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LINER FOR THE CYLINDERS OF INTERNAL COMBUSTION ENGINES.

APPLICATION FILED APR. 17, 1916.

1,208,744. Patented Dec. 19, 1916.

Fig. 1

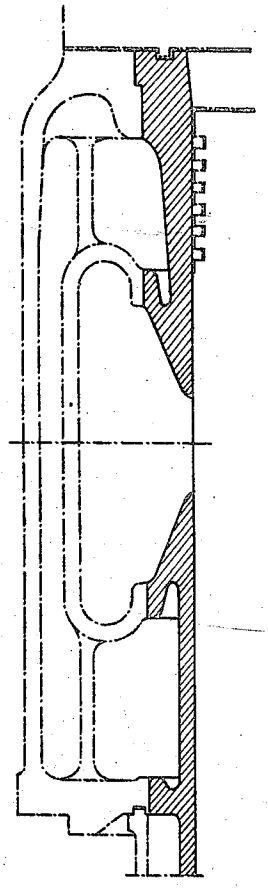


Fig. 2

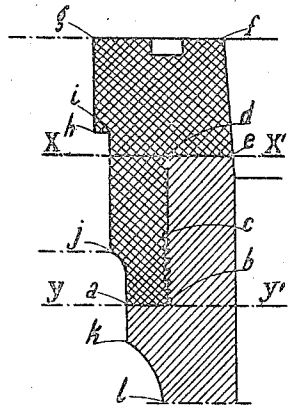


Fig. 3

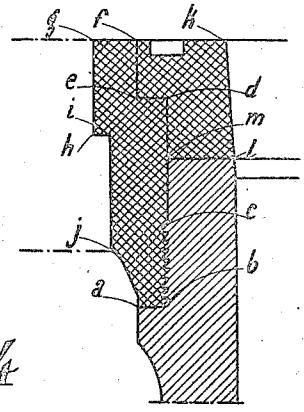
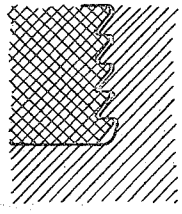


Fig. 4



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UNITED STATES PATENT OFFICE.

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LINERS FOR THE CYLINDERS OF INTERNAL-COMBUSTION ENGINES.

1,208,744. Specification of Letters Patent. Patented Dec. 19, 1916.

Application filed April 17, 1916. Serial No. 91,718.

To all whom it may concern:

Be it known that I, GEORGES EUGÈNE CANHAC, of Rue de l'Ermitage, at St.-Denis, Department of the Seine, France, citizen of the French Republic, have invented certain new and useful Improvements in Liners for the 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.

The cylinders of high power internal combustion engines are generally provided with cast iron liners fitted into cast iron or cast steel casings. Fracture of such cast iron liners is a frequent mishap; and the present invention relates to a construction intended to avoid this disadvantage.

Figure 1 shows in section, a cast iron liner formed in accordance with the usual principles; the dot and dash lines externally of the liner indicate the cast iron, or cast steel casing, and the dot-and-dash lines internally of the said liner indicate the piston and piston packing rings, or segments, in the position they assume at the end of the stroke. Fig. 2 is a section of the upper part of a liner constructed in accordance with the present invention. Fig. 3 is a section of a modification based on the same principle. Fig. 4 illustrates a detail of construction.

The thickness of metal forming the liner of cylinders is generally determined in such a manner that the metal suffers very little under the action of the pressures normally developed in the interior of the cylinder. Accidental over-pressures which may be produced, are almost always inadequate to raise the stress on the metal to its limit of elasticity. Nevertheless fractures are frequent and they can only be explained by stresses due to expansion of the metal.

