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AIR COOLED ENGINE CYLINDER AND METHOD OF MAKING SAME

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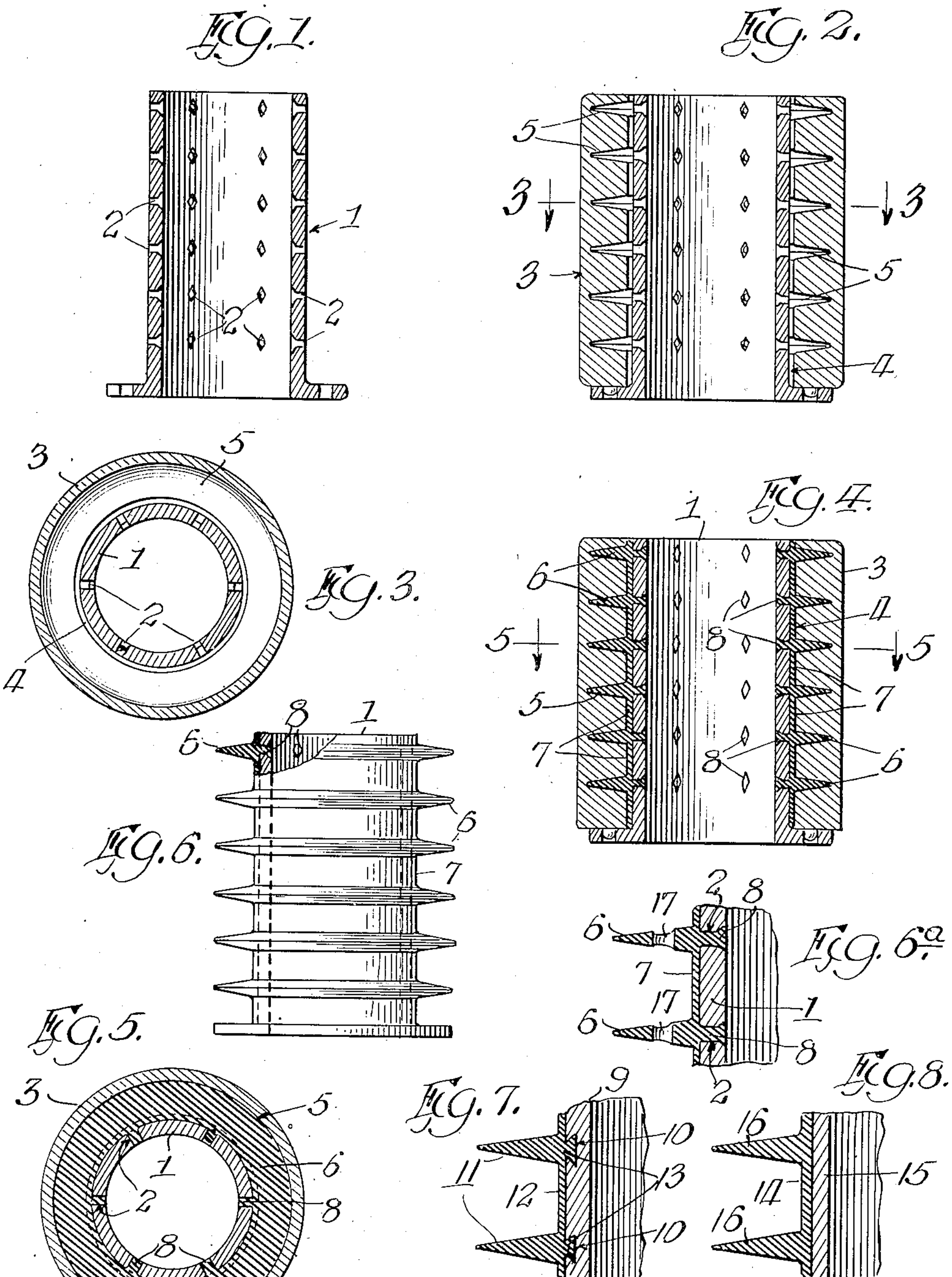

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UNITED STATES PATENT OFFICE.

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AIR-COOLED ENGINE CYLINDER AND METHOD OF MAKING SAME.

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To all whom it may concern:

Be it known that I, ALVIN C. McCORD, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented new and useful Improvements in Air-Cooled Engine Cylinders and Methods of Making Same, of which the following is a specification.

