

G. H. CURTISS & W. L. GILMORE.
FLYING BOAT.

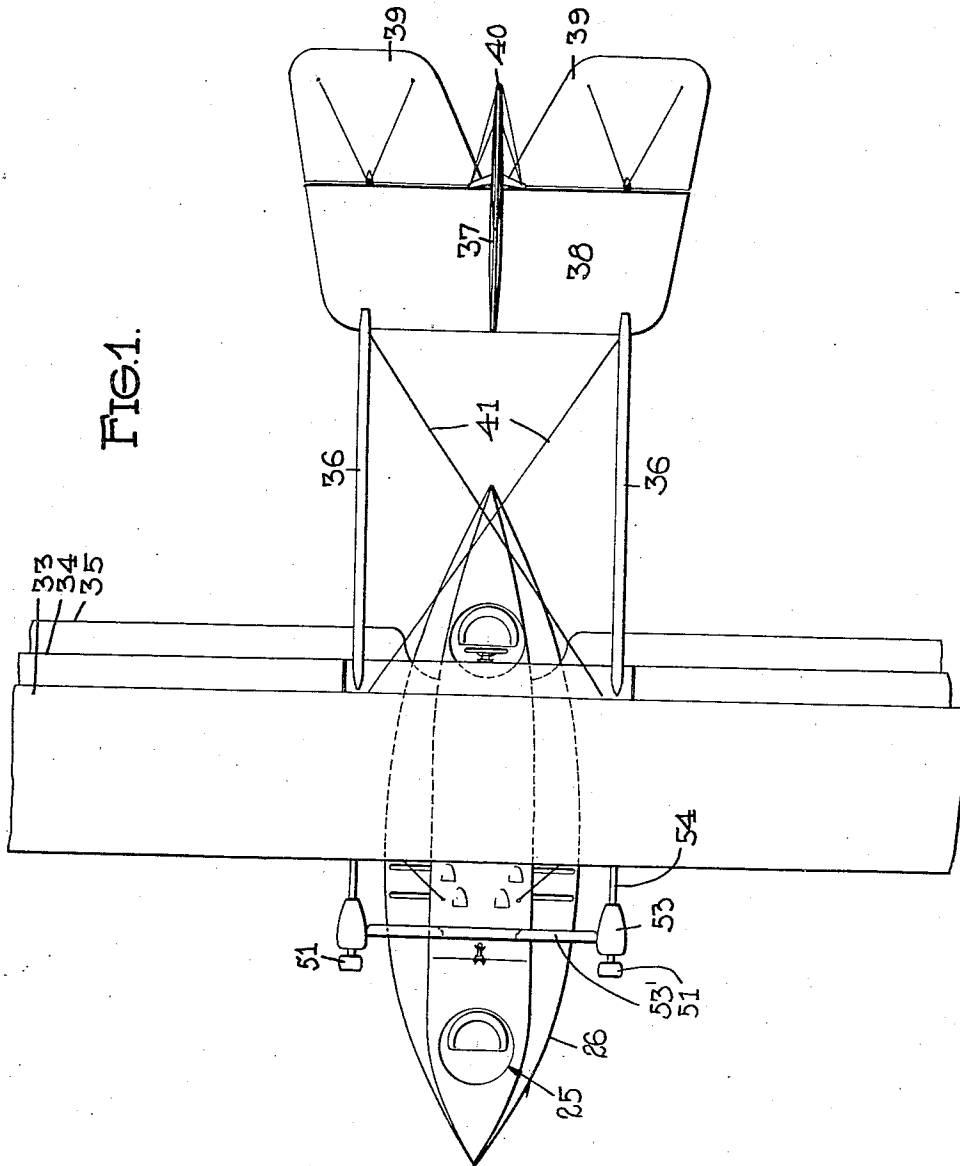
APPLICATION FILED MAR. 13, 1918.

Patented Feb. 18, 1919.

7 SHEETS—SHEET 1.

1,294,415.

FIG. 1.



