

Feb. 21, 1939.

H. M. KNIGHT

2,147,654

AIRSHIP

Filed June 26, 1936

7 Sheets-Sheet 1

Fig. 1.

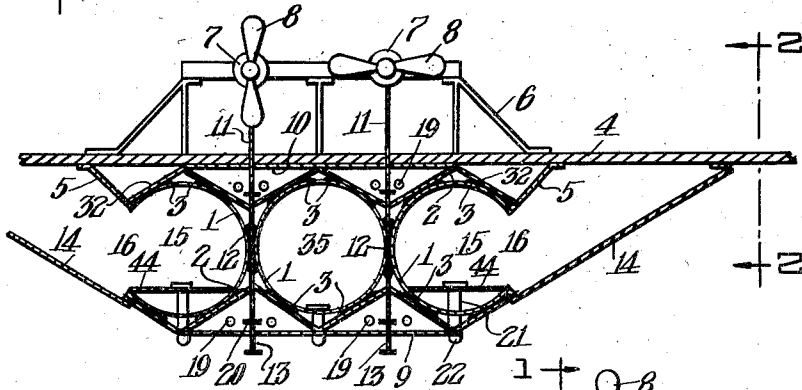


Fig. 2.

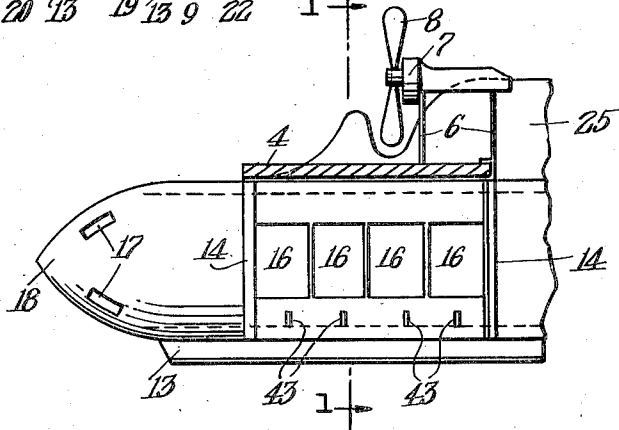
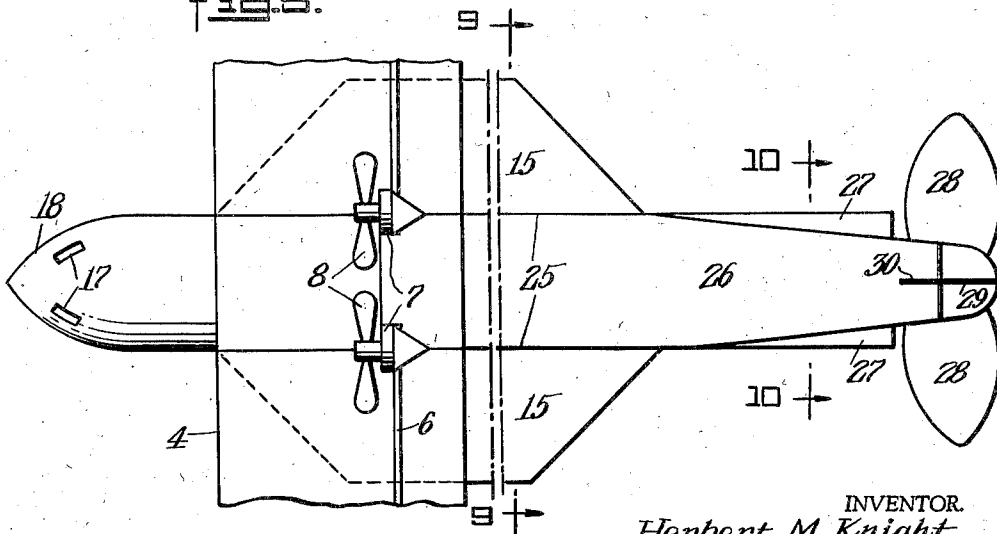


Fig. 3.



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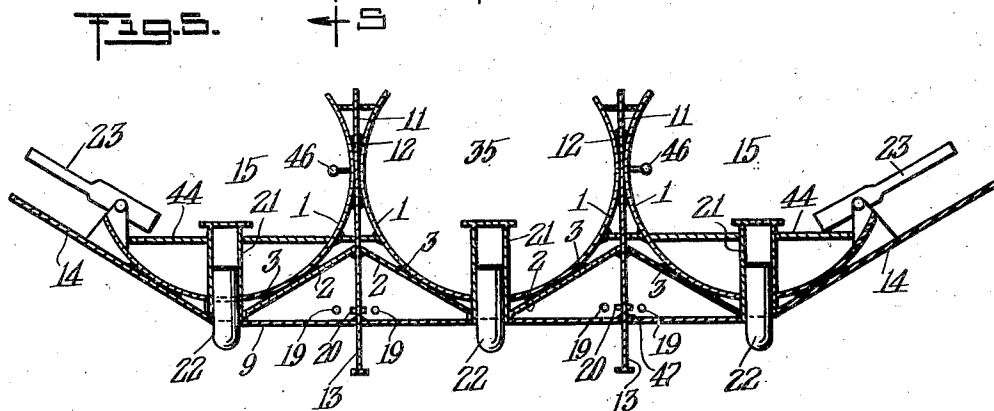
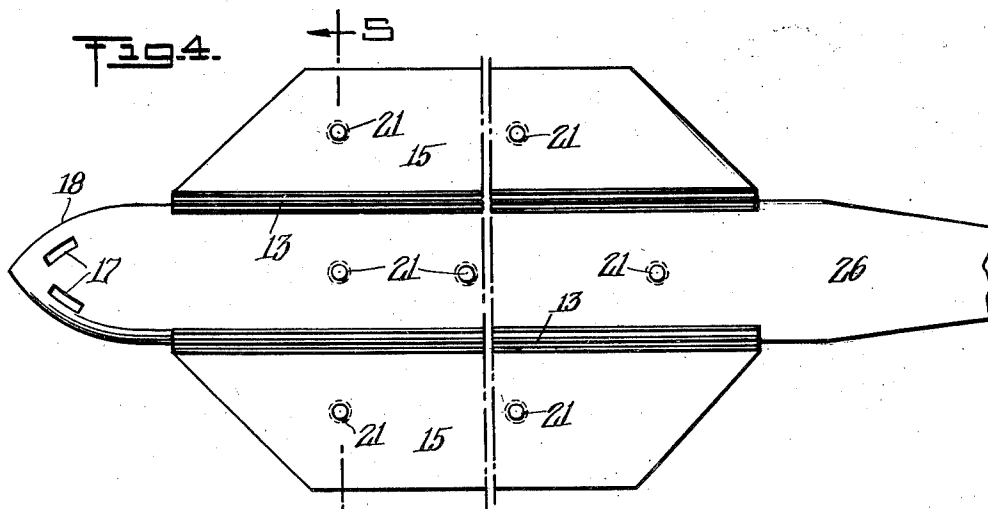
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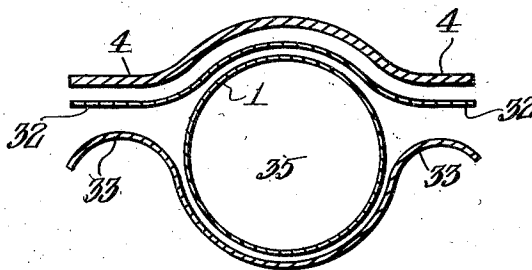
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Filed June 26, 1936

