April 11, 1939. C. W. PROCHASKA 2,153,992

METHOD FOR TREATING WORN PISTONS

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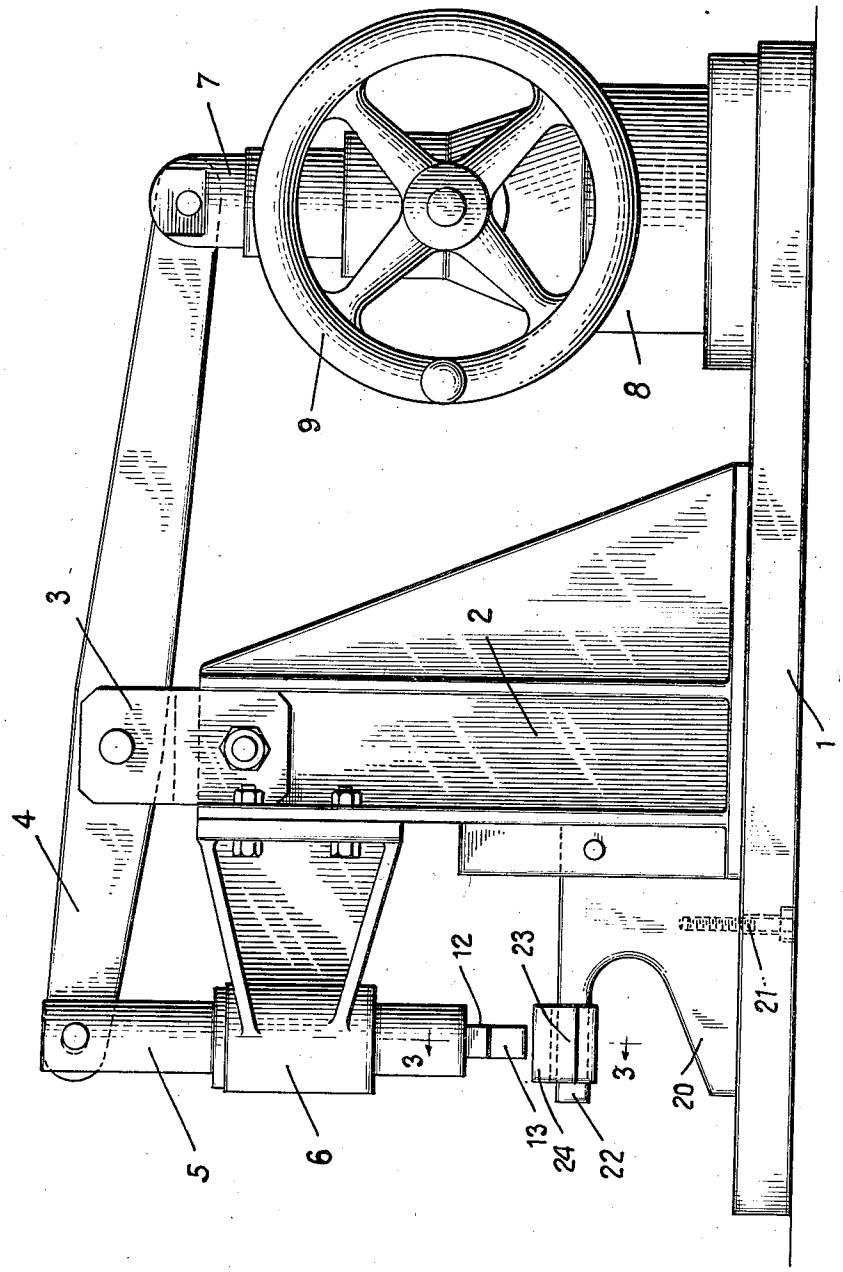


Fig. 1.