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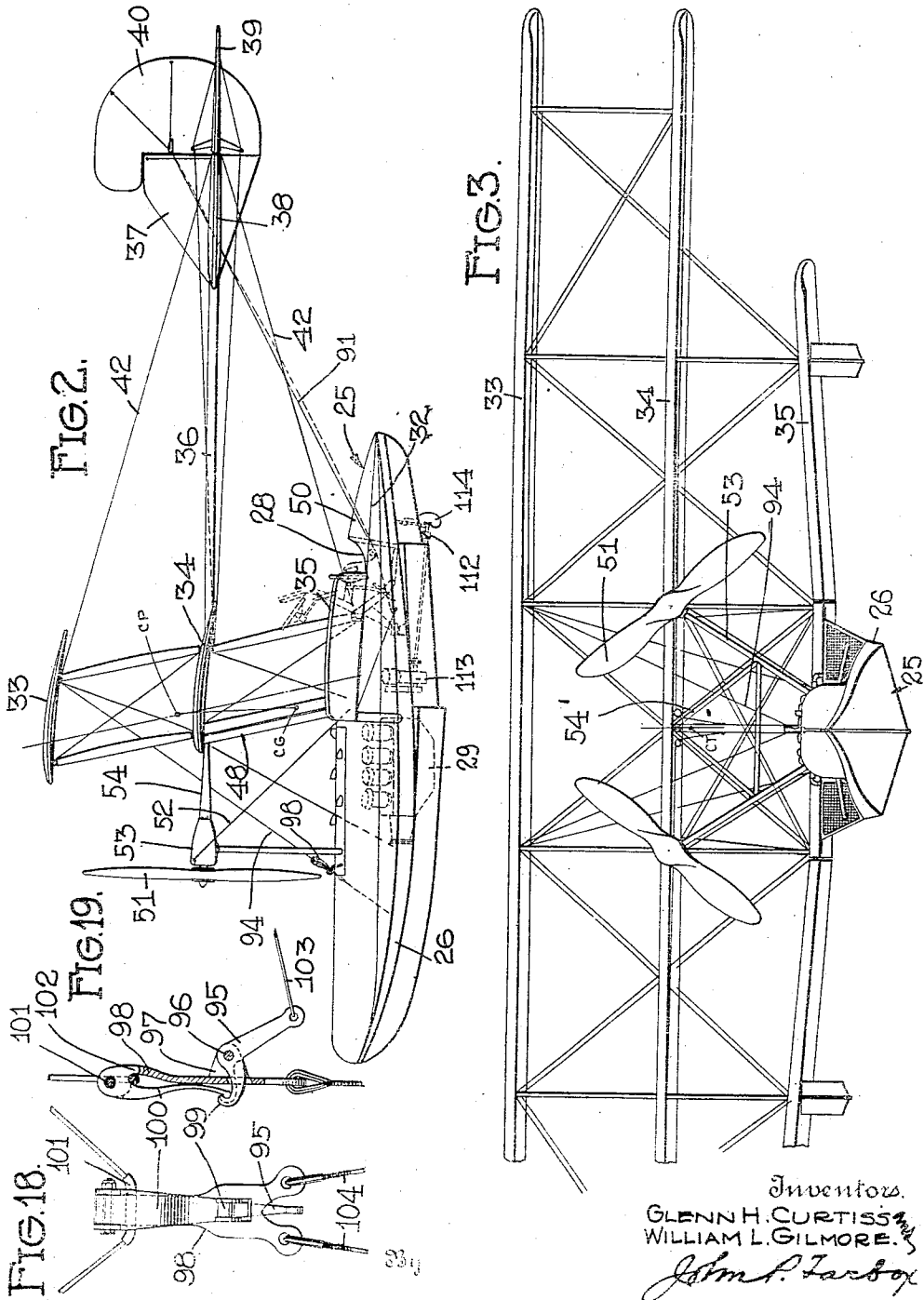
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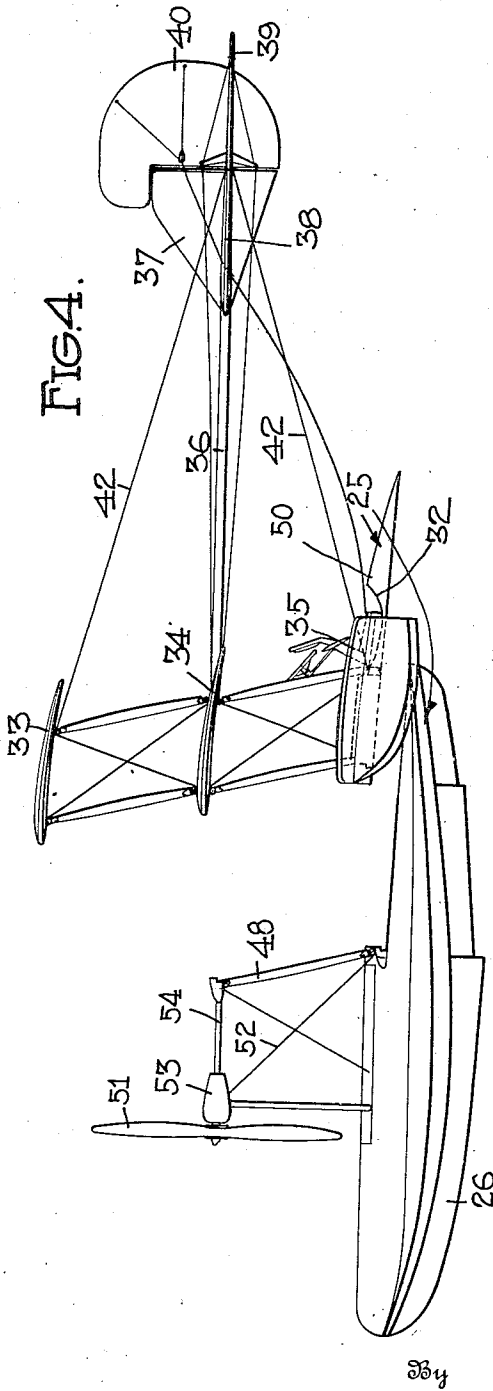
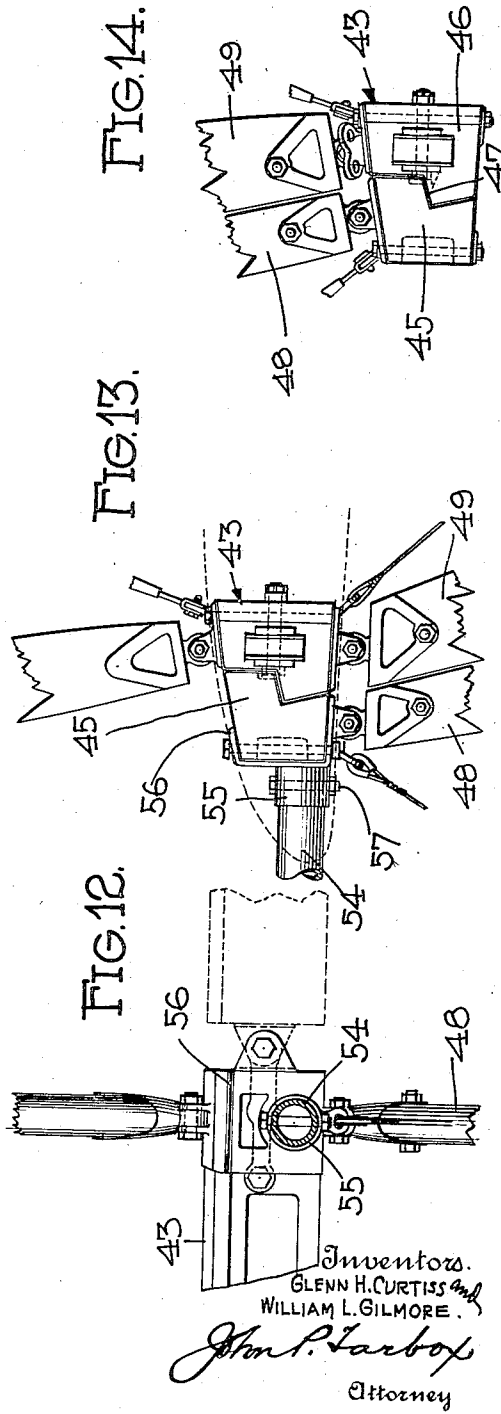
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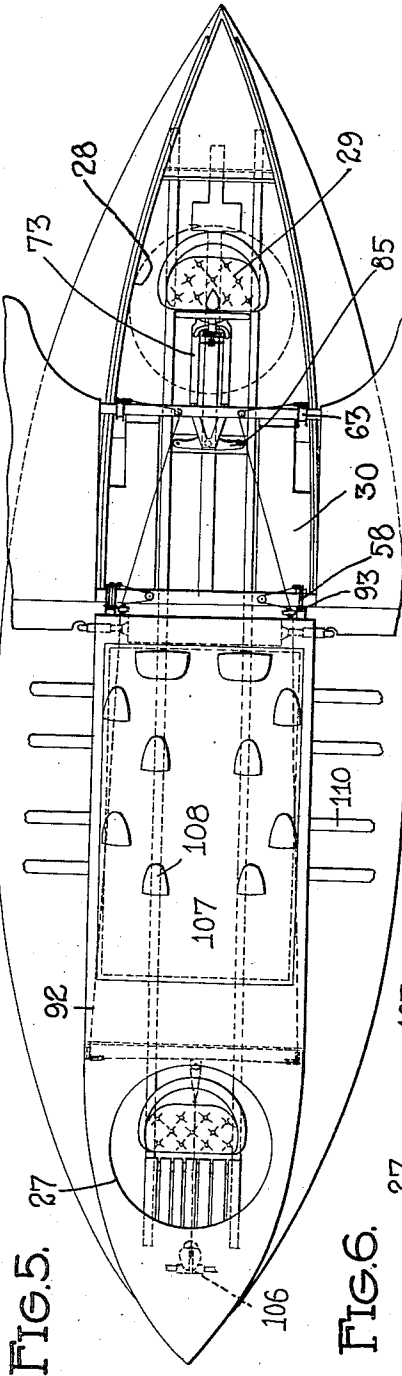
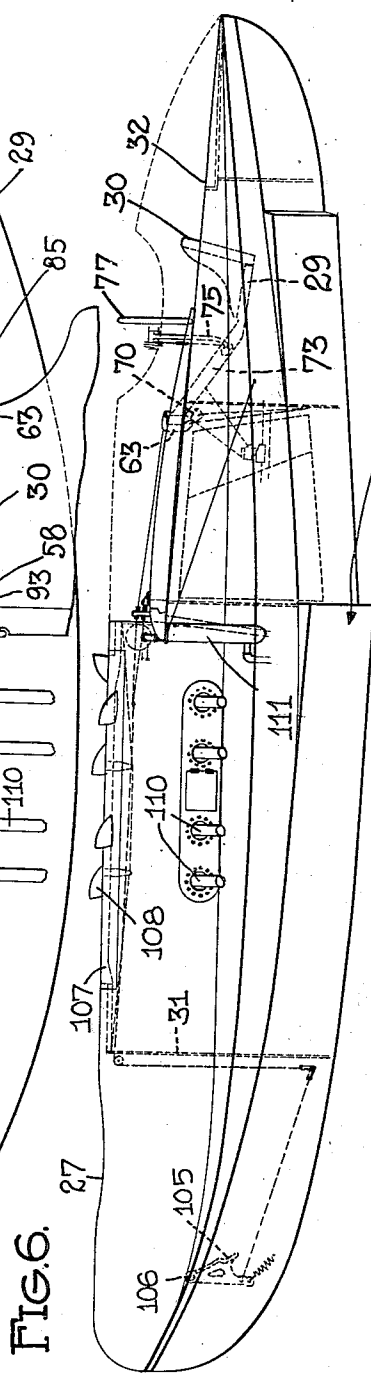
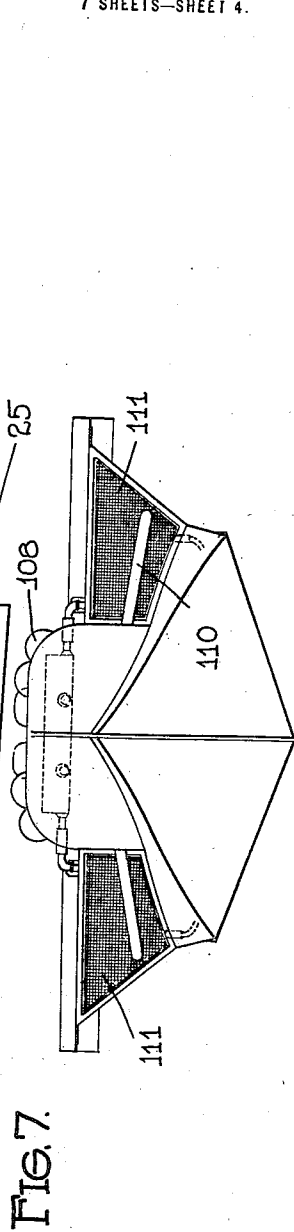
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7 SHEETS—SHEET 4.

