May 21, 1968 H. F. SCHULTE ET AL 3,383,803

MEANS FOR TREATING COIL SPRINGS

Filed Oct. 18, 1965 2 Sheets-Sheet 1

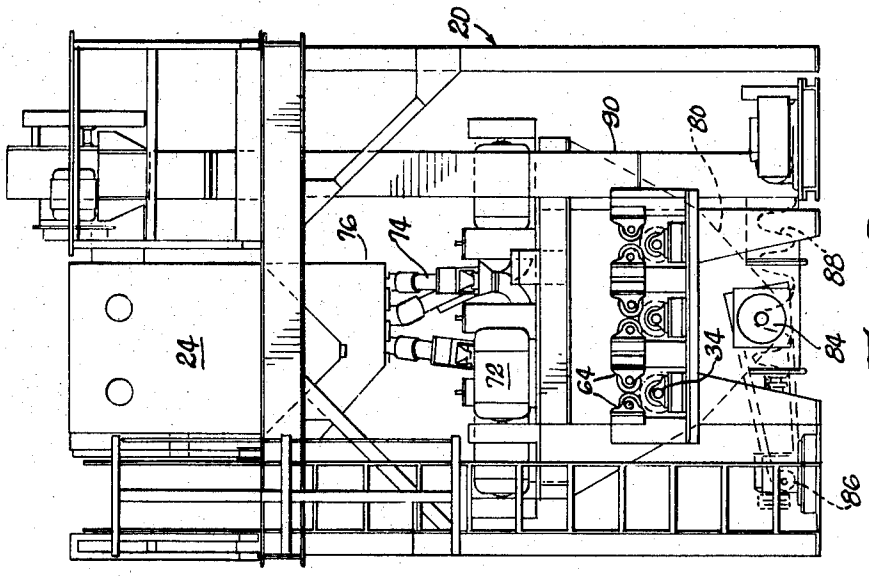


FIG. 2

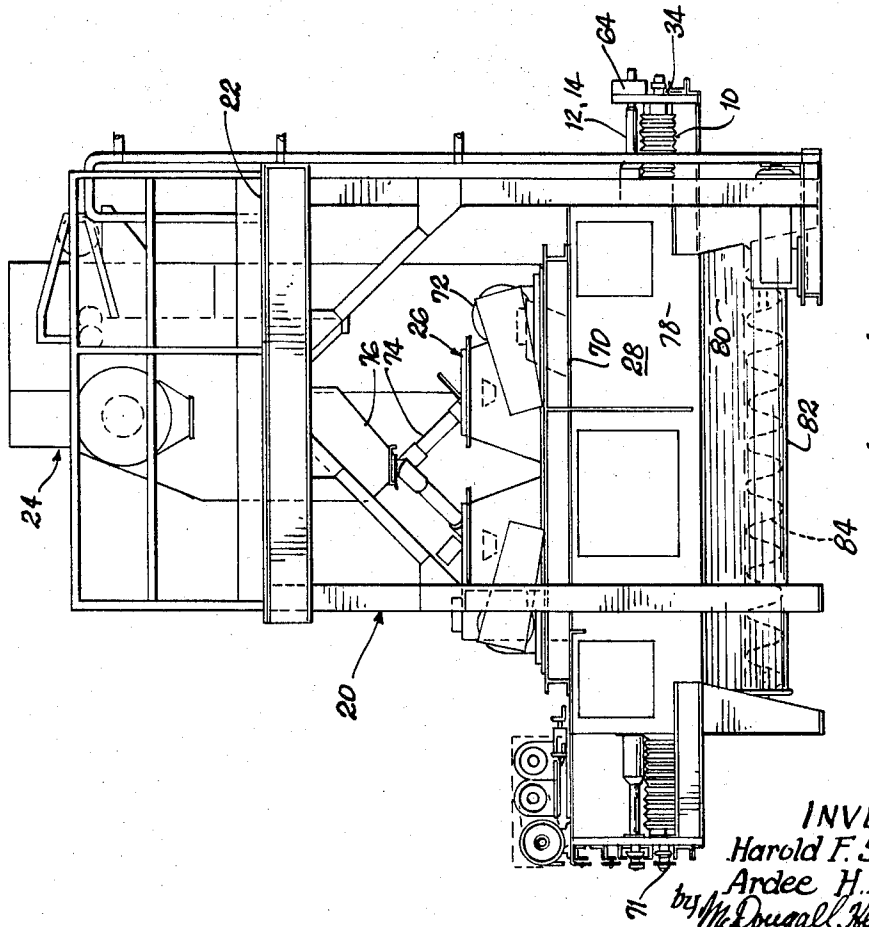


FIG. 1

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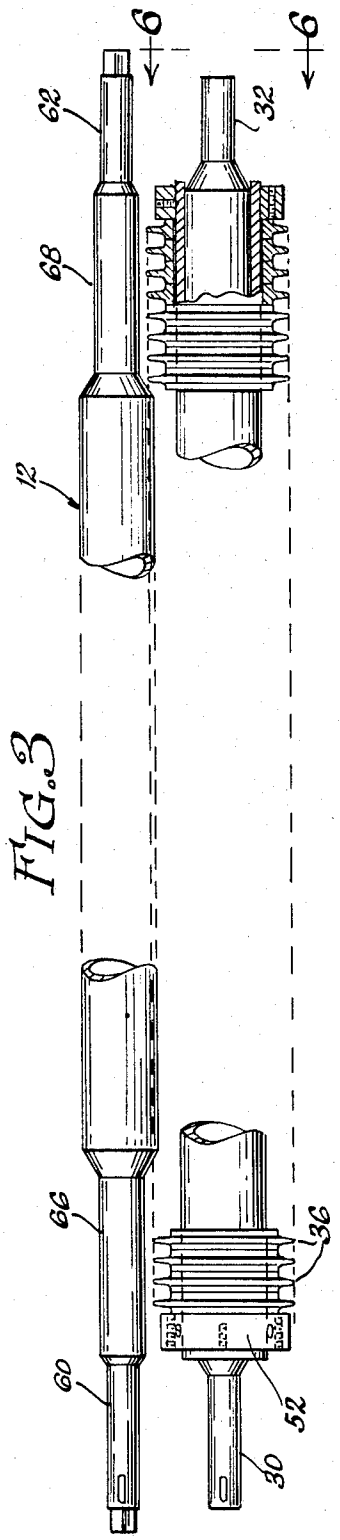


