Jan. 17, 1928. 1,656,780

F. G. DIAGO

AMPHIBIAN BALLOON

Filed Oct. 15 1926 5 Sheets-Sheet 1

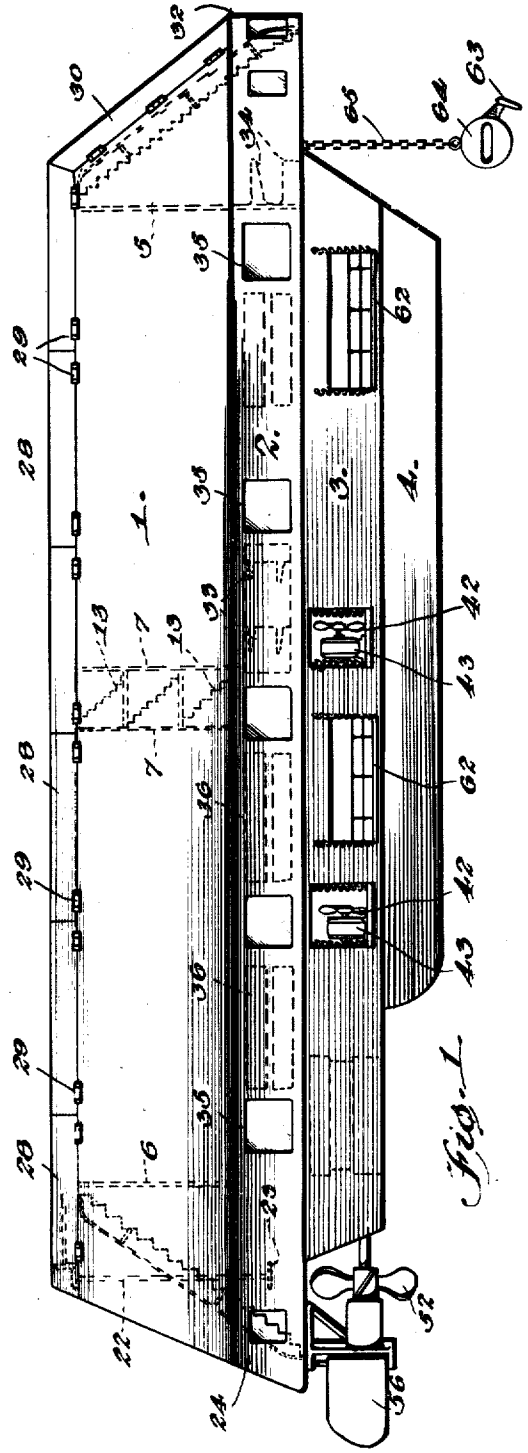


Fig. 1.

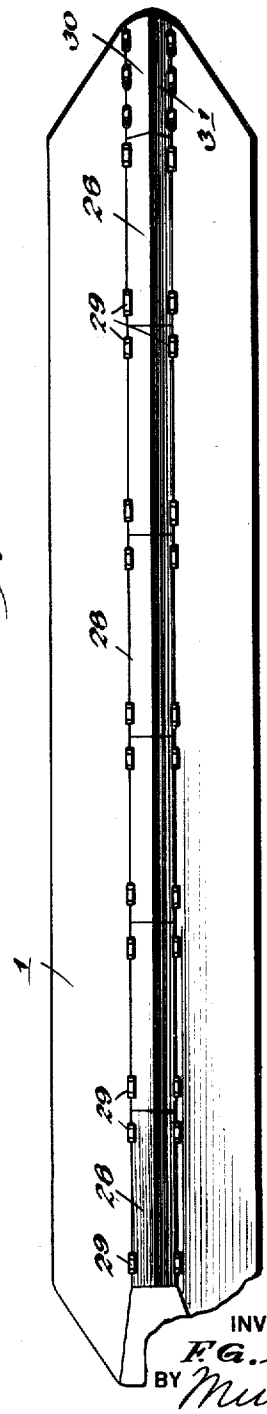


Fig. 2.

