Sept. 15, 1970 B. J. TAMARIN 3,528,624

CORD-REELS

Filed June 20, 1968 2 Sheets-Sheet 1

Fig. 1.

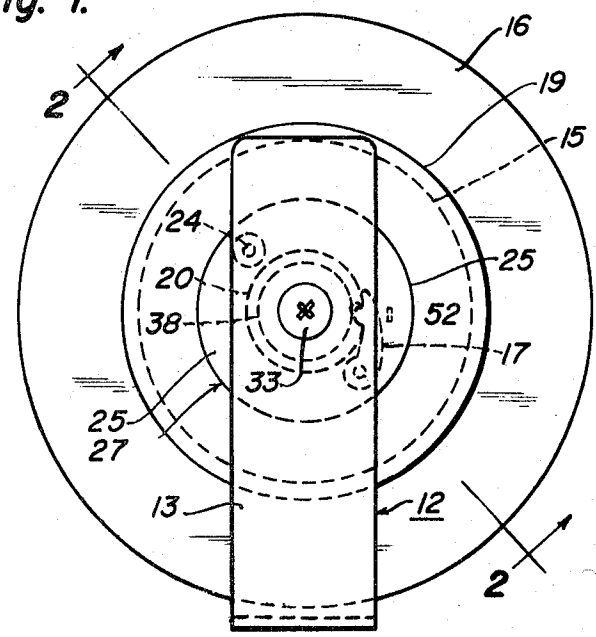


Fig. 2.

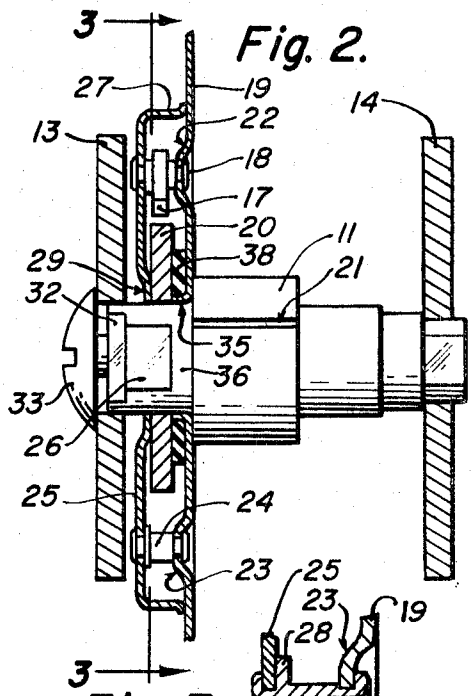


Fig. 7.

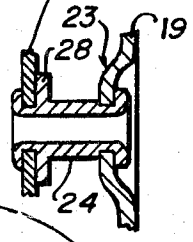


Fig. 3.

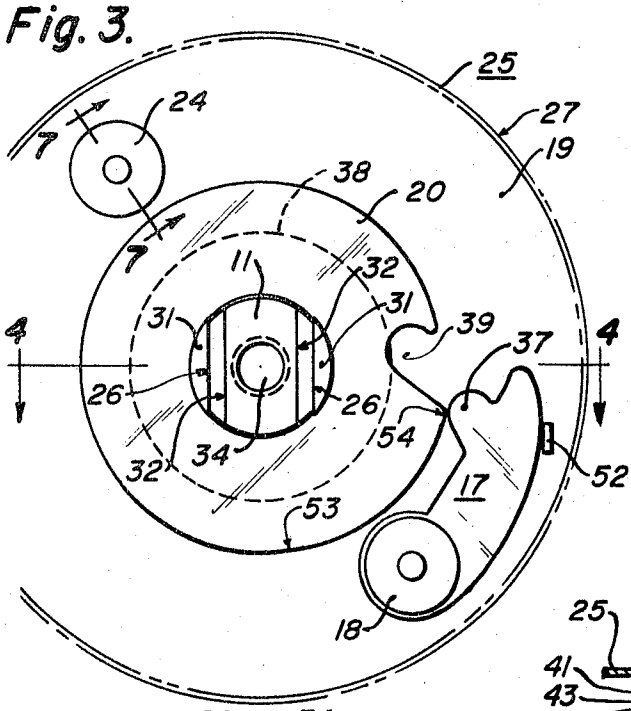


Fig. 5.

