Sept. 13, 1932. C. S. C. READ 1,877,530

METHOD OF TREATING PISTONS

Filed Jan. 12, 1931

Fig. 1

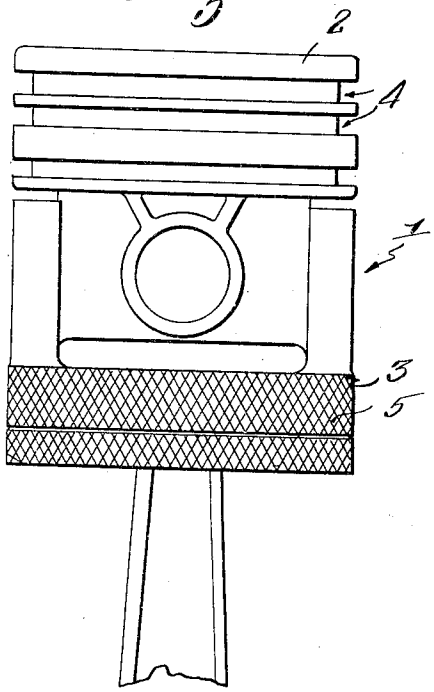
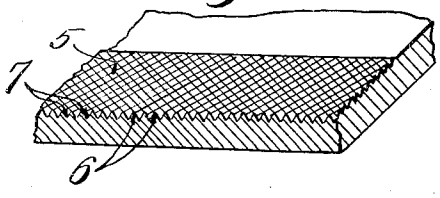


Fig. 2



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UNITED STATES PATENT OFFICE

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METHOD OF TREATING PISTONS

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Prior to this invention it has been found difficult to provide sufficient lubrication on the cylinder walls to prevent excessive wear on the piston and walls which results in undesirable "piston-slap". Furthermore when an engine becomes worn it has heretofore been necessary to replace the old worn pistons by a new set, which involves the work of "grinding-in" the cylinders to fit the new pistons which is expensive and it has also been necessary in replacing pistons to use "oversize" pistons, that is, pistons somewhat larger than the original pistons in order to compensate for the wear on the cylinder walls.

Objects of this invention are to provide a method of treating pistons whereby only portions of the surface contact with the cylinder wall, resulting in low friction and good lubrication for the piston; to provide a method of treating worn pistons to increase the diameter whereby they may be used again and fit tightly within the cylinder, although both cylinder and piston are worn to a considerable extent; and also to provide a method of making oversize pistons for use in worn engine-blocks.

Other methods have been used in an attempt to overcome this objectionable wear. Pistons have been expanded, that is, the diameter of the piston has been increased by spreading portions of the skirt of the piston. This results generally in an elliptical or oval shaped piston which aggravates the objectionable conditions instead of curing them. Another method has been to weld or shrink a band of metal around the outside of the skirt portion to increase the diameter somewhat. This makes a heavier piston, throwing the engine out of balance, the attachment of the band is often insecure, causing damage to the cylinder walls, and the grain structure is further changed undesirably by the heating effect. In the practice of the method of this invention the weight of each piston remains the same and, since no heating is necessary, the desired properties in the metal remain the same.

The article of this invention comprises a piston in which the surface or portions of the surface of the cylindrical walls thereof have a series of depressions and ridges or protuberances, the summits of the ridges providing small surface areas for contact with the cylinder wall and the depressions acting to carry oil for lubricating the contacting surfaces. The method comprises, as one step in the treatment of a piston, upsetting the piston wall as by extrusion, preferably at the skirt portion, whereby the diameter of the piston in certain portions is increased. The invention also comprises a method of treating the surface of pistons to provide grooves or recesses and ridges or protuberances, which results in a better lubricated piston as well as in enlarging the diameter of worn pistons.

In the drawing:

Fig. 1 is an elevational view of a piston showing the invention; and

Fig. 2 is a perspective view of a developed section of the skirt portion of the piston.

The piston 1 is provided with the usual head portion 2 and skirt portion 3, the head portion having the usual series of circumferential grooves 4 for receiving piston rings. Adjacent the lower edge of the skirt portion of the piston of the preferred construction is provided a circumferential band or bands of knurling 5 which may be applied in any desired manner as for example by mounting the piston in a lathe and rotating it while a knurling tool is acting upon the surface. This results in a series of spaced ridges or protuberances 6 and corresponding interconnected grooves 7 as shown most clearly in Fig. 2.

