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BY A. P. C.

A. LESAGE

INSIDE-LINED LIGHT METAL ENGINE-CYLINDER AND METHOD OF MAKING SAME

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Fig. 2.

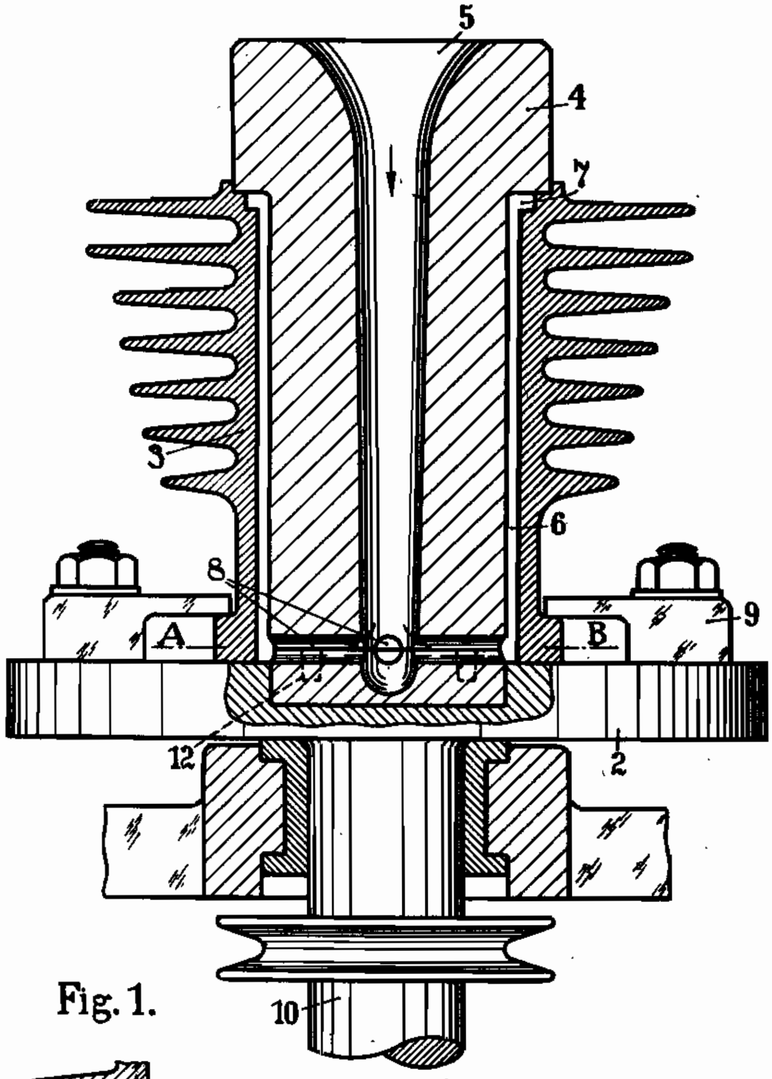
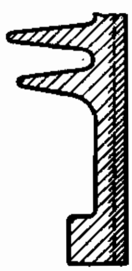



Fig. 1.



Inventor

Alfred Lesage

per

Dean Fairbank & Hirsch

his Attorneys

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# ALIEN PROPERTY CUSTODIAN

## INSIDE-LINED LIGHT METAL ENGINE-CYLINDER AND METHOD OF MAKING SAME

Alfred Lesage, Schweinfurt, Germany; vested in the Alien Property Custodian

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This invention relates to cylinders of engines, and more particularly internal combustion motors made of light metal, with a view of preserving the inner face thereof from wear by the application thereto of a lining of harder and stronger metal or alloy.

In order that motor cylinders made of aluminium or aluminium alloys are prevented from quickly wearing out it has repeatedly been suggested to coat the surface of contact with the piston with a layer of higher hardness. For instance, for this purpose there has been utilised the well-known metallization process for creating a layer of iron or of another metal in this way. On the surface of contact also galvanic deposits of hard metals have been produced or iron or steel liners have been pressed by means of hydraulic presses into the bore of the cylinders. In all these methods is inherent the inconvenience that the coat forming the surface of contact with the running piston is insufficiently united with the light metal cylinder proper and that the heat is thus carried off rather poorly.

