C. SPILKA.

AIR CRAFT.

APPLICATION FILED FEB. 17, 1911.

1,045,337.

Patented Nov. 26, 1912.

6 SHEETS—SHEET 1.

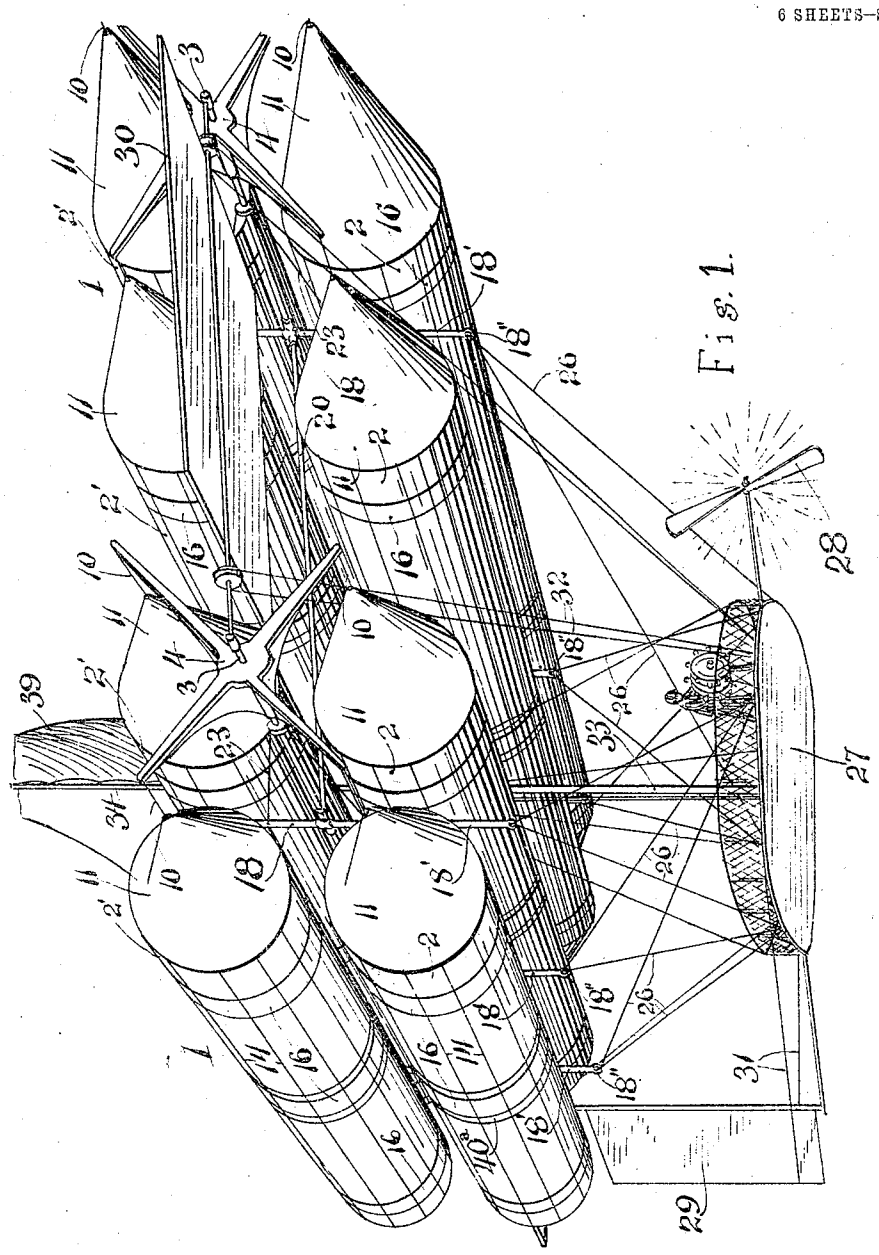

Fig. 1.

Witnesses

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Inventor:

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By Edgar M. Kitchin

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6 SHEETS—SHEET 2.

