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CYLINDRICAL SURFACE OF INTERNAL COMBUSTION ENGINES

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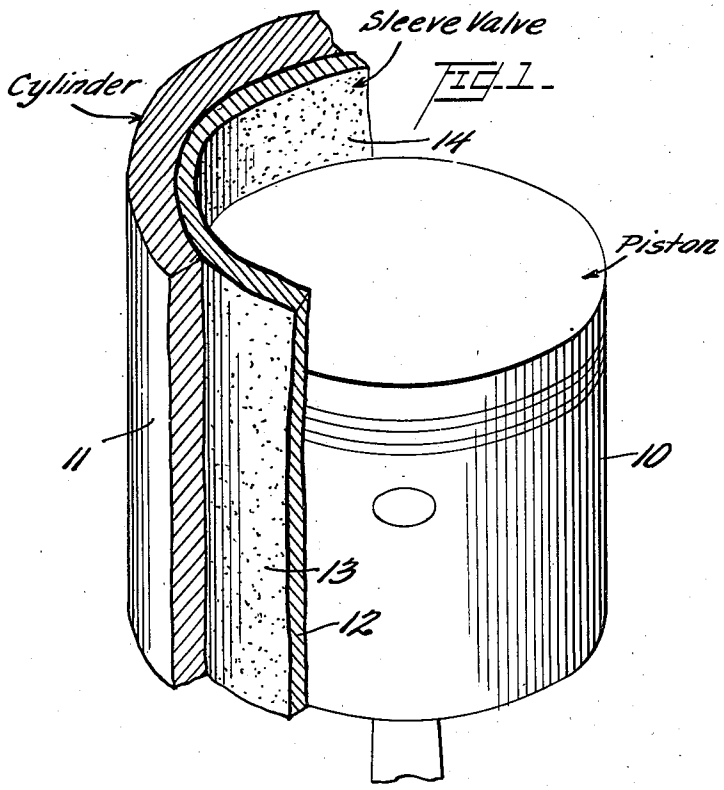

FIG. 1.

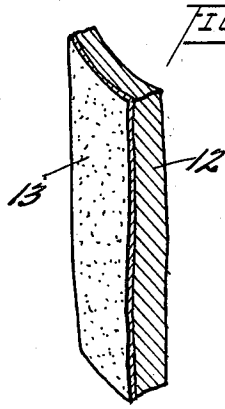

FIG. 2.

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CYLINDRICAL SURFACE OF INTERNAL COMBUSTION ENGINES

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1 Claim. (Cl. 309—2)

This invention relates to the cylindrical surfaces of internal combustion engines subject to sliding friction, the parts having such surfaces being made of an alloy which is either an alloy of aluminium or magnesium or an alloy having a coefficient of expansion substantially similar to that of aluminium or magnesium alloys, such alloy having also a good thermal conductivity, that is to say it is not less than the thermal conductivity of high carbon steel, say 0.55% carbon steel. Suitable alloys having the desired properties may be those of which the base metals are aluminium, magnesium, copper or silver. The invention has for its object to provide a cylinder, cylinder liner or sleeve valve which is made of such an alloy as is indicated above, and has a hardened surface which can be satisfactorily lubricated and will resist abrasion.

According to this invention, a cylinder, cylinder liner or sleeve valve made of an alloy as above defined has a surface which is in rubbing contact with another cylindrical member coated by a metal spraying process with a layer of a hard metal, for example a steel, which when thus deposited provides a good oil-carrying surface and will resist abrasion. The sprayed-on layer may be formed of a steel such as a .75% carbon or like steel, or it may be formed of another metal which has a hardness comparable to that of steel from the aspect of resistance to abrasion. A metal such as indicated applied as a coating by the spraying process referred to has a degree of porosity, not only when the coating is first formed but after the member thus coated has been "run in," this porosity causing the coated surface to act as an oil carrier.

As mentioned, an alloy of aluminium, magnesium, copper or silver may be used to form the member on to which the metal coating is sprayed. It is particularly advantageous, from the practical point of view, to provide a sprayed-on hard coating as indicated on the bore of a cylinder made of what is commonly known as a "light alloy," that is to say an alloy of aluminium or magnesium. The sprayed-on coating may be deposited directly on the cylinder bore or a separately formed liner having its inner surface thus coated may be inserted in the cylinder bore. A cylinder liner or a sleeve valve may be constructed of some other metal, a copper or silver alloy being indicated by way of example, such a metal having the properties mentioned, namely the coefficient of expansion and thermal conductivity indicated. A sleeve valve may have both its inner and outer surfaces provided with such a coating of metal as described. Alternatively, the inner surface only of the sleeve valve may have this coating, the outer surface lying and moving in contact with the bore of the cylinder or a liner fixed therein the surface of which in either case may have been provided with such a coating as above referred to.

