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PROCESS FOR RECONDITIONING PISTONS

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This invention relates to a process for reconditioning pistons and more particularly to processes for reconditioning the worn pistons of internal combustion engines by stretching, expanding, or ovalizing them, so that they will fit their cylinders with proper operating clearance.

It is well known that when an internal combustion engine piston has been subjected to alternately hot and cold temperatures as a phase of operation of the engine, the metal of the piston in them becomes seasoned and tempered. Piston metal seasoned in this manner is more wear-resisting and suitable than the material of a new piston. This is due to the fact that operation for long periods of time results in making the piston surface very smooth and closing the pores of the metal. By the time a piston has become thus seasoned and the pores closed, it has worn down to such an extent that there is too much clearance between the piston and the engine cylinder walls for proper and efficient operation, excessive clearance resulting in piston slap, excessive oil consumption and blow-by. Thus, when the metal of a piston has attained its most efficient characteristics, the piston itself has become too small.

In the reconditioning of motors after the pistons and cylinder walls have worn, it has been common to install new pistons of enlarged diameter, but this procedure does not take advantage of the improved condition of the metal of the old piston. Another method heretofore followed in some instances has been to insert devices within the old piston having a tendency to exert an expanding force particularly on the split skirt of the piston, so as to spread the skirt and enlarge the diameter to take up excessive clearance. It has been found, however, that the inserted expanding device produces only a temporary correction, since in a short time, it loses its expansive force, permitting the piston to return to its normal diameter as reduced by wear. Continued flexing at high temperatures contributes to the early failure of such expanding devices.

Another method which has been followed with only some degree of success in the past is to stretch the piston on an expanding or stretching machine, but insofar as I am aware, piston expanding machines and methods heretofore known have not produced uniformly satisfactory results, one very common difficulty having been the crystallization or other disturbing of the piston metal, resulting in subsequent cracking or breaking of the pistons.

In accordance with my invention, worn pistons are treated and expanded in a novel manner, so as to give the metal a permanent set to an enlarged diameter, without harmfully disturbing the crystalline structure. The advantages of thus using the old piston are many, the most important being that the piston metal being seasoned and the pores being already closed, the pistons will be less subject to wear than even entirely new pistons. A further advantage is that the using of the old pistons eliminates the necessity of providing new piston pins and furthermore, of course, the cost of expanding the pistons is very small as compared to the cost of new pistons. Moreover, when using new pistons, it is necessary to supply and install new piston pins, whereas by reconditioning old pistons, this substantial added expense is eliminated.

It is an object of the present invention to provide a method for expanding pistons in such a manner as to stretch the piston to the desired increased diametral dimension and to cause the metal to set permanently to such increased dimension without, however, disturbing the internal metal structure and without rendering the piston susceptible or subject to cracks or breakage.

Generally stated, a process in accordance with my invention includes the steps of heating the piston to a suitable temperature, then while it is hot, stretching the piston transversely of its axis and thereafter cooling the piston slowly, so as to not set up any internal stresses. I have found that the temperatures to which the piston is heated at the time during which the stretching forces apply and the rate of cooling must be controlled quite carefully in order to obtain the best results.

The invention will be more fully understood from a consideration of the control exercised over the process as set forth below, it being understood, however, that although the temperatures, stretching times, and cooling rates are important and must be controlled with care, the temperatures and so forth stated are given by way of example and are subject to reasonable variation within the limits indicated. As a result of both laboratory tests and the successful commercial reconditioning of many thousands of pistons, I have found that the pistons first should be heated in any suitable oven or the like to a temperature of between approximately 575° F. to 700° F. for a period of about one-half hour. A somewhat longer heating period may be employed without harmful results, but is usually unnecessary. The pistons should, however, be maintained at the temperature indicated for a period of about one-half hour and it is imma-

terial whether the pistons are put in a cool oven and brought up to temperature with the oven, or whether they are put in an oven already at a temperature of from about 575° F. to about 700° F.

