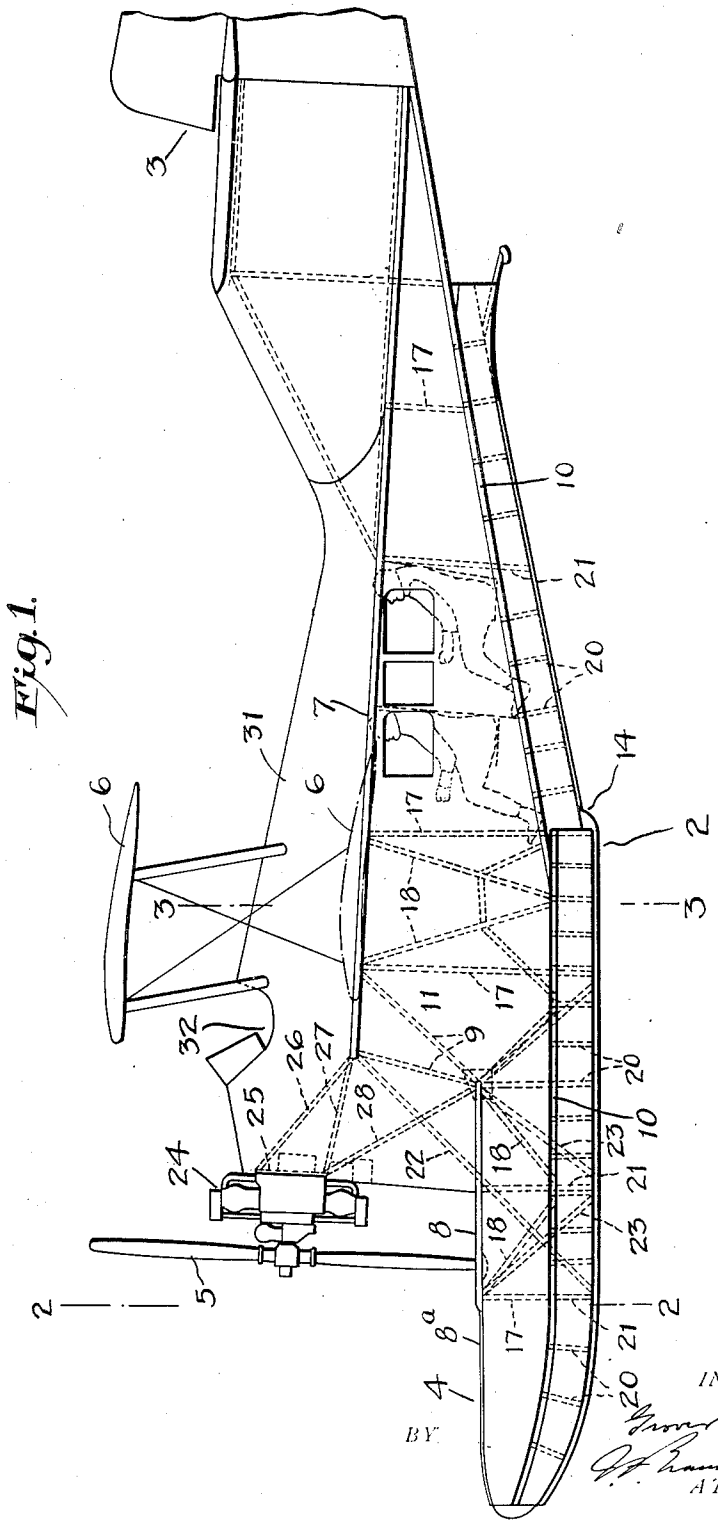
Oct. 14, 1930. G. LOENING 1,778,113

SEAPLANE OR AMPHIBIAN

Filed Feb. 16, 1928 5 Sheets-Sheet 1

Fig. 1.