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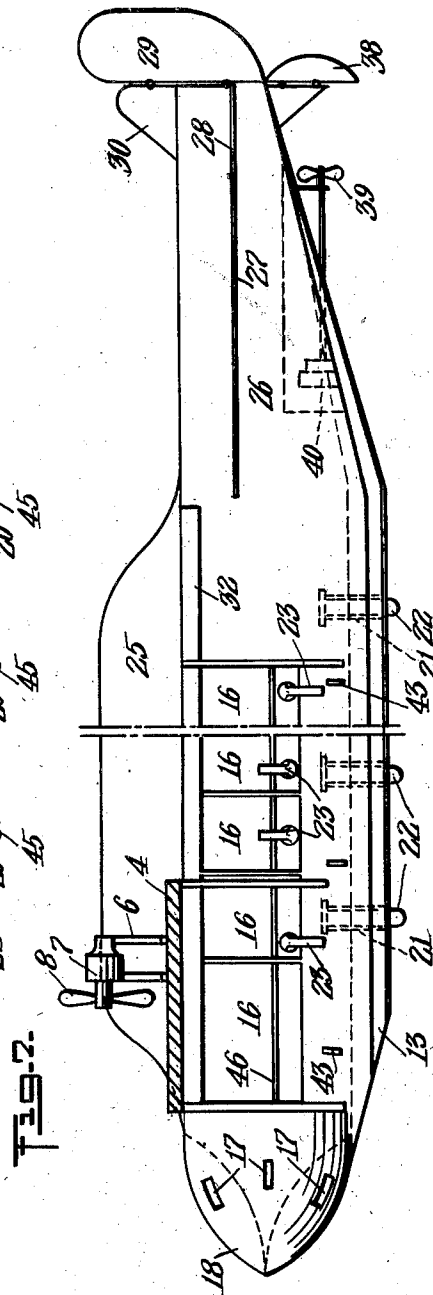
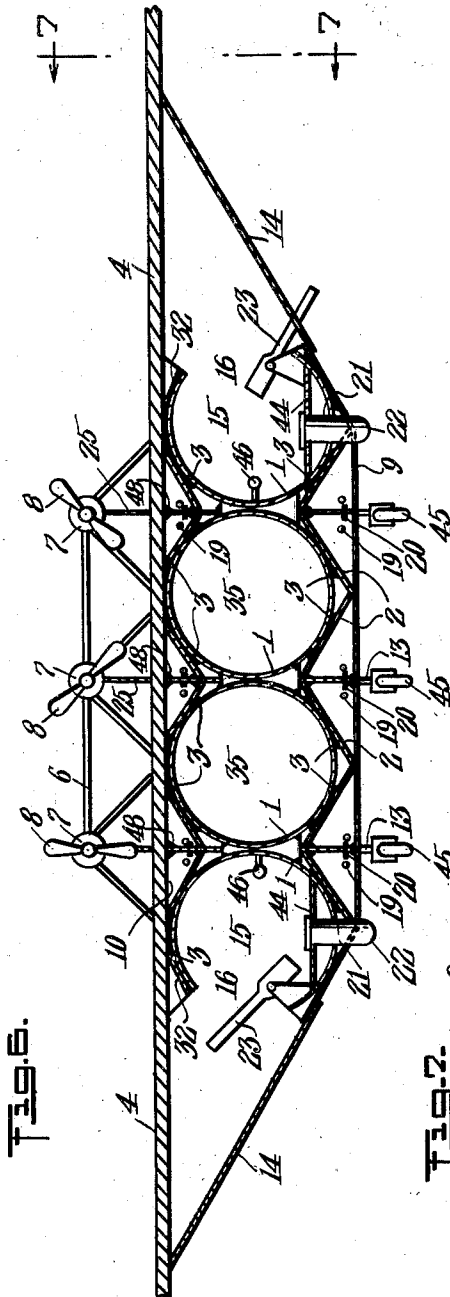
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Filed June 26, 1936