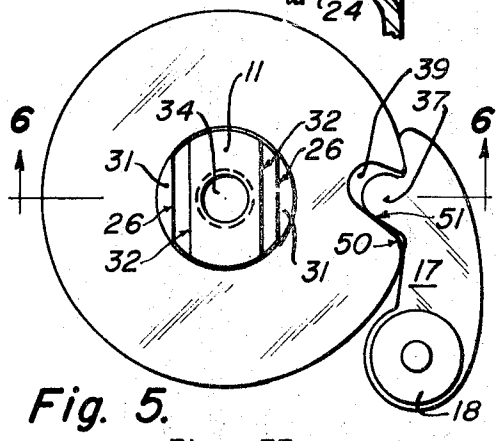


Fig. 6.

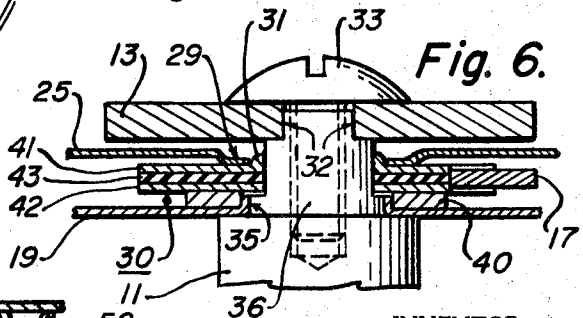
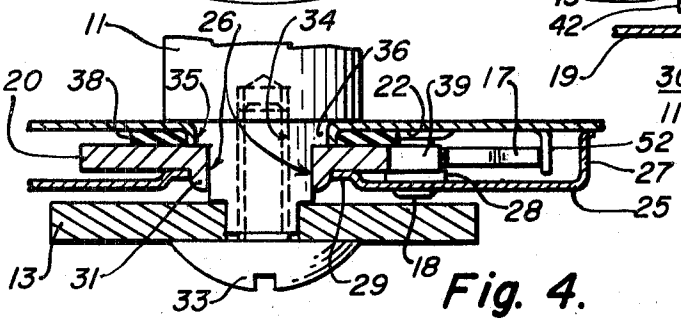


Fig. 4.



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CORD-REELS

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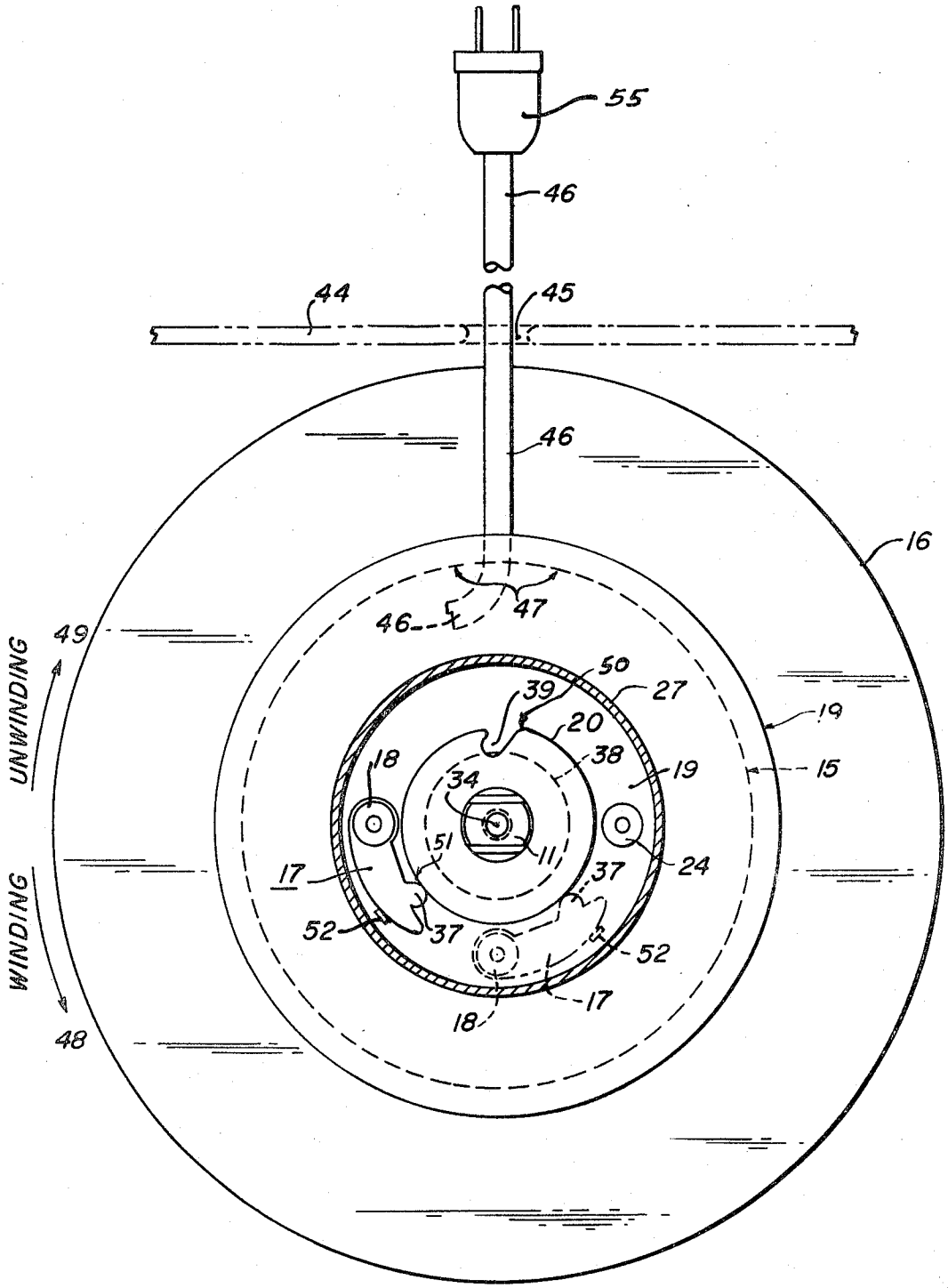


