SPRING PEENING

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The present invention relates to the peening of springs so as to increase their resistance to fatigue cracking and the like.

It is generally desired to peen springs of the elongated or leaf type so that the section of the spring which is under tension during use, is under tension when it is peened.

Among the objects of the present invention is the provision of a very simple process and apparatus for carrying out the above peening under tension. This as well as other objects of the present invention will be more clearly understood from the following description of several of its exemplifications, reference being made to the accompanying drawings wherein:

FIG. 1 is a plan view, somewhat diagrammatic, of one form of apparatus in accordance with the present invention.

FIG. 2 is a similar view of a different form of the above apparatus.

According to the present invention springs of the above type are peened on a continuous basis by mounting a succession of the springs in an unstressed condition on a conveyor having a series of securing members, fitting the securing portions of the respective springs on the securing members, actuating the conveyor to carry the secured springs through a peening zone, said zone having deflector means that engages the successive springs and deflects them to place under tension those portions that are under tension when the springs are in use, so that the springs are automatically peened under tension.

The conveyor can be a rotary one or an elongated linear one and can have a series of pins over which loops on the ends of the springs are placed.

Referring now to the drawings, the construction of FIG. 1 is built around a table 10 journaled for rotation on a vertical post 12 and carrying on its upper face a series of fixed pins 14 and yieldably held pins 16. In the form shown the yieldability of pins 16 is provided by having these pins mounted on arms 18 which are in turn pivoted as at 20 to the table. The arms 18 can then be resiliently held in a position that brings their pins 16 to the desired location with respect to pins 14 so that both pins will receive the end loops 21, 22 of a leaf spring 24.

Immediately above the table and in the plane of the pins 14, 16 there are shown two deflecting rollers 31, 32, each journaled on a bearing support 34 secured from above. The deflecting rollers 31, 33 are located above one side of the table in a zone that is sealed off by a flexible curtain 35 from the other side of the table as in the manner shown in U.S. Patent 2,719,387 granted October 4, 1955. The side of the curtain in which the deflecting rollers 31, 33 are provided with peening equipment shown in the form of blasting wheels 38, 40 arranged to project a stream of peening shot against the outwardly facing surfaces of the springs 24 as they are carried through the blasting zone in the direction indicated by the arrow 42. As the springs come into position near the blasting wheels, the deflecting rollers are arranged to flex the springs as illustrated, so that the outer faces of the springs are under tension as they are blasted.

The apparatus of FIG. 1 is used by mounting the springs on the spring-receiving pins as these pins are carried past a loading zone indicated by the legend "Load". These springs can be exceedingly stiff and therefore very difficult to flex, yet the simple slitting of the springs over the receiving pins is all that is needed at the loading zone. As the springs are carried around by the rotation of the table they successively come into engagement with deflecting rollers 31, 33 which cause the springs to be deflected as they continue in their rotary path. While in deflected condition they also move through the blasting area of wheel 38. The springs then move away from deflecting roller 31 and are subjected to another peening treatment by a similar coaction with deflecting roller 32 and blasting wheel 40. After the second peening treatment the springs are carried away from deflecting roller 32 and to the unloading position shown by the legend "Unload" where they can be easily lifted off their mounting pins.

The two peening treatments can be arranged with the blasting directed at the springs from different perspectives so as to assure adequate peening at all desired portions of the springs. Additional peening can also be arranged for other surfaces of the spring and these other surfaces are not under compression when the supplemental peening is carried out.

Alternatively only a single peening action can be used by eliminating the deflecting roller 32 and the blasting wheel 40. On the other hand, where two or more blasting wheels are used, at least one can be located somewhat above the plane of the pins and tilted downwardly to more effectively treat the upper edges of the springs and one or more other wheels can be in the opposing position tilted upwardly to better reach the bottom edges of the springs. For access to these lower edges, the pins 14, 16 can be arranged to hold the springs spaced a few inches above the top of the table, or if desired, the table rim can be scalloped or notched so as to expose these lower edges.

The construction of FIG. 2 is arranged to effect an operation similar to that of FIG. 1, using a linear conveyor 100. This conveyor need be nothing more than a pair of endless chains 101, 102, each one and looped around sprockets 104, 106 and carrying a series of cross-slats 108 and 110. The slats 108 are provided with fixed pins 114, and the slats 110 with yieldable pins 116.