7 Sheets-Sheet 3



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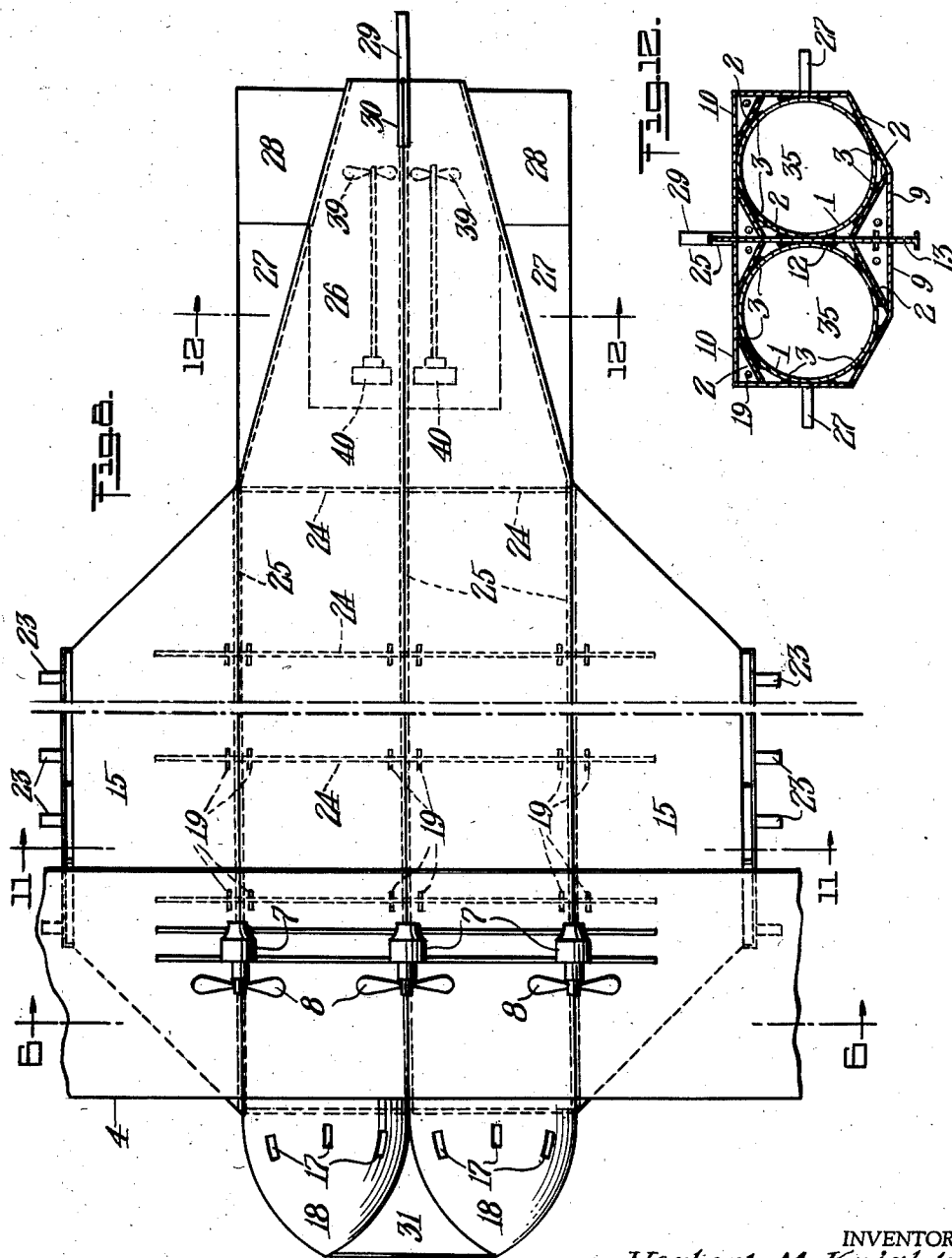
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Filed June 26, 1936

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AIRSHIP

Filed June 26, 1936

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Fig. 9.

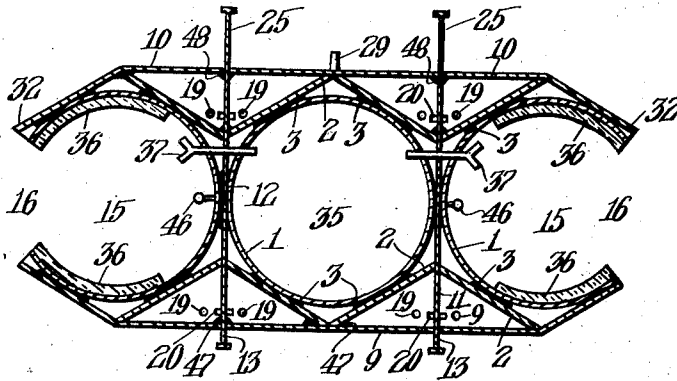


Fig. 10.

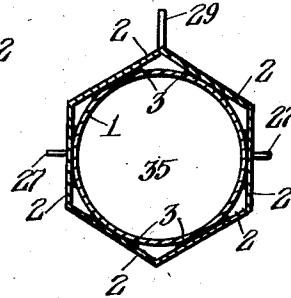


Fig. 11.

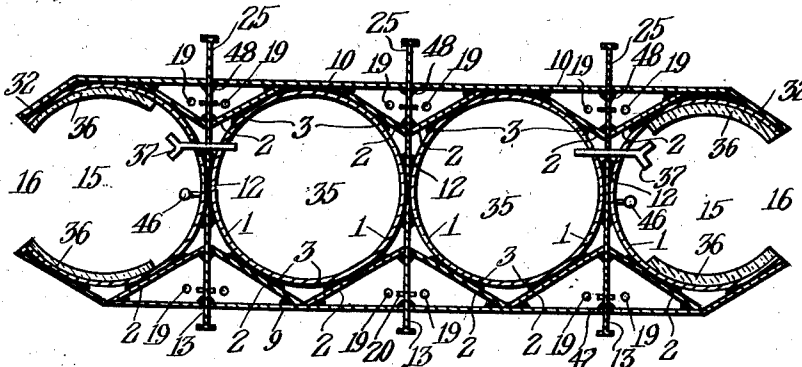
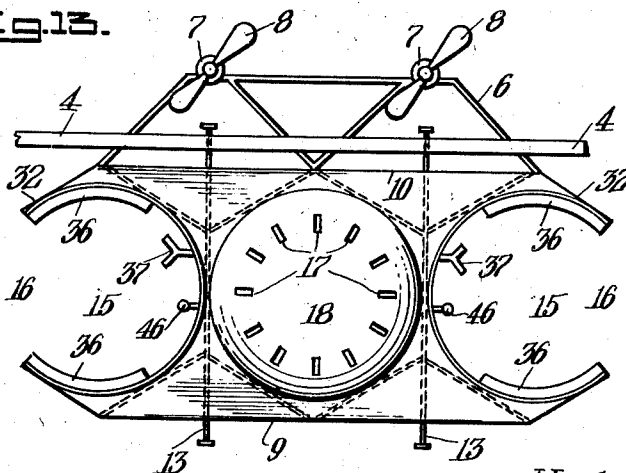


Fig. 13.



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Fig. 14.

