United States Patent

Modrey

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[54] FOIL WRAPPED COIL SPRING

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[52] **U.S. Cl.** ..... **206/46 H**, 139/39, 206/65 R, 229/3.5 MF, 267/153

[51] **Int. Cl.** **B65d 85/00**

[58] **Field of Search** ..... 132/33, 39–41; 206/46 R, 46 H, 65 R; 229/3.5 MF, 87 R; 267/153

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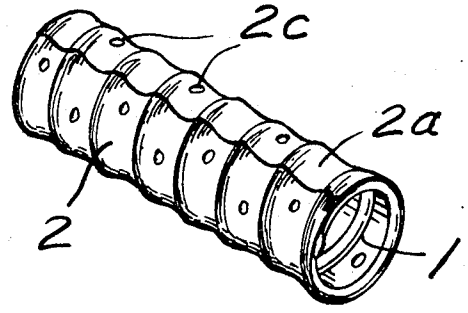
[57] **ABSTRACT**

An open coil compression spring is enveloped by frangible pliable metal foil forming a continuous wall enveloping all windings of the spring and secured against axial sliding on the spring. A thus shrouded or wrapped spring can be packaged or stored in bulk without danger of nesting or tangling with other springs. Prior to delivering the springs to a point of utilization the shroud thereon is removed by stripping the foil off the spring.

