Nov. 30, 1965 J. J. ROY 3,220,101

METHOD OF REBUILDING PISTONS

Filed Jan. 11, 1965 2 Sheets-Sheet 1

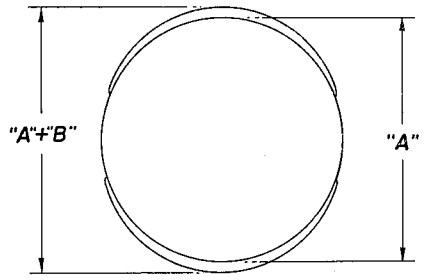

FIG. 4

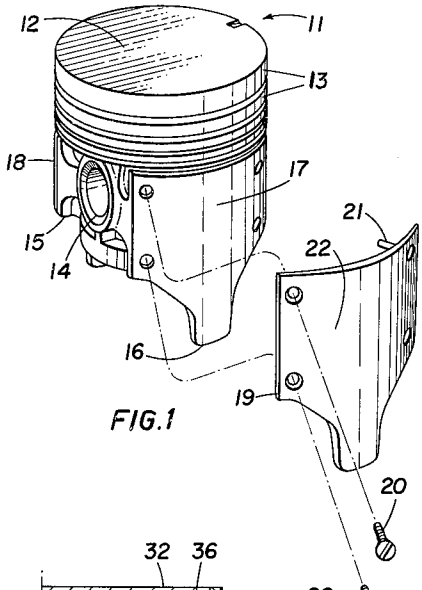

FIG. 1

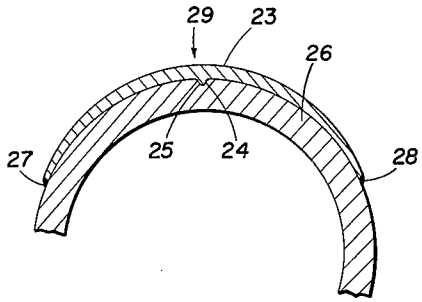

FIG. 2

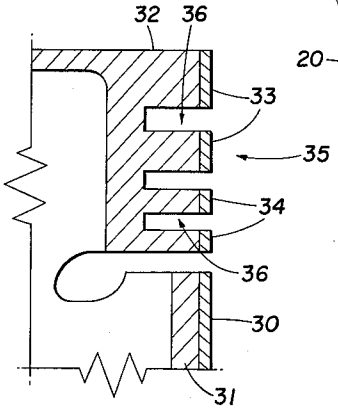

FIG. 3

	DIMENSION "A"	OVERSIZE "B"	SHIM NOMINAL THICKNESS $\frac{"B"}{2}$
REBORE RANGE	3·75"	·020"	·010"
	3·95"	·020"	·010"

FIG. 5

Inventor

JOHN JEROME ROY

by: Cavanagh & Norman.

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METHOD OF REBUILDING PISTONS

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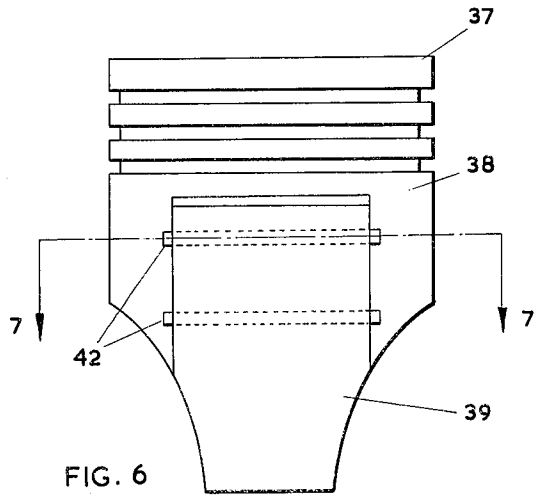

