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C. F. KETTERING ET AL

CYLINDER CONSTRUCTION

Filed Dec. 11, 1919

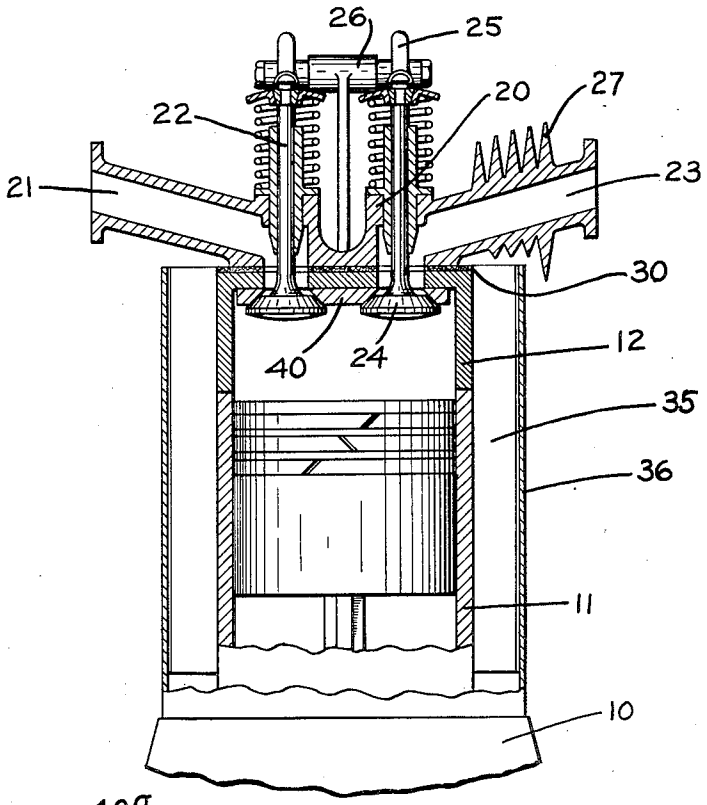

Fig. 1.

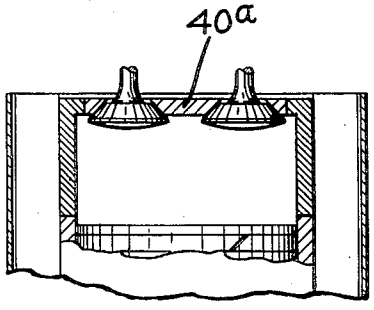

Fig. 2.

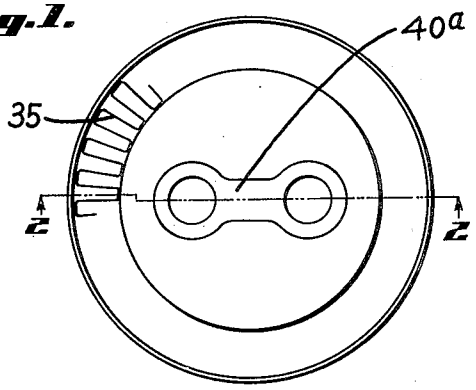

Fig. 3.

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UNITED STATES PATENT OFFICE.

CHARLES F. KETTERING AND WILLIAM B. EARNSHAW, OF DAYTON, OHIO, ASSIGNORS, BY MESNE ASSIGNMENTS, TO GENERAL MOTORS RESEARCH CORPORATION, OF DAYTON, OHIO, A CORPORATION OF DELAWARE.

CYLINDER CONSTRUCTION.

Application filed December 11, 1919. Serial No. 344,070.

To all whom it may concern:

Be it known that we, CHARLES F. KETTERING and WILLIAM B. EARNSHAW, citizens of the United States of America, residing at Dayton, county of Montgomery, State of Ohio, have invented certain new and useful Improvements in Cylinder Construction, of which the following is a full, clear, and exact description.

This invention relates to engine cylinder construction and more particularly to an improved form of engine cylinder for use in air-cooled internal-combustion engines.

One of the principal objects of the invention is to provide an engine cylinder adapted for use in connection with air-cooled internal-combustion engines, which is so constructed as to give satisfactory operation by maintaining a more uniform distribution of heat through the head of the cylinder and at the same time lending itself to a more ready dissipation of heat into the cooling air.

Other objects and advantages of the invention will be apparent from the description thereof set out below, when taken in connection with the accompanying drawing.