7 Claims, 16 Drawing Figures



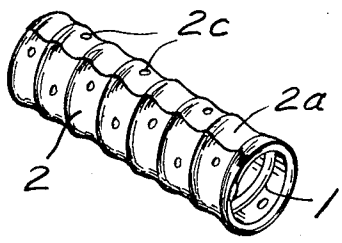


FIG. 1

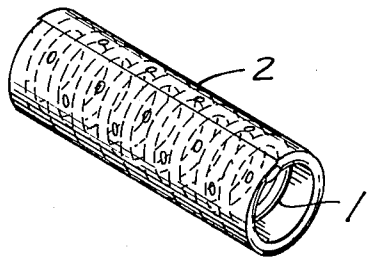


FIG. 2

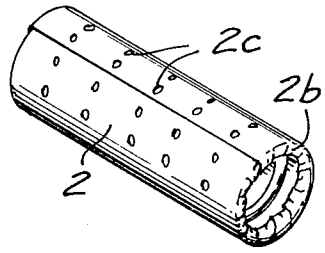


FIG. 4

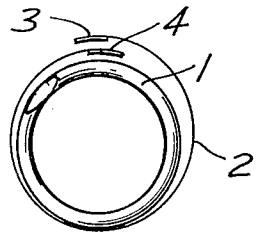


FIG. 3

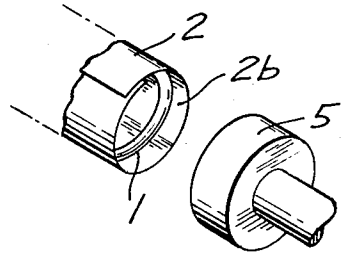


FIG. 5

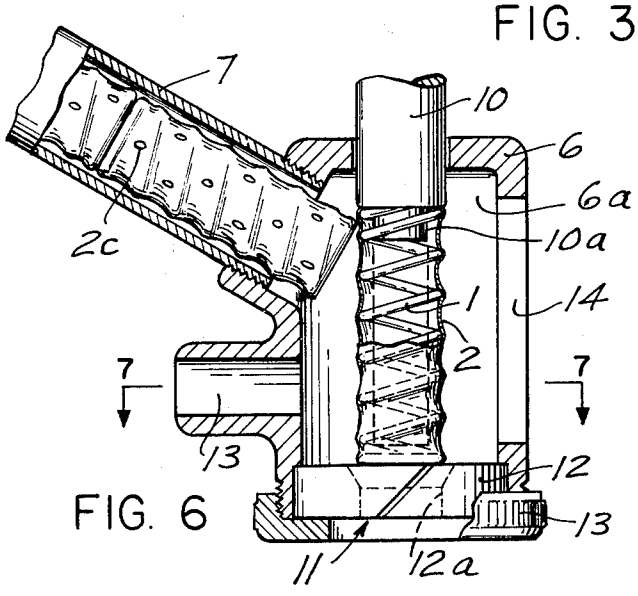


FIG. 6

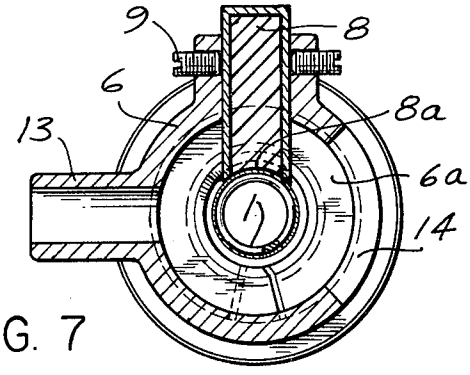


FIG. 7

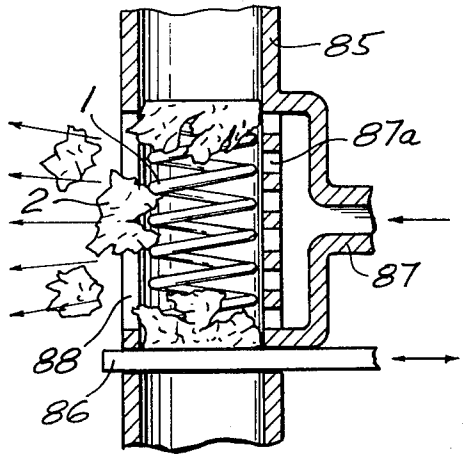


FIG. 8

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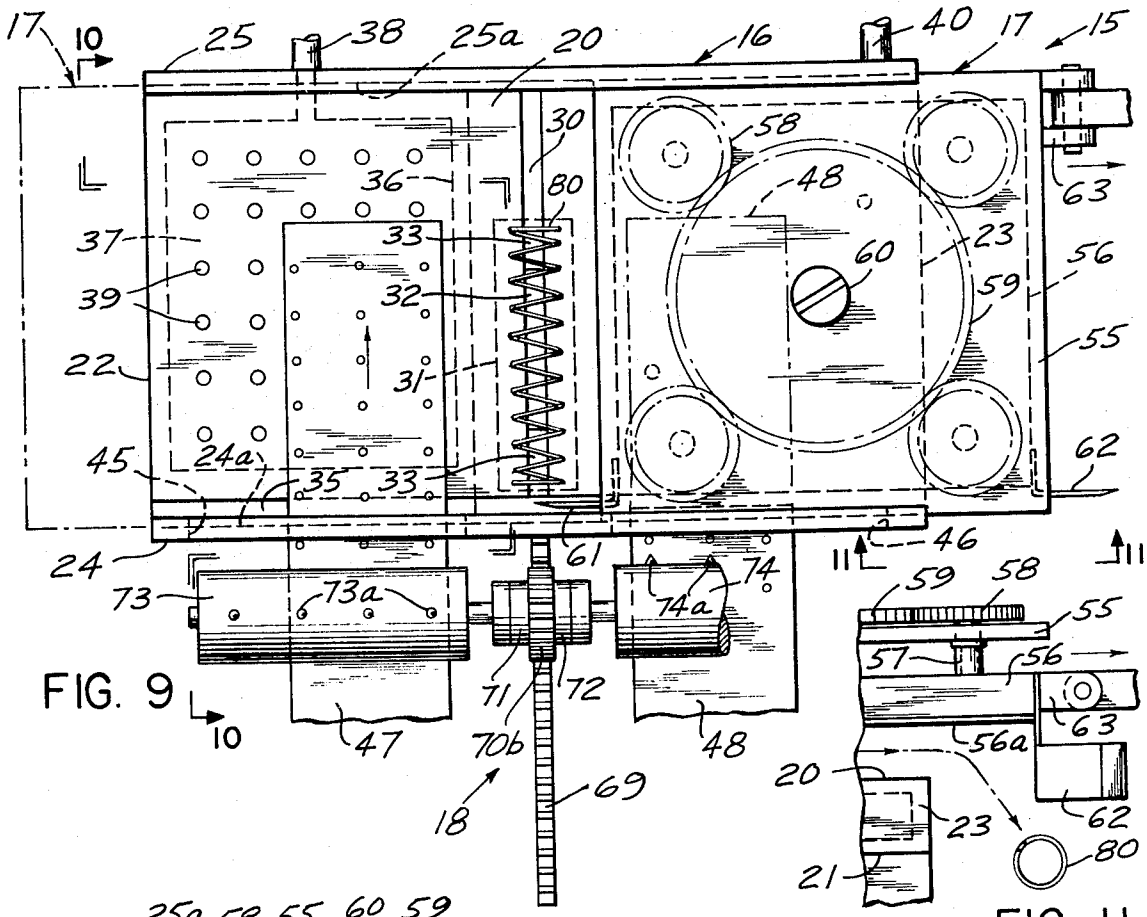