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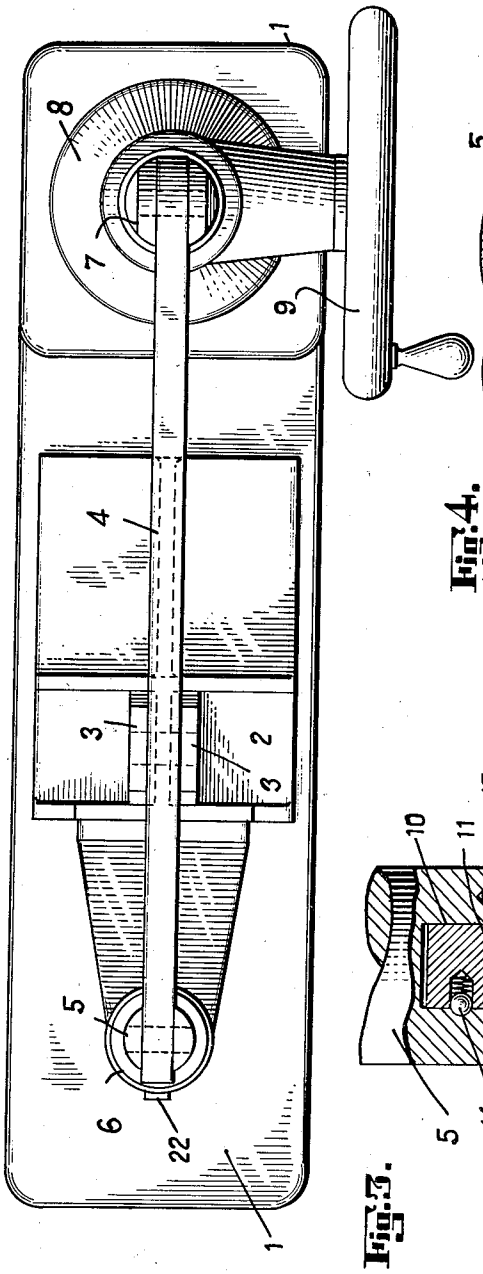


Fig. 2.

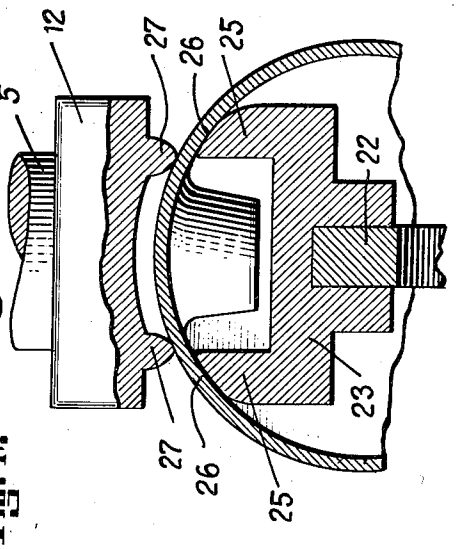


Fig. 4.

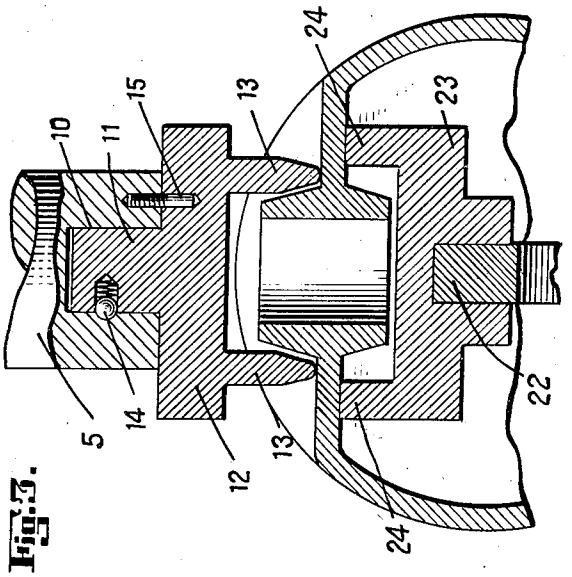


Fig. 3.

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Fig. 6.

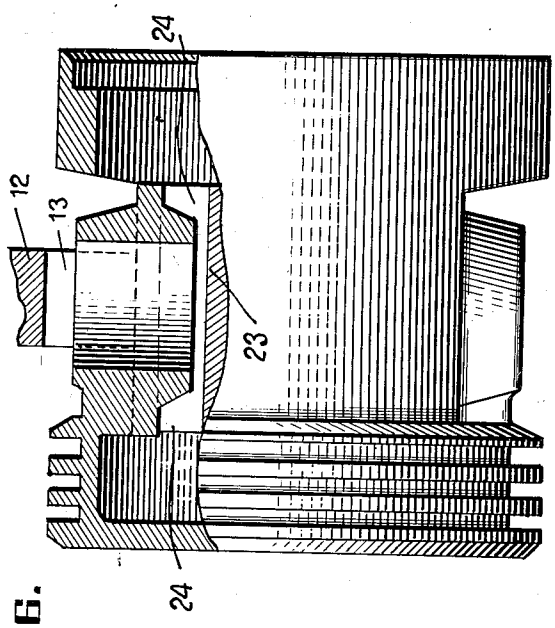


Fig. 7.

