May 2, 1933. G. A. PAGE, JR 1,906,404

APPARATUS FOR COOLING INTERNAL COMBUSTION ENGINES

Filed Dec. 12, 1930

FIG. 1.

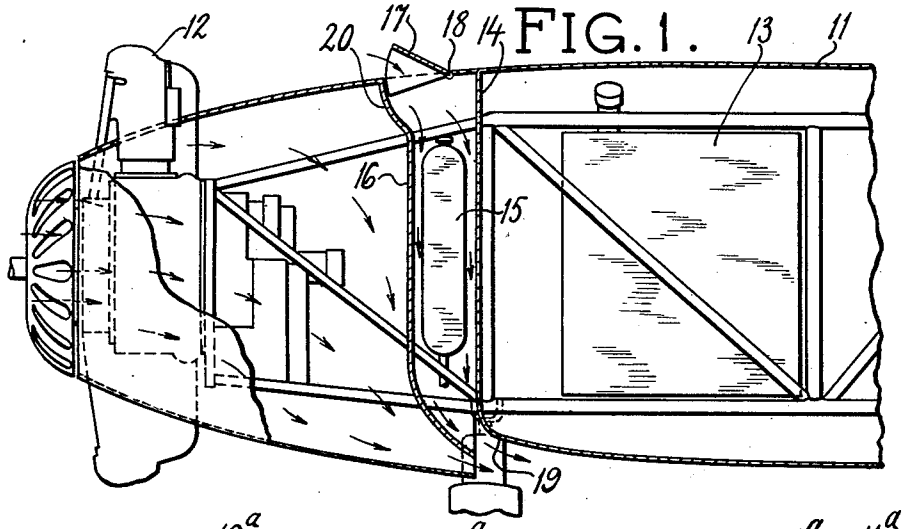
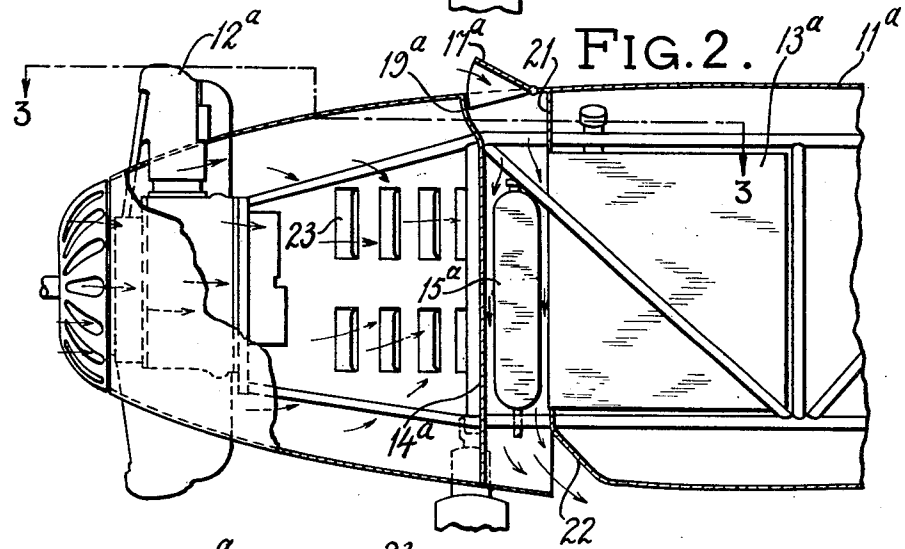


FIG. 2.



