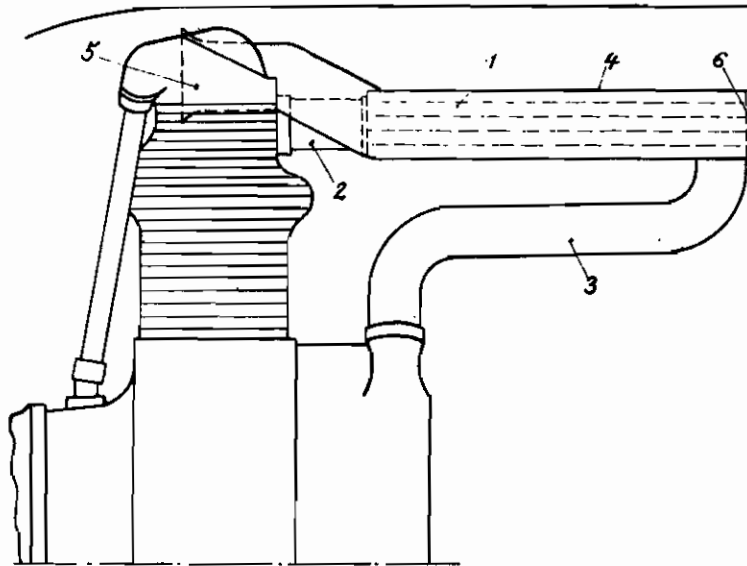


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T. HELMBOLD  
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Fig. 1



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Fig. 2

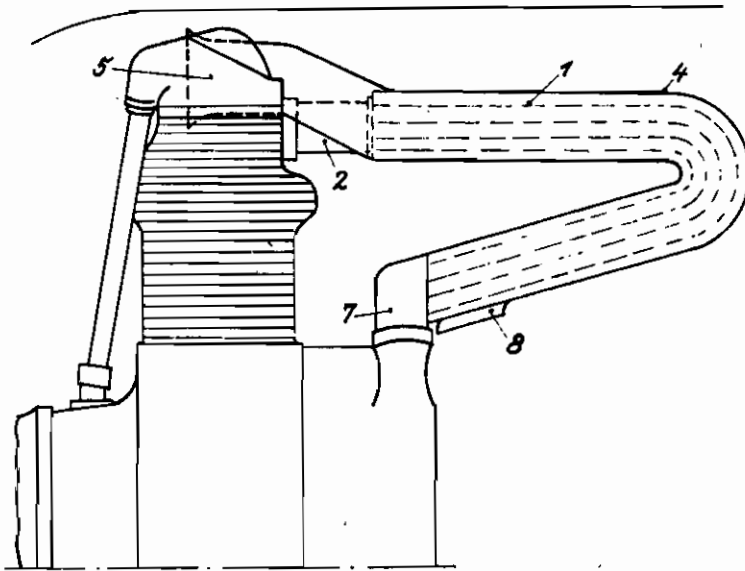
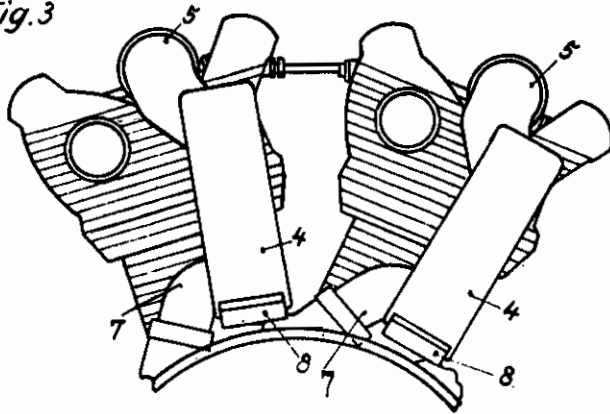


Fig. 3



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# ALIEN PROPERTY CUSTODIAN

## CHARGE-COOLERS FOR RADIAL ENGINES

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Application filed September 26, 1939

This invention relates to the arrangement and construction of charge-coolers located behind the central plane through the cylinders of air-cooled radial engines.

