June 12, 1934. F. M. GREEN 1,962,685

COOLING OF INTERNAL COMBUSTION ENGINES

Filed Feb. 10, 1932

Fig. 1.

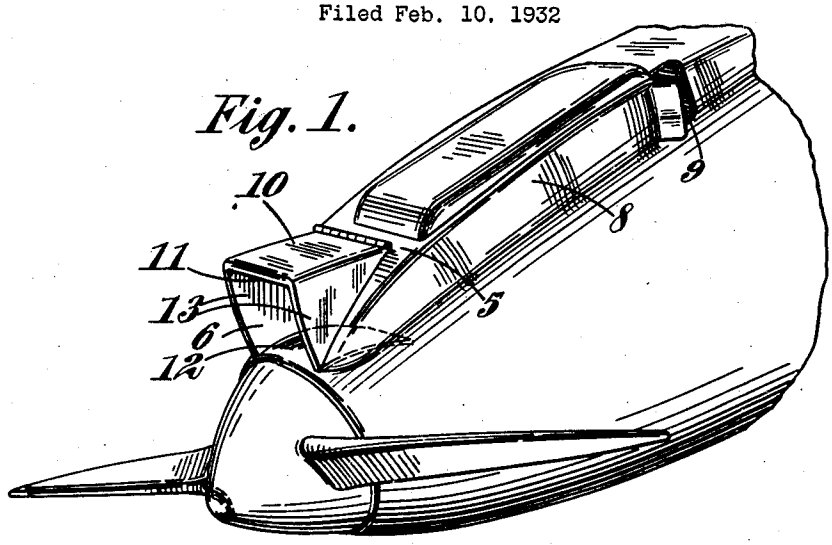


Fig. 3.

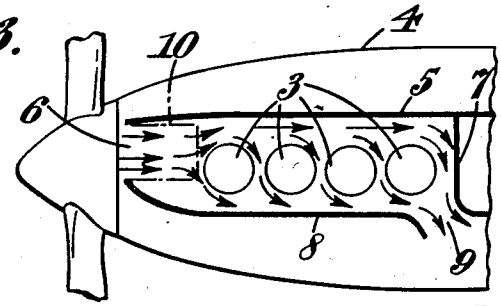
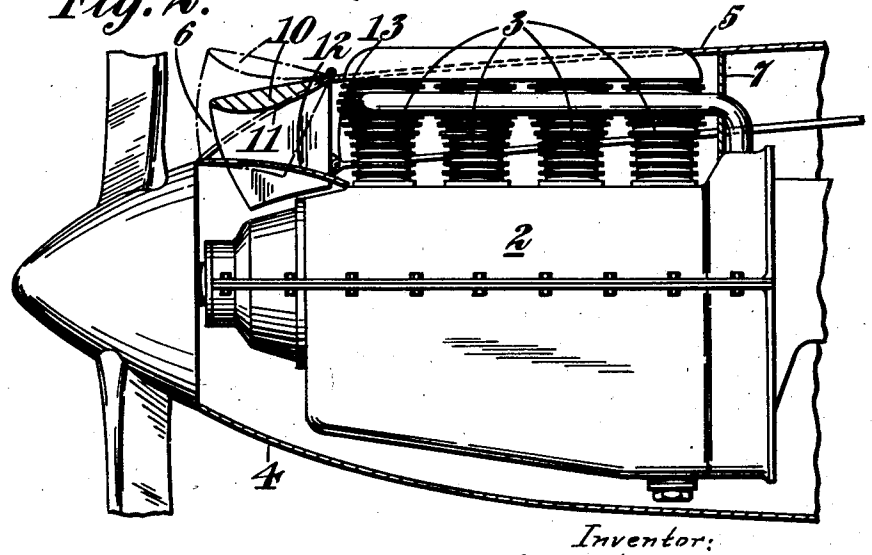


Fig. 2.



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COOLING OF INTERNAL-COMBUSTION ENGINES

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3 Claims. (Cl. 123—171)

This invention relates to the cooling of aircraft internal-combustion engines where cooling air is directed along a passage with an adjustable inlet on to the cylinders of the engine, preferably by means involving the use of a streamline cowling, and particularly to the cooling of tractor-type aircraft.