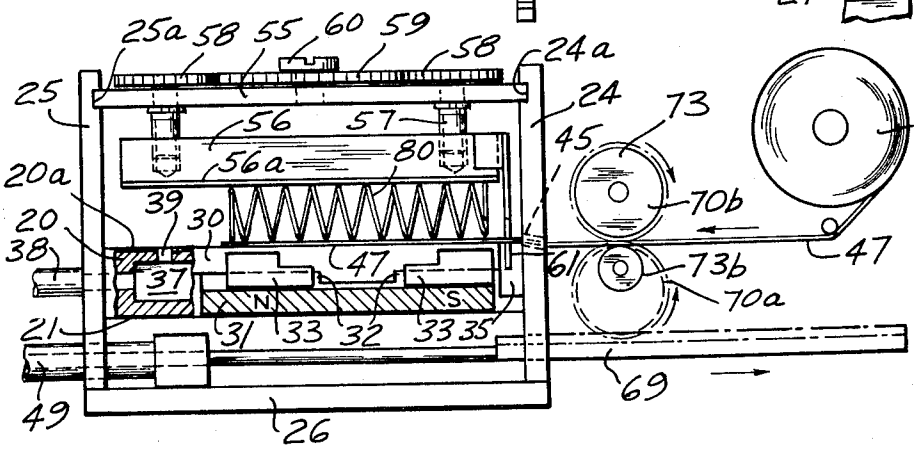

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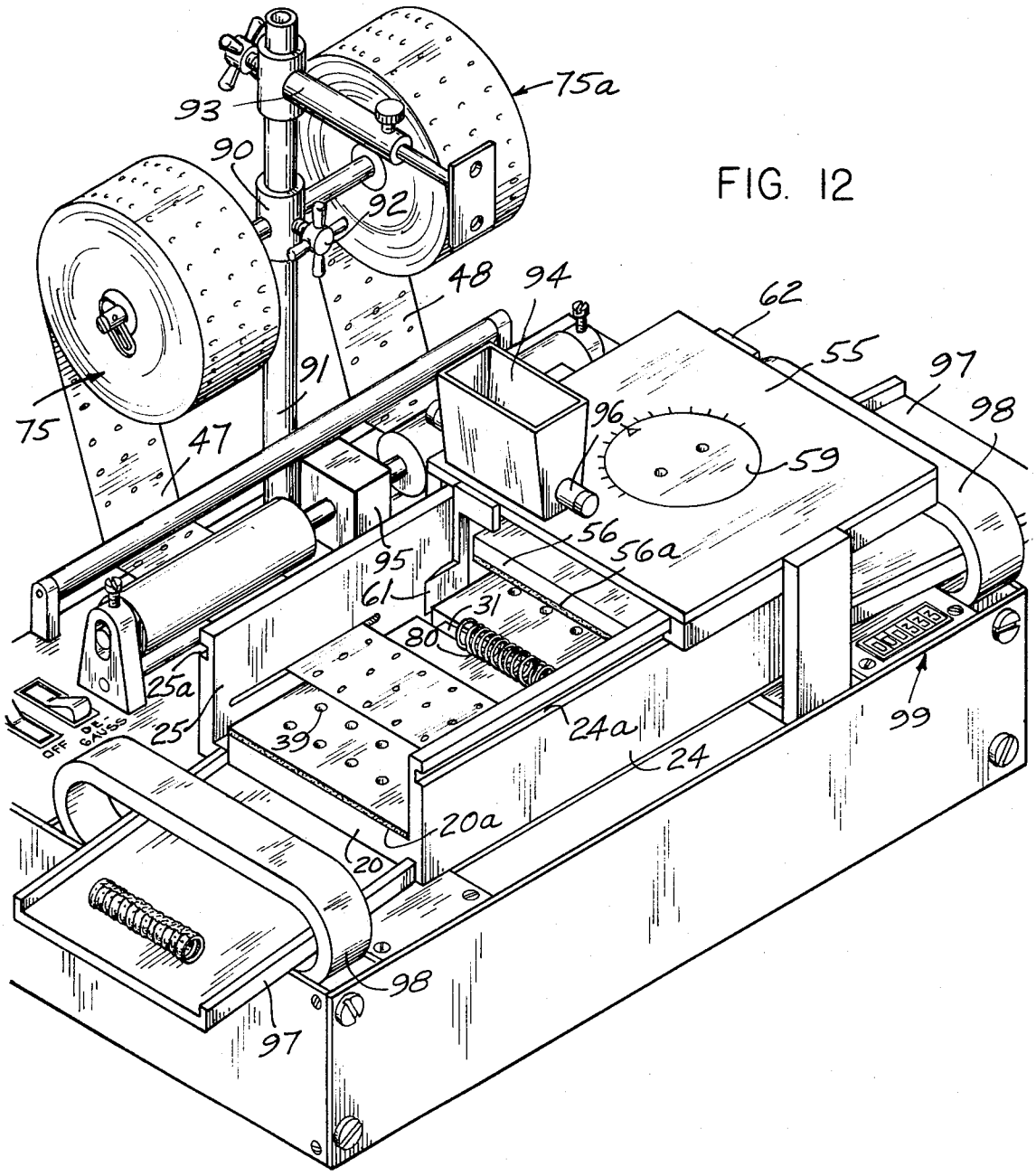

FIG. 12

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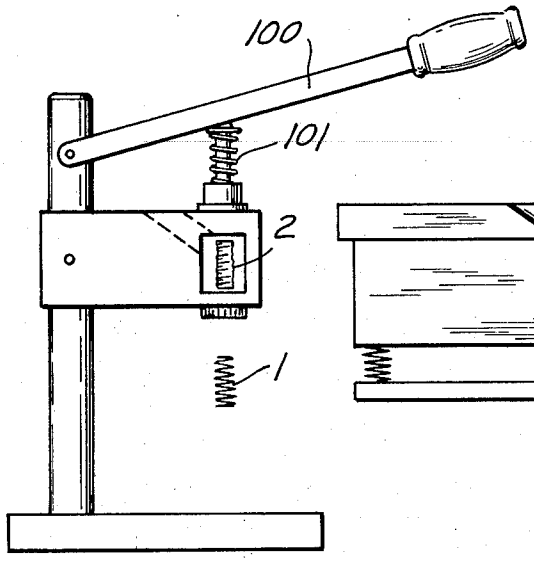

