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Fidler

[11] **3,748,716**

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[54] **STARTER SPRING ASSEMBLY TOOL AND METHOD**

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[52] **U.S. Cl.** **29/228,** 81/7.5

[51] **Int. Cl.** **B23p 19/04,** G04d 1/04

[58] **Field of Search** 29/228, 464, 240, 29/173, 225, 228; 81/7.5

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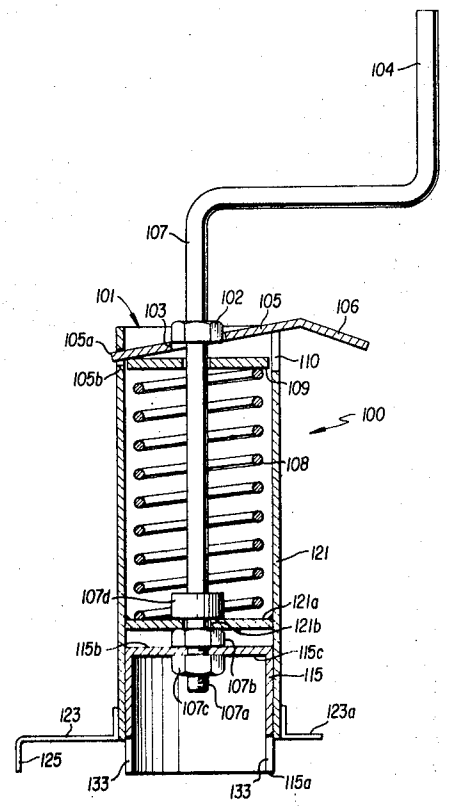
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Assistant Examiner—D. C. Crane
Attorney—Burns, Doane, Swecker & Mathis

[57] **ABSTRACT**

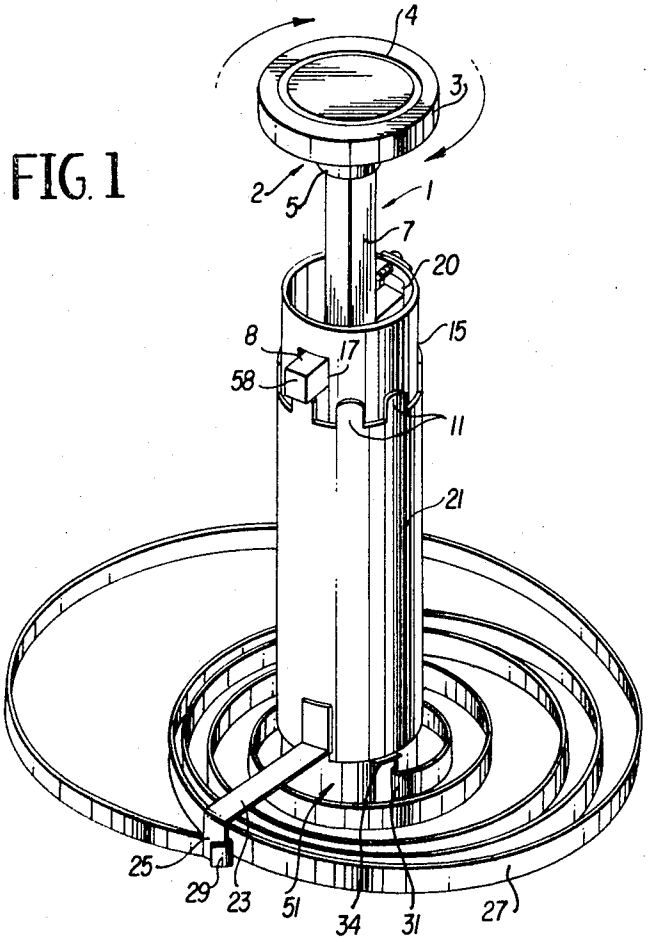
A starter spring assembly tool utilizing relatively rotatable bodies for selectively holding the ends of the starter spring to be coiled prior to its insertion within a housing. An inner cylinder is rotatably disposed within an outer cylinder so that rotation thereof will cause the spring to coil or uncoil. Locking or clutching means are provided for preventing relative rotation of the inner and outer cylinders while the spring is being coiled and after it is tightly wound, or coiled, and engaged with the outer periphery of the inner member.

4 Claims, 8 Drawing Figures



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FIG. 1



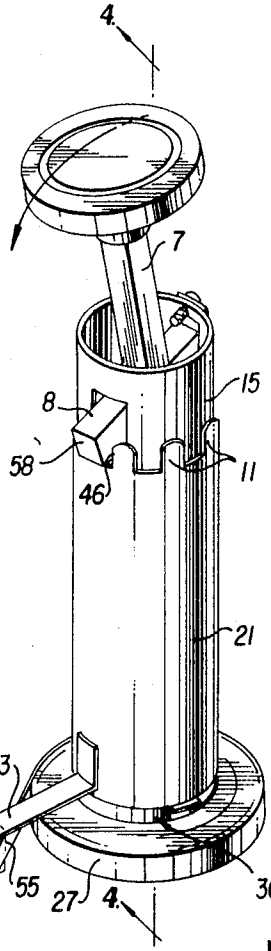
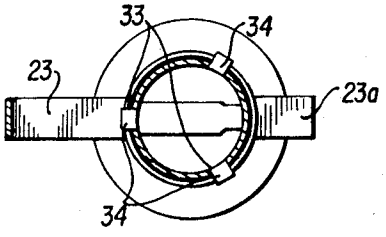