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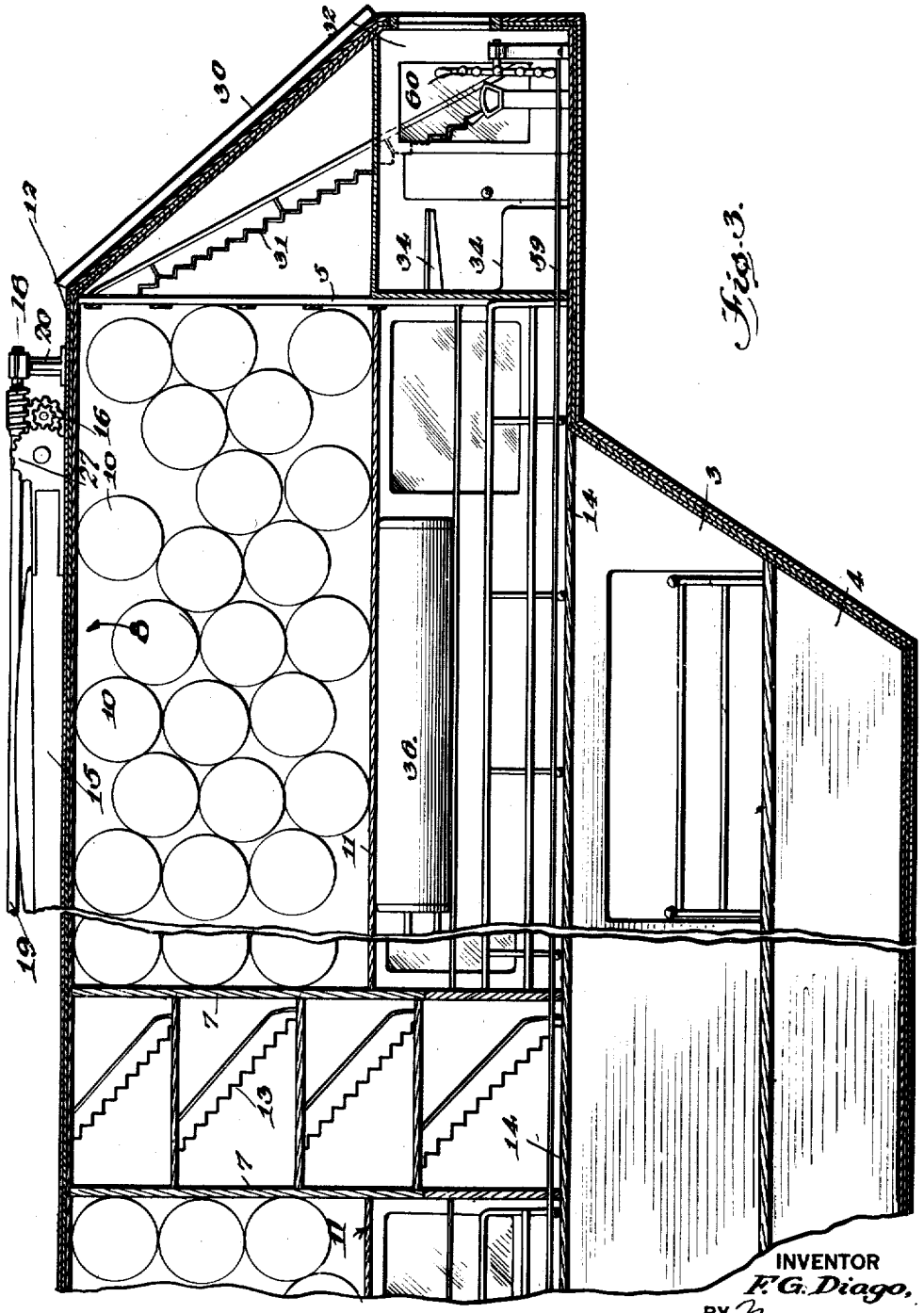


Fig. 3.