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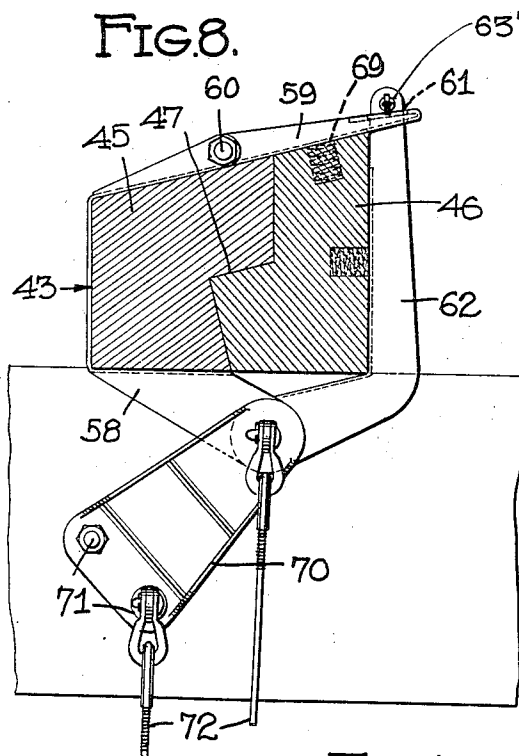
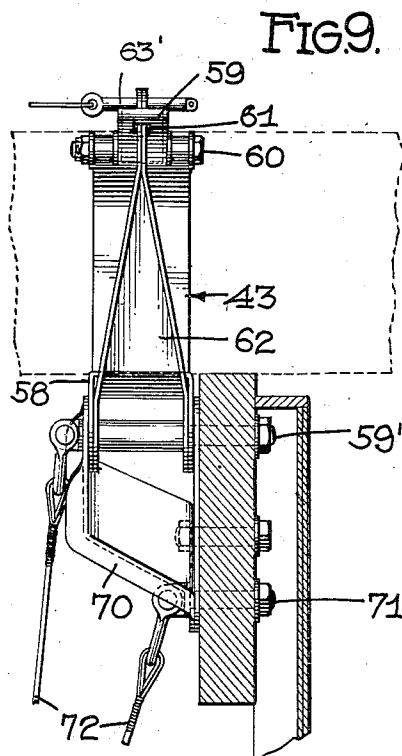
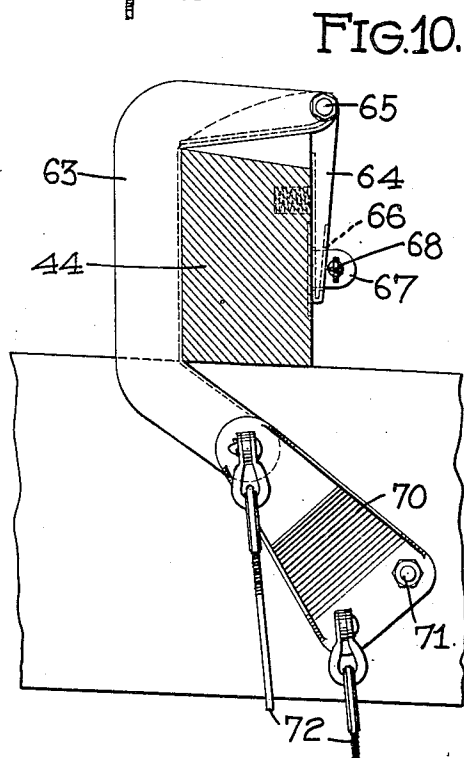
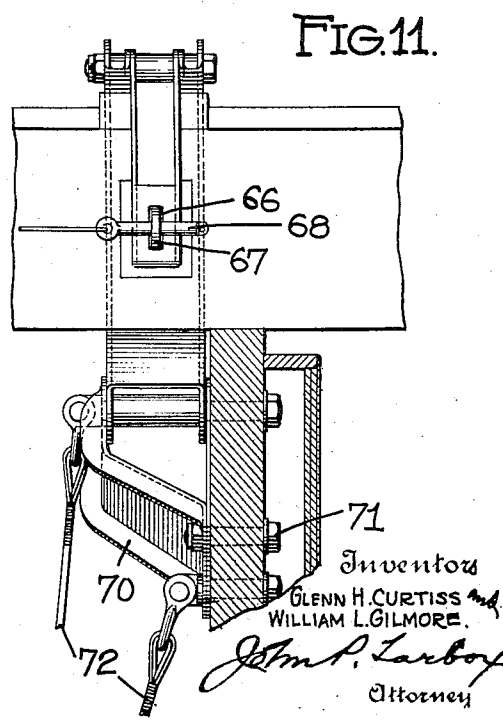
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FIG. 15.