FIG. 2

FIG. 6



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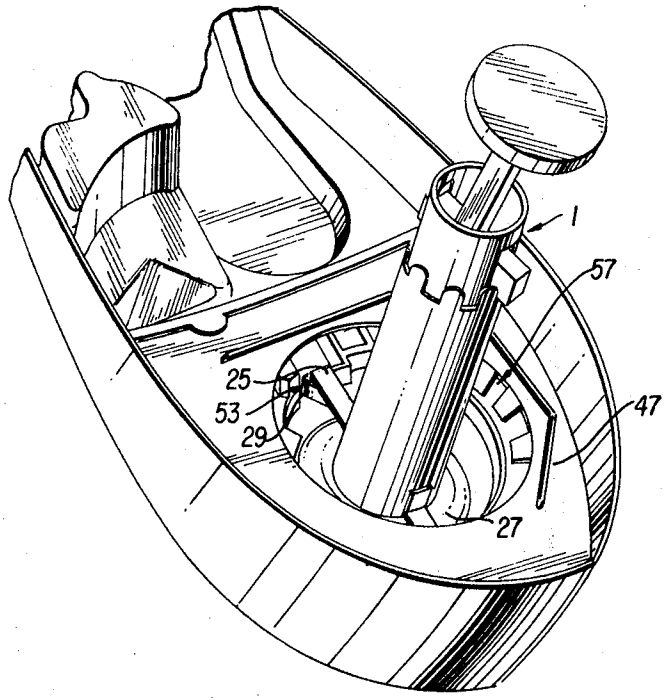


FIG. 3

FIG. 4

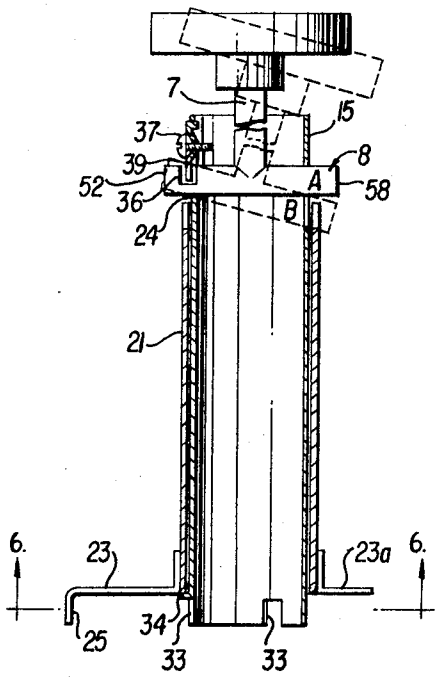


FIG. 5

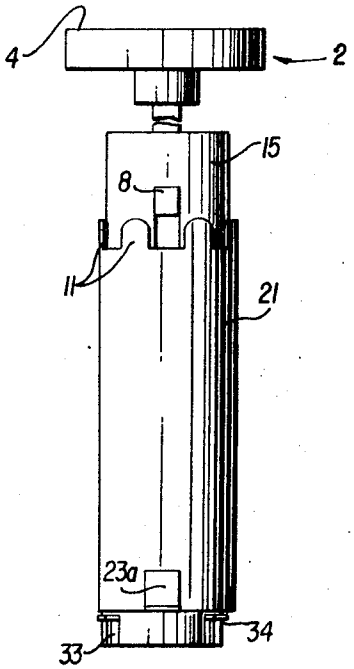
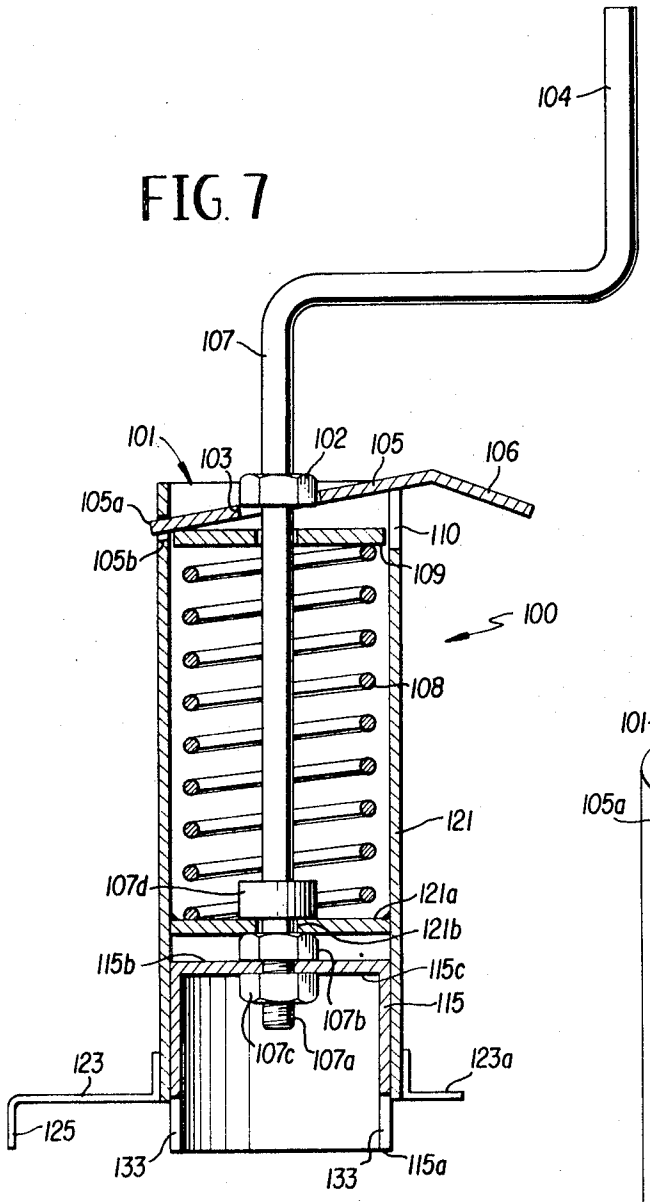


FIG. 7


104
107
101
103
102
105
106
105a
105b
110
109
100
108
121
107d
121a
121b
115b
115c
115
107b
107c
107a
123
123a
125
133
133
115a