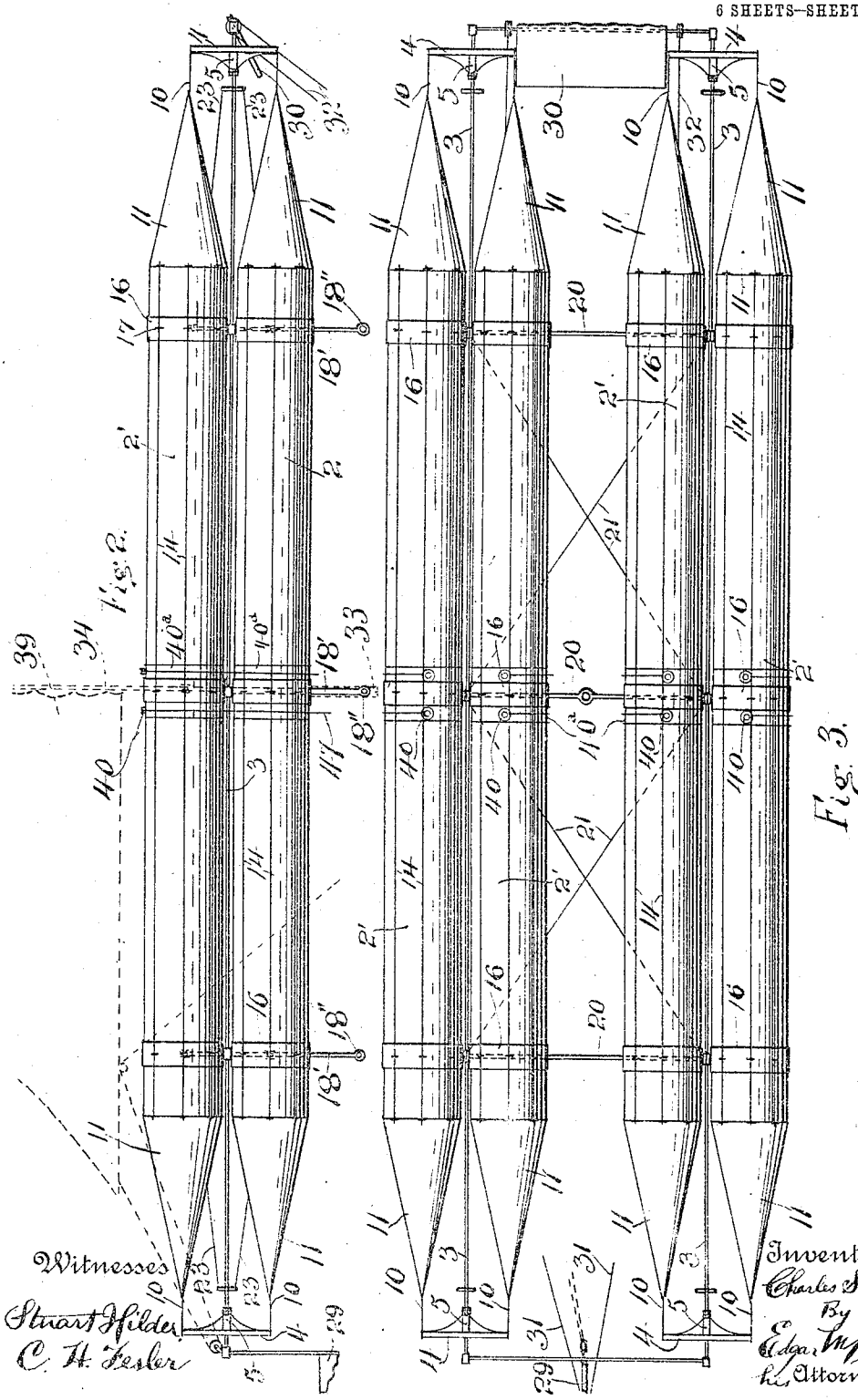

Fig. 2.

Fig. 3.

Witnesses
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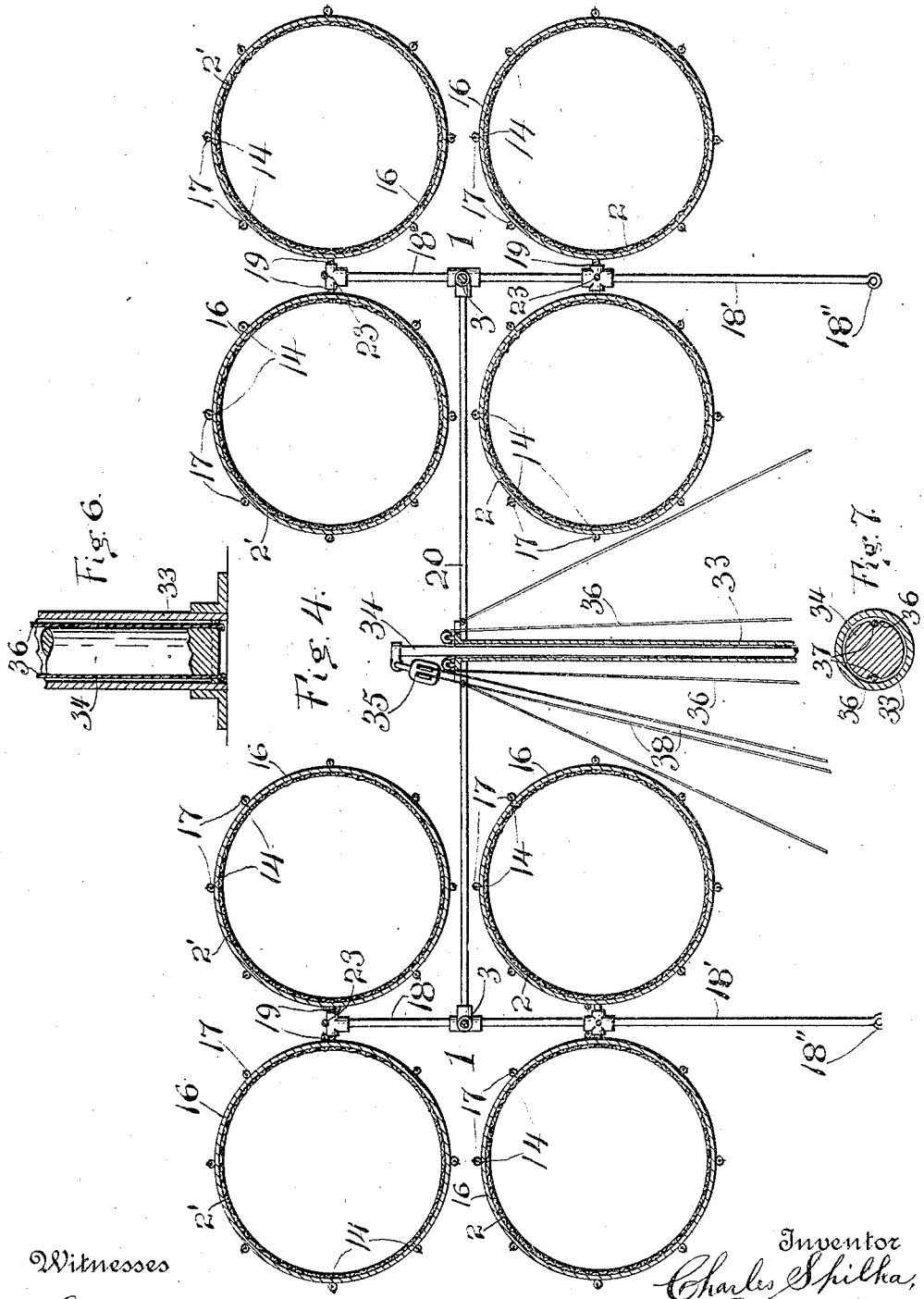

