Dec. 6, 1932. S. E. HITT 1,890,113

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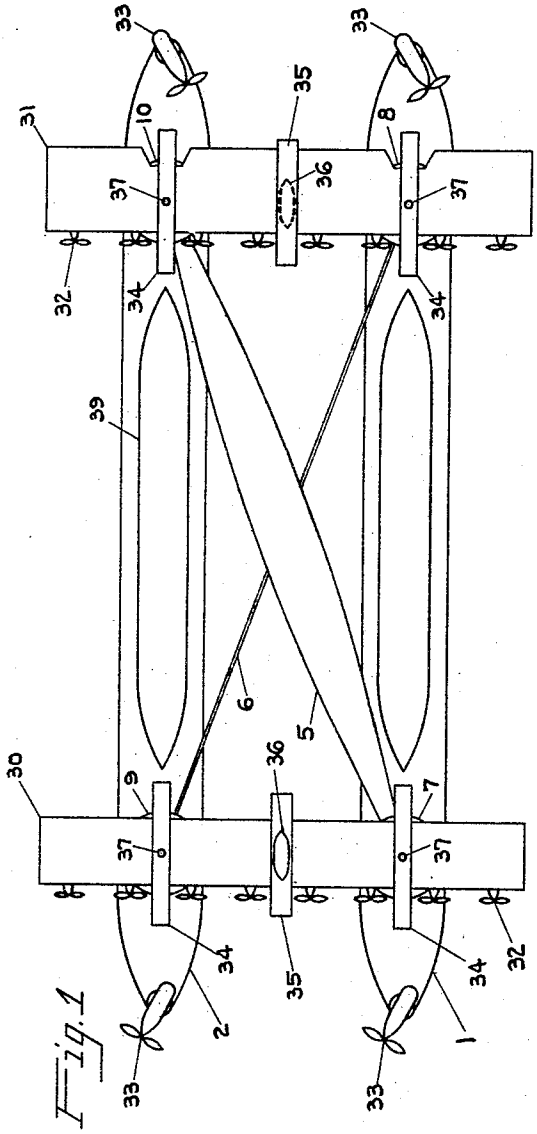


Fig. 1

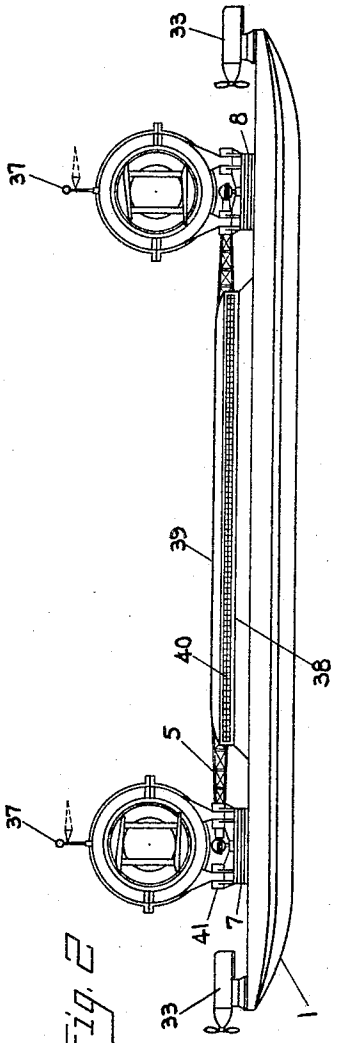


Fig. 2

INVENTOR

WITNESS
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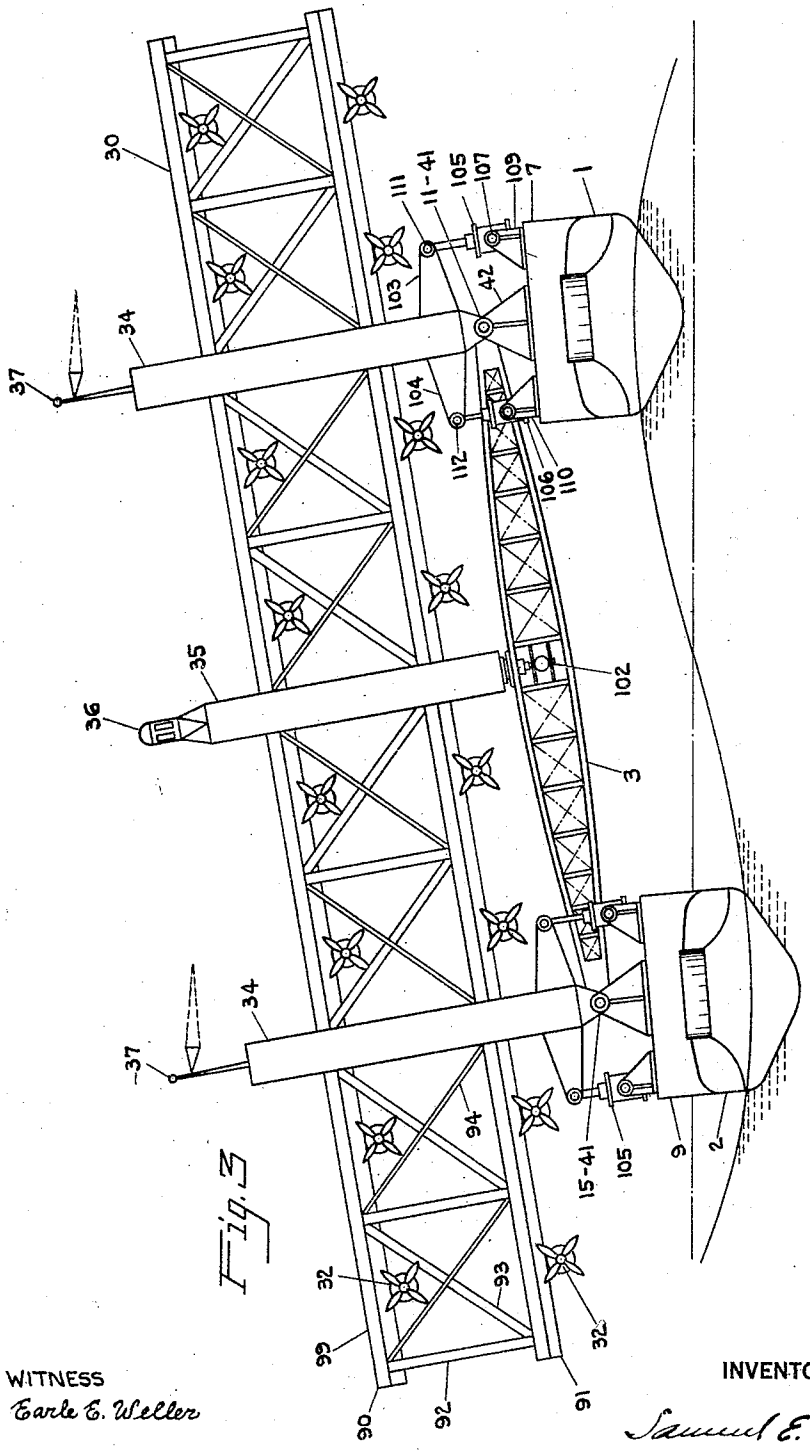


Fig. 3

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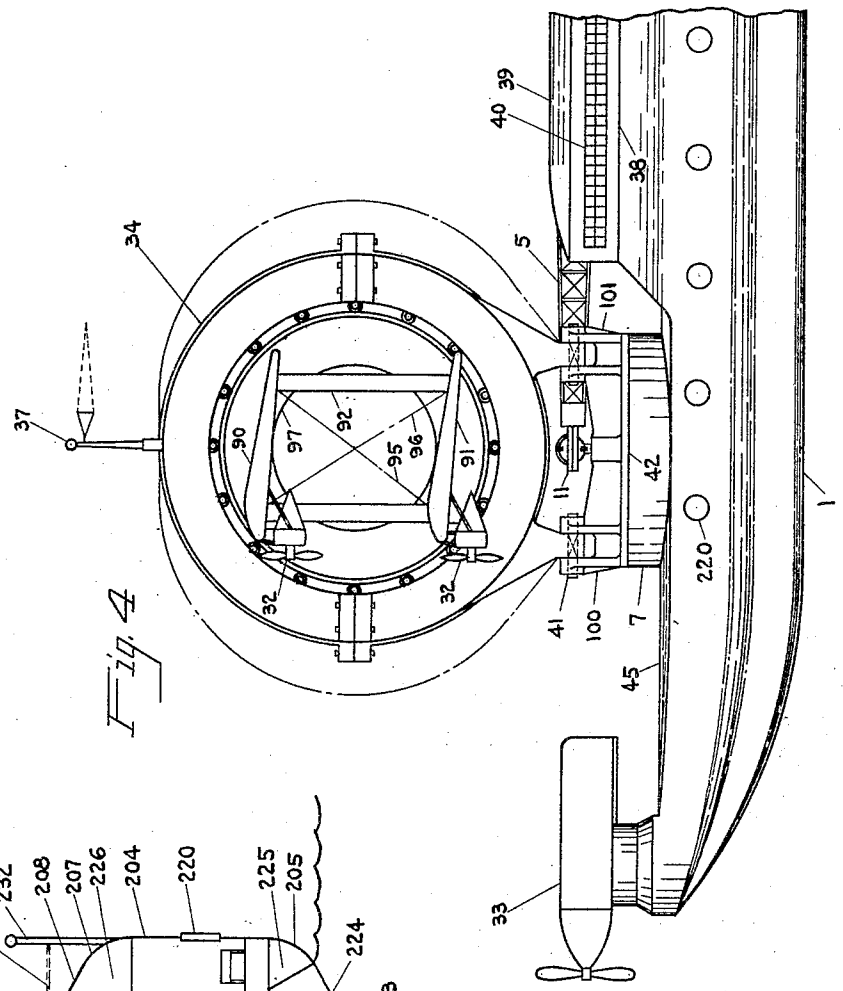


