3,094,768
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; and

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 unstressed condition on a conveyor having a series of securing members, fitting the securing portions of the respective springs on the successive 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** journalled 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 journalled 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 are located is also 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 slipping 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 roll **31**, which causes 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 treatments can be carried out at locations where they operate on the spring while in undeflected condition, as for example in the area where the springs are disengaged from both deflector rollers. In this way the supplemental 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** parallel to each other 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 flexing 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 constructions 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-

flecting 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 surfaces 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 engage 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 blasting 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 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 also said deflecting 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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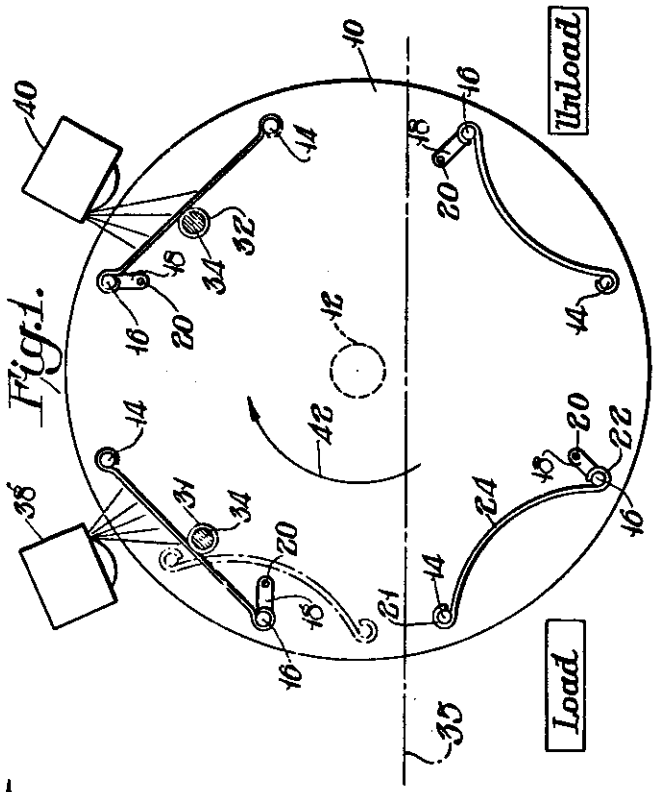

Fig. 1.

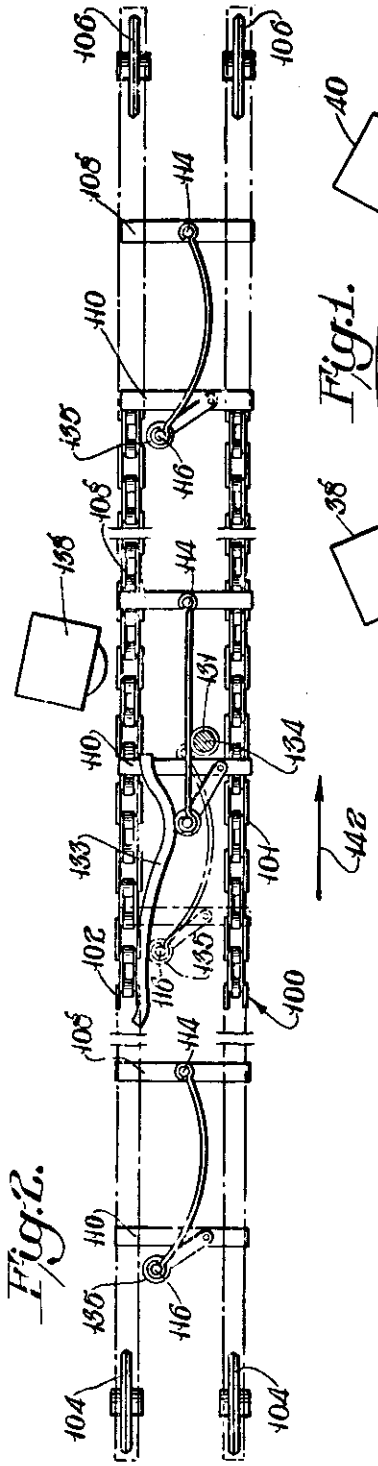

Fig. 2.

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