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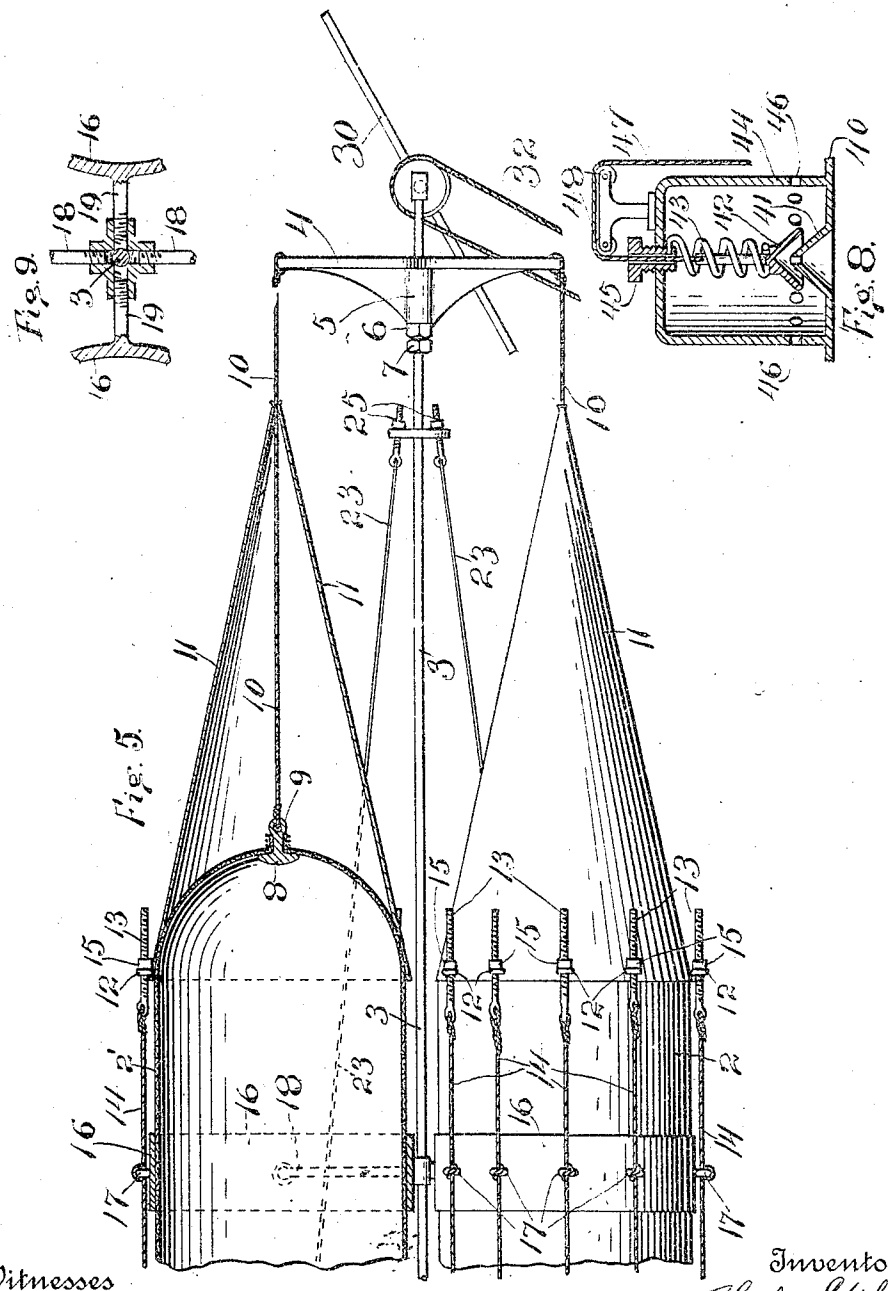

Fig. 5.

Fig. 9.

Fig. 8.

Witnesses

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6 SHEETS—SHEET 5.

Fig. 14.