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SEAPLANE OR AMPHIBIAN

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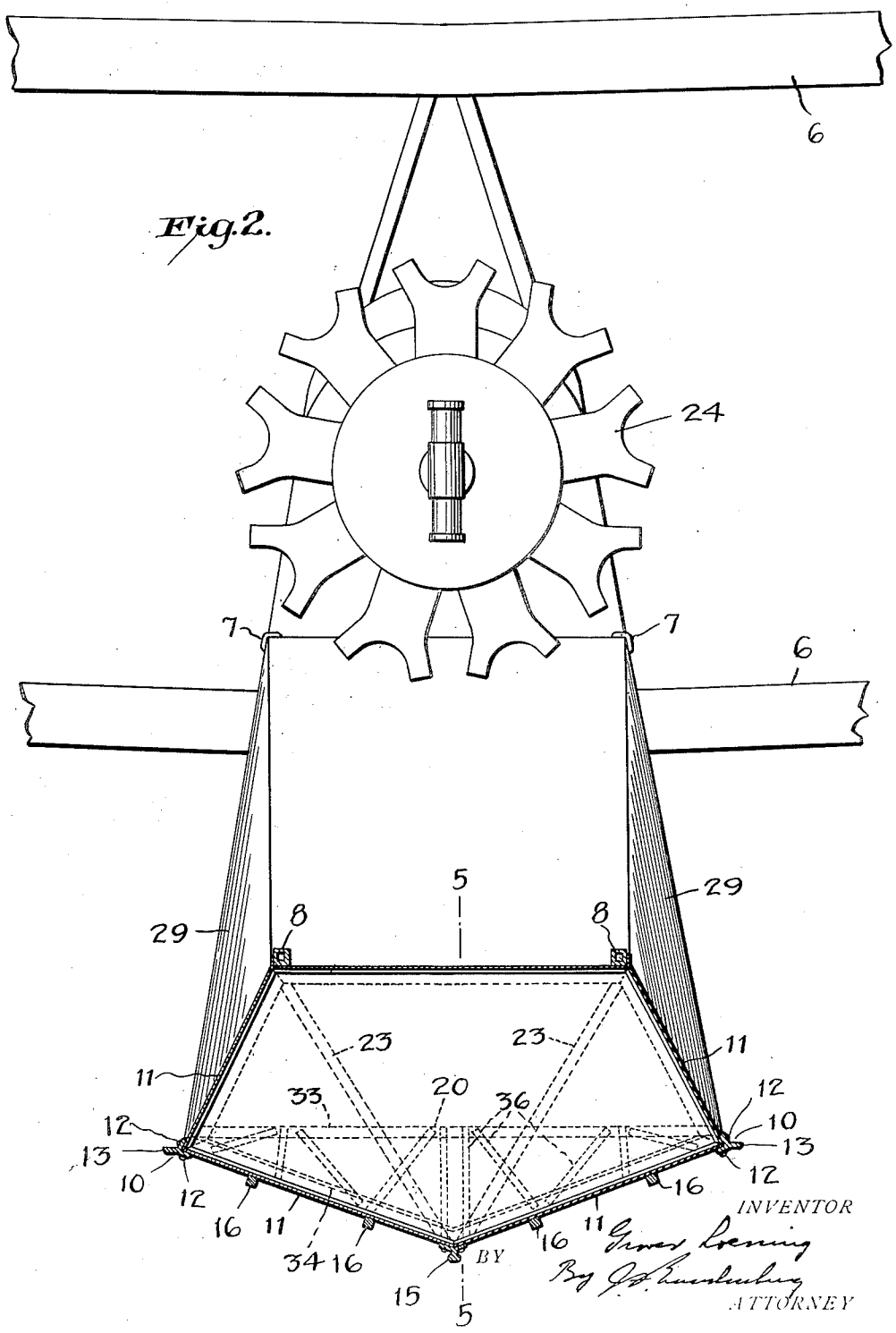
Fig. 2.



