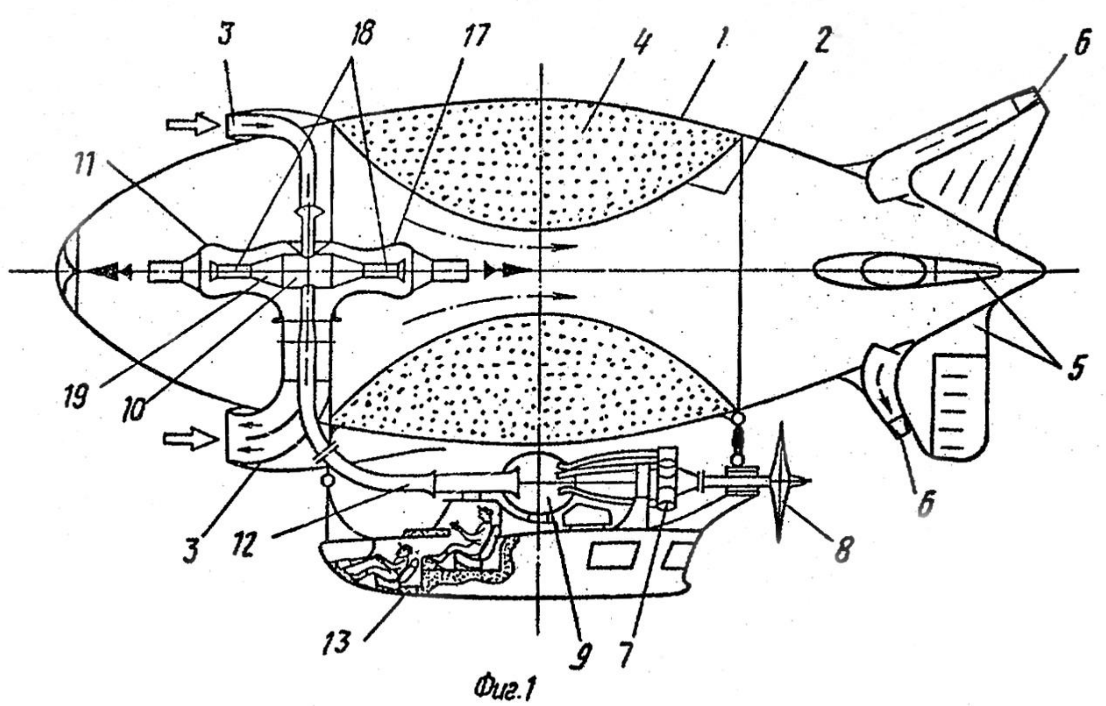
Vadim Nikolaevich Pikul - Thermal airship

Peter Lobner, 22 December 2024

Thermal airships become lighter-than-air during operation with the combined aerostatic lift of a fixed mass of lifting gas and a variable temperature volume of heated air. When its heat source is shutdown and the air volume has cooled to ambient, thermal airships are heavier-than-air, but still semi-buoyant.

In the late 1980s, Russian engineer Vadim Pikul developed and patented a design concept for a streamlined thermal airship with a novel means for controlled heating of its air volume.



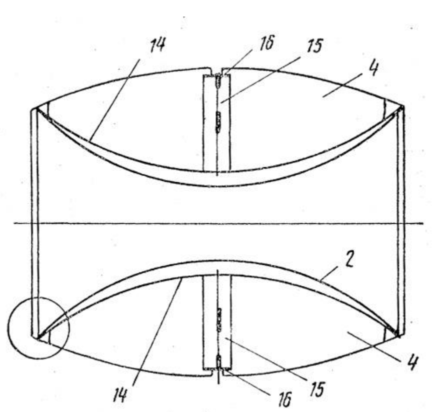
General arrangement of Vadim Pikul's thermal airship.
Source: Russian patent SU1735117A1, Fig. 1

Pikul's thermal airship has a rigid hull (1) with a flexible internal wall forming a venturi-shaped air flow channel (2) along the centerline of the hull, surrounded by a toroidal lifting gas cell (4) formed in the space between the hull and the flexible internal wall.