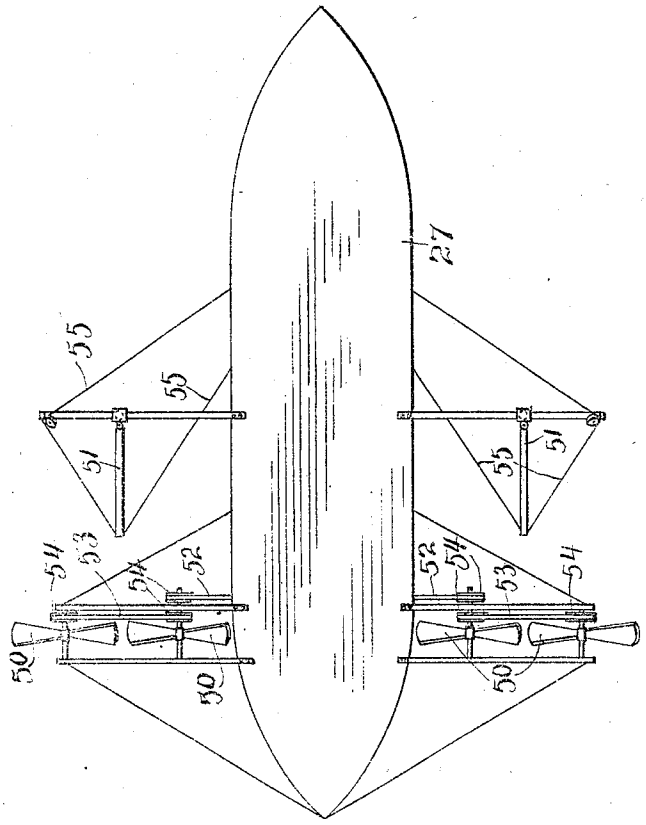
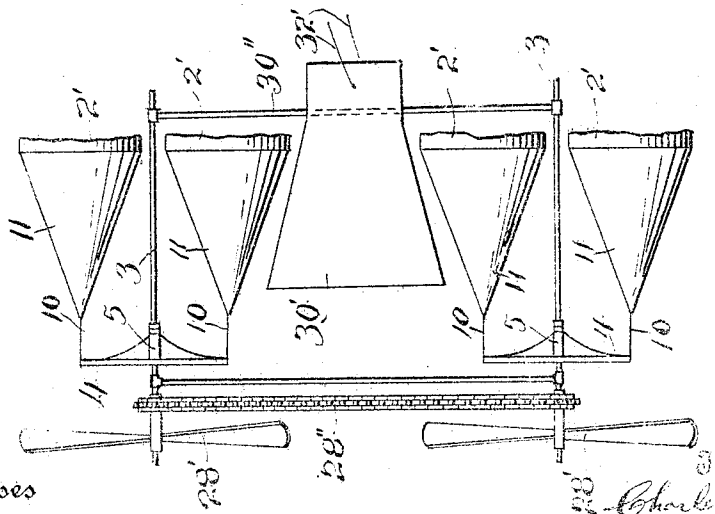


Fig. 10.



Witnesses

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Patented Nov. 26, 1912.

6 SHEETS—SHEET 6.

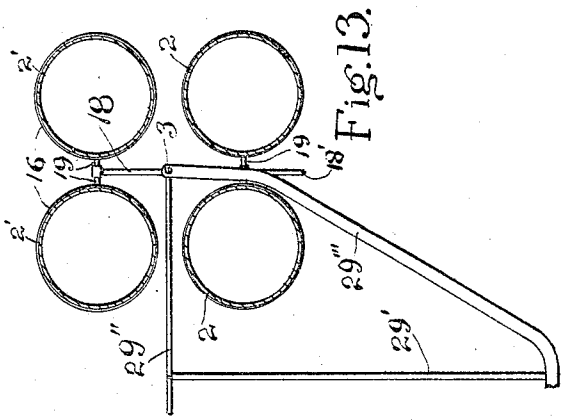

Fig. 13.

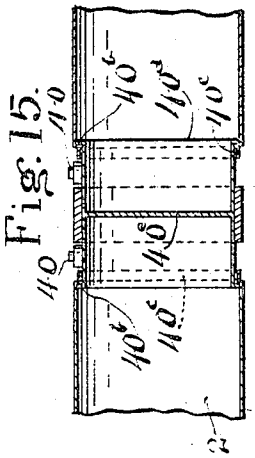

Fig. 15.

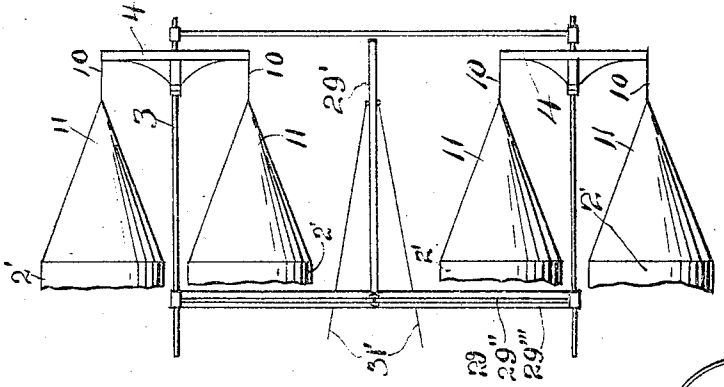

Fig. 12.

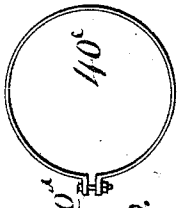

Fig. 16.