In the particular embodiment disclosed, the knurling extends from the lower edge of the skirt portion up to a point where the sides of the piston are cut away for the wrist pin bearing, as in Fig. 1, forming two bands of knurling one on either side of the oil groove 9. However, the particular width of the band or bands may be varied as desired, as, for example, by extending the knurling only over the area between the oil groove and the base of the skirt portion. If desired, a band of knurling may also be applied adjacent the top of the piston between one or more pairs

of adjacent ring grooves in order to produce a tighter fit at the top of the piston. It has been found, as a result of the knurling, that the diameter of the piston may be increased to compensate for wear as much as 25/1000 of an inch without additional or removal of any material. After the knurling operation the outer surface may be treated, to provide a surface of contacting areas which define a perfect cylinder and to obtain the desired piston diameter, as by a grinding or turning operation. Other treatments of the piston wall will produce a surface having desirable characteristics similar to the knurled surface, as for example, a series of prick-punch marks, a series of rolled threads, or any similar extrusion of metal on the surface. The surface area of the protuberances and the amount by which the diameter of the piston is increased may be varied within wide limits, depending on the type of treatment and the extent of such treatment. The ratio of the area of the protuberances which contact with the cylinder to the corresponding area of the usual piston may be varied widely (e. g. between 25% and 75%) and is dependent on the width and depth of the indentations in the extrusion means.

This invention also includes an embodiment in which the knurling or extruding operation is not carried entirely around the circumference but is confined to certain portions thereof, preferably in at least three spaced portions. In this embodiment the desired tight fit of the piston to prevent piston-slap is obtained, due to contact with the cylinder in at least three locations around the circumference.

The surface of the piston after being treated will normally be characterized by having a portion of the peripheral surface divided into areas of small dimensions, certain of the areas being located at one radius and other areas at other radii, forming, in the preferred embodiment, a surface of small bearing areas at one radius and a series of interconnecting channels between said areas at a shorter radius along which channels oil may flow to lubricate the bearing areas. These areas may have any desired surface contour; they preferably conform with the curvature of the cylinder wall, although the surface of the areas may be rounded, providing less surface contact but allowing for more efficient lubrication since, by reason of the resultant spacing of the edge of the areas from the cylinder wall, the oil may readily flow onto the areas to lubricate the surfaces. The bearing areas or protuberances are staggered axially in the preferred embodiment, that is, the areas are not in line longitudinally of the piston. As a result of the staggered surfaces the channels therebetween do not run directly longitudinally of the piston permitting no direct line of flow for oil past the contacting surfaces of the skirt portion of the piston and cylinder wall.

By the use of this structure on a piston, the friction between the piston and cylinder is decreased to an appreciable extent, there being a much smaller area of contact between surfaces; also there is less wear on the cylinder wall because of the smaller surface contacting with the wall, thus the friction is reduced and at the same time excessive oil leakage is prevented.

This construction is particularly applicable to worn pistons in order to enlarge the diameter, as will be apparent from a consideration of Fig. 1, in order to make the diameter of the skirt portion sufficiently large to prevent piston-slap, since by the knurling operation portions of the piston are raised or extruded about the normal surface forming protuberances or projecting areas and corresponding portions are lowered, forming depressions. However, this construction is also useful on new pistons for use in new engines, since this structure of piston by reason of the increased oil supply decreases the wear on the engine block. In pistons of this type the skirt portion will be made somewhat smaller than the normal size and increased by a knurling or other operation to the normal diameter. A further use is found in providing oversized pistons for use in worn engine blocks. A piston of substantially normal diameter is treated by knurling or the like, whereby the diameter is increased and compensates for the enlarged diameter of the cylinder and avoids the necessity of buying new oversized pistons and grinding in the cylinder walls to fit the pistons.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents which fall within the scope of the appended claims.

I claim:

1. Method of increasing the diameter of a piston, which comprises extruding a peripheral surface thereof by knurling, thus providing a plurality of mutually crossing grooves between spaced protuberances having outer surface areas substantially defining a cylindrical surface.

2. Method of increasing the diameter of a piston, which comprises extruding a peripheral surface thereof by knurling, thus providing a plurality of mutually crossing grooves extending diagonally in relation to the central axis of the piston between spaced protuberances having outer surface areas staggered in relation to said axis and substantially defining a cylindrical surface.

3. Method of increasing the diameter of a piston, which comprises extruding a peripheral surface thereof by knurling, thus providing a plurality of mutually crossing grooves between spaced protuberances having

outer surface areas substantially defining a cylindrical surface, and thereafter subjecting the knurled portion to a finishing operation to cause said areas accurately to assume the form of small portions of a cylindrical surface.

Signed by me at Toronto, Ontario, Canada, this 10th day of September, 1931.

CHARLES S. C. READ.