April 15, 1930. W. E. DÖRR 1,754,883

AIRSHIP

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Fig. 1.

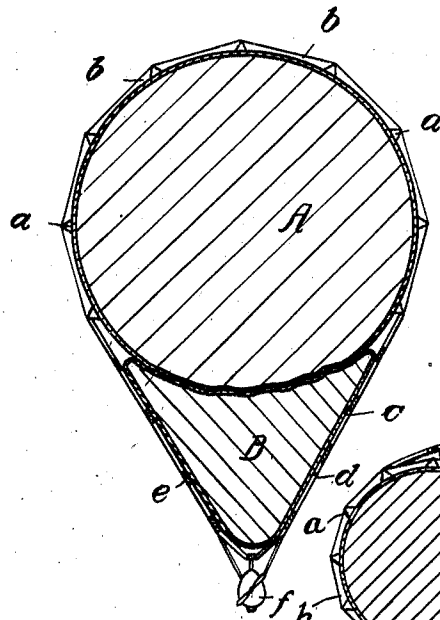


Fig. 5.

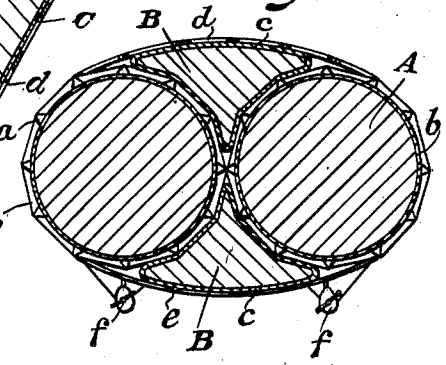
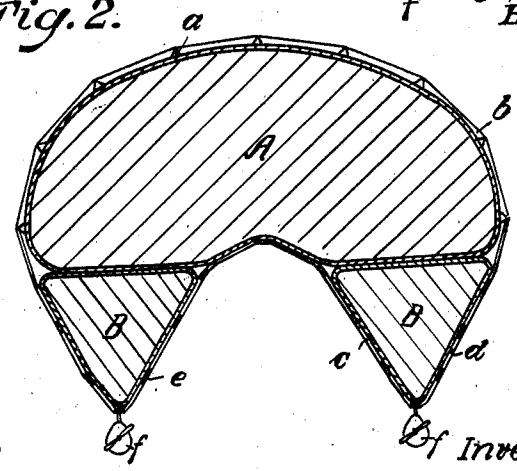


Fig. 2.



Inventor:

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Fig. 3.

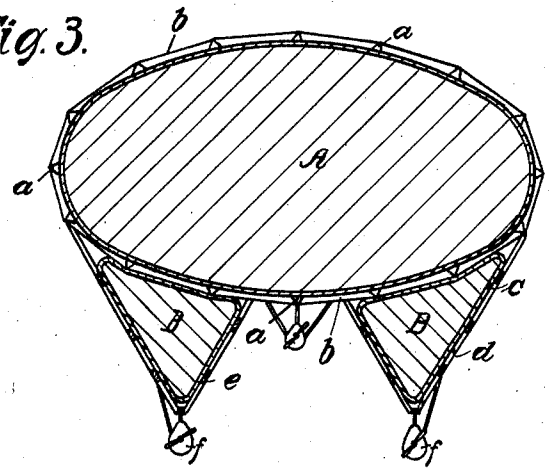


Fig. 4.

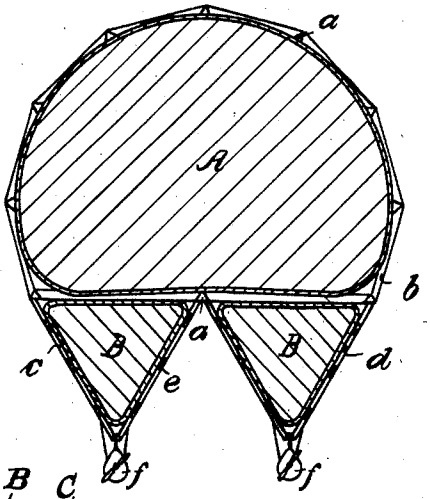
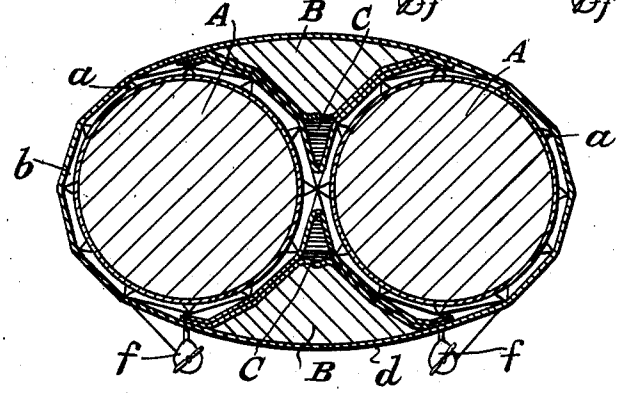


Fig. 6.



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Patented Apr. 15, 1930

1,754,883

UNITED STATES PATENT OFFICE

WILHELM E. DÖRR, OF FRIEDRICHSHAFEN, GERMANY, ASSIGNOR TO LUFTSCHIFFBAU ZEPPELIN GESELLSCHAFT MIT BESCHRÄNKTER HAFTUNG, OF FRIEDRICHSHAFEN, GERMANY

AIRSHIP

Application filed April 18, 1927, Serial No. 184,504, and in Germany May 15, 1926.

My invention relates to airships and more especially to such ships of the kind in which the motor is driven by gaseous fuel instead of liquid.