FIG. 13

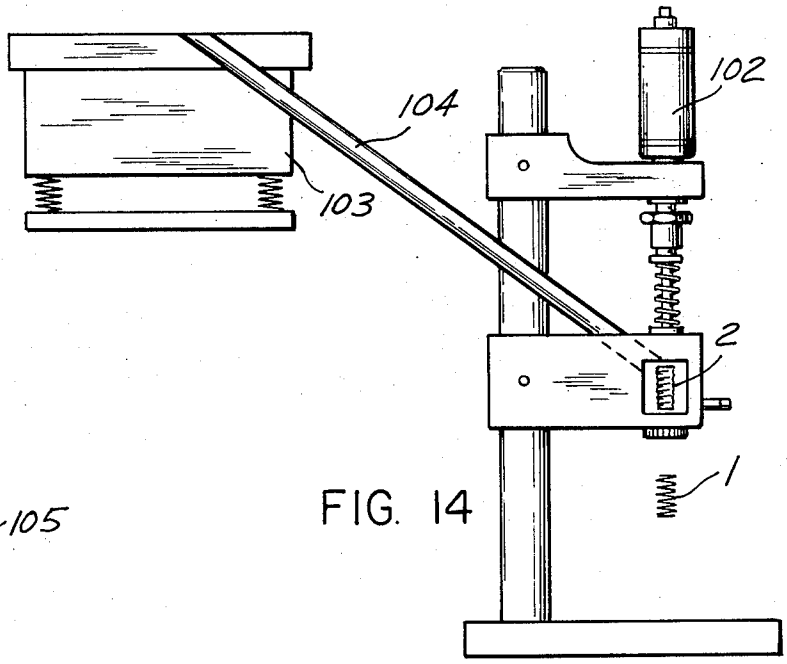

FIG. 14

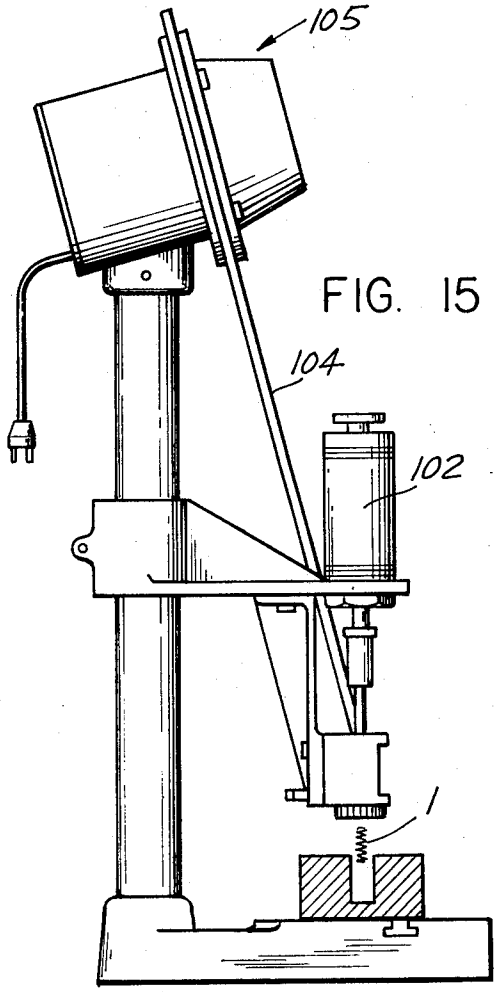

FIG. 15

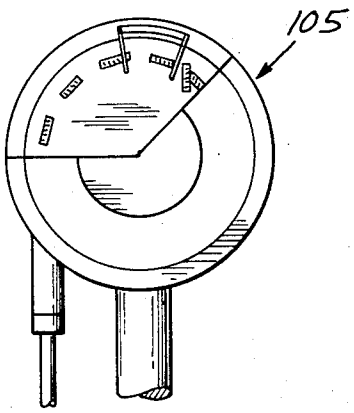

FIG. 16

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FOIL WRAPPED COIL SPRING

BACKGROUND

The vast majority of springs used in industry are open-coil compression springs which are generally supplied in bulk, packed in cartons or barrels. Inevitably, such springs interlock and become entangled and tend to form cohesive clusters. If the springs are heat-treated, the tangling and nesting of the springs is aggravated by repeated bulk handling of the springs. It is further aggravated by shipment and handling in storage. Every movement of the springs contributes to the nesting process.

It is therefore practically impossible to process open-coil springs in the same manner as most other assembly components (screws, rivets, pins) that are fed to bulk feeder magazines which release and feed them one after another. It is likewise practically impossible to maintain an even work flow in assembly operations involving springs because the operator is forced to disentangle spring clusters, at irregular time intervals. The time consumed in this preparatory operation varies from cluster to cluster and represents a non-predictable time interval which slows an integrated assembly down to the level of the slowest such time intervals.

The springs themselves are inexpensive components, but their inherent tangling and nesting tendency represents a very serious cost factor. This factor reflects not only the time consumed in placing a spring by hand, but additionally, the cost of slowing the overall assembly cycle. Assembly speed is necessarily geared to the slowest process in a composite work cycle.

Various methods are used to alleviate this condition. However, the most obvious method is not practical. Spring Winders could be integrated with other assembly suits, and springs could be fed singly, as they emerge from the spring winder, except for the fact that nearly all springs are heat-treated after winding. Consequently, the springs tangle when falling into the container in which they are transferred to the heat-treatment furnace, and tangling and nesting continues in the furnace and in the shipping container. Basically, springs can only be kept separate during the short moment when they emerge from the spring winding machine.

The methods presently used to alleviate this condition use the principle of "intermediate storage. " The springs are first disentangled by hand and are subsequently stored individually.

1. Storage on Rods or in Tubes —This method uses "intermediate storage " to improve the actual work cycle. The springs are disentangled by hand and pushed by hand on rods or inserted into tubes. These two hand operations are obviously slow and expensive.

2. Storage in Turntable Cavities —The heat-treated springs are again disentangled by hand and inserted by hand into cavities in a turntable or other work transport. This method does not like the first-mentioned one save work, but improves conditions in the actual assembly cycle. The irregular time intervals caused by disentangling are made regular by the use of advance storage.

3. Individual Packaging —The springs are first disentangled by hand and then placed by hand in individual cavities in cardboard or styrofoam, or on a tray or sheet covered with a tacky substance which keeps the springs separated. In the assembly operation, each spring is removed and inserted by hand, making a total of three hand operations.

The spring handling methods described above show that the spring assembly problem is so serious that two additional hand operations still offer economies in the assembly cycle.

THE INVENTION

It is a broad object of the invention to provide a novel shroud for preventing nesting and tangling of coil springs when packaged or stored in bulk or handled.

It is also an object of the invention to provide a novel, tightly fitting shroud for coil springs which permits bulk feeding of springs by standard feeder magazines of any type (vibratory, hopper, magnetic, etc.), automatically and at any required speed.

Another object of the invention is to provide a novel shroud for coil springs which permits heat treatment of the springs while the shroud is in position without detriment to the shroud so that the springs can be heat-treated in bulk without danger of nesting and tangling.

A further object of the invention is to provide a novel shroud for coil springs which can be rapidly and conveniently removed from the springs when no longer needed, for instance, immediately prior to installation of the springs.

A still further object of the invention is to provide a novel shroud for coil springs which can be applied to the springs at minimal costs for material and labor.

Another important object of the invention is to provide a novel device for stripping a shrouded spring prior to feeding the spring to a point of utilization.

It is also an object of the invention to provide a novel and improved shrouding device for successively encasing coil springs with a preferably tight shroud by an operation which can be carried out intermediate the winding of the springs and the feeding thereof to a storage container.

SUMMARY OF THE INVENTION

The aforepointed out objects, features and advantages and other objects, features and advantages which will be pointed out hereinafter are obtained by encasing the coil springs, after the winding thereof with a cover or shroud which overlies all gaps between the spring windings. A thus shrouded or covered spring presents a generally cylindrical body with a continuous wall and can be handled, heat-treated or stored in bulk without danger of tangling or nesting of the springs.

The shroud or cover is advantageously made of thin pliable and frangible metal foil, preferably wound with overlap. The overlapping ends of the foil will stay in place due to the pliability of the foil, especially when the foil is somewhat depressed into the gaps between the spring windings. Such deformation of the foil also prevents axial slipping of the wrapping. The overlapping foil ends may also be suitably sealed together, or the foil material may be folded over at the ends of the spring, thereby securing it in position without the use of deformations as aforesaid. The use of frangible wrapping material has the advantage that it can be rapidly and easily removed, when no longer needed, by stripping or fragmentation and blowing away of the pieces of the material by sufficiently powerful streams.

A further and very important advantage of shrouding the coil springs with metal foil such as aluminum foil is that the springs can be heat-treated at a temperature conventional for the purpose without deterioration of the wrappings.

Another important advantage of coil springs encased with a shroud according to the invention is that such shroud is equally efficient for open and closed end coil springs.

