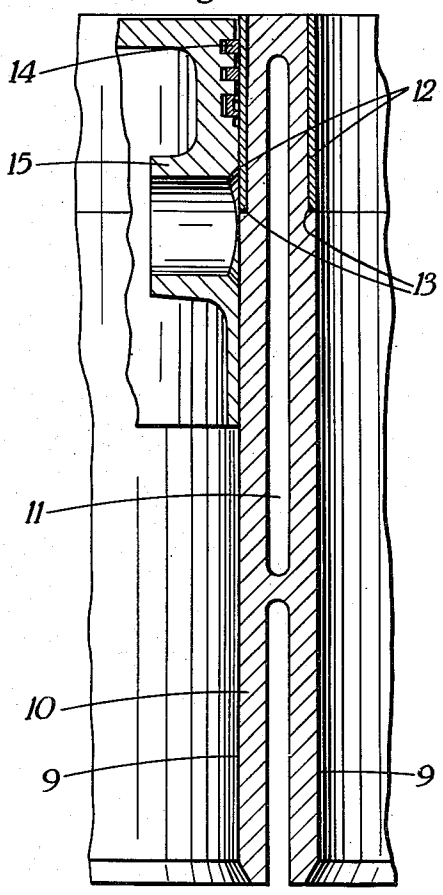
March 1, 1938. E. G. GRINHAM ET AL 2,110,064

LINER FOR THE CYLINDERS OF RECIPROCATING PISTON MACHINES

Filed Sept. 14, 1936

Fig. 1.



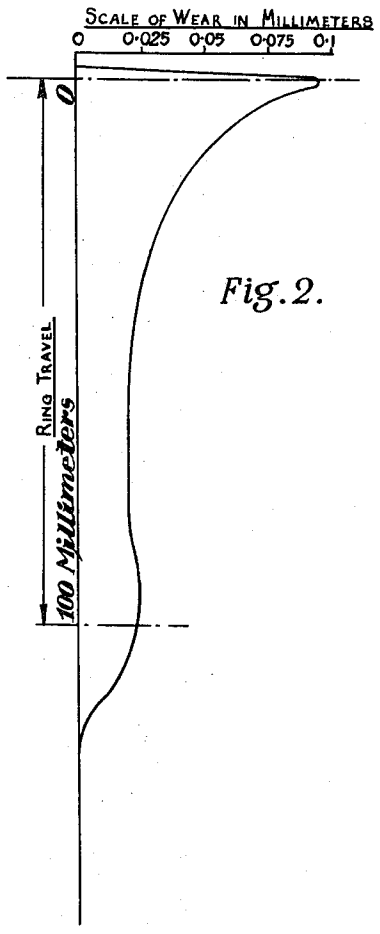


Fig. 2.

Fig. 3.

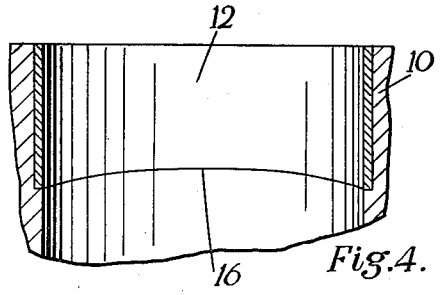


Fig. 4.

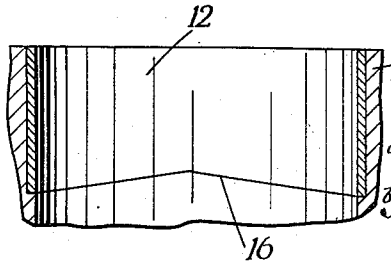


Fig. 5.

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UNITED STATES PATENT OFFICE

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LINER FOR THE CYLINDERS OF RECIPROCATING PISTON MACHINES

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Application September 14, 1936, Serial No. 100,740
In Great Britain May 22, 1936

2 Claims. (Cl. 123—173)

This invention relates to multi-cylinder internal-combustion engines, whether spark-ignited or operating by compression-ignition, of the kind having cylinder liners of hard-wearing material fitted in bores in a cylinder block having a liquid-cooling passage in it.

The invention does not relate to so-called "wet" liners such as are built up of two or more parts and the outer surfaces of which are in direct contact with the cooling liquid.