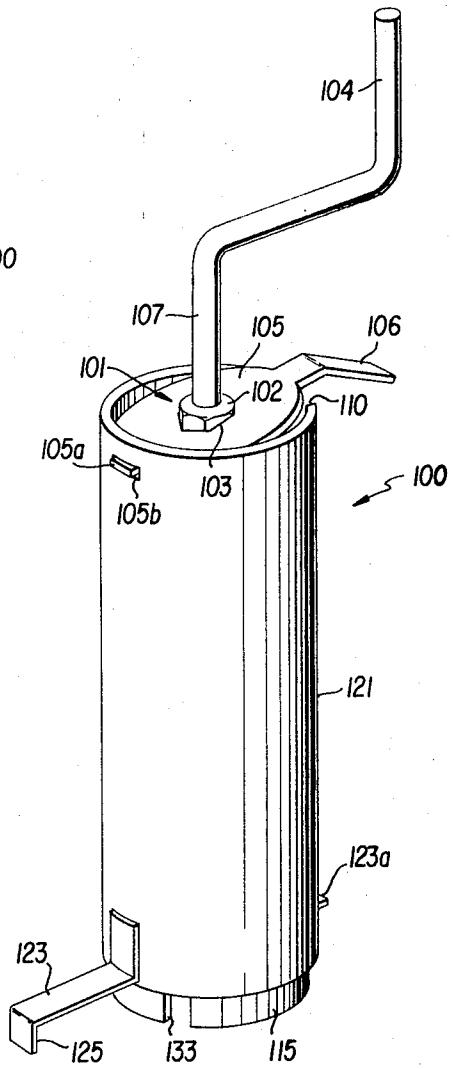

104
107
105
106
101
102
110
105a
103
105b
100
121
123a
123
125
133
115

FIG. 8

STARTER SPRING ASSEMBLY TOOL AND METHOD

BACKGROUND OF THE INVENTION

The present invention relates to a spring assembly tool for coiling a spring and installing or removing it from a housing. The invention relates specifically to a spring coiling device utilizable for installation and removal of starter springs for use in starting internal combustion engines such as those in chain saws.

A frequently utilized means of coiling and inserting starter springs in motor housings is to perform this operation by hand. The inner end of a starter spring is held while the outer end is wound thereabout until a tightly wound spring is formed. Care has to be exercised while hand coiling the spring to prevent axial displacement of the windings, i.e., telescoping of the coiled spring layers. At chosen intervals the spring, as it is being wound, can be flattened out against a table top or the palm of the hand to insure that a flatly wound spring results.

Once the spring is sufficiently coiled it is held at its outer periphery by a workman's finger tips to prevent uncoiling. This could be especially hard on the finger muscles since the coiled spring tries to achieve a relaxed or unbiased condition.

While preventing the spring from uncoiling, axial displacement or telescoping of it must also be avoided. As the spring is held, it may be gingerly inserted within a narrow motor housing. The bottom of the motor housing is generally wider than the housing walls through which a coiled spring is placed for positioning so that it is usually necessary for the spring to be relatively tightly coiled prior to installation. Due to the tight confines of the motor housing walls knuckles and fingers are sometimes skinned as the wound spring is inserted. When the spring is in its proper position at the bottom of the housing it is released and allowed to uncoil. The particular housing configuration often utilized for spring starter devices in chain saws presents additional interference caused by an upwardly extending centrally positioned spindle used later in the assembling of the arbor and remaining starter parts. Thus, when the spring is coiled and inserted, a large enough central opening must be provided in the wound spring to clear the upwardly extending spindle.

After the spring is placed within the motor housing confines and uncoiled, one end of the spring is hooked at its appropriate location within the housing. This operation is also performed by hand. The spring end would have to be grabbed and placed about a projection or protrusion provided for that purpose at the bottom of the housing.

The entire coiling operation, including subsequent insertion, and hooking of the spring end is extremely time consuming and, as noted, hazardous. The operation requires a high degree of manual dexterity and patience since an error while coiling may require that the operation be restarted. Once the spring is inserted and properly hooked, the free spring end can receive an arbor used in the starter device associated with the chain saw being assembled, as previously noted.

The operation would be done in reverse for starter spring removal, however, this also would require some hand winding. Winding the spring while inside the housing and removing it, as can be appreciated, may be even more difficult and precarious than the previously

described insertion operation. The spring is grabbed by the finger tips and then gingerly manipulated for removal. Sharp housing surfaces and walls often leave a scratched or skinned hand.

It would therefore be highly desirable to provde a spring coiling device which coils a spring and allows for its safe insertion within a housing while avoiding skinning of a workman's hands.

It would also be desirable to provide a starter spring installing tool which will allow for the guiding and securing of one end of the spring within a housing and then allow spring uncoiling and subsequent tool removal.

It would be additionally advantageous to provide a tool which winds an uncoiled spring and prevents the layers thereof from axial displacement or telescoping.

It will be appreciated that it would also be extremely desirable to provide a tool to hold a tightly coiled spring from unwinding while it was being inserted into a housing without excessive strain on a workman's fingers.

It would also be particularly desirable to provide a tool which can remove an uncoiled spring from a housing without requiring the workman to use his fingers for spring winding.

A number of hand operated spring coiling devices have been long known in the watchmaking art for coiling a mainspring of a watch. These coiling devices (spring coiling devices of the type discussed are shown in U.S. Pat. No. 2,717,527; U.S. Pat. No. 3,263,532; and U.S. Pat. No. 1,812,494) are characterized by hollow chambers or holding elements within which is wound the watch mainspring. A separate and detachable coiling or winding element is fitted within the holding element with one end of the spring held on a central rod of the winding element. The outer end of the spring being coiled is unrestrained and is pulled into the chamber during the coiling operation. Once the spring is wound the winding element is removed and, the holding element is utilized to insert the wound spring within a watch casing. The spring in these devices is entirely captured, when wound, within the cylindrical chamber. The holding element is further provided with a plunger which when depressed causes the wound spring to be ejected from the holding element.

Although devices of this general type may be acceptable for some purposes, they may not be entirely desirable for a number of reasons. For example, the repairman or assembly worker intending to insert the spring cannot perform a securing operation of the ends of this spring without first ejecting the spring and then securing its end by hand or with a separate tool insertable within the watch.

Such spring coiling devices, also include a plunger design comprising a centrally disposed shaft extending from a finger activatable plunger head to the spring holding element or chamber. These plungers are spring biased and have substantially flat pusher heads or discs within the coiling chamber. The construction of tools of this type is relatively expensive due to the independent assemblies required for spring winding, holding and ejection.

Finally, it should be noted that since the spring ends once wound are entirely within the holding element, the workman cannot see where the spring ends are going to be positioned prior to ejection of the spring. This is especially significant since one spring end can

not be attached within the watch housing with the same tool that performs the winding operation. A separate installation tool would be required to position a spring end within the watch once the spring is installed and properly inserted. Springs once placed within the housing cannot be rewound for removal when using a tool such as those discussed above since a separate winding element is required.