Fig. 4

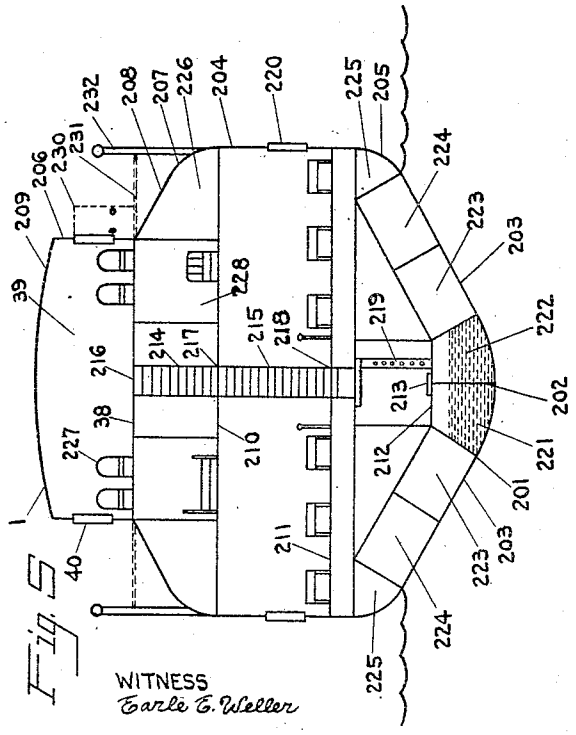


Fig. 5

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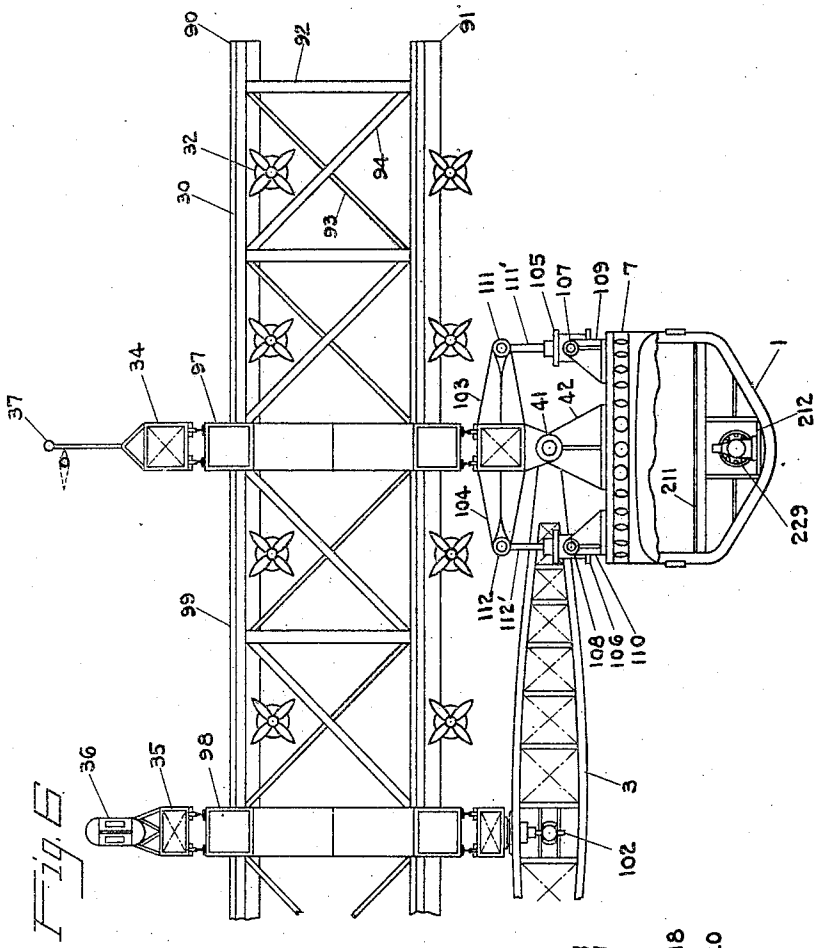


Fig. 6

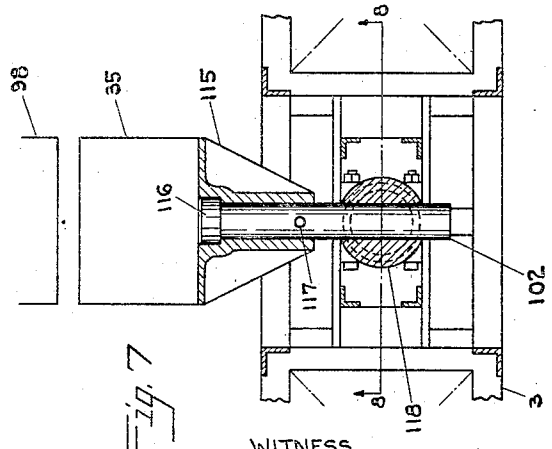


Fig. 7

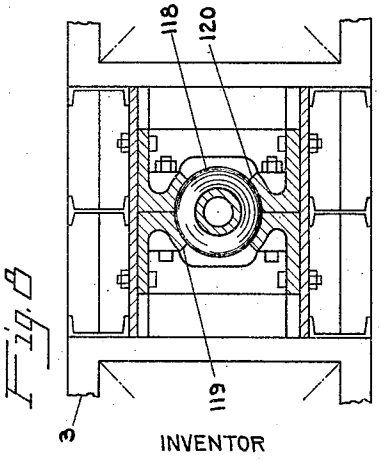


Fig. 8

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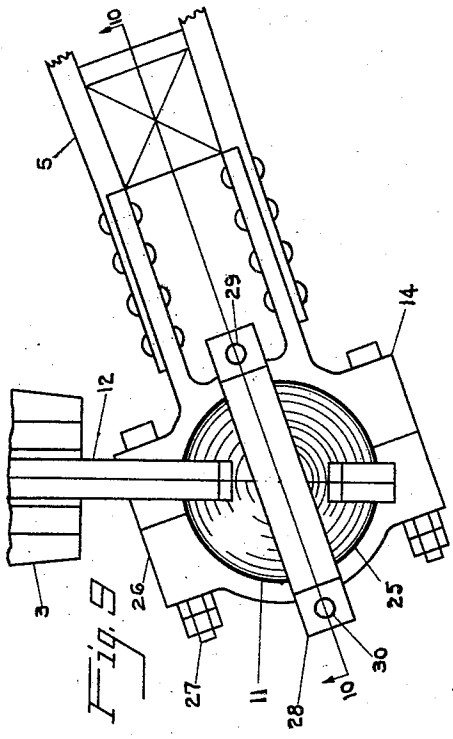