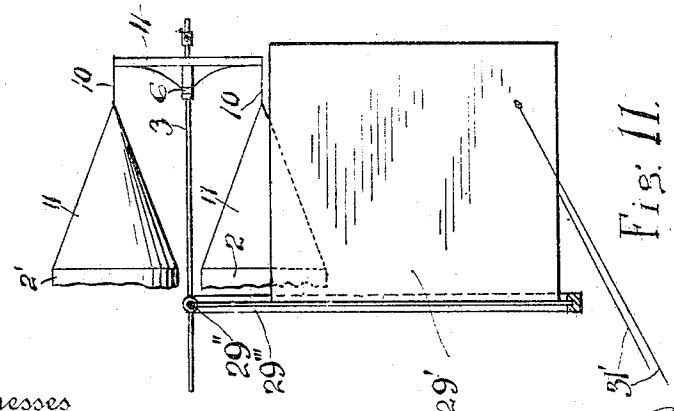

Fig. 11.

Witnesses

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CHARLES SPILKA, OF NEW YORK, N. Y.

AIR-CRAFT.

1,045,337. Specification of Letters Patent. Patented Nov. 26, 1912.

Application filed February 17, 1911. Serial No. 609,275.

To all whom it may concern:

Be it known that I, CHARLES SPILKA, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Air-Crafts; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in air crafts of the lighter than air type, and among the objects in view is the disposition of the gas containers or bags in such relation as to reduce to a minimum the exposed area to wind pressure in an air craft of a given displacement.

A further object is the provision of an efficient framing adapted to such an arrangement of gas containers or bags for affording a maximum rigidity with a minimum weight of parts.

With these and other detail objects in view as will in part be hereinafter stated and in part become apparent, the invention comprises certain novel constructions, combinations and arrangements of parts as herein specified and claimed.

In the accompanying drawings—Figure 1 is a perspective view of an air craft embodying the features of the present invention. Fig. 2 is a view in side elevation of the gas bags and a portion of the framing. Fig. 3 is a plan view thereof. Fig. 4 is a central section therethrough on an enlarged scale. Fig. 5 is a detail view of one end of some of the gas bags, parts being seen in section. Fig. 6 is a fragmentary, longitudinal section through the mast. Fig. 7 is a detail, cross-section of the mast. Fig. 8 is a detail section of the controlling valve. Fig. 9 is an enlarged, fragmentary, detail section through one of the connections between the bag bands and the framing. Fig. 10 is a fragmentary plan of a portion of an embodiment illustrating the preferred arrangement of propellers. Fig. 11 is a longitudinal section through a fragment of a portion of the opposite end to that seen in Fig. 10. Fig. 12 is a plan view thereof. Fig. 13 is a fragmentary cross section therethrough. Fig. 14 is an inverted plan view of the car showing a modified adaptation of the guiding planes and the propellers. Fig. 15 is a longitudinal, central section through a fragment of the central portion of one of the bags. Fig. 16 is a detail view of one of the clamping bands detached.

In the present art difficulty has been experienced in securing the requisite displacement by bag structures or other gas containers without at the same time rendering the structure objectionable by reason of an excessive area of exposure to lateral wind pressure. I propose to overcome this difficulty by constructing the gas containers in the form of clusters of bags, the bags in each cluster being so spaced as to allow the free passage therebetween of lateral wind currents for reducing the amount of lateral pressure on the bags, and one cluster of bags being disposed laterally relative to the other and in substantially the same horizontal planes for multiplying the displacement without increasing the lateral area exposure.

Referring by numerals to the accompanying drawings, 1 indicates clusters of bags each made up preferably of four bags 2, 2, and 2′, 2′, the bags 2′ being superposed above the bags 2 and spaced therefrom for affording an intervening air space, and one cluster 1 being disposed laterally with respect to and in the same horizontal planes with the other. Obviously, as many bags may be provided in a cluster as desired, but preferably such a number of bags is employed in each instance as will produce a cluster having appropriately symmetrical form.

Lying centrally with respect to all of the bags of each cluster 1 and extending throughout the length of the bags and beyond the ends thereof is a shaft 3 carrying at each end a tension wheel or spider 4, each spider 4 having a sleeve 5 surrounding and sliding upon the respective shaft 3 for guiding the spider in movements longitudinal with respect to the shaft and gas bags. Each end of each shaft 3 is threaded, and a nut 6 is threaded on the shaft into engagement with the respective spider 4 for forcing the same longitudinally outwardly for tensioning purposes as hereinafter specified. A suitable follower or lock nut 7 may also be threaded on shaft 3 at the inside of each nut 6 and in position for engaging the same for preventing accidental loosening thereor.

Each of the bags 2 and 2′ has each of its ends contracted or drawn together about an end piece 8 having an outstanding eye 9, the respective end of the bag being secured by multiple wraps of cord or other attaching means about the contracted end of the bag and about the shank of the end piece 8. A cable 10 engages the eye 9 of each end piece 8 and extends outwardly therefrom to and is connected with an arm of the respective spider 4 for being tensioned thereby. For strengthening purposes, and to relieve wind pressure, a preferably metallic cap 11 surrounds each end of each gas bag. Each cap 11 is preferably substantially conical in form with its end tapering outwardly and formed with a central opening for the passage of the respective cable 10. Spaced about and fixed to the inner edge of each cap 11 are eyes 12, 12, through which the nipple ends 13 of cables 14 extend, each nipple 13 being threaded and engaged by a nut 15 outside of the respective eye 12 in position for being threaded longitudinally of the nipple 13 for tensioning the cable 14. Each bag 2, 2, and 2′, 2′, is surrounded at various points intermediate its ends by metallic bands 16, 16, each provided with eyes 17, 17, corresponding in form and number to the eyes 12, and each cable 14 extends from the respective eye 12 at one end of a particular bag throughout the length of the bag and to a corresponding eye 12 at the other end of the bag, the cable 14 at intermediate points engaging and being fixed to the eyes 17 of bands 16. It thus becomes apparent that by threading the nuts 6 outwardly on each shaft 3, cables 10 at the opposite ends of the bag will be drawn taut, pulling the ends of the bags snugly into the caps 9 and tending to tension the cables 14, the said cables 14 serving to prevent longitudinal separation or independent movement of the caps in opposite outward directions, whereby each bag is insured against longitudinal distention, and each bag is also maintained against excessive circumferential distention by the bands 16.

