E. F. COOK.

PISTON.

APPLICATION FILED MAR. 27, 191.

1,389,099.

Patented Aug. 30, 1921.

2 SHEETS—SHEET 1.

Fig. 1.

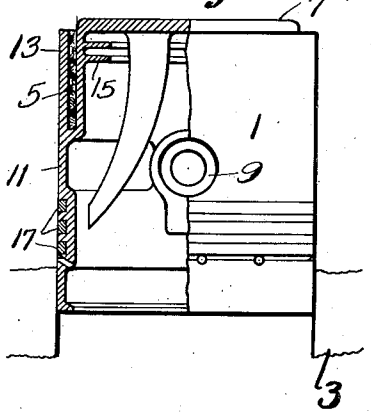


Fig. 2.

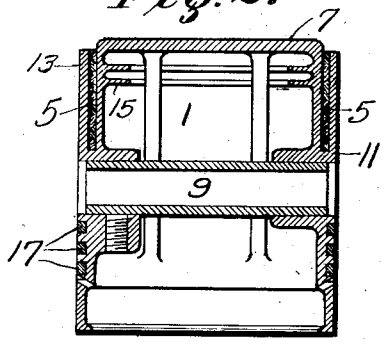


Fig. 3.

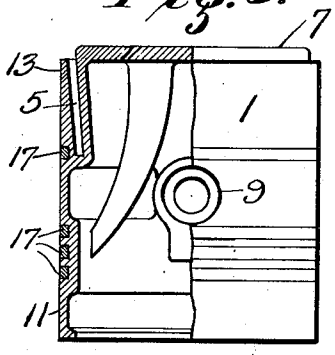
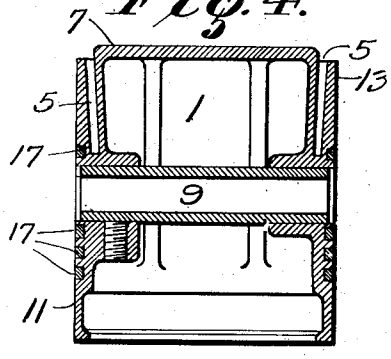


Fig. 4.



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2 SHEETS—SHEET 2.

Fig. 5.

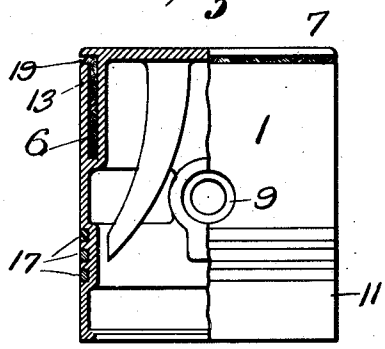


Fig. 6.

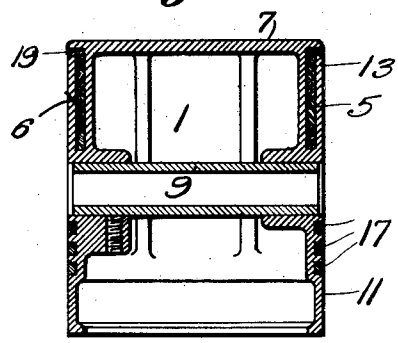


Fig. 7.

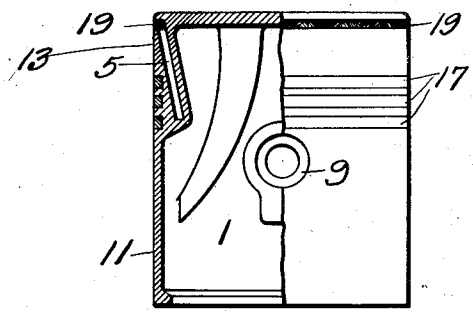
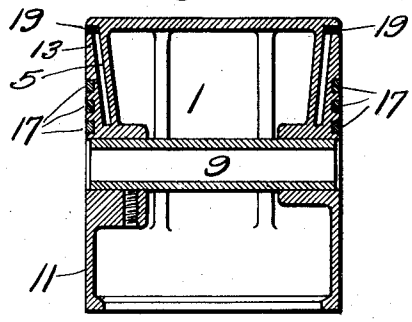


Fig. 8.



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PISTON.

1,389,099. Specification of Letters Patent. Patented Aug. 30, 1921.

Application filed March 27, 1919. Serial No. 285,423.

To all whom it may concern:

Be it known that I, EUGENE F. COOK, a citizen of the United States, and a resident of Richmond Heights, in the county of St. Louis and State of Missouri, have invented an Improvement in Pistons, of which the following is a specification.

This invention relates to pistons, and with regard to certain more specific features, to pistons for use in connection with internal combustion engines.