Fig. 9

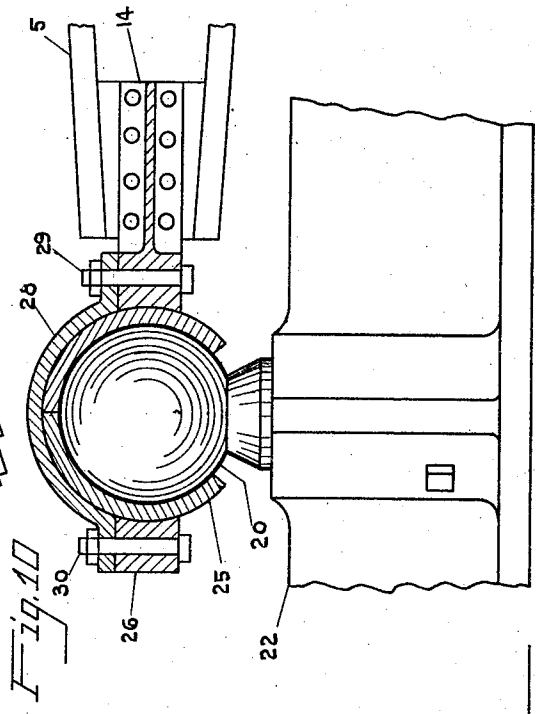


Fig. 10

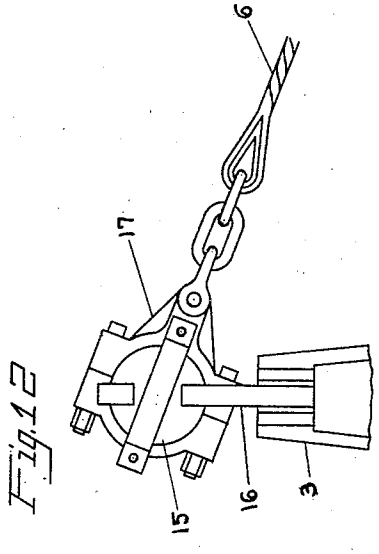


Fig. 12

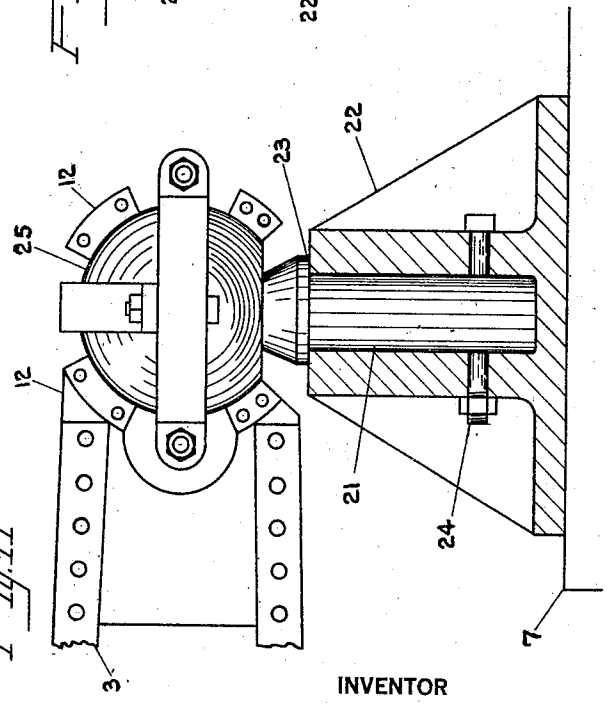


Fig. 11

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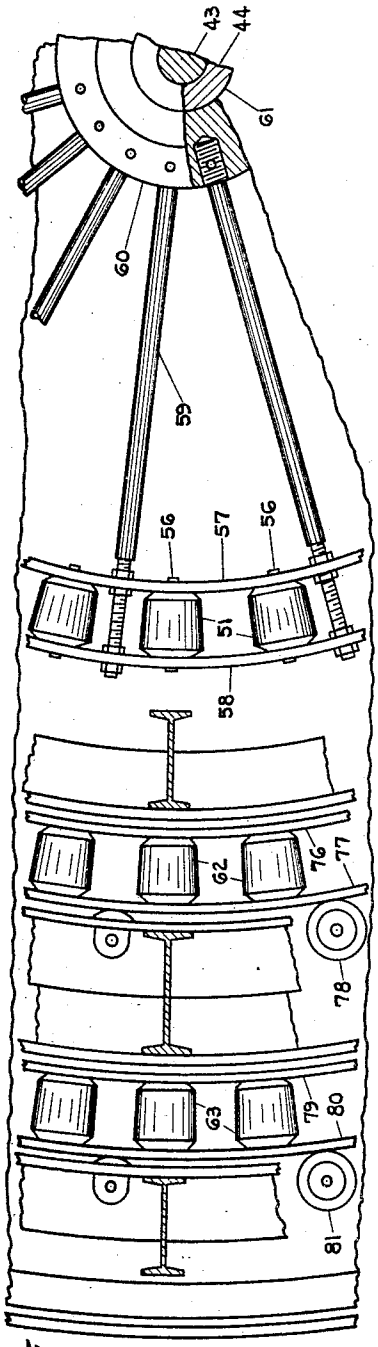


Fig. 13

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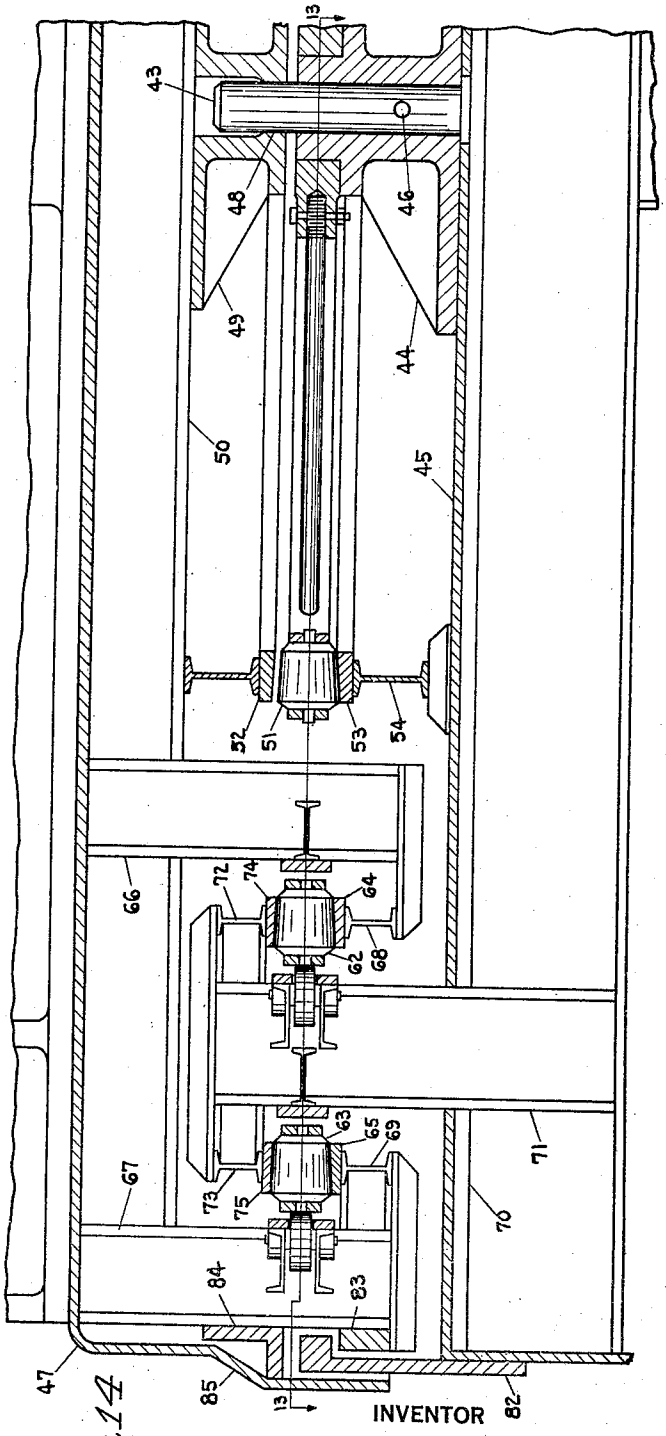


Fig. 14

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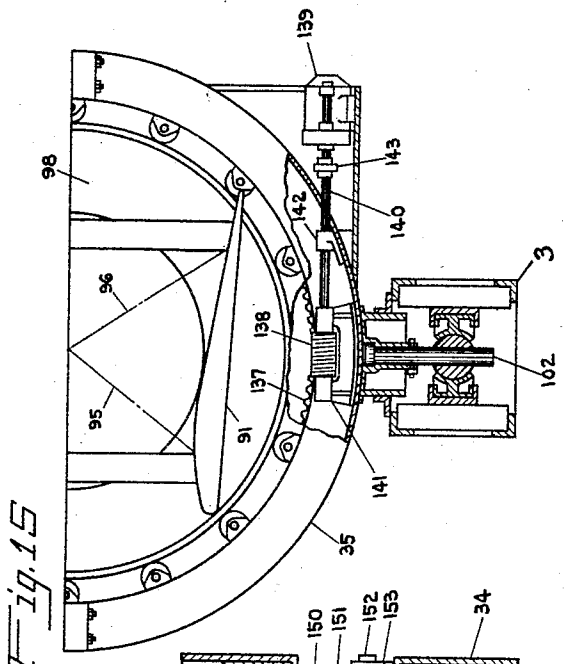