FIG. 3

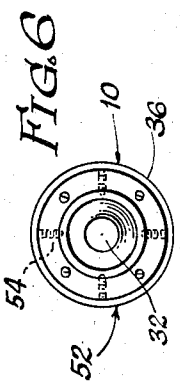


FIG. 6

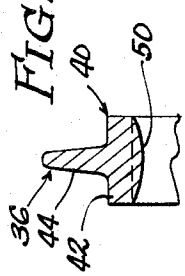


FIG. 5

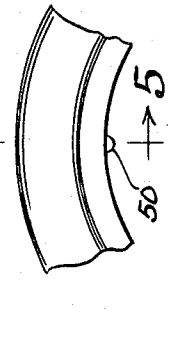


FIG. 4

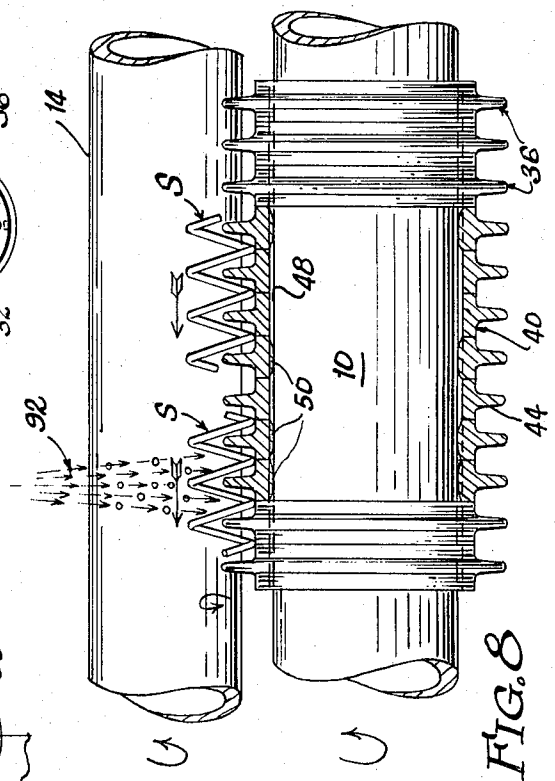


FIG. 8

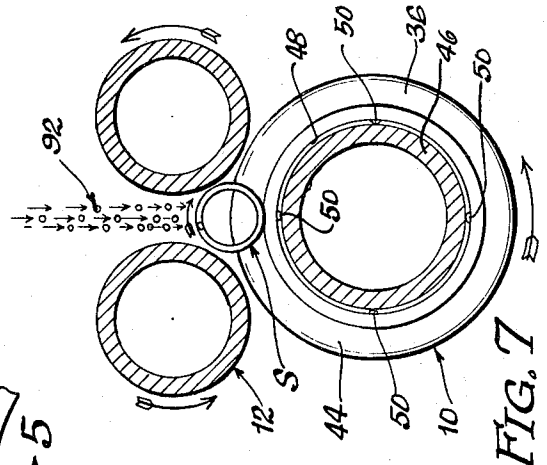


FIG. 7

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MEANS FOR TREATING COIL SPRINGS

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ABSTRACT OF THE DISCLOSURE

A machine for surface treatment of continuous pitch coil springs comprising horizontally disposed roll cluster having a feed end at one end portion and a delivery end at the opposite end portion and including a support roll and a pair of guide rolls located above the support roll with the rolls spaced one from another to define a spacing therebetween greater than the diameter of the coil springs adapted to be processed therethrough; the support roll has annular ribs extending outwardly radially from the periphery and axially spaced apart by an amount corresponding to the pitch of the coils of the coil springs and which includes means for rotating the rolls in a direction to impart turning movement to the coil springs located on the support roll and for advancing the coil springs from the feed end to the delivery end and means for throwing treating material onto the coil springs as they are advanced through the roll cluster from the feed end to the delivery end and in which the guide rolls at the feed end and at the delivery end are of smaller diameter than the remainder to provide a spaced relationship therebetween which is greater than the diameter of the coil springs to enable radial displacement of the coil springs into and out of the roll cluster.

This invention relates to the surface treatment of coil springs and more particularly to a means for uniform exposure of the surfaces of coil springs to engagement by treating material thrown at high velocity onto the surfaces of the coil springs.

This invention will be described with reference to the blasting of the surfaces of coil springs with dry abrasive or other particulate material for surface cleaning, for surface hardening, or for producing a matte or the like surface on the springs but it will be understood that the described means for exposure of the surfaces of the coil springs to the blast of particulate materials can be employed in other processes or procedures for surface treatment.