As is well known, open end coil springs can be manufactured more rapidly than closed end springs but have an even greater tendency to become entangled than closed end springs. The invention permits use of open end coil springs wherever acceptable without danger of entanglement prior to installation.

DETAILED DESCRIPTION OF THE INVENTION

In the accompanying drawing, several embodiments of the invention are shown by way of illustration and not by way of limitation. In the drawing:

FIG. 1 is a perspective view of a tightly shrouded open-coil compression spring;

FIG. 2 is a view similar to FIG. 1 but showing a modification of the shroud applied to the spring;

FIG. 3 is an end view of FIG. 2 showing an intermediate operational step of finishing the shroud for the spring;

FIG. 4 is a perspective view of a shroud, the ends of which are folded over the ends of the spring;

FIG. 5 is a perspective view of a tool or fixture for folding over the ends of the shroud in the manner shown in FIG. 4;

FIG. 6 is a diagrammatic sectional view of a stripping device for stripping the shroud from the spring when no longer needed;

FIG. 7 shows a section taken on line 7—7 of FIG. 6;

FIG. 8 is a diagrammatic sectional view of a device for removing the shroud from the spring by fragmenting the wrapping material and blowing away the fragments;

FIG. 9 is a diagrammatic perspective plan view of a device for automatically applying a shroud to springs tightly fitting the same;

FIG. 10 is a section taken on line 10—10 of FIG. 9;

FIG. 11 is a section taken on line 11—11 of FIG. 9;

FIG. 12 is a perspective view of a shrouding device similar to the device of FIG. 9;

FIG. 13 is a diagrammatic elevational view of a device manually operable for stripping springs and feeding the same to a point of utilization;

FIG. 14 is a diagrammatic elevational view of an automatic device for stripping springs and feeding the same to a point of utilization;

FIG. 15 is a diagrammatic elevational view of a modification of an automatic device for high speed feeding shrouded springs to a stripping device and from the stripping device to a point of utilization; and

FIG. 16 is a detailed view of the feeding assembly of FIG. 15.

Referring now to the figures more in detail, and more particularly to FIG. 1, this figure exemplifies a shroud covered coil or encased according to the invention. There is shown a coil spring 1 such as a compression spring. While all springs irrespective of the material of which they are wound, have the aforedescribed tendency to become entangled with other springs when stored in bulk, the invention envisages particularly the protection of springs wound of metal wire, and especially of magnetizable wire such as steel wire, for reasons which will be more fully explained hereinafter. The spring may have any length and width and may have any number of windings. However, it may be noted that the thinner the spring wire is and the more open the windings of the springs are, the more pronounced is the tendency of tangling, nesting and forming cohesive clusters.

To prevent such tangling or nesting of the springs, the invention provides to cover the gaps between the windings of the springs by a shroud. This shroud is formed by closely wrapping a strip 2 of a pliable and preferably frangible metal foil circumferentially about the spring windings. The width of the strip is preferably approximately equal to the length of the spring in the relaxed condition thereof and the length of the strip should be at least equal to the circumference of the spring, but is preferable to provide overlap at the meeting strip ends. Under certain circumstances, however, a small gap may be left in the shroud, the purpose of which is described below in connection with the air-stripping process which is part of the invention.

As is shown, the shroud overlies all gaps between the spring windings but leaves open the ends of the spring.

Metal foil has an inherent tendency of retaining its configuration. It has further the very important advantage that it permits heating-treating of the springs, as is often necessary, at the temperature generally used for this purpose. Aluminum foil and many other metal foils can readily stand this temperature without deterioration.

Wrapping of the foil about the spring may be manually or automatically effected by any device suitable for the purpose. Devices particularly advantageous for the purpose will be described hereinafter in connection with FIGS. 9 to 12 inclusive.

To prevent axial slipping of the shroud, as may occur especially when the shrouded springs are repeatedly handled, circumferentially elongate indentations or depressions 2*a* may be formed in the foil material overlying the gaps between adjacent spring windings. As it is indicated in the figure, the indentations extend below the outer circumference of the spring windings, thereby effectively preventing axial displacement of the shroud even though both the springs and the foil material generally have rather slippery surfaces. The indentations also have the advantage of resisting any partial unwrapping of the shroud when and while the springs are handled. Convenient and suitable means for forming the indentations will be more fully described hereinafter. The indentations are shown in the figure as forming a continuous spiral, but it should be understood that in actual practice they need not be as regular and continuous as shown by way of example.

A multitude of small holes 2*c* may be provided in the foil for a purpose which will be more fully explained hereinafter.

FIGS. 2 and 3 show a spring 1 also covered by a fairly closely fitting shroud 2, but according to these figures the foil material of the shroud is left smoothly cylindrical. As previously described, a shroud of this type may slide on the underlying spring and may also become partly unwrapped. To counteract such tendency, the overlapping ends of the foil strip are secured to each other by an adhesive stripe 3 on the inside of the outer end, and an adhesive stripe 4 on the inside of the inner end of the foil. As is readily evident, these stripes, when the foil ends are pressed together, will adhere to each other and also the underlying spring windings — thereby securing the shroud in position on the spring. Other suitable means for sealing the overlapping foil ends together may, of course, be used.

Turning now to FIGS. 4 and 5, the shroud 2 according to these figures is held in position on the shroud by folding back a protruding strip portion 2*b* at one or both ends of the shroud. Folding back of the shroud end may be effected by any tools or fixtures conventional and suitable for the purpose, as are indicated by a die 5.

Shrouding of the springs in the aforedescribed manner is effected preferably immediately after the springs leave the spring winder and before they drop into the storage container.

As is evident, the shroud must be removed, at least in most cases, before the springs are fed to a point of utilization, such as insertion into a work piece. FIGS. 6 and 7 show a stripping device suitable for the purpose.