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5 Sheets-Sheet 3

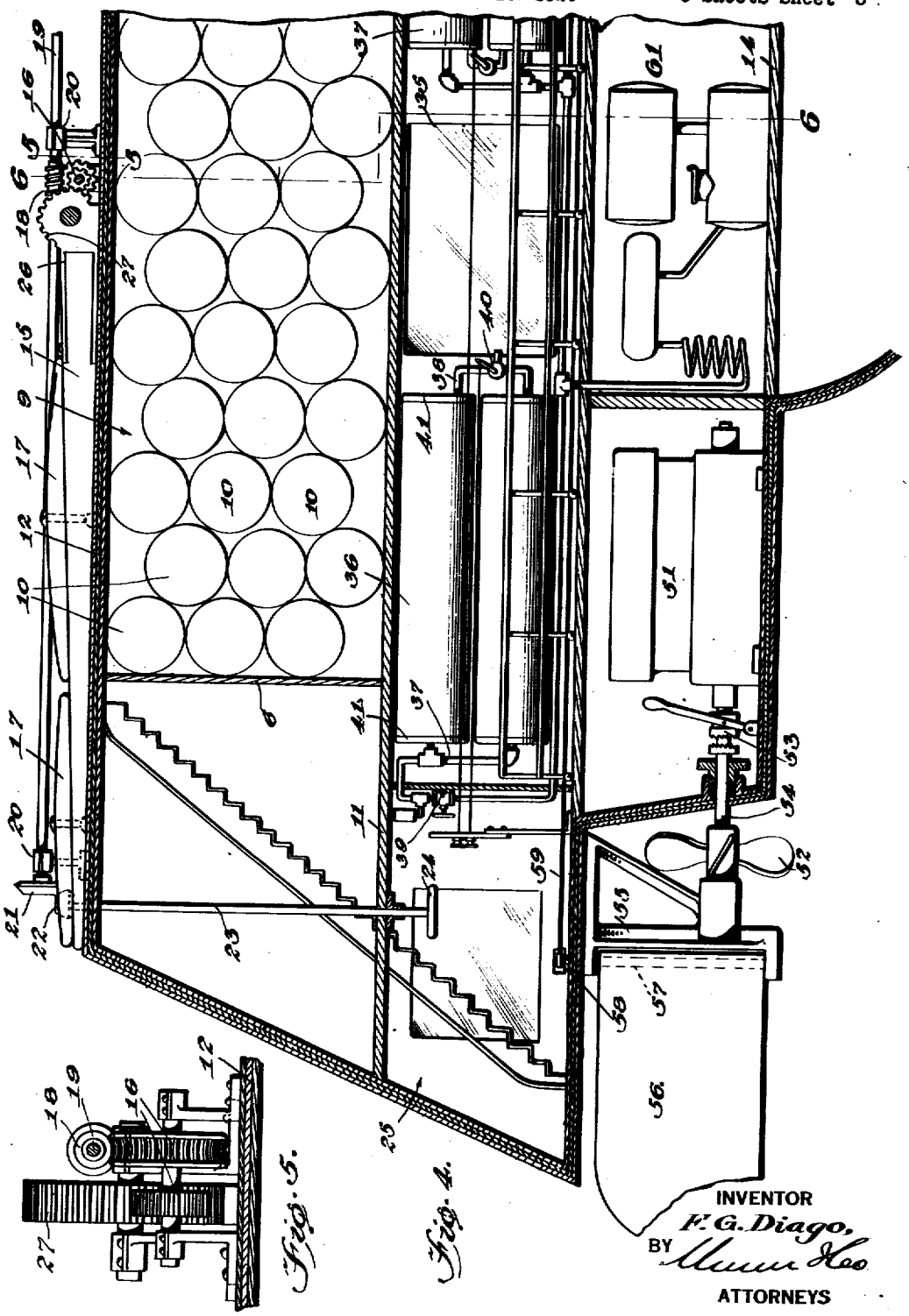


Fig. 4.

Fig. 5.

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AMPHIBIAN BALLOON

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5 Sheets-Sheet 4

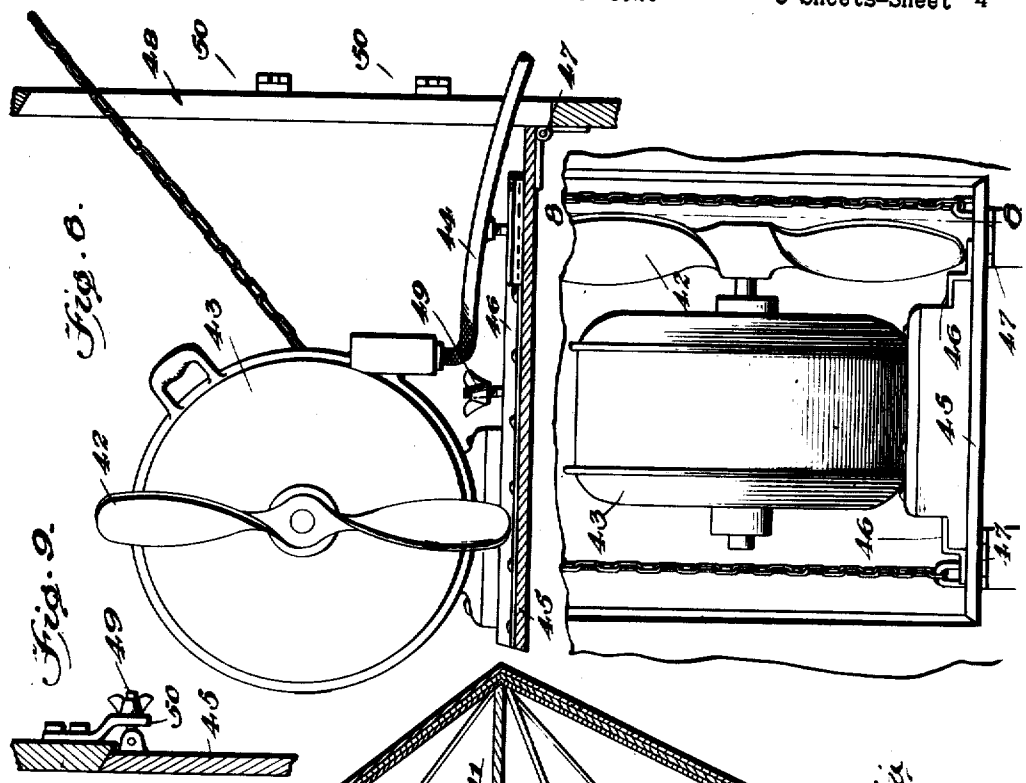


Fig. 8.

Fig. 9.