Fig. 8.

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United States Patent Office 3,528,624 Patented Sept. 15, 1970

3,528,624

CORD-REELS

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Int. Cl. B65h 75/48
U.S. Cl. 242—107.7 16 Claims

ABSTRACT OF THE DISCLOSURE

A spring-wound cord-reel including a revolvably mounted cord-storage sheave, a cord having its inner end anchored to the hub of the sheave, a stationarily mounted notched disc in operative juxtaposition to the sheave, a pawl pivotally mounted to the sheave in operative juxtaposition to the disc, means creating a permanent magnetic field along the edge of the disc, attracting the pawl and tending to swing it into latching engagement with the disc, whereby the pawl will latchingly engage the disc at a slow rotary speed of the sheave and will be de-activated by the centrifugal force thereon at a higher rotary speed of the sheave, and the notch and pawl being so complementarily shaped that the pawl can hookingly engage in the notch of the disc against rotation of the sheave in its cord-winding direction and will be cammingly disengaged from the notch if the sheave is rotated in its unwinding direction.

A spring-wound cord-reel mounted in a housing having a cord-passage opening and having pawl-and-ratchet type sheave latching and unlatching means, in which the cord-attaching point on the hub of the reel-sheave and the cord-passage opening of the housing and the pawl-pivot carried by the sheave are angularly spaced in relation to each other and in which the notch in the ratchet-disc is angularly disposed in relation to the pawl when the cord is fully pulled out and taut to the hub in a generally radial direction in respect to the hub and extending through said opening, so that the non-releasable latching of the sheave in such fully pulled out and taut condition of the cord is prevented.

The present invention relates to spring-retracting or spring-wound cord-reels with cord-controlled pawl-and-ratchet type latching means for optionally latching the cord-storage sheave thereof in any desired cord-pay-out position and releasing the sheave from such latching so as to permit the cord-winding spring thereof to retract or wind the cord back onto the sheave thereof.

Some heretofore conventional cord-reels of this type have gravity-actuated pawls, as exemplified, for instance, in my U.S. Pat. No. 2,314,177. Other conventional cord-reels of this type have spring-actuated pawls, as exemplified, for instance, in U.S. patents to Gross No. 2,375,917, Meletti No. 2,391,840 and Johnson No. 2,530,773.

Cord-heels with gravity-actuated-pawl type sheave-latching means have the disadvantage that they are inoperable when the axis of rotation of the sheave thereof is vertical. Cord-reels with spring-actuated-pawl type sheave-latching means have the disadvantage of not being as easily operated and of the need for the operator to hear the clicking sound of the pawl against the ratchet in order to release the cord just at the right moment for its spring wound retraction.

Heretofore conventional cord-reels have the further disadvantage that when the cord is fully pulled out and radially taut to the hub of the sheave, the sheave sometimes becomes locked in such position so that it cannot be unlatched for its rewinding rotation, by the release

of the cord or by a short quick pull-and-release of the cord.