The metal employed in carrying out the invention in the manufacture of a cylinder, cylinder liner or sleeve valve must have a coefficient of expansion which may be indicated as 16×10^{-6} per degree centigrade, or rather over this number, the expansion coefficient being thus approximately equal to that of what is commonly referred to as a "light alloy," that is to say an alloy of aluminium or magnesium. With regard to the thermal conductivity which the metal employed should possess, this may be defined as being not less than that of 0.55% carbon steel.

With regard to the metal which constitutes the sprayed-on coating, this must be a hard metal which is substantially harder than a surface of that member which is in rubbing contact with the coated surface. For instance if the surface thus coated is the inner surface of a sleeve, which in itself may constitute a liner fixed in a cylinder or may be a reciprocating sleeve valve, then the sprayed-on metal coating must have a hardness greater than the hardness say of the surface of the skirt on a piston which reciprocates within the sleeve. A metal other than steel may be employed, if found suitable for deposition by a spraying-on process, and if such metal has a hardness comparable to steel or is substantially harder than the base metal on to which it is sprayed. Also the metal when thus deposited must not only resist abrasion, but provide a good oil-carrying surface by reason of its having some degree of porosity.

The spraying-on process as at present conveniently employed for the purposes of this invention is a known process.

A cylindrical part or member of an internal combustion engine as indicated and provided with a hardened surface as described above is to be distinguished from, say, a cylinder which has on its surface a layer of a metal, such as chromium, formed by electrodeposition or some like process. In that case, the hard surface produced tends to have so great a smoothness as to prevent its carrying readily the oil necessary for lubrication. On the other hand, where the surface has been produced by spraying-on of the hard metal, the surface has a degree of porosity which tends to persist even after that smoothing

of the surface which results from "running in" the reciprocating part which has been treated or which moves in contact with the treated surface.

In the known process as used in the present invention there appears to be no fusing or alloying of the metal which is sprayed on with the metal of the surface on which it is applied. Thus the spraying-on of the metal does not cause undue heating of the base metal in the part treated and hence does not interfere with the heat treatment to which that part may have been subjected.

In carrying the invention into practice the surface of the cylinder, cylinder liner or sleeve valve is sprayed with a hard metal and this surface may then be ground or otherwise finished. It is found that this grinding does not destroy the original porosity of the layer which thus constitutes a good oil-carrying surface.

One suggested means of carrying the invention into practice is illustrated in the accompanying drawing, in which:

Figure 1 is a fragmentary perspective view of an automotive engine cylinder and piston assembly, in which a sleeve valve is interposed between the piston and cylinder walls; said parts being shown broken away for clarity of illustration; and

Figure 2 is a fragmentary perspective view of an outer portion of the sleeve valve showing the novel coating applied thereto.

In the drawing the piston is indicated by the reference numeral 10, the cylinder by the numeral 11 and the intervening sleeve valve by the numeral 12. The sleeve valve has the hard metal coating, which has already been described, applied thereto on both sides, as indicated by the reference numerals 13 and 14. It is apparent from the previous descriptions that this is but one embodiment of the invention and if desired the walls of the cylinder or of the piston, or the wall of but one side of the sleeve valve, may be so coated, the co-acting walls being, of course, of the materials described in the earlier portions of the specification.

What we claim as our invention and desire to secure by Letters Patent is:

In an internal combustion engine, the combination with a cylinder made of a light alloy, of a sleeve valve made of a copper base alloy having a coefficient of expansion of at least 16×10^{-6} per degree centigrade and a thermal conductivity which exceeds that of high carbon steel, the coefficient of expansion of the sleeve being slightly lower than that of the light alloy of which the cylinder is made and the strength and elasticity modulus of the sleeve being higher than those of said light alloy, said sleeve valve having a sliding fit with said cylinder and having its inner surface spray-coated with a layer of a metal which is substantially harder than the base metal of which the sleeve valve is formed, this metal when sprayed on having a degree of porosity which causes the coated surface to act as an oil carrier as set forth.

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