The device comprises a housing 6 defining a stripping chamber 6*a*. A feed duct or chute 7 is connected to chamber 6*a*. This chute should be visualized as a hand-insertion funnel or as part of or connected to a feed magazine for feeding successive shrouded springs into the chamber. There are shown shrouded springs of the type shown in FIG. 1, but it should be understood that the device can also be used for shrouded springs of the type shown, for instance, in FIGS. 2 and 4. The chamber includes a positioning means for holding a shrouded spring dropped into the chamber in a predetermined or stripping position. The positioning means are shown by way of example as a magnet 8. The use of such magnet, of course, requires that the spring to be held in position is made of magnetizable material such as steel wire, or if the spring is made from non-magnetizable material such as brass, beryllium copper or certain grades of stainless steel, the foil itself should be made from magnetizable material such as steel. The respective face end of the magnet which is axially elongate, is preferably curved, as it is indicated at 8*a* to obtain good magnetic attraction. As is evident, the magnet will automatically attract a spring entering the chamber into the position of FIG. 6, that is, into the stripping position, and will releasably retain the spring in this position. To make the stripping device suitable for stripping springs of different diameters within a certain range, the magnet is preferably adjustably mounted within the housing, as is clearly shown in FIG. 7 and can be secured in the required position by means such as set screws 9. The non-operative surfaces of the magnet may be covered by a brass cap 8*b* which prevents the adhesion of springs to surfaces other than holding surface 8*a*.

Stripping is effected by an actuating means shown as a plunger 10 with a projection 10*a*. The diameter of the plunger

is larger than that of the spring, and projection 10*a* fits inside of spring 1. The plunger should be visualized as being axially displaceable between the position of FIG. 6 in which it is just clear of the uppermost spring winding, and a position in which it emerges from a stripping ring 12. This ring, which is preferably slitted, is held in position by an apertured screw cap 13. The diameter of the opening 12*a* in the ring 12 is selected in accordance with the outer diameter of the spring to be stripped. As the plunger descends, it compresses the spring and pushes it forcibly through the opening in ring 12. As a result, the foil shroud is stripped off the spring and fragmented, whilst the spring falls clear. The described mounting of the ring 12 permits a convenient exchange thereof for a ring with a differently dimensioned opening 12 *a*. The slit in the ring gives a certain resiliency to the ring which permits a tight fit between ring opening and spring and thereby assists in the stripping action.

As hereinbefore described, the stripped spring drops from the stripping chamber, ready for insertion by hand at the point of utilization. By placing the assembly piece into which the spring is to be inserted directly under the opening of stripping ring 12 by means of an appropriate fixture, the spring can drop directly into its assembly place without intervening hand operation. If a degree of force is required to insert the spring, the plunger 10 may be visualized as descending below stripping ring 12 while carrying the stripped spring which is temporarily held to the plunger by the friction between projection 10*a* and the inside of the spring. This force-fitting feature affords a considerable extension of the assembly arrangements which can be achieved.

The shroud fragments present in the stripping chamber after depression of the plunger, are removed from the chamber by directing a flow of pressure fluid such as pressurized air into the chamber through an inlet port 13. The pressurized air blows the shroud fragments from the chamber through an outlet port 14. The sequence of operation involved in stripping successive springs is inherently automatic and does not require exterior control devices. As long as the spring is held firmly by magnet 8 inside the chamber it prevents the next spring 2*b* from entering the chamber. As the plunger 10 descends, it continues to block the way for admission of the next spring which now lies in the inclined feeder tube 7. On its return to the initial position, the plunger unblocks this spring which then slides down by gravity into the chamber where it is magnetically positioned and oriented, as hereinbefore described. This arrangement therefore constitutes an automatic feeding escapement. The flow of compressed air may be visualized as constant, although it is generally advisable to provide a shut-off valve which admits air only immediately after the plunger has descended so that the sharp airstream does not dislocate the spring which is held by magnet 8.

FIG. 8 shows another stripping device. According to this figure, springs to be stripped are fed, one by one, through a tubular member 85, the inner diameter of which is such that the springs will be held in the desired axial position. They are retained in the stripping position which is shown in FIG. 8 by a shuttle 86 which should be visualized as being intermittently moved into and out of the illustrated closing position. As is evident, withdrawal of the shuttle permits the springs to continue through tubular member 85, which should be visualized as leading to a point of utilization.

A shrouded spring when in the position of FIG. 8 is exposed to a flow of pressurized air directed into the tubular member through an inlet port 87 and discharged therefrom through an outlet port 88. The inflow of air is preferably divided into a plurality of air streams by means of apertures 87*a*, distributed along the length of the spring. The impact of the air flows will break up and fragment the frangible shroud material, as it is shown in FIG. 8. The fragments will be blown out through outlet 88, as is also illustrated.

The operation of shuttle 86 and the control of the air flow should be visualized as being effected by suitable and conventional cycling devices, which are not shown or described in detail as they are well known in the art and readily available in the market, and do not constitute part of the invention.

The principal practical distinction between mechanical stripping of shrouded springs as shown in FIGS. 6 and 7, and air-stripping as shown in FIG. 8, is the fact that in mechanical stripping the spring is exposed to considerable compression. If a spring is wound from very fine wire, it may take a permanent set as the result of this compression. For such springs, the stripping chamber of FIG. 6 can be instantly converted into an air-stripping chamber by removing stripping ring 12. Without the ring, the chamber operates as an air-stripping chamber, with the additional feature of spring ejection and placement by means of the plunger.

It is essential that the shroud be removed as fast as possible. It has been found that the air-stripping is assisted considerably if some air is admitted also to the inside of the shrouded spring. This is achieved most conveniently by providing in the shrouding material the aforementioned small holes 2*c* as shown in FIGS. 1, 4, 6, 9 and 12. These perforations do not only admit air to the inside of the shrouding tube and thereby assist in unrolling the shroud, but are of considerable assistance also for tearing and fragmenting the shroud. They are, in fact, starting points from which tears in the surface of the foil will originate, analogous to holes in aircraft skins which interrupt the integrity of the continuous surface and thereby form starting potential points for fractures.

The stripping process can be further assisted by rolling the spring shroud in such a manner that the ends do not overlap, as stated initially, but leave a small gap. The coils of the spring which are projected from this gap cannot nest or tangle, but the gap is nevertheless helpful in facilitating loosening of the shroud under the impact of the stream of compressed air.

In certain instances, the loosening process of the shroud can be assisted by forcing compressed air directly into the inside of the shrouding tube, for example by means of an air-conducting bore in the plunger.

