Nov. 24, 1931. M. B. PUPP 1,833,336

GAS CONTROL FOR AIRCRAFT

Filed April 17, 1930

Fig. 1.

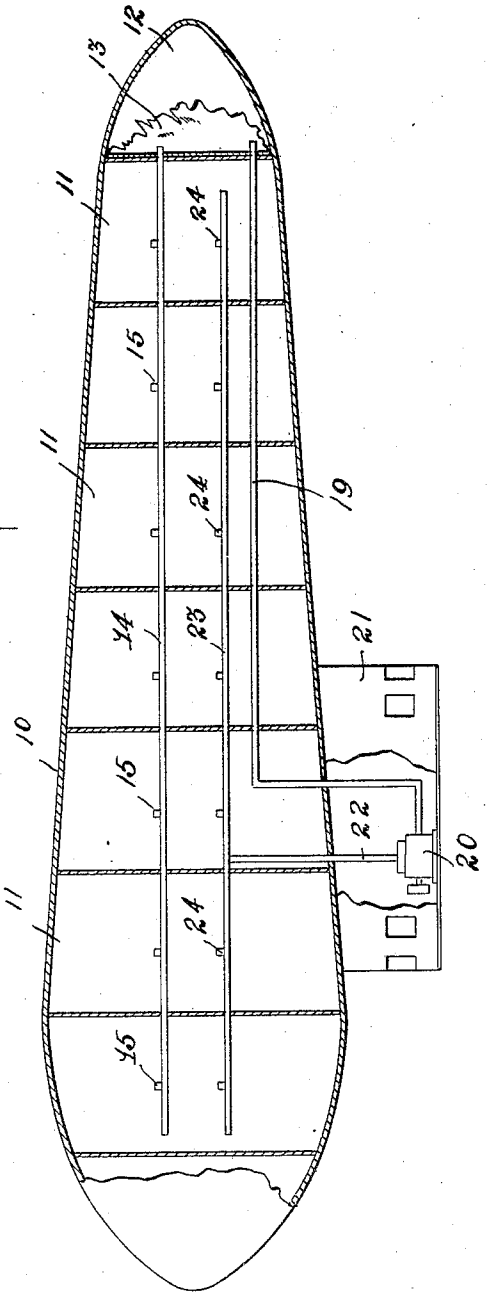


Fig. 3.

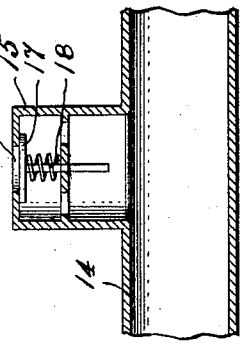
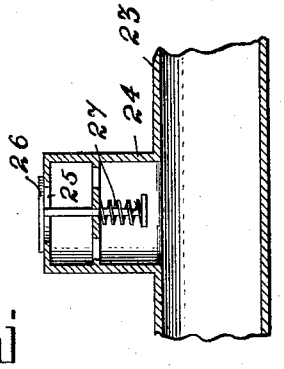


Fig. 2.



WITNESSES:

A. M. Cook

Irma V. Brown

INVENTOR

Max B. Pupp

BY

Joshua R. H. Potts

HIS ATTORNEY

Patented Nov. 24, 1931 1,833,336

UNITED STATES PATENT OFFICE

MAX B. PUPP, OF SOUDERTON, PENNSYLVANIA, ASSIGNOR OF ONE-HALF TO CLAYTON K. GOTWALS, OF SOUDERTON, PENNSYLVANIA

GAS CONTROL FOR AIRCRAFT

Application filed April 17, 1930. Serial No. 444,939.

This invention relates to gas control for aircraft and has for an object to provide improved means for conserving gas when by reason of its expansion it would otherwise be dissipated.

It is well known that in aerial navigation, non-explosive gases are at the present time very high in cost, for which reason it is desirable to conserve such gases and to thereby eliminate a great portion of expense of aerial navigation. In the navigating of buoyant aircrafts employing gas, it is also well known that when the craft ascends, the atmosphere, because of its attenuation, is of lower pressure relatively than the gas at sea level or starting, that the relative increase of gas pressure is dangerous as perhaps disrupting the chamber to the damage of the craft and the loss of gas. The same condition is sometimes brought about by heat expanding the contained gases.