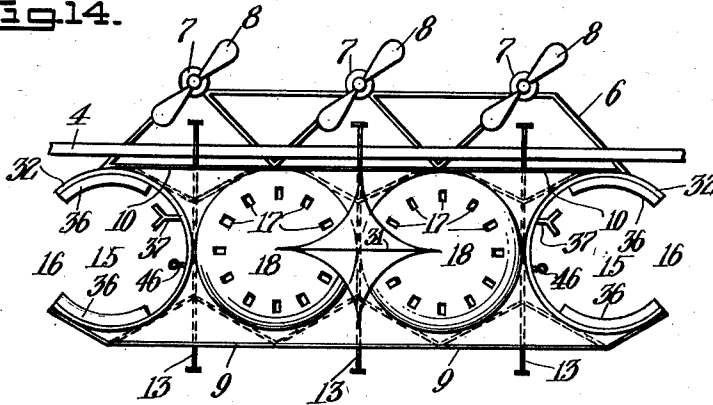


Fig. 15.

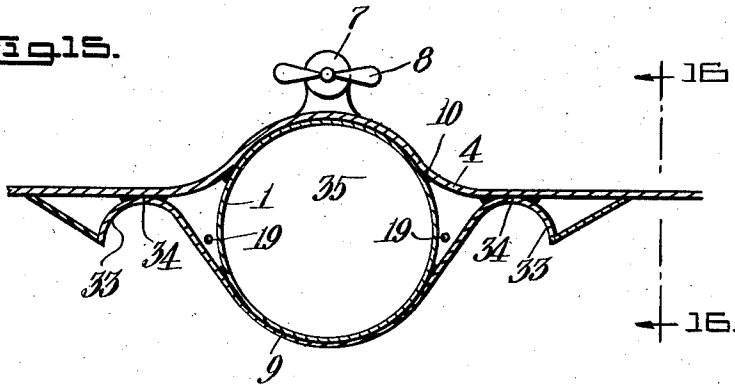
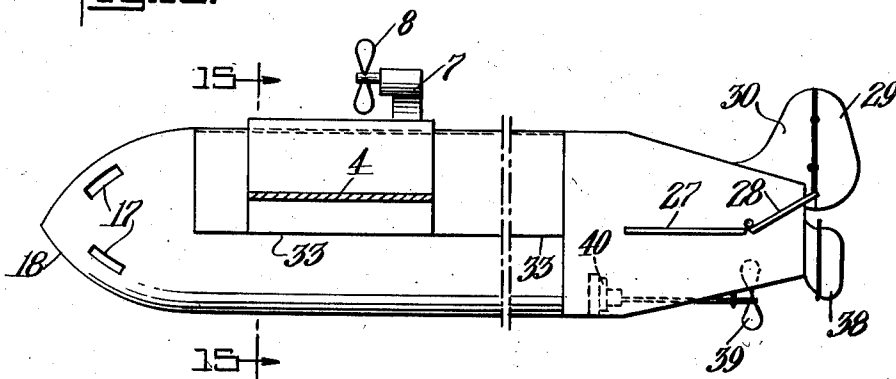


Fig. 16.



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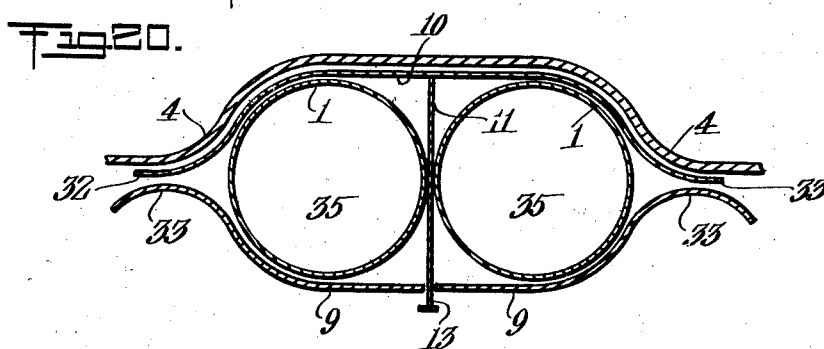
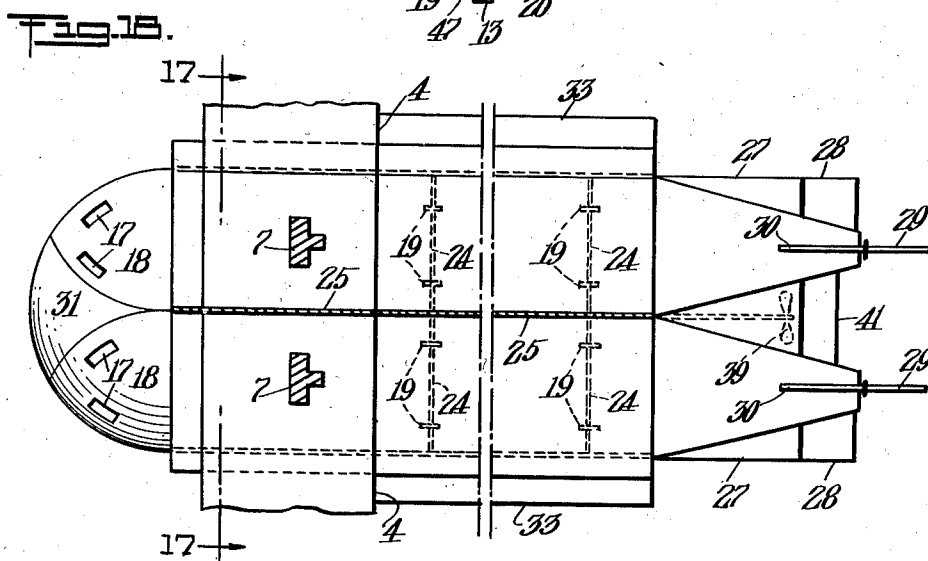
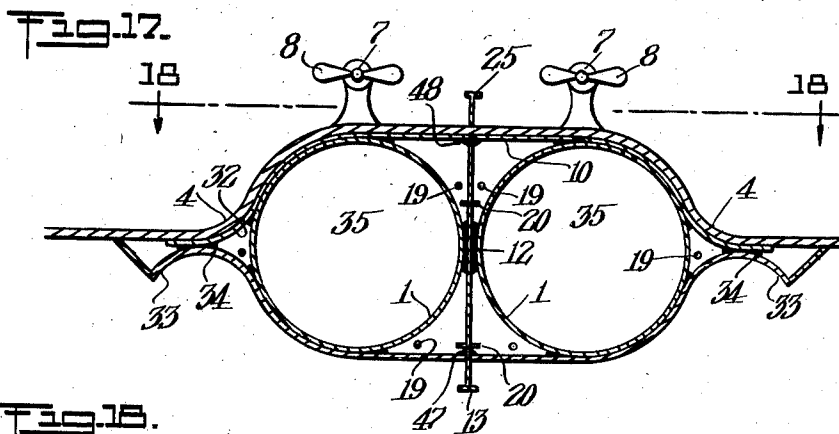
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Filed June 26, 1936