OBJECTS AND SUMMARY OF THE INVENTION

It is therefore a general object of the invention to provide a spring coiling device which obviates or minimizes the disadvantages of the sort previously noted.

It is a particular object of the invention to provide an improved spring coiling device which is easy to operate and inexpensive to manufacture.

It is a further object of the invention to provide a spring coiling device which is hand operable and capable of coiling a spring for insertion into a relatively narrow housing chamber.

It is a related object of the invention to provide a spring coiling device which can selectively secure and guide at least one spring end and release, i.e. uncoil the spring, once it is placed in position.

It is yet another object of the invention to provide a spring coiling device which may be selectively locked for holding a spring in its coiled or biased position after it is tightly wound and during intermittent winding.

It is a related object of the invention to provide a spring coiling device which provides for easy removal of the coiling device once the spring is guided into its proper location.

A still further object of the invention is to provide clutching or locking mechanisms which permit coil spring ends to be mutually secured at a variety of circumferential positions, so as to permit selective interruption and resumption of a spring winding operation.

In this same connection, it is an object of the invention to provide, in one embodiment, a clutching mechanism which will automatically cause winding components to assume an interlocked condition.

A preferred embodiment of the invention intended to accomplish at least some of the foregoing objects comprises a spring coiling device, including means for holding an uncoiled spring at a position near an end thereof and means for selectively coiling the spring about a first rotatable body for guidance and placement in a housing.

A second rotatable body is disposed about the first rotatable body and also provided with spring retaining means; the first and second bodies being relatively rotatable and telescopingly mated. The first and second bodies, in the preferred embodiment, comprise two rotatable cylindrical members.

Upon relative rotation of the two cylinders the spring is caused to coil about the first cylindrical body, the spring being held near its outer and inner ends and frictionally engaging the inner cylinder. As it is tightly wound complementary engaging locking means included in the first and second cylinders cooperate to selectively prevent relative rotation of the cylinders.

The spring coiled for insertion and prevented from unwinding is placed and guided within a housing with the coiling device. The spring outer end is positioned to hookingly engage within the housing at a desired location about an upwardly extending protrusion in the housing. The first and second cylinders are then "unlocked" or "declutched" to allow relative rotation of the cylinders and thereby cause the spring to unwind. Once the spring has been allowed to completely unwind, most of the friction and tension holding the spring against the inserting tool is relieved and the tool may be relatively easily removed.

THE DRAWINGS

Other objects and advantages of the present invention will become apparent from the subsequent detailed description thereof in connection with the accompanying drawings in which like numerals designate like elements and in which:

FIG. **1** is a perspective view of the starter spring assembly tool of the invention illustrating the tools engaging a spring prior to a coiling operation;

FIG. **2** is a perspective view of the assembly tool of the invention with a starter spring tightly wound and coiled for insertion, the tool being locked to prevent spring unwinding; the location of a hookable protrusion within a housing chamber is also shown in phantom;

FIG. **3** is a perspective view of the assembly tool with a coiled spring being positioned within a chain saw housing;

FIG. **4** is a cross-sectional view of the spring assembly tool of the invention and taken along lines **4**—**4** of FIG. **2** and showing in phantom locking of the tool;

FIG. **5** is a front elevational view of the spring assembly tool of the invention showing locking features incorporated therein;

FIG. **6** is a cross-sectional view of the starter spring assembly tool of the invention and taken along lines **6**—**6** of FIG. **4**;

FIG. **7** provides a partially sectioned, vertical elevational view of an alternative, preferred embodiment of the invention; and

FIG. **8** provides a perspective, top plan view of interclutched clutch components of the FIG. **7** embodiment.

DETAILED DESCRIPTION

Referring now to FIG. **1**, a preferred form of the starter spring assembly tool **1** of the invention is there shown. The assembly tool **1** includes an inner rotatable member **15** slidably and rotatably disposed or received within an outer rotatable member **21**. These rotatable members, in the preferred embodiment, are generally cylindrical. The outer cylinder **21** has an inner diameter slightly larger than the outer diameter of the inner cylinder **15** thereby allowing freedom for rotational movement when the two cylinders are telescopingly mated, as shown. The inner cylinder **15** is, in the preferred embodiment, provided with an extended lower spring receiving portion shown at **51** which projects beyond the lower periphery of the outer cylinder **21**, when the tool is assembled. Adjacent the lower end of the outer cylinder **21** a generally L-shaped spring guide **23** is provided. This guide is a flat, generally horizontally disposed member below which the spring to be coiled is held. A generally diametrically aligned and oppositely extending projection **23***a*, as shown in FIG. **6**, is additionally provided for guiding a spring **27**.

During coiling of the spring **27** with the tool **1**, the spring is kept in a relatively flat condition, i.e., no axial displacement or telescoping of the spring layers, by the guides **23** and **23***a*. This militates against upward axial displacement of the spring layers while the spring is being coiled and when it is in a relaxed condition. The

spring coiling tool 1, as shown in FIG. 1, is normally held against a level surface (not shown) to prevent the downward axial displacement of the spring 27 during the coiling operation. A table top serves most effectively as a surface upon which the coiling device may be utilized.

Additionally, the perpendicularly disposed end at 25 is utilized for retaining an end of the spring being coiled. Prior to coiling, one end of the spring is hooked to the guide at 25 and to the inner cylinder 15. For this purpose, the inner cylinder 15 is provided with three spring retaining notches 33 (FIG. 6). While in the preferred embodiment three notches are provided, it will be appreciated that only one notch is actually required for hooking an inner end 31 of the spring 27.

The spring retaining notches 33 are bounded by lateral protrusions 34 extending from and integral with the inner cylinder 15. As previously noted, the inner cylinder extends beyond the outer cylinder at its notched end. By means of protrusions 34, the relative positions of the cylinders 15 and 21, are maintained. These protrusions serve to maintain the distance shown at 51 and maintain the guides at their most effective height above a coiling spring. The importance of this feature will be more easily understood when referring to the spring coiling operation, since the outer cylinder is pushed down while winding. The lateral protrusions 34 abut the lower periphery of the outer cylinder 21 thereby preventing complete downward movement thereof. The lower ends of the spring retaining notches 33 are open to allow for easy insertion of the spring end 31 prior to beginning the winding operation and to permit subsequent removal of the wound spring when released into its housing.

