E. G. GUNN & A. L. NELSON.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED MAR. 10, 1917.

1,301,254. Patented Apr. 22, 1919.

Fig. 1.

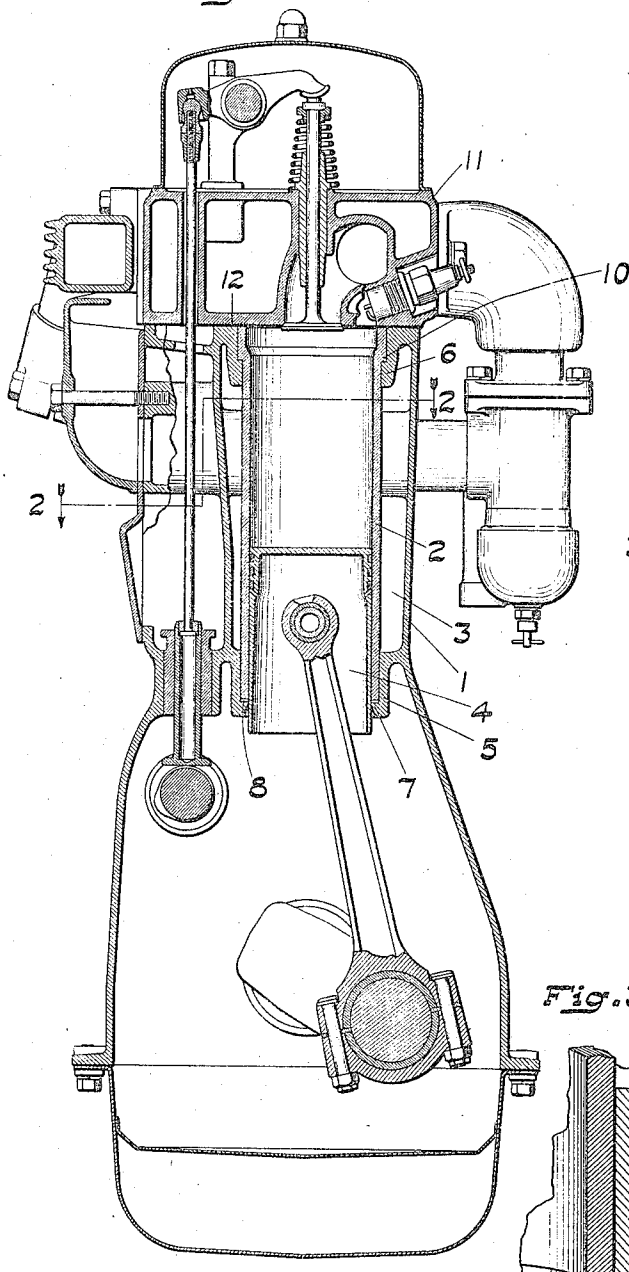


Fig. 2.

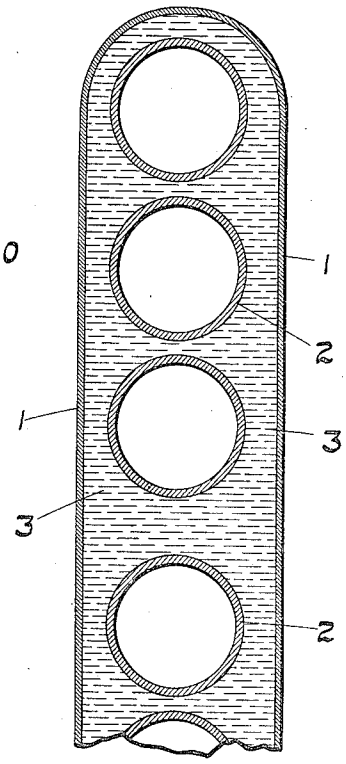


Fig. 4.

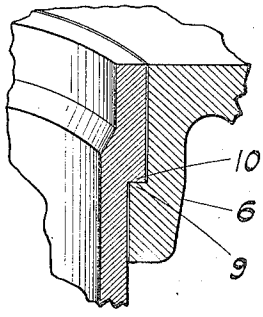
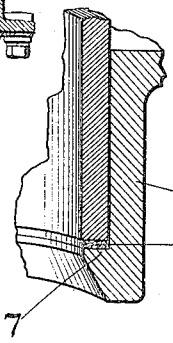


Fig. 3.



INVENTORS

Earl G. Gunn

& Adolph L. Nelson

by Bradford & Dodier

ATTORNEYS

UNITED STATES PATENT OFFICE.