Fig. 15

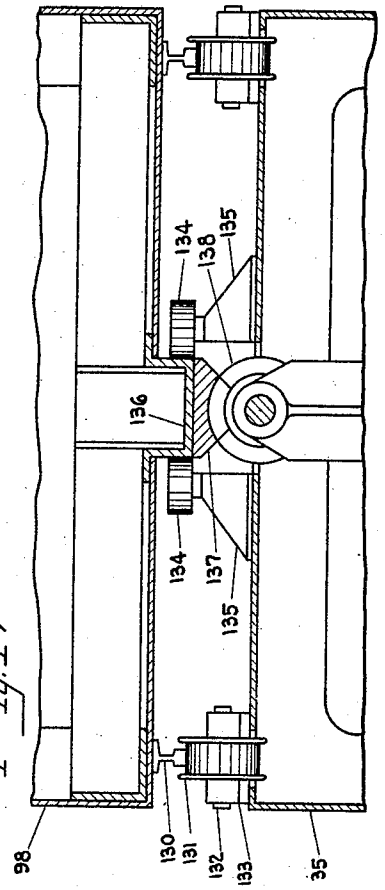


Fig. 17

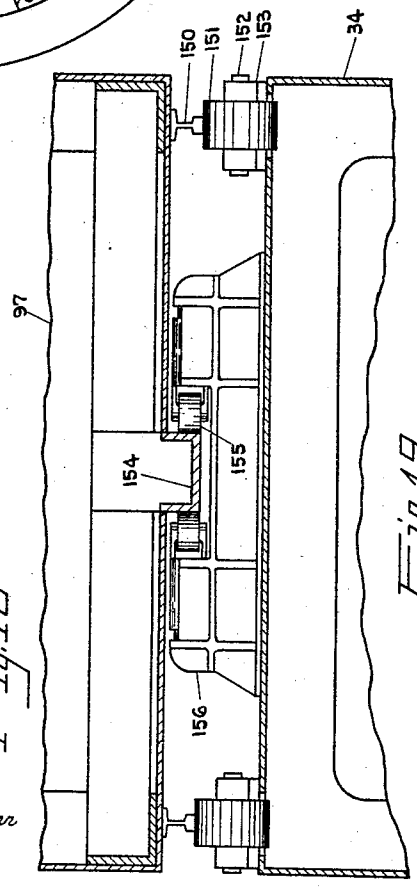


Fig. 16

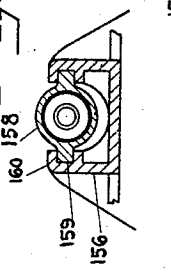


Fig. 19

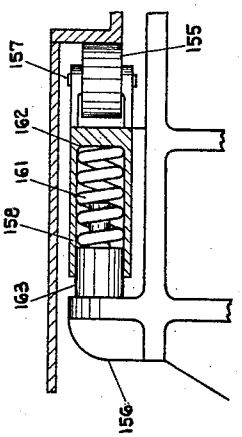


Fig. 18

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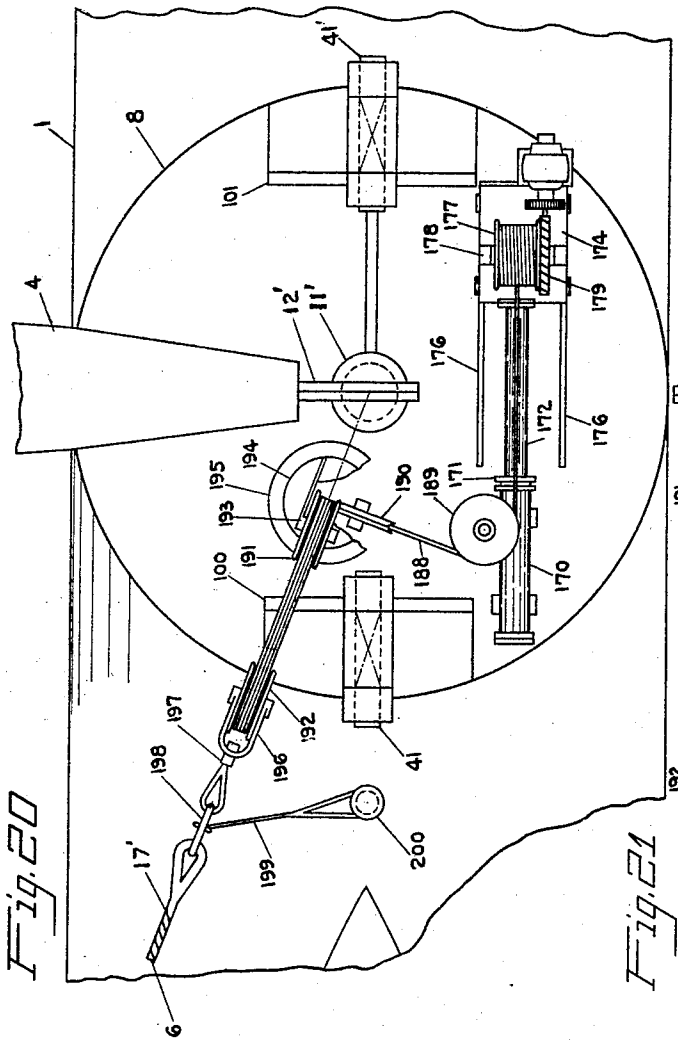


Fig. 20

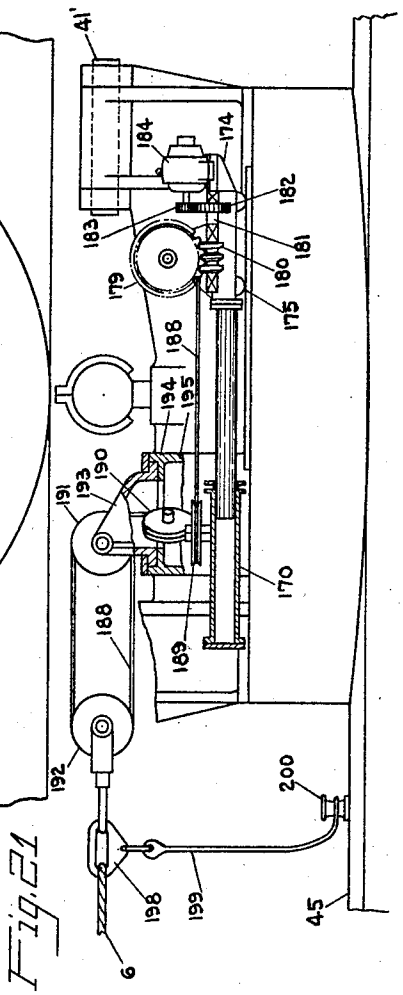


Fig. 21

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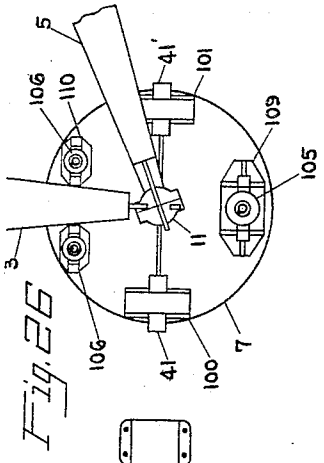


Fig. 26

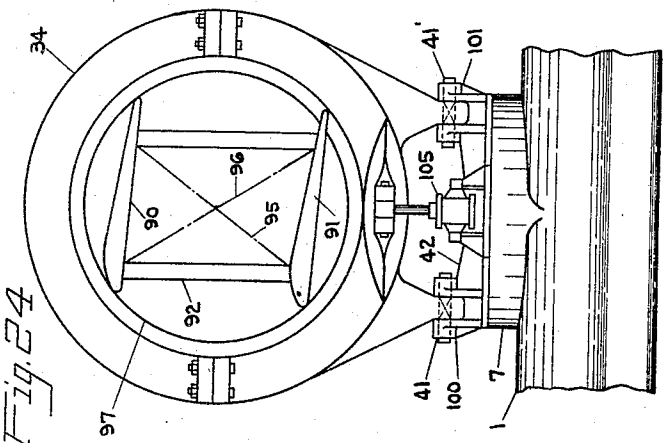


Fig. 24

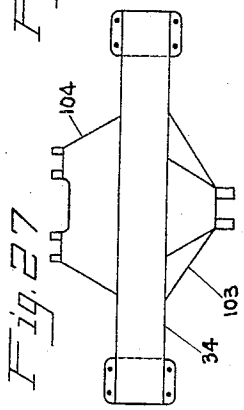


Fig. 27

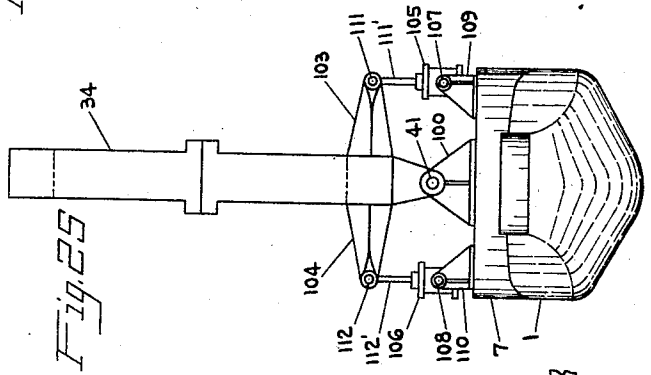


Fig. 25

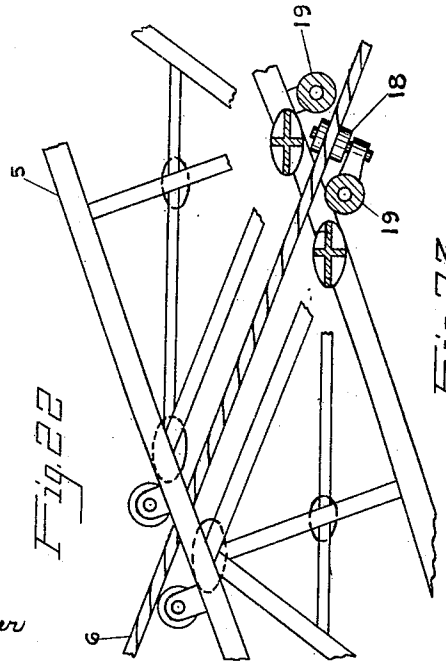


Fig. 22

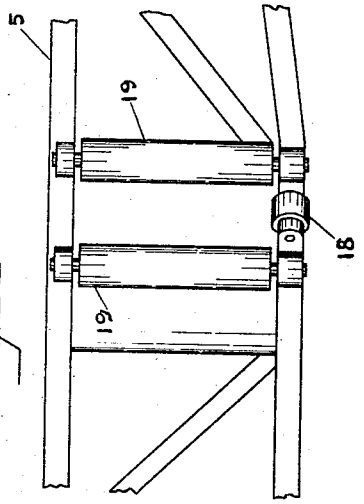


Fig. 23

WITNESS
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INVENTOR
Samuel E. Hitt

Patented Dec. 6, 1932 1,890,113

UNITED STATES PATENT OFFICE

SAMUEL E. HITT, OF ELYRIA, OHIO

AEROSHIP

Application filed March 14, 1932. Serial No. 598,578.

This invention relates to an aero-plane-ship, hereinafter called an aeroship, a two hulled seagoing vessel carrying air propulsion units and lifting planes and which at high speeds glides over the surface of the water or skips upon the crests of waves on an even keel.

The lifting planes are further described in my application, Safety surfaces for aerofoils, filed November 11, 1931, Serial No. 574,264.

My aeroship carries a thousand passengers and is equipped to provide them with the speed, safety, conveniences, comfort and luxury of modern travel.

In my aeroship the hulls are 600 feet long or more and are spaced 150 feet apart or more, to reduce rolling and pitching to a minimum.

In good flying weather, the aerofoils lift the hulls as the speed increases until they are almost out of the water and the water resistance is reduced to a minimum.

My aeroship is equipped with sixty thousand horse power, consisting of thirty-two, 1500 horse power air propulsion units and four, 3000 horse power steering units, and has a cruising speed of eighty miles an hour and a maximum speed of one hundred miles an hour, crossing the Atlantic Ocean in twenty-four hours.