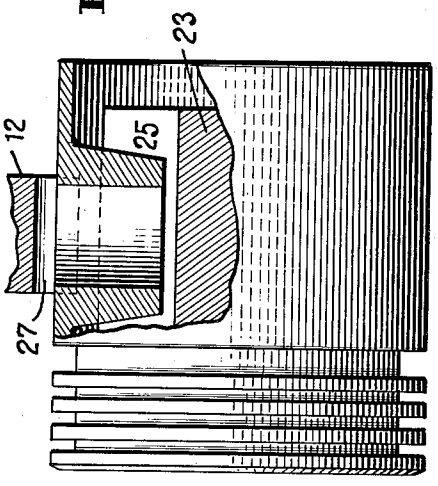
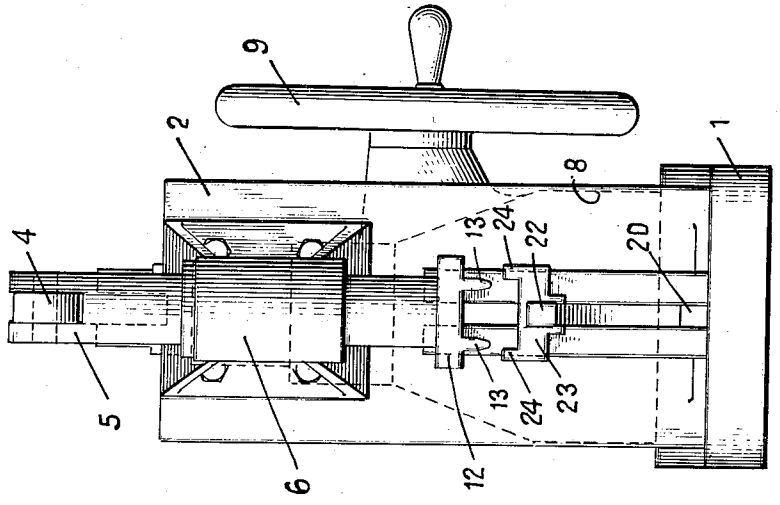


Fig. 5.



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METHOD FOR TREATING WORN PISTONS

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Application May 29, 1936, Serial No. 82,401

5 Claims. (Cl. 153—48)

This invention relates to methods and apparatus for treating worn pistons.

It is an object of this invention to provide a simple and inexpensive method and apparatus for reforming worn or collapsed pistons to restore them to condition for further efficient use. Other objects and advantages of the invention will appear hereinafter.

In engines of various types in which skirted pistons are used, the outside wall of the piston skirt wears against the inside wall of the cylinder. Due to the fact that the thrusts applied to the piston in normal use have a tendency to tilt the piston on its pin, the greatest wear occurs on those portions of the skirt which are intermediate the piston bosses. When sufficient wear of this kind has occurred, the piston begins to wobble on its pin and an audible sound is produced which is known as "piston slap".

This condition is aggravated to some extent by the expansive effect of heat on the pistons when they are heated to ordinary engine temperatures. When a cold piston is heated by the operation of an engine, it does not expand uniformly because of the varying thickness of the metal at different points in the piston, and it is found that the skirt expands more in a direction parallel to the axis of the pin than it does in a direction perpendicular to the axis of the pin. Therefore, if a cold piston having a perfectly circular skirt is heated to ordinary engine temperatures, it will be found to have assumed a substantially elliptical shape in which the major axis of the ellipse is parallel to the axis of the pin. Consequently in a worn piston the effect of ordinary engine temperatures is to increase any eccentricity which may already exist because of wear.