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UNITED STATES PATENT OFFICE

2,147,654

AIRSHIP

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Application June 26, 1936, Serial No. 87,381

21 Claims. (Cl. 244—13)

This invention is related to improvements in air-ships, and is more particularly related to air-ships for use in transoceanic flights and for use in warfare.

5 One of the objects of this invention is the production of a ship, in which an interior tubular shell, continuous of said ship, constitutes a rigid girder. Another object of the invention is a ship in which an interior tubular shell is surrounded
10 by an exterior skin. Another object of the invention is a ship in which multiple tubes of such shell and skin construction are employed. A further object of the invention is a ship in which side galleries attached to the tubes are employed.
15 Still another object of the invention is a ship in which guns, or similar engines of war may be discharged from such galleries. Another object of the invention is a ship, in which mirrors are located in said galleries so as to give an extended
20 upward and downward view by reflection to an observer located within said tubes. Another object of the invention is a ship in which a longitudinal bulkhead extends vertically, and in contact with the tubular shells, said bulkhead extending
25 upwardly and downwardly exterior to said shells. The invention also provides for a ship in which a multiple of such bulkheads are extended beyond the exteriors of said shells. A further object of the invention is a ship in which
30 upwardly extending bulkheads support the engines used in propelling the ship. Still another object of the invention is a ship in which the areas between skin and shell is utilized for the storage of fuel. Still another object of the invention is a ship in which such fuel storage spaces
35 are separated by bulkheads. This invention also covers a ship in which bombs or similar engines of war, may be discharged through the bottom of the ship. Another object of the invention is a ship in which outwardly extending, curved
40 brackets extend along the fuselage. Still a further object of the invention is a ship in which such curved brackets act as a cantilever support for the wings. Other objects of the invention
45 will appear from the specification and from the accompanying drawings.

The specification and the accompanying drawings illustrate the usual and preferred embodiment of the invention, but it is not to be held
50 that such illustration represents the only form in which the invention may be embodied, nor as excluding such forms as are not shown.

I illustrate my invention by the accompanying drawings in which Fig. 1 is a vertical, transverse
55 cross-section of a single tube air-ship, on the line

1—1 of Fig. 2; Fig. 2 is a vertical, longitudinal view on the line 2—2 of Fig. 1; Fig. 3 is a horizontal view of the top of a single tube ship; Fig. 4 is a horizontal view of the bottom of a single tube ship; Fig. 5 is an enlarged cross-sectional
5 view of the lower portion of a single tube ship on the line 5—5 of Fig. 4; Fig. 6 is a vertical, transverse section of a multiple tube ship on the line 6—6 of Fig. 8; Fig. 7 is a vertical, longitudinal view of a multiple tube ship on the line 7—7 of
10 Fig. 6; Fig. 8 is a top view of a multiple tube ship; Fig. 9 is a cross-section of a single tube ship on the line 9—9 of Fig. 3; Fig. 10 is a cross-section of the tail of a single tube ship on the line 10—10 of Fig. 3; Fig. 11 is a cross-section of
15 a multiple tube ship on the line 11—11 of Fig. 8; Fig. 12 is a cross-section of the tail of a multiple tube ship on the line 12—12 of Fig. 8; Fig. 13 is a head-on view of a single tube ship; Fig. 14 is a head-on view of a multiple tube ship; Fig. 15
20 is a vertical cross-section of a small, single tube ship on the line 15—15 of Fig. 16; Fig. 16 is a side elevation of such small, single tube ship on the line 16—16 of Fig. 15; Fig. 17 is a cross-section of a small, multiple tube ship on the line 17—17
25 of Fig. 18; Fig. 18 is a top view of a small, multiple tube ship on the line 18—18 of Fig. 17; Fig. 19 is a diagrammatic view showing the disposition of the assembling in a small, single tube ship of this type and Fig. 20 is a diagrammatic view
30 of the assembling of such a double tube ship.

Referring to the drawings, in which similar figures refer to similar parts:—1, is an inner shell, attached to an outer skin 2, by fastening means, 3. Wings 4, are supported above such skin by
35 braces 5, stiffening said wings. A bridge 6, supports engines 7, to which are attached propellers 8. Bottom plates 9, connect the lower apexes of skin plates. Top plates 10, connect their upper apexes. Girders 11, extend vertically, being attached to said shells by fastening means 12.
40 Keels 13, are the lower extremities of said girders. Guys 14, connect said skin and said wings. Galleries 15, extend laterally along the sides. Openings 16, are in the outer perimeters of said galleries. Observation ports 17, are in the nosing
45 18, of said ship. Longitudinal drains 19, connect adjacent longitudinal compartments, and transverse drains 20, connect adjacent longitudinal compartments. Bomb casings 21, are in the
50 floors, and bombs 22, are in said casings. Guns 23, are located in said galleries. Transverse bulkheads 24, divide the ship into a plurality of compartments exterior to said shells. A fin 25, is an upward extension of said girder. A fuselage 26, 55

has stabilizers 27, thereon, with elevators 28, at the end thereof. A rudder 29, and fin 30, are at the rear of said ship. A plow 31, is located at the nosing of multiple tube ships. Cantilevers 32, are extensions of the top plates, to broaden the support of the wings, while brackets 33, are attached to the lower portion of the wings. Means 34, fasten said wings to said brackets. Tubes 35, are created by the balanced combination of skin, shell and girders. Mirrors 36, are located in the galleries, and periscopes 37, protrude through the tubes. An auxiliary rudder 38, is in the tail, and a screw 39, is likewise at said tail, propelled by a motor 40. An interior rudder 41, is connected to an interior stabilizer 42. Drainage ports 43, are in the walls of the galleries. A floor 44, is located in the galleries. Wheels 45, are fastened to the bottoms of the girders. Hand-rails 46, are located along the galleries. Means 47 and 48 fasten bottom and top plates to tubes and girders.