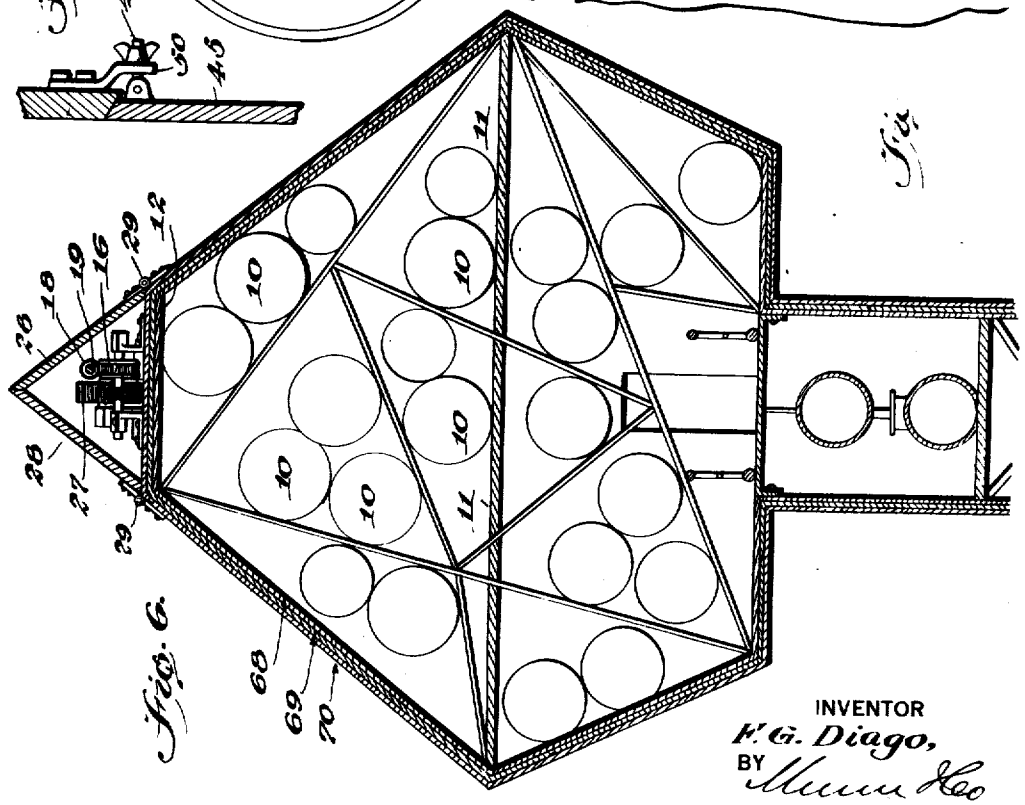


Fig. 6.

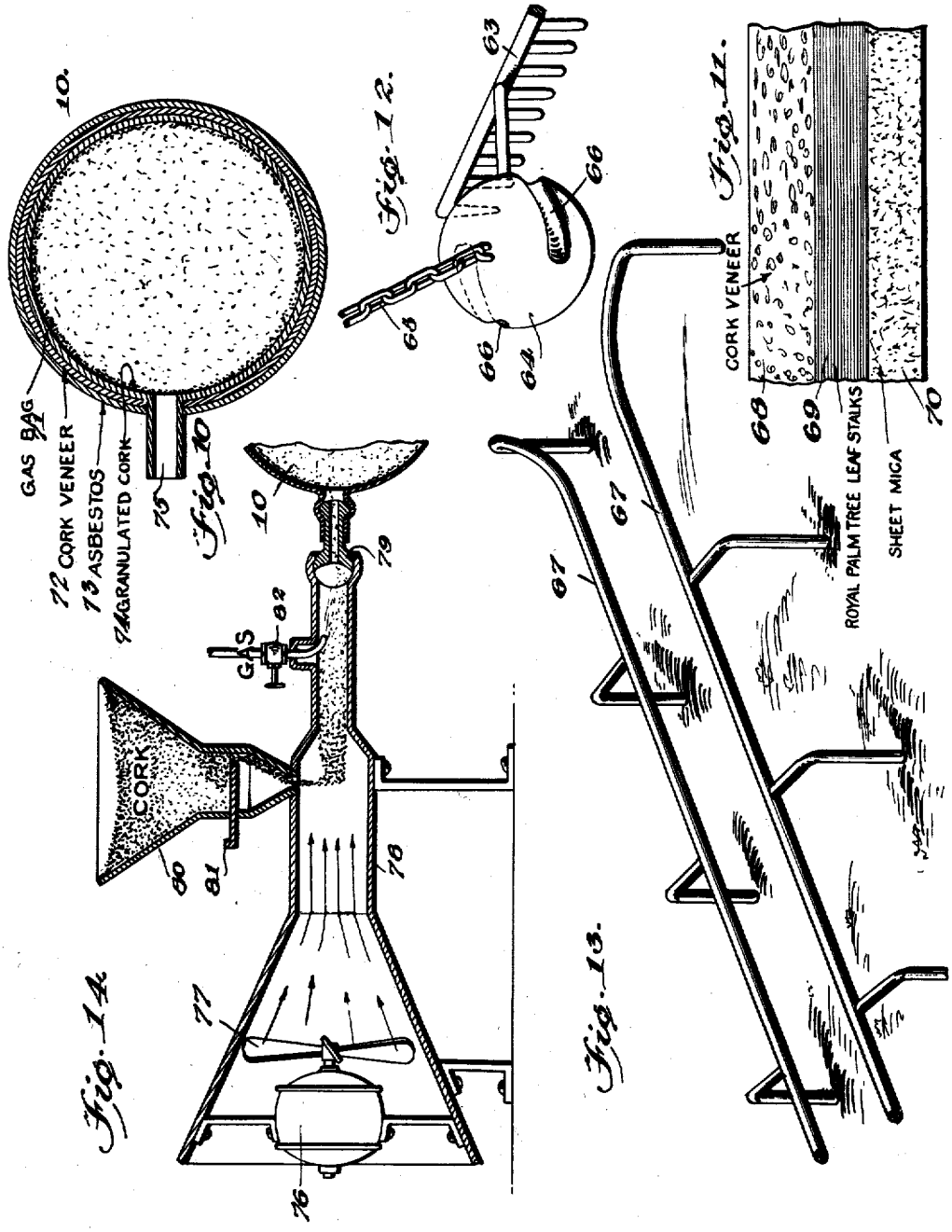
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AMPHIBIAN BALLOON

