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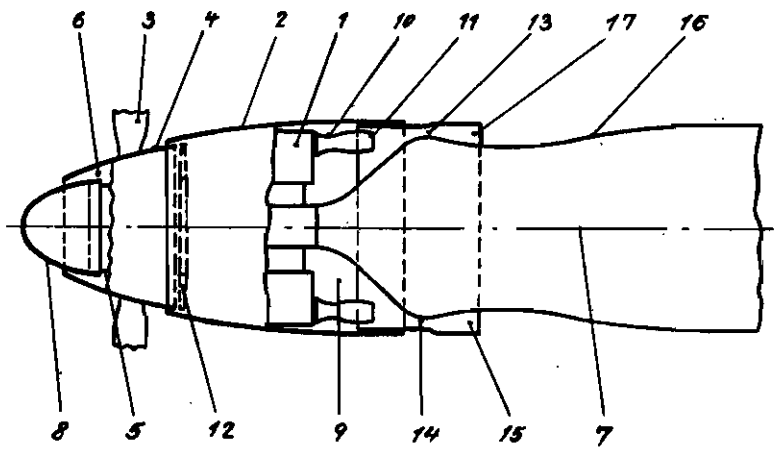

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CONTROLLABLE COWLING FOR AIR-COOLED INTERNAL COMBUSTION ENGINES

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It is known to use e. g. for radial engines an annular element arranged slidably in the direction of axis on the engine cowling or spreading flaps arranged circumferentially on the cowling for the purpose of controlling the cross-sectional area of the air—resp. gas outlet.

Regulating devices of the above type, however, in connection with the construction of the baffles have the great disadvantage that they permit an efflux of the air resp. exhaust gases in a direction including an oblique angle with the direction of flow passing outside the cowling, so that enlargement and eddying of the boundary layer takes place, which forcibly causes an increase of the profile drag. When utilising spreading flaps the increase of this drag is most striking. A further circumstance of an unfavourable effect is that by varying the outlet cross-sectional area simultaneously the control of the air quantity is effected and thus up to now mostly it was not possible to equalise velocity and pressure of air resp. gases to the conditions prevailing in the atmosphere, so that always a difference in velocity resp. pressure of a varying amount exists thus still increasing the above mentioned unfavourable effects.

In order to obviate these disadvantages according to the invention it has been proposed to control the quantity of air not by regulating the outlet cross-sectional area but at another point e. g. at the air inlet of the engine cowling, e. g. by a control device consisting of a cap of the like movable in the direction of travel and to provide an eventually annular outlet passage or several outlet passages of diffuser type extending approximately parallel to the longitudinal axis of the engine and arranged at the periphery of the nacelle resp. of the fuselage of an aircraft resp. vehicle, one wall of said outlet passages representing the wall of the nacelle resp. of the fuselage whilst the other wall is formed by an annular element or the like, slidable in the direction of the langitudinal axis and eventually subdivided resp. provided with recesses.

By the proposal according to the invention it is possible to provide an efflux of the escaping gases—the word gases taken in a general sense—in the direction of flow of the outer air and in any case to choose the length of the diffuser-like passages and the cross-sectional area of the outlet conditioned therethrough, by displacing the annular element resp. the parts thereof so that the amount of velocity resp. of pressure of the gases escaping from the passages is equal resp. approximately equal to the corresponding amounts of the atmosphere passing along the passages in order to avoid by equalising the velocities resp. pressures any kind of increase in drag to a far extent. Of course it is also possible in order to accelerate the boundary layer flowing over the adjacent fuselage par resp. in order to originate an additional propelling force to permit the gases to flow out with a higher velocity.

A great advantage according to the invention is to arrange the annular element resp. its corresponding control member possibly in extension of the nacelle—resp. fuselage wall or of the engine cowling inserted seen in the direction of travel in advance thereof and to effect the regulation of the length of the passages resp. of the outlet cross-section or cross-sections by displacing the corresponding control member and to determine the diffuser-like enlargement of the passage cross-sectional area in the direction of flow of the gases only by correspondingly dimensioning of the diameter resp, cross-sectional area of the nacelle resp. of the fuselage.

With regard to the course of flow it can further be of advantage to gradually enlarge again the above mentioned diameter resp. cross-sectional area in the direction of flow, taking regard however to an aerodynamically favourable form, and that e. g. to an amount corresponding to the dimensions of the annular element, so that the original cross-sectional areas can be obtained not only for reasons of space but at the same time an acceleration of the boundary layer and an equalisation of the differences eventually still existing, with regard to velocity resp. the direction of flow takes place.

A far-reaching equalisation of this magnitudes is realised according to the invention already within the fairing parts through the circumstance that the gases are forced to flow from the collecting space behind the cylinders first through a contraction constituted between the nacelle or the fuselage and the annular element resp. the wall in advance thereof, before reaching the diffuser-like passage resp. passages in which the acceleration is followed by a retardation of velocity to the already abovementioned amount adjustable by the displacement of the annular element, takes place.

