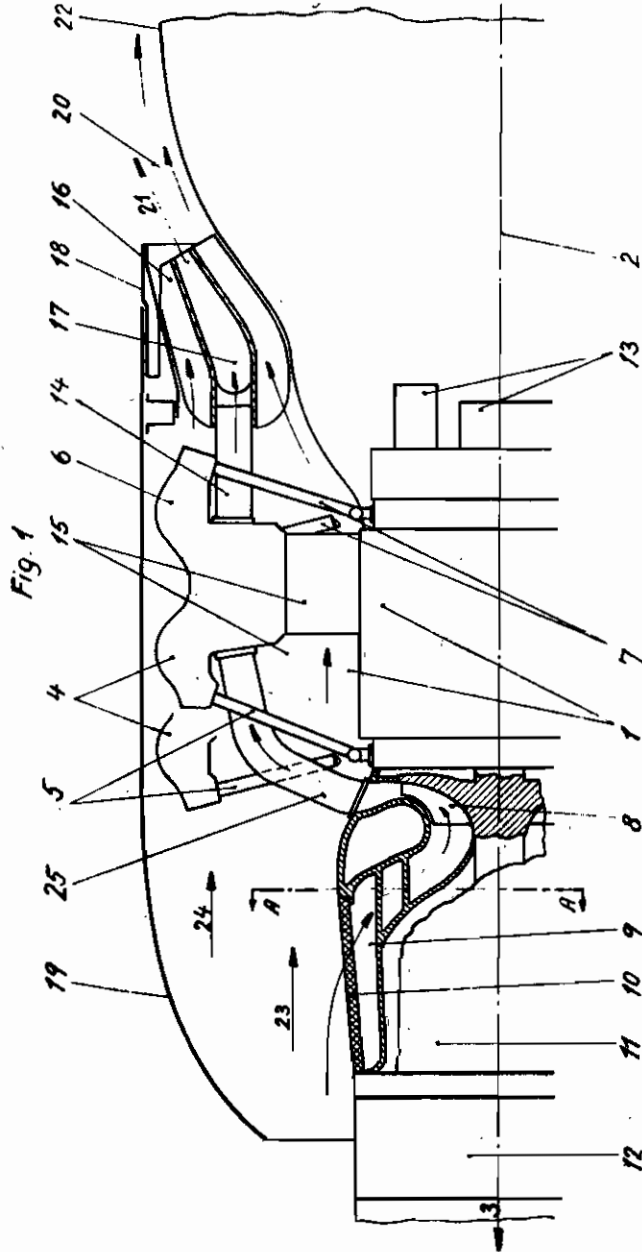


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AIR COOLED RADIAL ENGINE  
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296,469  
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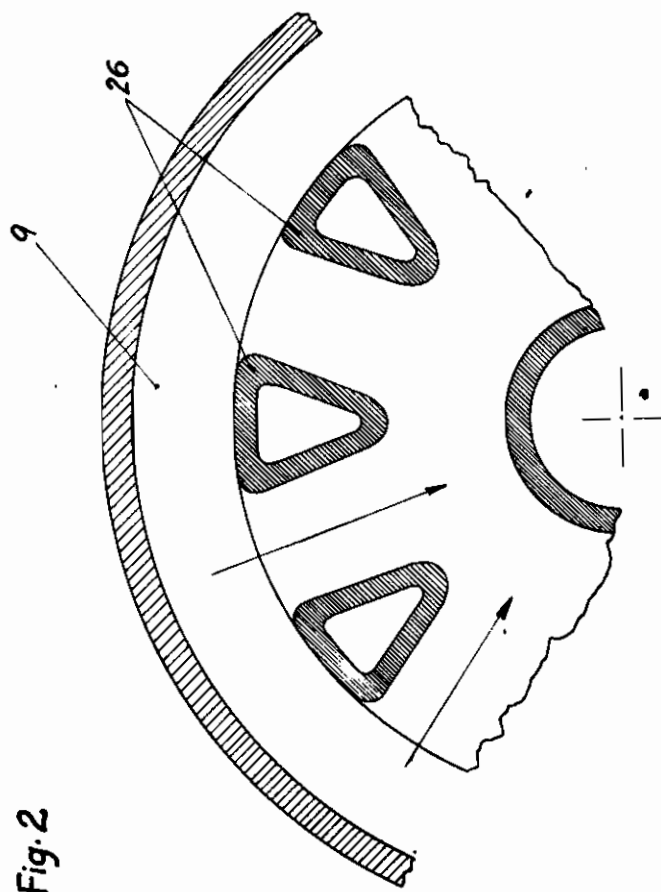


Fig. 2

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# ALIEN PROPERTY CUSTODIAN

## AIR COOLED RADIAL ENGINE

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Application filed September 25, 1939

The invention relates to the conformation of air cooled radial engines and particularly to double-row radial engines with fuel injection and wherein a charging blower with one or more stages is used.

It is known, in connection with radial engines, to fit the blower for precompressing the charging air at the rear of the engine. The air is lead to the blower through intake hoods or through pipes which are arranged outside along the engine covering and terminate within the front part of the engine cowling.

With the usual form of construction the air stream is deflected by 180° on its way to the blower and is subjected to a further deflection of about the same amount within the cylinders of the engine.

In this manner there will not only occur a loss in output owing to the increased flowing resistance in the pipes and the air resistance caused thereby, but also the arrangement of the guide means for the air must be realized at the cost of simplicity and clearness.

