

Feb. 4, 1941.

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2,230,739

AIRPLANE POWER PLANT

Original Filed June 1, 1934

Fig. 1.

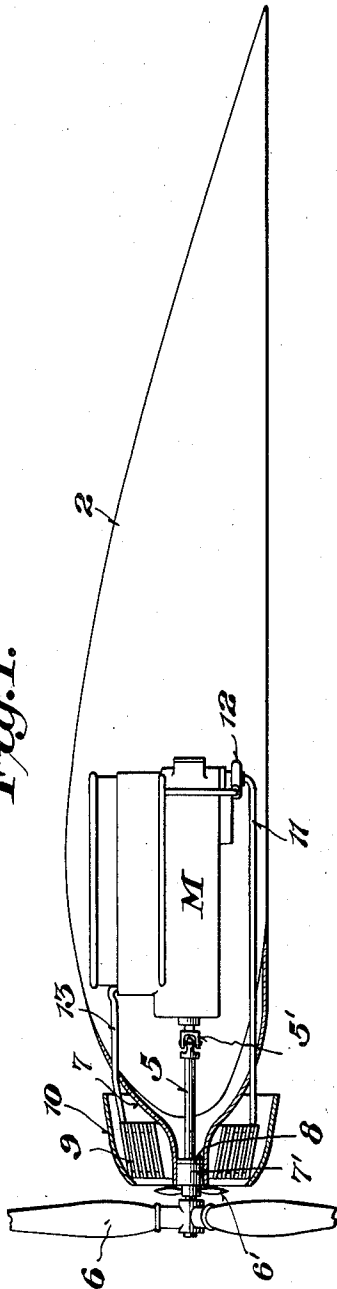
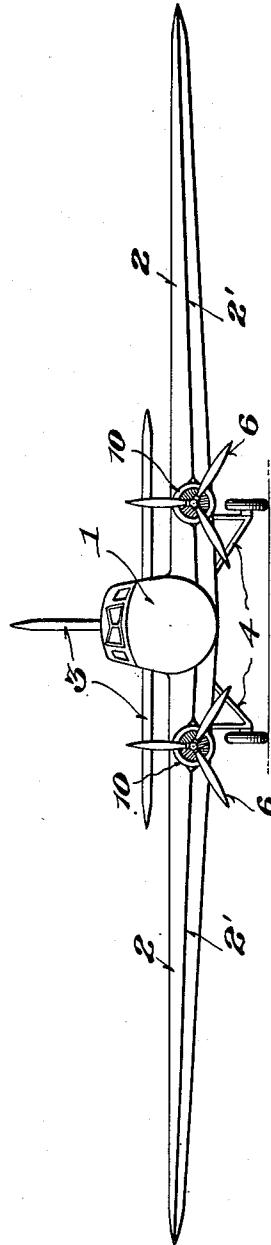


Fig. 2.



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UNITED STATES PATENT OFFICE

2,230,739

AIRPLANE POWER PLANT

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Application June 1, 1934, Serial No. 728,594
Renewed August 26, 1937

6 Claims. (Cl. 244—57)

This invention relates to airplanes, more particularly to an improved type of airplane power plant.

It is recognized by aerodynamic engineers that the proper position and installation of the power plant is of salient importance. In the typical modern plane, the power plant, which is usually of the air cooled type, is positioned in the nose of the fuselage. Cooling is secured by allowing a material area of the cylinders to project outwardly of the surface of the plane. Such a mounting presents well recognized disadvantages.

In the development of the larger type of planes, it has become the practice to utilize power plants of existing types and to satisfy the increased power requirements of the larger planes by multiplying the number of engines. This has necessitated mounting at least some of the engines on or adjacent the wings.

The utilization of a water-cooled motor likewise presents a radiator problem. Using such a motor, of course, presents the advantage of displacing the radiator from the engine and many such suggestions have been made. Thus it has been proposed to locate the radiator of a water cooled motor at the side of the fuselage, in the wing and at an angular position in the cowl.

With the development of multimotored planes and high speed planes, the location of the radiator becomes increasingly important due, among other things, to the fact that the radiator resistance increases approximately as the square of the velocity. The radiator of a plane absorbs power in two ways; first, by requiring a quantity of power to carry its own weight and secondly by expending power to overcome its head resistance.

While the power requirements are the most important in designing and locating a radiator, there are, however, other factors which must also be considered, such as a clear line and range of vision for the pilot, structural mounting features, and in military planes, exposure to hostile fire.

I have found that when employing liquid cooled motors, effective cooling with diminished head resistance may be attained by a novel association of radiator and motor with respect to the structural parts of the plane.

A major object of the present invention is, therefore, to provide a novel motor and radiator assemblage.

Another object is to provide an improved association of a liquid cooled motor and radiator.

Yet another object is to provide a novel type of motor wing assemblage.

With these and other equally important objects

in view, the invention comprehends the concept of so associating a liquid cooled motor and its radiator with a wing that optimum cooling is secured with minimal head resistance.

