and a novel organization comprising an anchorage float and a sea navigating and supply station so connected together and equipped that suitable supply and navigating stations can be located at desired points or intervals of the ocean crossing, at such depths of the ocean and such distances apart as desired, thus enabling such anchored stations to be utilized as navigation stations and fuel supply points, whereby a much greater carrying capacity of an aeroplane than heretofore may be used in transporting useful load, much of the cargo space heretofore taken up for gasolene, oil and other supplies being capable of being utilized for carrying freight, express or mails.

To the above ends, my invention consists of the novel combination of a sea navigating and supply station connected to an anchorage float of certain predetermined dimensions, through the medium of a towing hawser and towing engine, the float being so proportioned with respect to its adjuncts that its displacement is greater than all submerging forces it is subjected to, while performing its proper functions, said anchorage float having attached to it, an anchorage cable of such predetermined weight, strength and length that the lifting effect of the anchorage float on the anchorage cable caused by drifting forces acting on the sea station, is at its maximum insufficient to raise all of the anchorage cable from the bottom of the ocean, whereby a sufficient predetermined length, weight and strength of the cable is left in contact with the bottom of the ocean at all times to keep the anchor acting in its most effective poistion, the effect of various forces acting on the sea station resulting only in varying the predetermined displacement of the anchorage float and varying the predetermined amount of the anchorage cable in contact with the bed of the ocean.

By the employment of an anchorage float and a sea station having in its bow a towing engine to which one end of the anchoring hawser is connected, the weight of the anchoring cable and its connections is supported by the anchorage float in such a manner that strains induced in the anchorage hawser by the action of the wind and waves on the sea station are in such a direction as not to limit in any degree the normal reactions of the sea station under the combined force of wind and waves, and in addition said anchorage float constitutes a safeguard which renders the apparatus stable and efficient under the force of the wind and waves under storm conditions, said float being in addition provided with apparatus

for discharging oil on the sea to produce the well known calming action.

My invention further consists of a novel construction and combination of a sea station more or less boatlike and fitted with propelling engines, which can when necessary be used to prevent the strain on the anchorage hawser from exceeding a fixed maximum, said sea station having in its bow a towing engine to which one end of the anchoring hawser leading to the anchorage float is connected, the function of said towing engine being to prevent the tension on the anchoring hawser exceeding a predetermined amount, the other end of the anchoring hawser being connected through a suitable shackle to said anchorage float, the displacement of which latter being greater than all submerging forces it is subjected to while functioning in this organization and the displacement of said anchorage float being considerably in excess of the total weight of itself, the anchor cable and the drifting force of the wind and waves on the sea station during the worst storms.

My invention further consists in the novel construction of a sea station having the main deck, the lower deck, and hold, in combination with a repair float, and secondary float structures collocated so as to accommodate a plurality of aeroplanes at one time, and provided with suitable compartments for the storage of oil, gasolene and other supplies.

It further consists of a novel combination of a sea station of the aforesaid general character combined with a float, said sea station having at its bow a towing engine to which one end of the anchoring hawser is connected, the other end of said anchoring hawser being suitably connected to a novel anchorage float whose displacement is sufficient to support all submerging forces to which it may be subjected while functioning as an anchorage float, the latter having a signal mast and being provided with pendant chains converging to a common point or ring to which the anchor cable is attached.

To the above ends my invention consists of the novel method and apparatus hereinafter described and pointed out in the claims.

For the purpose of illustrating my invention I have shown in the accompanying drawings one form thereof which is at present preferred by me, since the same will be found in practice to give satisfactory and reliable results, although it is to be understood that the various instrumentalities of which my invention consists can be variously arranged and organized and that my invention is not limited to the precise arrangement and organization of these instrumentalities as herein shown and described.

Figure 1 represents a diagrammatic view illustrating my novel method of anchoring a sea station at a point in the ocean where the depth approximates 15,000 feet, showing diagrammatically the surface and bottom of the ocean, the sea station, anchorage float and their adjuncts.

Fig. 2 represents a plan view of the main deck of the sea station.

Fig. 3 represents a side elevation of Fig. 2.

Fig. 4 represents a plan view of the lower deck of the sea station seen in Fig. 2.

Fig. 5 represents a plan of the hold of said sea station.

Figs. 6 and 7 represent respectively a side elevation and a plan view of my novel anchorage float employed.

Similar numerals of reference indicate corresponding parts in the figures.

Referring to the drawings,

In the diagrammatic view seen in Fig. 1, I have indicated 1 as the surface of the ocean, and 2 the bottom thereof and have based my computations hereinafter referred to on the assumption of my novel supply station being located at an approximate ocean depth of about 15,000 feet or three miles.