According to the present invention I propose to treat the piston to reform the shape of the skirt to increase the diameter of the piston along a line perpendicular to the axis of the pin. Inasmuch as I do not actually expand the metal of the skirt to any appreciable extent, this increase in one diameter results in decreasing to some extent the other diameter of the piston along a line parallel to the axis of the pin, thus producing, in most cases, a substantially elliptical shape in which the major axis of the ellipse is perpendicular to the axis of the pin. By controlling the extent of the reforming operation as hereinafter described, it is possible to provide an elliptical skirt which when heated to ordinary engine temperatures will assume a substantially circular shape, or by carrying the reforming operation somewhat further, it is possible to provide an elliptical skirt which, when heated to ordinary engine temperature, will still remain elliptical with the major axis of the ellipse still perpendicular to the axis of the pin. The extent to which the reforming operation is carried will depend on whether the cylinder wall to which the piston is to be fitted is substantially circular or somewhat elliptical.

I have found that the piston may be reformed to secure the results previously described by bending and deforming the metal of the piston by applying pressure thereto, preferably immediately adjacent the bosses thereof at points laterally offset from said bosses. In certain types of pistons the said bosses are connected to the cylindrical wall of the piston by struts, and in reforming such pistons I bend and deform the metal of said struts. In other types of pistons the bosses are formed as part of the wall of the piston and in reforming such pistons I bend and deform the metal of the piston wall itself.

When I say that I bend and deform the metal of the piston, I mean that as the metal is bent to reform the shape of the skirt, it is also deformed sufficiently to cause it to retain substantially the bend which is applied; otherwise the resilience of the metal would tend to restore the skirt to its original shape as soon as the pressure was relaxed. Preferably this is accomplished by bending the metal on a relatively short radius by applying pressure at points slightly offset from each other. Preferably also the pressure is applied over relatively limited areas so that the metal will be indented as the pressure is applied, as I find that this form of deformation of the metal assists in retaining the bend.

It is desirable, however, that the pressure be applied over an area extending a substantial distance lengthwise of the piston, although it need not, and preferably should not extend far circumferentially of the piston.

The extent of the reforming of the skirt may be controlled by controlling the application of the pressure to the piston. For this purpose it is preferable to attach a suitable gauge to the piston in such manner as to measure the increase in the diameter of the skirt along a line perpendicular to the axis of the pin as the pressure is applied. In this manner the extent of the reforming operation may be very closely controlled, and the piston may be brought to a shape to fit its cylinder.

Usually it is desirable to carry the reforming to an extent such that the diameter of the piston on a line perpendicular to the axis of the pin ex-

ceeds the corresponding cylinder diameter by approximately .001" in order to allow for wearing in after the piston is replaced in the cylinder. This does not interfere with the insertion of the piston into the cylinder, of course, for the customary slot in the piston wall permits the necessary contraction.

Several types of metal are now in common use in pistons including aluminum or aluminum alloys, cast iron, steel and in some cases composite pistons are made in which the body is aluminum and the bosses and struts are steel. I am able to reform pistons of any of these metals in the cold state by my method, but I find that it is preferable to heat the pistons before treating them, particularly when they are made of aluminum. A temperature of 400° F. is usually adequate to soften the metal sufficiently for easy bending and deformation.

A preferred embodiment of apparatus suitable for carrying out the previously described method is shown in the accompanying drawings, in which,

Figure 1 is a side elevation.

Figure 2 is a top plan view.

Figure 3 is an enlarged section on the line 3—3 of Figure 1 showing a piston with a strut.

Figure 4 is a similar view showing a piston without a strut.

Figure 5 is a front elevation.

Figures 6 and 7 are enlarged side elevations partly broken away corresponding to Figures 3 and 4.

Referring to the drawings, the apparatus comprises a base 1 having a standard 2 mounted thereon, said standard having secured thereto a bifurcated member 3 on which is pivotally mounted a lever 4. One end of the said lever is pivotally connected to a plunger 5 which slides in the sleeve 6 secured to the standard 2, and the other end of the lever 4 is pivotally connected to a plunger 7. This plunger is the actuated part of a jack 8 which may be of any suitable conventional construction such that operation of the hand-wheel 9 will raise and lower the plunger 7 to operate the lever 4 and plunger 5.