In the art of constructing air-planes as usually, and heretofore conducted, the practice has consisted in the construction of an interior framework, usually in the form of trussed hollow rods, as a foundation, on which an outer skin, either of metal or fabric, could be applied, the said framework being made as light as possible, and at the same time secure sufficient strength so as to maintain the structure, both during flight and while at rest upon the earth.

This invention eliminates this interior tubular framework, substituting in place thereof a curvilinear girder, either single or in multiple, which said girder, or girders, extend longitudinally throughout the length of the air-ship. This curvilinear girder, 1, in the accompanying drawings, is known as the shell, to the outer surface of which is applied a skin, 2, said skin being a series of plates, arranged as planes. At points of contact, tangential to the interior shell, the said shell and the said skin are rigidly and immovably fastened together by means 3, the said skin and the said shell thereby acting in unison, and in concert to resist all strains and stresses of every name and nature whatsoever to which the said ship may be subjected, whether in flight, or otherwise. The inter-action of these two major elements, through such fastening means, permits of the use of very thin plates, both in the shell and in the skin, resulting in a very light craft, much lighter, relatively, than is the present type of construction.

In addition to the skin acting as a strengthening medium, girders, 11, are introduced between the adjacent shells, which said girders are fastened to said shells at tangential points of contact, by fastening means, 12. As a result, the shells, 1, the skin, 2, and the plate-girders, 11, act together as a completely unified girder, of great strength and rigidity.

The interior shell, 1, may, as heretofore stated, be a single shell or in multiple, but both single shell and multiple shell ships, have longitudinal galleries running parallel with the shells, along the fuselage. These galleries may, when desired, be eliminated, but as they are a feature adding materially to the strength and operation of the craft, they are usually included as part of the design. These galleries are open on one side to the atmosphere, through openings, 16. While the construction of the galleries is a combination of shell and skin, similar to that of the ship as a whole, the construction admits of the using the upper portion of the gallery as a bracket, 32, which bracket acts as a cantilever

to support, and to extend the support, of the wings to a greater distance from the body of the ship, and thereby permit of a great enlargement of the said wings, in area and in length, which enlargement greatly increases the supporting power of the wings.

In some of the ships, the wings, covering the compartmented portion of the ship, act as continuous girders, being curved to the form of the compartments, this construction carrying the wings from tip to tip as a single and continuous unit, still further adding to the strength and the supporting power of the said wings. The top plate, 10, abuts along this supported portion of the wings, both being securely fastened together, so that the ship as a whole acts to aid the wings in their supporting and sustaining power. Likewise the bottom plate, 9, is carried outwardly, ending in the upwardly curved brackets, 33, which are likewise of great material advantage in the strength and operation of the ships, as they act as sponsons, and greatly increase the buoyancy of the ship when resting upon a body of water. The continuation of the shells as upper and lower brackets, the one extending the support of the wings, and the other giving full sponson effect, are cardinal elements in this improved type of airship.

The form of construction of interior shell, girders and exterior skin, results in a series of pockets, or compartments, between said shell, skin, girders and transverse bulkheads, 24. This produces a number of such small compartments, all isolated from each other, but which are connected and inter-connected by means of longitudinal drains 19, and transverse drains 20. These compartments and divisions become storage spaces, for the storage of liquid fuel, the capacity of such storage spaces being, relatively, very large. By means of the interconnecting ports all portions of the storage space is connected to the engines, so that a large amount of, and a large reserve of, fuel is always available. Again, by reason of the division and subdivision into a large number of compartments, all small, and the isolation of the fuel in a comparatively small amount in each of said compartments, the liability of, and the danger and damage from fire or explosion of the volatile and inflammable liquid fuel, is minimized and very largely eliminated.

Bomb casings, 21, are installed in the floor of the ship, through which bombs, 22, are released. The galleries, 15, are arranged for gun emplacements on which guns, 23, are manipulated, discharging through openings, 16, in the sides of said galleries.

The stability of the ship is largely increased by carrying the longitudinal girders, 11, above the fuselage as a fin, 25, and below as a keel, 13, the said girder being fastened to skin and shell by fastening means, 12. These upward and downward extensions of the girders, 11, aid materially in maintaining a course while flying in the air, and also give stability when floating or travelling on the water.

The craft directly related to these specifications, are intended to take off from, and to come to rest upon a body of still water, and the design, as regards form and immersion, is such as to make them either upon landing or during take-off, substantially water borne craft. There are times, however, when, due to accident, or failure of the engines employed to propel the craft while in the air, another, or additional

propulsion means is desirable or necessary. For this purpose, rear screws, which are shown at 39, and which are submerged when the craft is resting upon the water, are connected to motive power sources, 40, and are included in the equipment for the ship, such additional and auxiliary motive and propelling means serving to transport the ship through and over the waves, which auxiliary means, either alone, or in combination with the propelling engines for air use, will move the ship to a point of rescue or repair, or back into the air again. While the craft is designed for water rest and take-off, it is also provided with wheels, 45, in order to permit of land rests and take-offs, should this become necessary. By means of all of these appliances, the ship becomes an amphibian, although primarily adapted for aqueous air ports.

The craft, being primarily for such aqueous landings, it becomes necessary to guard against any conditions which would impede or prevent the ship from rising from the water. Due to the special form of gallery construction, water is liable to find its way into the lower brackets, either upon landing, or through other causes, and such water, if trapped therein, by reason of its added weight, would prevent the ship from rising from the surface. In order to obviate this possibility, drains, 43, are introduced, such appliances serving to secure the egress of water from the brackets, and so relieve the ship from such undesirable and additional weight.