Filed Oct. 15, 1926 5 Sheets-Sheet 5



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Patented Jan. 17, 1928. 1,656,780

UNITED STATES PATENT OFFICE.

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AMPHIBIAN BALLOON.

Application filed October 15, 1926. Serial No. 141,819.

This invention relates to improvements in air craft, an object of the invention being to provide a dirigible balloon capable of navigating the air, upon the surface of water and in some instances upon a level earth surface.

Another object of the invention is to provide movable masts which are readily erected upon the balloon to permit navigation in the last two instances stated should other means of locomotion fail.

Another object of the invention is to provide large window openings which are intended to be opened in an event of a storm, permitting the wind to blow through and thus save the balloon from destruction due to abnormal air pressure upon the sides.

A further object of the invention is to provide not only a novel arrangement of the gas containing means, but also to provide a novel construction in the gas container by which quick changes of temperature in the gas are avoided.

Other objects and advantages appear in the following specification, reference being had to the accompanying drawings, in which

Figure 1 is a side elevation of the improved balloon.

Figure 2 is a plan view thereof.

Figure 3 is a longitudinal section of the front end of the balloon.

Figure 4 is a longitudinal section of the rear end of the balloon.

Figure 5 is a detail cross section taken substantially on the line 5—5 of Figure 4 and showing the means for erecting one of the masts.

Figure 6 is a vertical section taken on the line 6—6 of Figure 4.

Figure 7 is a detail elevation of one of the propellor motor hatches in the extended position.

Figure 8 is a sectional view thereof taken substantially on the line 8—8 of Figure 7.

Figure 9 is a detail cross section illustrating the mode of fastening the motor hatches.

Figure 10 is a detail cross section illustrating the particular construction of one of the gas containers.

Figure 11 is a sectional view of the balloon covering or fabric.

Figure 12 is a detail perspective view of an anchor used in connection with the balloon.

Figure 13 is a detail perspective view of the mooring device.

Figure 14 is a longitudinal section of an apparatus for injecting granulated cork into the gas container.

Recognition of the fact that aerial navigation has not reached that perfection at which a large margin of safety is assured aerial craft while in flight has led to the development of the herein disclosed aircraft which is capable of descending under force of necessity and navigate upon either water or land. The aircraft is of the lighter-than-air but dirigible type, and in view of the foregoing capabilities has been termed an amphibian balloon.

In its general aspect (Fig. 1) the balloon comprises a superstructure 1, mid-section 2 and a base section 3. The base section has a keel 4 appended thereto, this device being of a special value when the balloon alights upon the water thus acting in the capacity of a ship. In this event it is estimated that the water line will come approximately to the bottom of the mid-section 2. The keel 4 is also capable of acting in the capacity of a skid as when the balloon alights upon the ground. The structure of the keel is herein disclosed in a general way only, it being regarded as understood that actual practice may make requirements not easily anticipated here.

The superstructure 1 has front and rear headers 5 and 6 (Figs. 3 and 4) and intermediate headers 7 (Fig. 3) which serve as end closures for compartments 8 and 9 which contain numerous gas bags or containers 10 at present shown as round balloons. A floor 11 divides the superstructure 1 from the mid-section 2. The superstructure is surmounted by a deck 12. This deck may be used as a promenade for the passengers of the balloon, in addition to the other purposes which it serves, for which first purpose the intermediate headers 7 are spaced apart (Fig. 3) to permit the installation of a suitable arrangement of stairways 13 reaching, principally, from the floor 14 of the mid-section 2.