After the pistons have been maintained at the temperature indicated for this period, they are removed from the oven and immediately placed on a suitable stretching apparatus, preferably such as is disclosed and claimed in my copending application, Serial No. 118,964. The process may be employed for reconditioning various types of pistons, whether of the split-skirt or non-split-skirt type. When treating split skirt pistons, they should be placed on the stretching apparatus in such a manner that the stretching force is applied at diametrically opposite points respectively mid-way between the splits in the skirts. The stretching force is then applied against the insides of the piston skirts until the pistons have been expanded or stretched transversely of their axes to the desired diameter as indicated by a suitable gauge or the like. After they have been stretched to the desired increased diameter, the pistons are allowed to remain on the stretching apparatus for about twenty seconds to permit the metal to set. The pistons are then removed from the stretching apparatus and placed so as to be well protected from drafts or cold air, so that they will cool gradually to about 250° F. They should be cooled at such a rate that they will reach 250° F. within about fifteen minutes, and usually this will require a cooling rate of not more than about 15° F. per minute. This slow cooling may be caused to take place in a slightly heated oven or in an enclosure which need not be heated by any source other than the pistons themselves, but which is so constructed as to protect the pistons from drafts or the like and to cause them to cool at the desired slow rate. After the pistons have reached a temperature of about 250° F., they may be permitted to cool more rapidly without harmful results, thus making it possible to conduct the process more rapidly. Experience has shown that by following my improved process, the pistons retain their desired characteristics, including their smooth surface with closed pores and their ability to resist wear. Actually, therefore, pistons reconditioned in accordance with my process are superior to new pistons, and it is much more economical to recondition the old pistons than it is to provide new pistons.

The process described above by applying the stretching force midway between the splits of a split skirt piston expands the piston to a somewhat ovalized shape, which is desirable.

The method described above has been found to produce the most satisfactory results in the reconditioning of hundreds of pistons and is the at present preferred method in accordance with my invention, but it will be understood that various changes may be resorted to without departing from the invention as defined in the claims.

I claim:

1. A process for expanding pistons comprising heating the piston and maintaining it at a temperature of from 575 to 700 degrees Fahrenheit for about one-half hour; stretching it by external force applied transversely of its axis while hot; and then cooling it substantially without disturbing its crystalline structure and initially at the approximate average rate of about 15 degrees Fahrenheit per minute until it reaches a temperature of about 250 degrees Fahrenheit.

2. A process for expanding pistons comprising heating the piston and maintaining it at a temperature of from 575 to 700 degrees Fahrenheit for about one-half hour; stretching it by external force applied transversely of its axis while hot; and then cooling it at the approximate average rate of about 15 degrees Fahrenheit per minute until it reaches a temperature of about 250 degrees Fahrenheit, and then cooling it more rapidly to room temperature.

3. A process for expanding pistons comprising heating the piston and maintaining it at a temperature of from about 575 to 700 degrees Fahrenheit; stretching it by external force applied transversely of its axis while hot; and then cooling it substantially without disturbing its crystalline structure at the approximate average rate of about 15 degrees Fahrenheit per minute.

4. A process for expanding pistons comprising heating the piston and maintaining it at a temperature of from about 575 to 700 degrees Fahrenheit; stretching it by external force applied transversely of its axis while hot and for about twenty seconds; then cooling it substantially without disturbing its crystalline structure and initially at a rate slower than that at which it would cool in ordinary room air; and then cooling it in air at room temperature.

5. A process for reconditioning split-skirt pistons comprising heating the piston for about one-half hour at a temperature of from about 575 degrees Fahrenheit to about 700 degrees Fahrenheit, applying stretching pressure for about twenty seconds at opposed points on opposite sides substantially midway between the splits in the skirt; and cooling the piston substantially without disturbing its crystalline structure and initially to a temperature of approximately 250 degrees Fahrenheit in about fifteen minutes.

6. A process for expanding pistons comprising heating the piston and maintaining it at a temperature from 575 to 700 degrees Fahrenheit; stretching it while hot by external force applied interiorly only at diametrically opposite points to a predetermined extent; and cooling the piston while it is stretched to said predetermined extent substantially without disturbing its crystalline structure.

7. A process for expanding pistons comprising heating the piston and maintaining it at a temperature from 575 to 700 degrees Fahrenheit for about one-half hour; stretching it while hot by external force applied interiorly only at diametrically opposite points to a predetermined extent; and cooling the piston while it is stretched to said predetermined extent substantially without disturbing its crystalline structure.

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