Referring now to FIGS. 9, 10 and 11, these figures show a device 15 for successively forming a shroud on an open coil spring, and more particularly, an indented shroud as it is shown in FIG. 1.

The device broadly operates as follows:

A spring after leaving a spring winder (not shown) is fed upon a bed plate of the device where it is magnetically positioned and held. Delivery of a spring to the device initiates the operational cycle of the device. A sliding top plate is now displaced and a knife carried by this plate cuts off a foil strip of suitable length which is held in position on the bed plate. Displacement of the top plate also causes rolling of the spring on the bed plate which, in turn, causes wrapping of the foil about the spring. The shrouded spring is released for conveyance to a point of utilization. The device is now ready for another cycle.

More specifically, the device comprises a stationary assembly 16, a movable assembly 17 and a foil advancing assembly 18.

Stationary assembly 16 is shown as a generally box-shaped unit having a bed plate 20, a bottom plate 21, end walls 22 and 23, a front wall 24 and a rear wall 25. Walls 24 and 25 are extended downwardly to a base plate 26 and have guide grooves 24*a* and 25*a* at their upper ends. Bed plate 20 has adhered to its upper surface a layer of softly yielding material such as a rubber mat 20*a*. The plate includes midway a slot 30 in which is located a magnet 31. This magnet has a slot 32 which is aligned with slot 30 in which a pair of interchangeable pole pieces 33 are frictionally and magnetically retained. The tops of these pole pieces are slightly below the surface of rubber mat 20*a*. The distance between the pole pieces is adjustable to accommodate springs of different lengths. Adjacent to wall 24, bed plate 20 is recessed to form a channel 35.

A wall 36 together with portions of walls 22, 24 and 25 defines an enclosed space 37 underneath the left side of the bed plate 20 which includes a plurality of holes 39 also extending through mat 20*a*. The space is connected to a suction pipe

38. A like construction is provided on the right side of the bed plate as it is indicated by a suction pipe 40.

Wall 24 has slots 45 and 46 for passage of foil strips 47 and 48. Finally, base plate 26 supports an air operated cylinder 49 which constitutes part of foil advancing assembly 18, as will be more fully described hereinafter.

Sliding assembly 17 comprises a vertically stationary but horizontally slidable plate 55 engaged in guides 24*a*, 25*a*, and a vertically adjustable plate 56 having adhered to its bottom side a rubber mat 56*a*. Plates 55 and 56 are joined by four threaded studs 57 which are driven by four gears 58 engaged by a master gear 59. Vertical spacing between plates 55 and 56 is adjusted by turning gear disc 59 and is locked in the adjusted position by tightening a screw 60.

Attached to plate 56 are knives 61 and 62 extending downwardly into channel 35. Sliding assembly 17 is actuated by a pressure air operated cylinder (not shown) connected to the assembly by a link 63.

Foil advancing assembly 18 comprises a rack 69 operated by air cylinder 49. The rack cooperates with a gear train 70*a* and 70*b*, gear 70*b* being integral with two oppositely acting clutches or ratchets 71 and 72 connected to foil drive rollers 73 and 74 which are backed up by pressure rollers 73*b*. Foil 47 is supplied from a reel 75 and foil 48 is similarly supplied from another reel.

The device as hereinbefore described operates as follows:

The vertical position of plate 56 is adjusted by means of gear 59 so that the vertical spacing between plates 56 and 20 is such that a spring 80 placed between the plates engages the rubber mats 56*a* and 20*a* thereon with a slight pressure, for a purpose which will be more fully explained hereinafter.

Arrows indicate the direction of rotation of the parts prior to obtaining the positions shown in FIGS. 9 to 11. Rack 69 when moved toward the right by means of air cylinder 49, advances foil 47 to the left, as shown in FIG. 10, due to the positive engagement of clutch 71, that is, foil is fed upon the left side of plate 20 as shown in FIG. 9.

Suction applied through pipe 38 holds the foil 47 on bed plate 20.

Plate 56 of sliding assembly 17 while traveling from right to left moves knife 61 into cutting engagement with foil 47 to start slicing of the foil prior to the engagement of the foil by spring 80. The knife is so positioned that it will cut off a length of foil corresponding to the length of the spring to be shrouded.

As plate 56 reaches the spring, the pressure engagement between the rubber mats and the spring will cause the spring to roll over the foil and thus to press the foil against the mat 20*a* upon which it rests. The resulting slight deformation of the foil causes it to wrap or fold itself about the spring as the movement of plate 56 continues. Moreover, the elastic rubber mats will depress the foil material into the gaps between the spring windings. In other words, the indented shroud shown in FIG. 1 is automatically obtained.

As the top plate 56 approaches the end of its movement toward the left, the shrouded spring will roll off exit chute 97 of the device for conveyance to a point of utilization.

Air cylinder 49 is now switched so that it will pull back rack 69. Clutch 71 is disengaged; clutch 72 becomes engaged and foil 48 is advanced, as previously described for foil 47. Suction is transferred from pipe 38 to pipe 40 and the next spring is dropped into position for shrouding. Top plate 56 now begins its return stroke, that is, it moves from left to right. On the return stroke, knife 62 cuts foil 48 in advance of the rolling of the spring. The device is double-acting in both directions. The aforedescribed sequence and timing of operations are automatically effected by suitable cycling devices. Many types of suitable devices are readily available in the market.

In the event the setting of the spacing between top plate 56 and bed plate 20 is to be changed to accommodate springs of different diameters, such a resetting can be easily effected by turning master gear 59. The setting arrangement as shown will displace plate 56 exactly in its own plane. If desired, the master gear may be calibrated against an index mark for easy resetting between runs. It is also possible to change the setting in such a manner that the top plate 56 is inclined to one side in relation to bed plate 20. In this configuration, the device is capable of rolling a foil shroud as described upon a conical spring.

Referring to FIG. 12, this figure shows a shrouding or wrapping device generally similar to the device shown in FIGS. 9, 10 and 11. The same reference numerals are used to designate corresponding components.