Disposed vertically between the bags 2′, 2′, and 2, 2, of each cluster are the vertical posts or shafts 18, 18, each post being disposed immediately opposite a band 16 of each bag, and all of the adjacent bands 16 being connected to the respective post 18 by relatively short horizontal cross bars 19, 19, which may be formed integral with the bands. The shafts 18 of one cluster are connected directly to the shafts 18 of the other cluster by horizontal bars or shafts 20 which rigidly connect the parts, and for purposes of trussing the structure a piano wire or other cable 21 is preferably connected at its ends to the end shafts 18 of each cluster and is passed about the intermediate shaft 18 of the other cluster, so that wires or cables 21 cross between the end shafts 18 of the two clusters and the intermediate shafts 18 thereof, thereby materially stiffening the structural connection between the clusters without adding greatly to the weight of the structure. Each wire 21 preferably is provided at each end with suitable tensioning means, not illustrated, but which may be the same as the nipples 13 and coöperating parts for tensioning cables 14.

Each shaft 3 may consist simply of a tubular member, but is preferably stiffened and strengthened by trussing cables 23, 23, fixed at their ends to the respective tubular member of shaft 3 adjacent the respective ends thereof, and the cables extending intermediate their ends, either upwardly or downwardly as the case may be, through or in engagement with shafts 18 which serve as struts for the truss cables. Any suitable tensioning device, such as illustrated at 25, may be provided for each cable 23 for maintaining the same taut, and thus materially strengthening the shaft 3 against central bending moment.

Each shaft 18 is formed with a pendent extension 18′ extending below the respective cluster, and formed at its lower end with an eye 18″ to which cables 26 are attached, and all of the cables 26 extend downwardly to and engage and support the car 27 which may be of any preferred type. The car 27 sustains the enginery for driving the propeller 28 which serves as the main source of driving power. A vertically disposed plane 29 is mounted to swing pivotally transversely of the longitudinal axis of the car in horizontal planes for guiding the air craft as to direction, while the plane 30 is pivoted horizontally to swing through vertical planes for controlling the elevation of the air craft. By providing a plane 30 of sufficient area the necessity for discharging gas for allowing the craft to descend is obviated, and the craft may readily be forced downwardly by the proper disposition of the plane. Each of the planes 29 and 30 is suitably fixed through their framing to their respective pivotally mounted shafts, and are engaged by actuating cables 31 and 32, respectively, which extend to points within the car 27 for being manipulated by the operator.

As a further means of strengthening and rendering more rigid the framework of the craft, a hollow mast or upstanding shaft 33 is fixed at its lower end to the floor of the car 27, and extends upwardly substantially centrally of the framework and centrally, fore and aft, between the clusters of gas bags, the upper end of the shaft 33 being fixed to the intermediate cross bar 20. Nested within the hollow mast or shaft 33 is a longitudinally movable mast 34, to the upper end of which is connected a block 35.

Connected to the lower end portion of the mast 34 are cables 36, 36, which extend upwardly longitudinally of the mast in grooves 37 formed therein and extend about the upper end of shaft 33 and downwardly to the car 27, where the ends of the cables 36 may be clamped or otherwise retained in a given position. The mast 34 extends normally to a point just below the horizontal plane of the uppermost points of each of the clusters of bags, and the mast 34 may be projected above this plane by pulling down upon the outer end portions of cables 36, the mast being sustained at any desired elevation by the chocking of the cables 36. Suitable tackle 38 engages block 35 and is suitably connected to a sail 39 which may be of the leg-o'mutton type and provided with a boom at its lower edge, or any other sail may be provided according to the rigging preferred. When the craft is being driven with the wind, the speed will be greatly accelerated by the running up of the mast 34 and exposing the sail 39. When running otherwise than with the wind, it will, of course, be preferable to allow the mast 34 to remain nested in the shaft 33 and leave the sail furled.