EARL G. GUNN AND ADOLPH L. NELSON, OF INDIANAPOLIS, INDIANA, ASSIGNORS TO PREMIER MOTOR CORPORATION, OF INDIANAPOLIS, INDIANA, A CORPORATION OF INDIANA.

INTERNAL-COMBUSTION ENGINE.

1,301,254. Specification of Letters Patent. Patented Apr. 22, 1919.

Application filed March 10, 1917. Serial No. 153,980.

To all whom it may concern:

Be it known that we, EARL G. GUNN, a citizen of the United States, residing at Indianapolis, Marion county, and State of Indiana, and ADOLPH L. NELSON, a citizen of the United States, residing at Indianapolis, Marion county, and State of Indiana, have invented and discovered certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

Our invention relates to internal combustion engines and its objects are to obtain a tight joint between the motor body and an insertible cylinder sleeve without liability of distortion of the sleeve by pressure due to expansion, to provide means whereby the tightly fitting surfaces of the sleeve and its engaging parts will be only in horizontal planes, to provide for more effectively cooling the engine and maintaining a substantially equal temperature of body and sleeve, to enable the sleeve to be readily inserted and removed, and particularly to enable such results to be obtained in connection with an engine in which the body and sleeve are made of metals of different co-efficients of expansion such as aluminum and cast-iron respectively, or aluminum and steel.

With these objects in view, our invention is embodied in preferable form in the construction and arrangement hereinafter described and illustrated in the accompanying drawings.

In the drawings, Figure 1 is a vertical section through one cylinder of the engine, Fig. 2, a horizontal section in the line 2—2 of Fig. 1, through several cylinders of a six-cylinder motor; Fig. 3, an enlarged detail perspective of the lower end of a cylinder sleeve and Fig. 4, an enlarged detail perspective of the upper end thereof.

Referring to the drawings, 1 indicates the body or shell of the cylinder block. This body is preferably made of aluminum or an aluminum alloy, although the invention, in respect to some aspects thereof, is not limited to the kind of metal of which the engine may be made. It is hollow throughout the length of the block, which preferably includes six cylinders although the invention is of course applicable to an engine having a greater or less number of cylinders.

Mounted within this shell are sleeves 2 constituting the explosion cylinders. These sleeves are made of cast iron or some other metal suitable to the requirements of explosion cylinders, and which metal therefore possesses a less co-efficient of expansion than aluminum. The cylinder sleeves are separated from one another and from the body wall by a space 3, extending continuously from end to end of the body and entirely around the sleeves and forming part of the cooling system, and adapted to be filled with water. In each cylinder sleeve is a piston 4 preferably of aluminum or aluminum alloy.

Each cylinder sleeve fits within an annular, vertical bore section or flange 5, projected inwardly from the lower end of the engine body, and within a similar bore section 6 at the upper end thereof. The lower section is provided with a lateral shoulder 7, the face of which lies on a plane at right angles to the axis of the cylinder, on which is mounted a packing gasket 8, composed of a suitable resilient material such as granulated cork. The lower face of the sleeve 2 bears against this packing and serves to compress the same so as to form a tight joint therewith.

The sleeve is held in the annular bore section 5 with a slip fit, enabling the sleeve to be readily inserted and removed, without heating the parts or forcing the sleeve into the bore and permitting of slight relative expansion without undue compression of the sleeve and wall of the engine. There may be clearance between these parts, the necessary tight closure of the joint between the sleeve and body wall at the lower end being obtained solely by means of the compressible gasket.

The upper bore section 6 is provided with a similar supporting shoulder 9, against which is adapted to seat with a tight fit, the lower face of a complementary shoulder 10, formed on the sleeve. The portion of the sleeve above the shoulder has a slip fit with the upper part of the bore section, and may have a clearance similar to that at the lower end which permits expansion of the bore section without undue pressure against the sleeve. The slip fit clearance between the sleeve and the bore section below the shoulder 9 may be slightly greater than the other clearance to prevent any binding that may tend to be produced in clamping the head and body together.

Above the cylinders and bearing down tightly against the upper face of the engine body and the sleeves is a removable head 11, preferably of aluminum, in which the valves and spark plugs are mounted. Between this head on one side, and upper faces of the body and sleeve on the other side, is a flexible packing 12.

The vertical length of the sleeve 2 between the shoulder 7 and the shoulder 9 is less than the length of the body between the horizontal surfaces of said shoulders and the thickness and compressibility of the gasket 8 are relatively such that when the sleeve is inserted into the bore sections of the body and clamped down by the pressure of the head until the upper end of the sleeve is flush with the top face of the body, the gasket will be slightly compressed, such compression being less than its limit of compressibility.