According to the invention, the bores in the cylinder block are machined to receive the pistons and their outer ends are counter-bored and fitted with the liners each of which has an axial length which does not exceed half the piston stroke.

In the accompanying drawing:—

Figure 1 is a fragmentary sectional elevation of a cylinder block, of an internal-combustion engine, adapted according to the invention;

Figure 2 is a graph showing cylinder wear along the length of the bore;

Figures 3 and 4 are sectional elevations of another form of liner for use according to the invention, Figure 4 being a section taken on the line IV—IV of Figure 3; and

Figure 5 is a section showing another form of liner.

Like numerals indicate like parts throughout the drawing.

In Figure 1 of the drawing parts of only two bores 9, 9 in the cylinder block 10 are shown, the latter having at 11 a liquid-cooling passage of known form. The outer ends of the cylinder bores are shown as having been machined to receive the liners 12, 12. The liner may be of cast iron provided that it is suitably hardened and tempered, or it may be formed of other materials. In the preferred method of fitting, a liner is inserted in position in the counter-bored end after having had its temperature materially reduced, as by means of liquid air. The inner end of the liner may with advantage be suitably chamfered externally, as shown at 13, to facilitate its being driven into position when in the "frozen" state.

The axial length of a liner is approximately only ⅓ of the piston stroke, as it will be seen from Figure 2 that the wear occurring in the cylinder bore is a maximum at a plane of the bore corresponding to the position of the outer piston-ring 14 when the piston 15 is at top dead centre, and that the wear is localized so that the length of any material wear is approximately only one-third of the piston stroke from top dead centre, the remaining length of the cylinder bore being relatively unworn.

Figure 3 shows the inner end 16 of the liner as being in a plane which is inclined at between 80° and 85° to its main axis.

Figure 4 is a view on line IV—IV of Figure 3.

Figure 5 shows the liner with a shallow V-shaped inner end 16. By arranging for the inner end of a liner not to be in a plane at right-angles to its main axis, it is possible to reduce the likelihood of a ledge eventually forming as wear takes place.

When the liners are in position the bores of the cylinder block and liners can be machined together.

By fitting a short liner of the kind described the cost of a full-sized liner is avoided. Moreover, a short liner can in most cases be fitted to existing engines without risk of weakening the cylinder block, owing to the fact that the latter is relatively stiff at its outer end where the liner is fitted. Furthermore when designing a new multi-cylinder engine, if full length liners are to be fitted it may be necessary, if the water space between the cylinders is not to be unnecessarily restricted, to provide for a larger cylinder-block than would be the case if short liners according to the invention were to be fitted as these do not tend to restrict the water space.

Another important advantage of an arrangement according to the invention, is the following: the heat from the piston head is dissipated mainly through the piston rings to the contacting surface. With the present construction the piston rings are in contact with the cylinder blocks casting for longer periods during the piston stroke than with the relatively short liner. Thus the conduction of heat from the piston head is increased above a construction with a long liner due to the fact that the conductivity of the heat passage from the rings through the liner to the cylinder block casting is not so great as that from the piston rings direct to the cylinder block casting.

What we claim as our invention and desire to secure by Letters Patent of the United States is:—

1. A multi-cylinder internal-combustion engine having a cylinder block, the latter having a plurality of bores therein and a liquid-cooling space between the bores, said block having the outer ends of the bores counterbored, hard-wearing liners immovably fitted in said counterbores, and pistons adapted to be reciprocated in the bores of said block and in the bores of said liners and at top dead centre to reach substantially to

the outer ends of said liners, each of said pistons having a piston ring near the head which at top dead centre engages the associated liner near its outer end, said liners being of a length approximately equal to one-third of the distance traversed by said rings.

2. A multi-cylinder internal-combustion engine having a cylinder block, the latter having a plurality of bores therein and a liquid-cooling space between the bores, said block having the outer ends of the bores counterbored, hard-wearing liners immovably fitted in said counterbores, the external inner edges of said liners being chamfered to facilitate said liners being driven into said counterbores, and pistons adapted to be reciprocated in the bores of said block and in the bores of said liners and at top dead centre to reach substantially to the outer ends of said liners, each of said pistons having a piston ring near the head which at top dead centre engages the associated liner near its outer end, said liners being of a length approximately equal to one-third of the distance traversed by said rings.

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