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SEAPLANE OR AMPHIBIAN

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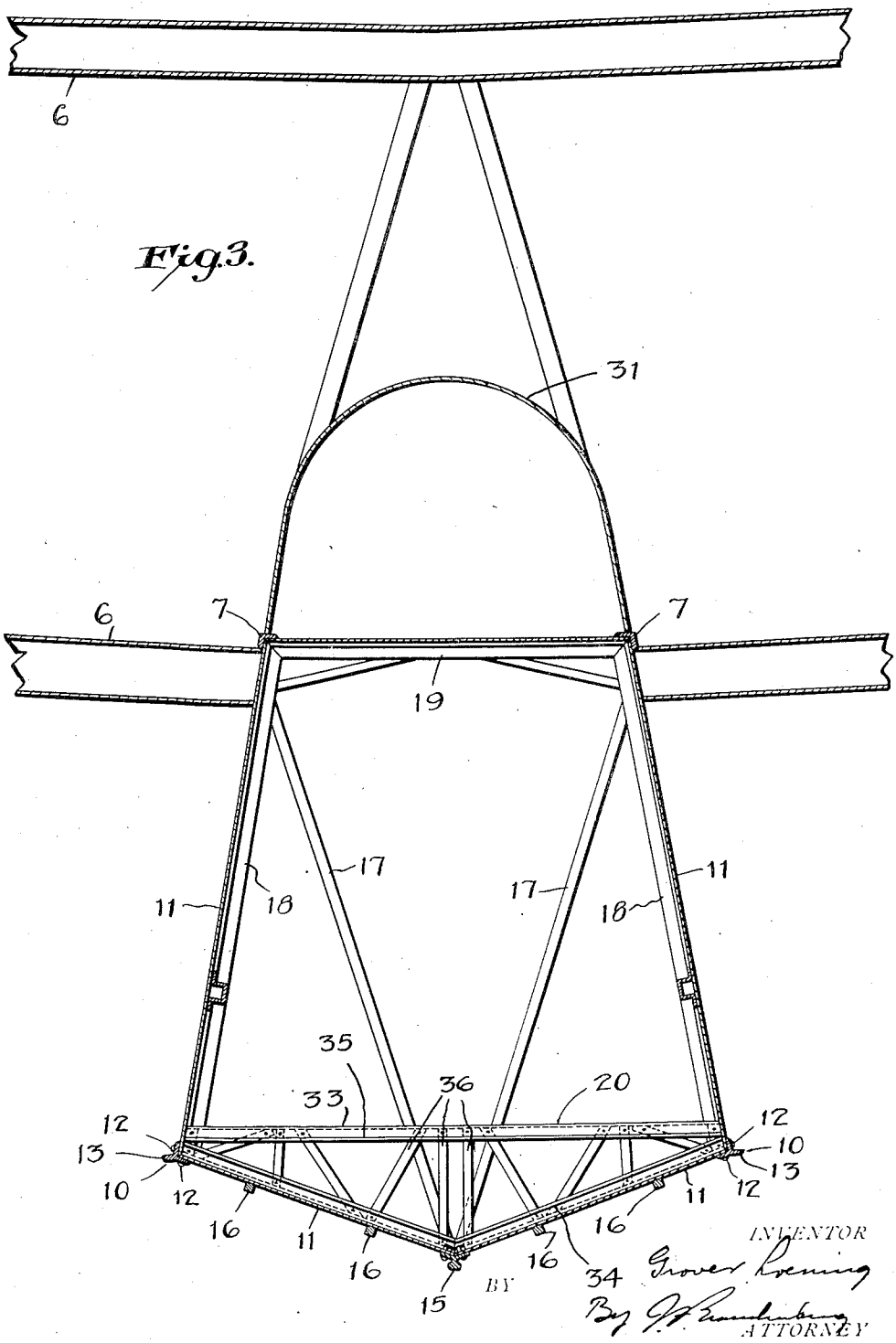
Fig.3.