Still referring to FIG. 1, the spring 27, to be wound, is usually provided with hooked ends which have a generally U-shaped configuration and are shown at 29 and 31. The spring 27 is provided with an outwardly extending hooked end at 29 and an inwardly extending hooked end at 31. While the chain saw housing shown in FIG. 3 uses the particular spring shape shown it can be appreciated that most any coilable spring can be wound by the tool of the invention. These hooked ends 29 and 31 are disposed about the spring end retainer 25 and within one of the notches 33, respectively.

As noted, three notches have been provided, in the preferred embodiment, to facilitate spring end engagement. This feature prevents unnecessary coiling of the spring 27 by hand since a notch 33 can be easily positioned close to the location of the inner free end of the spring 27.

Winding means comprising a knob assembly 2 cooperating with the inner cylinder 15 will be hereinafter explained.

A knob assembly 2 which facilitates coiling and locking is shown in FIG. 1. The knob assembly 2 comprises a knob end 4 having a series of vertical grooves or knurls 3 therein, the vertical grooves facilitating gripping of the knob end 4. Knob end 4 has a generally central hub portion 5 which serves as a collar to securely receive a longitudinally extending shaft 7. This may be accomplished in any suitable manner so long as unitary rotation occurs, for example, by press fitting of the shaft 7 within the knob hub 5. While a number of materials are suitable, in the preferred embodiment, the knob is made of a plastic material.

The shaft 7, which may be of metal stock of square cross-section as illustrated, is suitable attached, e.g., by welding, to a laterally extending bar means 8. The shaft 7 is shown in FIG. 1 vertically or longitudinally disposed within an upper portion of the inner cylinder 15.

The inner cylinder 15 is provided with two diametrically opposed and generally longitudinally extending parallel slots 17 and 20. Slot 20 is slightly larger in its longitudinal dimension than the length of a side of the bar 8. However, the other slot 17 extends downwardly well into the area bounded by the upper end of the outer cylinder 21 when the coiling device is assembled. Referring to FIG. 4, there is shown the lower end of the slot 20 at 24 which ends above the upper periphery of the outer cylinder 21.

The knob assembly 2 comprising the knob end 4, the generally vertical shaft 7, and the generally horizontal bar 8 is removably mounted within the slotted portions 17 and 20 of the inner cylinder 15. When assembling the spring coiling device, the inner cylinder 15, exclusive of the knob assembly 2, is upwardly telescoped within the outer cylinder 21 until the lateral protrusions 34 abut the lower periphery of the outer cylinder 21, as previously noted.

Once the inner cylinder 15 is within the outer cylinder 21, the bar 8 of knob assembly 2 is inserted within the slots 17 and 20 respectively. This is accomplished by tilting the knob assembly (actual insertion is not shown) sufficiently to lower it within the inner cylinder 15 so that one end of the bar 8, at 58, (FIG. 4) extends beyond the inner cylinder outer surface. The bar 8 is then straightened until it is positioned for lateral movement into slot 20. The knob assembly 2 is then centered within the cylinder 15 so that bar ends 52 and 58 extend outwardly a relatively equal amount.

It can be appreciated that the knob assembly 2, once within the slots 17 and 20, may shift laterally transversely of the cylinders until the shaft 7 abuts the inner walls of the inner cylinder 15. To prevent transverse shifting after assembly of the knob assembly 2, the transversely extending bar 8 is provided with a notched portion shown in FIG. 4 at 36. This notched portion receives a washer 39 which is suitably fastened to the inner cylinder 15, for example by means of a screw 37. Once the knob assembly 2 has been placed inside the inner cylinder 15 and properly positioned, the screw 37 and washer 39 are positioned within the notch at 36 thereby restricting further transverse shifting of the knob assembly 2. It can be appreciated that other means for preventing lateral movement of the knob assembly 2 may be utilized in place of the screw and washer arrangement of the preferred embodiment.

The slotted portions 17 and 20 are formed at positions slightly below the upper periphery of the inner cylinder 15 (FIG. 1). Since the knob assembly 2, including the horizontal bar 8, is tiltingly inserted within the inner cylinder 15, the vertical slots 17 and 20 must be sufficiently close to the upper periphery of the inner cylinder to allow insertion of the knob assembly when it is tilted. This dimension, below the upper periphery of the inner cylinder 15, is determined by several factors including the length of the bar 8 and the diameter of the inner cylinder 15.

With reference to FIG. 4, the bar 8 is shown slotted and having the plate or washer 39 therein. The slot 36 is so formed, as previously mentioned, to prevent lateral shifting of the bar 8. It is additionally provided with

sufficient vertical depth to permit non-interfering cocking of the knob assembly 2 about slot 20, as shown in phantom. The knob assembly 2 and associated bar 8 may thus be selectively cocked or tipped downwardly within the larger slot 17 as previously described. The bar 8 thus pivots within the slot 17 and about the slot 20. This cocking can be more clearly seen in FIGS. 1 and 2 and will be subsequently described in conjunction with the operation of spring coiling tool.

The outer cylinder 21 is formed with a castellated upper periphery indicated as 11 and shown in FIGS. 1 and 2. The castellations 11 have rounded ends 46 which smoothly extend into the formed depressions within which the bar 8 engages. The bar 8 with the outwardly protruding end portion at 58 is engageable within the castellations 11.

Referring to FIG. 4, there is shown two positions of the knob assembly 2. In position A the knob assembly is illustrated with bar 8 in a generally horizontal plane and the shaft 7 in a generally vertical position. Position A as previously discussed allows relative rotational movement of the inner and outer cylinders. In position B the knob assembly 2 is shown tipped or cocked so that the protruding end 58 of the bar 8 engages a castellation 11 (also shown in phantom in FIG. 4 and in FIG. 6). This engagement will lock the inner and outer cylinders 15 and 21 to prevent against relative rotation therebetween.

Although the preferred embodiment discloses the use of a castellated outer cylinder lockably engageable with the bar 8 of the knob assembly 2 associated with the inner cylinder, it is within the scope of the invention to provide different locking arrangements for selectively preventing relative rotation of the inner and outer bodies. For example, the inner body may be provided with an annular flange extending outwardly at a position above the upper periphery of an outer circular plate. The annular flange may include a longitudinally adjustable pin.

