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PROCESS FOR MANUFACTURING AIR-COOLED FINNED ENGINE CYLINDERS

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Fig. 1

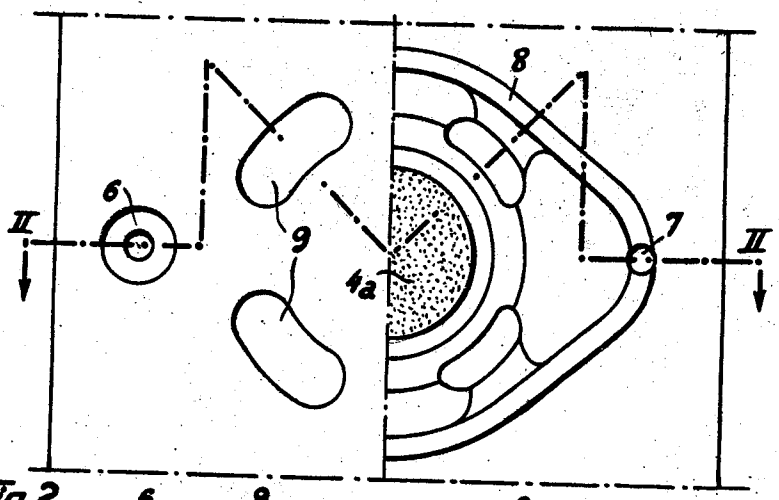



Fig. 2

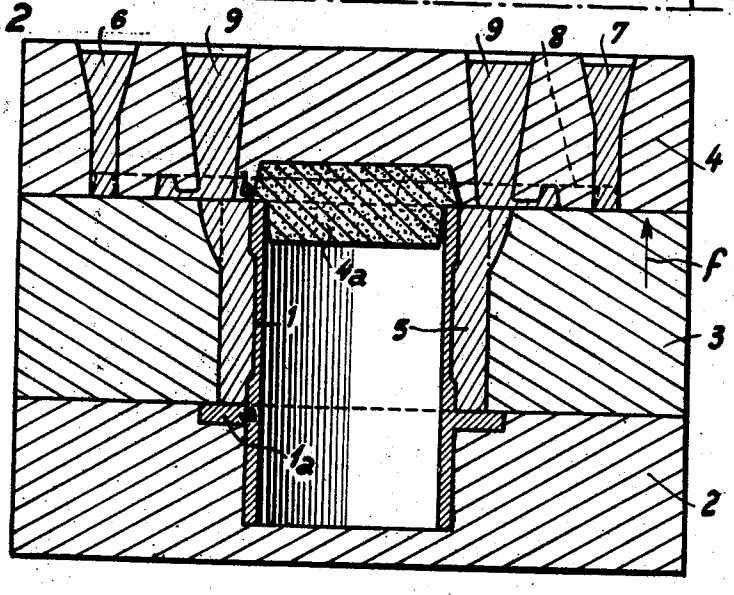
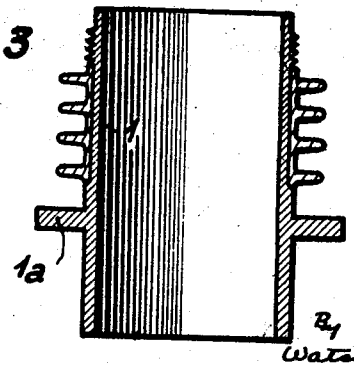



Fig. 3




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## PROCESS FOR MANUFACTURING AIR-COOLED FINNED ENGINE CYLINDERS

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2 Claims. (Cl. 22—204)

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Air-cooled engine cylinders, especially air craft engine cylinders, are usually manufactured starting from relatively thick ferrous metal tubes within whose mass and outside which fins are machined.

Obviously the disadvantage of such a process is to require relatively elaborate operations and to entail losses in ferrous metal; besides, it does not allow decreasing the weight of the engine.

It has been noted that aluminum fins provide a more efficient cooling than steel fins.

Owing to this fact, it has already been proposed to manufacture cylinders starting from steel tubes around which is cast an aluminium mass within which the fins are machined. According to such a known process, the body-portion of the steel cylinder is first dipped into a molten aluminium or aluminium alloy bath, with the purpose of coating the cylinder with an aluminium film. The cylinder withdrawn from the bath and thus coated with that aluminium film, is then laid inside a mould for castings which enables to cast a thick aluminium mass around the surface of the cylinder already coated with the initial film. After this mass has become solid, it is machined for shaping the fins. This process is performed at various convenient predetermined temperatures for subjecting simultaneously the steel of the cylinder to a thermal treatment. The first aluminium or aluminium alloy bath into which the cylinder is dipped, is at a relatively high temperature corresponding to a preharden-ing heating. As soon as the member is withdrawn from this former bath, it is dipped into a second one at a lower temperature, so as to achieve a hardening which is then completed by cooling in ambient air. The final casting of the aluminium mass into the mould is carried out at a still slightly lower temperature, thus causing some sort of tempering.

