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CYLINDER FIN CONSTRUCTION FOR AIR-COOLED ENGINES

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Fig. 1

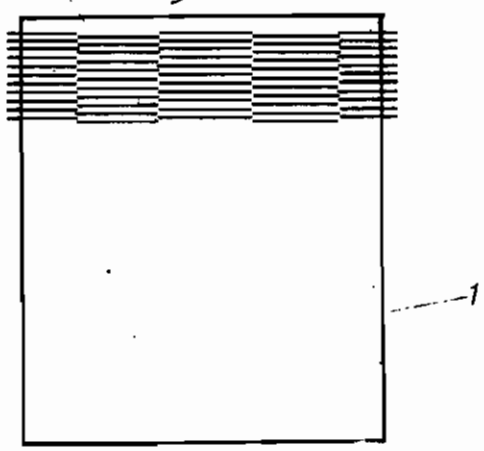
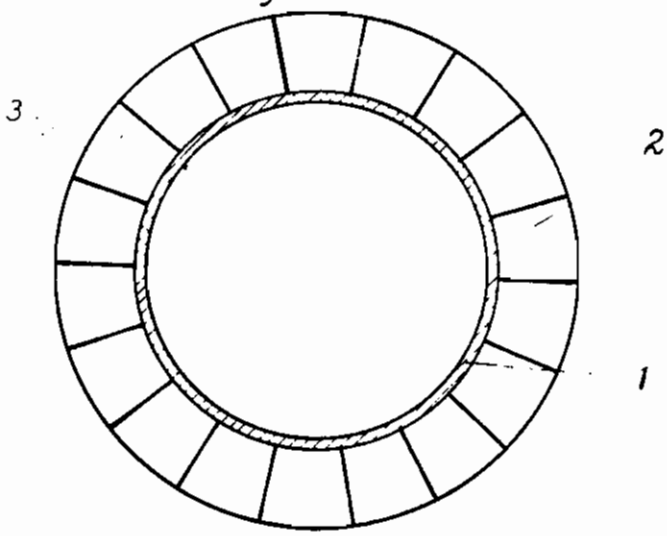


Fig. 2



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CYLINDER FIN CONSTRUCTION FOR AIR-COOLED ENGINES

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It is usual with air-cooled internal combustion engines to provide the cylinder walls with fins which are intended to enlarge the surface in order to obtain a more rapid radiation of heat produced within the cylinder to the cooling air.

There are known quite a number of most different forms of constructing fins. It has been proposed in this connection instead of arranging the fins annularly along the entire periphery to subdivide them and to arrange the different fin parts in stagger so that the air is not allowed to flow through between two radiating fins without resistance, but is forced to flow the way prescribed. All forms of construction of radiating fins, known hitherto of the said type, are based on the principle to originate a vortex motion of the cooling air stream as a consequence of its deflection and by this means to obtain a better removal of heat which is only possible at the cost of a high expenditure of output.

The object of the present invention is to provide for the removal of heat a favourable, i. e. in the first place a possibly non-vortical course of flow and to so construct the radiating fins the best possible removal of heat is obtained. By avoiding the formation of vortices at least the same cooling effect may be obtained with a considerable less power consumption. This is of great importance especially with air-cooled aircraft engines, for, as is known, the transition of heat is influenced by the variation of density, temperature and viscosity of air in accordance with different altitudes and besides that every economy of power, especially with increasing altitude, is of particular importance, precisely wth aircraft engines.

From this will result that the transition of heat must be increased with increasing altitude which e. g. may be effected by increasing the velocity of the cooling air. The cooling air velocity must be low in vicinity of the ground in order to keep this velocity within admissible limits, which requires very high radiating fins thus causing constructional difficulties. The way that suggests itself to solve the problem of obtainlng a sufficient removal of heat would be to care for a multiplication of the cooling area necessary at ground level in accordance with the provided maximum flying altitude, which fails owing to the fact that the clear span between the fins permits no further reduction for manufacturing reasons as it is already the case with air-cooled cylinders for aircraft engines.

Besides the manufacturing difficulties a reduction of the clear span between the fins is not practicable in the main for the reason that a certain lower limit must not be exceeded which is conditioned in so far, that the cooling air, when flowing along the walls, is submitted to an increasing braking effect and hence a limit layer growing with the course of flow is produced, in which a bad emission of heat takes place.

The possibility of increasing the heat transmission according to the invention is based on the fact that the limit layer continuously growing with the course of flow may be considerably reduced by interrupting the course of flow. This is obtained by subdividing in single fin parts in which case the intervals between the single plates must have about the length of the plate passed over previously in order to obtain the desired result. Owing to the diminution of the thickness of the limit layer, thus obtained, it is possible to reduce the clear span between the fins along the cylinder wall so far, that it requires no consideration. The invention provides for this reason very closely spaced fins of thin sheet metal in which case the single fin plates are in staggered relation to each other and fitted outwardly in a suitable manner.

From the knowledge according to the invention results that no constructional difficulties will occur when keeping the distance between the fins unlimited small. For this reason a cooling area has been provided which represents a multiple of the largest surface hitherto possible with radiating fins and ensures a sufficient and practicable air cooling even in the case of altitude engines; practicable in so far as the power needed for this purpose is within admissible limits.

The constructional execution of fixing the single fin parts may be realized e. g. by soldering or welding to the surface to be cooled or the single parts may be casted to the outside of the cylinder or any other manner of fixing may be choiced for the purpose in question.

It is of particular importance in this connection that in consequence of the thin-walled fins and of the unlimited small distance between the fins there does not occur any formation of vortices in spite of subdividing the fins in single plates. By giving the fin parts a stream-lined section seen in the direction of the cooling air current, it is possible to further avoid the formation of vortices. In this case approximately the entire fall of pressure along the whole course of flow, which otherwise is consumed by the formation of vortices, may be utilized to overcome the

increased wall friction occurring with the device according to the invention.

The particular advantage of the invention consists in a considerable economy of power, for in the case of heat transmission by the formation of vortices such a high expenditure of power is necessary that it is no longer in a reasonable relation to the delivered engine power, particularly for the large quantities of heat to be carried away with aircraft engines. In addition to that by the formation of vortices itself again heat is produced, which impairs the emission of heat from the cylinder wall. Besides that the fins that would be necessary for producing vortices would have a much higher weight than those according to the invention.

By subdividing the radiating fins according to the invention avoiding the formation of vortices on the one hand and by the possibility to increase the cooling area by a multiple on the other hand a substantial improvement of the transmission of heat is obtained, the power necessary for cooling being simultaneously reduced.

Many series of tests have proved that e. g. with altitude engines the cooling based on the vortex principle is not practicable at all owing to the high power necessary for this purpose. In contrast to this the power necessary for the cooling according to the invention is well within reasonable limits.

Fig. 1 of the drawing shows the cylinder 1 with the single fin plates 2 which are very closely spaced one upon another. The intervals 3 correspond about the length of the fin plates 2.

Fig. 2 is a section through the cylinder 1 showing the arrangement of the single fin plates 2.

THEODOR HELMBOLD.