For regulating the length of the passages resp. the effective area of the outlet cross-section and thus the outflow velocity resp. the pressure of the gases the annular element resp. its corresponding parts are used as it appears from the above. The adjustment of the latter can be effected manually or automatically by a control

device operating in response to the relative velocity and/or the pressure difference between the gases leaving the passages and the atmosphere and eventually in accordance with the regulation of the air inlet.

In an advantageous manner two stem tubes can be used for this purpose one of which being arranged within the passage to be controlled and the other exposed to the atmosphere. These tubes are connected with the part in question to be controlled in case of need by inserting a servo-motor in such a manner that an occurring difference in velocity resp. pressure will adjust this part in such a sense that the difference becomes zero or approximately zero as owing to the difference in temperature an exact equalising of velocities and pressures cannot be obtained.

As a matter of course for increasing the propelling force the regulation can be effected also in such a manner that a predetermined adjustable difference is maintained.

Further it appears to be advantageous especially for accelerating and straightening the air delivered from the engine and flowing to the passages to arrange a device comprising a nozzle and/or an adjacent diffuser connected to the outlet openings of the cylinder, which device permits the exhaust gases delivered from the engine to enter approximately in the direction of flow of the atmosphere into the space between engine and outlet passages at a velocity greater than that of the air delivered to the passages.

Further advantageous particulars are described in the following:

The drawing shows the object of the invention by one form of embodiment, representing an engine cowling in longitudinal section.

The engine cowling serving for fairing the cylinder star 1 is subdivided and consisting of a stationary part 2 and a part 4 rotating with the propeller 3. On the propeller hub 5 is arranged a cap 8 slidable in the direction of axis 7 for controlling the cross-sectional area of the annular air conduit 6 to the engine 1 is arranged, which cap has the advantage to reduce the profile drag caused by the inflow of air in any case to the smallest possible degree.

The air entering through the conduit 6 serves as usually partly to charge and partly, i. e. the remaining part, to cool the engine 1. The latter part reaches, after flowing over the cylinder star 1, the collecting space 9 behind the cylinders, in which space the junction with the exhaust gases takes place, which for straightening their stream lines, for equalising the differences in velocity, and for conforming their velocity to that of the cooling air have flown through a device connected to the outlet openings of the engine 1, each device comprising a nozzle 10 and a diffuser 11. If in this case the outflow velocity of the gases is chosen in a manner known per se greater than that of the air, the output of the fan 12 resp. of its corresponding device can be reduced or completely saved.

The air straightened and accelerated as above described is submitted to a further acceleration first when entering the annular passages 13 shaped according to the invention, i. e. when flowing through the nozzle-like contraction at 14 and is then brought in the diffuser-like part 15 of the annular passage 13 to the velocity resp. pressure of the air passing outside the cowling 2, 4, so that when these two flows join no remarkable disturbances will occur and thus an important reduction of the profile drag existent up to now is realised.

To obtain a complete equalisation of the differences in speed eventually still existing within the gases leaving the passage 13 resp. in order to accelerate the boundary layer, flowing along the wall 16 of the adjacent nacelle resp. fuselage and increasing the profile drag, it is eventually of advantage to gradually enlarge again according to the invention the diameter of the nacelle of fuselage 16 e. g. to an amount corresponding to the dimensions of cowling part 2.

As it appears from the drawing the nozzle— resp. diffuser-like shape of the passage 13 can be realised in an advantageous manner by a proper dimensioning of the respective diameter or of the cross-sectional area. The effective area of the outlet cross-section of the passage, upon which the outflow speed of the air resp. of the gases depends, is controlled, according to the invention, by means of an annular element 17 arranged in extension of the cowling part 2 and slidably in the direction of axis 7, said annular element being adjustable manually or automatically by means of a control device operating in response to the relative velocity and/or the pressure difference between the outflowing gases and the atmosphere. To obtain an automatic control e. g. two stem tubes not shown in the drawing, can be used in this case one of which being arranged within the passage 13 to be controlled and the other exposed to the atmosphere.

From all the above mentioned appears clearly that the device according to the invention is not only of special advantage for guiding the air resp. the gases flowing into the atmosphere, but also shows in connection with means for obtaining additional propelling force by utilising the energy still inherent in the exhaust gases e. g. by accelerating the cooling air current in contrast to the constructions known hitherto considerable advantages of aerodynamic nature which finally always have as a consequence an increase of efficiency of the propelling device.

It is, of course, also possible by a corresponding adjustment of the annular element 13 to cause the air resp. gases to flow out at a higher velocity than that of the atmosphere with the object to increase the propelling force.

Further, e. g. with engines mounted in the wings of aeroplanes, the passage 13 eventually can be subdivided or divided into several separate passages in such a manner that part of the air resp. gases flows out above and another below the wings. An assimilation to such conditions resp. the best possible utilisation of the same can be realised or by correspondingly dimensioning the passage cross-sectional area and/or by varying the adjustment of the parts corresponding the annular element 7.

Besides that it is possible to arrange the exhaust-gases and the cooling air separately by corresponding construction and arrangement of outlet openings and e. g. by locating the device constructed according to the invention and controlling the cooling air outflow to another place e. g. into the second half or last third of the wing profile resp. of the fuselage of an aeroplane.

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