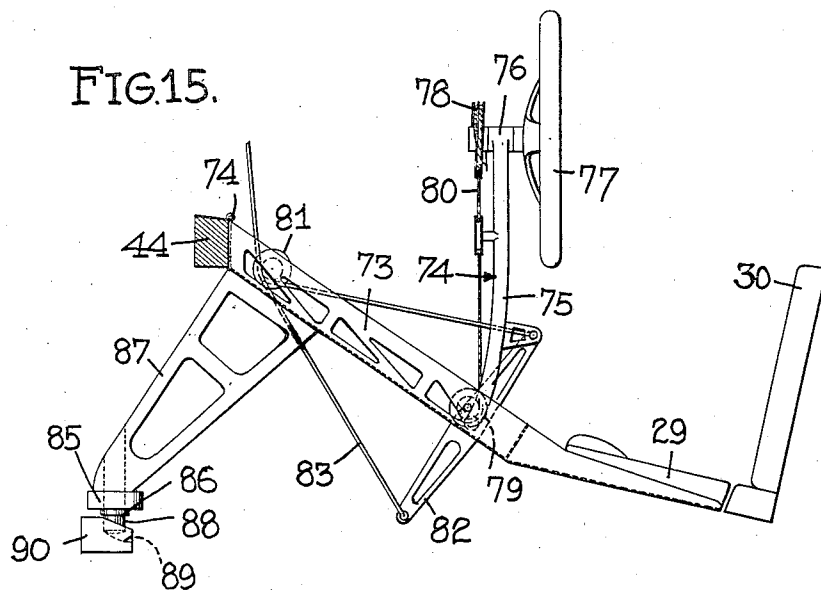


FIG. 16.

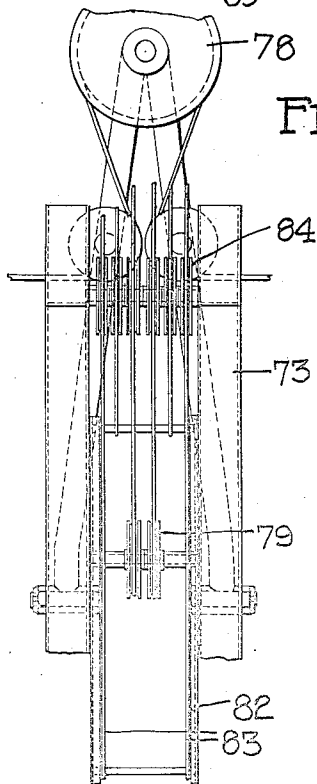
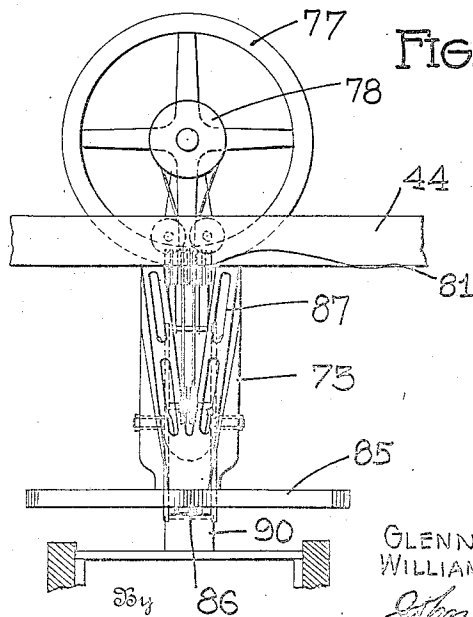


FIG. 17.



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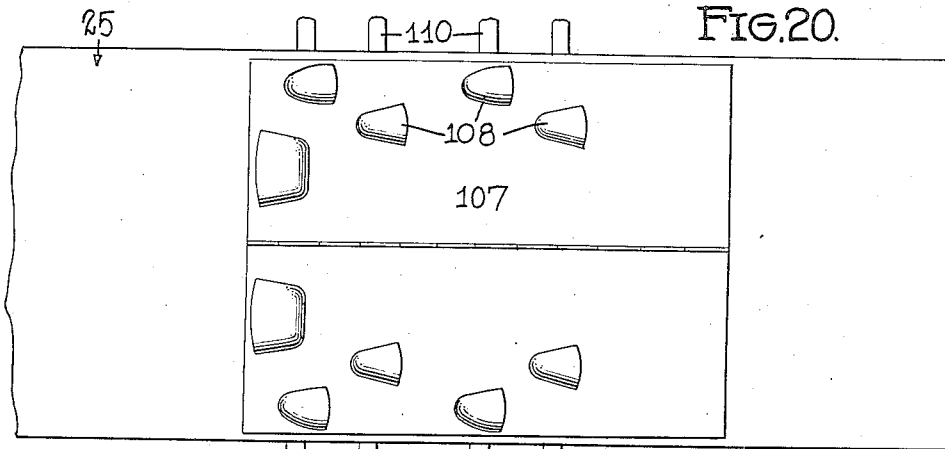
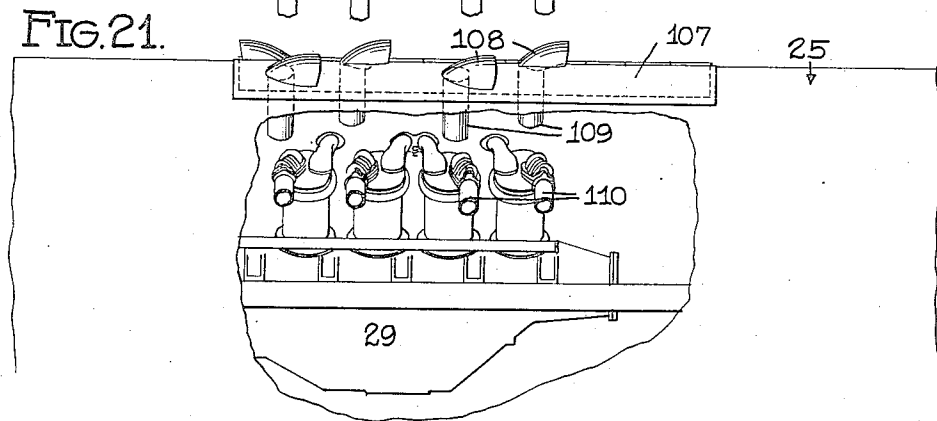
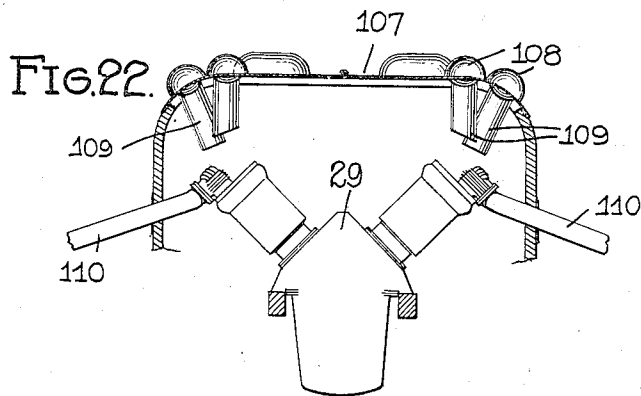
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7 SHEETS—SHEET 7.

1,294,415.



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UNITED STATES PATENT OFFICE.

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FLYING-BOAT.

1,294,415.

Specification of Letters Patent.

Patented Feb. 18, 1919.

Application filed March 13, 1916. Serial No. 222,212.

To all whom it may concern:

Be it known that we, GLENN H. CURTISS and WILLIAM L. GILMORE, citizens of the United States, residing at Garden City, in the county of Nassau and State of New York, have invented certain new and useful Improvements in Flying-Boats, of which the following is a specification.