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SEAPLANE OR AMPHIBIAN

Filed Feb. 16, 1928 5 Sheets-Sheet 4

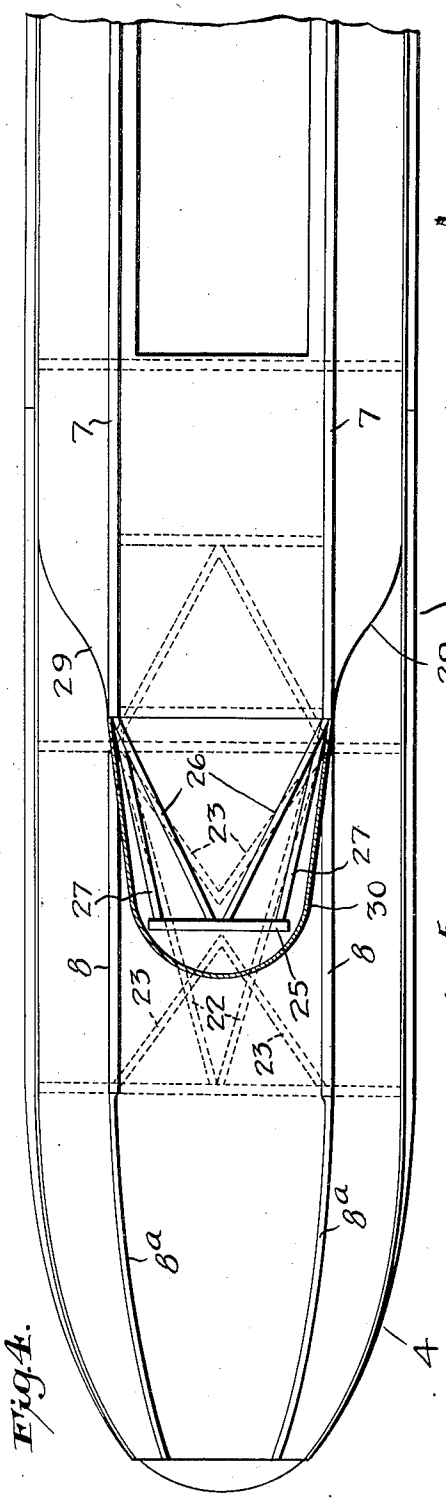

Fig. 4.

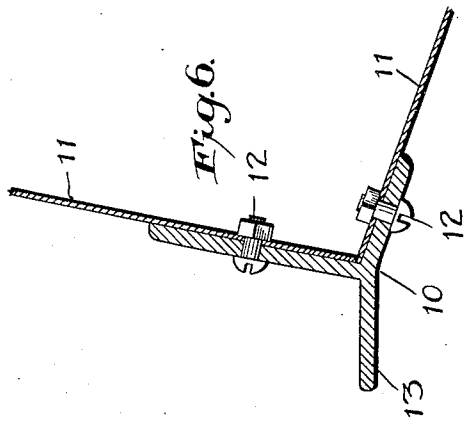

Fig. 6.

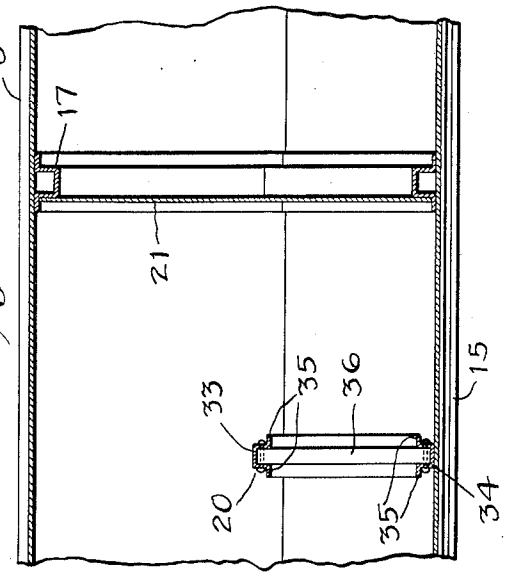

Fig. 5.