In order to clearly explain the invention a typical physical embodiment of it is shown in the accompanying drawing in which:

Figure 1 is an enlarged detail view of a wing structure.

Fig. 2 is a front view of a plane constructed according to the present invention.

As indicated hereinbefore, several locations of water cooled motors and their associated radiators have been proposed. Among such are, location of the motor in the nose of the fuselage with the radiator positioned in the propeller slipstream; location of the motors in a multimotored plane on or adjacent the wings with the associated radiators nested within the wing structure. It has also been proposed to mount the motor at the leading edge of a wing and to interpose the radiator between the motor and the propeller.

In the present invention, the liquid cooled motor is preferably housed within the wing or other air sustentation surface, and the tractor propeller is spaced forwardly of the leading edge of the wing. Interposed between the nose of the wing and the propeller is a radiator for the cooling fluid. Since the motor is within the wing, or similar streamlined member, the radiator bears no necessary size relationship to it and hence a radiator of optimum dimensions may be utilized, especially one having a relatively small frontal area. Furthermore, as will be seen more fully hereinafter, the radiator may be positioned directly in the propeller slipstream and increased cooling thus achieved.

The principles of the present invention are applicable to any type of plane, more particularly, as shown in the drawing, to multimotored planes. The invention may, for example, be embodied in a plane having a fuselage (or float) 1 provided with the air sustentation surfaces 2 and empennage 3. The plane is provided with any approved type of alighting gear illustrated by the ground landing gear 4. The plane illustrated in the drawing is a double motored low wing monoplane; it will be appreciated, however, that such plane may comprise a high wing monoplane, a biplane, sesquiplane or any other desired type and furthermore, may be a land or seaplane or combination thereof, i. e., an amphibian. Likewise the plane may be equipped with any desired number of motors.

In the preferred form of the invention, the

motor M, which is of the liquid cooled type, is mounted directly within the wing 2. In order to simplify the description, the structural elements of the wing, such as the spars and ribs, have been omitted. It will be understood, however, that the wing is ruggedly constructed and that the engine bed is securely attached to the structural elements such as the spars and/or ribs. Preferably, as shown, the motor is positioned in the forward section of the wing, i. e., in the area of greatest lift.

The motor is provided with a relatively elongated propeller shaft 5, to the end of which is attached the propeller 6 of any approved type. The propeller shaft is preferably provided with a universal joint 5'.

Attached to the main wing and extending forwardly of the nose 2' is the rugged fairing or cowling member 7. This is of streamline form and at the forward end is extended at 7' to form a mounting means for the elongated propeller shaft bearing 8. The fairing 7 may be constructed of a relatively heavy gauge light weight metal, or of any other material and is so designed as to withstand stresses imposed by the propeller shaft as well as sustain the weight of the radiator 9 and collector ring 10. Similarly the unit 7 may be constructed of tubular framing to which is attached a curved cowling.

As shown in Figure 1, the liquid cooling cycle includes the liquid inlet line 11, fluid pump 12, the water jacket of the motor, the outlet line 13 and radiator 9. It will be understood, that a fluid expansion tank (not shown) is provided. The radiator 9 is located in the slipstream of the tractor propeller and preferably is encircled by the collector ring which is of suitable curvature at the forward part and contours gradually toward the wing. The ring 10 therefore serves, in conjunction with the streamline fairing 7, to streamline the radiator and thus diminish head resistance and improve the airflow through the radiator.

It is particularly to be observed that the streamline fairing 7 extends through the center of the radiator and thus serves to diminish turbulence caused by the radiator, and smooth out the slipstream flow over the wing in the adjacent area.

With this type of construction, it will be appreciated that the frontal area of the radiator may be reduced to the optimum value and that this is not dependent upon the size or location of the motor. Being positioned in the slipstream, the airflow through the radiator core is rapid and hence increased cooling effect is achieved. The radiator itself may be of any desired type; thus it may be in the form of flat, radial, hollow plates, placed edgewise to the slipstream, or it may be of the typical cellular construction such as a cartridge core radiator.

It will likewise be observed that the construction shown in Figure 1 permits of any desired ratio of free radiator area to total radiator area. Due to the encircling position of the radiator with respect to the fairing 7, practically the entire frontal area is a free area, that is to say, open to the passage of air. This large free area increases the airflow and presents a compact structure.

Since, as noted above, the head resistance of a radiator is substantially proportional to the square of the flying speed, and since such resistance is substantially directly proportional to the frontal area, the present type of construction is

especially useful in high speed planes. By utilizing the radiator having a very large free area, the resistance is further diminished, especially if cellular radiators or the flat plate type are employed.