Charge-coolers are known in many different forms of construction. It is common to all these previous constructions that the charge-coolers are arranged in a direction extending from the cylinder head of one cylinder to the cylinder base of the adjacent one. When disassembling a cylinder there is a necessity of disassembling 2 coolers, i. e. the one belonging to it and besides that a second one the point of connection of which is located behind the first one. This last mentioned cooler partly covers the cylinder head screws and does not permit the loosening of them thus preventing a rapid and easy dismantling.

These drawbacks are eliminated in such a manner that the cooler is arranged according to the invention so that it extends from the connecting branch at the inlet valve parallel or approximately parallel to the axis of the engine. Each cooler consists of a nest of tubes surrounded by a cooling jacket and through which the air charge is flowing. Because of the covered position of the cooler relatively to the direction of flight the cooling jacket has an extension reaching into the space between the valve casings and assumes at its end a form of a spout to improve the air entrance, so that the cooling air is taken from the sphere of dynamic pressure in front of the cylinders. The cooling air entering the funnel-shaped opening flows within the cooling jacket along the charging air tubes and leaves the jacket at the connecting point of the tube leading to the blower. Owing to the simple and straight-lined arrangement of the cooling jacket in the direction of flight there is obtained a high velocity of the cooling air within the cooler and thus an effective cooling of the air charge, which is very important in connection with the dimensions of the cooler.

This form of construction of the charge cooler is applied with special advantage with engines in which the energy inherent in the exhaust gases, is utilised to produce an additional propelling force by discharging them through nozzles.

In this case the air leaving the cooler in a relatively cool condition may be used without special guide means together with the air passing over the cylinders for the cooling of the exhaust gases which results in the heating of both. In this manner and owing to the high velocity it contributes to increase the propelling force.

The conduits for the air charge and also the

jacket or the conduits for the cooling air may be of any cross section and at their length being straight, curved or of any other form. In order to increase the surface impinged by the cooling air, the cooling jacket containing the tube nest and being arranged parallel to the engine axis may have an arc-shaped extension leading to the connecting branch of the blower, so that it assumes the shape of a rearwardly extending hair pin and extends in a plane through the cylinder induction branch and the engine axis. With this form of construction the cooling air which may be conducted to the air charge conduits in continuous or counter flow or in any other way, likewise enters the space between the valve casings and leaves the cooling jacket only through an opening in the vicinity of the blower branch. It is true that the deflection of the cooling air stream will somewhat reduce its velocity thus diminishing the cooling effect, which is however compensated with this form of construction by extending the cooling jacket and the tube nest to the blower branch.

Some examples of construction of the cooler according to the invention are shown in the accompanying drawings:

Fig. 1 shows a side elevation of the cooler extending parallel to the engine axis;

Fig. 2 a side elevation of the cooler of hair pin shape;

Fig. 3 a view in the direction of the engine axis.

The tube nest 1 for cooling the air charge is connected to the cylinder by the branch 2 at the inlet valve casing and to the blower casing by the connecting pipe 3. The cooling jacket 4 surrounding the tube nest 1 serves as guide means for the cooling air. To improve the entrance of the cooling air the jacket 4 has an extension reaching into the space between the valve casings and assumes at its end a spout-shaped opening 5. The air entering through this opening passes along the tube nest 1 and leaves the cooling jacket 4 at the outlet opening 6 at the connecting point of the tube nest with the connecting pipe.

Fig. 2 illustrates a further form of construction, which only differs from the above described in that the cooling jacket 4 containing the tube nest 1 is extended to the blower branch 7. The cooling air leaves the jacket 4 through its opening 8 in immediate vicinity of said branch 7. As shown in Fig. 3 the cooler extends in a plane through the cylinder induction branch and the engine axis.

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