The foregoing additional purpose to which the deck 12 is put is that of a mounting for

a pair of masts 15 which, by means of the gearing 16 are capable of either being depressed into a recumbent position as shown or moved into an erect position as when the use of sails is necessitated. For the latter purpose each mast has a number of spars 17 capable of being turned around into customary position to aid in supporting the sails (not shown).

The gearing 16 is driven by worm pinions 18 on a common shaft 19 which extends lengthwise of the superstructure and is journalled in suitable bearings 20. Meshing gears 21 and 22 (Fig. 4), the latter upon an upright shaft 23 which carries a handwheel 24 and is located in the rear cabin 25, provide for the turning of the shaft 19 and for the action of the masts stated. Each mast has a stirrup 26 with a gear quadrant 27 connecting with the gearing 16.

For the purpose of protecting the mechanism of the masts and to avoid an accumulation of rain or snow upon the top deck 12, provision is made of longitudinal gates or hatches 28 which are hinged at 29 so that they may be swung up or down as occasion may require. When swung up (Fig. 6) they assume the shape of a gable the sides of which are in line with the inclined sides of the superstructure 1. In practice the top deck 12 will be of sufficiently large proportion to permit its use as a promenade as already suggested, and it is therefore conceivable that the hatches 28 may be provided with windows permitting use of the top deck during inclement weather. The passengers may walk around the mast and the mechanism thereof.

Somewhat similiar hatches 30 may provide a cover for the front stairway 31 which leads from the front pilot's cabin 32. The rear cabin 24 is used by an assistant pilot. The front hatches 30 may be hinged upon the forwardly inclined portion of the superstructure, permitting swinging back and forth as may be desired.

The mid-section 2 is in practice most conveniently fitted out for passenger accommodation as indicated by the berths 33 and 34 (Fig. 1), the actual arrangement not being attempted herein because that is obvious and is subject to much modification. The mid-section is equipped with a plurality of large window openings 35 which ordinarily are left closed but are completely opened when the balloon is caught in a severe storm, permitting the wind to blow through and thus avoid breaking the aircraft in two. The window openings are obviously located elsewhere than at the spaces allotted to passenger accommodation, the idea being to provide unobstructed cross passages for the purpose described.

A plurality of gas bags or containers 36 also occupies the mid-section 2, these being capable of being emptied of their gaseous contents so that the draft occasioned through the mid-section upon opening the windows 35 may carry the gas away upon the necessity of lowering the aircraft. These bags or containers are shown as of elongated form but obviously may be made in other shapes. They may be arranged in pairs as suggested in Figures 1 and 4, or they may be distributed about the mid-section in a variety of ways as shown in Figure 6. In any event a certain number of the bags, constituting a set, will be coupled together at one end with a gas supply pipe 37 and at the other end with a discharge pipe 38. The first pipe is controlled by a valve 39, the second by a valve 40. Suitable controls for the various valves may extend to the rear cabin 25, the idea being to permit emptying of any one or all sets of gas bags.

In practice the gas bags will be provided with rigid heads 41 which are suitably supported. The gas bags themselves are collapsible as gas escapes therefrom, the collapse of the gas bags facilitating the passage of air through the mid-section when the windows adjacent to the bags are thrown open.

Propellers 42 drive the balloon forwardly when used as an aircraft. These propellers are driven by electrical motors 43 (Figs. 7 and 8) which are supplied with current through cables 44 from a source carried by the aircraft. It is not essential that the propellers be driven electrically since any known type of gasoline motor may be used if desired.

In any event, using the electrical motor 43 as an example, the power plant is mounted upon a hatch 45 which is provided with tracks 46 along which the base of the motor is movable to an extended position on the hatch, and in reference to which the motor base may be clamped by any suitable means. Prior to closing the hatch 45, as when the aircraft is forced to alight upon the water, the motor 43 is pulled inwardly along the tracks 46 to such extent that the hatch may freely swing upon its hinges 47.

The hatch 45 is swingable into an opening 48 in the side of the base section 3, both the edges of the hatch and the opening being beveled to insure making a tight joint when the hatch is closed. Suitable means are provided for making a water-tight closure, the provision consisting of swinging bolts and thumb screws 49 and brackets 50.

An engine 51 (Fig. 4) drives a propeller 52 when the ballon is used as a water craft, there being a shiftable clutch 53 by which the propeller can be stopped and started. The outer end of the propeller shaft 54 has bearing upon a bracket 55 which serves the additional purpose of a support for a rudder 56. The rudder shaft 57 has a cross arm 58

with the ends of which cables 59 are connected. These cables extend forwardly where they so connect with the steering wheel 60 in the pilot house or cabin 32 that turning of the wheel will serve to move the rudder and thus steer the balloon. The rudder serves the same purpose when the balloon acts as a watercraft. The gas lost by emptying the bags 36 may be replenished by a plant 61 of any suitable description, and located within the base section 3.