The object of the present invention is to provide a receptacle into which overflow gases are conducted, when by reason of relative expansion, the pressure within the gas containers becomes greater than desired and to further provide means for re-conducting the stored overflow gases back to the containers as relative pressures may vary.

A further object of the invention is to provide a receptacle normally containing no gas, or only the remnants of former gas, with a pipe-line leading from the gas container or containers to such empty compartment and with pumping means for withdrawing the gas from such empty compartment and returning it to the original gas compartment.

A further object of the invention is to provide a collapsible gas container in communication, by a valved pipe-line, with the gas containers of the craft and adapted to receive overflow gas therefrom, with manually controlled means for restoring the gas, from said collapsible container, to the buoyant chambers.

The invention therefore comprises the provision of a chamber of normally variable capacity with a valved conduit from the gas compartment, a pumping installation and a pipe-line from the variable compartment back to the gas compartment.

My invention is directed to other objects and possesses other features of novelty and advantage, some of which, together with the foregoing, will be hereinafter set forth.

In the drawings:—

Figure 1 is a schematic view of an aircraft showing conventional gas compartments and an auxiliary collapsible compartment with conduits communicating both to and from said compartments,

Figure 2 is an enlarged detail view of one of the inlet valves from the pump, and

Figure 3 is a detail view of one of the valves controlling the overflow of gas from the compartment to the collapsible container.

Like characters of reference indicate corresponding parts throughout the several views.

At Figure 1, in the drawings, a body 10 is shown, intended to conventionally illustrate a buoyant unit of an aircraft. It is to be understood that this unit may be the sole buoyant unit or coupled with other units to form the lift necessary for the craft and the showing of this individual unit is no limitation upon the invention as to the number of units, shape, proportion, size or other features related thereto.

Within this unit have been shown a plurality of gas compartments 11. These gas compartments, as illustrated, are purely conventional and may in fact be collapsible bags, rigid compartments or whatever type of gas container is favored by the construction engineer. Irrespective of the type of gas containers, a compartment 12 is provided at some convenient point in the craft. As shown in the drawings, this compartment 12 is indicated as located at the stern of the craft and within the same unit as the gas compartments. It will be obvious, as the explanation is unfolded, that this gas compartment may be located at any point within or without the unit. Wherever the compartment is located, it will contain a collapsible gas bag 13 normally empty.

Extending from the gas compartment or compartments 11 and communicating with

the collapsible bag 13 is a pipe-line 14. Within the gas compartment or the gas compartments as the case may be, valves 15 are interposed for the purpose of controlling the pressure within the compartments. At Figure 3, is illustrated a valve which may serve this purpose, it being understood, however, that the invention is not limited to this specific type of valve. As shown, the valve 15 is provided with a valve seat 16 and valve member 17 held resiliently to seat by the spring 18. It is obvious that this spring 18 may be of any tension required, the tension applying in the operation of the device as will be hereinafter more fully understood from the explanation of operation.

Communicating also with the bag 13 is a pipe-line 19 which extends to some pumping unit indicated conventionally at 20. As shown in the drawings, this pumping unit 20 is located in the conventionally shown car 21, but it is to be understood, of course, that the pump may be of any type and may be located at any point and preferably under manual control, although it is obvious of course, that automatic control may be applied and substituted, but such automatic control is only suggested and forms no part of the present invention.

From the pumping unit a pipe 22 extends to a pipe-line 23 which communicates with all of the several compartments 11 if more than one compartment is employed. This pipe-line 23 is provided with a valve 24 for each compartment. At Figure 2, a valve is shown which may be successfully employed for this purpose comprising a valve seat 25 with a valve member 26 resiliently held to seat by the spring 27. No particular pre-adjustment is necessary in regard to this valve as the gas pressure within the compartment will act upon the valve to hold it to seat augmenting the tension of the spring 27. It will be desirable that the tensioning of the several springs 27, if more than one is employed, shall be substantially equal so that the restored gas pressure in the several compartments may also be equal.

In operation, as the relative pressure within the compartments 11 increases, such pressure will operate to unseat the valve member 17 so that gas from the said compartments 11 may pass into the pipe-line 14 and therefrom into the collapsible bag 13 expanding such bag to such capacity as may be necessary to accommodate the overflow.

As the aircraft descends to denser atmosphere or when by reason of change of atmospheric or other contingencies, the pressure in the gas compartment should be reduced below normal relativity the pump 20 is actuated manually or automatically to withdraw gas from the bag 13, through the pipe 19 and to the pipe-line 23. The excess of pressure in this pipe-line over the pressure in the compartments will unseat the valve member 26 and gas will therefore pass from the pipe-line into such compartments as are under pressure, restoring the pressure first to those in which the pressure may be least and so building up until the pressure in all are normal.