Ambient air intakes (3) supply air to an “alignment chamber” (11), containing a pulse-jet engine (10) equipped with a combustion chamber (19), nozzles (18), and an ejector-style exhaust that discharges into the throat of the venturi-shaped air flow channel (17). A separate internal combustion engine (7) on the gondola (13) drives a pusher propeller (8) and the hot engine exhaust gases are discharged into a manifold (9) and then through a gas outlet line (12) to the “alignment chamber” (11) and finally discharge via the ejector-style exhaust (17) into the venturi-shaped air flow channel (17).

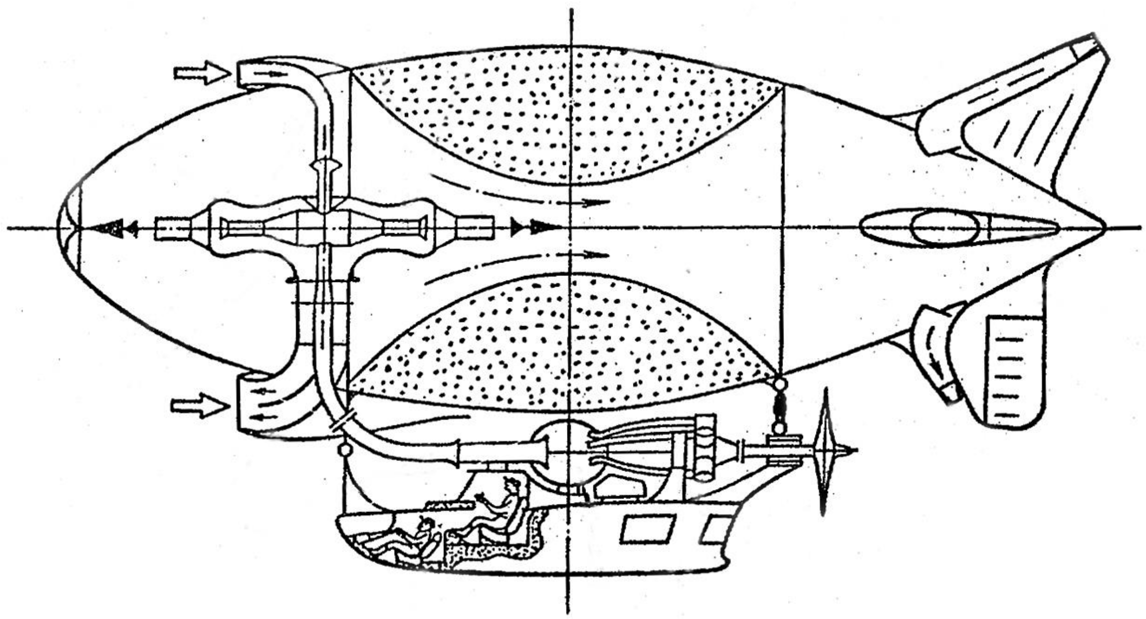
The engine exhaust gases discharged into the airflow channel start heating the air volume and the exhaust gas flow through the venturi results in a pressure drop in the venturi throat. The pressure difference between ambient and the venturi starts drawing fresh air into the pulse-jet engine via the ambient air intakes (3) and enables the pulse-jet engine to be started. Air and exhaust gases exiting the venturi are discharged back to the atmosphere via exit nozzles (6) in the four cruciform tail stabilizer fins (5). As the average air temperature in the internal flow channel (2) increases, total aerostatic buoyancy increases, the airship becomes lighter-than-air, and it can ascend for powered flight, driven by the pusher propeller and directed by the controlled gas flow from the exit nozzles (6).

The internal wall forming the venturi-shaped flow channel (2) is the inner wall of the toroidal lifting gas cell (4), the outer wall of which is the hull of the airship (1). The shape of the flow channel is defined by longitudinal stringers (14) connected in the radial direction by cables (15) that are attached to a frame (16) fastened to the hull (1). These details are shown in the following figure.



Фиг. 2

Venturi-shaped air flow channel details.
Source: Russian patent SU1735117A1, Fig. 2



Vadim Pikul's thermal airship, longitudinal cross-section.
Source: Adapted from Russian patent SU1735117A1, Fig. 1

For more information

- SU1735117A1, "Thermal Airship," Inventor: Vadim Nikolaevich Pikul, Filed 19 December 1989, Granted 23 May 1992: https://patents.google.com/patent/SU1735117A1/en

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