Our invention relates to hydro-aero-machines and more particularly to flying boats.

The characteristic of the invention is the construction of the hull and the arrangement of the aeroplane parts in a manner such that the wings and tail structure may be shed as a unit, the size and weight of the hull lessened, the tail unit or empennage raised high out of the water, the motor inclosed in the hull or body, and the head resistance or "drag" cut down in consequence thereof. Instead of continuing the hull rearwardly throughout the full length of the craft as heretofore, it is terminated abruptly slightly aft of the trailing edge of the rear-most supporting surface and may be likened to a hydro-aeroplane pontoon in this respect. The aeroplane wings extend intermediately across the hull nearer its rear end than its forward end. The tail unit is supported high above the water by spars extending rearwardly from the aeroplane surfaces. These spars should exceed in length the distance between the trailing edge of the lowermost wing and the stern end of the hull so that the empennage may be properly located.

The hull or body is, as stated, relatively short and of very wide beam (after the fashion of a life-boat), whereby when its wings and super-structure are shed it will still float upright in the roughest seas. Moreover, the hull is provided with appropriate bulk heads and water tight compartments.

The sheddable wing structure comprises a unitary cell of triplane wings which are secured to the back of the boat by means of a saddle. This saddle is held in place by suitable locking devices, and upon release of these locking devices the entire set of wings, and the outriggered tail structure which is supported from the wing cell only, falls or slides backward from the stern of the boat.

The operator's seat is carried in the boat body but the control is connected with the

wing structure so that when the wing structure goes backward the control mechanism and the control wires go with it. The arrangement of the operator's seat is such that it affords an auxiliary fastening means for the sheddable wings. The only wire which needs to be loosened when the wings are shed is the wire from the center panel to the bow of the boat. This wire is equipped with special locking means, preferably at its forward end, operated simultaneously with the locking devices of the saddle upon which the wings are mounted.

The drive means consists of twin-tractor propellers geared to the motor by means of beveled gear transmission triangulated as shown in front elevation by means of a stiff cross brace between the upper gear boxes. These gear boxes are provided with rigidly connected integrally formed extensions which reach back to the leading edge of the center panel and fit freely in appropriate sockets. This fixes the upper transmission and propeller drive shaft against axial distortion or displacement, but at the same time it does not bind the wings to the boxes in any way.

Instead of having these extensions of the gear boxes socketed in the leading edge of the wings, they are to be connected to a false frame work just in advance of the leading edge of the wings (or constituting a section of the leading edge itself) but not connected in any way with the wing cell proper. Cables extending downwardly and rearwardly from the gear boxes to the boat body absorb the traction effort or pull of the propellers and brace the transmission without connection to the cell. Furthermore, a water propeller and rudder are provided, the water propeller preferably to be on a universally connected shaft so that it may be lifted up into a recess in the bottom of the tail of the boat.

While the invention is described as being applied to flying-boats it is to be understood that its application is not so limited. It may be used in connection with any and all hydro-aero-machines such as hydro-aeroplanes, etc.

Of the drawings, wherein like numerals of reference designate like or corresponding parts:

Figure 1 is a top plan view of our improved sheddable wing flying-boat.

Fig. 2 is a side elevation.

Fig. 3 is a front end elevation.

Fig. 4 is a side elevation (the wings and out-rigged tail structure being shown detached).

Fig. 5 is a top plan view of the hull or body of the craft showing the general arrangement of the various hull parts.

Fig. 6 is a side elevation of the hull or body as illustrated in Fig. 5.

Fig. 7 is a front end elevation of the hull.

Fig. 8 is a side elevation of one of the forward wing beam fastening devices, the wing beam itself being shown in section.

Fig. 9 is an end elevation of the fastening device above referred to.

Fig. 10 is a side elevation of one of the rear wing beam fastening devices.

Fig. 11 is an end view of this latter fastening device.

Fig. 12 is a front end elevation of a portion of the center panel of the intermediate wing showing the manner in which the gear box extension and wing posts are connected thereto.

Fig. 13 is a side elevation of that portion of the craft illustrated in Fig. 12.

Fig. 14 is a view similar to Fig. 13 showing the connections for the wing posts with the forward wing beam of the center panel of the lower wing.

Fig. 15 is a side elevation of the control mechanism showing its mounting and placement with respect to the operator's seat.

Fig. 16 is an end elevation (enlarged) of a portion of the control mechanism illustrated in Fig. 15.

Fig. 17 is an end elevation of the control mechanism illustrated in Fig. 15 looking aft.

Fig. 18 is an elevation of the fastening device for the cables or wires which extend from the wing structure to the bow end of the hull.

Fig. 19 is a longitudinal vertical sectional view of said fastening device.

Fig. 20 is a top plan view of the cowl for the engine section of the hull showing louvers formed thereon.

Fig. 21 is a side elevation of that portion of the hull shown in Fig. 20, and

Fig. 22 is a transverse sectional view showing the location of the motor relatively to the louvers of the cowl.

The hull or body of the craft is designated as an entirety by the numeral 25. Fins or excrescences extend out laterally from its sides to amplify its beam and consequently its hydro-plane surface. These fins designated 26, emanate from the extreme bow and widen gradually to a point substantially amidships. From the amidships portion the fins decrease in width gradually. They thus extend for the full length of the hull and not only strengthen it but materially increase its displacement. Two

rearwardly facing steps are provided in the hull bottom. One of these steps is located in the approximate vertical plan of a line passing transversely through the center of gravity and the other nearer the rear end of the hull.

The interior construction of the hull is best illustrated in Figs. 5 and 6. At its extreme forward end a cockpit 27 is provided for an observer or gunner. This is desirable in that the machine is designed primarily for coast defense purposes, scout and rescue work. At the rear end of the hull a second cockpit 28 is provided. This cockpit is intended to accommodate the aviator or pilot and is equipped with a movable seat 29, the back 30 of which is relatively fixed. In the interior of the hull are also inclosed the motor 29, fuel tanks 30 and bulk heads 31. The latter sub-divide the hull into a number of non-communicating water-tight compartments. The details of the hull however will be described at length in an application subsequently to be filed.

From a point substantially amidships a track-way 32 is inclined rearwardly and slightly downwardly for termination at the extreme rear end of the hull. This track-way serves as a guide for the wing structure when released. The rails of the track-way constitute an integral part of the hull and are free from obstruction throughout their length.

The wing structure comprises superposed supporting surfaces 33, 34 and 35. The upper surface 33 unlike the intermediate surface 34 and lower surface 35, comprises but a single panel of a length equal to the combined length of the three panels which constitute the intermediate surface 34. The reason for this difference in construction is that a portion of both the intermediate and lower surfaces remain fixed to the hull at all times while the upper surface is shed clear of the hull in its entirety when released. The length of the lower surface 35 is preferably somewhat less than that of the two surfaces above it. All of the surfaces except a portion of the center panels of the lower and intermediate surfaces are shed as a unit and in a manner hereinafter more fully explained.

An outrigged tail structure is supported out from and to the rear of the supporting surfaces by spars 36 extending rearwardly and in parallelism from the intermediate surface 34. These spars carry at their rearward extremities the empennage or tail unit which comprises the usual stabilizing surfaces 37 and 38 and directional control surfaces 39 and 40. The tail structure is braced transversely by wires 41 and vertically by wires 42. The transverse wiring is located in the horizontal plane of the spars 34.