When running at such speeds my aeroship maintains an even keel and does not roll.

In case the aeroship runs into a fog or bad weather and comes to anchor to ride out the storm and a high sea is running, the ship is put to a severe test.

The two hulls are therefore positively and pivotedly connected in such a way as to leave each hull free to ride the waves, i. e., to pitch independently.

The two hulls are spaced and pivotedly connected fore and aft by aerofoils or truss like biplanes and by spanners directly under them, the biplane truss and spanner at each end of hull being in the same plane when the hulls are parallel. Should the hulls pitch and be not parallel, then the biplane truss and the spanner under it have a relative rotative motion, causing the parallelogram to slightly warp.

Likewise, should the action of the waves tilt one of the bows up for instance, and leave the sterns of the two hulls at the same level, the forward spanner swings upwardly and draws the two bows closer together, horizontally, causes the forward biplane to tilt and leaves the aft biplane level.

The rolling of the hulls is stabilized by connecting each hull fore and aft indirectly to the plane trusses.

To meet these conditions and problems, the objects of my invention are as follows:—

To provide an aeroship for ocean travel to transport safely a thousand passengers at speeds from eighty to one hundred miles per hour.

To provide entirely enclosed hulls with sealed water-tight chambers to render the hulls practically non-sinkable.

To provide a distribution of such chambers to safeguard the hull from turning turtle in case the hull becomes detached from the rest of the aeroship.

To provide the hull with three water-tight decks and means of water closure at the stairways or other openings.

To provide each hull with sufficient buoyancy to float the whole ship in case of accident.

To provide the hulls with side plates and partitions so reinforced as to constitute a truss capable of carrying the hull load when the hull is supported by wave action principally at the center or ends, or when the hull is lifted nearly out of the water by the aerofoils and is supported principally near the hull ends.

To provide lifting planes forward and aft, the planes carried by trusses capable of carrying most of the propulsion units.

To provide ring mounting of the plane trusses, the ring housings being pivotally mounted on turntables on the fore and aft decks, constituting a universal joint between the plane truss and the hull.

To provide spanners under the plane trusses to space the hulls apart.

To provide connection of the spanner to

hull on center line of pivotal connection of plane housing to turntable so that the plane truss and spanner are parallel when the hulls are parallel and constitute a near parallel motion when the hulls are not parallel.

To provide a turntable for support of the outer ring housings, with one set of rollers to support the planes at rest or at slow speeds and another set of rollers to carry the reversed load when the planes lift more than their own weight and what they carry above the rollers.

To provide a center ring mounting at the center of the plane truss, midway between hulls, to stabilize the plane, the ring housing prevented from turning by pin connection to the spanner below it, so that when the hulls pitch relatively to one another, the plane only pitches half the angle between hulls.

To provide wheel or roller bearings in the ring mountings of the aerofoils or planes, permitting rotation of the planes.

To provide the center ring mounting of the plane with an electric motor drive for control of plane inclination.

To provide the motor drive for plane inclination with worm gearing to automatically lock the plane in place when the motor is cut off.

To provide a diagonal connector to keep the hulls practically abreast at all times.

To provide a diagonal tension cable between hulls with forward and aft connections opposite to those of the diagonal connector, the cable kept taut to relieve the connector from compressive strain.

To provide universal joints at connections of spanners, connector and diagonal cable to the hulls.

To provide a pneumatic take up for the diagonal cable to compensate variation in distance between connections of cable to hulls, when the hulls pitch.

To provide the cable take up with an electrical windlass for adjustment of length of the diagonal cable between universal joint and windlass.

To provide air cylinders between the hull turntables and the plane ring housings to stabilize the rolling of hulls.

To provide for automatic pressure regulation for the hull stabilizing cylinders.

To provide air propulsion units at the bow and stern of hulls with turntable mountings for steering.

To provide a search light, mounted on the forward plane and counterbalanced to maintain a level beam.

To provide an air compressor for the air cylinders.

To provide electrical power for the motors, air compressor unit, lighting, heating, cooking and other purposes.

To provide a pilot house with switch board and other apparatus for the control of propulsion units, steering units, plane inclination, plane safety surfaces, cable tension and search light.

In the drawings:—

Fig. 1 is a general plan of the aeroship.

Fig. 2 is a side view of the aeroship.

Fig. 3 is a front view, steering units omitted, showing the aeroship at low speed taking a huge wave.

Fig. 4 is a side view of forward part of the aeroship.

Fig. 5 is a general section of hull.

Fig. 6 is a part front view of aeroship, steering unit omitted.

Fig. 7 shows pin connection of center ring housing to spanner.

Fig. 8 is a sectional plan on line 8—8 of Fig. 7.

Fig. 9 is a plan of forward connections of diagonal connector and spanner to the port hull.

Fig. 10 is a sectional elevation on the line 10—10 of Fig. 9.

Fig. 11 is an end view and part section of the same.

Fig. 12 is a plan of forward connections of diagonal cable and spanner to starboard hull.

Fig. 13 is a part sectional plan of turntable.

Fig. 14 is a part sectional elevation of turntable.

Fig. 15 is a part side view of central plane ring housing showing motor drive for plane inclination.

Fig. 16 is a sectional elevation showing roller mounting of an outer plane ring in its ring housing.

Fig. 17 is a sectional elevation showing the roller mounting of the center plane ring housing on its ring.

Fig. 18 shows the spring mounting of rollers on the outer housings.

Fig. 19 is an end view of the same.

Fig. 20 is a plan of aft connections of diagonal cable and spanner to port hull, showing take up.

Fig. 21 is an elevation of the same.

Fig. 22 is a plan and part section of center part of diagonal connector and diagonal cable.

Fig. 23 is an elevation of the same.

Fig. 24 is an elevation of an outer ring housing and hull cylinder and mounting on turntable.

Fig. 25 is a side view of the same.

Fig. 26 is a plan of the turntable.

Fig. 27 is a plan of an outer ring housing.

Numerals:—In Figs. 1, 2, 3, 4, 5, 6, 20, 24 and 25, 1 is the port hull and 2 the starboard hull, spaced apart by the forward spanner 3 and aft spanner 4 and kept abreast by the diagonal connector 5 and the diagonal cable 6.

Turntables 7 and 8 are mounted on the forward and aft decks of hull 1. Turntables

9 and 10 are mounted on the forward and aft decks of hull 2.

The forward and aft spanners 3 and 4 are connected to the hulls 1 and 2 by universal joints 11 and 15, 11′ and 15′ shown in Figs. 9, 10, 11, 12, 20 and 26, mounted on the turntables 7, 8, 9 and 10. The diagonal connector 5 and the cross spanners 3 and 4 are connected to the same universal joints 11 and 15′ and have the same pivotal centers.

On the forward turntable 7 of hull 1, the universal joint 11 carries the connection 12 of the port end of spanner 3 and connection 14 of the forward end of connector 5. On the forward turntable 9 of hull 2, the universal joint 15 carries the connection 16 of the starboard end of spanner 3 and connection 17 of the forward end of the diagonal cable 6. On the aft turntable 10 of hull 2, the universal joint 15′ and connections are similar to those of the forward end on hull 1.

In the double universal joint 11, shown in Figs. 4, 9, 10, 11 and 12, the spherical ball 20 is mounted on the stationary shaft 21 carried by the base 22 with collar seat 23 and fastening bolt 24. The split shell 25, of uniform thickness, fits over the ball 20 and is fastened to the spanner 3 by the plates 12.

The connector 5 is connected to the universal joint 11 by the split strap 14, cap 26 and bolts 27. The strap 14 and cap 26 fit over the shell 25. The weight of connector 5 is carried by the strap 28 secured to the strap 14 by bolt 29 and to the cap 26 by bolt 30. The spanner 3 and the connector 5, therefore, swing about the same center.

The base 22 is mounted on top of each of the four turntables, centering the spherical joints 11 and11′, 15 and 15′ on vertical center line of turntable. Therefore, the turntable is free to revolve without affecting the angular motions of the spanners 3 and 4 and the connector 5.

On the aft turntable 8 of hull 1, the universal joint 11′ carries the connection 12′ of the port end of the aft spanner 4. The aft end 17′ of the diagonal cable 6, in plan, is in line with the center of the universal joint 11′ as shown in Fig. 20.

When the hulls pitch unevenly, the triangle formed by the hull 1, the aft spanner 4 and connector 5, and the triangle formed by hull 2, the forward spanner 3 and connector 5, both angles fold or hinge about the center line of connector 5, which is the line between centers of the universal joint 11 and 15′.

Therefore, should the bow of hull 1 rise, as shown in Fig. 3, and the above triangles start to fold up, then the longitudinal center of diagonal cable 6 rises with regard to center of connector 5.

In Figs. 22 and 23, the cable 6 is shown passing through the connector 5 with a bottom roller 18 to carry its weight when down and with side guide rollers 19, giving the central portion of cable 6 a free vertical travel equal to the maximum relative pitch of hulls measured at the turntable centers.

In Fig. 3, the aeroship is shown at slow speed or at anchor, taking a huge wave thirty feet high from trough to crest, without disadvantage to the hull connections.

30 is the forward lifting plane and 31 the aft lifting plane, both of which carry air propulsion units 32. 33 are the steering units, decribed in the patent to me, Propeller turret for propulsion and steering of aeroships, Dec. 29, 1931, No. 1,838,258.

34 are the outer plane ring housings and 35 the center ring housings, which carry the pilot houses 36. 37 are the pennant masts, located on the outer ring housings 34, in plain view of the pilot for direction of wind.