Only a single peening treatment is shown in FIG. 2 using a combination of a blasting wheel 138 and an opposing deflecting roller 131 held on a fixed bearing 134. Although such fixed deflecting roller will give the desired deflection without any further deflection means, the apparatus of FIG. 2 also includes a stationary cam 133 that coacts with rollers 135 carried by the pins 116 at a level below the springs. The combination of the deflecting cam 133 and the deflecting roller 131 as the springs are carried in the direction of the arrow 142, provides whatever spring deflection is needed.

With the linear conveyor as in FIG. 2, the springs can be arranged to automatically unload as by merely having the pins 114, 116 small enough to fit very loosely in the spring loops. The movement of the chains around the sprockets 106 will then cause the pins to be withdrawn from the loops so that the springs will automatically drop from the conveyor. In the construction of FIG. 1 or FIG. 2, the pins 16 and 116 need not be arranged to receive a spring loop. Instead the corresponding end of the spring can merely be placed on the side of these pins which faces the de-
fecting rollers. With such an arrangement the table-type conveyor can have the pins 16 fixed rather than yieldable since these pins would not have to move to permit the spring to be flexed. The small amount of friction in the movement in the flexing spring along these pins is no problem, but if desired these pins can be rotatably held so that they rotate around their own longitudinal axes. Similarly the pins 116 of the linear conveyor can also be fixed where no deflecting cam is used.

The use of only one spring loop for mounting simplifies the loading and unloading. Where such fixed pins are used and one partially obstructs some of the surface that is to be peened, a multiple peening treatment can be used, as in FIG. 1, with different degrees of flexing at each peening site so that the surface obstructed in one peening operation is fully treated in another.

Instead of using pins, the springs can be held by any other kind of mechanism such as receiving pockets or gripping clamps or the like. Receiving pockets need be nothing more than short metal angles facing each other and separated by a distance sufficient to allow the spring to extend between them, and arranged to permit the received spring to flex. Such pockets or clamps can be arranged to be movable if desired, so as to permit them to follow the flexing of the spring. Such arrangements are effective for treating leaf springs that have no loops, and the clamps can be used on both ends of such leaf springs or the clamp at one end can cooperate with a pin or other support for the other end.

The movement of the rotary conveyor of FIG. 1, or the linear conveyor of FIG. 2 can either be continuous or it can be intermittent. Also the operation of the peening equipment such as the throwing wheels of these FIGURES can also be either continuous or they can be cut off except at such times when the flexed surface are in the proper position for receiving the peening treatment.

The conveyors of the present invention can also be used to tilt the springs as they pass through the peening zones. By way of example, the mounting pins 14 and the pivots 20 for the mounting pins 16 can be extended through generally radial slots in the table so as to project below the table, and can be secured to the table top by aligned horizontal pivots. At the peening zones tilting cams can be provided beneath the table to en-gage the lower projecting ends of the pins 14 and pivots 20 to tilt them in one or more steps or in a continuous manner as the peening takes place. This would provide better peening action where only a single peening apparatus is used.

The peening can be carried out by mechanisms other than blasing wheels if desired. Thus a set of pneumatic hammers can be provided in the peening zone and positioned to cause the hammers to operate against the spring surface to be peened. Such an arrangement would not need to be sealed as by the curtain 35 unless it is combined with a supplemental wheel blast.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is, therefore, to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed:

1. A spring peening apparatus comprising a conveyor, securing means on the conveyor for holding a spring in an unstressed condition, deflector means positioned adjacent the path of travel of said conveyor for stressing the spring as it is moved into contact with said deflecting means by the conveyor, peening means positioned adjacent the path of travel of said conveyor and said deflector means for projecting peening particles against said spring as it is deflected, and means for moving said conveyor to, past, and beyond said deflector means.

2. The combination of claim 1 in which the securing means includes a pair of spaced pins over which the loops of an individual spring fit, and one of the pins is yieldably mounted so as to permit the spring length to change when it is deflected.

3. The apparatus of claim 2 wherein the conveyor is rotary with respect to the deflector means.

4. The apparatus of claim 2 wherein the conveyor is linearly movable in a straight path past said deflector means.

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