3 designates a sea station more or less boat-like in structure and shown in detail in Figs. 2 to 5 inclusive, 4 designates an anchorage float, the preferred construction of which is shown in detail in Figs. 6 and 7.

5 designates an anchoring hawser having one end connected to the towing engine 6, (see Fig. 4) which is located at the bow of the sea station 3, the other end of said anchoring hawser being connected through the shackle 7 to the anchorage float 4, the displacement of which is sufficient to support all submerging forces it may be subjected to while functioning as an anchorage float in my novel organization.

The function of the towing engine 6 is to prevent the tension on the anchoring hawser exceeding a predetermined amount.

The anchorage float 4 is provided with the signal mast 13 and the connected pendant chains 8, which are suitably secured to the body of the float and converge downwardly toward the ring 9, to which is attached the upper end of the anchor cable 10, the lower end of which terminates in an anchor chain 11, a portion of which always lies on the bottom of the ocean and which is attached to the anchor 12. I construct or proportion the anchorage float 4 so that its displacement is considerably in excess of the predetermined total weight of itself, the anchor cable 10 and the drifting force of the wind and waves on the sea station 3 during the worst storms.

It will be evident to those skilled in the art, that at the approximate indicated ocean depth of three miles, if it were attempted to make an anchorage in the customary manner, by attaching the anchor cable 10 di-

rectly to the ship or sea station 3, the great weight of the anchor cable 10 and its chain 11 would be supported by the sea station and would so seriously hamper the movement of the ship under the force of the wind and waves under storm condition, that an attempted anchorage made in this manner would be liable to result in disaster.

By the use of an anchorage float having the anchor cable directly connected thereto in conjunction with the sea station 3 collocated with said anchorage float, as herein disclosed, the weight of the anchor cable 10 and its connections is supported by the anchorage float 4 in such a manner, that strains induced in the anchorage hawser 5 by the action of the wind and waves on the sea station 3 are in such a direction as not to limit in any degree the normal reactions of the sea station 3 under the combined forces of wind and waves.

As an example of a practical anchorage by my novel method, assuming a sea station 3 of about 1600 tons, I may arrange the anchorage and proportion the weights of the anchor, cable, float and sea station approximately as follows:—The anchor 12 of the mushroom type weighs 5,000 pounds and is connected by a chain cable 11 of 2″ in diameter, weighing 230 pounds per fathom to the anchorage cable 10, approximately 1,000 feet of said chain cable, as indicated at 11, Fig. 1, being used.

To this chain cable is connected 5,000 feet of galvanized steel cable 1½″ in diameter, then comes 5,000 feet of a 1¾″ steel cable, then comes 5,000 feet of steel cable 2″ in diameter, and then comes the last upper stretch of 5,000 feet of 2¼″ steel cable, whose upper end is secured to the float 4 as indicated in Fig. 6, making a total length of anchorage cable 10 of about 21,000 feet, weighing approximately 75 tons.

It will be obvious that while I have described the anchorage device as being a cable, any other form of attachment, such as a chain might be used to equal advantage.

I preferably construct the anchorage float 4 about approximately 36 feet in diameter by 15 feet in depth with a displacement of 380 tons, the same being made of steel plating, water tight and provided with a signal mast 13. To the shackle 7 of the anchorage float is connected the end of the 1¾″ galvanized steep deep sea towing hawser 5 which is 1200 feet in length, the other end of the towing hawser being connected to the winding drum of an automatic steam towing machine 6, seen in Fig. 4, located at the front end of the sea navigating and supply station 3, as seen in Fig. 4, the general construction of said sea station being understood from Figs. 2 to 5 inclusive, the same being provided with a repair float 14 and the secondary floats 15 upon which the sea planes 16 may be landed, as indicated in Figs. 2 and 3.

In the diagrammatic view seen in Fig. 1, I have shown the surface of the ocean spaced off in half mile intervals from a vertical line extending from the position of the anchor 12 to the surface of the ocean, to indicate the approximate drift of the anchorage float 4 and sea station 5, when collocated with a cable 10 of the aforesaid weight and dimensions, and I have shown in full lines the approximate position of the cable 10, anchorage float 4, hawser 5, and sea station 3 under normal conditions.