The upper deck 38, floor of the observation cabins 39, being about thirty feet above the water line, the glazed sides 40 of the cabins 39, are not subject to heavy wash.

The lifting planes 30 and 31 are roller mounted in the outer ring housings 34, which are pivotedly connected at 41 to brackets 42 centrally mounted on the top of turntables 7, 8, 9 and 10 on the decks of and in the medial planes of hulls 1 and 2. The center line of the pivotal connection 41 of the outer ring housings 34 to the brackets 42, passes through the center of the universal bearings 11 and 11′, 15 and 15′ for the spanners 3 and 4 and the connector 5.

When the hulls 1 and 2 pitch unevenly, the ring mounting centers of the outer housings 34 move forward and backward, causing the lifting planes 30 and 31 to get out of square with the hulls. The outer housings 34 are always square with the lifting planes 30 and 31 and therefore turn same relatively to the hulls when the hulls pitch, causing a small movement of the turntables 7, 8, 9 and 10.

In Figs. 13 and 14, the turntable is shown to have a kingpin 43 mounted in bracket 44 secured to the hull deck 45, kingpin 43 is held in place by bolt 46. The turntable top 47 is centered by the bearing 48 of the center bracket 49 carried by the top framing 50.

The load due to the weight of lifting plane 30 or 31, is carried by the inside rollers 51, running between the upper track 52 carried by the upper framing 50 and the lower track 53, supported by the lower framing 54 on the hull deck 45. The inside rollers 51 are spaced by pins 56 between rings 57 and 58 centered by radial spokes 59 secured to the hub 60, which turns on the hub 61 of the bracket 44.

The reversed load due to the lift of the plane, 30 or 31, is carried by the outside rollers 62 and 63, running on tracks 64 and 65, supported by the upper framing 50 by hangers 66 and 67, which carry beams 68 and 69. The hull load is transmitted from hull fram-

ing 70 through posts 71 to beams 72 and 73 and upper tracks 74 and 75.

The inner set 62 of outside rollers are spaced by rings 76 and 77, centered by rollers 78. The outer set 63 of the outside rollers are spaced by rings 79 and 80 and centered by rollers 81.

In case some of the rollers fail, the turntable then operates on the safety surfaces between the hook ring 82 mounted on the turret and the ring 83 and flanged ring 84 carried by the top framing 50. The turntable cover 85 extends down over the safety surfaces to protect them from the weather so they may be greased.

As shown in Figs. 2, 3, 4, 6, 15 and 24, the lifting aerofoil 30 is shown a biplane, with upper plane 90 and lower plane 91, with struts 92, bracing 93 and 94, cross bracing 95 and 96, outer rings 97 and central rings 98, all built together to form a plane truss 99, capable of carrying the loads due to lift and the weight of the propulsion units 32.

The propulsion units 32 are secured below the lower surfaces of both the upper plane 90 and the lower plane 91, and are spaced clear of the struts 92 and the bracing 93 and 94.

The lifting plane truss 99 is carried by the outer housings 34, having pin connections 41 and 41′ in bearings 100 and 101 on bracket 42 carried on turntables 7, 8, 9 and 10. The center housing 35, as shown in Figs. 3, 6, 7, 8 and 15, is carried by the plane truss 99 and is held from turning by pin connection 102 to the spanner 3.

The plane truss 99 is roller mounted in the housings 34 and 35 and held from revolving by worm gear connection on center housing 35. By making the plane truss 99 fast at the center only, the pitching of the plane is equalized to half the angle of pitch between the hulls.

When the hulls pitch, therefore, and the outer housings 34 tilt relatively forward and backward, the plane truss 99 revolves through a small angle in the outer housings 34.

As shown in Figs. 24, 25 and 27, the brackets 103 and 104 are a part of the outer housing 34. The hull stabilizing cylinders 105 and 106 are pivotedly mounted at 107 and 108 on brackets 109 and 110, which are mounted on top of each of the four turntables and are pivotedly connected at 111 and 112 to the brackets 103 and 104 by connecting rods 111′ and 112′.

The forward hull cylinders 105 and 106 and the aft hull cylinders 105*a* and 106*a*, are for the purpose of reducing the roll of the hulls to a minimum.

To accomplish this purpose I have devised a system of step-up pressures in the cylinders, automatically controlled by a pendulum located in the transverse longitudinally central plane of hull and at a height approximating the average location of the rolling center, which depends on the shape of the bottom and the displacement, which is variable.

When the hull rolls two degrees from vertical, a conductor element carried by the hull makes contact with a conductor element carried by the pendulum and energizes a magnet which operates a pneumatic valve at the cylinder, admitting to the cylinder an air pressure of twenty-five pounds per square inch.

When the hull rolls five degrees from vertical, another contact, magnet and valve admits to the cylinder an air pressure of fifty pounds.

When the hull rolls ten degrees from vertical, a third contact, magnet and valve admits to the cylinder an air pressure of one hundred pounds.

This device is called by me an automatic pneumatic electric three stage step-up pressure regulator.

By having three distinct constant pressures, the action is always positive.

For instance, should hull 1 roll to starboard, the outer cylinders 105 and 105*a* on hull 1 are put in compression and the reaction against the outer housings 34 held by the forward and aft planes 30 and 31, tends to check the rolling and to return the hull 1 to normal. In a similar way, when either hull starts to roll outwardly, the inside pairs of cylinders 106 and 106*a* are under compression.

For a light sea, the hulls roll about two degrees, for a moderate sea, about five degrees and for a heavy sea, about ten degrees on each side of vertical, when the aeroship is at slow speed or at anchor.

In Figs. 7 and 8, the pin connection 102 of the center ring housing 35 to the cross spanner 3 shows the pin 102 carried by bracket 115, held in place by pin head 116 and bolt 117. The pin 102 is free to turn in and to slide up and down in its cylindrical bearing in the ball 118, which is free to turn in the spherical bearing 119—120, which is rigidly mounted in the cross spanner 3.

The center ring housing 35 is thus centered by and held against rotative movement by this universal connection 102—118—119 to the cross spanner 3. Relative to the spanner 3, the housing 35 is therefore free to move up and down, to rotate horizontally, or to swing bodily about the center of the universal bearing 118—119.

As shown in Figs. 4, 6, 15, 16 and 17, the outer and central plane truss rings 97 and 98 are rail and wheel mounted in the plane ring housings 34 and 35.

In Fig. 17, the rails 130 are mounted on the center ring 98 and run on the wheels 131 mounted within the center ring housing 35 by axles 132 and bearings 133. The center

ring 98 is centralized with its housing 35 by rollers 134 mounted with brackets 135 on the center housing 35, the rollers 134 engaging a central annular projecting flange 136 on the central plane ring 98.

The flange 136 carries an annular worm gear 137 engaged by the worm 138 driven by the motor 139 and mounted on housing 35 with shafting 140, bearings 141 and 142 and coupling 143 as shown in Fig. 15.

The outer plane truss rings 97 are mounted within their housings 34 with rails 150 running on flangeless wheels 151 carried within the outer ring housings 34 by axles 152 and bearings 153. The outer ring 97 is provided with a central annular projecting flange 154, engaged by rollers 155, spring mounted on bracket 156 within the outer housing 34. The outer rings 97 are built integral with the plane truss 99 and their distance apart is fixed. When the hulls pitch and the plane truss 99 is no longer parallel to the spanner 3, the two are a little closer together and the outer housings 34 also draw in a little. This small end movement or sliding of the outer housings 34 relative to the plane truss 99 is taken up by spring mounting of the rollers 155 as shown in Figs. 18 and 19, in which the roller 155 is carried by the pin 157 on shell 158 with side bearings 159 in guides 160 on the bracket 156. The shell 158 encloses the spring 161, which has a bearing at the shell end 162 and on the cylindrical boss 163 carried by the bracket 156. The advantage of this arrangement is the assistance given to the rail wheel contacts in moving the turntable and thus holding the outer ring housings 34 square with the plane truss 99.

In Figs. 20 and 21, the take-up for the aft end of the diagonal cable 6 consists of the pneumatic cylinder 170 mounted on top of the turntable 8, gland 171, plunger 172, car 174, with wheels 175 running on track 176, rope drum 177 mounted on the car 174 with bearings 178, worm gear 179 secured to drum 177 and driven by worm 180, shaft 181, gears 182 and 183 and motor 184, mounted on the car 174.

The drum cable 188 passes over sheaves 189 and 190 and serves the sheaves 191 and 192. The sheave 191 is carried by bracket 193 mounted on a turntable 194 on a stand 195 secured to the top of the hull turntable 8. The turntable 194 is centered on the center line of diagonal cable 6, which passes through the universal joint 11′, when hulls 1 and 2 are parallel. The sheave 192 is carried by the sheave block 196 with swivel 197 and link 198, connection to end 23 of diagonal cable 6.

The link 198 carries a safety cable 199 fastened to a stanchion 200 on the hull deck 45, so that, in case the cable 188 parts, the diagonal cable 6 is held from falling into the sea.

The electric take-up is for the purpose of erection, replacement and adjustment. The pneumatic take-up is for the purpose of taking up slack when the hulls 1 and 2 pitch unevenly and the distance between centers of connections of the diagonal cable 6, varies, and also for the purpose of maintaining a constant tension in the diagonal cable 6.

As shown in Fig. 5, the hulls 1 and 2 are entirely enclosed.