It is further to be noted that this type of construction differs considerably from prior proposals in which a motor and associated radiator were positioned on the nose of the wing. In such proposals, the motor itself formed an obstruction for the radiator and in order to provide an appreciable free area for the radiator, this latter had to be enlarged to such a degree that its frontal area was quite great. The present radiator, on the other hand, is of the unobstructed type. Whereas in the prior proposals, the cylinder and crank case of the engine were positioned immediately behind the radiator serious restriction of the airflow through the radiator resulted and a larger size radiator was required. In the present construction, the radiator is placed outside of the wing and is in a substantially "free air" position because of the fact that the streamline fairing 7 does not materially retard airflow through the radiator. In the present construction, therefore, by mounting the motor within the wing and extending the wing in a streamlined continuation, as by the fairing 7, the radiator is reduced to minimal frontal area while yet securing a large free area. This type of radiator construction also is a distinct improvement over the wing type of radiator, that is to say, a radiator positioned in the body of the wing. An outstanding disadvantage of the wing type as is known, is the disturbance of the vacuum effect over the upper surface of the wing due to the radiator. In the present type of construction, on the other hand, the motor is completely enclosed within the most effective streamlined member; namely, the wing and the radiator itself is designed to attain proper cooling capacity without being compromised or complicated in design either by the size or the position of the engine.

It will be appreciated that the increased efficiency of the present type of structure becomes more striking as the speed of the plane is increased, and this type is particularly useful in planes designed for high speed, such as the supercharger equipped planes.

It will be understood, of course, that variations in the cooling capacity of a given radiator of the present type may be secured by varying the speed of flow of the liquid through the cooling cycle or varying the exposed frontal area of the radiator as by means of shutters and the like. A preferred mode of increasing the cooling capacity of the radiator and, if desired, of varying the cooling effect comprises the utilization of a supplemental short radius propeller 6'. This may be mounted either directly on the propeller shaft 5' or intermediately associated with the shaft through a system of gears so as to increase the speed of propeller 6' with respect to the motor speed. This propeller 6' may, if desired, be of the variable pitch type so that the cooling effect of the radiator may be modified within relatively wide limits by varying the pitch of propeller 6'.

It will be understood that the construction described herein, namely the utilization of a housed motor in conjunction with a special radiator interposed between the motor and the main propeller may be utilized with elements other than the wing. This unit, for example, is par-

particularly useful for association with a nacelle in which the motor is mounted and from which the propeller shaft projects and is surrounded by the novel type of radiator.

5 While a preferred modification of the invention has been described, it is to be understood that this is given to explain the underlying principles involved. The invention is applicable to any type of plane and particularly to the multi-
10 motored and high speed types. This invention, therefore, is not intended to be limited to the particular embodiment shown and described except as such limitations are clearly imposed by the appended claims.

15 I claim:

1. An airplane comprising a fuselage and a wing, a liquid cooled motor housed completely within the wing having a shaft projecting through the nose of the wing and forwardly of the leading edge thereof and a radiator located
20 in an unobstructed position in front of the leading edge of the wing and surrounding the propeller shaft and means forming a bearing support for the shaft and being contoured into the
25 wing to deflect air passing through the radiator over the wing.

2. An airplane comprising a fuselage and a wing, a liquid cooled motor within the wing and having a shaft projecting through the nose of the wing, a propeller mounted on the shaft and spaced forwardly of the nose of the wing, a streamlined fairing extending from the rear of the propeller to the wing and being contoured into the wing and a radiator positioned in the rear of the propeller and in front of the wing
35 and encircling a portion of the fairing and bearing means for the propeller supported by said fairing.

3. An airplane comprising a fuselage and a wing, a liquid cooled motor positioned within the wing and having a propeller shaft projecting through and extending forwardly of the wing, a streamlined fairing extending forwardly of the wing and having a journal portion for the shaft and an unobstructed radiator mounted
45 on and encircling a portion of the fairing and

being positioned forwardly of the leading edge of the wing.

4. An airplane comprising a fuselage and a wing, a liquid cooled motor positioned within the wing and having a propeller shaft projecting through the nose of the wing, a propeller mounted on the shaft, a fairing of streamlined form encircling the shaft and forming a support therefor, the fairing being contoured into and attached to the wing and an unobstructed radiator encircling the fairing and positioned within the propeller slipstream between the propeller and the leading edge of the wing.
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5. An airplane comprising a fuselage, an air sustentation member, a motor mounted within the member, a tractor propeller driven by the motor and spaced forwardly of the leading edge of the member, and an unobstructed radiator for the motor interposed between the propeller and motor and means forming a journal mounting for the propeller shaft and faired into the wing, and a supplemental propeller of a shorter radius than the main propeller driven from the motor, the said propellers being spaced forwardly of the leading edge of said member whereby air forced by the propeller through the said radiator is deflected over the surfaces of the wing.
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6. An airplane comprising a fuselage and a wing, a liquid cooled motor mounted completely within the wing and having a shaft projecting through the leading edge of the wing, a propeller mounted on the shaft and spaced forwardly of the leading edge of the wing, a streamline fairing attached to the wing adjacent the leading edge and projecting forwardly thereof and being formed at its forward portion with means to support the propeller shaft, a radiator positioned forwardly of the leading edge and supported by said fairing, the said fairing being contoured into the wing in such manner that the radiator is of the unobstructed type and the entire frontal area thereof is subjected to the cooling effects of the slipstream, and a collector ring enclosing the radiator.
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