The approximate positions the cable, float and sea station may assume under abnormal climatic conditions are graphically indicated in dotted lines. Referring now to the extreme right hand of Fig. 1 and assuming that the drift of the float 4 and sea station 3 has been about 2½ miles from a line perpendicular to the position of the anchor 12, and assuming a backward drifting force on the sea station 3 of say 30,000 pounds, which might be the drift experienced by a 2,000 ton boat in a powerful hurricane, said backward drifting force results in an increased displacement of the anchorage float of about 51,000 pounds, and it will be seen that this increased displacement in turn increases the strain on the anchor cable 10, 60,000 pounds as indicated, resulting in raising from the bottom of the ocean such a weight of the anchor chain and cable that will produce this additional strain at the angle produced by balancing the resulting forces, approximately as indicated at the right of Fig. 1. I have also shown in said Fig. 1, the approximate intermediate position and resulting forces of the anchor cable 10 due to various drifting forces of the sea station 3.

By the above proportioning of the various elements comprising my novel organization, it will be seen that I have provided a novel combination of a sea navigating and supply station 3 connected to an anchorage float 4 through the medium of a towing hawser 5 and towing engine, the displacement of said float being greater than all the submerging forces it is subjected to while functioning as part of this organization, said anchorage float having attached to it an anchorage cable 10 of such weight, strength and length that the lifting effect of said anchorage float on said anchorage cable 11 caused by drifting forces acting on the sea station 3, is at its maximum insufficient to raise all of said anchorage cable from the bottom of the ocean, since a sufficient weight, strength and length of the same will be left in contact with the bottom of the ocean to keep the anchor 12 acting in its most effective position, it being apparent that the effect of various forces acting on said sea station 3 results only in varying the displacement of the an-

chorage float 4 and varying the amount of the lower terminal end 11 of the anchorage cable 10 in contact with the bed of the ocean.

I preferably utilize the anchorage float 4 also as an oiling device, provision being made to discharge oil therefrom on the surface of the water as weather conditions may require, so as to produce that calming action well-known to mariners.

In the foregoing I have described the broad principles appertaining to my invention, and it is obvious that details thereof are susceptible of various modifications.

In the plan view of the main deck of the sea station 3 I have shown an arrangement which may be employed for the temporary quarters of the passengers and crew, at the points indicated, and I have shown an arrangement of the hoisting or towing machinery at 17 and derricks at 18 for handling the floats or the aeroplanes.

19 designates a spar or mast which may have a lookout 20 thereon. The lower deck of the sea station as seen in Fig. 4 may have the compartment 21 for general storage, the compartment 22 for motor testing and motor supplies, and the compartment 23 for plane storage. The machine shop is indicated at 24 and the wood room at 25, while the space at 26 may be employed for plane repairs and assembly. In the hold seen in Fig. 5, the tank 27 may be used for gasolene storage and the side tanks 28 for oil storage, while at 29 I have indicated the location of propellers which can be driven by suitable mechanism, when necessary to propel the sea station to the desired extent in the desired direction so as to prevent the strain on the anchorage hawser 5 from exceeding a fixed maximum, a condition which might arise under the worst storm disturbances.

It will be apparent that any desired number of sea stations or supply stations, as four, five or six, may be utilized in the line of aerial travel, as from America to England, and that the proportioning of the weights or displacements of the anchorage float and its cable and their adjuncts may be readily computed for lesser ocean depths than that indicated herein in substantially the same ratio.

While I have described my novel organization as being especially adapted for the anchoring in deep water of an aeroplane supply and navigation station, it will be apparent that the broad principles of my invention are applicable to the anchoring in deep water of a supply or other station adapted to any desired use. It will be apparent that in my invention, the anchor cable is of such length that it is longer than the vertical height from the anchor to the float and is enough longer, as the ship drifts and pulls, to provide that the weight of the cable lifted from the bottom is enough to take up at an angle the drifting force and still leave a reserve on the bottom, the displacement of the float being such that the float even under the excess pull of the extra length of cable will stay on top, whereby the pull on the ship will be parallel to the surface of the water.

It will be further apparent that the engine in the station is utilized as a propelling means for urging the station toward the float, thereby preventing the pull of said station becoming greater than the maximum pull that the gravitational pull of the anchor cable is adapted to counteract.

It will be further apparent that the towing engine in the station is a means for keeping the cable taut, when the propelling means moves the station toward the float, so that the system will not be unduly stressed by sudden fluctuations in the pull of the station, it being further apparent that there are two reasons for the cable lying on the bottom, to some extent, at all times,— first, to get a horizontal pull on the anchor, and, second, keep a reserve to balance increased pull of the station on the float.