This invention relates to a method of providing cylinders of internal combustion engines with heat radiating fins or members and also to the engine cylinders so made.

One object of my invention is to make the heat radiating fins or members of a metal having a heat conductivity greater than that of the metal of which the cylinder is made, and to have parts of said members extending into the cylinder wall to be close to the heat produced in the cylinder so that the heat need not traverse the full thickness of the cylinder wall in order to reach said members or fins, and thus allow for a rapid and effective dissipation of heat from the cylinder.

Another object of my invention is to jacket the cylinder wall with a metal having a tensile strength greater than that of the metal of which the cylinder is made, and thus enable the thickness of both the jacket and the cylinder wall to be reduced to the minimum for lessening the weight of the completed cylinder.

A further object of the invention is to make said jacket of a relatively non-porous metal and fit the same tight about said cylinder wall for preventing leakage therethrough and thus make possible the use of practically all cylinder castings.

A still further object of the invention is to provide said jacket with heat radiating fins or members made integral therewith.

A further object of the invention is to make said fins or members as well as the jacket of copper and apply the same to the engine cylinder by an electrolytic process whereby the copper is deposited on the cylinder in a manner to form the jacket and the fins.

The invention consists further in the matters hereinafter described and more particularly set forth in the appended claims.

In the accompanying drawings—

Fig. 1 is a vertical sectional view of an engine cylinder casting provided with a plurality of holes extended therethrough in accordance with the first step of the method of my invention;

Fig. 2 is a like view showing a mold block applied about said cylinder for making the heat radiating fins or members and the jacket;

Fig. 3 is a horizontal sectional view taken on line 3—3 of Fig. 2;

Fig. 4 is a view similar to Fig. 2 and showing the jacket and heat radiating members formed on the cylinder by an electrolytic process;

Fig. 5 is a horizontal sectional view taken on line 5—5 of Fig. 4;

Fig. 6 is a side elevational view of the cylinder with jacket and members so formed, after the mold block has been removed;

Fig. 6[a] is an enlarged fragmentary vertical sectional view of a portion of the cylinder wall after the jacket and members have been deposited; and

Figs. 7 and 8 show modifications to be hereinafter described.

In carrying out the method of my invention, I take an engine cylinder casting 1, as shown in Fig. 1, made of gray iron, and provide it with a plurality of holes 2 extending through the cylinder wall into the bore thereof and arranged in horizontal rows, vertically spaced apart. The inner ends of the holes 2 are preferably made diamond shape, while the remaining portions of the holes 2 may be made circular in cross-section.

Placed about the cylinder 1 is a mold block 3 made of lead or other desired material. As shown herein, said block 3 is solid and has a length to extend the full length of the cylinder 1. The inside diameter of the block 3 is slightly greater than the outside diameter of the cylinder 1, so that when the block 3 is placed about the same in concentric relation there is an annular space 4 provided between the block and the cylinder 1, as shown in Fig. 2. As there illustrated, the block has depending pins in the bolt holes in the base flange of the cylinder for centering the block and holding it spaced from the cylinder wall. Provided in the block 3 are a plurality of horizontally arranged, vertically spaced, annular channels 5 opening into the inside of the block, and these are arranged in line with the horizontal rows of holes 2, as shown. The parts when thus assembled are clamped together in any desired way and the outer surface of the block 3 is coated with grease or other material on which copper will not deposit. The open ends of the cylinder are plugged to close them and the inner ends of the holes 2 are also closed to prevent copper depositing in the bore of the cylinder.

When so arranged, the assemblement is submerged or placed in an electrolytic bath containing copper in solution and allowed to remain in the bath until copper, by the depositing process, has filled the holes 2, the annular space 4 between the cylinder 1 and the block 3, and the annular channels 5 in the block. These, as shown in the drawings, are made V-shape so that copper deposited in them is given like form and thus provides on the outside of the cylinder wall a plurality of outwardly projecting, V-shaped, heat radiating fins or members 6 connected together on the outside of the cylinder by the coating 7 formed in the space 4 and constituting a jacket fitting tightly about the cylinder with the parts 8 filling the holes 2.