Among the several objects of the invention may be noted the provision of a simple and efficient piston, so constructed as to minimize the carbonizing action incident to internal combustion engines; the provision of an inexpensive piston constructed to operate at a lower temperature at the walls thereof for a given temperature of the explosive gases, as compared with pistons of the usual type; the provision of a reliable and compact construction for maintaining a comparatively large temperature difference between the side walls of a piston and the surface thereof that is in contact with the explosive gases, such surface being referred to herein for convenience as the top surface or head of the piston; and the provision of a piston of a material expanding at a higher rate than the cylinder, and yet constructed with a clearance that is small in comparison with the clearances now in use in pistons made of such materials. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts which will be exemplified in the structure hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, in which are shown several various possible embodiments of the invention—

Figure 1 is an elevation partly in section, of one form of piston.

Fig. 2 is a sectional elevation of Fig. 1.

Fig. 3 is an elevation, similar to Fig. 1, of another form of piston.

Fig. 4 is a sectional elevation of Fig. 3.

Fig. 5 is an elevation, similar to Fig. 1, of a third form of piston.

Fig. 6 is a sectional elevation of Fig. 5.

Fig. 7 is an elevation, similar to Fig. 1, of a fourth form of piston.

Fig. 8 is a sectional elevation of Fig. 7.

Similar reference characters refer to corresponding parts throughout the several views of the drawings.

Referring now more particularly to Figs. 1 and 2 of the drawings, there is illustrated a piston 1 made preferably of aluminum or some aluminum alloy, to reduce its weight. Materials of this type usually have a higher coefficient of expansion than do the materials such as cast iron of which cylinders 3 are ordinarily constructed. This means that there is less clearance between piston and cylinder at high temperatures than at low temperatures. As a result, aluminum pistons as ordinarily constructed are made with a clearance that is so large at the lower temperatures as to involve a member of disadvantages in operation. This clearance at the lower temperatures cannot be reduced much without bringing the clearance of the pistons at high temperatures down to a point below a safe minimum and rendering the apparatus liable to derangement or other disadvantageous operation due to an unduly tight fitting of the piston within the cylinder. In the present invention the advantages of a light-weight piston are retained, and many of the disadvantages ordinarily attending the use of such a piston are obviated.

The piston 1 (Figs. 1 and 2) is provided with an annular groove 5 extending in this instance from the top surface or head 7 inwardly in a direction axially or substantially axially of the piston, to a point between the said top surface and the axis of the wrist-pin 9. In certain embodiments of this invention, the groove 5 does not extend substantially axially of the piston, but tapers, to effect a more economical construction by making possible the use of less material for a given strength, and by facilitating the location of the piston rings at a point above the wrist-pin, that is, between the wrist-pin and the top surface 7 of the piston. Such a groove is shown, for example, in Figs. 7 and 8, hereinafter described.

By the above construction the side wall 11 of the piston, and particularly the top

portion 13 thereof, is not in direct metallic thermal contact with the top surface of the piston, and is not therefore, subjected to the same temperatures of operation as said top surface. The latter is of course in contact with the gases that propel the piston, and is subjected to comparatively high temperatures. By thus insulating the piston wall from the top of the piston, the former is not subjected to such high temperatures, and as a result operates at a lower range of temperatures than heretofore. This effects a number of advantages, such as reducing the amount of oil that is volatilized, thereby reducing the carbon formed and lowering the oil consumption of the engine.

The heat from the top surface of the piston travels inwardly toward the wrist-pin, and reaches the side wall at a point substantially mid-way between the top and bottom thereof. The heat distribution along the side-wall is thus better equalized than if the heat traveled principally downward through the wall from the top portion thereof.

Vanes 15 may be provided if desired to increase the radiation of heat from the piston to the air inside the piston shell.

With the construction above described, the rings 17 operate at a lower temperature than is usual, and therefore do not warp so much, because they are subjected to less heat strain. Furthermore, the wall of the piston does not distort as much from the heat.

The wall, particularly the upper portion 13 thereof, is not forced to expand and contract with expansions and contractions of the piston head 7, since the two are free to move radially with respect to each other; the wall and head thus have what may be termed an unequal or differential expansion. The operation of the wall at a lower temperature improves the bearing surface thereof, since walls of aluminum and other materials do not ordinarily present as good a bearing surface at high temperatures as at lower temperatures. Again, the lowering of the maximum expansion to which the wall is subjected permits the use of smaller clearance, thereby reducing the losses that vary with the clearance, and making it unnecessary to provide the same efficacy of ring action that would be required with larger clearance. In fact, with the construction of the present invention it is practicable to use rings of a cheaper construction than ordinarily employed, or to reduce the number of rings, or both.