The figure shows clearly plate 55 movable in unison with plate 56 to which rubber mat 56*a* is adhered; it also shows bed plate 20 and the rubber mat 20a thereon. In addition, the figure shows a reel 75*a* from which foil 48 is dispensed. The two reels are slidably supported by a bracket 90 slidable on a post 91 on which the bracket can be secured at a selected level by tightening a wing screw 92. Post 91 also mounts a bracket 93 for mounting a feeder magazine (not shown) which delivers springs to be shrouded, one by one, to a discharge chute 94 which inturn feeds the springs upon bed plate 20 on which each spring is positioned by magnet 31 as described in connection with FIGS. 9 to 11. Each spring when passing through chute 94 activates a suitable control device such as a photo relay 96 which in turn starts a cycling device of the above referred to type.

The mechanism for alternately feeding foil from reels 75 and 75*a* upon bed plate 20 is indicated by a block 95. This block may be visualized as indicating a feeding mechanism of the type shown in FIG. 10. However, it should be understood that it is also possible and within the concept of the invention to feed the two foils simultaneously upon the bed plate. Such simultaneous feeding of the foils requires of course a rearrangement of knives 61 and 62 so that both cut the foil in either direction of movement of the top plate assembly 55, 56 and also a corresponding setting of the cycling device. Such modification of the device is well within the skill of an expert in the art and may be readily effected by using conventional components.

As the positioning of springs on the bed plate is effected by the action of a magnetic field, the springs may become somewhat magnetized. If this should be undesirable for the purpose for which the springs are intended to be used, the springs can be readily demagnetized before leaving the device via ejection chutes 97. As seen, the springs pass de-gaussing coils 98 while traveling on the chutes. A counter 99 of conventional design may be provided to count the number of springs shrouded on the device.

The foil strip used in the aforedescribed machine is shown with the perforations holes 2*c*. Such holes can be applied to an unperforated foil strip, for instance by providing rollers 73 and 74 which form part of the foil transport mechanism, with sharp projections 73*a* and 74*a* which perforate the tape while advancing it.

The magnetic holding and orienting device for the spring which has been hereinbefore described, is an essential part of the invention. Its addition to conventional packaging or labelling machines would be indispensable for attaining a useful operational speed. Its principal advantage for any operation concerned with springs is the fact that the magnetic attraction used in orienting and holding the spring prevents bouncing of the spring. A spring falling unto a surface will bounce repeatedly before it finds its rest position. This bouncing action consumes time within the operation cycle. It also interferes with the placement of the spring through gravity alone, quite especially as the springs after ejection from the winder do not always arrive in identical orientation and with identical velocity. Bouncing therefore precludes fast orientation of dropped springs and interferes with correct placement, since bouncing results in an irregular rebound.

FIG. 13 shows diagrammatically a stripping device for stripping shrouded springs, one by one, prior to feeding the springs to a point of utilization. The device of FIG. 13 may be visualized as being of the type shown in FIGS. 6 and 7 and

described in connection therewith. The plunger for stripping a spring fed into the stripping chamber is operated by depressing a handle **100** against the action of a spring **101**.

FIG. **14** shows a stripping device also using as stripping assembly a device of the type shown in FIGS. **6** and **7**, but stripping of successive springs is automatically effected. There is indicated a pneumatically or hydraulically operated mechanism **102** which effects successive up and down movements of the stripping plunger (see FIG. **6**). Mechanisms of this kind are well known in the art. Springs are fed, one by one, to the stripping chamber from a magazine **103** via a feed tube **104**. The feed magazine is shown as a vibrating magazine, but any other types of feeder magazines can also be used. The device of FIG. **14** is capable of delivering stripped springs to the point of assembly for insertion by hand or for automatic insertion into a work piece at a high rate of speed.

FIGS. **15** and **16** show a preferred type of automatic feeding and stripping device. In this type, there is no danger whatsoever of the wrapped springs being damaged because the springs remain stationary and are not grabbed by mechanical means. Instead, the totally smooth surface of a slowly rotating disc passes through the heaped springs.

A magazine of this type is capable of feeding single springs at high speeds. It iis noiseless in operation and highly suitable for integration with other automatic processing units. Magnetic feeder magazines are described in detail in my prior U.S. Pat. No. 3,442,894, issued June 10, 1969, and are known under the trademark "Pintrex " Feeders.

The stripping process is not indispensable to the invention. As the thin shroud does not interfere with the action of the spring, it is feasible, in certain applications, to install shrouded springs without stripping them. Further, it is likewise possible and even advantageous to strip shrouded springs by hand prior to assembly, preferably by using wrappings which have been rolled with a slight gap as hereinbefore described, which facilitates peeling. Although a hand operation, this procedure is still much faster than the disentangling of springs, especially since the time consumed is fixed and predictable, so that the hand-stripping process can be conveniently integrated with other assembly operations.

While the invention has been described in detail with respect to certain now preferred examples and embodiments of the invention, it will be understood by those skilled in the art, after understanding the invention, that various changes and modifications may be made without departing from the spirit and scope of the invention, and it is intended, therefore, to cover all such changes and modifications in the appended claims.

What is claimed is:

1. The combination of a coil spring and of a strip of magnetizable frangible metal foil wrapped about the circumference of the spring, said strip forming a generally cylindrical shroud overlying the gaps between the windings of the spring, said shroud protruding from at least one end of the spring, the protruding shroud end being folded back upon the adjacent spring winding thereby covering the underlying ends of the spring.

2. The combination according to claim **1** wherein said shroud is made of magnetizable metal foil.

3. The combination according to claim **1** wherein said foil is aluminum foil.

4. The combination according to claim **1** wherein said foil strip includes a plurality of spaced apart perforations.

5. The combination according to claim **1** and comprising fastening means retaining the shroud on the spring in a fixed axial position relative to the spring windings.

6. The combination according to claim **5** wherein said fastening means comprise circumferentially elongate indentations in said foil disposed in gaps between windings of the spring and extending below the outer peripheral outline of the spring.

7. The combination according to claim **5** wherein the ends of the foil forming the shroud overlap and said fastening means comprise adhesive stripes between the overlapping shroud ends and the inner side of the shroud and next adjacent to the spring windings.

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