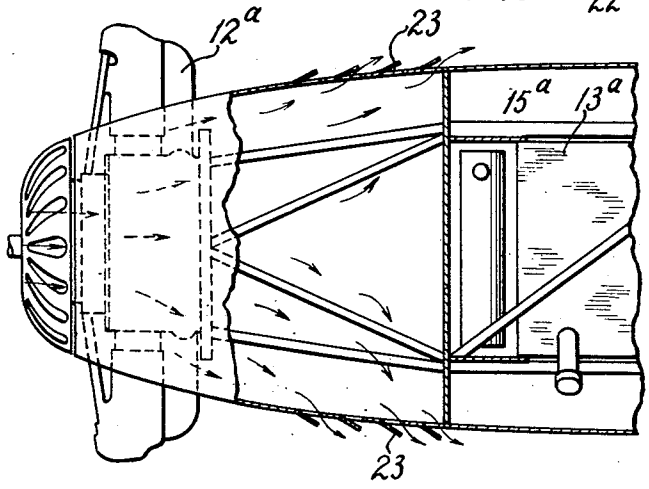


FIG. 3.

INVENTOR
GEORGE A. PAGE Jr.
BY W. E. Trace Jr.
ATTORNEY

Patented May 2, 1933

1,906,404

UNITED STATES PATENT OFFICE

GEORGE A. PAGE, JR., OF FREEPORT, NEW YORK, ASSIGNOR TO CURTISS AEROPLANE & MOTOR COMPANY, INC., A CORPORATION OF NEW YORK

APPARATUS FOR COOLING INTERNAL COMBUSTION ENGINES

Application filed December 12, 1930. Serial No. 501,778.

My invention relates to aircraft, and more especially to methods of and means for cooling internal combustion engines associated with aerial vehicles.

Airplane engines are cooled to a large extend by reason of the circulation of the oil from the heated parts of said engines, to points outside of the engines where the oil is cooled. It has been usual, therefore, in such internal combustion engines to provide relatively large surfaces such as oil radiators for the cooling of the oil. Usually also, there have been provided large areas comprising the oil tanks which prior to my invention have not been generally utilized in cooling of the oil of the engine. In a copending application of Samuel T. Payne, one of the surfaces of an oil tank is utilized for the purpose of cooling the engine oil in aircraft of the type known as "pushers". This application, therefore, in a sense relates to an invention which is an improvement on the invention of said application of Samuel T. Payne.

In many instances, the conventional oil tank has sufficient surface area to satisfactorily cool the oil if a definite effort is made to utilize the area. The system described in this application has been used with success on several airplanes actually built and flown. Some of the features of the invention are set out below in this paragraph. The oil tank is in part or entirely surrounded by several partitions so that heated air which has passed around the engine crankcase or cylinder bases will not be permitted to make contact with the oil tank. An opening, either adjustable or fixed and leading to the outer air, scoops in fresh air which has not been heated by passing over the engine. Air taken from the rear of the cylinder heads is not sufficiently heated to reduce cooling of the oil appreciably. The air is passed around the oil tank at comparatively high velocities, the partitions being placed fairly close to the oil tank (such as 1″ to 2″) so that the air is caused to wipe off the heat from the tank walls. A direct outlet to the outer air is provided so that circulation of other air inside the cowling will not detract from the positive circulation desired. One of the partitions mentioned may be the fire wall and the oil tank may be either forward or aft of the fire wall. Other portions of the partitions may be formed by the cowling itself or by the fuel tank. Circulation of the air may be in any direction. That shown is downward but it may be crossways with an inlet opening on one side and an outlet opening on the other, or upward with the inlet at the bottom and the outlet at the top. It may be desirable in some instances to corrugate the surface of the tank or pass tubes through it or use other means to increase the cooling area. The partitions mentioned need not necessarily be air tight, inasmuch as some openings where control rods, pipes, etc. pass through will probably not affect the cooling seriously. One or more walls of the tank may be exposed directly to the outer air and partitions utilized only to circulate air around the other walls.

One of the objects of this invention is to provide a device capable of aiding to a large extent in efficiently cooling an internal combustion engine of an aerial vehicle.

A further object of the invention is to provide such a cooling device which will set up a minimum amount of wind resistance during the operation of said aerial vehicle.