The object of the invention is to do away with the said drawbacks by the lining being obtained by pouring liquid metal, preferably iron, steel or a hard aluminium alloy, into the cylinder, e. g. with the aid of a special core which can be readily removed subsequently. Preferably the liquid metal is poured through a central bore of the core centered within the cylinder, and through ducts branched from said bore and directed to the inner face of the cylinder; there the melted metal enters the annular channel between the cylinder and the core so as to fill the same as far as the top and to intimately unite itself with the inside of the light metal cylinder by fusing the adjacent face thereof, thus substantially forming an intermediate alloy of the two metals at their contacting faces, as diagrammatically illustrated in Fig. 1 by a partial sectional view of the cylinder wall and liner. This will result in a better transmission of heat to the cooling ribs of the cylinder.

The union between the different metals can even be improved in such a way that while the liquid metal is being poured the cylinder together with the core in place is subject to a rapid rotation so that by the centrifugal force the metal is under higher pressure urged into the annular channel and against the interior surface of the cylinder so as to form a coating of higher density.

Other objects and advantages will appear in the following specification while the features of the invention will be pointed out in the appended claims.

The annexed drawing by way of example shows a device for carrying out a method for the production of the liner. Fig. 2 is a sectional elevation of the cylinder and the core placed therein. This figure also shows means for centrifuging in side elevation, partially in section.

The cylinder **3** made of a light metal, such as aluminium or its alloys, is secured e. g. by means of clamps **9** to a support **2** which also closes its bottom end. A core **4**, which may comprise several parts and is provided with a central bore **5** for the reception of the liquid metal, is put into the bore of the cylinder. Between the inside surface of the cylinder **3** and the peripheral surface of the core **4** there is left an annular space **6** the width of which depends on the thickness required of the cylinder liner and on the liquidity of the metal used for the latter. At the top of the cylinder, which is closed by a shoulder of the core, the bore of the cylinder is flared as at **7** in order that in this place a flange securing the liner to the cylinder is formed. From the bore **5** there are in any suitable hight branched radial channels **8** which communicate with the annular space **6**. In order that the core **4** is centred more reliably the closing support **2** is e. g. provided with a depression into which the bottom end of the said core extends while at the top end this core may be engaged with the cylinder.

The same device may also be used for casting with the assistance of centrifugal force inasmuch as the support **2** carrying the cylinder is fast on a vertical shaft **10** adapted to be rotated at high speed about the axis of the cylinder **3**. When this is done the liquid metal is caused to flow under higher pressure in an outward direction in the channels **8** so that it rises in the annular space **6** more quickly and is given a denser structure therein.

The use of the special device for pouring the metal results in certain advantages. The core **4** which may be fastened in any suitable way in the cylinder extends beyond the top by any length desired so that a high lost head is obtained. It is preferably made of a bad heat conductor in order to prevent the metal poured in from quickly cooling down. To this end it may be moulded of sand or a heat resisting material. In the first instance it can readily be removed by being crushed while a solid core would at least be made in two parts the joint of which is disposed about in a plane passing through the channels **8**, as indicated by the broken line A—B of Fig. 2, the two parts being interconnected by dowel pins **12**. Then the top portion of the core, which has a slightly tapered peripheral surface, can readily be withdrawn upwardly and detached from the lower portion.

Finally the core may even be dispensed with in case the metal is poured into the cylinder being spun about its axis in vertical or horizontal position.

The welded unification of the two different metals forming the engine-cylinder will be best attained by casting with well regulated temperatures. The light metal or aluminium alloy of the outer portion of the cylinder melting at a lower temperature than the harder lining metal, such as cast-iron, steel, hard aluminium or similar alloy, is liquefied when the latter enters the space left for the lining thereby forming an intermediate alloy uniting the two metals. By cooling the cylinder the said liquefaction can be limited to a superficial zone of the cylinder wall. On the other hand, the cylinder may be pre-heated or heat otherwise conveyed when the temperature of the lining metal does not suffice to melt the cylinder wall superficially.

The compound engine-cylinder above-disclosed has the advantage that its structure is not anywhere interrupted so that continuous transmission of the heat resulting from the combustion to the cooling ribs takes place while extension by heat is almost uniform throughout.

ALFRED LESAGE.