After the copper depositing has been completed, the assemblement is removed from the bath and heat applied to the lead block 3 to melt it and cause it to run off, leaving a copper jacket 7 about the cylinder and made fast thereto with a plurality of copper fins or members 6 on the outside thereof, horizontally disposed and extending circumferentially about the cylinder 1, as shown in Fig. 5 and vertically spaced apart as shown in Fig. 6.

Internal combustion engine cylinders are usually made of gray iron as this material has sufficient strength to withstand the pressures to which the cylinders are subjected when in use, and also has sufficient hardness to provide proper working surfaces for the reciprocating pistons. The tensile strength of gray iron is much less than that of copper and when a copper jacket is made fast about the cylinder wall, as above described, it is apparent that the combined tensile strength of the two metals is far greater than would be the tensile strength of a gray iron wall of that thickness. Consequently, by the use of a copper jacket, the thickness of the cylinder wall may be reduced to the minimum and thus lessen the weight of the engine, yet gaining a cylinder which will withstand the duties imposed upon it. Moreover, reducing the thickness of the cylinder wall lessens the distance the heat must travel from the inside of the cylinder to reach the heat radiating fins or members. This is further aided by having the parts 8 extend into the cylinder wall and thus be near the zone of greatest heat so that the heat need not travel through the full thickness of the cylinder wall before reaching the fins 6.

Instead of having the parts 8 extended through the cylinder wall into the bore as described above, I may make the construction as shown in Fig. 7, wherein the cylinder wall 9 is provided on its outside with a plurality of relatively shallow recesses 10, which terminate short of the inside or bore of the cylinder. Following the same method as heretofore described, copper is deposited on the cylinder wall 9 to form fins 11 and a jacket 12 with parts 13 filling the recesses 10. By having the parts 13 extended into the cylinder wall, such parts are brought nearer the bore of the cylinder than the jacket 12 and therefore are nearer the zone of greatest heat.

Instead of having copper deposited in holes or recesses as heretofore described, the construction could be made as shown in Fig. 8. In this figure, a copper jacket 14 is deposited about the cylinder wall 15 and at the same time integral fins 16 are formed on the jacket, as shown. Instead of depositing the copper jacket 14 and its fins on the cylinder wall 15, such parts could be cast on the cylinder wall 15 and be secured in tight contact therewith.

As a means for enhancing or increasing the heat radiation of the fins, I may provide the same with a plurality of holes 17, as shown in Fig. 6[a]. This permits a circulation of air through the fins and thus enables heat to be carried off with much more rapidity than is likely possible with fins having no apertures through them.

In all the several forms of my invention as shown, it is to be observed that the cylinder wall is made of a metal which has suitable hardness and strength for withstanding the pressure produced within it and also to stand the wear of the piston as it moves endwise of the cylinder, and the fins which carry off the heat of the explosions are made of a metal having a heat conductivity of a degree much greater than that of the metal of which the cylinder is formed.

Gray iron is porous and heretofore considerable loss occurred in the manufacture of engine cylinders due to that fact, because the porosity of the material produced defective cylinders and made scrapping of them necessary. Copper, on the other hand, is relatively non-porous, and providing a jacket of that metal about a cylinder wall, as described, prevents leakage through the cylinder wall. Manifestly, by the use of copper jackets, the percentage of scrappage of gray iron cylinders is greatly reduced and the cost of manufacture lessened and losses due to the porosity of gray iron markedly overcome.

While I have shown and described herein my method applied to one cylinder, it is of course to be understood that it may be applied to a plurality or block of cylinders without departing from the spirit and scope of my invention.

I claim as my invention:

1. An engine cylinder having its inner surface continuous and unbroken and constituting the wearing surface of the cylinder, a jacket fitting about the outside of said cylinder, heat radiating members on said jacket and projecting outward therefrom, said jacket having parts extending into said cylinder wall and terminating short of the inner wearing surface thereof, and said jacket, members and parts being made of a metal of a greater heat conductivity than the metal of which the cylinder wall is made.

2. An engine cylinder having its inner surface continuous and unbroken and constituting the wearing surface of the cylinder, a jacket fitting about the outside of said cylinder, heat radiating members on said jacket and projecting outward therefrom, said jacket having parts extending into said cylinder wall and terminating short of the inner wearing surface thereof, and said jacket, members and parts being made integral and of a metal of a greater heat conductivity than the metal of which the cylinder wall is made and made fast to said cylinder wall in the process of forming the same.