A further object of the invention is the accomplishment of the cooling of the engine largely by the cooling of the oil and the utilization of functionally unrelated structure, which structure is necessarily and economically positioned adjacent to parts of the internal combustion engine for the purpose of aiding in the cooling of said oil.

Further objects will be apparent from a reading of the subjoined specification and claims and from a consideration of the accompanying drawing.

In order to explain the invention more clearly, two embodiments thereof are shown in said drawing, in which:

Fig. 1 is a view partly in elevation and partly in vertical section of an airplane constructed according to my invention;

Fig. 2 is a view similar to Fig. 1 of an aerial vehicle constructed acording to a modified form of my invention; and

Fig. 3 is a view partly in plan and partly in horizontal section taken substantially on the line 3—3 of Fig. 2 and looking in the direction of the arrows.

Referring particularly to the drawing, I have shown an airplane provided with a fuselage 11 and with a radial air-cooled motor 12 positioned at the forward end of the fuselage. Rearward of the motor is a fuel tank 13 and intermediate the fuel tank 13 and the motor 12 is a fire wall 14. Such a fire wall is required by existing Department of Commerce requirements as a safety measure in order to prevent fire from the motor spreading to other parts of the airplane. According to preferred practice the fire wall is usually interposed intermediate the engine and the fuel tank thus preventing fire from spreading to said fuel tank and causing an explosion thereof.

I utilize the fire wall not only for its primary purpose but also for forming one of the walls of a passage through which air flows in order to cool the oil in the oil tank and to aid in cooling the motor, as will be more specifically described hereafter. The oil tank 15 is positioned in front of the fire wall 14 and an auxiliary partition 16 is positioned in front of the oil tank 15. The partition 16 and the fire wall 14 thus form a passage through which air flows to cool the oil in the oil tank 15. At the upper or inlet end of the passage there is provided an air-scoop 17 which may be moved about its pivot 18 to the position shown in the drawing in which air is caused to flow through the passage or from said position to a position in which the upper part of the passage is closed. The scoop is made adjustable to any intermediate position. As may be clearly seen from the drawing the oil tank 15 is positioned upright within the passage so that a maximum amount of area thereof is exposed to the cooling air flowing through the passage. Moreover, the partitions are positioned so nearly adjacent to the tank that the space for the flow of air around the oil tank is appreciably reduced, whereby the flow of air is speeded up and maximum cooling is obtained therefrom. Due to the rounded shape of the upper and lower sides of the tank, the resistance to the flow of air is reduced to a minimum. The lower part of the fire wall 14 may be rounded as at 19 and the upper part of the auxiliary wall 16 may be rounded as at 20 in order to lessen the interference and resistance to the air moving through the passage. It is to be noted that the air which passes through the central part of the engine is also deflected downward and passes out adjacent to the outlet of the oil cooling passage but cannot enter the oil tank cooling passage.

In Figs. 2 and 3 I have shown a modified form of my invention in which not only the fire wall is utilized as one side of the passage, but also the front of the fuel tank is utilized for a part of the opposite side of the passage. Therein, the fuselage 11^a is adapted to be associated with a motor 12^a and to contain a fuel tank 13^a. The fire wall 14^a is disposed at the rear of the engine 12^a and the oil tank 15^a is disposed intermediate the fire wall 14^a and the front of the fuel tank 13^a. Secured to the upper part of the fuel tank 13^a is an auxiliary wall 21 and secured to the lower end thereof is a curved auxiliary wall 22. It may be noted also that the upper part of the fire wall 14^a is curved as at 19^a to aid the flow of air through the passage. A scoop 17^a is provided at the upper end of the air passage.

The air passes into the passage through the opening formed adjacent to the scoop 17^a and downward around the oil tank 15^a and out through the opening adjacent to the auxiliary wall 22, thus cooling the oil in the tank in its passage in a manner similar to that in which the oil in the tank 15 is cooled. The air which passes around the central part of the motor 12^a passes out through louvres 23 in the side of the cowling of the front end of the fuselage.