No difficulty is experienced in the method and means for exposure of the coil springs for surface treatment when the coil springs are formed with flat ends as when the terminal coils of the coil springs are distorted to provide flat ends. Under such circumstances, the coil springs can be aligned in end to end relationship on a support for advancement through the treating zone by endwise displacement of the aligned row of coil springs as a new spring is inserted into the end of the line. Thus the coil springs are advanced in endwise alignment through the machine while being supported on a revolving member for turning movement to expose all of the surfaces of the springs for treatment.

Such endwise displacement from one end of the aligned row of coil springs cannot be employed when the coil springs are formed with a continuous pitch or without flattened ends. When so formed, the end of one coil spring does not abut with the end of adjacent coil springs for transmission of endwise forces for displacement. Instead, the ends of one coil spring may engage with the non-uniform ends of others to effect displacement in a radial direction whereby the coil springs may pile up and/or jam

and thus interfere with the ability to provide smooth and continuous surface treatment. When the end of one coil spring engages the non-uniform end of an adjacent continuous coil spring, one spring can be lifted from its support by the other whereby the desired turning movement for overall surface exposure cannot be achieved.

It is an object of this invention to provide a means for uniform exposure of the surfaces of coil springs formed with continuous pitch or without flattened ends for uniform treatment of the surfaces thereof.

More specifically, it is an object of this invention to provide a means for surface treatment of coil springs with particulate material thrown for engagement with the surfaces and in which the coil springs are formed with non-flattened ends; in which the coil springs are advanced smoothly and continuously through the area of treatment; in which the coil springs are free from jamming or lifting during advancement through the treating zone; in which the advanced coil springs are turned continuously about their axes for exposure of the surfaces while being continuously advanced in one direction through the machine; in which the machine can be adapted for use in the treatment of coil springs having a right hand pitch or a left hand pitch, or coil springs of different pitch dimensions, different diameters and the like; in which uniform exposure is made of the surfaces of the coil springs for surface treatment, and in which the machine is adapted for automatic feed and removal of the individual coil springs thereby to provide for continuous operation.