Other heretofore conventional latching reels involve mechanisms of undue complexity and multiplicity of parts inherently too expensive, and not as durable or reliable.

The object of the present invention is a spring-wound cord-reel with pawl-and-ratchet type sheave-latching means which can be operated with its axis of rotation vertically disposed (or disposed in any other direction) and which will be less expensive to produce and easier to operate than the spring-actuated-pawl type and more reliable and durable.

With these and other objects in view, which will appear more fully from the more detailed description and accompanying drawings, the present invention comprises a spring-wound cord-reel including magnetically latching and centrifugally de-activated pawl-and-ratchet means.

Another aspect or feature of the present invention comprises means for maintaining the pawl in sufficiently close proximity to the ratchet-disc at all times to keep it in the effective magnetic field along the periphery of the ratchet-disc.

Another aspect or feature of the present invention is so balancing of the radial-distance of the pawl-pivot from the rotational axis of the sheave and the weight and angular disposition and length of the pawl and the strength and direction of the magnetic field, and so limiting the outward swinging motion of the orbiting pawl, as to make the outward centrifugal force on the orbiting pawl, equal to the inward magnetic force thereon (in its so limited outer position) at a rotary speed of the sheave which is a suitable dividing point between minimum pawl-de-activating speed and the maximum latching speed.

Another aspect or feature of the present invention is creating a magnetic field along the periphery of a soft steel ratchet-disc by placing alongside thereof a permanently cross-magnetized disc formed of a sheet of a rubber-like or other suitable plastic material (or of a ceramic or sintered material) suitably filled with permanently magnetizable particles (as, for instance, barium ferrite powder) embedded therein and uniformly distributed therethrough and which has thereafter been permanently cross-magnetized, namely, permanently magnetized across its thickness, thereby forming a magnetic circuit including such permanently cross-magnetized disc and the soft steel ratchet-disc, creating a generally uniform radial magnetic attraction along the periphery of the ratchet disc.

In the following description, the term "cord-reel" is intended also to comprehend a tape-reel, and the term "cord" is likewise intended also to comprehend a tape or a tape-like strand stored on and withdrawable from and retractable onto a spring-powered reel.

Another aspect or feature of the present invention is providing a slight gradual cam-like rise on the periphery of the ratchet-disc whose increase is in the direction in which the toe of the pawl traverses the periphery in its latching direction, so as to increase the effectiveness of the magnetic field towards the latching position.

Still another aspect or feature of the present invention is so angularly positioning (in relation to each other) the cord-point of the hub of the sheave and the pawl-pivot on the sheave and the latching notch on the ratchet-disc and the cord pay-out-grommet or opening of the appliance in which the reel is mounted (and of which it is a part), that when the cord is fully pulled out and hence radially taut to the hub and with such cord-radius extending through said grommet or opening the toe of the pawl will be at a substantial angular spacing from the ratchet-notch in the cord unwinding direction (namely, in the direction from which the pawl approaches the notch during the rewinding rotation of the sheave), so as to

insure that the sheave will attain a re-winding speed in excess of its minimum pawl de-activating speed before a toe of the pawl reaches the notch for the first time after the release of the cord from its said fully-pulled-out and radially-taut condition.

In the accompanying drawings, described below, like reference indicate like parts.

FIG. 1 represents a side elevational view of the cord-reel embodying the present invention.

FIG. 2 represents a fragmentary cross-sectional view on line **2—2** of FIG. 1, on an enlarged scale, showing the magnetic pawl-and-ratchet mechanism.

FIG. 3 represents a side elevational view, on a similarly enlarged scale, of the magnetic pawl-and-ratchet means shown in FIGS. 1 and 2, as viewed on line **3—3** of FIG. 2.

FIG. 4 represents a cross-sectional view on line **4—4** of FIG. 3.

FIG. 5 represents a side elevational view similar to that shown in FIG. 3, but representing a modified embodiment of the present invention.

FIG. 6 represents a cross-sectional view on line **6—6** of FIG. 5.

FIG. 7 represents a cross-sectional view on line **7—7** of FIG. 3, on a still further enlarged scale.

FIG. 8 shows the reel with the cord fully puled out and radially taut to the hub, viewed on line **3—3** of FIG. **2**, and illustrating the angular orientation of the hub-cord-point, the pawl, the notch and the cord-pay-out grommet of the housing, in respect to each other.