The buoyancy of gas contained in a compartment is controlled by the temperature of the ambient atmosphere. When the temperature without the buoyant chamber rises, the temperature within the chamber likewise rises, and the gas within the compartment has a tendency to expand and increase the pressure. It is desirable to maintain the pressure of the gas within the chamber as nearly atmospheric as possible at all times irrespective of the temperature and expansion. When by reason of expansion gas has moved from the buoyant chamber to the collapsible bag 13, it does so at substantially normal temperature by the displacement of the valve 15 so that the gas contained in the collapsible bag 13 is substantially at atmospheric pressure. When by reason of cooling, the gas within the buoyant chambers is likewise cooled, it is necessary to return gas to these chambers, but the temperature of the return gas should be substantially the same as that of the gas within the compartments so that it will neither expand or contract the already contained gas. The pump 20 withdraws gas from the flexible bag 13, and forces it into the compartment through the pipe 22 with but very little rise in pressure, only enough to overcome the very slight resistance of the valves 24. As the gas in the bags 13 is at atmospheric temperature, the gas will be returned to the compartments at like temperature and any rise in temperature occassioned by compression at the pump will be exactly counterbalanced by the cooling of the gas as it expands into the chambers, so that the gas as introduced will be at atmospheric temperature. This manner of introducing the gas exactly at atmospheric temperature is distinguished from introducing the gas to the chambers from a high compression reservoir which has given up its heat by elapse of time and when the gas is expanded into the chamber, the contained gas is cooled and the volume reduced. As soon then as it is expanded by the heat of the atmoshpere, the pressure rises. Instead of maintaining the gas at constant temperature and pressure, it is contantly raised and lowered by such changes of temperature of introduced gas.

In this manner the non-explosive, non-inflammable gases now favored in aerial navigation and at present represented generically by helium will be conserved and, with the differential loss from leakage, will continue to serve the purpose indefinitely.

Of course, the gas control for aircraft

herein illustrated, may be modified in various ways without departing from the invention herein set forth and hereinafter claimed.

The invention is hereby claimed as follows:—

1. The combination with an aircraft comprising a buoyant gas compartment and an overflow bag of flexible material, a conduit forming communication from the buoyant compartment to the overflow bag, a relief valve in said conduit adapted to maintain a predetermined uniform gas pressure in the buoyant compartment, and means remote from the bag to return gas from the overflow bag directly to the buoyant compartment.

2. The combination with an aircraft comprising a buoyant gas compartment and an overflow bag of flexible material, a valved conduit leading from the buoyant compartment to the bag and manually controlled means remote from the bag for returning gas from the bag directly to the buoyant compartment.

3. The combination with an aircraft comprising a buoyant gas compartment, an overflow bag of flexible material and pumping means remote from the bag adapted to withdraw gas from the bag and return it directly to the buoyant compartment.

4. The combination with an aircraft comprising a plurality of buoyant gas compartments, an overflow bag of flexible material, a conduit forming communication from said buoyant compartments to the overflow bag equalizing relief valves controlling the discharge of gas from the buoyant compartments into the conduit, and means remote from the bag to return gas from the bag directly to the buoyant compartment.

5. The combination with an aircraft comprising a plurality of buoyant gas compartments, an overflow bag of flexible material, a conduit forming communication from said buoyant compartments to said bag equalizing relief valves controlling the gas flow from said buoyant compartments to said conduits, a pumping installation remote from the bag, a pipe communicating directly from said pumping installation communicating with all of said buoyant compartments and equalizing valves adapted to control the introduction of gas from said pumping installation to said buoyant compartments.

6. The combination with an aircraft embodying a plurality of buoyant gas compartments, an overflow bag of flexible material, a conduit communicating with all of said buoyant compartments, equalizing relief valves controlling the flow of gas from the buoyant compartments to the conduit, a pumping installation remote from the bag adapted to withdraw gas from the bag, a conduit in direct communication from the pumping installation to each of the buoyant compartments and a spring pressed valve for said conduit controlling the communication with each buoyant compartment, said valve being held normally closed by the combined action of said spring and the contained gas pressure.

In testimony whereof I have signed my name to this specification.

MAX B. PUPP.