In the drawing, in which like characters of reference designate like parts, Fig. 1 is a vertical sectional view through an engine cylinder constructed in accordance with this invention;

Fig. 2 is a sectional view through a cylinder of a slightly modified form, along the line 2—2 of Fig. 3; and

Fig. 3 is a plan view of the cylinder shown in Fig. 2.

While cylinders constructed in accordance with the invention are adapted for use in connection with any type of engine, for purposes of easier description the invention is illustrated in connection with a single cylinder, air-cooled, internal-combustion engine, such an engine for example as is shown in the copending application of Charles F. Kettering, Serial No. 305,782, filed June 21, 1919. In the modification disclosed in Fig. 1, 10 represents the upper part of the crank case of an air-cooled internal-combustion engine, such engine having associated with the crank case thereof, some means, not shown, for causing a flow of cooling air over the cylinder. Mounted upon the crank case is a cylinder which comprises a barrel portion 11 and a head portion 12, these two portions being united in any desired manner. The barrel portion comprises that part of the cylinder within which the piston reciprocates, and should be constructed of some metal which has good wear resisting qualities. This metal is preferably either cast iron or steel, though it is to be understood that the invention is not limited to a cylinder having a barrel portion of any one particular metal, any metal which will normally function effectively as the material comprising the barrel portion of an engine cylinder, being satisfactory. By the head portion of the cylinder is meant that part of the cylinder which contains the combustion chamber. This head portion of the cylinder is constructed of a metal which is a comparatively good conductor of heat. Many of the serious troubles encountered in the operation of internal-combustion engines, arise from the unequal heat distribution throughout the head portion of the engine cylinder. This unequal heat distribution causes unequal expansions, with ensuing distortions, and other troubles. By constructing the head portion of the cylinder of a metal which is a comparatively good conductor of heat, it becomes in effect an "equalizer" of the heat, that is, there will be a more ready flow of heat through such a head portion and, consequently, a much more uniform distribution of the heat. Copper, having a higher heat conductivity than any other of the commoner metals, is preferably used as the material of which this head portion of the cylinder is constructed. But other metals might be used if preferred, as for instance aluminum, it being merely desirable that such material be a good conductor of heat. It is obvious that inasmuch as the piston, during its reciprocation, does not come in contact with the walls of the head portion, or combustion chamber, there is no wear on these walls, and so it is not necessary that the walls of the head portion be constructed of a wear resisting material, as is desirable in the case of the barrel portion of the cylinder.

Mounted upon the head portion 12 is a superstructure, designated generally, 20. This superstructure comprises an inlet 21 controlled by a valve 22 and an exhaust 23 controlled by a valve 24, the valves 22 and 24 being actuated by rocker arms 25 carried upon the standard 26, which rocker arms are

in turn operated in any desired manner. Mounted upon the exhaust pipe 23 are ribs 27 adapted to assist in radiating into the cooling air some of the heat from the exhaust pipe.

Interposed between the superstructure 20 and the head portion 12 is a layer of heat insulating material 30, which may be of asbestos, or similar material. The purpose of this layer of heat insulating material is to prevent the back flow of heat from the superstructure 20 to the head portion 12.

Carried by the cylinder is a plurality of cooling elements 35. These cooling elements, in the construction shown, have a large radiating surface exposed to the cooling air and consist of a number of fins of sheet copper; but other good conducting material may be used in place of copper, if desired. These fins are attached to both the barrel portion and the head portion in suchwise that they are in effective thermal contact therewith. They may be connected to the parts of the cylinder in any desired manner, but to secure the most desirable results and the most effective operation of the cylinder they should be actually united, or bonded, with the metal of the cylinder in suchwise that there is a true thermal contact between the metal of the fins and the metal of the cylinder. Such desired thermal contact is called, for purposes of convenience, "effective" thermal contact, and it may be secured by soldering the fins to the cylinder, using silver solder. The desired contact may, of course, be obtained in other ways. This is set forth in detail in the copending application above referred to. The fins may be of any desired shape, those shown being made from a continuous strip of metal which is corrugated or bent upon itself, as shown most clearly in Fig. 3.