It is to be understood that the above described embodiments of the invention are for the purpose of illustration only, and various changes may be made therein without departing from the spirit or scope of the invention.

I claim as my invention:

1. In aircraft, a body, an internal combustion engine associated with said body, an oil tank of a relatively thin shape, associated with said internal combustion engine, a plurality of walls associated with said oil tank and forming therewith passages through which air flows for cooling the sides of said oil tank, the walls being positioned substantially parallel to the long sides of said oil tank.

2. In aircraft, an internal combustion engine, an oil tank associated with said internal combustion engine, a fuel tank associated with said internal combustion engine, and means comprising a fire wall for coacting with one of the sides of said fuel tank for forming an air passage for cooling the sides of said oil tank.

3. In aircraft, in combination, an internal combustion engine; an oil tank for said internal combustion engine; a fire wall adjacent to said oil tank, an auxiliary wall positioned on the opposite side of said tank from said firewall; and cowling for said aircraft formed with an inlet at the top of said aircraft and an outlet at the bottom of said aircraft whereby air may pass in said inlet, through said passage, around said oil tank, and out said outlet for the purpose of cooling the oil in said oil tank.

4. In aircraft in combination, an internal combustion engine; an oil tank for said internal combustion engine; a fire wall adjacent to said oil tank: an auxiliary wall positioned on the opposite side of said tank from said fire wall; cowling for said aircraft formed with an inlet at the top of said aircraft and an outlet at the bottom of said aircraft whereby air may pass in said inlet, through said passage, around said oil tank, and out said outlet for the purpose of cooling the oil in said oil tank; and a fuel tank for coacting with said auxiliary wall for forming one of the sides of said passage.

5. In aircraft; an air-cooled internal combustion engine having a crank case and a plurality of cylinders, a fuselage associated with said internal combustion engine; a fire wall also associated with said internal combustion engine and included in said fuselage; a fuel tank positioned rearward of said fire wall; an oil tank interposed between said fire wall and said fuel tank of a substantially flat tall shape; a cowling for said fuselage formed with an inlet opening at the top thereof intermediate said fire wall and said fuel tank and formed with an outlet opening at the bottom of said fuselage intermediate said fire wall and said fuel tank; an adjustable scoop for causing air to enter said inlet opening, passed downward between said fire wall and said fuel tank, around the sides of said oil tank, and outward through said outlet opening for the purpose of cooling oil in said oil tank; and means for causing the heated air which has passed around the crank case and bases of the cylinders of said air-cooled motor to pass out from said fuselage through the sides of said cowling so as not to disturb the passage of the cooling air around the oil tank.

6. In aircraft, a body, a wall in said body, a second wall in said body and spaced from said first wall, an oil tank disposed in the space between said walls and being of a width to provide a restricted passage between each side of said tank and the wall adjacent thereto, said body having openings formed therein for entrance of air to and egress of air from said passages.

7. In aircraft, a body, an internal combustion engine associated with said body, an oil tank associated with said engine, said tank being relatively thin, a plurality of walls spaced from and parallel to the sides of said oil tank for forming open passages between said tank and said walls, and means for causing cooling air to sweep thru said passages.

8. In aircraft, a body, a power plant associated with said body, a pair of transverse spaced walls within said body, said walls in conjunction with the interior of said body defining a compartment, an oil tank within said compartment, the several sides of said tank being arranged in spaced parallel relation with said walls to thereby define passages, and means for allowing cooling air to enter said passages, to contact said tank sides, and to leave said passages.

9. In aircraft, a body, a power plant associated with said body, an oil tank for said power plant mounted within said body, means associated with said tank for forming relatively narrow air ducts in conjunction with said tank, and means for directing air into said ducts.

In testimony whereof I hereunto affix my signature.

GEORGE A. PAGE, JR.