FIG. 6

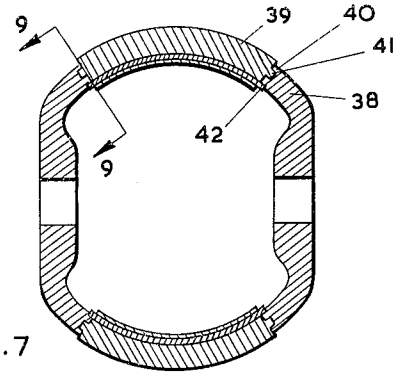

FIG. 7

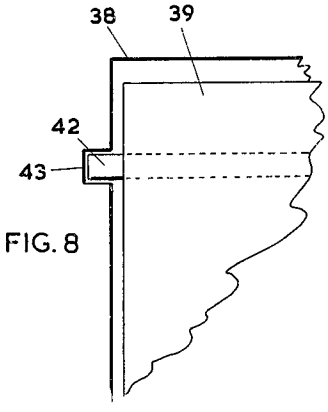

FIG. 8

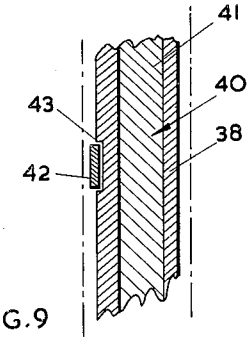

FIG. 9

INVENTOR.
JOHN JEROME ROY
BY
Cavanagh & Norman

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METHOD OF REBUILDING PISTONS

John Jerome Roy, 6 Sultana Ave., Toronto, Ontario, Canada

Filed Jan. 11, 1965, Ser. No. 425,685
12 Claims. (Cl. 29—401)

This is a continuation-in-part of my copending application Serial No. 349,327, filed March 4, 1964, entitled Method of Rebuilding Pistons, now abandoned.

This invention relates to a method for providing original pistons for re-use with a rebuilt engine, wherein the cylinders have been rebored to a larger size.

It is conventional practice when rebuilding engines, such as gasoline engines where the cylinders can become worn due to the action of the rings and cylinders have to be rebored to a larger size than standard, to discard the original pistons and to install oversize pistons in their place. The cost of new pistons is a considerable portion of the cost of parts for a rebuilt engine and therefore some means for saving this cost is desirable.

It is known that on an engine which has been worn to the point of requiring to be rebuilt that the major portion of the wear of the pistons and cylinders occurs between the rings and the cylinder walls and that the pistons wear very little, if any. This is due to the fact that the piston acts as a means for positioning the rings only and thus comes in slight contact with the cylinder walls at certain positions which are the areas of contact. These areas of contact are the high points on the periphery of the piston skirt provided by the slightly elliptical form of the piston. The piston during normal operation rocks slightly on the piston pin to accommodate for the movement of the rings, the areas of contact, usually diametrically opposite on the skirt, coming in contact with the cylinder walls only from time to time and with comparatively slight pressure.

Upon a cylinder being rebored to a comparatively large oversize such as for instance twenty one-thousandths of an inch on a three and three quarter inch diameter nominal size cylinder, it is usually necessary to provide an oversize piston. In the case where a small amount of oversize is used, such as perhaps ten to fifteen one-thousandths of an inch on a similar size cylinder, it is often not necessary to replace the piston since the amount of support for the new oversize rings offered by the old piston is deemed sufficient and the areas of contact having negligible wear offer sufficient steadying of the piston and rings.

For the above reasons resort has been had to the present invention which provides a method for enlarging the original pistons where these pistons may be used in the rebuilt engine. The invention does this by providing skirt shims applied by various means to the areas of contact of the skirt, whereby the skirt diameter can be brought out to meet the rebore diameter of the cylinder walls.

It is a further objective of the invention to provide an automobile piston provided with such skirt shims.

Other objects and features of the invention will be apparent from the following description of the drawings in which like numerals refer to like parts throughout the various views.

In the drawings:

FIGURE 1 is a perspective view of an embodiment according to the method of the present invention and illustrates a skirt shim removed from the piston;

FIGURE 2 is a partial section of a piston showing a skirt shim secured thereto;

FIGURE 3 is a partial vertical section of a piston showing the method for providing enlarged upper surfaces in the region of the piston lands;

FIGURE 4 is a diagram to illustrate the method of the present invention; and

FIGURE 5 is a chart to illustrate the method of the present invention;

FIGURE 6 is a side elevation of a further embodiment;

FIGURE 7 is a section along the line 7—7 of FIGURE 6;

FIGURE 8 is a section along the line 8—8 of FIGURE 7; and

FIGURE 9 is an enlarged side elevation of a detail of FIGURE 6.

