Sept. 8, 1931. R. N. STEELE 1,822,322

ENGINE PISTON

Filed Feb. 27, 1928

Fig. 1

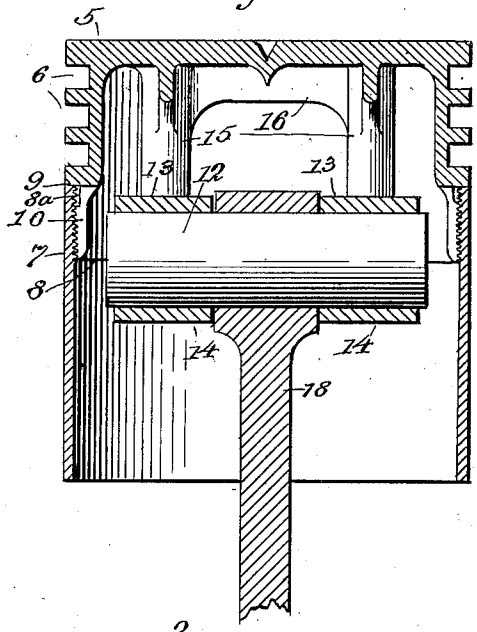


Fig. 2

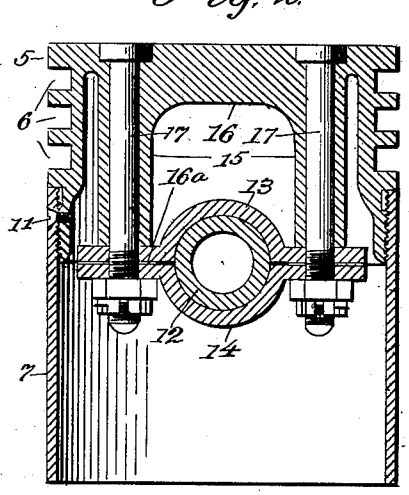


Fig. 3

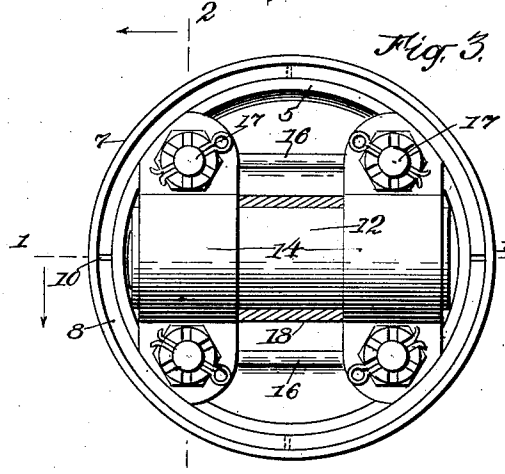


Fig. 4

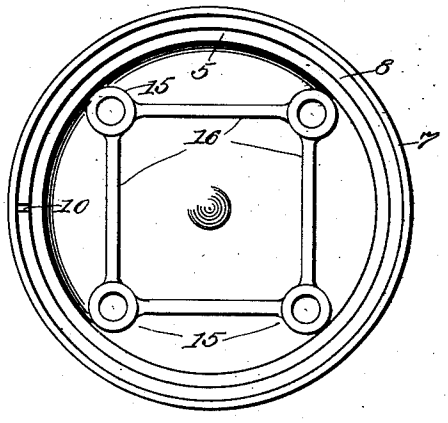


Fig. 5

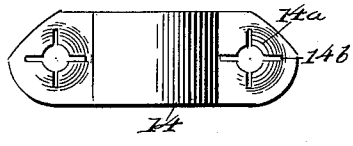
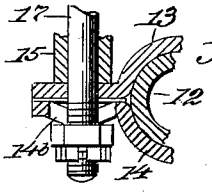


Fig. 6



Inventor

Ray N. Steele

By J. M. St. John

Attorney

Patented Sept. 8, 1931 1,822,322

UNITED STATES PATENT OFFICE

RAY N. STEELE, OF CEDAR RAPIDS, IOWA

ENGINE PISTON

Application filed February 27, 1928. Serial No. 257,512.

This invention relates to pistons, and more particularly the pistons of internal combustion engines, such as are commonly applied to motor vehicles.

The object of the invention is to produce a piston having the requisites of extreme lightness, adequate strength, and little or no liability to distortion under varying conditions of temperature or service.

A further object is to secure great durability and a smooth wearing quality.

Further objects are to simplify construction by a design which will admit of the piston being fitted to the cylinder bore and to the connecting-rod with perfect accuracy and by simple lathe and drill work, without any nice and separate operation in fitting the cross-pin to the piston, and by virtue of this special design and construction make it possible to simplify and improve the connection of the pin with the connecting-rod, and the operative connection of the pin and rod with the piston.