The outer circular plate may also be provided at its lower end with a detent arm or pin stop matable and complimentarily engageable with the adjustable pin of the inner body. When the pin and pin stop are in cooperating abutting relation, relative rotation of the two cylinders may be prevented. The locking pin of this alternate embodiment may be movable to circumferentially adjustable positions about the annular flange to provide locking at one of many angular positions about the inner cylinder annular flange. Also, the inner or outer relatively rotatable bodies may be provided with locking means which are adjustable to one of several positions.

OPERATION

Referring now to FIGS. 1, 2 and 3, the operation of the starter spring assembly tool 1 may be more clearly understood.

Initially the spring 27 having hooked ends 29 and 31 will be relaxed, i.e., not tightly wound, and disengaged from the spring assembly tool. A workman may slip the spring's hooked end 29 about the spring retaining end 25 of the outer cylinder and also hook the inner hooked end 31 with the nearest available notch 33, on the lower periphery of the inner cylinder 15, as previously disclosed. The partially relaxed spring 27 engaged with the winding tool 1 is shown in FIG. 1. The spring 27 is first placed on a flat surface such as a table top while it is being wound and then hooked to the tool.

The workman grasps the outer cylinder 21 with one hand, pressing it downwardly, and rotates the knob 4 in a clockwise (for a spring wound as that shown in the drawings) direction with the other hand. The knob is positioned upright when being turned. The horizontally disposed bar 8 fastened to the shaft 7 causes the inner cylinder 15 to rotate within the outer cylinder 21. This positive rotation is produced by the two protruding ends of the bar 8 acting within and against the walls of the vertical slots 17 and 20. The spring 27 then is caused to tightly wind around the lower end of the inner cylinder at 30, as is more clearly shown in FIG. 2.

During winding of the spring 27 the operator will generally have to release his grip momentarily, from the knob 4, so that he can continue to rotate the inner cylinder 21. This intermittent winding is facilitated by the use of the locking bar 8, during the winding operation. Since the spring 27 will be trying to uncoil and assume a relaxed position it will tend to unwind unless held momentarily while the workman resecures his grip. After each intermittent wind the knob assembly may be tilted into locking engagement with the castellations 11, preventing spring unwinding. Thus, relative rotation of the inner and outer cylinders may be selectively prevented.

The spring 27 shown in FIG. 2 is tightly coiled and wound about the inner cylinder 15 and is frictionally engaged therewith. Once this spring is tightly wound, the knob assembly 2 is cocked downwardly as shown in phantom in FIG. 4 (indicated at B) and in FIG. 2. The protrusion at 58 lockably engages within one of the castellations 11 disposed about the upper periphery of the outer cylinder 21. Relative rotation of the two cylinders is thus prevented thereby tending to insure the maintenance of the spring in a coiled condition.

By winding the spring tightly the spring layers are prevented from axially displacing while setting the coiled spring within a housing. Thus when the tool 1 is picked up from a table or other winding surface, to be transferred to the housing, the spring 27 is frictionally held against the inner cylinder and prevented from axially telescoping by being tightly wound thereabout.

FIG. 3 shows the starter spring assembly tool having a tightly coiled spring 27 thereon, disposed within a housing 47 for insertion. The hooked end 29 of the spring 27 is shown positioned within the housing and hooked to the housing wall at 53.

By slightly cocking the entire winding tool, having the tightly wound spring 27 thereon, it may be passed through the housing opening. Referring again to FIG. 3, the protrusion 57 (see phantom in FIG. 4) at 53 within the housing 47 is seen having an open area within which the spring retainer 25 and the hooked spring end 29 may be fitted. As the tool is placed into an inserting position, the protrusion at 53, within the housing, would generally abut the spring at 55 (See FIG. 4), with the retaining end 25 being beyond the protrusion 57 and within the aforementioned open area behind the protrusion. The protrusion is situated below the horizontal guide member 23, again as shown in FIG. 4.

Once the spring is properly positioned, the operator or workman uncocks the knob assembly 2, as shown in FIG. 4 position A, and holds onto the outer cylinder 21

to prevent its rotation. The knob assembly and its associated inner cylinder **15** rotates counterclockwise caused by the unwinding of the spring **27** held at one of notches **33.** Unwinding rotation is caused by the uncoiling of the spring **27** as it seeks a relaxed or unbiased position. The operator may cup his fingers over the knob **2** during unwinding to slow down and control its rotational movement. Throughout this entire unwinding operation the outer hooked end of the spring **27** is held and guided in its properly hooked position, within the housing at **53,** as previously noted. Unwinding can take place by merely pushing down on the knob assembly **2** to straighten out the assembly thereby unlocking the inner and outer cylinders. The outer cylinder is held during unwinding and pressed downwardly so that the uncoiling spring layers will remain relatively free from axial displacement.

As can be seen, once the locking protrusion **58** is lifted from interfering engagement with the castellations **11,** the inner cylinder **15** is free to rotate relative to the outer cylinder **21.** Once the spring is allowed to completely unwind within the confines of the housing **37,** the tool may be easily removed. Upon the uncoiling of the spring **27,** frictional engagement with the lower end of the inner cylinder **15** at **30** is relaxed thereby allowing removal of just the spring assembly tool **1.** The aforementioned open notch **33** permits easy removal of the tool and disengagement of the inner spring end. However, the spring may be held momentarily, while removing the tool to insure that no axially displacement occurs when the tool is removed. The spring will, thus, remain within the housing and be in position for insertion of an arbor or self-starting assembly (not shown) engageable with the inner hooked end **31.** A self-starting assembly engageable with the starter spring shown and utilizable on internal combustion engines is sold by McCulloch Corporation of Los Angeles, Calif. The preferred embodiment is particularly suited for McCulloch chain saws such as Model Number 116, but can be utilized as well on other commercially available chain saws.

The starter spring assembly tool **1** may also be utilized to remove the spring **27** from the housing **37.** This operation is carried out in a manner the reverse of that just described.