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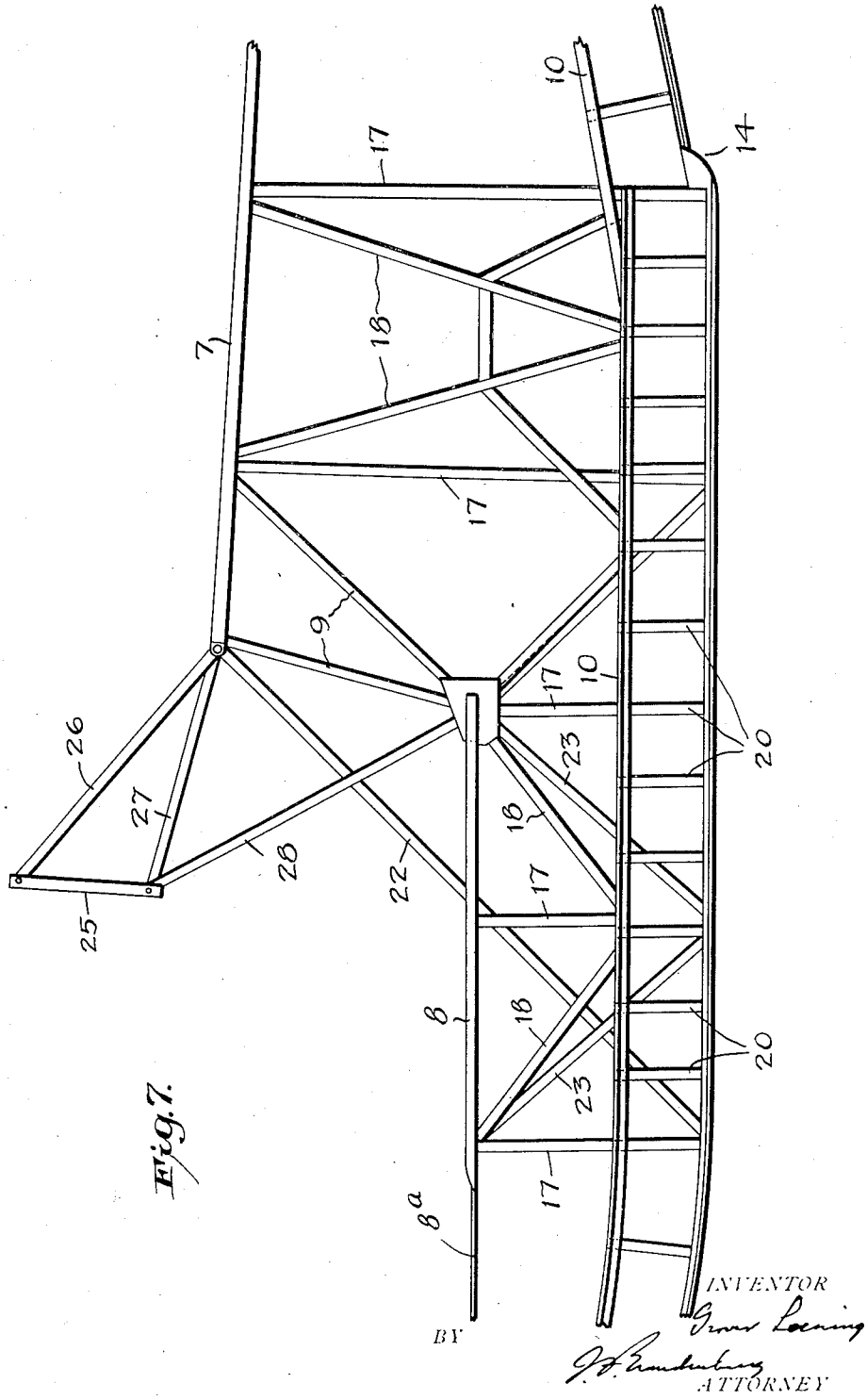

Fig. 7.

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UNITED STATES PATENT OFFICE

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SEAPLANE OR AMPHIBIAN

Application filed February 16, 1928. Serial No. 254,694.

The invention relates to improvements in seaplanes, flying boats or amphibian airplanes, more especially when of metal construction. Among the objects are to simplify and lighten the construction, to reduce the cost of production, to secure advantages in respect to strength, to provide more room inside the body for passengers and other load, to enable the pilot and passengers to sit in advantageous positions, to provide for advantageous positioning and support of the engine, and to secure other advantages which will become apparent.

The invention comprises a novel construction of hull and fuselage in one structural unit, wherein the main strength system is concentrated in the four longitudinal corners and the sides, and wherein the main strength system carrying the tail is not dependent on the keel, or on obstructing girders running lengthwise of the interior of the hull. The keel section or region of flying boats being subject to injury from driftwood and other causes, it is highly desirable that such injuries should not affect the combination of structural elements upon which safety mainly depends.

The invention also involves a novel plan according to which the longitudinal strength members, such as longérons and chine members, and also the keel and intermediate keelsons whether these are principal strength members or not, are external to the sheet covering of the body, yet cooperate in one system with cross members and side frame members on the inside of the covering. By thus disposing the longitudinal members and the cross members at opposite sides of the covering, the large amount of expensive notching, cutting and fitting usually necessary to permit the members to pass each other, as well as the numerous corners and recesses thus formed which collect water, are avoided, and a simpler and stronger construction is secured. Moreover, joints are rendered accessible for oiling, greasing, cleaning and painting against corrosion, and for repair.

This feature of external longitudinals coacting with internal cross members and frame parts is susceptible of application to hull and float construction for seaplanes generally, but is of particular advantage in a unit hull and fuselage construction of the kind herein disclosed, in which the features outlined are combined.

The longitudinal members consist of an upper longéron or longérons, at the top of the strength structure, and members at the chine regions, these members, or the upper member or members, extending rearward to the tail. Immediately inside the covering, vertical members and diagonal members extend from the chine members to the upper longéron member or members, forming vertically continuous side frames which constitute the main fore and aft bracing of the body, not requiring, or necessarily requiring, intermediate longérons, and avoiding a construction of hull and fuselage in united sections. These side frames are suitably connected by cross members, and, in particular, bottom stresses are carried to the side frames by numerous low triangular cross members of special construction lying in the bottom region of the hull, whereby internal longitudinal girders, such as, for example, keel girders, can be eliminated.