These and other objects and advantages of this invention will hereinafter appear and for purposes of illustration, but not of limitation, an embodiment of the invention is shown in the accompanying drawings in which:

FIG. 1 is a side elevational view of a machine embodying the features of this invention;

FIG. 2 is an end elevational view of the machine shown in FIG. 1;

FIG. 3 is a fragmentary elevational view of the support and guide rolls for advancing and guiding the coil springs through the machine;

FIG. 4 is a fragmentary view of a portion of a sleeve making up the support roll;

FIG. 5 is a sectional view taken along the line 5—5 of FIG. 4;

FIG. 6 is an end view taken along the line 6—6 of FIG. 3;

FIG. 7 is a sectional view taken across the roller assembly of FIG. 4 while in the blast section of the machine; and

FIG. 8 is a side view of the portion of the machine shown in FIG. 7.

Briefly described, the basic elements of the machine comprise an elongate rotatable support roll 10 which extends continuously lengthwise through the machine and a pair of guide rolls 12 and 14 mounted for rotational movement about an axis parallel with the support roll but spaced laterally one from the other and above the support roll by an amount to define a spaced relationship between said rolls adapted loosely to receive a coil spring therebetween with the end portions of the guide rolls being dimensioned to a lesser diameter than the remainder whereby the spaced relationship between the corresponding ends of the support and guide rolls become less than the diameter of the coil springs to enable the coil springs to be loaded onto the support roll at one end and to be displaced therefrom at the other end.

The support roll is formed with a plurality of annular ribs extending radially outwardly from the periphery with the ribs spaced one from the other axially by an amount corresponding to the pitch between the coils of the coil springs S. Each of the rolls including the support

roll 10 and the guide rolls 12 and 14 are mounted for positive rotational movement whereby engagement between the coils of the spring and the annularly ribbed support roll operates continuously to advance the coil spring axially between the rolls while the turning movement of the guide and support rolls operates also to impart rotational movement to the coil spring during such linear advancement.

Thus the coil springs in endwise alignment on the support roll 10 are advanced continuously linearly in one direction while being turned during advancement through the area wherein the surfaces of the coil springs are blasted with particulate material thrown downwardly centrifugally from centrifugal wheels mounted on the blast housing.

Having briefly described the essential elements of the machine and their operation, reference will now be made to the drawings for a detailed description of a machine for blasting the surfaces of coil springs of continuous pitch with steel shot to introduce a matte surface on the springs or to work the metal at the surface of the springs.

The machine illustrated in the drawing is constructed with three sets of rolls of the type described for use in processing three different springs differing in pitch or diameter or differing as between right hand and left hand spring coils. The differences between the sets of rolls are therefore differences in spacing between the rolls and differences in spacing between the ribs for use with spring combinations of different diameters or pitch, otherwise each of the three sets of rolls are substantially the same in construction and operation such that it will be sufficient to give detailed description of but one set, it being understood that each set of rolls is similarly constructed and provided with its own aligned blast machine, as will hereinafter be described.

In the drawings, the numeral 20 illustrates a metal framework on which a platform 22 is provided for access to the separator 24 which is employed to separate the steel shot from dirt, dust or other material removed from the treated surfaces of the coil springs and which operates to return the steel shot for feed with makeup material to the centrifugal blasting wheels 26 mounted on the top of a metal housing 28 enclosing the blast area through which the coil springs S are advanced for treatment. The separator and the centrifugal blasting wheels are of conventional construction such that detailed description thereof is deemed to be unnecessary. Suffice it to say that the wheels are bladed wheels having a plurality of blades extending radially outwardly from a central feed trough through which the particulate treating material, such as steel shot, is introduced onto the inner ends of the blades while the bladed wheel is rotated rapidly about its axis by an electrical motor means whereby the steel shot travels rapidly outwardly to the ends of the blades and is shot centrifugally from the blades onto the surfaces of the coil springs.