To limit vibration it is found to be very desirable to reduce the weight of the pistons of an automobile engine to the minimum. The most common expedient is to make the piston of aluminum or one of its alloys, but in practice such pistons wear out rapidly, and when so worn and loose in the cylinders cause many detrimental effects in the operation of the engine. Furthermore, as ordinarily constructed, with hubs for the cross-pin integral with the side walls, such pistons are especially subject to distortion, owing to the high coefficient of expansion of the designated metal. In pistons of this type the fitting of the pin is also a separate and very nice operation, as it should be located, or rather the holes to receive it, with exact diametrical and transverse accuracy, precisely perpendicular to its outer walls. The means whereby these and other defects are remedied will fully appear in the description and claims following, reference being had to the accompanying drawings, in which;—

Fig. 1 is a vertical section of a piston embodying my improvements, substantially along the plane indicated by the line 1—1 of Fig. 3. Fig. 2 is a similar section, in the line 2—2 of Fig. 3. Fig. 3 is a plan view of the piston as seen from the open end, the head of the connecting-rod being in section. Fig. 4 is a similar view of the head of the piston. Fig. 5 shows one of the pin-bearing halves designed to compensate for stresses due to changes in temperature, as will be more fully set forth hereafter. Fig. 6 is a fragmentary sectional view showing the improved feature of the bearing as in working position.

In order to combine lightness with an adequate wearing quality, the piston is a composite of a cast aluminum head 5, grooved at 6 for the rings (not shown), and an attached skirt 7 of thin tubular steel. To this end the head is provided with a flange 8, externally screw-threaded to connect with the internally threaded end of the skirt, which is screwed tightly against an abutting shoulder at 9. In ordinary practice the parts will remain tightly connected, notwithstanding the difference of coefficients of expansion of the diverse metals, owing to the fact that the flange expands and contracts endwise as well as diametrically, and in practically the same proportion. Accordingly when the metals cool and shrink, the flange shrinks endwise, and the skirt is still drawn tightly against the abutting shoulder. Provision is made, however, for allowing the flange to yield elastically under extreme conditions, by slitting the flange at one or more points, as shown at 10. This permits the flange to yield inwardly according to the slight difference of expansion between it and the skirt, and to spring back to the original position when the piston cools. A small detent pin or screw 11 prevents the skirt from turning away from the head under any conditions.

As a pre-requisite to the action just described, and in order that the piston may always be perfectly cylindrical, it is desirable to completely detach the piston-pin 12 from the walls of the piston. The mass of metal in the pin-hubs, as commonly constructed, when heated, tends to distort the cylindricity of the piston, especially when

a metal of high expansion is used. This is of course detrimental to the best efficiency of the piston in any case, and greatly increases the difficulty involved in forming a composite piston. Instead, therefore, of using internal side-hubs to receive the pin, detachable half-bearings 13 and 14 are provided therefor, and bolted to posts 15 springing from the end of the head. These posts may be braced by cross-connecting webs 16, but are quite detached from the side walls of the head, as clearly shown in Fig. 4. It will be evident that the posts may be faced for the bearings while the piston is still chucked in the lathe for other operations, and the proper locating of the pin thus becomes not only a very simple, but a perfectly accurate operation.

In practice the bearings are pressed out of flat steel stock, and require little or no machining other than grinding to make a nice bearing on the pin. They may then be case-hardened (or ground after such hardening), and properly lubricated will maintain a working fit on the pin indefinitely. A shim 16*a* is shown for such adjustment as may at any time be necessary.

As will be evident, the construction makes it possible to attach the pin permanently to the head of the connecting rod 18. This is preferably done by giving the head a slightly undersize bore, and pressing the pin therein. This in turn allows the head of the connecting-rod to be of minimum size, and with no clamping lugs or set-screws to add weight. For repairing, the construction is also very convenient, since the pin and rod may be readily attached and detached by the manipulation of four bearing nuts.

For the bearing bolts 17 it may be possible to use duralumin, since there is little direct strain upon them. In this case no provision is necessary for compensating the difference in expansion between the bolts and enclosing posts. To prevent any possible loosening of steel bolts, the bearing 14 may be cupped and slit at 14a and 14b, and any difference in expansion will be compensated for by the slight spring of the cupped segments.

It will be noted that a relief groove 8*a* is shown at the root of the flange 8, for the purpose of rendering the flange more yieldable and elastic in response to changes of temperature.

With the possible exception of the limited wall-bearing portions of the piston-head, if any, all the wearing parts of the piston are of case-hardened steel, and thus calculated to give the maximum of durability and efficiency.

A further practical use for the relief groove, not noted above, is to prevent the expansion of the aluminum head portion at the root of the flange from bulging out the engaging end of the skirt, which would be detrimental. The weakening of the flange at this point tends to prevent this effect.

Incidentally it may be noted that in addition to lightness and durability, the piston has the advantage of high heat conductivity at the head of the piston, where such conductivity is most needed, this quality being many times greater in aluminum than in iron.

Having thus described my invention, I claim:

1. An engine piston formed with cylindrical walls and a closed head, and with bearing-supports springing from the head and wholly detached from the side walls, top and bottom bearing-halves, and bolts connecting the bearing with the ends of said posts, all wholly separated from the side walls.

2. In an engine piston formed with cylindrical walls and with bearing supports detached from said walls and springing from the head of the piston, bearing-halves for the piston-pin, one of the halves of each bearing being cupped for a slight elasticity at the bolt-holes, and bolts adapted to secure said bearings to the inner ends of the posts.

In testimony whereof I affix my signature.

RAY N. STEELE.