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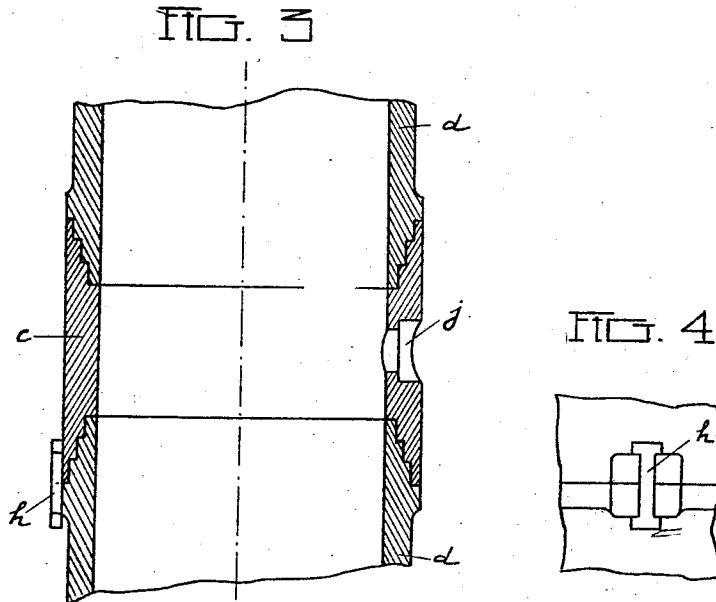
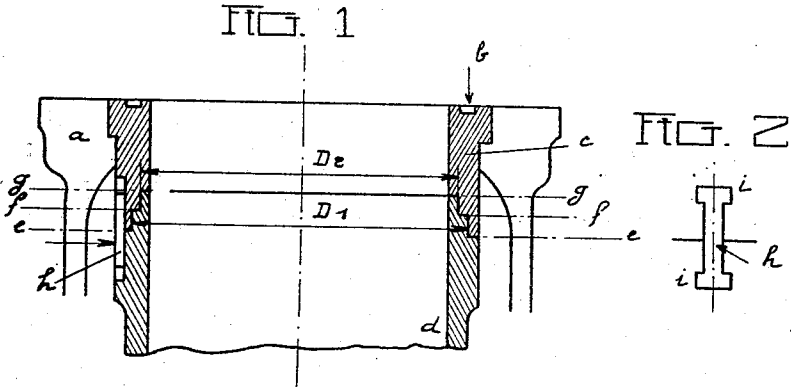
March 17, 1925.

J. ROMEYN

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LINER FOR CYLINDERS OF INTERNAL COMBUSTION ENGINES

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LINER FOR CYLINDERS OF INTERNAL-COMBUSTION ENGINES.

Application filed January 15, 1924. Serial No. 636,374.

To all whom it may concern:

Be it known that I, JEAN ROMEYN, a citizen of the Kingdom of Netherlands, and resident of Brussels, Belgium, have invented certain new and useful Improvements in or Relating to Liners for Cylinders of Internal-Combustion Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked therein, which form a part of this specification.

The present invention relates to multi-part liners for cylinders of internal combustion engines.

It is known to make the part of the cylinder which is in contact with the hot gases at or near the inner dead center of steel, which may be forged or cast, whereas the parts subjected to the friction of the piston rings are made of cast iron and are fixed to the first named part by pressing adjacent ends of the parts one into the other.

The invention relates especially to means for firmly securing the parts together.

It consists in using bars provided with heads at both ends, which are forced or shrunk into grooves formed in the outer surface of the liner.

In order that the invention may be easily understood, it is illustrated by way of example in the accompanying drawing in which:

Figure 1 is a central longitudinal section through the upper part of a cylinder liner,

Figure 2 is a detail thereof,

Figure 3 is a central longitudinal section through a liner for a cylinder of an internal combustion engine of the opposed piston type and

Figure 4 is a detail thereof.

Referring to Figure 1, the liner, which is placed in the water jacket (the upper part of which is shown at *a*) in the known manner and which has at *b* the usual circular groove to receive the packing joint against which the cylinder cover is secured, consists of two parts *c* and *d*.

The part *c* is of forged or cast steel, whereas the part *d* is of cast iron. The latter is so long that the piston rings continuously remain within it, and the part *c* surrounds the combustion chamber, i. e. the part of the

cylinder in which the highest temperature is developed. The part *d* is pressed into the lower end of the part *c*. As shown, the end of the part *d* is preferably stepped and the end of the part *c* is shaped correspondingly for the purpose hereinafter explained.

A comparison can be made between the stresses due solely to the press fitting in two adjacent portions of the liner, namely: first between the planes *ee* and *ff*, and second between the planes *ff* and *gg*. Assuming that the shrinkage, i. e. the slight difference of diameters foreseen, is the same in parts *ee-ff* and *ff-gg*, it will be found, having in mind the thicknesses of the walls, that the extension of the outer part is more pronounced in part *ee-ff* than in part *ff-gg*, whereas the compression of the inner liner is less pronounced in part *ee-ff* than in part *ff-gg*. Consequently there is in both parts of the liner a shearing stress in the plane *ff*. This shearing stress will be the less as the difference between the diameters *D₁* and *D₂* will be slighter. Hence it will be realized that it is advantageous to have a stepped press fitting instead of passing at once from the part where there is no compression nor extension at all to a part where the shrinkage stress is at a maximum.

In order to hold together the parts of the liner, bars *h* provided with two heads *i* are shrunk or forced into grooves formed on the outer wall of the liner; the grooves being widened at their opposite ends to receive the bar heads, as will be understood. Figure 2 is a view of one of the bars looking in the direction shown by the arrow, where the heads *ii* are clearly visible. There are several such bars around the liner and they are disposed parallel to its centre line, so that one end is inserted into the part *c*; whereas the other is inserted into the part *d*.

Referring to Figure 3, which relates to an opposed piston engine, there is one ring of forged or cast steel encircling the combustion chamber and provided with holes such as *j* for the valves, and there are two extensions *d* in which both pistons travel. The same stepped arrangement as in Figure 1 is provided together with double headed bars *h* for a similar purpose.

What I claim is:

1. An engine cylinder liner, comprising a plurality of structurally-separate members and having a plurality of grooves formed in its outer surface which lie partly in one of

said members and partly in another; and fastening bars secured in said grooves to hold the said members together.

2. An engine cylinder liner, comprising a plurality of structurally-separate members and having a plurality of grooves formed in its outer surface which lie partly in one of said members and partly in another and which are widened at their opposite ends; and double-headed fastening bars secured in said grooves to hold the said members together.

3. An engine cylinder liner, comprising a plurality of structurally-separate members having interfitting stepped ends, said liner being provided on its outer surface with a plurality of grooves which lie partly in one of said members and partly in another; and

fastening bars secured in said grooves to hold the said members together.

4. An engine cylinder liner, comprising a plurality of structurally-separate members having interfitting stepped ends, said liner being provided on its outer surface with a plurality of grooves which lie partly in one of said members and partly in another and which are widened at their opposite ends; and double-headed fastening bars secured in said grooves to hold the said members together.

In testimony whereof I affix my signature in presence of two witnesses.

JEAN ROMEYN.

Witnesses:

LEONARD CEVO,
MARIE DEFREDDY.

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