Extending continuously lengthwise through the housing 28 is a support roll 10 having reduced bearing end portions 30 and 32 adapted rotatably to be received in bearing members 34 mounted on each end of the frame for support of the roll. The support roll is formed on its surface, substantially throughout its length, with annular ribs 36 extending outwardly radially from the periphery thereof with the spacing between the ribs 36 being dimensioned to correspond with the pitch between the coils of the coil springs processed thereover. Since it is desirable to be able to change the spacing between the ribs for use in processing coil springs having a different pitch or a different diameter, the ribs are embodied in separate sleeves adapted replaceably to be received in fixed relationship on the roll.

The ribs are provided in the form of sleeve sections 40 having a cylindrical base 42 and an annular ring 44 extending radially outwardly from the base intermediate its ends thereby to provide a plurality of spaced annular ribs when mounted in abutting side by side relationship upon the roll. The spacing between the ribs can be varied either by the width of the base 42 or by the use of spacers positioned between the base members whereby the spacing between the ribs can be made more or less to correspond with the pitch between the coils of the spring intended to be processed thereover Thus the supporting roll 10 can be modified for use with coil springs of various pitches and diameters.

Since particulate material with which the surfaces of the coil springs are treated can find its way into any openings between the sleeves or between the sleeves and the core 46 on which the sleeves are mounted, it is desirable to minimize surface contact between the sleeve sections and the cylindrical core to enable easier displacement of the sleeve members axially onto and off of the core. For this purpose, the core 46 is formed with an outside diameter less than the inside diameter of the tubular sleeve so that a spaced relationship 48 exists therebetween. The sleeve is formed on its inner periphery with a number of circumferentially spaced apart projections or knobs 50 dimensioned to span the space and to engage the peripheral surface of the core at spaced apart points to center the sleeve and hold the sleeve firmly on the core. In the preferred practice, three or four such projections 50 are provided in equally spaced apart relationship on the inner periphery of the tubular sleeve for balanced support of the sleeve on the roll and so that dust, dirt or particles which become lodged in the area between the sleeve and core will not interfere with the ability for axial displacement to remove the sleeve from the core.

The sleeves are secured in position on the core by end locking rings 52 provided with setscrews 54 for attachment to the core. The core and the sleeves are formed of metal characterized by high abrasion resistance, such as nickel steels, high alloy steels and the like.

Mounted above each of the support rolls 10 and spaced laterally one from the other is a pair of relatively smooth guide rolls 12 and 14 having reduced bearing end portions 60 and 62 adapted rotatably to be received in bearing members 64 fixed to the opposite ends of the frame and with cylindrical sections 66 and 68 of lesser diameter than the remainder at the loading end and at the discharge end to enable coil springs S to be fed into the cluster between the guide and support rolls at the loading end and to enable the coil springs to be removed from between the roll cluster at the discharge end.

The guide rolls 12 and 14 are spaced one from the other laterally by a distance between their peripheral surfaces which is less than the diameter of the coil spring and preferably closely approaching the diameter of the coil springs to provide for a maximum opening thereebtween through which the particulate material may be thrown into engagement with the coil springs confined therebetween. Each of the guide rolls are spaced from the support roll by a distance between their peripheral portions which is also less than the diameter of the coil springs so that once the coil spring is advanced beyond the feed end into the area between the cluster of guide and support rolls, the coil spring will be confined between said rolls but preferably with a slight spaced relationship between the periphery of the coil springs and the guide rolls when the coil springs are at rest on the support roll. This is to permit greater freedom of movement of the coil springs in response to turning movement of the rolls and the action of the blast thrown to engage the surfaces of the coil springs.

The feed and discharge end portions of the guide rolls are reduced by an amount to space the peripheral surfaces of the guide rolls one from the other by an amount greater than the diameter of the coil springs to enable the coil springs to be dropped therebetween onto the guide roll for advancement by the support roll into the confining cluster of rolls. At the discharge end, it is preferred to have the reduction in the guide roll dimensioned to

space the rolls one from the other by an amount greater than the diameter of the coil springs and also to provide for a spaced relationship between the peripheries of the guide rolls and the support roll which is also greater than the diameter of the coil springs so that the latter will automatically be discharged by falling from between the cluster of rolls as the coil spring is advanced into the discharge area.