The spring end retaining portion **25** is inserted at the open area **57** within the housing **37,** the outer hooked end **29** of the spring **27** being disposed about protrusion **57.** The spring retaining notch **33** is slidably engaged over the inner hooked end **31** of the spring **27.** With the locking bar **8** being horizontally disposed and removed from engagement with the castellations **11,** the inner cylinder **15** would be rotated in a clockwise, or winding, direction as shown in FIG. **1.** Once the spring **27** is tightly coiled and frictionally engaged at **30** on the inner cylinder **15** and the tool is locked against relative rotation, it may be removed from the housing **37** by simply lifting upwardly on the tool **2** and extracting the spring **27.**

ALTERNATIVE PREFERRED EMBODIMENT

FIGS. **7** and **8** illustrate an alternative preferred embodiment **100** including a spring biased clutching or locking mechanism.

As shown in FIG. **7,** alternative embodiment **100** includes an outer cylindrical member **121** corresponding, in general, to component **21** of the FIG. **1** embodiment.

First or outer cylindrical member **121** supports, on its periphery, and at a lower end, a radially outwardly projecting, first spring end securing means **123.** Spring end securing means **123** includes an outer tab portion **125** extending generally longitudinally of component **121.** Tab **125** is operable to engage and secure an outer end of a coil spring in the same manner that tab **25** of the FIG. **1** embodiment is operable to secure a spring end.

As shown in FIG. **7,** another radial appendage **123***a* may be secured to the lower end of body **121.** Component **123***a* serves, along with the radially extending portion of element **123** to provide spring coil edge engaging means operable to engage upper edges of spring coils. As will be appreciated, this engagement, coupled with the engagement of the undersides of the coil edges by a flat supporting edge extraneous of the apparatus (i.e., flat table top) will prevent axial displacement of coils during the spring winding operation.

The mechanism included in embodiment **100** for securing the inner end of a coil spring and effecting spring winding includes a second, generally cylindrical, member **115** shown in FIG. **7.** This second cylindrical member **115** includes a lower extremity **115***a* which projects beyond the lower end of first member **121.** One or more circumferentially spaced apertures **133,** carried by member end **115***a*, function as second spring end engaging means. Thus, these apertures **133** function like apertures **33** of the FIG. **1** embodiment to secure an inner end of a spring to be wound.

The upper end **115***b* of member **115** terminates within the body of member **121** generally adjacent a barrier **121***a.* This barrier **121***a* may be fixedly secured to the interior of member **121** as, for example, by brazing or welding.

As shown in FIG. **7,** a winding shaft **107** is connected with the inner relatively rotatably member **115.** This mode of connection comprises a lower shaft portion **107***a* which supports two threaded nuts **107***b* and **107***c.* These nuts are disposed on opposite sides of an upper wall portion **115***c* of inner member **115,** and thus serve to threadably secure the member **115** to the lower end of the shaft **107.**

The position of shaft **107,** and thus member **115,** within the member **121** may be stabilized by a thrust bearing means **107***d.* Thrust bearing means **107***d*, as shown in FIG. **7,** may comprise an enlargement of shaft **107** which is disposed in abutting engagement with the upper side of barrier **121***a* so as to limit downward movement of shaft **107.**

Upward movement of shaft **107** relative to member **121** limited by the engageable nature of nut **107***b* with the underside of barrier **121***a.*

As shown in FIG. **7,** the shaft portion **107***a* extends from thrust bearing **107***d* through an aperture portion **121***b* of barrier **121***a.*

Rotation of shaft **107** to effect winding of a coil spring, with an inner coil spring end secured by means **133** and an outer coil spring end secured by means **125,** is effected by a shaft handle means **104,** representatively depicted in FIG. **7.**

Selective control over the winding operation which permits intermittent and automatically locking of components **121** and **115** during a winding operation is provided by a clutch means **101.**

This clutch means **101** includes a polygonally cross sectioned, nut like abutment member **102** carried by shaft means **107.** Clutch means **101** also includes a po-

lygonally cross sectioned aperture **103** carried by a plate means **104.** With aperture means **103** disposed in generally mating and at least partially encircling cooperation with nut like component **104,** as shown in FIGS. **7** and **8,** rotation of shaft means **107** and member **115** relative to member **121** is substantially prevented.

This clutching action results because aperture **103** is carried by a plate means **105** which is non-rotatably secured to member **121.** This non-rotatable securing action is effected by securing one end **105***a* of plate **105** in a recess **105**b of member **121** for generally vertical pivotal movement, while another end **106** of plate **105** is mounted for longitudinally slidable but non-rotatable movement in a longitudinally extending slot **107** formed in the upper end of member **121.**

Plate member **105** is biased upwardly, so as to bias the clutch component **103** into clutching cooperation with component **104,** by coil spring means **108.** As shown in FIG. **7,** coil spring **108** is disposed in a compressed condition between barrier **121***a* and plate means **103.** If desired, one or more washer means **109** may be interposed between the upper end of coil spring **108** and plate means **103.**

Thus, during operation an operator will depress lever **106** toward a spring supporting surface so as to declutch components **103** and **104** and permit the shaft **107** to be manipulated for spring winding purposes. At any point when spring winding is to be interrupted and components **115** and **121** interlocked, an operator merely need release plate end **106** so as to permit the spring **108** to restore the components **103** and **104** to their interlocked or interclutched condition as shown in FIGS. **7** and **8.**

This interclutched condition is illustrated in FIG. **8,** in perspective view, with the polygonal and mating cross sections of clutch components **103** and **104** being there shown.

As will be appreciated, in the FIG. **7** embodiment, as in the case of the FIG. **1** embodiment, the spring edge engaging means **123***a* and **123** and the clutching or locking means **103** and **104** cooperate to secure or stabilize a wound coil spring. With the wound spring being thus secured, so as to prevent coil displacement or unwinding, the interlocked members **121** and **115** may be manually manipulated as described in connection with FIG. **3** to effect the transportation of a spring and its installation in a device. This mode of wound spring stabilization and securing permits manually induced disengagement of the wound spring from the first and second spring end engaging means **133** and **125.**

SUMMARY OF ADVANTAGES

Thus, it may be seen that according to the present invention a novel spring winding tool employing relatively rotatable bodies and a spring placing device for positioning a spring within an assembly or housing is provided. Particularly significant is the fact that the utilization of two telescopingly disposed rotatable bodies having spring ends attached thereto facilitates the easy winding and unwinding of a spring.