When expansion takes place the pressure will be exerted against surfaces lying in horizontal planes only and will be taken care of primarily by the gasket 8, and also by the packing 12, and such pressure being vertical will not impose any side stress against the sleeve, such as would tend to distort the same. The unyielding metallic contact between the upper shoulders 9 and 10, serves to limit the initial compression of the packing 8 so that the latter possesses a range of resiliency after the parts have been assembled and is free to yield under pressure and to expand to tightly close the joint upon any separation of sleeve and body.

Owing to the fact that the water is in direct contact with the thin walls of the sleeves throughout their entire outer surface between the bore sections, a considerable increase in cooling effect is obtained as compared with the usual solid wall construction or the close fitting sleeve construction and the heat is conducted away by water instead of by metal. The short upper bore section itself, it will be noticed, is also surrounded by water.

By the above arrangement it will be seen that the temperatures of the sleeve and body at the bore section will be kept low and the expansion of the parts will be substantially the same, thus preventing unequal stress and pressure.

The vertical clearances between the sleeve and body are closed at opposite ends thereof by the horizontally disposed packings 8 and 12, and since the latter packing is ordinarily employed between the head and body, only one additional packing member is required in the construction to effect the results described.

The invention in its main features, is not limited to a body and sleeve of diverse metals, but however, it is particularly advantageous in association with engines having aluminum bodies and iron or steel sleeves, owing to the greater expansibility of aluminum.

It has heretofore been the custom in the construction of aluminum motors with cast-iron sleeve to have the latter fit closely within and in contact entirely throughout with the aluminum cylinder wall, in order to obtain support therefor and to conduct the heat away from the sleeve. This arrangement requires careful machining of the block and sleeve to attain proper fitting, requires special heat treatment for the insertion and withdrawal of the sleeve, prevents the ready removal of the sleeve and entails the use of unnecessary metal.

The present invention overcomes these difficulties and in addition to the advantages of prevention of distortion, ready insertibility and removability, provides a construction having a large water filled cooling chamber closely adjacent the most highly heated surfaces of the combustion chamber, and enables the cost of the engine to be considerably reduced.

Having thus described our invention, what we claim is:

1. An internal combustion engine having a body and an insertible and removable cylinder sleeve separate from the body, said sleeve and body having two joint closing faces only, said faces lying in horizontal planes adjacent the outer and inner ends of the cylinder, the outer faces having metallic contact only, the outer end surfaces of the cylinder being flush with the adjoining surface of the body when the sleeve is seated, and a flexible packing gasket interposed between the inner faces of the sleeve and body, the vertical length of said sleeve between its said horizontal closing faces being less than the vertical distance between the corresponding faces of the body and proportioned to the compressibility of the gasket so that when the cylinder sleeve is seated upon the upper face of the body the gasket will be compressed by the pressure of the lower end but below the limit of compressibility of said gasket.

2. An internal combustion engine having a body and a separate cylinder sleeve, said body being of a metal of greater co-efficient of expansion than that of the sleeve, said parts having vertical clearance between the bore of the body and the sleeve, said sleeve and body having complementary lateral shoulders near the upper ends meeting with a metallic fit only when the sleeve is inserted, the upper end of the sleeve being flush with the adjacent surface of the body when the former is inserted within the latter, said body having a lateral shoulder at the lower part thereof opposing the lower end of the sleeve, a flexible packing inter-

posed between said shoulder and said end, the length of the sleeve between said end and its upper shoulder being less than the distance between the two shoulders of the body whereby the compression of the packing by the sleeve is limited by the metallic contacting shoulder at the upper end of the body.

3. In an internal combustion engine the combination of a body and a separate cylinder sleeve having adjoining vertical faces with clearance between said vertical faces of the body and sleeve and complementary horizontal shoulders adjacent the upper ends of said body and sleeve having a metallic contact when the sleeve is in position, said body being formed with a bore adapted to receive the lower end of the sleeve and formed with a shoulder, and an elastic gasket disposed between the end of the sleeve and said shoulder, the shoulder being so positioned that the gasket is partially compressed when the parts are in normal assembled position.

In witness whereof, we have hereunto set our hands and seals at Indianapolis, Indiana, this 5th day of March, A. D., nineteen hundred and seventeen.

EARL G. GUNN. [L. S.]
ADOLPH L. NELSON. [L. S.]

Witness:
H. P. DOOLITTLE.