The guide and support rolls are each provided with sheaves **71** on the end portions extending beyond the bearing for engagement with a common drive belt for concurrent movement of the rolls at about the same peripheral speeds. The rolls are adapted to be turned in a direction, depending upon the direction of pitch of the coil springs, for turning the coil springs in one direction while being advanced along the support roll in response to engagement between the coils of the coil springs and the ribbed support roll.

The roll assembly is enclosed by a housing **28** which extends from the loading end to the discharge end and which is provided with end flaps or curtains (not shown) to prevent escape of the steel shot or other treating material into the atmosphere. The centrifugal wheels **26** are mounted on the top wall **70** of the housing with a separate wheel in lengthwise alignment with each roll cluster and with a corresponding opening in the top wall through which the wheel can extend for throwing the steel shot downwardly onto the roll cluster and the coil springs advanced between the roll cluster through the housing. The wheel housing is fixed to the top wall and each wheel is provided with its own motor drive **72** and a tube feed **74** which communicates the wheel with the feed hopper **76** for feeding steel shot to the wheel.

The housing includes a pair of spaced side walls **78** and bottom walls **80** which converge downwardly and inwardly from the lower ends of the side walls to form a trough **82** into which the spent steel shot and material removed from the surfaces of the coil springs falls gravitational for collection. Operative within the trough **82** is an elongate screw conveyor **84** which is belt driven from the motor **86** for rotational movement to effect displacement of the material collected in the trough to one end where another short screw **88** operates to displace the collected material laterally to an elevator **90**, preferably in the form of a bucket elevator operating through the vertically disposed housing to elevate the material to the separator **24**. In the separator, the steel shot is separated from dirt, dust and fine metal particles and the reusable shot is returned to the hopper **76** for storage or for feed through the conduits **74** to the wheels **26**.

In operation, the coil springs S are dropped one at a time through the feed opening between the guide rolls **12** and **14** onto the ribbed support roll **10**. Each of the guide and support rolls are turned continuously in the direction indicated by the arrows in FIG. 7 for coil springs having a right hand pitch and in the oppoite direction for coil springs having a left hand pitch. The rolls are turned at a rate to provide substantially uniform peripheral speed so that when the coil spring S comes to rest on the ribbed support roll, the ribs operate to screw the coil spring forwardly for axial movement over the roll into the housing **28** while concurrently imparting rotational movement to the spring. Each coil spring is advanced independently of the others so that each coil spring is displaced at a uniform rate forwardly over the suport roll and through the housing.

The aligned centrifugal wheel **26** which is located on the roof **70** of the housing operates to spray the steel shot at high linear speed over substantially the entire length of the roll cluster located within the housing so that steel shot **92** will be thrown into the space between the aligned guide rolls **12** and **14** and onto the surfaces of the coil springs, as illustrated in FIGS. 7 and 8 of the drawings. Continuous advancement of the coil spring through the housing with concurrent turning movement operates to expose all of the surfaces of the spring uniformly to the thrown particulate material whereby the surfaces of the coil springs receive uniform treatment. By reason of the slight amount of play within the roll cluster and responsive to the reaction to the force of the thrown steel shot, the coil springs are often raised from their support thereby to provide for more complete surface exposure.

The spent shot and other solids removed from the surfaces of the coil springs will fall gravitationally into the trough **82** for displacement by the auger **84** to the elevator **90** and to the separator **24**.

In order to maintain positive control of the coil springs during advancement through the treating section and to maintain their separated relationship and smooth linear travel through the machine, it is desirable to make use of ribs **44** having a depth greater than the amount of play between the peripheries of the coil springs and the guide rolls so that the coils of the springs will always remain in operative engagement with the ribs during travel through the housing.

When the coil spring clears the flap and enters the discharge end portion of the rolls, it can fall laterally between the support roll and a guide roll into a suitable receiver thereby to clear the discharge area for the oncoming springs.

The power source may be a variable speed drive for modification of the rate of rotational movement of the rolls for adjustment of the linear speed of the coils through the blast area thereby to enable variation of the span of time during which the coil springs are exposed to the treating material.

The following is typical of the dimensional characteristics of the rolls adapted for use with coil springs having an outside diameter of $2\frac{9}{16}$ inches formed of $\frac{3}{16}$ inch spring wire and having a $1\frac{1}{4}$ inch pitch.