The present invention is applicable to both electric cord-reels and non-electric cord-reels. Such reels generally include a stationary arbor, a cord-storage sheave revolvably mounted thereon and having a hollow cylindrical drum-like hub to (or within) which the inner end of the cord is anchored and onto which the cord is wound, and two generally parallel spaced-apart flanges extending radially outwardly from the hub for laterally confining the cord on the hub, and a flat helical cord-winding spring within the hub, having its inner end anchored to the arbor and its outer end anchored to the hub.

For illustrations of the general construction and arrangement of the hollow hub and the flange of the sheave and the revolvable mounting thereof on the stationary arbor and for the disposition of the cord-winding spring within the hub and for the anchoring of the inner end of the cord to or within the hub, reference may be had to FIG. 3 of each of U.S. Pats. 2,375,917, 2,391,840 and 2,948,913 (and to other U.S. patents) which show electrical cord-reels exemplifying such construction and arrangement. In non-electric cord-reels the electric-cord (within the hub) and the electric collector rings and brushes would be omitted.

Therefore, FIGS. 1 to 7 of the accompanying drawings are generally confined to the sheave latching and unlatching mechanism and FIG. 8 is confined to showing the angular orientation of the cord-attaching-point **47** on the hub **15** of the sheave, the pawl-pivot on the sheave, the notch on the ratchet-disc and the cord-pay-out grommet or hole in the appliance in which the reel is mounted, without showing the details of the sheave and the spring within the hub thereof and without showing the electric-cord within the hub thereof or the details of the attachment of the inner end of the cord within the hub of the sheave. For such details, reference may be had to the aforementioned Pats. 2,375,917, 2,391,840 and 2,948,913 as well as to other U.S. patents illustrating such details and variants thereof.

In the accompanying drawings the stationary arbor is designated by the numeral **11**, and the stationary support therefor is designated generally by the numeral **12**. While in the drawings the support **12** is shown as being a generally U-shaped bracket having opposite legs **13** and **14** to which the opposite ends of the arbor **11** are keyed and secured, the support can be of any other suitable form

or character, and the arbor need not necessarily be supported at both of its ends but may have only one of its ends so secured to a suitable support. The outer reduced-diametered ends of the arbor **11** are keyed to the stationary leg or legs of the bracket or support **12** by a pair of opposite flats **32** on the arbor and by correspondingly shaped holes in the stationary support (**13** and/or **14**) and by a headed screw **33** threaded into an axial hole **34** in the arbor, as indicated in FIGS. 1 to 6.

The sheave of the reel, revolvably mounted on the arbor **11** includes the hub **15** and a pair of spaced-apart flanges **16** extending radially outward from the hub thereof.

The hub **15** of the sheave is preferably formed of two shallow cup-like halves, having generally cylindrical outer side-walls and inner flat radial walls or bottoms with central arbor-receiving holes therethrough; their inner flat radial walls or bottoms being arranged back-to-back and secured to each other by spot-welding or by crimped tangs pressed out of one of the flat walls and extending through slots in the other and crimped thereover. One of these cup-like hub-portions constitutes the electrical chamber in which the electric-core is mounted and the other constitutes a spring-chamber in which a flat helical cord-winding spring is operatively mounted.

The flange **16** on the electrical side of the sheave is preferably formed integrally with the corresponding cup-like hub portion, by forming both out of the same single sheet of metal. The flange **16** on the spring side of the sheave is preferably formed separately from the corresponding cup-like hub-portion, and extends not only radially outwardly from the cylindrical wall of said hub-portion but also extends radially inwardly therefrom and thus encloses the cord-winding spring within such hub-portion and is secured thereto by means of tangs or tabs extending from the cylindrical wall thereof through corresponding slots in the adjacent flange **16** and crimped on the outside thereof so as to secure the flange to such hub-portion. The spring within such hub-portion (not shown) has its inner end anchored in the slot **21** of the arbor **11**, and has its outer end secured to the hub-portion.