Referring to FIGURE 1 a piston indicated as **11** is illustrated and comprises a piston top **12** having the piston lands **13** depending therefrom. A piston pin mounting **14** is secured to the piston and extends diametrically thereacross to provide means for securing the piston to a conventional connecting rod.

Piston **11** is provided with a pair of skirts **15** and **16**, these skirts providing the areas of contact for piston **11**, the area of contact **17** being exposed for the skirt **16**. It will be understood that the skirt **15** is provided with a similar area of contact (not shown) and that both areas of contact are diametrically opposite and substantially at right angles to the pin mounting **14**.

A pair of skirt shims **18** and **19** of a configuration similar to the skirts **15** and **16** are adapted to be secured to the respective skirt by means of bolts **20** or by the rivets **21**. The attachment means whether bolts or rivets are used to provide attachment away from the areas of contact such as area of contact **22** on skirt shim **19** and preferably to either side of the area of contact, whereby upon the piston being reinstalled in the cylinder the attachment means will not come in contact with the cylinder walls and thus will not tend to loosen under any scraping or sliding action.

Referring to FIGURE 2 a further embodiment according to the invention is illustrated wherein a skirt shim **23** is provided with a dimple **24** which mates with an indentation **25** in the piston skirt **26**. It will be understood that other forms of protuberances may be resorted to, such as for instance, ribs or the like molded or otherwise formed on the inner face of the skirt shim **23**, whereby suitable indentations or slots may be cut or otherwise formed on the outer surface of the skirt **26** to match with the protuberances to form suitable locating means for the skirt shim. In the embodiment as shown in FIGURE 2 the skirt shim **23** is secured to skirt **26** by means of welds **27** and **28** which are beyond the area of contact as indicated at **29**.

It will be seen that the skirt shim **19** or **23** is provided with a thickened centre portion at the area of contact and a tapered side portion to either side of the area of contact thereby to ensure that only a portion of the skirt shim contacts cylinder walls. In this manner an area of contact similar to that provided in the original piston and cylinder diameter is maintained.

Referring to FIGURE 3 a further embodiment according to the present invention is illustrated wherein a skirt shim **30** secured to a skirt **31** of a piston **32** is provided in a manner similar to that as heretofore described. In addition, piston **32** is provided with enlarged portions **33** and **34** in the area of the piston lands as indicated at **35**. The enlarged portions may be secured to the piston **32** by any number of well known methods, a preferred method being to fuse the material of the portions **33** and **34** to the piston **32** whereafter slight reworking of the piston may be resorted to to ensure that ring grooves **36** are cleared to receive the new piston rings.

This enlargement of the upper portion of the piston may be resorted to in cases where the oversizing due to rebore makes it desirable to provide larger lands for supporting the rings or an increased piston diameter to retard the penetration of heat past the piston top and into the area of the piston rings. In many cases this enlargement may not be necessary since the amount of oversize

due to rebore would not seriously affect the operation of the piston with regard to ring support and heat isolation.

With reference to FIGURE 4 and FIGURE 5 the method of the present invention is illustrated as applied to a specific size of piston and degree of oversize therefor. The dimension A refers to the nominal size of the original cylinder diameter and the dimension B refers to the amount of oversize due to rebore. The dimension A plus B refers to the rebore size, that is, the new nominal cylinder diameter.

As an example of the method according to the present invention, the amount of oversize is first determined and in this example the first line of the chart in FIGURE 5 indicates that the oversize is twenty one-thousandths of an inch. The thickness for the skirt shim therefor according to the method is approximately one half this amount of oversize which gives a nominal shim thickness of ten one-thousandths of an inch. The appropriate size shims are then secured by means as noted above to the piston skirts to give an enlarged piston of the desired oversize, this being a nominal piston diameter of three and ninety-five one-hundredths of an inch as indicated on line 2 of the chart in FIGURE 5.