Swingable platforms 62 located in the base section 3 provide convenient places at which the passengers may step out to view the landscape. These platforms will be made much on the order of the hatches 45, previously described. Provision must be made for rendering the openings in the side of the base section 3 water tight when the platforms are closed, and as in the case of the hatches 45, suitable hoisting mechanism must be provided within the base section for moving the platforms up and down.

An anchor for the aircraft comprises a toothed holding member 63 and a heavy ball or other weight 64. The anchor is suspended by a chain 65 which, in practice, will be wound upon an appropriate windlass within the aircraft. The weight 64 has a pair of side grooves 66 (Fig. 12) arranged to engage the parallel rails 67 of the mooring device shown in Figure 13. These rails are flared at one end as shown so that the weight may be guided into place to better advantage. The mooring device is rigidly fixed upon the ground at the entrance to an appropriate hanger or other housing contrivance for the balloon.

It is noted in a number of the views of the drawing (for example Fig. 6) that the aircraft has a covering composed of a plurality of plies. The first of these consists of a layer of cork veneer 68 (Fig. 11). The next layer 69 is composed of the fibre of royal palm tree leaf stalks, the last and outside layer being composed of sheet mica 70. The last layer gives the covering or envelope a glazed appearance, not only lowering the air resistance but protecting the aircraft in a large measure against fire from outside sources. The layers 68 and 69 form good insulators, preventing sudden changes in temperature within the balloon.

A special construction of the gas containers themselves adds further protection against sudden changes of temperature of the gas. One of the gas bags 10 (Fig. 10) may be described as an example. This gas bag, like the covering of the balloon, is composed of a number of plies of material, the first being composed of canvas or other suitable material 71, the next a layer of cork veneer 72, the last a layer of asbestos 73. The interior of the gas bags 71 is coated with granulated cork 74 which is applied in a special manner. The gas bag has a filling tube 75 which, when the gas bag is filled with gas, is closed and sealed in any appropriate way.

Figure 14 illustrates a special apparatus for coating the interior of the container 10 with granulated cork, and later for filling it with gas. The motor 76 of a fan 77 is suitably mounted in the flared intake of a conduit or body 78 which, after a number of reductions in diameter, finally terminates in a swiveled nozzle 79 over which the filling tube 75 is stretched.

A hopper 80, mounted upon the body 78, contains granulated cork, the flow of which is controlled by a gate 81. Prior to applying the gas container 10 to the nozzle 79 it is partly filled with an elastic and fluid cement which is moved about within the container until the entire interior is coated after which it is poured out again and the tube 75 applied to the nozzle 79 as stated.

The fan 77 is then set in motion and the gate 81 partly opened. The escaping granules of cork are then blown into the container 10 wherein they are distributed by the action of the air blast. The cork granules will adhere to the cement until the entire interior surface is covered, whereupon the air blast is cut off and the residual air in the container 10 permitted to escape. A gas cock 82 is then turned on and the container 10 filled to the desired pressure. The mode of filling the gas containers 36 (Fig. 4) is different, as has already been explained, but the structure of the flexible bags 36 is intended to be the same as that described in connection with Figure 10.

The operation may be readily understood. At this period in the history of aerial navigation the security of aircraft in flight is none too certain, and while comparatively safe descents can be made upon land there is practically no provision for the descent of aircraft upon water. Realizing that transoceanic flight must soon be realized the improved balloon has provision for navigation upon the water should it be forced to alight.

Although the mid and base-sections 2 and 3 have numerous openings these may be closed when required, the openings of the latter being especially equipped for making water tight joints around the hatch openings 48 when the base section 3 is submerged.

At such time the propeller 52 is used to drive the craft. Or, should it be so desired, the use of the propeller 52 may be dispensed with and the masts 15 moved to erect position upon the upper deck 12 whereupon suitable sails are hung thereon.

The latter provision also permits driving the craft upon level land surfaces, for example the sand of a desert. The keel 4 then acts as a skid upon which the craft slides.

When the balloon is used as an aircraft

the hatches 45 (Figs. 1, 7 and 8) are let down and the propellers 42 moved into position. Should it happen that the aircraft encounters a severe storm, the windows 35 are opened so as to let the wind blow through and thus avoid destroying the balloon. If necessary, one or more sets of the gas containers 36 may be emptied to lower the aircraft, this being accomplished by opening the discharge valves 40. In cross sectional shape (Fig. 6) the upper part of the aircraft as shown should be built on acute angles, thus differing from the more or less conventional whaleback type. The sloping surfaces presented by the special construction will more readily shed rain or snow. No mention has been made previously of the mode of bracing illustrated to some extent in Figure 6. The bracing of a dirigible balloon is usually somewhat complicated so that no attempt is found necessary to be made herein at the illustration thereof. It is believed sufficient to say that any known method of bracing may be employed.