For processing springs of the above dimension, the support can be formed of a cylindrical core having a diameter of $5\frac{1}{2}$ inches. The sleeves are dimensioned to have a width of $1\frac{1}{4}$ inches at their base and an inside diameter of 6 inches and an outside diameter of $6\frac{1}{2}$ inches with curvilinear knobs **50** having a depth of $\frac{1}{4}$ inch to span the space between the sleeve and the cylindrical core firmly to mount the sleeves on the core. The rib **44** is formed to a depth of about 1 inch. The guide rolls which are also formed of high nickel alloy steels, or of high abrasion resistant cast iron, will have an outside diameter of 5 inches in the body portion and $2\frac{5}{8}$ inches in the feed and delivery end portions each of which are dimensioned to have a length of about 1 foot. The support rolls are located on centers $4\frac{3}{8}$ inches to each side of the center of the support roll and $5\frac{3}{8}$ inches above the center of the support roll.

It will be apparent that the dimensional characteristics set forth above will vary depending upon the size and diameter of the coil springs adapted to be processed therebetween.

It will be apparent from the foregoing that we have provided a machine for the continuous and uniform exposure of the surfaces of continuous pitch coil springs for engagement with solid treating material during continuous advancement through a treating zone whereby a continuous operation is provided for the surface treatment of coil springs of the type described.

It will be understood that changes may be made in the details of construction, arrangement and operation without departing from the spirit of the invention, especially as defined in the following claims.

We claim:

1. A machine for the surface treatment of continuous pitch coil springs comprising a horizontally disposed roll cluster having a feed end at one end portion and a delivery end at the opposite end portion and including a support roll and a pair of guide rolls located above the support roll and in which the rolls are spaced one from another

to define an opening therebetween greater than the diameter of the coil springs, said support roll having annular ribs extending outwardly radially from the periphery and axially spaced apart by an amount corresponding to the pitch of the coils of the coil springs, means for rotating the rolls in the cluster in a direction to impart turning movement in one direction to the coil springs located therebetween and for advancing the coil springs from the feed end to the delivery end, and means for throwing treating material onto the coil springs as they are advanced between the roll cluster from the feed end to the delivery end.

2. A machine as claimed in claim 1 which includes a housing enclosing the roll cluster between the feed end and the delivery end.

3. A machine as claimed in claim 1 in which the guide rolls at the feed end and at the delivery end are of smaller diameter than in the remaining portion in between whereby the spaced relationship between the rolls in the feed end and in the delivery end is greater than the diameter of the coil springs while the spaced relationship between the rolls in the remaining portion is less than the diameter of the coil springs.

4. A machine for the surface treatment of continuous pitch coil springs comprising a horizontally disposed roll cluster having a feed end at one end portion and a delivery end at the opposite end portion and including a support roll and a pair of guide rolls located above the support roll and in which the rolls are spaced one from another to define an opening therebetween greater than the diameter of the coil springs, said support roll having annular ribs extending outwardly radially from the periphery and axially spaced apart by an amount corresponding to the pitch of the coils of the coil springs, means for rotating the rolls in the cluster in a direction to impart turning movement in one direction to the coil springs located therebetween and for advancing the coil springs from the feed end to the delivery end, and means for throwing solid particulate material into the roll cluster in the area

between the feed end and the delivery end for engagement with the surfaces of the coil springs advanced therebetween.

5. A machine as claimed in claim 4 in which the means for throwing solid particulate material into the roll cluster comprises centrifugal wheels mounted above the roll cluster and in alignment therewith and means for feeding the particulate material to the wheels.

6. A machine as claimed in claim 4 which includes a collector below the roll cluster for receiving the particulate material and other solids, a separator for separating the particulate treating material from the other solids, means for transferring the particulate material and other solids from the collector to the separator, and means for returning the separated treating material from the separator to the throwing means.

7. A machine as claimed in claim 4 which includes a housing about the roll cluster between the feed end and the delivery end.

8. A machine as claimed in claim 4 in which the guide rolls having a main body portion are spaced one from the other and from the support roll by an amount less than the diameter of the coil springs processed therebetween.

9. A machine as claimed in claim 8 in which the guide rolls are of smaller diameter at the feed end portion and at the delivery end portion whereby the spaced relationship therebetween and between the support roll is greater than the diameter of the coil springs to enable the coil springs to be inserted radially into the roll cluster at the free end and to enable the coil springs to be removed from between the roll cluster at the delivery end.

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