In the navigation of air crafts, it has been found that some difficulty is experienced in the controlling of the displacement of the gas container by reason of differential temperatures, as for instance, in the early morning when the gas bag is laden with dew and cold, the gas will be contracted very materially, whereas as the sun rises and dries off the dew and raises the temperature of the gas a material expansion thereof occurs with the resultant liability of over-taxing the capacity of the bag. To obviate this danger, I provide each bag or container with a safety valve structure 40. Each bag 2 and 2'' is divided centrally by an interposed cylinder 40^a having terminal annular flanges 40^b over which the respective portions of the bag are passed and clamped by clamping bands 40^c surrounding the cylinder 40^a and the respective lapping end portions of the bag. A bolt 40^d engages the ends of each band 40^c for drawing the ends toward each other and thus effecting the clamping action. Each cylinder 40^a is preferably provided with a diaphragm 40^e for dividing the respective gas bag into two independent compartments for preventing a complete loss of the charge of gas in case of puncture, it being obvious that the diaphragm will prevent loss of gas from the non-punctured half of the bag. Each cylinder 40^a is of a diameter adapted to receive and be surrounded by the respective central band 16. The valve structure 40 comprises a valve seat 41 on which normally rests a valve 42, the valve 42 being held on the seat by a spring 43. A valve casing 44 surrounds the valve and valve seat, and above the same is formed with a threaded aperture into which is threaded a tension screw 45, the lower end of which engages and retains in position the upper end of the spring 43, the screw 45 being adapted to be threaded longitudinally in or out of the casing 44 for increasing or decreasing the tension of the spring 43, and thus varying the requisite pressure of gas capable of automatic operation of the valve 42.

It is obvious from the disclosure in Fig. 8 that when the gas pressure becomes sufficient within any particular bag, the pressure being exerted directly on the valve 42 through the port in the valve seat, it will lift the valve 42 off of its seat against the pressure of spring 43, and will escape into the valve casing, and thence through discharge openings 46, 46, to the atmosphere. The screw 45 is preferably formed with a central bore through which extends an operating cable 47, which is connected to the upper end of the valve 42 and extends upwardly beyond the screw 45 about guiding pulleys 48, and thence down to the car to a convenient point for the operator. When through a defective condition of the plane of elevation 30, or when for any reason it is found impracticable to descend without the loss of gas, it is only necessary to pull the cables 47 for allowing the escape of a sufficient quantity of gas to reduce the displacement sufficiently for permitting the required descent.

While as a matter of convenience of illustration, I have shown the propeller 28 in Fig. 1 as disposed in front and carried directly by the car, it should be obvious that other dispositions are contemplated, and in fact for the purposes of this application, I consider the arrangement seen in Fig. 10 as preferred. The structural features are the same as described above and the same reference numerals are applied, but instead of the use of a single screw, the propeller consists of a plurality of screws 28', 28', one for each shaft 3 and disposed axially in line therewith and having a thrust-bearing engagement with the respective shaft 3. The screws 28' are connected for synchronism by belting 28'', and are driven by enginery in car 27 geared in any ordinary manner, not illustrated. The framing above described is admirably adapted to receive and transmit practically uniformly throughout the entire area of all the gas bags the car sustaining stresses as well as driving stresses, regardless of the point of application of such driving stresses.

In Fig. 10, I have also disclosed a further adaptation of the plane of elevation, a plane 30' being disposed between the end portions of the respective clusters of gas bags, and being sustained by a supplemental cross bar 30'' connecting shafts 3. Plane 30' is shown

at the rear of the craft as a convenient disposition for efficiently controlling the elevation of the craft, suitable cables 32′ being disposed for enabling manipulation of plane 30′.

In Figs. 11, 12 and 13, I have shown the opposite or front end portion of the bags. The rudder or guiding plane 29′ in this embodiment is disposed at the front end of the craft and pivotally sustained in a supplemental cross bar 29″, and cross stay 29‴, suitable operating cables 31′, 31′ engaging plane 29′ for facilitating manipulation thereof.

It is, of course, understood that it is impracticable to illustrate all of the practically endless number of possible embodiments of the present invention, but to make more readily apparent certain contemplated variations, I have shown an inverted plan in Fig. 14, illustrating the car 27 as having a plurality of screws 50, 50, and guiding planes or rudders 51, 51, mounted to give in the first instance maximum driving capacity, and in the other instance, ease and certainty of control. The propellers and rudders are carried by suitable outrigging, and the propellers are driven from enginery, not illustrated, through belting 52 and 53 and pulleys 54. Each rudder is engaged by a pair of operating cables 55.

What I claim is,—

1. In an air craft, the combination of a plurality of relatively elongated bags disposed in parallelism and spaced apart, a frame-work therefor comprising a shaft extending throughout the length of the bags, means connecting the shaft to the bags intermediate the ends of the bags, and tension means connecting the bags to the shaft.

2. In an air craft, the combination of a plurality of clusters of bags, a frame-work for each cluster, the bags of each cluster being relatively elongated and disposed in parallelism and spaced apart, and the frame-work for each cluster comprising a shaft extending longitudinally throughout the length of the bags, means connecting the shaft to the bags intermediate the ends thereof, and tension means connecting the shaft to the bags, and means connecting the frame-work of one cluster with the frame-work of the other.

3. In an air craft, the combination of a plurality of clusters of bags, a frame-work for each cluster, the bags of each cluster being relatively elongated and disposed in parallelism and spaced apart, and the frame-work for each cluster comprising a shaft extending longitudinally throughout the length of the bags, means connecting the shaft to the bags intermediate the ends thereof, tension means connecting the shaft to the bags, cross shafts connecting the shaft of one cluster with the shaft of the other, and diagonal stays connecting the first-mentioned shafts at points adjacent the engagement therewith of the cross shafts.

4. In an air craft, the combination of a plurality of relatively elongated gas bags disposed in parallelism and spaced apart, of a longitudinally disposed shaft arranged between and extending throughout the length of the gas bags, and tensioning means connecting the shaft with the gas bags for maintenance and regulation of the tension of the bags in a longitudinal direction.