There is a marked advantage in providing a large number of air bags 10. According to present practice the gas is contained by very large cells which are comparatively few in number. The puncturing of one of these cells will seriously disable the aircraft, but the puncturing of a few of the gas bags 10 will have little or no effect upon the buoyancy of the aircraft.

While the construction and arrangement of the improved balloon is that of a generally preferred form, obviously modifications and changes may be made without departing from the spirit of the invention or the scope of the claims.

I claim:—

1. A device of the character described comprising a structure having an arrangement of gas containers rendering the device buoyant when employed as an aircraft, a displaceable housing on said structure, masts mounted upon said structure housing, and means for moving the masts to depressed or erect position in reference to the structure and housing depending upon the use of the device as an air or water craft.

2. A device of the character described comprising a superstructure, gas containing means situated within the superstructure, a mid-section disposed below the superstructure, a base-section disposed below the mid-section and having a keel employed both when the device alights upon water or upon land, means carried by the base-section for propelling the device when used either as an air or water-craft, and means associated with the mid-section for controlling the movements of the device.

3. An aircraft having gas bags, a mid-section in which said gas bags are located said mid-section having windows adapted to be opened to permit a wind to blow through the aircraft, and control means permitting the escape of gas from the bags to lower the aircraft said gas being carried away by the draft through the windows.

4. An aircraft having a plurality of gas bags arranged in sets, a mid-section containing said sets of gas bags and having windows adapted to be opened to permit a wind to blow through the mid-section, and means to control each set of gas bags permitting the discharge of gas from one or more sets into the air current passing through said window.

5. A device of the character described having a mid-section, a base section having openings, hatches movably mounted in said openings being extensible when the device is used as an aircraft and closed in said openings when used as a water craft, a propeller having a driving motor mounted upon each hatch being operative to drive the device when used as an aircraft, an engine contained by the base section, and a propeller carried by the engine shaft being supported upon and located beneath the mid-section for driving the device when used as a water craft.

6. An aircraft having a base section provided with an opening, a hatch mounted in said opening being movable to extended and closed positions, and a propeller having a motor mounted upon said hatch for driving the aircraft when the hatch is extended.

7. An aircraft comprising a base section provided with an opening, a hatch mounted in the opening being movable into extended and closed positions, tracks carried by said hatch, and a propeller having a motor mounted upon said tracks and being shifted into operative position to drive the aircraft when said hatch is extended.

8. An aircraft provided with a mid-section including a cabin, a superstructure having a deck, a mast movably mounted upon the deck, means to move the mast into depressed or erect position depending on the use of the aircraft, and means extending to said cabin for operating the moving means from said cabin.

9. An aircraft having an upper deck, a mast mounted upon the deck including a stirrup having a gear quadrant, gearing in connection with said quadrant for moving the mast to erect or depressed position with reference to the deck, means to operate said gearing, and hatches applied to said deck being movable in gable-like position over said mast and the operating mechanism thereof to shelter the same from rain and snow.

10. An aircraft comprising a body structure including a mid-section and a base section, a plurality of gas bags assembled in said mid-section said gas bags being collapsible but having rigid heads at opposite

extremities, piping connecting the heads of a given number of bags at one end into a set, piping connecting the heads at the other end, a common valve connected in the second piping for permitting the escape of the gas from the bags should it be necessary to deflate the bags, gas generating apparatus situated in the base section and connecting with said first piping for replenishing the supply of gas, and a valve in said connection for controlling the flow of gas.

11. An aircraft comprising an elongated body including a superstructure and a mid-section, a deck included in the superstructure, and a floor included in the mid-section, the sides of the superstructure and mid-section being at acute angles in respect to each other and in respect to the floor and the deck for the purpose described.

12. A covering for aircraft comprising a layer of cork veneer, a layer of fiber composed of leaf stalks of the royal palm tree, and another layer of sheet mica.

13. An aircraft having a gas bag compartment, and a plurality of gas bags assembled into a compartment each gas bag being composed of a fabric envelope having a filling tube, a layer of cork veneer, a layer of asbestos sheeting upon said cork veneer, and a layer of granulated cork applied to the interior of said envelope.

FEDERICO GUILLEMO DIAGO.

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FEDERICO GUILLEMO DIAGO.

CERTIFICATE OF CORRECTION.

Patent No. 1,656,780. **Granted January 17, 1928.**

It is hereby certified that the name of the patentee in the above numbered patent is erroneously written and printed as "Federico Guillemo Diago", whereas said name should have been written and printed as "Federico Guillermo Diago"; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 1st day of May, A. D. 1928.

M. J. Moore,
Acting Commissioner of Patents.

(Seal)

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