The manner in which the mechanism provides stabilization of spring coil edges, so as to impede displacement thereof, while each coil spring end is secured provides a particularly effective spring winding technique which facilitates not only winding but spring installation.

The clutching or locking devices incorporated in each embodiment provide effective mechanisms which permit the winding operation to be interrupted as desired, with the components being interlocked or stabilized at a variety of relative circumferential positions.

Of independent significance is the use of complementary locking means on the cylinders to prevent relative rotation between the two cylinders once the spring is tightly wound. This also aids in intermittent winding. This particular feature allows the coiled spring to be moved from place to place while minimizing the danger of its being prematurely uncoiled or having its layers axially displaced.

In connection with the FIG. **7** embodiment, it is significant to note that the clutching mechanism serves to automatically interlock or clutch winding components together when an operator releases the mechanism. This automatic interlocking feature provides a safety factor, tending to prevent inadvertent releasing of the spring during the winding operation or spring installation operation.

Also, it is significant that one end of the spring which has been coiled and hooked on a guide means of the tool is easily visible by the workman so that it may be easily positioned into hooking engagement within a housing.

Also of importance is the use of two relatively simple, rotating parts, which are easily manufactured.

Although the present invention has been described in connection with one preferred and illustrated embodiment, it will be appreciated by those skilled in the art that additions, modifications, substitutions and deletions not specifically described may be made without departing from the spirit and the scope of the invention as defined in the appended claims.

What is claimed is:

1. Apparatus for coiling a spring and inserting the spring in an installation, said apparatus comprising:

a first member;

a second member rotatable relative to said first member;

first means for securing an outer end of the spring to said first member;

second means for securing an inner end of said spring to said second, relatively rotatable, member;

means for causing relative rotation of said first and second members to wind said spring about one of said members while said spring is supported by an auxiliary supporting surface means extraneous of said apparatus;

spring edge engaging means carried by one of said members and operable to prevent axial displacement of coils of said spring during said winding;

a locking mechanism for selectively locking said first and second members to prevent relative rotation therebetween; and

said spring edge engaging means and said locking means cooperating to secure said spring when wound, with said first and second members being operable, in response to manual manipulation, to transport said wound spring to an installation and permit said wound spring to be disengaged from said first and second securing means;

said first member comprising hand grip means operable to permit manual support of said apparatus while said second member is being manually rotated;

said locking mechanism including
first locking means carried by said first member,
second locking means carried by said second member,
one of said first and second locking means being displaceable generally longitudinally of said apparatus to lockingly engage the other of said first and second locking members while said first member is being manually supported;
said spring edge engaging means being operable to engage top edge means of coils of said spring during the winding thereof while bottom edge means of said coils of said spring are engaged by said auxiliary supporting surface means,
said spring engaging means and said auxiliary supporting surface means cooperating during the winding of said spring to prevent axial displacement of coils of said spring; and
said second means, for securing an inner end of said spring, comprising recess means operable to detachably receive and secure a hook means carried by an inner end of said spring, with
said recess means being operable to freely disengage from said hook means of said spring means in response to rotation of said second member in a direction away from said hook means and toward an adjacent coil portion of said spring.

2. Apparatus as described in claim **1**:
wherein said second relatively rotatable member extends longitudinally of and projects beyond opposite ends of said first member;
wherein said first locking means includes castellation means carried by one end of said first member; and
wherein said second locking means includes locking lug means carried by said second member and selectively, lockingly engageable with said castellation means.

3. An apparatus as described in claim **1**:
wherein said second member includes one end portion projecting beyond said first member and another end portion contained within said first member; and
said second securing means being carried by said one projecting end portion;
wherein said locking means includes:
shaft means extending from said other end portion of said second member,
first clutch means, comprising said first locking means and carried by said first member,
second clutch means, comprising said first locking means and carried by said shaft means,
resilient means yieldably biasing said first and second clutch means into clutching cooperation operable to impede relative rotation between said shaft means and said first member,
connecting means between said shaft means and said second member operable to cause said shaft means, when substantially immobilized relative to said first outer member, to substantially immobilize said second member, and
manually manipulatable declutching means carried by said first member and operable to declutch said first and second clutch means and permit rotation of said shaft means and said second member relative to said first member.

4. A method for coiling a spring and inserting the spring in an installation, said method comprising:
securing an outer end of a coil spring means to a first member of a spring winding apparatus;
securing an inner end of said coil spring means to a second relatively rotatable member of said spring winding apparatus;
manually causing relative rotation of said first and second members to wind said spring means about one of said members while said spring means is being supported by auxiliary supporting surface means extraneous of said apparatus;
manually supporting said apparatus by engaging hand-grippable means of said first member while said second member is being manually rotated;
engaging edge means of coils of said coil spring means during the winding thereof to prevent axial displacement of said coils during said winding;
effecting said prevention of coil displacement with spring edge engaging means carried by said first member and operable to engage top edge means of coils of said spring during the winding thereof while bottom edge means of said coils of said spring are engaged by auxiliary supporting surface means, with
said spring engaging means and said auxiliary supporting surface means cooperating during the winding of said spring to prevent axial displacement of coils of said spring;
selectively interlocking said first and second members to prevent relative rotation therebetween and secure relative positions of said inner and outer spring ends;
effecting said interlocking with
first locking means carried by said first member,
second locking means carried by said second member, with one of said first and second locking means being displaceable generally longitudinally of said apparatus to lockingly engage the other of said first and second locking members while the first member is being manually supported;
manually transporting said first and second members to an installation, with said spring means being disposed with said edge means thereof stabilized against mutual displacement;
utilizing said first and second members to position said spring means in said installation; and
disengaging said inner and outer ends of said spring from said first and second members and engaging at least one of said inner and outer spring ends with said installation;
effecting said disengaging of said inner spring end with recess means carried by said second member and operable to detachably receive and secure a hook means carried by an inner end of said spring, with
said recess means being operable to freely disengage from said hook means of said spring means in response to rotation of said second member in a direction away from said hook means and toward and adjacent coil portion of said spring.

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