Heretofore it has been the custom to feed the motors of airships with liquid fuel, such as gasoline or the like, but recently it has been proposed to use gaseous fuel instead of liquid. If the gas or mixture of gases used for this purpose have a specific gravity approximating that of air, a great advantage is assured with this method of operating airships. With liquid fuel the consumption of the fuel causes a constant loss in weight, which must be compensated by expulsion of lifting gas. This results in an excessive loss of lifting gas, especially on long journeys, which loss will be avoided by operating airships in the above mentioned modern manner. Here the consumption of fuel does not effect the static equilibrium of the air ship while traveling, because the fuel gas consumed will be replaced by air, both gases having approximately the same specific gravity.

In air ships intended to be operated in this new manner it will not be necessary to provide particular stress transmitting members for the purpose of carrying the fuel by means of the lift exerted by the lifting gas. Accordingly my invention provides two different kinds of gas spaces, one for the purpose of receiving the lifting gas and adapted to transmit the buoyancy of the gas to the load carried by the airship, and a second kind of gas space intended to receive the fuel gas which practically has no weight. This manner of constructing an airship according to my invention results in a great advantage in that it will be necessary to provide stress transmitting members only for the structure intended to be inflated with lifting gas and to carry the loads, whereas for the purpose of confining the fuel gas it will be sufficient to provide merely shape giving outside walls. For this latter gas container it may be possible to have no circumferential rigid structure at all, but to have bags blown up by the gas. In such case, for the purpose of making sure that the outer shape of the airship will not change, it may be advisable to provide additional air bags, which may be inflated with air to a degree commensurate with the consumption of the fuel gas.

Of course, such circumstances may arise that it will be considered practical to combine my new arrangement of construction with previously known constructions; that is, it may be profitable to partly use the shape giving wall structure of the fuel gas space for also transmitting a minor portion of the stresses occurring between the lifting gas space and the loads. This will depend principally upon the shape chosen for the airship especially upon the shape of its cross section. According to my invention it may, for example, be advantageous to make use of the, in many respects, very suitable pear-shaped cross section, its upper portion being surrounded by a structure adapted to receive the lifting forces and to carry the loads, whereas the lower portion which is of more or less triangular shape, may have stress transmitting sides and be inflated with fuel gas.

According to my invention structures may also be used which allow for bulging of one of the gas containers into the space originally provided for the other kind of gas. The main principle of my invention is that the carrying structure of the airship, especially the hull of rigid ships, is reduced correspondingly with the reduction of the space necessary for containing the lifting gas, whereas the fuel gas is confined by walls being substantially shape-giving only, thereby providing for a great saving in weight.

Having given a general description of my invention I now want to point it out more in detail referring to the drawings which represent examples embodying my invention.

All the figures are cross sections through rigid airships, but each representing a different example. In all of them A represents the space for the lifting gas and B the space for the fuel gas. The longitudinal girders of the load carrying hull are designated by the letter *a*, while the transverse girders are indicated at *b*. The walls *c* of the fuel gas containers may be enclosed by a common outer cover *d* surrounding also the hull containing the lifting gas. There may be provided longi-

tudinal stiffening members *e* between walls *c* and cover *d*. The cars *f* are suspended from the hull containing the lifting gas.

In Fig. 1 a pear-shaped cross section is shown wherein the upper portion is intended to receive the lifting gas and the lower portion the fuel gas.

Fig. 2 represents a somewhat horse-shoe-like cross section, its upper portion again being intended for inflation with lifting gas, and the two lower portions receiving the fuel gas.

Fig. 3 gives another example resembling that of Fig. 2, but here the upper hull structure differs from that of Fig. 2 in that it constitutes an individual upper closed portion from which the lower fuel gas containers are suspended.

In Fig. 4 another modification of the structure according to Fig. 2 is shown.

In the examples represented in Figs. 5 and 6 two separate lifting gas spaces are provided, each of circular cross section, and two wedge-shaped fuel gas containers are inserted between the lifting gas hulls in such manner that all four containers together form a suitable shape for an airship cross section. In Fig. 6 additional air bags C are provided for the purpose of being inflated with air in proportion with the consumption of fuel gas.

I do not want to be limited to the details described or shown in the drawings, as many variations will occur to those skilled in the art.

What I claim is:

1. An airship comprising two kinds of gas containers, lifting gas in one kind of container, fuel gas of approximately the same specific gravity as air in the other kind of container, and a rigid hull surrounding the lifting gas container for receiving the lifting forces and the loads of the airship, the fuel gas container being composed of material of relatively light weight and located outside the rigid hull.

2. An airship comprising two kinds of gas containers, lifting gas in one kind of container, fuel gas of approximaely the same specific gravity as air in the other kind of container, a rigid hull surrounding the lifting gas container for receiving the lifting forces and loads of the airship, a cover of light weight surrounding the fuel gas container outside the hull, and an airbag arranged in conjunction with the fuel gas container, said airbag being adapted to be inflated to replace the volume of fuel gas consumed.

3. An airship comprising a lifting gas container, a flexible inflatable fuel gas container, a structure surrounding the lifting gas container, said lifting gas acting against said structure to sustain all the loads of the airship, the fuel gas container being outside the structure and being free from all load forces acting upon the structure surrounding the lifting gas.

4. A rigid airship comprising a lifting gas container, a load-carrying rigid structure surrounding the lifting gas container, and an inflatable fuel gas container attached outside the rigid structure, the structure of the fuel gas container being composed of material of less weight and strength than the material constituting the rigid structure.

5. A rigid airship having a cross-section of horse-shoe shape, the upper portion thereof having a surrounding rigid hull, lifting gas in said upper portion, the lower portions being outside the rigid hull and having surrounding walls of materially less weight and strength than the rigid hull, and fuel gas in said lower portions.

WILHELM E. DORR.