It will now be apparent that I have devised a novel and useful method of anchoring aeroplane, navigating, and supply stations at any depth of the ocean, which embodies the features of advantage enumerated as desirable in the statement of the invention and the above description, and while I have, in the present instance, shown and described a preferred embodiment thereof which will give in practice satisfactory and reliable results, it is to be understood that the same is susceptible of modification in various particulars without departing from the spirit or scope of the invention or sacrificing any of its advantages.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:—

1. The herein described method of anchoring an aeroplane supply and navigation station, which consists in collocating said station with an anchorage float having an anchorage cable attached thereto of such weight, strength and length that the lifting effect of said float on said cable caused by drifting forces acting on said sea station is at its maximum insufficient to raise all of said anchorage cable from the ocean bottom.

2. The herein described method of anchoring an aeroplane supply and navigation station, which consists in securing said station to an anchorage float having displacement greater than all submerging forces it is subjected to while functioning in the organization, a cable whose weight, strength and length are so proportioned to the displacement of said anchorage float that the lifting effect of said float on said cable caused by drifting forces acting on said sea station is

at its maximum insufficient to raise all of said cable from the ocean bottom, whereby a sufficient length of said cable is always in contact with the bottom of the ocean to keep its anchor acting in its most effective position, the effect of various forces acting on said sea station resulting only in varying the displacement of said float and varying the amount of cable in contact with the ocean bed.

3. In a device of the character stated, the combination of an anchorage float whose displacement is greater than all submerging forces it is subjected to while functioning as a part of the organization, a sea navigating and supply station, a connection common to said station and said float, and a cable connected to said float of such weight, strength and length that the lifting effect of said float on said cable caused by drifting forces acting on said sea station is at its maximum insufficient to raise all of said cable from the bottom of the ocean.

4. In a device of the character stated, the combination of an anchorage float, the displacement of said float being greater than all submerging forces it is subjected to, while functioning as a part of the organization, a sea navigating and supply station, a towing engine carried by the latter, a towing hawser having one end connected to said float and the other end to said towing engine, and a cable whose diameter decreases downwardly connected to said float, said cable being of such weight, strength and length that the lifting effect of said float on said cable caused by drifting forces acting on said sea station is at its maximum insufficient to raise all of said cable from the bottom of the ocean.

5. In a device of the character stated, the combination of a sea navigating and supply station, an anchorage float whose displacement is greater than all submerging forces it is subjected to, while functioning as a part of the organization, and a cable connected to said float, the diameter of said cable increasing at predetermined intervals from its bottom extremity to its top end and said cable being so proportioned that the lifting effect of said float on said cable caused by drifting forces acting on said sea station is at its maximum insufficient to raise all of said cable from the bottom of the ocean.

6. In a device of the character stated, a sea station, an anchorage float connected thereto, whose displacement is sufficient to support all submerging forces to which it may be subjected, a hawser connecting said float and station, means on said sea station for taking up slack in said hawser, and an anchoring cable secured to said float and of such weight and dimensions that the lifting effect of said float on said cable caused by drifting forces acting on said sea station is at its maximum insufficient to raise all of said cable from the ocean bottom

7. In a device of the character stated, the combination of a sea station, an anchorage float connected thereto, and an anchoring cable connected to said float and secured to an anchor, the displacement of said anchorage float being in excess of the total weight of itself, the anchor cable, and the maximum drifting force of the sea station under extreme climatic conditions.

8. In a device of the character stated, a sea station, an anchorage float connected thereto, whose displacement is sufficient to support all submerging forces to which it may be subjected, a series of pendant converging chains depending from said float, and secured to an anchoring cable of such weight, strength and length that the lifting effect of said float on said cable caused by drifting forces acting on said sea station is at its maximum insufficient to raise all of said cable from the ocean bottom.

9. In a deep-sea supply station assembly, in combination, a sea station proper, an anchorage float, a mooring cable connecting said sea station and float, an anchor for said float, an anchoring cable connecting said anchor and float and of greater length than the vertical or sea-depth distance between the floor of the sea and the surface thereof, thereby providing a substantial excess length in said cable permitting a range of travel of said float along the surface of the sea and horizontally away from said anchor, without the lifting of all of said excess length from the sea floor; said anchoring cable being of predetermined weight whereby as successively increasing drifting forces are exerted on said sea station proper, and the latter moves thereunder, sufficient length of anchorage cable is lifted from the ocean floor to gravitationally balance at successively greater distances of said station from said anchor, the successively increasing drifting forces; and said float having a displacement sufficient to support said anchorage cable when lifted its predetermined maximum amount, whereby said float remains always upon the surface of the sea and the pull of said mooring cable upon said station is always substantially parallel to the surface of the sea.

EDWARD R. ARMSTRONG.

Witnesses:

E. HAYWARD FAIRNBANKS,

C. D. MCVAY.