The orbiting pawl **17** is preferably pivotally mounted, by means of pivot **18**, to inner spring-enclosing portion **19** of the flange **16**, of the sheave, on the spring side thereof. Alternatively, the flange **16** on the spring side of the sheave may also be formed integrally with the spring-mounting hub-portion, and a separate circular pawl-mounting and spring-enclosing disc or plate **19** may be provided, extended across the thus open outer end or side of such cup-like hub-portion, to enclose the spring therewith, such separate spring-enclosing plate being similarly secured to the flange **16** by crimping tabs pressed out of the flange **16** and extending through such separate pawl-mounting disc and crimped on the outside thereof to secure it to the flange. In either case, the inner pawl-mounting portion **19** of the flange **16** (or the separate pawl-mounting and spring-enclosing disc **19**) has an arbor-journalling flange **35**, and the pawl-pivot **18** is mounted on and secured to the side of the sheave and orbits therewith.

A pair of angularly spaced-apart apertured bosses **22** and **23** are pressed outwardly from the inner spring-enclosing portion **19** of the flange **16** or from the separate pawl-mounting disc or plate **19**, as indicated in FIGS. 2, 4 and 7.

The pawl **17** is first mounted on the tubular stepped rivet **18**, adjacent the washer-like flange **28** thereof (which is near its outer end, as shown in FIG. 7), and thereafter the rivet **18** is extended through the hole in the boss **22** and its outer end is flared over so as to be affixed to the boss **22**; the rivet **24** being similarly secured to the boss **23** in the manner indicated in FIG. 7. The two washer-like flanges **28** serve as enlarged supporting shoulders for the cap-members **25** which is then similarly riveted to the

outer ends of the rivets **18** and **24**, as indicated in FIGS. 2 and 7.

The cap member **25** has a generally cylindrical flange **27** (shown in FIGS. 2 and 4), the edge of which bears against the pawl-mounting portion **19** of the sheave-flange **16**. The cap-like member **25** is also provided with an inwardly offset annular portion **29**, which prevents the axially outward displacement of the notched disc (**20** or **30**), without however restraining the free rotation of the cap member **25** or of the pawl-mounting disc **19** about the stationary arbor **11**.

The inner pawl-mounting portion **19** of the flange **16**, or the disc **19**, is provided with a generally cylindrical inner annular flange **35** which serves to journal the sheave on the uninterrupted cylindrical portion **36** of the arbor **11**.

The single-ply or annealed steel notched-disc **20** shown in FIGS. 2, 3 and 4, as well as the three-ply laminated notched-disc **30** shown in FIGS. 5 and 6, are keyed to the reduced diametered portion of the arbor **11** on which the two opposite flats **26** are provided, and the arbor-receiving hole through the notched-disc (**20** or **30**) is correspondingly shaped so as to be stationarily keyed to the stationary arbor **11**, as indicated in FIGS. 2 to 6. Adjacent the flat sides of the hole through the notched-disc (**20** or **30**), a pair of opposite projections **31** are pressed outwardly, which serve to increase the effective axial thickness of the notched-disc in the zones adjacent the flats of the holes therethrough, so as to provide a firmer keying of the discs to the arbor.

In the preferred embodiment of the present invention the pawl **17** is formed of iron or soft annealed steel (as, for instance, cold-rolled steel) or other equivalent ferrous material which can be magnetically attracted but which cannot be permanently magnetized or which does not retain any significant magnetism of its own, independently of the attractive magnetic field otherwise provided by another permanent magnetic source.

In such preferred embodiment, the stationary notched-disc (**20** or **30**) is permanently cross-magnetized or arranged in a permanent cross-magnetic field so that it will magnetically attract the latching-toe **37** of the orbiting pawl **17** with generally uniform force throughout the periphery of the notched-disc (**20** and **30**), if the toe is in uniformly close proximity to its periphery.

I may obtain such cross-magnetization by forming the notched-disc **20** of a single-ply sheet of permanently magnetized hardened steel or Alnico or other material which has been or can be permanently cross-magnetized (namely, magnetized transversely of the plane of the disc) so that its North pole will extend throughout one face thereof, or at least throughout an outer annular peripheral marginal zone of such face, and so that the South pole thereof will extend throughout the other face thereof (or at least through an outer annular peripheral marginal zone of such face), thereby creating a uniform magnetic attraction (of the pawl **17**) throughout its peripheral or edge-surface thereof.

In such embodiment, the washer **38** in FIG. 2 may be formed of any more or less hard fiber-board or of any other non-magnetic material (the same as the washer **40** in FIG. 5), through whose central hole the journal-flange **35** of the pawl-mounting plate **19** extends; such washer serving as a spacer between the main body of the revolvable disc **19** and the stationary notched ratchet-disc **20**.