Each of the supporting surfaces includes

in its framework a forward wing beam and a rear wing beam. The forward wing beam of the center panel of the lower supporting surface is designated as an entirety by the numeral 43 and the rear wing beam as 44. The former, beam 43, and the corresponding center panel beam of the intermediate supporting surface (see Fig. 13) are made up of separable beam sections 45 and 46. In each instance the beam construction is identical and in each instance the reason for constructing it in two part form is the same. The engaging faces of the sections constituting the two beams is such that the sections in a sense interlock, that is, complementally engage to prevent relative movement under conditions encountered in flight. This interlocked engagement of the beam sections is clearly portrayed in Figs. 8, 13 and 14 wherein the structure 47 constituting the interlock will be seen. The section 45 of the forward beam of the center panel of the lower supporting surface extends transversely through the hull or body and is constructed as an integral part of it. It is connected with the corresponding section of the forward beam of the center panel of the intermediate surface by strut-sections 48 which form with engaging strut-sections 49 two-piece wing posts comprising parts respectively fixed and detachable with respect to the hull or body. The beam section 45 of the center panel of the intermediate wing and the strut-sections 48 together provide a fixed frame work to which the detachable wing structure is releasably fastened. By reason of the built-in form of the section 45 of the center panel of the lower surface the false frame work is made a rigid or rather non-sheddable part of the machine.

When released, the wing structure, (excluding the false frame work) and the outriggered tail structure are shed as a unit with the track-way 32 acting as a guide. The control mechanism, including the control leads and surfaces are also shed as a unit with the wings as is also a false decking 50 provided at the rear of the hull to continue the lines thereof rearwardly from the point of intersection of the forward wing beam of the lower wing. The details of the control release and the wing structure release will be hereinafter more fully explained.

The motor 29, as stated, is inclosed within the hull. Its location is such that twin-tractor propellers 51 may be driven by suitable beveled gear transmission appropriately housed. The line of thrust of the propellers 51 is preferably in direct continuation of the tail spars 36 so that the inertia of the empennage in landing may be carried forwardly to suitable wiring 52. The wires 52 not only take up the landing strains but by reason of their placement and connection

transmit the thrust effort of the tractor screws into the hull. The propeller transmission is preferably triangularly arranged and also triangularly braced (see Fig. 3). The triangular arrangement of the transmission comprises upwardly diverging shafts which extend from the forward end of the motor to the propeller shafts (not shown). These shafts are inclosed in suitable gear boxes 53 mounted directly behind the propellers.

Conical compression tubes 54 reach back from the gear boxes to the center panel of the intermediate wing. A cross brace 53' completes the triangular transmission arrangement above mentioned. This brace directly interconnects the opposed gear boxes and with the triangular brace 54' fixes the upper transmission and propeller drive shafts against axial distortion or displacement and at the same time relieves vibration. The rear extremities of the conical compression tubes 54 fit freely in suitable sockets 55 integrally formed upon fittings 56 carried by the rigid beam section 45 of the forward wing beam of the intermediate surface panel. Bolts 57 are used for fastening the tubes 54 in their sockets. In Fig. 4 the sheddable and non-sheddable parts of the craft may be distinguished. It will be noted in this connection that the propellers and propeller transmission remain intact. It will also be noted that the wing structure in its entirety, together with the outriggered tail structure, wing pontoons and false decking 50 are shed as a unit, the direction of motion of the structure released causing the air stream from the propeller and the air reaction upon the wings to assist directly in the shedding of the detachable parts. Moreover, the termination of the hull at a point but slightly removed from the transverse vertical plane of the center of gravity obviates all danger of submerging the hull by its after end through the rearward movement of the wing structure when released. The backward movement of the wing structure and forward movement of the hull insure a quick and positive shedding even under the most adverse conditions.

In Figs. 8 to 11 inclusive the wing fastening devices are shown. These devices in each instance are fastened to the rails of the trackway 32 upon which the wing beams rest. The fastening means for the forward wing beam section 46 of the center panel of the lower wing comprises a lateral U-shaped fitting 58 fastening as at 59'. The construction of the fitting is such that it embraces the beam section 45. At its free end a retaining lever 59 is pivoted as at 60. This lever is provided with an opening 61 through which the free end of a locking lever 62 is extended. The locking lever is pivoted with the fastening bolt 59' affording its pivot

axis. The construction of this lever is such that it complementally engages the beam section 46 and with the fitting 58 and lever 59 completely embraces the wing beam to securely hold its sections locked together. A locking pin 63' passes transversely through the outer end of the lever 62 to lock the levers 59 and 62 together.

The fastening means for the rear wing beam of the center panel of the lower wing is very much the same as the fastening means just described. It comprises a fitting 63 which partly embraces the beam and a locking lever 64 pivoted to it as at 65. This locking lever is provided with an opening 66 through which a keeper 67 extends. Like the lever 59, the lever 64 is held in place or locked by means of a locking key 68 extending transversely through the keeper. The keeper is rigidly fastened to the beam 44 itself. Furthermore, springs 69 are provided to throw the different parts of the fastening devices out of engagement with the wing beams upon withdrawal of the pins 63' and 68 when it is desired that the wings be shed.

Brackets 70 are used in connection with both types of fastening devices for holding the outer ends of the bolts 59' in place. These brackets 70 are fastened as at 71 to the rails of the trackway and form with them appropriate anchorages for the movable parts of the fastening devices. Both bolts 59' and one of the bolts 71 (in each instance) are in turn anchored or fastened by wires 72 to the chine stringers (not shown) or other interior elements of the hull or body.

The control mechanism release is illustrated in Figs. 15, 16 and 17. Its arrangement is such that the pilot or operator, when seated, tends to prevent and in fact actually does prevent a release of the controls. The character of control used in connection with a craft of this type may of course be varied. It is essential however that the elements of the mechanism be commonly mounted upon a structure capable of being shed as a unit with the wings. This is accomplished in the embodiment disclosed by means of a seat bracket 73 hingedly connected as at 74 to the rear wing beam of the center panel of the lower wing. From its point of connection the bracket 73 extends downwardly and rearwardly and thence substantially horizontally for termination in the immediate vicinity of the seat back 30 referred to heretofore. The horizontally extended portion of the bracket carries the operator's seat 29. Forwardly of the seat 29 and upon the bracket 73 the control column is mounted. This column, designated as an entirety by the numeral 74 comprises upwardly converging column sections 75, and a bearing 76. A shaft (not shown) is jour-

naled in the bearing 76 and carries upon its extremities a control wheel 77 and cable drum 78; the latter being located upon that side of the column remote from the seat 29. At the foot of the column a pair of pulleys 79 are provided over which the aileron leads are trained. These leads extend upwardly and forwardly from the pulleys 79 to pulleys 81 mounted near the hinge point 74 and thence upwardly and outwardly to the ailerons. There is also mounted at the foot of the column and upon the bracket 73 a walking beam 82 to the ends of which the elevator leads, 83 are fastened. These leads, like the aileron leads extend forwardly and upwardly for engagement with pulleys 84 axially aligned with the pulleys 81.

The rudder control is also carried by the bracket 73. It comprises a foot-bar 85 centrally pivoted as at 86 at the free end of a leg 87 extending forwardly and downwardly from the bracket 73 to support the foot bar in its customary position. The leg 87 also serves as a supporting means for the bracket in that it is provided with a lug 88 which is normally seated in a recess 89 formed in a block 90 rigidly fastened upon the interior of the hull.