This process is liable to lead to results of interest, but it is too elaborate. It further requires large scale industrial equipment.

The process of the present invention is of much simpler operation, while leading to important results both as regards economy and cooling efficiency.

The present invention relates to a process for manufacturing air-cooled engine finned cylinders wherein a steel cylinder blank, having previously undergone the usual thermal treatment and been machined on at least its outer surface, is coated electrolytically over at least a part of said outer surface with a metal film, a metal mass designed to be shaped into fins being then cast around said metal film.

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According to a feature of the invention the film is made of tin, the cylindrical blank being preferably of steel and the fins of a light metal or alloy, for instance aluminium.

The electrolytically deposited film is conveniently of small thickness: one to a few hundredths of a millimetre. The ferrous metal cylinder thus coated at ambient temperature, is next laid inside a mould for castings with the provision of an annular space into which the light metal or alloy mass designed for making the fins, is poured.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the accompanying drawing forming a part of this application and in which like numerals are employed to designate like parts throughout the same:

The left half of Fig. 1 is a horizontal projection of the mould as seen from above, and the right half shows the lower side of the upper part of the mould as seen in the direction of arrow *f*,

Fig. 2 is a section along broken line II—II of the mould and of the cylinder previously coated with tin, and

Fig. 3 is an axial section of a finished cylinder.

The steel cylinder 1 (Fig. 2) with its fixing flange 1*a* is of a type commonly found in aircraft engines. However, it may be noted that this cylinder is different from the common non-machined cylinders in so far as it is much thinner since it does not carry its finning. Thus for instance, although the common type cylinders as forged before machine-finishing, are about 30 to 40 millimetres thick, the cylinder illustrated in the drawing, completely machine-finished on its outer surface designed to bear the aluminium finning and in process of being machine-finished on its inner surface, is about 5 millimetres thick.

This cylinder is first cleaned or sand-blasted on its outer surface, then it is coated with tin by electrolysis in the zone *a*—*b* of its outer surface, the electrolysis being stopped as soon as the thickness of the tin layer reaches one to two hundredths of a millimetre. The cylinder thus coated with tin is heated to a temperature of about 120° C. and is then laid, at that temperature, inside a mould for castings.

The drawing shows a sand mould comprising three parts 2, 3, 4 arranged one on top of the other, the lower part 2 forming the seating of the cylinder, the medium part 3 being provided with an annular space 5 between itself and the cylinder, for receiving the aluminium or aluminium alloy, and the upper part forming a lid. A sand

core 4a inserted between this lid and the cylinder, constitutes a plug preventing molten metal from flowing into the cylinder. The light alloy is poured into the mould through two inlets 6, 7 leading to the annular space 5 by way of a launder 8 meant to distribute the metal all around space 5 while quiescing it. Both inlets 6, 7 may be simultaneously used to allow a quick filling of the mould. Vents 9 are provided as outlets for gases. The lid being thick, a pressure casting is possible. The pouring is stopped as soon as molten metal rises into the vents 9.

Before laying the cylinder inside the mould, it is heated to a temperature lower than the melting point of tin—for instance around 120° C.—so that, when pouring starts, the tin layer which has slightly cooled down, is at a temperature of about 100° C. This enables to achieve excellent adhesion and continuity between light alloy and tin, and hence between the light alloy and the steel of the cylinder.

After the casting, cooling down is allowed to take place naturally. Drawing is then effected and the risers corresponding to vents 9 are cut off; it only remains to machine-finish the fins out of the light metal mass integral with the cylinder, and then to finish the cylinder itself.

The casting of light metal in a sand mould may obviously be replaced by a chill casting under pressure.

It is to be understood that the form of the invention herewith shown and described is to be taken as a preferred example of the same and that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claims.

We claim:

1. In a process for manufacturing aircooled engine finned cylinders wherein the outer surface of a steel engine cylinder is united with an external mass of aluminium alloy shaped into fins, the steps which comprise: machining the outer surface of a steel engine cylinder blank, electrolytically depositing tin on said outer surface to provide a homogeneous and thin layer of tin in ring formation around said outer surface, stopping the electrolysis when the thickness of the tin layer reaches a value lying substantially between one and two hundredths of a millimeter, and pouring aluminium alloy in molten state around the electrolytically deposited tin layer and in direct contact therewith.

2. The process of claim 1, wherein the cylinder blank provided with the electrolytically deposited tin layer is heated to a temperature lower than melting point of the tin before pouring light alloy.

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