The hull has a smooth bottom 201, with long radius keel 202, and flat portions 203 tapering upwardly therefrom at 30 degrees, vertical sides 204, long radius bilge 205 between the bottom 201 and the sides 204, cabin sides 206, curved gunwale plate 207, sloping side tops 208 inclined 30 degrees from horizontal between the gunwale plate 207 and cabin sides 206, and cabin top 209. The bottom, sides and top of hull are tangent to a circle to obtain high ratio of volume of weight.

This construction of hull bottom 201, together with the long radius bilge 205, reduces the pounding effect of the waves to a minimum. The V-shaped bottom 203 also reduces the water resistances rapidly as the hull lifts and the hull water line falls.

The observation cabins 39 extend between the turntables 7 and 8 on hull 1 and between 9 and 10 on hull 2.

38 is the upper deck for the observation cabin 39. 210 is the main deck in line with the fore and aft decks 45. 211 is the lower deck, 212 flooring of the hold, with manhole 213 over the oil reservoir. The above decks are all water tight.

A stairway 214 leads from the upper deck 38 to the main deck 210. Stairway 215 leads from the main deck 210 to the lower deck 211. At stairway openings 216 and 217, water tight floor doors are provided similar to those shown in the patent to me, Cabin for air and water craft, July 21, 1931, No. 1,815,103. 218 is a hinged floor door with water tight closure in the lower deck 211 at top of the ladder 219.

Sealed port holes 220 are provided for the lower deck 211. The sides 206 of the observation cabin 39 are provided with water tight windows 40. In all living quarters of the hull, the air is changed by artificial ventilation.

The oil reservoir is in the keel chambers 221 and 222, provided with baffling plates to prevent the oil from surging.

For life saving purposes, air tight chambers 223, 224, and 225 are provided next to the hull bottom 203 and 205 and chambers 226 at the gunwales.

The hull is further divided lengthwise by cross partitions into a number of compartments capable of water tight closure by means of rubber doors similar to those described in the cabin patent referred to above. The hulls are heavily loaded at the turntables at slow speeds and almost entirely suspended from turntables at high speeds. The hull

is therefore provided with longitudinal partitions and bracing, which, with the hull shell, constitute a truss capable of carrying the hull load.

The observation cabin 39 is provided with comfortable chairs 227, writing tables, smoking room and every convenience.

State rooms 228 are located on the main deck 210. The lower deck 211 is provided with main cabin, dining room and kitchen, office, forward quarters for officers and aft quarters for crew.

The electric generator unit 229, air compressor and other machinery are located in the hold on the floor 212.

The outside doors 230 for entrance and exit open outwardly from the observation cabin 39 on the perforated platform 231 between the cabin sides 206 and the bulwark netting 232. Doors 230 are capable of water closure from the inside.

Larger doors are provided on the lower deck level for machinery, furniture and baggage.

Operation

Passengers board the aeroship at the upper deck level on the perforated platform 231 and enter the observation cabin 39 by the door 230.

The captain gives the signal, motors are started and all is made ready. The inspector reports the temperature and ventilation system right and all outside openings closed. Order is given to cast off and the aeroship puts to sea on its own power.

On reaching open water, the aeroship is steered into its course.

The steering is effected by the pilot wheel. The pilot observes the switchboard and sees that the reversing switch for the forward turrets is up and the reversing switch for the aft turrets is down, or in reverse. A movement of the pilot wheel to the right, then steers the aeroship to starboard and a movement to the left, steers the aeroship to port, as explained in patent to me, Propulsion and steering of aeroships, Jan. 12, 1932, No. 1,840,716.

Speed is increased to eighty miles an hour, when the aeroship glides lightly over the surface of the water or skips upon the crest of waves.

Should there be a strong wind off port, for instance, then, as soon as the compass indicates the aeroship is on its course, the pilot throws up the reversing switch for the aft steering turrets, so that all of the steering turrets will revolve in the same direction.

The pilot then turns the pilot wheel to the left, turning all turrets so their propellors face part way toward the wind. An adjustment of this kind is made every few minutes until the steering units face sufficiently into the wind to counteract the abeam or side component of the wind force and hold the aeroship on its course straight ahead without drift.

Further adjustment of the steering units is necessary as the wind changes in direction or velocity.

After each adjustment, the pilot wheel is brought back to center to cut out the steering motors.

If there is no wind, the turrets all stand in straight ahead position and all of their power is utilized for forward movement of the aeroship.

When it is desired to change direction of the course, the aeroship is steered by the propeller turrets in a similar manner and a new adjustment made for direction of the wind.

Should the aeroship encounter bad weather or run into a fog and it becomes necessary to run at slow speed or come to anchor to ride out a storm, the lifting planes are partially uncovered as explained in patent to me referred to above, Safety surfaces for aerofoils, and the aeroship rides the heavy sea. On account of the weight of the all metal lifting planes and hulls, and with the lifting planes partially uncovered, no wind short of a cyclone can do the aeroship any serious damage.

The length and spread of hulls prevents the aeroship from being turned over by action of the waves.

The pilot is forewarned of major atmospheric movements and avoids violent storms by increasing the speed of aeroship to one hundred miles per hour and by changing his course to keep out of its way, even if he finds it necessary to turn back. In such a case, if a heavy sea is running and it is not advisable to turn about, the aeroship can be run backward at reduced speed by the propellor turrets. If more speed is required, the lifting planes are turned upside down and all of the air propellers become available for backward movement, with some assistance from the lifting planes.

In cases of emergency, as a precautionary measure, the passengers in the observation cabin are ordered below and the floor door closed after them.

On occasion, the openings for the ventilation system can be closed and sealed from the inside.

Thus, at no time are the lives of passengers endangered.

On nearing harbor, signal is given to slow down and the aeroship is gradually brought to rest.

Casting anchor, passengers leave as they entered.

I claim:

1. In a two hulled aeroship or similar craft, a lifting aerofoil mounted forward on the two said hulls, a lifting aerofoil mounted aft on the two said hulls, air propulsion units carried by the said aerofoils, each of the said

hulls consisting of an outer shell capable of water closure, doors in the said shell opening outwardly and means of water closure of the said doors.

2. In a two hulled aeroship or similar craft, a lifting aerofoil mounted forward on the two said hulls, a lifting aerofoil mounted aft on the two said hulls, air propulsion units carried by the said aerofoils, the said hull consisting of an outer shell capable of water closure, upper, main and lower decks capable of water closure within the said outer shell, stairway between the said upper and main decks, stairway between the said main deck and the said lower deck, stairway openings in the said decks for the said stairways and means of closure of the said stairway openings, the said means consisting of a floor car door construction, substantially as specified.

3. In a two hulled aeroship or similar craft, a lifting aerofoil mounted forward on the two said hulls, a lifting aerofoil mounted aft on the two said hulls, air propulsion units carried by the said aerofoils, each of the said hulls consisting of an outer shell capable of water closure, three water tight decks, water tight cross partitions, openings in the said decks and the said partitions for communication, and means of water closure of the said cross partition, the said means consisting of a disappearing rubber door, substantially as specified.

4. In a two hulled aeroship or similar craft, a lifting aerofoil mounted forward on the two said hulls, a lifting aerofoil mounted aft on the two said hulls, air propulsion units carried by the said aerofoils, the said hull having an outer shell capable of water closure, compartments for passengers and crew capable of water closure, sealed floating chambers adjacent to the gunwales, sealed floating chambers adjacent to the bilge, sealed floating chambers adjacent to the sloping bottom, and sealed oil chambers adjacent to the shell keel plate, substantially as specified.

5. In a two hulled aeroship or similar craft, an aerofoil mounted forward on the two said hulls, an aerofoil mounted aft on the two said hulls, air propulsion units carried by the said aerofoils, the said hull consisting of an outer shell capable of water closure, upper, main and lower decks and cross partitions within the said shell constituting compartments for passengers and crew, longitudinal and transverse partitions constituting a double bottom with oil tank in the said double bottom adjacent to the keel plate of the said hull, sealed floating chambers adjacent to the sloping bottom, sealed floating chambers at the bilge adjacent to the hull sides, sealed floating chambers at the gunwales, adjacent to the hull sides, and a chamber located symmetrically about the vertical medial plane of hull in the hold on the lowest floor level, for machinery.

6. In a two hulled aeroship or similar craft, a lifting aerofoil mounted forward on the two said hulls, a lifting aerofoil mounted aft on the two said hulls, air propulsion units carried by the said aerofoils, a forward spanner spacing the two said hulls apart latterly and forwardly, an aft spanner spacing the two said hulls apart latterly and aft, the said forward and aft spanners having the same length, a diagonal connector connecting the forward part of one of the said hulls with the aft part of the other of the said hulls, a diagonal cable connecting the forward part of the hull opposite to the aforesaid forward connector hull connection, the said cable connecting the aft part of the other of the said hulls opposite to the aforesaid aft connector hull connection, double universal joints mounted on the forward parts of the two said hulls and the aft part of one of the said hulls, the said universal joint having the same center for one of the said spanner connections and one of the said diagonal connections.

7. In a two hulled aeroship or similar craft, a lifting aerofoil mounted forward on the two said hulls, a lifting aerofoil mounted aft on the two said hulls, air propulsion units carried by the said aerofoils, double universal joints mounted forward and aft on the decks of the said hulls, the said mounting being in medial plane of hull and on vertical center line of the said mounting of the said aerofoil, spanners spacing the said hulls forward and aft connecting to the said universal joints, diagonal connector between the forward part of one hull and the aft part of the other hull connecting to the said universal joints, a diagonal cable connecting the forward part of the hull opposite to the aforesaid forward connector hull connection, and means for taking up slack in the said cable, the said means consisting of an air cylinder, plunger, car, rope drum with power drive, the drum rope serving a multiple sheave reduction rigging connecting the said drum with the aft end of the said cable, substantially as specified.