However, in one of the preferred embodiments of the present invention, the ratchet-disc **20**, having the latching notch **39**, is formed of soft or annealed steel, such as cold-rolled steel, and the washer **38** is formed of a permanently cross-magnetized ferrous material, as, for instance, a rubber or rubber-like or other suitable plastic sheet-material through which permanently magnetizable ferrous particles, as, for instance, barrium ferrite powder, are uniformly distributed, and which is thereafter permanently cross-magnetized. Such permanently cross-magnetized disc **38** (FIGS. 2 and 3) is thus sandwiched between the soft steel or annealed steel pawl-mounting plate **19** and the soft-steel or annealed-steel notched-disc **20**, thereby forming a magnetic circuit through the plate **19** and the notched-disc **20** whose outer periphery thereby has a uniform magnetic attraction for the toe **37** of the pawl **17**; such magnetic circuit accentuating the magnetic pull of the periphery of the notched-disc **20** upon the toe **37** of the pawl **17**. In this embodiment, the magnetic washer **38** also serves as a spacer between the notched-disc **20** and the pawl-mounting plate **19**.

In another embodiment of the present invention, shown particularly in FIGS. 5 and 6, the spacing of the notched-disc **30** from the pawl mounting flange-portion or plate **19**, is by means of an ordinary fiber washer **40**, and a three-ply notched-disc, designated generally by the numeral **30**, is formed of two outer soft-steel or annealed-steel washers **41** and **42** and an intermediate permanently cross-magnetized washer **43**.

The permanently magnetized washer **43** (like the permanently magnetized washer **38** in the embodiment shown in FIGS. 2, 3 and 4) may be formed of a rubber-like sheet or plastic sheet of suitable form-retaining quality, through which permanently magnetized ferrous particles are uniformly distributed. The magnetic washer **43**, as well as the magnetic washer **38**, may also be a sintered disc or a ceramic disc formed of such permanently magnetizable particles or through which such permanently magnetizable particles are uniformly distributed, and which disc has been or is permanently cross-magnetized, namely, permanently magnetized across its thickness. The soft steel discs **41** and **42** may be secured to the intermediate permanently cross-magnetized disc **43** by any suitable adhesive, cement or bonding material, although the keying of each of the discs **41**, **42** and **43** to the flats **26** of the arbor **11**, with the notches **39** thereof in registration with each other, may also be sufficient to hold them together in sufficiently close adjacent spaced relationship to each other. A magnetic circuit is created between the central permanently cross-magnetized disc **43** and the two flanking soft-steel discs **41** and **42**, and such circuit accentuates the magnetic attraction upon the toe **37** of the pawl **17** along the edges of the notched disc **41** and **42**.

In the embodiment in which a permanently cross-magnetized disc is provided adjacent a soft-steel ratchet-disc, the magnetized disc may be of a diameter less than that of the ratchet-disc.

Where the ratchet-disc itself is formed of permanently cross-magnetized sheet of magnetic metal, as, for instance, permanently cross-magnetized hardened steel or Alnico or the like, the thickness of the ratchet-disc may be of the general order of $\frac{3}{32}$", more or less.

Where the ratchet-disc is of soft-steel and depends on an adjacent permanently magnetized disc or washer, the ratchet-disc and the magnetic washer can likewise be of the same general order of thickness.

Where the two soft-steel discs flank an intermediate permanently cross-magnetized disc, and together constitute the ratchet-disc, the soft steel discs (**41** and **42**) may be of a thickness of the order of a thirty-second of an inch, more or less, and the intermediate permanently cross-magnetized disc **43** may likewise be of a thickness of the general order of a thirty-second of an inch, more or less.

In each instance, the pawl **17** may be of a thickness of the general order of a sixteenth of an inch, more or less.

It is to be understood that the thicknesses here indicated for the various ratchet-discs and magnetic washers and for the pawl, are merely illustrative and not restrictive.

The cap member **25**, which encloses the pawl **17** and the notched ratchet-discs or members (**20** and **30**), may be made out of a non-magnetic material such as aluminum, brass or the like, so as not to divert or dilute the magnetic

field of the magnetic circuit which is formed through the cross-magnetized washer **38** and the notch-disc **20** and plate-portion **19**, as in the magnetic-washer embodiment described above in relation to FIGS. 2, 3 and 4 or the magnetic field of the magnetic circuit which is formed through the cross-magnetized washer **43** and the flanking soft-steel washers **41** and **42** in the embodiment shown in FIGURES 5 and 6.