At the present time the cooling is usually arranged to give the best results, as regards an aeroplane, when the same is climbing. In consequence, there is slight under-cooling when the aeroplane is running on the ground prior to taking off—though this is relatively unimportant—and a slightly greater over-cooling effect at normal air speeds. This over-cooling at normal air speeds may not be deleterious to the running of the engine, but unnecessary drag is introduced by which the speed of the aeroplane is reduced. Furthermore, in some conditions, there is material over-cooling which may impair the subsequent running of the engine, as, for example, when diving from a great height with the engine shut off.

It is the object of the present invention to provide an improved air-cooling arrangement by which the above disadvantages will be obviated to a greater or less extent; and to this end the invention broadly consists in various improvements specifically set forth in the accompanying claims and the nature of which is hereinafter described with reference to the accompanying drawing.

In a preferred arrangement according to the invention, the adjustable inlet portion of the cooling-air passage is of streamline bore for all its different-sized openings, and it is adapted to open outwardly (i. e., away from the propeller axis) so as to collect air at a greater radius when a greater cooling effect is desired, such air having a greater velocity than that passing the propeller nearer its axis.

In the accompanying drawing,

Figure 1 is a perspective view of part of a streamline cowling adapted in accordance with the invention,

Figure 2 is a vertical section of the cowling and inlet passage thereto more or less diagrammatic, with the engine in elevation, and

Figure 3 is a diagrammatic horizontal section, to a smaller scale than the foregoing, through that part of the cowling around the engine cylinders showing the direction of air flow.

In the construction shown an air-cooled aeroplane engine 2 with a bank of individual cylinders 3, 3 which are arranged in line is enclosed within a substantially streamline cowling 4 with a raised or channel portion 5 for the accommodation of the upper part of the cylinder bank, the raised portion being offset laterally from the bank to one side more than to the other, as shown in Figure 3. The air inlet 6 is provided at the forward end of this raised portion so as to direct air partly against the forward cylinder and mainly down one side of the cylinder bank. A transverse baffle 7 at the rear end of the cylinder bank causes the air which enters the inlet to be forced laterally between the cylinders to the other side of the bank, where a further baffle constituted by a side 8 of the channel portion 5 directs the air rearwardly to an outlet opening 9.

In accordance with the invention, a hinged shutter 10 operable by means of the rod 13 provides the roof or outer wall of the inlet, the under surface 11 of the shutter and the upper surface 12 of the bottom or inner wall of the inlet being convex or substantially Venturi-shaped (in longitudinal section) to provide a more or less streamline air flow through the inlet. The arrangement is preferably such that for normal air speeds the outer surface of the shutter will conform to the streamline shape of the raised channel.

The Venturi inlet acts efficiently to convert the velocity of the air into pressure which builds up on the appropriate side of the cylinder bank, so that air is forced between the cylinders. When diving from a height, or at other times, when desired, the shutter 10 can be further or entirely closed without introducing any material additional drag. When a greater cooling effect is required, as when climbing, the shutter can be opened materially to increase the sectional area of the inlet, and in this position the throat is still substantially Venturi-shaped (in longitudinal section) so that the increase of drag occasioned by the larger inlet opening is relatively small. When opened in this way the air collected from the slip stream is taken from a greater radius, so that a given cross-section of inlet is more efficiently used.

It will be evident that when applying the invention to an engine with a number of banks of cylinders radially arranged around a common crankshaft, separate and similarly-spaced cooling passages, each with its own adjustable inlet portion, are preferably provided for each bank.

It will be seen that by means of the invention it is possible to ensure that the engine shall be correctly cooled at all speeds with a minimum

variation in the drag introduced by the air-cooling arrangements.

What I claim as my invention and desire to secure by Letters Patent of the United States is:—

1. The combination with an air-cooled internal-combustion engine, of a cooling-air passage therefor, said passage having an inlet a portion of which is angularly adjustable and which is substantially Venturi-shaped for all its different-sized openings.

2. The combination with an internal-combustion engine having a number of cylinders in line, of a streamlined cowling adapted to direct air on to the cylinders, said cowling having an adjustable internally streamlined opening offset slightly to one side of the cylinders and providing a substantially Venturi-shaped bore.

3. The combination with an internal combustion engine having a number of cylinders in line, of a streamlined cowling adapted to direct air on to the cylinders, said cowling having an adjustable air inlet including a bottom and an angularly adjustable shutter each of which is internally streamlined to provide a Venturi-shaped bore in all the open positions of the shutter.

FREDERICK MICHAEL GREEN.