The rings may be located at the bottom portion of the piston, as indicated in Figs. 1 and 2, and in Figs. 5 and 6. Such location of rings keeps the rings cooler and thus reduces carbonizing and allied disadvantages. Or the rings may be located partly at the bottom and partly above the wrist-pin, as indicated in Figs. 3 and 4; or all in the upper portion of the piston, as in Figs. 7 and 8.

In the second embodiment of the invention, shown in Figs. 3 and 4, three rings are shown below the wrist-pin, and one above. For many purposes, however, it will be found that a total of three rings is adequate, and even one or two rings often suffice, thereby greatly reducing such factors as the cost of manufacture, the friction between rings and cylinder, and the liability of derangement that accompanies any apparatus having many relatively movable parts.

In Figs. 5 and 6 the groove 5 is shown as terminating in a radial groove 19, so that the piston wall is to a certain extent protected from contact with the explosive gases. The radial groove or the main groove or both may, if desired, be filled with an elastic heat-insulating packing 6, preferably some asbestos composition. In this embodiment of the invention the piston head is of substantially the same diameter as the piston wall, but a slight difference is preferably maintained, so that the piston head can expand to a greater extent than the wall, and yet at the higher temperatures have still adequate clearance with respect to the cylinder.

In this embodiment of the invention, all of the rings are shown at the bottom as in Fig. 1. This arrangement of rings solely below the wrist-pin effects a number of advantageous results, such as protecting the rings from the higher temperatures that prevail in the upper portions of the piston walls, and therefore reducing the heat strains and the carbonizing and the resulting sticking of the rings.

In Figs. 7 and 8, the structure shown in Figs. 5 and 6 is repeated, except that the rings are shown in a position above the wrist pin.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As various possible embodiments might be made of the above invention and as various changes might be made in the embodiment above set forth, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. In apparatus of the class described, in combination, a piston, having a body, a head integral therewith, a ring on the body, and a groove extending from a point adjacent the central portion of the length of the piston to a point adjacent the head above the ring, said groove having heat insulating material therein.

2. A piston having a substantially flat head, a groove in the piston extending from

the central portion of the length of the piston and separating the head from the upper portion of the side wall of the piston, a piston ring located on said side wall, the head being out of contact with the cylinder in which the piston operates, and insulating material in said groove.

3. A piston having a groove therein extending from a point adjacent the central portion of the length of the piston to a point adjacent the piston head and terminating in a substantially radial groove extending through the outer side wall of the piston to separate the piston head from the upper portion of the side wall of the piston, and a piston ring on the side wall, the head having no piston rings thereon.

4. In apparatus of the class described, in combination, a piston having a groove therein, extending from a point adjacent the central portion of the length of the piston to a point adjacent the piston head and terminating in a substantially radial groove extending through the outer side wall of the piston to separate the piston head from the upper portion of the side wall of the piston, and piston rings on the side wall only.

5. In apparatus of the class described, in combination, a piston having a groove therein, extending from a point adjacent the central portion of the length of the piston to a point adjacent the piston head and terminating in a substantially radial groove extending through the outer side wall of the piston, and heat-insulating material in said groove.

6. In apparatus of the class described, in combination, a piston having a substantially flat head and having a groove therein to separate the piston head from the upper portion of the side wall of the piston and permit differential expansion of head and wall, and heat-insulating means in said groove, whereby the piston wall and rings operate at a temperature materially lower than the temperature of the piston head.

7. In apparatus of the class described, in combination, a piston having a groove therein to separate the piston head from the upper portion of the side wall of the piston, and piston rings mounted on the piston below the wrist-pin, and thereby operating at a temperature materially lower than the temperature of the head.

8. A piston, having a wrist-pin, a groove in the body of the piston extending from a point adjacent the wrist-pin to a point adjacent the piston head and terminating in a groove extending through the outer side wall of the piston, and piston rings mounted on the piston below the wrist-pin only.

9. In apparatus of the class described, in combination, a piston constructed of a material having a greater coefficient of expansion than the cylinder, having a groove therein and extending from a point in or adjacent the piston head to a point adjacent the central portion of the length of the piston and terminating in a substantially radial groove extending through the outer side wall of the piston to separate the piston head from the upper portion of the side wall of the piston, heat-insulating means in said groove, internal ribs to increase the radiation of heat from the piston to the air within it, the piston wall and rings operating at a temperature materially lower than the temperature of the piston head, and relative expansion between piston head and piston wall being permitted, so that the clearance between the piston wall and cylinder may be comparatively small.

10. In apparatus of the class described, in combination, a piston adapted to operate within a cylinder, said piston comprising a head and body, a flange surrounding the head and separating the same from the cylinder walls, a groove between the head and flange, insulating material within said groove, and a piston ring on the body.

In testimony whereof, I have signed my name to this specification this 24th day of March, 1919.

EUGENE F. COOK.