The body is preferably of the kind having a forwardly projecting hull nose, and for this purpose the upper longéron or longérons are made in two sections or parts, namely a longéron or a pair of longérons running along the top of the fuselage part of the structure from the bow rearward to the tail, and a short longéron or a pair of such longérons at the top of the sides of the bow nose, the forward portions of these fuselage longérons and the rearward portions of these nose longérons being strongly connected by diagonal members so as to form in effect upper

longérons which dip downward into the nose, these longérons being founded on the chine members, and the latter in turn on the cross members.

The arrangement of upper longérons may be utilized if desired for supporting with excellent effect a forwardly located engine, carried and braced by a simple organization of struts and tension members running directly to the forward ends of the upper longéron or longérons of the fuselage and the rear portions of the upper longéron or longérons of the nose. The construction of the longérons and the supporting of the engine is such that the covering at the bow region above the nose can be curved inward to secure a most desirable streamline formation behind the propeller.

Other features, parts, combinations and relations of a novel and advantageous character will become apparent as the specification proceeds.

In the accompanying drawings illustrating the preferred and complete embodiment of the invention:

Fig. 1 is a side elevation of a flying boat or like airplane constructed in accordance with the invention, the extreme end of the tail being broken away for lack of space;

Fig. 2 is a sectional front elevation taken on the line 2—2 of Fig. 1;

Fig. 3 is a cross-section taken on the line 3—3 of Fig. 1;

Fig. 4 is a partial plan view of the body, with the top covering removed;

Fig. 5 is a fragmentary vertical longitudinal section taken in the nose portion;

Fig. 6 is an enlarged cross-section through one of the combined integral chine members and spray strip, constituting one of the features of the invention, and portions of the side and bottom covering sheets united thereby; and

Fig. 7 is a fragmentary side elevation showing framework.

The drawing shows a biplane flying boat or amphibian plane (illustration of landing gear being omitted for simplicity), having a unit hull and fuselage body 2, the rear end of which supports the tail 3, and the forward end of which is extended as a nose 4 projecting from the lower hull region in continuation with the bottom and sides, this nose being sufficiently shallow to clear the propeller 5 of a tractor installation, if an installation such as illustrated is employed. The wings 6, 6 may be replaced by a monoplane wing placed at or about the location of the lower of the two wings 6. It will be understood that the invention, in its broader aspects, is not limited to the number or location of the engines and propellers.

In this type of body, there has heretofore been functional unity, but structurally there have been two parts, corresponding roughly to hull and fuselage, which were united together. This involved making the hull section with top longérons, located in an intermediate position with respect to the height of the combined structure, on top of which was placed the fuselage section with additional longérons. The intermediate longérons gave strength to the framing, but in the present construction I have found a way to omit them and gain substantial benefits thereby. The hull and fuselage are, by this invention, made truly integral structurally as well as functionally, in such a manner as to secure very important simplification, reduction in cost and lightening in weight, and this, not only without sacrifice in strength, but with gain in that respect, due to a novel organization in the strength system.

The strength system of the present preferred embodiment of the invention may be said to have only four longérons, namely two upper longérons at the top of the structure proper, and two longérons at the chines. However, as hereinafter indicated the precise number of longitudinal strength members may be varied. Because of the bow nose, the upper longérons are made in two parts, marked 7 and 8. The parts 7 extend in the form of angles along the top of the fuselage portion of the structure from the forward region to the tail. The parts 8 extend along the tops of the sides of the nose, and originate in the forward part of the structure not far from the transverse plane where the parts 7 terminate at the front. Naturally, the precise construction and relations may be modified. The parts 8 might, for instance, be extended further to the rear, but there would not be sufficient advantage in doing so to compensate for the extra weight. The main portions of the longéron parts 8 are preferably made of heavy square tubing, and the forward portions 8^a extending to the end of the nose are preferably solid and of smaller section, the two portions being suitably united together.

The forward ends of the longéron parts 7 and the rearward portions of the parts 8 are strongly connected by diagonal members 9.