It is evident that one of the purposes in the design of this invention, was to produce a craft susceptible of travelling at great heights; in the strathosphere, or where very rarefied air would be encountered. The compartments of the ship are fully enclosed, thereby maintaining atmospheric, or nearly atmospheric, pressures within the ship, independently of pressures without. Such a fully enclosed cabin, in order to successfully meet the conditions to be encountered, can have only a limited outward view, it being impossible to provide the extensive window apertures common in craft not intended for extremely high altitudes. This limited view is extended, in this craft, by means of mirrors, 36, on the inner surfaces of the brackets, and by periscopes 37, protruding from the walls of the compartments. By means of such mirrors and periscopes, practically unlimited view may be had both above and below, giving even a wider extent of vision than in present types of craft. For military purposes, these provisions are of incalculable value, permitting the combatants within a ship a complete and wide amplitude of observation, from which vantage point they can direct fire upon enemy territory or plane, without themselves being seen. The operators of such craft, both as to number and position are unknown to an enemy, and, as in multiple tube ships, such craft can carry, with fuel and munitions up to one-hundred men, the possibilities of such completely enclosed craft must be very great.

While for larger craft there is a considerable complication in the design and assembling of the parts, for small ships, the design and construction, either for single or multiple tube craft, is very simple. Fig. 19 indicates that for a single tube ship, except for the wings, assembling consist only in adjusting and fastening three elements, the shell and an upper and a lower plate, which have all been pressed to shape in one operation. For a multiple tube, small ship this consists of a plurality of shells, an upper plate, a

lower plate and a girder, all as shown in Fig. 20. The entire arrangement is simple and compact.

What I claim:—

1. In an air-ship having laterally extending wings at opposite sides thereof, the combination of a plurality of longitudinal tubes; said tubes comprising a plurality of inner curvilinear shells; outer skins; said skins comprising a plurality of plane surfaces tangentially in contact with said shells; means fastening said shells and said skins together at said contact points; girders between said tubes and in contact therewith; means fastening said tubes and said girders together at said points of contact; and fins extending upwardly above said tubes at said girders.

2. In an air-ship having laterally extending wings at opposite sides thereof, the combination of a rigid, continuous, interior, curvilinear shell; a rigid, exterior, continuous skin; said skin comprising a plurality of plane surfaces tangentially in contact with said shell, portions of said skin bracing said wings from front to rear of said wings at a distance from the shell more than the radial distance from the center of the shell; and means immovably fastening said shell and said skin together at said contact points.

3. In an air-ship having laterally extending wings at opposite sides thereof, the combination of a longitudinal tube; said tube comprising a rigid, continuous, interior, curvilinear shell; a rigid exterior, continuous skin; said skin comprising a plurality of plane surfaces tangentially in contact with said shell; portions of said skin bracing said wings from front to rear of said wings at a distance from the shell more than the radial distance from the center of the shell; and means immovably fastening said shell and said skin together at said contact points.

4. In an air-ship having laterally extending wings at opposite sides thereof, the combination of a plurality of longitudinal tubes; said tubes comprising a plurality of rigid, continuous, interior, curvilinear shells; a plurality of rigid, exterior, continuous skins; said skins comprising a plurality of plane surfaces tangentially in contact with said shells, portions of said skins bracing said wings from front to rear of said wings at a distance from the shells more than the radial distance from the center of the shells; and means immovably fastening said shells and said skins together at said contact points.

5. In an air-ship having laterally extending wings at opposite sides thereof, the combination of longitudinal tubes; said tubes comprising a plurality of rigid, continuous, interior, curvilinear shells and a plurality of rigid, exterior, continuous skins; said skins comprising a plurality of plane surfaces tangentially in contact with said shells; plate girders between said tubes, said girders extending upwardly to an elevation above the uppermost level of the tubes and functioning both as reinforcement and as supports; and means immovably fastening said tubes and said girders together.

6. In an air-ship having laterally extending wings at opposite sides thereof, the combination of longitudinal tubes; said tubes comprising a plurality of rigid, continuous, interior, curvilinear shells, and a plurality of rigid, exterior, continuous skins; said skins comprising a plurality of plane surfaces tangentially in contact with said shells; plate girders between said tubes, said girders extending downwardly a distance below the lowermost levels of the tubes and functioning both as reinforcement and as supports; and

means immovably fastening said tubes and said girders together.

7. In an air-ship, the combination of a plurality of longitudinal tubes; said tubes comprising a plurality of rigid, continuous, interior, curvilinear shells and a plurality of rigid, continuous, exterior skins; said skins comprising a plurality of plane surfaces tangentially in contact with said shells; plate girders between and in contact with adjacent tubes, said girders extending upwardly to an elevation above the uppermost level of the tubes and functioning both as reinforcement and as supports; means immovably fastening said tubes and said girders together; and a bridge supported upon said girders.

8. In an air-ship, the combination of a plurality of longitudinal tubes; said tubes comprising a plurality of rigid, continuous, interior, curvilinear shells and a plurality of rigid, exterior, continuous skins; said skins comprising a plurality of plane surfaces tangentially in contact with said shells; plate girders between adjacent tubes, said girders extending upwardly to an elevation above the uppermost level of the tubes and functioning both as a reinforcement and as supports; means immovably fastening said tubes and said girders together; a bridge supported upon said girders; and propelling engines supported upon said bridge.

9. In an air-ship having primary wings, the combination therewith of open-sided lateral galleries forming secondary wings, said galleries being curvilinear and providing a means for bracing the primary wings.

10. In an air-ship, the combination of a rigid, continuous, interior, curvilinear shell and a rigid, continuous, exterior skin; said skin comprising a plurality of plane surfaces tangentially in contact with said shell; means immovably fastening said shell and said skin together at said contact points; said shell and said skin forming a rigid, continuous, longitudinal tube; open-sided lateral galleries exterior of said tube, said galleries forming secondary wings; plate girders between said tube and said galleries; means immovably fastening said tube, said girders and said galleries together; and primary wings superimposed upon said tube and said galleries and fastened to said tube and said galleries.

11. In an air-ship, the combination of a plurality of longitudinal tubes; said tubes comprising a plurality of rigid, continuous, interior, curvilinear shells and a plurality of rigid, exterior, continuous skins; said skins comprising a plurality of plane surfaces tangentially in contact with said shells; means immovably fastening said shells and said skins together at said contact points; open-sided lateral galleries exterior of said tubes, said galleries forming secondary wings; plate girders between adjacent tubes, and plate girders between lateral galleries and adjacent tubes; means immovably fastening said tubes, said girders and said galleries together; and primary wings superimposed upon said tubes and said galleries and attached to said tubes and said galleries.