Upon further wear occurring in the engine and a second rebore being required the above steps may be carried out again where in this case the oversize is again twenty one-thousandths of an inch, the shim thickness being ten one-thousandths of an inch. At this point the upper portions of the piston may be enlarged as shown in FIGURE 3 to provide more support for the piston rings, the election of this other step depending upon the amount of oversize in relation to the nominal piston diameter.

With reference to FIGURE 6 a piston **37** is shown having a lower skirt portion **38**. It will be understood that the view on the piston **37** shows a lower portion of the skirt somewhat tapered and only shows one-half of the skirt, the other skirt being directly behind that as shown.

A slipper **39** is removably secured in skirt **38** within square grooves **40** by means of square projections **41** formed on the slipper **39** and locked against movement therefrom by spring clips **42** formed integrally within the slipper **39**, this being done by conventional molding techniques. It will be further understood however, that the spring clips **42** can also be secured to the slipper by means of riveting and similar means.

With particular reference to FIGURES 8 and 9 the interior of skirt **38** is shown provided with indentations **43** whereby the spring clips **42** are secured therein.

As a preferred method for forming the slipper **39**, it is contemplated that a slight wedge fit on the sides of the slipper **39** may be provided whereby upon clips **42** springing into indentations **43** a slight wedging action will take place in order to secure the slipper **39** in place.

From the foregoing it will be seen that the method of the present invention is utilized by first determining the amount of oversize as required from the rebore of the engine thereafter selecting a pair of shims each approximately one half of the oversize dimension then securing the shims by suitable means to the piston skirts. In this manner, an enlarged piston suitable for use in the rebuilt engine is provided thus saving the original pistons for reuse and thus reducing the cost of parts for a rebuilt engine.

It will be further understood that although specific embodiments of the invention have herein been described and illustrated, the invention also contemplates such variations as may fall within the scope of the appended claims.

What I claim is:

1. A method of enlarging original pistons for use in the rebuilt engine wherein the cylinders have been rebored an oversize larger than the original diameter and by the addition of skirt shims to the areas of contact of said piston, said method comprising the steps of:

determining the amount of said oversize;

selecting two said shims each of a thickness substantially equal to one half of said oversize; and

securing said shims to either said areas of contact of said piston, said securement being beyond said area of contact.

2. A method of enlarging original pistons for use in the rebuilt engine wherein the cylinders have been rebored to an oversize larger than the original diameter and by the addition of skirt shims to the areas of contact of said piston, said method comprising the steps of:

determining the amount of said oversize;

selecting two said shims each of a thickness substantially equal to one half of said oversize; and

riveting said shims to either said areas of contact of said piston, said riveting being beyond said area of contact.

3. A method of enlarging original pistons for use in the rebuilt engine wherein the cylinders have been rebored to an oversize larger than the original diameter and by the addition of skirt shims to the areas of contact of said piston, said method comprising the steps of:

determining the amount of said oversize;

selecting two said shims each of a thickness substantially equal to one half of said oversize;

securing said shims to either said areas of contact of said piston, said securement being beyond said area of contact; and

bolting said shims to either said areas of contact of said piston, said bolting being beyond said area of contact.

4. A method of enlarging original pistons for use in the rebuilt engine wherein the cylinders have been rebored to an oversize larger than the original diameter and by the addition of skirt shims to the areas of contact of said piston, said method comprising the steps of:

determining the amount of said oversize;

selecting two said shims each of a thickness substantially equal to one half of said oversize; and

welding said shims to either said areas of contact of said piston, said weldment being beyond said area of contact.

5. A method of enlarging original pistons for use in the rebuilt engine, wherein the cylinders have been rebored to an oversize larger than the original diameter, said method utilizing skirt shims of concave configuration to match the areas of contact of said pistons and having at least one locating protuberance on the inner face thereof, said method comprising the steps of:

determining the amount of said oversize;

selecting two said shims each of a thickness substantially equal to one half of said oversize;

reworking said piston to provide locating indentations to match said protuberaance, thereby to locate said skirt shims on said areas of contact; and

securing said shims to either said areas of contact of said piston, said securement being beyond said area of contact.