The longitudinal strength members at the chine corners are marked 10, these members being strong angles to the flanges of which the side and bottom sheets of the sheet covering 11 are united by bolting, as shown at 12 in Fig. 6. These members, which constitute in themselves a feature of the invention, are rolled with an additional outward projecting flange 13 forming an integral spray strip, having the familiar function of such strips, and serving to lend much additional strength to these longérons, without adding to the weight. These members may be described as exhibiting a distorted Y or three-flanged section.

For convenience the members 7, 8, 8a may be referred to as longérons, and the members 10 as chine members. Both, however, are longérons or longitudinals of the main strength system. The members 10 extend from the forward end of the nose to the tail, and with the members 7 afford support for the tail. The members 10 are naturally made in sections suitably united together at the region of the step 14 amidships of the bottom.

It is to be noted that the members 7, 8, 8a and the members 10 are external to the sheet covering. The same is true of the keel member 15 and the intermediate keelsons 16, which, however, need not be, and preferably are not, vital to the integrity of the main strength system.

The suppression of the intermediate longérons of the earlier constructions would tend to make the deep sides between the upper longéron members and the chine members weak, but I have found that it is possible to connect and space these members by suitable verticals and diagonals, partly indicated at 17 and 18, located immediately inside the sheet covering, to form entirely adequate side frames, which afford a fore and aft bracing for the entire airplane, as well as stiffening the sides against buckling.

The side frames may be connected and spaced at the top by suitable cross members 19. At the bottom they are connected and spaced by numerous low cross members 20, the latter being advantageously constructed as light but very strong trusses lying in the interior of the V bottom of the hull. These members 20 serve to carry keel and bottom stresses to the main side frames and their longitudinals, irrespective of injury to the keel or bottom. The usual deep keel girders, or other girders running fore and aft in the interior of the hull can thus be dispensed with, thereby effecting a great saving in interior space, allowing more, and more useful, room for passengers and other load. Similarly, the cross diagonals with which it is usually necessary to clutter the interior can be eliminated or reduced in number.

Bulkheads 21 are placed where needed.

It will be understood that the external members are connected with the internal members by bolts or rivets passing through the sheet covering, and that the covering itself is similarly fastened to the inside members. The multiplicity of these familiar fastenings would obscure the drawing, and it has not been thought necessary to show them.

The keel, in the nose and forward part of the hull, may be braced to the longéron parts 7 and 8 by suitable diagonal members 22 and 23.

As previously stated, the number and location of engines and propellers can be varied without departing from other features of the invention. In the present preferred embodiment of the invention, however, the propeller 5 is driven by a radial or other suitable engine 24, which is fixed to an engine mount 25 carried at the front of the fuselage at a point above the nose as low as will permit of propeller clearance.

The mount 25 is supported from the forward ends of the upper longéron parts 7 and from the regions of the rear ends of the lower longéron parts 8, in a simple and effective fashion, by pairs of members 26, 27 and 28 passing downward and rearward. The members 26 are tension braces connecting the upper central portion of the mount with the forward ends of the longéron parts 7, and the members 27 are compression struts connecting the lower lateral portions of the mount with the same region. The members 28 are struts connecting the lower lateral portions of the mount with the rear portions of the longéron parts 8. These members converge toward each other, inwardly from the sides, in the forward direction.

The disposition of the engine supporting members, and the fact that the longéron parts 8 are set inward at a less distance apart than the transverse spacing between the chine members 10, make it possible to curve in the sides of the covering at 29 (Fig. 4) and thence carry it forward in a good streamline shape 30, outside of and around the members 26, 27 and 28, and directly behind the propeller.

The longéron parts 7, while at the top of the main strength structure, are not necessarily at the top of the fuselage, the covering being preferably carried up and over to form an arched top cover 31.

The pilot's seat is placed at 32, behind the engine and in front of the wings, and behind and below the pilot's place the body encloses a cabin suitably arranged for carrying passengers. Heretofore, this has been possible only in land planes or in fuselage seaplanes (that is to say ordinary seaplanes with separate floats), but by the disposition and combination of parts here shown these same advantages are secured in a unit hull body flying boat or amphibian. By building this unit body with the location of members shown, that is to say, with the longéron at, or very nearly above or below, the lower wing, or the main wing of a monoplane which would occupy substantially the same position, the passengers can sit deeply enough in the hull to look out under the wing. This is made possible also by the fact that the lower portion of the hull interior is not obstructed by deep girders. As is seen in Fig. 1, the cross trusses 20 are low enough to lie beneath the passenger seats placed well down in the hull.