Surrounding the cylinder, and the fins carried thereby, is a draft tube 36, of metal or other suitable material, which is carried by the crank case. The purpose of this draft tube is to form a confined passage surrounding the cylinder and cooling elements through which the cooling air is passed and thus caused to contact intimately with the cooling elements to secure the most effective, and at the same time efficient, operation of the cylinder. No means for causing a flow of cooling air through the draft tube 36 is shown in the drawing, but any desired means for causing this flow of cooling air may be used, such means, for instance, as is shown in the copending applications above referred to, and the copending application of Charles F. Kettering and William A. Chryst, System of electrical generation, Serial No. 58,207, filed October 27, 1915.

Where a metal such as copper or aluminum is used for the head portion 12, it has been found necessary to associate therewith a member, such as 40, adapted to carry the valve seats. Copper, for instance, is, comparatively, so soft that the valve seats, if formed directly therein, will not stand up satisfactorily. In order to overcome this defect a plate of hard material, such as cast iron, is rigidly attached to the inside of the copper head and the valve seats formed therein. This plate may be attached to the copper in any desired manner, as for example, by soldering.

In Figs. 2 and 3 is shown a slightly modified form of cylinder construction, the valve seats being carried in a plate 40^a, of comparatively hard material, which is inserted in the metal of the head portion 12, instead of being attached to the inner side thereof. In this particular construction the plate 40^a consists of a comparatively hard metal, such as cast iron, which is formed to fit within an opening in the head portion 12 and is then rigidly secured therein, as by soldering. The function of the plate 40^a is the same as that of the plate 40.

The construction described above lends itself to a more effective and efficient cooling of the engine cylinder. The head portion 12, because of its comparatively good conducting qualities, insures a more uniform distribution of heat therethrough. The fins 34, which are of copper, or some other good conducting material, and which are in effective thermal contact with the portions of the cylinder, are so proportioned that there is ample metal therein to conduct from the cylinder through the fins the quantity of heat which it is desired to remove therefrom, and so that there is ample radiating surface to radiate into the cooling air, contacting therewith, so much of the heat as it is desired to pass off into the cooling air. The proportions of these fins will necessarily vary with the material of which they are constructed. And because of the good conductivity of this equalizer the valve seats, during operation, will be cooler, thus obviating the troubles resulting from such valve seat condition. This is especially true with regard to the exhaust valve seat. Further, such an equalizer, in cooperation with such fins, permits of removing the same quantity of heat from the inner wall of the combustion chamber to the outer wall and fins with a smaller temperature differential between the inner and outer surfaces of the cylinder head than is the case with cylinders not having such an equalizer. These desirable heat conditions in a cylinder head are furthered by the insulating member 30, between the head portion 12 and the superstructure 20, which is adapted to prevent the back flow of heat from the exhaust pipe 23 to the head portion. The construction described, thus, lends itself to effective operation of the engine, because of the main-

tenance of desirable operating conditions within the engine cylinder, such desirable conditions being largely due to the more efficient cooling thereof.

While the forms of mechanism herein shown and described constitute preferred forms of embodiment of the invention, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What we claim is as follows:

1. A cylinder for internal-combustion engines, comprising a barrel portion of wear resisting metal; a head portion of a metal which is comparatively a good conductor of heat; and a plurality of cooling elements each associated with the barrel portion and the head portion and in effective thermal contact therewith.

2. In an engine cylinder, a barrel portion of wear resisting metal, such as iron; a head portion of a metal which is a comparatively good conductor of heat; and cooling elements each associated with the barrel portion and the head portion, such cooling elements being in effective thermal contact with both portions of the cylinder and composed of a metal which is a good conductor of heat.

3. In an internal-combustion engine cylinder, a barrel portion of wear resisting metal, such as cast iron; a head portion of copper; and cooling fins of copper, each in effective thermal contact with the barrel portion and the head portion.

4. A cylinder for internal-combustion engines, comprising a barrel portion of wear resisting metal; a head portion of a metal which is a good conductor of heat; a superstructure mounted upon the head portion; and heat insulating material intermediate the head portion and the superstructure.

5. A cylinder for internal combustion engines comprising a cylinder of wear resisting metal, such as iron; a combustion chamber of metal which is comparatively a good conductor of heat; and a plurality of cooling elements each associated with and in effective thermal contact with the cylinder and combustion chamber; the combustion chamber portion being provided with suitable valve seats.

In testimony whereof we affix our signatures.

CHARLES F. KETTERING.
WILLIAM B. EARNSHAW.

Witnesses:
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