12. In an air-ship, the combination of a rigid, continuous, interior, curvilinear shell and a rigid, continuous, exterior skin; said skin comprising a plurality of plane surfaces tangentially in contact with said shell; means immovably fastening said shell and said skin together at said contact points; said shell and said skin forming a rigid, continuous, longitudinal tube; open-sided lateral galleries exterior of said tube, said galleries forming

secondary wings; plate girders between said tube and said galleries, said girders extending upwardly above said tube and said galleries; means immovably fastening said tube, said girders and said galleries together; primary wings superimposed upon said tube and said galleries; means fastening said tube, said galleries and said primary wings together; and propelling engines supported upon said girders.

13. In an air-ship, the combination of a plurality of longitudinal tubes; said tubes comprising a plurality of rigid, continuous, interior, curvilinear shells and a plurality of rigid, exterior, continuous skins; said skins comprising a plurality of plane surfaces tangentially in contact with said shells, means immovably fastening said shells and said skins together at said contact points; open-sided lateral galleries exterior of said tubes, said galleries forming secondary wings; plate girders between adjacent tubes and plate girders between lateral galleries and adjacent tubes; said girders extending upwardly above said tubes and said galleries; means immovably fastening said tubes, said girders and said galleries together; primary wings superimposed upon said tubes and said galleries; means fastening said tubes, said galleries and said primary wings together; and propelling engines supported upon said girders.

14. In an air-ship, the combination of a rigid, continuous, interior, curvilinear shell and a rigid, continuous, exterior skin; said skin comprising a plurality of plane surfaces tangentially in contact with said shell; means immovably fastening said shell and said skin together at said contact points; said shell and said skin forming a rigid, continuous, longitudinal tube; open-sided lateral galleries exterior of said tube, said galleries forming secondary wings; plate girders between said tube and said galleries, said girders extending upwardly above said tube and said galleries; means immovably fastening said tube, said girders and said galleries together; primary wings superimposed upon said tube and said galleries; means fastening said tube, said galleries and said primary wings together; a bridge supported upon said girders; and propelling engines supported upon said bridge.

15. In an air-ship, the combination of a plurality of longitudinal tubes; said tubes comprising a plurality of rigid, continuous, interior, curvilinear shells and a plurality of rigid, exterior, continuous skins; said skins comprising a plurality of plane surfaces tangentially in contact with said shells; means immovably fastening said shells and said skins together at said contact points; open-sided lateral galleries exterior of said tubes, said galleries forming secondary wings; plate girders between adjacent tubes and plate girders between lateral galleries and adjacent tubes, said girders extending upwardly above said tubes and said galleries; means immovably fastening said tubes, said girders and said galleries together; primary wings superimposed upon said tubes and said galleries; means fastening said tubes, said galleries and said primary wings together; a bridge supported upon said girders; and propelling engines supported upon said bridge.

16. In an air-ship, the combination of a rigid, continuous, curvilinear shell; a bottom plate, 70 below and in contact with said shell; said plate having upwardly projected lateral extensions forming secondary wings; primary wings superimposed upon said shell and in contact with said extensions; and means fastening said primary 75

wings and said extensions together at said contact points.

17. In an air-ship, the combination of a rigid, continuous, curvilinear shell; a bottom plate, below and in contact with said shell; a top plate, above and in contact with said shell; upwardly projected lateral extensions of said bottom plate; said extensions forming secondary wings; lateral extensions of said top plate, said extensions of said bottom plate and said extensions of said top plate having points of contact; means fastening said extensions together at said contact points; primary wings superimposed upon said top plate and supported by said extensions; and means fastening said primary wings and said extensions together.

18. In an air-ship, the combination of a plurality of parallel, rigid, continuous, curvilinear shells; plate girders between and in contact with adjacent shells; means fastening said shells and said girders together at said contact points; a bottom plate, below and in contact with said shells; said plate having upwardly projected extensions forming secondary wings; primary wings superimposed upon said shells and in contact with said extensions; and means fastening said primary wings and said extensions together at said contact points.

19. In an air-ship, the combination of a plurality of parallel, rigid, continuous, curvilinear shells; plate girders between and in contact with adjacent shells; means fastening said shells and said girders together at said contact points; a bottom plate, below and in contact with said shells; a top plate, above and in contact with said shells; said bottom plate having upwardly projected lateral extensions forming secondary wings; said top plate having lateral extensions; said extensions of said top plate and said extensions of said bottom plate having points of contact; means fastening said extensions together at said contact points; primary wings superimposed upon said top plate and supported by said extensions; and means fastening said primary wings and said extensions together.

20. In an air-ship, the combination of a plurality of parallel, rigid, continuous, curvilinear shells, plate girders between and in contact with adjacent shells; means fastening said shells, and said girders together at said contact points; a bottom plate, below and in contact with said shells and said girders; means fastening said girders and said bottom plate together at said contact points; a top plate, above and in contact with said shells and with said girders; means fastening said girders and said top plate together at said contact points; said bottom plate having upwardly projected lateral extensions forming secondary wings; said top plate having lateral extensions; said extensions of said bottom plate and said extensions of said top plate having points of contact; means fastening said extensions together at said contact points; primary wings superimposed upon said plate and supported by said extensions and means fastening said primary wings and said extensions together.

21. In an air-ship, the combination of a plurality of parallel, rigid, continuous, curvilinear shells; plate girders between and in contact with adjacent shells, means fastening said shells and said girders together at said contact points; a bottom plate, below and in contact with said shells and said girders; means fastening said girders and said bottom plates together at said contact points; a top plate, above and in contact with said shell and with said girders; means fastening said girders and said top plate together at said contact points; said girders extending above said top plate and below said bottom plate; said bottom plate having upwardly projected lateral extensions forming secondary wings; said top plate having lateral extensions; said extensions of said bottom plate and said extensions of said top plate having points of contact, means fastening said extensions together at said contact points; primary wings superimposed upon said top plate and supported by said extensions; and means fastening said primary wings and said extensions together.

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