5. In an air craft, the combination of a plurality of gas bags, a band surrounding each gas bag, a shaft extending between the gas bags and beyond the same, and connected to all of said bands, and means connecting the ends of the shafts to the gas bags.

6. In an air craft, the combination of a plurality of relatively elongated gas bags, a plurality of bands surrounding each bag, a shaft extending longitudinally throughout the length of and between the bags and connected to all of said bands, a cable connected to the end of each bag, and tension means engaging the shaft and engaged by the cables for tensioning said cables.

7. In an air craft, the combination of a plurality of elongated gas bags, a band surrounding each bag, a shaft extending longitudinally of and between the bags and connected to all of said bands, a cable connected to each end of each bag, a tension device engaging and shiftable longitudinally of the shaft adjacent the respective ends of the bags and engaged by the cables, a cap surrounding each end of each bag, and tension cables for each bag engaging and connecting the caps of the respective bag.

8. In an air craft, the combination of a plurality of elongated gas bags, a band surrounding each bag, a shaft extending longitudinally of and between the bags and connected to all of said bands, a cable connected to each end of each bag, a tension device engaging and shiftable longitudinally of the shaft adjacent the respective ends of the bags and engaged by the cables, a cap surrounding each end of each bag, and tension cables for each bag engaging and connecting the caps of the respective bag, each of the last-mentioned cables engaging the respective band.

9. In an air craft, the combination of a plurality of elongated gas bags, a band surrounding each bag, a shaft extending longitudinally of and between the bags and connected to all of said bands, a cable connected to each end of each bag, a tension device engaging and shiftable longitudinally of the shaft adjacent the respeceive ends of the pags and engaged by the cables, a cap surrounding each end of each bag, tension cables for each bag engaging and connecting the caps of the respective bag, and

means for tensioning the last-mentioned cables.

10. In an air craft, the combination of a plurality of elongated gas bags, a band surrounding each bag, a shaft extending longitudinally of and between the bags and connected to all of said bands, a cable connected to each end of each bag, a tension device engaging and shiftable longitudinally of the shaft adjacent the respective ends of the bags and engaged by the cables, a cap surrounding each end of each bag, and tension cables for each bag engaging and connecting the caps of the respective bag, each of the bands having eyes corresponding in number to the number of the last-mentioned cables for the respective bag, and the last-mentioned cables engaging said eyes.

11. In an air craft, the combination of a plurality of relatively elongated gas bags spaced apart, a plurality of bands surrounding each bag intermediate the ends thereof, a shaft connecting all of said bands, and extending beyond the bags, a cable connected to each end of each bag, tension means engaging the shaft and engaged by said cables, a metallic substantially conical cap inclosing each end of each bag, and surrounding the respective cable, such cable extending through the apex of the cap, and cables for each bag connecting the caps thereof and engaging the several bands of the respective bag.

12. In an air craft, the combination of a plurality of gas bags, spaced apart, bands surrounding the same, a horizontal shaft extending between the bags, vertical shafts connected to the horizontal shaft and to the bands, and a car pendent from the vertical shafts.

13. In an air craft, the combination of substantially elongated gas bags spaced apart, a horizontal shaft extending between and longitudinally of said bags, vertical shafts fixed to said horizontal shaft and connected to all of said bags, and a car pendent from said vertical shafts.

14. In an air craft the combination of substantially elongated gas bags spaced apart, a horizontal shaft extending between and longitudinally of said bags, and vertical shafts fixed to said horizontal shaft and connected to all of said bags.

15. In an air craft, the combination of substantially elongated gas bags spaced apart, a horizontal shaft extending between and longitudinally of said bags, vertical shafts fixed to said horizontal shaft and connected to all of said bags, and tension means for the bags connected with said horizontal shaft.

16. In an air craft, the combination of a plurality of clusters of bags, each cluster comprising a plurality of bags, a horizontal shaft extending longitudinally thereof, vertical shafts connected to the horizontal shaft and connected to the bags of the respective cluster, a car pendent from all of the vertical shafts, a cross shaft connecting the respective horizontal shafts of the clusters, and a vertical shaft connecting the car to the cross shaft.

17. In an air craft, the combination of a plurality of clusters of bags, each cluster comprising a plurality of bags, a horizontal shaft extending longitudinally thereof, vertical shafts connected to the horizontal shaft and connected to the bags of the respective cluster, a car pendent from all of the vertical shafts, a cross shaft connecting the respective horizontal shafts of the clusters, a hollow, vertical shaft connecting the car to the cross shaft, and a mast nested in said hollow shaft and adapted to be shifted longitudinally thereof.

18. In an air craft, the combination of a plurality of clusters of bags, each cluster comprising a plurality of bags, a horizontal shaft extending longitudinally thereof, vertical shafts connected to the horizontal shaft and connected to the bags of the respective cluster, a car pendent from all of the vertical shafts, a cross shaft connecting the respective horizontal shafts of the clusters, a hollow, vertical, shaft connecting the car to the cross shaft, a mast nested in said hollow shaft and adapted to be shifted longitudinally thereof, and tackle and sail connected to the mast.

19. In combination, a plurality of clusters of relatively elongated gas bags, a longitudinally disposed shaft for each cluster, tensioning means for each bag of each cluster engaging the respective shaft, and means connecting the shafts.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES SPILKA.

Witnesses:
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EDGAR M. KITCHIN.