The construction of the cross trusses 20 is shown most clearly in Figs. 3 and 5. Each of these trusses has an upper member 33 which extends across the interior of the hull

slightly above the chine level, and a broad V bottom member 34 which lies in contact with the bottom sheets. These members are made of channels having laterally disposed flanges 35, the channels facing each other, and the ends of suitably disposed struts and diagonals 36 are received and held in the channels, where they are secured to the members 33 and 34 by riveting or otherwise. The result is a very strong yet light cross girder, well adapted for the purpose of transferring bottom stresses to the side frames.

The keel member 15 has flanges outside of the bottom sheets, by which these sheets are connected together by bolting or riveting.

While the preferred form of the invention has been described in detail, it will be understood that the description is to be taken as illustrative rather than limiting, and that there may be variations, changes, omissions or additions, and that parts of the invention may be utilized without others. The upper longitudinal strength members or sections 7, 8 have been shown and described as consisting of pairs of members transversely spaced apart, this being the preferred construction, but it will be understood that this is not necessarily the case since triangular forms of body or body tops are known, in which forms there may be either a single upper longérons or more than two upper longérons, in conformity with the particular design.

I claim:

1. A seaplane hull structure having a sheet covering, longitudinal strength members at the top and the chine regions of the structure, all said longitudinal strength members being outside the covering, and other members at each side of the structure inside the covering forming frames extending from the chines to the top and constituting a fore and aft bracing for the entire structure.

2. A seaplane hull structure having a sheet covering, longitudinal strength members at the top and the chine regions of the structure, all said longitudinal strength members being outside the covering, and other members at each side of the structure inside the covering forming frames extending from the chines to the top and constituting a fore and aft bracing for the entire structure, and internal cross members by which bottom stresses are carried to said side frames and said external longitudinal members.

3. A unit hull and fuselage structure having a sheet covering and formed with a forwardly extending hull nose portion, said structure comprising longitudinal strength members at the upper part of the fuselage and the upper part of the nose, two longitudinal strength members at chine regions, all said members being outside the covering, other members at each side of the structure inside the covering forming frames extending from the chine members to the upper external longitudinal members and constituting a fore and aft bracing for the entire structure, and internal cross members by which bottom stresses are carried to said side frames.

4. A unit hull and fuselage structure having a sheet covering, longitudinal strength members disposed outside the covering at the top of the structure and at the chine regions, a keel member also disposed outside of the covering, and side frame members and cross members inside the covering coacting with said longitudinal strength members outside the covering.

5. A unit hull and fuselage structure having a forwardly extending hull nose portion, said structure comprising longéron members at the upper part of the fuselage and the top of the nose, two longitudinal strength members at chine regions, members connecting said chine members and longéron members in a fore and aft strength system at the sides of the structure, diagonal members extending from the forward portions of the upper of said longéron members downward and forward to the lower of said longéron members, an engine and propeller at the front of and supported from the upper of said longéron members, with supporting members extending downward to the lower of said longéron members, and a covering the sides of which at the front are curved inward back of the propeller and around said engine supporting members.

6. A unit hull and fuselage structure having a forwardly extending hull nose portion, said structure comprising longéron members at the upper part of the fuselage and the top of the nose, two longitudinal strength members at chine regions, members connecting said chine members and longéron members in a fore and aft strength system at the sides of the structure, diagonal members extending from the upper of said longéron members downward and forward to the lower of said members, and an engine and propeller in front of the upper of said upper longéron members with supporting members extending downward to the upper of said members and other members extending downward to the lower of said members.

7. A flying boat having a unit hull and fuselage structure, said structure comprising longitudinal strength members connected in a vertically continuous main fore and aft strength system lying at the side of the structure, the top of said system being at or near the location of the lower wing, and numerous low cross members lying in the bottom portion of the hull for carrying bottom stresses to said side strength systems, an engine supported at the front of the fuselage, a pilot's place behind the engine and in front of the wings, and a cabin for passengers arranged

deeply in the hull below and in rear of the pilot's place.

8. In a seaplane hull structure, the herein described external chine members constituting longitudinal strength members of the structure, said chine members being of a general Y section to fit over and join the sheets at the corners of the sides and bottom of the hull and to provide integral outwardly projecting stiffening flanges so disposed as to serve as spray strips.

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