8. In a two hulled aeroship or similar craft, an aerofoil mounted forward on the two said hulls, an aerofoil mounted aft on the two said hulls, air propulsion units carried by the said aerofoils, turntables mounted on the forward deck and on the aft deck of each of the said hulls, an outer ring housing pivotally mounted on each of the said turntables, outer rings mounted on the said aerofoils in the medial planes of the said hulls, and roller mounting of the said aerofoil outer ring in the said outer housing.

9. In a two hulled aeroship or similar craft, an aerofoil mounted forward on the two said hulls, an aerofoil mounted aft on the two said hulls, air propulsion units carried by the said aerofoils, universal mounting of the said aerofoil on the said hull as per claim 8, spanners of equal length spacing the said

hulls apart latterly, universal mounting of the said spanners on the said hulls, one of the said aerofoils and its companion spanner constituting a near parallel motion when the hulls pitch, a center ring mounted on the said aerofoil midway between the said hulls, a center ring housing roller mounted on the said center ring, and a universal joint connection between the said center ring housing and the said companion spanner.

10. In a two hulled aeroship or similar craft, a lifting aerofoil mounted forward on the two said hulls, a lifting aerofoil mounted aft on the two said hulls, air propulsion units carried by the said aerofoils, spanners of equal length spacing the two said hulls forward and aft, universal mounting of the said spanners on the said hulls, a diagonal connector between the forward part of one hull and the aft part of the other hull, universal mounting of the said connector on the said hulls, a turntable mounted on forward and aft parts of each of the said hulls, an outer ring housing pivotedly mounted on each of the said turntables, outer rings carried by the said aerofoils, roller mounting of the said outer ring in the said outer ring housing, a center ring carried by each of the said aerofoils, a center ring housing, a roller mounting of the said center ring housing on the said center ring, a pin carried by the said center ring housing, a universal joint carried by the said spanner adjacent to the said aerofoil, the said pin engaging the said universal joint on the said spanner, a central annular flange on the said center ring, rollers mounted within the said center ring housing engaging the said center ring flange, a central annular flange on the said outer housing, and rollers spring mounted within the said outer ring housing engaging the said outer ring flange.

11. In a two hulled aeroship or similar craft, a lifting aerofoil mounted forward on the two said hulls, a lifting aerofoil mounted aft on the two said hulls, air propulsion units carried by the said aerofoils, universal mounting of the said aerofoils on the said hulls, spanners of equal length spacing the said hulls forward and aft, universal mountings between the said spanners and the said hulls, a diagonal connector between the forward part of one hull and the aft part of the other hull, universal mountings of the said connector on the said hulls, the universal connection of the said connector to hull having the same center as the said universal connection of the said spanner to hull, a center ring carried by the said aerofoil, a center ring housing, roller mounting of the said center ring housing on the said center ring, universal pin connection between the said center ring housing and the adjacent spanner, an annular worm gear carried by the said center ring, a worm carried by the said center ring housing and engaging the said worm gear, and a motor drive for the said center ring, the said drive consisting of the said worm, shafting, coupling, motor gear reduction and motor mounted on the said center ring housing.

12. In a two hulled aeroship or similar craft, a lifting aerofoil mounted forward on the two said hulls, a lifting aerofoil mounted aft on the two said hulls, spanners of equal length spacing the said hulls apart latterly forward and aft, the said aerofoil consisting of upper and lower aeroplanes built together as a biplane, an aerofoil structure for the said biplane consisting of upper and lower plane frames, struts, longitudinal diagonal bracing, and transverse diagonal bracing forming a truss, air propulsion units suspended from the upper plane frame below the lower lifting surface, between the said diagonal bracing, air propulsion units suspended from the lower plane frame below the lower lifting surface, between the said diagonal bracing, outer rings built integral with the said biplane structure, a center ring built integral with the said biplane structure, universal mounting of the said outer rings on the said hulls, and universal connection of the said center ring to the spanner adjacent thereto.

13. In a two hulled aeroship or similar craft, an aerofoil mounted forward on the two said hulls, an aerofoil mounted aft on the two said hulls, the said aerofoil constituting a biplane truss, air propulsion units carried by the said aerofoils, spanners of equal length spacing the two hulls latterly, forward and aft, diagonal connector between the forward part of one hull and the aft part of the other hull, turntables mounted forward and aft on the said hulls, outer housings pivotedly mounted on the said turntables, supporting the said aerofoils at equal heights above the said hulls, and roller mounting of the said aerofoil in the said outer housing, the said aerofoil, the said spanner under it and the outer housing adjacent thereto, forming a parallelogram when the two said hulls are parallel and constitute a near parallel motion when the said hulls pitch unevenly and are not parallel.

14. In a two hulled aeroship or similar craft, a lifting aerofoil mounted forward on the two said hulls, a lifting aerofoil mounted aft on the two said hulls, air propulsion units carried by the said aerofoils, spanners of equal length spacing the said hulls apart latterly forward and aft, diagonal connector between the forward part of one hull and the aft part of the other hull, universal mountings of the said spanners and the said connector on the said hulls, turntables mounted on the said hulls forward and aft, outer housings pivotedly mounted on the said turntables, roller mounting of the said aerofoils in the said outer housings,

brackets on the said outer housing, air cylinders mounted on the hull deck near the hull sides and in a transverse plane through the center of the said outer housing, a plunger engaging the said cylinder and pin connected to the said bracket, means for supplying fluid pressure to the said cylinder and means for stabilizing the said hulls against rolling by varying the intensity of the said fluid pressure.

15. In a two hulled aeroship or similar craft, a lifting aerofoil mounted forward on the two said hulls, a lifting aerofoil mounted aft on the two said hulls, air propulsion units carried by the said aerofoils, a pilot house mounted on the said forward aerofoil, steering units mounted at the bow and at the stern of each of the said hulls, the said steering unit consisting of an air propeller and combustion engine drive, turret mounting of each of the said steering units, electric motors, shafting and gearing for turning the said turrets in either clockwise or counterclockwise direction and centralized control of the said electric motors from the said pilot house, substantially as specified.

16. In a two hulled aeroship or similar craft, a lifting aerofoil mounted forward on the two said hulls, a lifting aerofoil mounted aft on the two said hulls, air propulsion units carried by the said aerofoils, steering units mounted on the bow and stern of each of the said hulls, the said steering unit consisting of an air resisting propulsion unit swiveled upon a vertical axis and mounted on a turntable having an electric motor drive, steering means for rotating the two forward turrets in the same direction, steering means for rotating the two aft turrets in the same direction, and in opposite direction to the said rotation of the forward turrets, and means for changing direction of rotation of the said turrets, independently or in groups.

17. In a two hulled aeroship or similar craft, a lifting aerofoil mounted forward on the two said hulls, a lifting aerofoil mounted aft on the two said hulls, air propulsion units carried by the said aerofoils, steering units mounted on the bow and stern of each of the said hulls, the said steering unit consisting of an air resisting propulsion unit swiveled upon a vertical axis and mounted on a turntable having an electric motor drive, steering means for rotating the four said turrets independently, steering means for rotating the said turrets in groups, one of said groups comprising the forward turrets, another of said groups comprising the two aft turrets, another of said groups comprising all four of the said turrets, and means for changing direction of rotation of the said turrets, independently or in groups.

18. In a two hulled aeroship or similar craft, a lifting aerofoil mounted forward on the two said hulls, a lifting aerofoil mounted aft on the two said hulls, air propulsion units carried by the said aerofoils, the said aerofoil consisting of upper and lower aeroplanes built together to form a biplane truss, a pilot house carried by the said biplane truss, the said pilot house being centrally located with regard to the said hulls, and mounted high enough above or low enough below the said biplane truss to be practically free from slip stream interference.

19. In a two hulled aeroship or similar craft, a lifting aerofoil mounted forward on the two said hulls, a lifting aerofoil mounted aft on the two said hulls, air propulsion units carried by the said aerofoils, the said aerofoil consisting of upper and lower aeroplanes built together to form a biplane, openings in the lifting surfaces of the said aeroplanes, slide valve closure for the said openings, electric motor drive for the said slide valve closure, the said valves arranged in groups on the said aeroplanes, a pilot house on the said biplane, and means for control of all of the said electric motors from the said pilot house.

20. In a two hulled aeroship or similar craft, a lifting aerofoil mounted forward on the two said hulls, a lifting aerofoil mounted aft on the two said hulls, air propulsion units carried by the said aerofoils, spanners spacing the said hulls apart latterly, diagonal cable between the forward part of one hull and the aft part of the other hull, a pneumatic electric takeup for the said diagonal cable, an electric motor drive for the said takeup, steering turrets mounted on the bow and stern of each of the said hulls, electric motor drives for the said turrets, openings in the lifting surfaces of the said aerofoils, arranged in groups, slide valve closure for the said openings, electric motor drive for the said slide valve closure, a pilot house centrally mounted on top of the said forward aerofoil, a pilot house centrally mounted underneath the said aft aerofoil, means of control of the said electric motors for the slide valve closures of the forward aerofoil from the said forward pilot house, means of control of the said electric motors for the slide valve closures of the aft aerofoil from the said aft pilot house, means of control of the electric motor for cable take-up from the aft pilot house, and means of control of the said electric motors for the steering turrets both from the said forward pilot house and from the said aft pilot house.

Signed at Elyria, in the county of Lorain and State of Ohio, this 12th day of March, 1932.

SAMUEL E. HITT.