The liner of an internal combustion engine may be compared with a metallic ring subjected to alternate heating and cooling, the temperature of the inner face being higher than that of the outer face when the ring is hot and the temperature being uniform throughout when the ring is cold. During heating or in the hot condition the inner circumference of the ring expands to a greater extent than the outer circumference; the inner circumference is therefore subjected to a contractive effort, which tends to shorten it while the outer circumference is subjected to a tensile stress, which tends to lengthen it. During cooling the tensile stress, however, is equal to the compressive effort and the sum of the elongation of the outer circumference and of the compression of the inner circumference is equal to the difference of expansion of the two circumferences. The tensions and compressions resulting from the different successive periods of heating may give rise to the fracture of the liner. In order to avoid these efforts assuming dangerous proportions, it is advisable to reduce the thickness of the liner in the heated region in order to decrease the inequality of the temperature, and to use a metal having a high limit of elasticity both in the hot and in the cold condition.

In the arrangement illustrated in Fig. 2, which is a partial section through the axis, the upper part of the jacket is constituted by a steel annulus or ring *a b c d e f g h i* screwed onto the body of the cast iron liner above the plane of section X X′. The liner is constituted by a steel ring the thickness of which is less than that necessary in the case of cast iron; this ring offers a greater resistance to the effects of unequal expansion for the reasons hereinbefore set forth. Between the section-plane X X′ and the section-plane Y Y′, the liner is formed by a cast iron ring hooped with, or encircled by, a steel ring; the two concentric rings are relatively thin and can therefore more readily accommodate themselves to the effects of contraction and expansion. Below the plane Y Y′ the liner is only formed by one cast iron ring both faces of which are subjected to a relatively small difference of temperature. The joint between the body of the cast iron liner and the steel ring must be fluid-tight; this is effected in the region *a b* where the inner face of the ring is provided with a screw-thread *b c* which engages a corresponding screw-thread on the end of a circular projection *a b l k* integral with the body of the jacket. In order that the joint may be fluid-tight notwithstanding the variation in the diameter of the ring and liner due to expansion, the screw-threads are preferably of the "buttress" type of screw thread or somewhat like the profile of the teeth of a

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saw, the operative edge of which is at right angles to the axis of the liner, as shown in Fig. 4; with a screw thread of this profile the diameter of the liner and that of the ring may vary without the tightening pressure of the screw-threads being varied.

In the arrangement illustrated in Fig. 3, the body of the liner is of cast iron, as in the preceding case, but the head is made up of two rings of steel *a b c d e f g h i* and *d e f k l m*. This arrangement may be used when for constructional reasons, it is necessary that the upper part of the liner should be much thicker than that necessary to insure the rigidity of the part; this is the case when exhaust openings are formed in the liner (as in the figure) and when the outer diameter in the region of the openings must be greater than the diameter which it is necessary to give the upper part of the liner to insure its rigidity. If the steel ring were made in one piece, its thickness may give rise to dangerous inequalities of temperature, and for that reason it is advantageous to make it in two pieces. The outer part is fixed to the body of the liner as in the case illustrated in Fig. 2; the inner part is fitted on without any clearance, the fluid-tightness being effected at the plane *d e* and the pressure requisite to obtain this being insured by the pressure exerted by the end of the cylinder on the liner.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:

1. The combination with the cylinder of an internal combustion engine, of a liner therefor having its upper portion laminated, for the purpose described.

2. The combination with the cylinder of an internal combustion engine, of a liner therefor, and an annular ring encircling the upper portion of said liner to augment the thickness of said upper portion.

3. The combination with the cylinder of an internal combustion engine, of a liner therefor, and an annular ring associated with the upper portion of said liner, at least a portion of said ring serving to augment the thickness of the liner, and said ring at the portion of its greatest thickness being laminated, for the purpose described.

4. The combination with the cylinder of an internal combustion engine, of a liner therefor, and an annular ring associated with the upper portion of said liner, at least a portion of said ring serving to augment the thickness of the liner, and an additional ring associated with one portion of said first-named ring and serving to augment the thickness thereof.

5. The combination with the cylinder of an internal combustion engine, of a liner therefor, and a ring screwed up on said liner to augment the thickness thereof, the threaded connection between the liner and said ring being of the buttress thread type.

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

GEORGES EUGÈNE CANHAC.

Witnesses:
CHAS. P. PRESSLY,
HENRI COHEN.