In shedding the control mechanism the operator climbs out of the cockpit 28 to the deck of the hull, pulling the control mechanism up after him. First, however, he removes the rudder control leads 91 which are fastened to the footbar from engagement with the pulleys with which the said leads normally engage. After having drawn the control mechanism out from within the interior of the hull the passenger or gunner in the forward cockpit simultaneously withdraws the locking pins 63 and 68 by exerting a pull upon the releasing wires 92 which are connected with the various locking pins and appropriately trained over pulleys 93 to permit such withdrawal. The arrangement of the release wiring may be noted upon reference to Fig. 5.

In addition to the withdrawal of the locking pins 63 and 68 it is necessary that the drift wires 94 which brace the wing structure be released. These wires extend upwardly and rearwardly in diverging relation from the bow end of the hull to the upper supporting surface where they are fastened by any suitable means. The fastening means for these wires 94 is illustrated in Figs. 18 and 19 and comprises a locking lever 95 pivoted as at 96 between ears 97 integrally formed upon the body 98 of the wire fastening device. One end of the locking lever 95 is upturned as at 99 to over-lap and retain the free end of a lever 100 in a determined position. The shape of this lever 100 is such that it forms an anchorage for the wires 94. It is pivoted as at 101 to the plate 98 and equipped with a lug 102

which engages the wire so as to displace it and accordingly release it the moment lever 100 is released. A release of the lever 100 is effected by means of a release wire 103 connected with it and with the release wiring 92 mentioned above. Cables 104 extend into the interior of the hull to anchor the plate 98. The entire release may be effected by pressure upon a foot lever 105 pivoted as at 106.

The motor location within the hull necessitates a special type of cowling; also a special type of exhaust. The cowling 107 which covers the engine section of the hull is provided with louvers 108 through which air is taken for effectually cooling the motor cylinders and exhaust valve cages. Pipes 109 extend inwardly from the cowling beneath the louvers to discharge directly above the engine cylinders that they may be adequately cooled even during the most severe motor operation. The exhaust from the motor is carried out through conduits 110 which penetrate the hull sides and terminate short of the fin edges to prevent flying spray from coming in contact with them when hydroplaning. The radiator for the motor or propelling power plant comprises duplicate sections 111 placed at opposite sides of the hull intermediate the forward wing beam of the center panel of the lower wing and the hull fins. The radiator sections thus come in the direct line of air rush and at the same time effectually brace the wings at points where bracing is most needed.

Additional features of the invention such as the means for preventing lateral displacement of the sheddable wing structure and the method of bracing the center panel of the intermediate wing should be noted. The construction of the false frame work is such that the nose portion of both the lower and intermediate wings are extended forwardly beyond the forward wing beam in order that the leading edge of the sheddable portion of the lower and intermediate wings might coincide or line up with the corresponding edges of the false frame work wing parts.

This arrangement provides abutting surfaces which take up the lateral strains. The control leads (both aileron and elevator) extend from the hull to the forward wing beam of the center panel of the intermediate wing and thence outwardly and rearwardly respectively to the control surfaces. This arrangement puts a strain upon the wing beam at a point intermediate its ends and necessitates the use of suitable brace wires for strengthening it. For this reason wiring of an arrangement calculated to best withstand the mentioned strains with the least resistance is used. It may be described as interrupted biplane wiring across and connected with the wing beam at the point where the strain is imposed.

The size of the wing pontoons is such that the principal part of the total weight of the wing structure is borne by them as the wings are shed, thus lessening the enormous weight which would be otherwise imposed on the tail end of the hull as the wings slide back. The foot bar placement is such that the thrust effort occasioned through manipulation of the rudder is borne almost entirely by the supporting lug 88 and block 99 rather than by the leg or extension 87 of the brackets 73. The divided beam construction is such that the lift strains of the wing structure are borne by the abutting shoulders of the divided beam sections in a manner permitting immediate separation of these sections should the wing structure be released. The weight of the beams and in fact the weight of the entire wing structure rests directly upon the rails of the trackway with the result that the weight is well distributed over the entire hull. Such features as these while more or less detail are of the utmost importance in that they have been worked out with the utmost care and are calculated to give the best results and strongest possible construction when it is considered that the exigencies to be met are unusual.

It is not to be understood that the wings cannot be shed without aid of the aerial propellers for motor trouble is likely to be the cause of an enforced landing upon heavy seas more than anything else. Even if the motor be dead the wings can be quickly shed by reason of the inclination of the trackway and the propulsion effort derived through water propeller 112.

It may be said in conclusion that the general arrangement of the various aeroplane parts is such that all equipment non-essential to water travel may be shed in an emergency; propulsion being obtained from the combined effort of the aerial propellers 51 and a water propeller 112 driven by means of an auxiliary motor 113 located in the hull or body. The construction and placement of the water propeller is preferably such that it may be withdrawn from operative position beneath the hull to a position upon the interior thereof. This latter feature is desired because of the decreased resistance incident to flight.

"Control mechanism" as used herein relates specifically to that portion of the control ordinarily confined within the body of a machine and directly under the control of the pilot. In construing the claims this interpretation of "control mechanism" should be given. Obviously the character of the control mechanism used is immaterial. The control mechanism of the "bridge" or stick type might equally as well be used.

While the foregoing illustrates a combination and arrangement of parts such as constitute one preferred embodiment of the

invention it is desired to emphasize the fact that departures may be made in later adaptations without departing from the spirit of the invention as set forth in the claims.

I claim:

1. In a flying boat, a hull, a multiplane wing structure extending intermediately across the hull nearer its rear end than its forward end, rearwardly extending spars connected at their forward ends to one of the intermediate wings of the multiplane wing structure and tied from above and beneath, an empennage mounted upon the spars above and to the rear of the stern end of the hull, propellers mounted forwardly of the supporting surfaces with their axes in alinement with the spars, a motor inclosed in the hull, and driving connections between the motor and the propellers.

2. In a flying boat, a hull, supporting surfaces extending intermediately across the hull, tractor propellers mounted above the hull, a frame-work mounted upon the hull for the rigid support of the propellers, a tail unit, and a driving means for the propellers, the relative arrangement of the driving means, tail unit, supporting surfaces and propellers being such that the tail unit and supporting surfaces may be shed clear of the hull independently of the propellers and the driving means.

3. In a flying boat, a hull, a motor unit, an aerial propeller, a framework mounted upon the hull for the rigid support of the propeller, and aeroplane wings extending intermediately across the hull, the arrangement of the airplane wings being such that they may be shed clear of the hull independently of the motor unit and the propeller.

4. In a flying boat, a rigid longitudinally continuous hull, supporting surfaces extending intermediately across the hull nearer its rear end than its forward end, a tail unit, an outriggered tail structure extending back from the supporting surfaces for the support of the empennage, a supporting framework erected upon the hull forwardly of the supporting surfaces, a motor unit, an aerial propeller supported by said framework, the relative arrangement of the supporting surfaces, tail unit, motor unit and propeller being such that the supporting surfaces and tail unit may be shed clear of the hull independently of the motor unit and the propeller.

5. In a flying boat, a hull, sheddable supporting surfaces extending intermediately across the hull nearer its rear end than its forward end, an aerial propeller, a non-sheddable support for the propeller erected upon the hull forwardly of the supporting surfaces, and a combined guide and support for the supporting surfaces forming a com-

posite part of the hull, the arrangement of the combined guide and support being such that shedding of the supporting surfaces is facilitated.