The lower end of the plunger 5 is recessed at 10 to receive the member 11 of the die block 12. The block is provided with a pair of feet 13 which engage the piston as hereinafter explained. If desired, a spring pressed ball 14 may be carried by the member 11 to cooperate with a suitable depression in the recess 10, thus retaining the block in place, but permitting the block to be easily removed and replaced by another block whenever desired. A guide pin 15 may also be mounted in the lower end of the plunger 5 to enter a suitably placed recess in the block 12 to insure that the block is located in its proper position thereon.

Also mounted on the base 1 is an anvil 20 which may be secured to the base by means of bolts 21. The anvil is cut away at its front face to provide a prong 22 which is adapted to receive and support a suitable die block 23, which in turn receives and supports the piston which is to be reformed.

Referring to Figures 3 and 4, die blocks are illustrated which are suitable for the treatment of two different types of pistons, those illustrated in Figure 3 being adapted for the treatment of pistons with struts, while those illustrated in Figure 4 are adapted for the treatment of pistons without struts. It will be understood that the precise form of the die blocks will have to be adapted to the particular size and type of piston to be treated, the die blocks illustrated in Figures 3 and 4 being merely representative.

In Figure 3, the lower die block is provided with a pair of feet 24 which are spaced to straddle the piston boss and to engage the under side of the strut at points laterally offset from the boss. As illustrated, the said feet are spaced more widely than the feet 13 of the upper die block 12, so that the area of contact beween the upper die block and the piston is offset somewhat from the area of contact between the lower die block and the piston. Accordingly, when pressure is applied by operating the jack 8, the strut is bent between the two offset contact areas with the result that the shape of the skirt is altered in the manner previously described.

In Figure 4, the feet 25 of the lower die block are also spaced to straddle the piston boss, and are provided with curved surfaces 26 which engage the curved inner wall of the piston skirt at points laterally offset from the bosses. As before, the spacing between said feet is somewhat greater than the spacing between the feet 27 of the upper die block. Accordingly, as in the previous case, the application of pressure bends the piston wall between the two offset contact areas, thus reforming the shape of the skirt.

It will be observed that in both cases illustrated, the bending radius is relatively short, and the areas of contact between the piston and the feet of the upper die blocks are relatively small, thus tending to cause the metal to be deformed and indented slightly in order to retain the bend which has been made. As illustrated in Figures 6 and 7, however, the feet of the upper die block extend for a substantial distance lengthwise of the piston and thus bend and deform the metal for a substantial distance lengthwise of the piston.

It will be understood that the invention may be variously modified and embodied within the scope of the subjoined claims.

I claim as my invention:

1. Method of treating worn pistons to reform the piston skirt which comprises bending the metal of the piston about a relatively short radius between two members, one engaging the outside surface of said piston skirt, and the other engaging the inside surface thereof, to lengthen the diameter of the skirt measured on a line perpendicular to the axis of the pin, and to shorten the diameter of the piston measured on a line parallel to the axis of the pin.

2. Method of treating worn pistons to reform the piston skirt which comprises bending the metal of the piston about a relatively short radius and over an area extending a substantial distance lengthwise of the piston between two members, one engaging the outside surface of said piston skirt, and the other engaging the inside surface thereof, to lengthen the diameter of the skirt measured on a line perpendicular to the axis of the pin, and to shorten the diameter of the piston measured on a line parallel to the axis of the pin.

3. Method of treating worn pistons to reform the piston skirt which comprises bending the metal of the piston adjacent the bosses thereof at points laterally offset therefrom about relatively short radii to lengthen the diameter of the skirt measured on a line perpendicular to the axis of the pin, and to shorten the diameter of the piston measured on a line parallel to the axis of the pin.

4. Method of treating worn pistons to reform the piston skirt which comprises bending the

metal of the piston adjacent the bosses thereof at points laterally offset therefrom about relatively short radii and over an area extending a substantial distance lengthwise of the piston to lengthen the diameter of the skirt measured on a line perpendicular to the axis of the pin, and to shorten the diameter of the piston measured on a line parallel to the axis of the pin.

5. Method of treating worn pistons to reform the piston skirt which comprises supporting the inner wall of the piston on two spaced supports located on opposite sides of the piston boss, and applying pressure to the outer wall of said piston at points more closely spaced than said supports and laterally offset therefrom to bend the metal of the piston to lengthen the diameter of the skirt measured on a line perpendicular to the axis of the pin, and to shorten the diameter of the piston measured on a line parallel to the axis of the pin.

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