For eliminating these disadvantages the invention proposes to arrange the blower coaxially with the crank shaft at the crankcase between engine and propeller. In addition to that the blower is provided on the one hand with one or more suction pipes, which may be of annular form and surround the casing between blower and propeller and on the other hand put in connection with the inlet openings of the cylinders, in case of need by interposing a cooling device for reducing the temperature of the charging air which has passed the blower. The cylinder heads or the corresponding inlet and outlet valves are preferably arranged so that the plane through the valve stems of each cylinder will coincide with the direction of the longitudinal axis of the engine so that the charging air stream will flow in a direction opposite the direction of travel or flight and find its continuance in the exhaust gases escaping in the same direction.

In this way there is obtained a most simple arrangement of the pipes which not only involves considerable advantages as to the manufacture, but also regarding the guidance of the charging air and of cooling air stream. Further there is avoided an additional air resistance of the vehicle or the aircraft by the arrangement of the pipes outside the engine covering.

Another essential advantage obtained by the arrangement according to the invention consists in the fact that the auxiliary devices as the starter, the dynamo etc. may be mounted directly

to the crankcase as originally made in radial engines without blowers, thus partly eliminating the disturbances produced by the disadvantageous arrangement of the auxiliary devices caused for want of place, which is of great importance especially in airplanes.

Furthermore it is now possible owing to the increased dimensions of the space available behind the engine, instead of pipes to arrange for the exhaust gases an annular pipe which may be provided with cooling ribs and located in the vicinity of the spreading flaps or of a sliding ring for controlling the outflow cross sectional area of the cooling air, so that the exhaust gases, distributed substantially uniformly around the entire periphery of the engine covering, pass out eventually together with the cooling air and serve by so doing in an advantageous manner for the production of an additional propelling force on the vehicle or the aircraft, for instance by smoothing the eddies occurring on the surface of the vehicle or the aircraft or by accelerating the limit air layer.

The valve timing of the engine constructed according to the invention is preferably effected by operating all valves by two cam rings or cam discs or the like of which one is arranged in front of the engine and the other behind it, the first serving for timing all inlet valves and the second for timing all outlet valves. The advantage of mode of operating the valves resides, besides in the simplicity of the members needed for the operation, in the possibility to effect in a simple manner a modification of the timing relation of the inlet and outlet valves by turning one of the cam rings or discs.

One example of construction of the subject of the invention is shown in a simplified form in the accompanying drawing, wherein

Fig. 1 shows a double row radial engine according to the invention; and

Fig. 2 shows a cross section on the line A—A in Fig. 1.

The double row radial engine 1 represented in the drawing is in driving connection with a propeller (not shown in the drawing) turning about the longitudinal axis 2 and propelling the vehicle or aircraft in the direction 3. The inlet valves 4 are operated by the push rods 5, and the outlet valves 6 by means of the push rods 7. To the engine 1 there are applied in the direction of the propeller, coaxially to the longitudinal axis 2, the cam disc (not shown in the drawing) for the inlet valves, the charging blower 8 with annular suction pipe 9 which is provided with a

filter 10 to prevent dirt from entering it, the multiplication gear 11 for the blower 8 and the reduction gear 12 between engine 1, and propeller. On the rear of the engine 1 there is provided the cam disc, to begin with, (not shown in the drawing) for the outlet valve. Further there are located the auxiliary devices 13 and the exhaust pipes 14 of all cylinders 15, which lead to an annular pipe 17 provided with cooling ribs 16. The exhaust gases leave the annular pipe 17 in the vicinity of the sliding ring 18 for controlling the outflow cross sectional area 20, provided in the engine covering 18, and flow out in the direction 21. It is of course also possible to discharge the exhaust gases of the cylinders 15 by separate pipes terminating in the vicinity of the outflow cross sectional area 20.

As already known it answers best the purpose to be obtained, no matter whether separate pipes or one annular pipe 17 are used, to reduce the cross sectional area of these guide means in the direction of flow 21 of the gases so that they pass out at a higher velocity than that of the air which passes over the engine covering 18 or the fuselage part 22 adjacent thereto, thus producing an additional propelling force and smoothing out the eddies on the surface of the vehicle or aircraft by this utilising a great part of the energies still inherent in the exhaust gases.

Furthermore, reference is made to special construction of the walls 26 shown in section in Fig. 2, which provide a rigid connection of the opposite parts of the casing forming the suction

pipe 8 of the blower 8. By selecting the form of construction of the walls 26, as shown in the drawing there is not only obtained a high bending and torsion strength of the corresponding parts, but also the possibility to connect the control members or the like in the front part of the crankcase or of the propeller with the auxiliary devices 13 or the pilot's cockpit. A further advantage of this form of construction consists in that by the arrangement of walls in the suction pipe of the blower the filaments of flow will be straightened. By a proper selection of the direction of the walls 26 these may simultaneously impart a twist to the air passing over them.

In the case of the construction and the arrangement of a double row radial engine according to the invention as described, which, however, also may be applied to radial engines with one or more rows, in the latter case after a modification of the valve timing, the air stream entering the covering 18 is divided into the charging air stream 23 and the cooling air stream 24, the latter passing over the engine and its charging air pipes 25 and the exhaust pipes 14 or the annular pipe 17. Instead of the pipes 25 a charging air cooler may be fitted with great advantage. The approximate course of the air stream being divided in the manner described and entering the covering 18 is indicated by arrows.

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