6. A method of enlarging original pistons for use in the rebuilt engine wherein the cylinders have been rebored to an oversize larger than the original diameter and by the addition of skirt shims to the areas of contact of said piston, said method comprising the steps of:

determining the amount of said oversize;

selecting two said skirt shims of substantially equal thickness, each said thickness being less than the one half the amount of said oversize; and

securing the shims to either said areas of contact of said piston, said securement being beyond said area of contact.

7. A method of enlarging original pistons for use in the rebuilt engine, wherein the cylinders have been rebored to an oversize larger than the original diameter, said method

utilizing skirt shims of concave configuration to match the areas of contact of said pistons and having at least one locating protuberance on the inner face thereof, said method comprising the steps of:

determining the amount of said oversize;

selecting two said skirt shims of substantially equal thickness, each said thickness being less than the one half the amount of said oversize;

reworking said piston to provide locating indentations to match said protuberance, thereby to locate said skirt shims on said areas of contact; and

securing said shims to either said areas of contact of said pistons, said securement being beyond said area of contact.

8. A method of enlarging original pistons for use in the rebuilt engine wherein the cylinders have been rebored to an oversize larger than the original diameter and by the addition of skirt shims to the areas of contact of said piston, said method comprising the steps of:

determining the amount of said oversize;

selecting two said shims each of a thickness substantially equal to one half of said oversize;

securing said shims to either said areas of contact of said piston, said securement being beyond said area of contact; and

enlarging the piston diameter in the area of the ring grooves to an amount substantially equal to said oversize.

9. A method of enlarging original pistons for use in the rebuilt engine, wherein the cylinders have been rebored to an oversize larger than the original diameter, said method utilizing skirt shims of concave configuration to match the areas of contact of said pistons and having at least one locating protuberance on the inner face thereof, said method comprising the steps of:

determining the amount of said oversize;

selecting two said shims each of a thickness substantially equal to one half of said oversize;

reworking said piston to provide locating indentations to match said protuberance, thereby to locate said skirt shims on said areas of contact;

securing said shims to either said areas of contact of said piston, said securement being beyond said area of contact; and

enlarging the piston diameter in the area of the ring grooves to an amount substantially equal to said oversize.

10. A method of enlarging original pistons for use in the rebuilt engine, wherein the cylinders have been rebored to an oversize larger than the original diameter, said method utilizing skirt shims of concave configuration to match the areas of contact of said pistons and having at least one locating protuberance on the inner face thereof, said method comprising the steps of:

determining the amount of said oversize;

selecting two said skirt shims of substantially equal thickness, each said thickness being less than the one half the amount of said oversize;

reworking said piston to provide locating indentations to match said protuberance, thereby to locate said skirt shims on said areas of contact;

securing said shims to either said areas of contact of said piston, said securement being beyond said area of contact; and

enlarging the piston diameter in the area of the ring grooves to an amount substantially equal to said oversize.

11. An enlargeable piston for an engine, compressor and the like and comprising:

a piston body having skirt portions depending therefrom;

slippers on said skirt portions;

grooves formed in said skirt portions and complementary mating ribs formed on said slippers for interlocking sliding engagement;

and clip means on said slippers and complementary mating recesses on said skirt portions for interlocking engagement.

12. An enlargeable piston for an engine, compressor and the like and comprising:

a piston body of predetermined diameter and having skirt portions defining a reduced diameter depending therefrom;

slippers on said skirt portions enlarging the overall diameter thereof and defining a diameter greater than said piston body;

slippers on said skirt portions;

grooves formed in said skirt portions and complementary mating ribs formed on said slippers for interlocking sliding engagement;

and clip means on said slippers and complementary mating recesses on said skirt portions for interlocking engagement.

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JOHN F. CAMPBELL, *Primary Examiner.*

THOMAS H. EAGER, *Examiner.*