3. An engine cylinder having its inner surface continuous and unbroken and constituting the wearing surface of the cylinder, a jacket fitting about the outside of said cylinder, vertically spaced, horizontal, heat radiating fins on said jacket projecting outward therefrom and extending circumferentially about the same, said jacket having parts extending into said cylinder wall and terminating short of the inner wearing surface thereof, and said jacket, members and parts being made integral and of a metal of greater heat conductivity than the metal of which the cylinder wall is made and made fast to said cylinder wall in the process of forming the same.

4. An engine cylinder, provided with heat radiating members made of a metal having a heat conductivity greater than that of the metal of which the cylinder wall is made, said members being applied to the cylinder wall by an electrolytic process.

5. An engine cylinder, having a jacket surrounding the same, heat radiating members integral with said jacket and projecting outward therefrom, and said jacket and members being made of a metal having a heat conductivity greater than that of the metal of which the cylinder wall is made and formed on said cylinder wall by an electrolytic process.

6. An engine cylinder having its inner surface continuous and unbroken and constituting the wearing surface of the cylinder, a jacket fitting about the outside of said cylinder, heat radiating members on said jacket and projecting outward therefrom, said jacket having parts extending into said cylinder wall and terminating short of the inner wearing surface thereof, and said jacket, members and parts being made integral and of a metal of a greater heat conductivity than the metal of which the cylinder wall is made and made fast to said cylinder wall by an electrolytic process.

7. An engine cylinder provided with a plurality of transverse apertures, a jacket fitting about said cylinder, heat radiating members on said jacket and projecting outward therefrom, said jacket having parts filling said apertures and terminating substantially flush with the inner surface of said cylinder, and said jacket, members and parts being made integral and of a metal of a greater heat conductivity than the metal of which the cylinder wall is made and being formed on said wall by an electrolytic process.

8. The method of providing an engine cylinder with outwardly projecting, heat radiating members of a metal having a heat conductivity greater than that of the metal of which the cylinder wall is made, consisting in, first, placing about the cylinder a mold block provided with cavities shaped to form said members, second, filling the cavities with a metal of which the members are to be made by an electrolytic process, and, third, removing the block from the cylinder after forming said members on the cylinder.

9. The method of providing an engine cylinder with a surrounding jacket and outwardly projecting, heat radiating members formed of a metal having a heat conductivity greater than that of the metal of which the cylinder wall is made, consisting in, first, placing about said cylinder a mold block having cavities shaped to form said members and providing an annual space between said block and said cylinder, second, depositing a metal of which the jacket and members are to be made in said cavities and space by an electrolytic process, and, third, applying heat to the block for melting it for removing the block from the cylinder.

10. The method of providing an engine cylinder with a surrounding jacket and outwardly projecting, heat radiating members formed of a metal having a heat conductivity greater than that of the metal of which the cylinder wall is made, consisting in, first, placing about said cylinder a mold block having cavities shaped to form said members and providing an annular space between said block and said cylinder, second, placing the assembled block and cylinder in an electrolytic bath containing in solution the metal of which the jacket and members are to be made and allowing the cavi-

ties in the block and said annular space to be filled by a deposit of said metal, third, removing the assembled block and cylinder from the bath after the metal has been deposited to form said jacket and members, and, fourth, applying heat to the block for melting it for removing the block from the cylinder.

11. The method of providing an engine cylinder with a surrounding jacket and outwardly projecting, heat radiating fins of a metal having a heat conductivity greater than that of the metal of which the cylinder wall is made, consisting in, first, providing the cylinder wall with a plurality of holes extending therethrough, second, placing about said cylinder a mold block having a plurality of channels shaped to form said fins and providing an annular space between the block and said cylinder wall, third, placing the assembled cylinder and block in an electrolytic bath containing in solution the metal of which the jacket and fins are to be made and filling said annular space, the channels in the block, and the holes in the cylinder wall with such metal, fourth, removing the assembled block and cylinder from the bath after the metal has been deposited, and, fifth, applying heat to the block for melting the same for removing it from the cylinder wall.

In testimony that I claim the foregoing as my invention, I affix my signature this 9th day of September, A. D. 1921.

ALVIN C. McCORD.