6. In a flying boat, a hull, sheddable supporting surfaces extending intermediately across the hull nearer its rear end than its forward end, wing beams incorporated in the framework of the lower supporting surface, a combined guide and support for the supporting surfaces built into the hull, the top surface of the guide sloping downwardly and rearwardly for termination at or near the rear end of the hull, and means for releasably fastening the wing beams of the lower supporting surface to the combined guide and support.

7. In a flying boat, a hull, supporting surfaces extending intermediately across the hull, the supporting surfaces being sheddable as a unit, control surfaces, and control mechanism for the control surfaces sheddable with the supporting surfaces.

8. In a flying boat, a hull, supporting surfaces extending intermediately across the hull, the supporting surfaces being sheddable as a unit, control surfaces, and control mechanism for the control surfaces normally carried within the hull but movable to a position without it to be shed with the supporting surfaces as a unit.

9. In a flying boat, a hull, supporting surfaces extending intermediately across the hull, control surfaces, control mechanism for the control surfaces mounted within the hull, said control mechanism being movable from a position within to a position without the hull, means for releasing the supporting surfaces and control mechanism that the two may be shed clear of the hull as a unit, and a seat carried by the control mechanism.

10. In a flying boat, a hull, sheddable supporting surfaces extending intermediately across the hull, and control mechanism carried by one of the structural elements of the supporting surfaces to be shed with them as a unit.

11. In an aircraft, sheddable supporting surfaces, control surfaces sheddable with the supporting surfaces, separate elements of control for operating different control surfaces, and a support common to the separate elements of control, sheddable with the supporting surfaces and the control surfaces as a unit.

12. In an aircraft, sheddable supporting surfaces, control surfaces, control mechanism for the control surfaces, a seat for an operator sheddable with the supporting surfaces, and a common support for the control mechanism and the seat.

13. In an aircraft, sheddable supporting surfaces, control surfaces, separate control elements for different control surfaces, and a support for the separate control elements

carried by one of the structural elements of the supporting surfaces and sheddable with the supporting surfaces as a unit.

14. In an aircraft, sheddable supporting surfaces, a body, a frame-work erected upon the body in advance of the supporting surfaces, a propeller rigidly supported by the frame-work, driving means for the propeller, and means to release the supporting surfaces that they may be shed clear of the body independently of the frame-work and propeller.

15. In an aircraft, a body, sheddable supporting surfaces, each including a wing beam as a structural element thereof, fastening means for the supporting surfaces comprising separate fastening devices mounted within the body and connected with the wing beams of one of the supporting surfaces, and a single means operable to simultaneously release the separate fastening devices.

16. In a flying boat, a hull, supporting surfaces extending intermediately across the hull, an aerial propeller, a motor unit mounted within the hull for driving the propeller, a tail unit, a support for the tail unit carried by the supporting surfaces, and a rigid frame-work for supporting the aerial propeller in advance of the supporting surfaces, the relative arrangement of the frame-work and supporting surfaces being such that the latter may be shed clear of the hull independently of the propeller.

17. In a flying boat, a hull, supporting surfaces extending intermediately across the hull, propellers mounted in advance of the supporting surfaces, a motor unit inclosed within the hull, a tail unit, spars extending rearwardly from the supporting surfaces to the tail unit, each spar being in direct continuation of one of the propeller axes, drive shafts extending outwardly and divergently from the motor to the respective propellers, and brace connections between the diverging shafts.

18. In an aircraft, a body, a rigid frame-work erected upon the body, and sheddable supporting surfaces extending intermediately across the body, a portion of the surface area of one of the supporting surfaces being non-sheddable and so relatively arranged to the rigid framework as to enter into and form a structural element thereof.

19. In an aircraft, a body, and supporting surfaces extending intermediately across the body including wing-beams divided longitudinally for separation as the supporting surfaces are shed.

20. In an aircraft, a body, and a sheddable supporting surface including a longitudinally divided wing-beam having one of its sections rigid with and another of its sections releasably attached to the body.

21. In an aircraft, a body, and a sheddable wing-structure including comple-

mental beam-sections together with means embracing them to releasably hold one of the said sections in engagement with the other.

22. In an aircraft, a body, a frame-work erected on the body, a sheddable wing-structure, the relative arrangement of the wing structure and the framework being such that a portion of the framework enters into and forms a composite part of the wing structure, and a connection between the wing-structure and the frame-work, said connection being releasable with the wing structure, whereby the wing-structure may be released and shed.

23. In an aircraft, a body, a wing-structure extending intermediately across the body, and a rigid frame-work erected on the body and extend above it forwardly of the wing structure to provide an interlock therefor.

24. A sheddable wing structure for aeroplanes including a longitudinally divided wing-beam having its sections respectively rigid and sheddable with respect to the airplane body.

25. A sheddable wing structure for aeroplanes including a longitudinally divided wing-post having its sections respectively rigid and sheddable with respect to the airplane body.

26. In a flying boat, a wing structure including a built-in wing-beam, a power plant, and a radiator therefor arranged beneath said wing beam at one side of the hull to brace the wing beam from beneath.

27. In a flying boat, a hull, fin excrescences formed from the hull, stub wings extending out laterally from the sides of the hull above the fins, a propelling power plant, and radiators for the power plant located between the stub wings and fins at opposite sides of the hull, the arrangement of the radiators being such that they rest upon opposite fin excrescences and brace the stub wings from beneath.

28. In an aircraft, a body, a sheddable supporting surface including a longitudinally divided wing beam having one of its sections rigid with and another of its sections releasably attached to said body, and means embracing the beam sections to normally hold them together.

29. In an aircraft, sheddable supporting surfaces, and a seat for an operator carried by the supporting surfaces to be shed with them as a unit.

30. In an aircraft, a body, sheddable supporting surfaces extending intermediately across the body, and a seat for an operator carried by the supporting surfaces to be shed with the wings as a unit, the seat being normally confined in the body.

31. In an aircraft, a body, sheddable supporting surfaces, control surfaces, a support

hinged to the supporting surfaces and movable from a position within to a position without the body, and control mechanism carried by the support and movable with it, said mechanism being sheddable with the supporting surfaces as a unit.

32. In an aircraft, a body, sheddable supporting surfaces, control surfaces, a support hinged to the supporting surfaces and movable from a position within to a position without the body, foot operated mechanism carried by the support, and hand operated mechanism carried by the support, the foot operated mechanism and the hand operated mechanism being movable with the support and sheddable with the supporting surfaces as a unit.

33. In an aircraft, a body, sheddable supporting surfaces, a support connected with the supporting surfaces and movable from a position within to a position without the

body, control surfaces, control mechanism carried by the support, and a seat likewise carried by the support, the control mechanism and the seat being movable with the support and sheddable with the supporting surfaces as a unit.

34. In an aircraft, a body, and a sheddable wing structure including contiguous beam sections, the adjacent faces of the respective beam sections being shouldered and the beam sections themselves respectively fixed relatively to the body and sheddable with the wing structure and so related to each other that the shoulder formed on the sheddable beam section engages beneath the shoulder formed on the fixed beam section.

In testimony whereof we hereunto affix our signatures.

GLENN H. CURTISS.
WILLIAM L. GILMORE.