The weight and length of the pawl **17** and the distance thereof from the center of the sheave, on the one hand, and the pawl attracting magnetic strength along the periphery of the ratchet-disc, on the other hand, are so proportioned in relation to each other that when the cord-winding spring of the reel is near its unwound or minimum-strength condition (as when the cord is almost fully retracted on the sheave) the rotary speed achieved by the sheave in less than one cord-winding revolution, from a standstill, will be at least of such order of magnitude that the centrifugal force upon the pawl will be somewhat greater than the magnetic attraction of the ratchet disc thereon.

The cord-reel shown in FIGURES 1 and 2 is without any housing of its own, to enclose the sheave thereof, and is instead provided with any stationary support (as, for instance, the bracket **12**), which in turn is fastened in or to the housing or stationary part of any more or less portable electric appliance such as a vacuum-cleaner, floor-polisher, television-receiver and the like, of which the reel is a component. In these and similar installations of such un-enclosed reels, the cord **46** passes through an opening **45** in the housing **44** of the appliance, which opening generally has a rounded edge or is provided with a grommet to reduce the friction between the cord and the edge of the opening as the cord moves inward and outward in relation to the opening during the winding and unwinding of the cord. When the cord-reel thus becomes a component of such electric appliance, a prong type plug **55** (shown in FIG. 8) may be provided at the free end of the electric cord **46** so that the appliance may be plugged into any appropriate electrical outlet.

Where the cord-reel is not mounted in or to the housing of such electric appliance, but is instead used as an extension-cord, the reel includes a generally circular housing of its own, enclosing the sheave and other elements thereof, and such circular housing is adapted to be fastened to a wall or to be rested on the floor or table or to be supported from an overhead support, as, for instance, exemplified in Meletti Pat. No. 2,391,840, and in Gross Pat. No. 2,375,917 and other U.S. patents. The circular sheave-enclosing housing of such reel is provided with a cord-passage hole or grommet in the periphery thereof, at a point in such relation to the reel as to provide a suitable orientation of the cord-passage hole or grommet in relation to such housing when the reel is operatively supported by a bracket or otherwise.

FIGURE 8 illustrates the orientation of the cord-attaching point or zone of the hub of the sheave and the location of the pawl, pivot on the sheave, and in relation to the notch of the ratchet-disc and in relation to such cord-passage hole or grommet. The element shown in phantom (in FIGURE 8) and designated generally by the reference numeral **44**, represents the wall of the housing of any such more or less portable electric appliance, in which the cord-passage or the grommet **45** is provided or carried, or represents a mechanical element of such appliance, carried by the housing thereof, on which such cord-passage or grommet is provided. Where the reel in and of itself includes a sheave-encasing housiug, as where the cord thereof is to be used as an extension-cord not housed in an appliance, then the element designated generally by the numeral **44** represents the peripheral portion of such sheave-enclosing housing; it being understood that in that case the element **44** would be circular instead of straight and would be generally concentric with the sheave. In either case, the cord **46** is extended and retracted through the cord-passage hole or grommet **45**, as the cord is pulled out from and as it is re-wound onto the sheave.

The inner end of the cord **46** passes through a suitable opening **47** in the hub **15** of the sheave and is anchored to the electric cord and hub in the manner indicated in FIGS. 3 and 6 of my Pat. 2,948,913.

The cord **46** is wound on the hub **15** when the sheave is rotated in the winding direction indicated by the arrow **48**, and is unwound from the sheave by pulling the cord **46** outwardly, when the sheave rotates in the unwinding direction of the arrow **49**.

The cord-passage opening **47** and the mouth of the cord-anchoring groove in the electric-core within the hub, constitute the cord-attaching point of zone of the hub, because it is from this point or zone that the core **46** extends radially outwardly from the hub when it has been fully pulled out and held taut to the drum, as indicated in FIG. 8. Such cord-attaching point **47** of the hub **15** is brought into general radial alignment with the cord-pasasge hole or grommet **45** of the appliance-housing **44**, whenever the cord is fully pulled out and radially taut to the drum, in the manner indicated in FIG. 8.

I so space the latching-notch **39** of the ratchet-disc (**20** or **30**) and the pawl-pivot on the sheave, in angular relation to each other, when the cord is fully pulled out (as indicated in FIG. 8), that the toe **37** of the pawl **17** will be spaced from about 60° to 270°, more or less, from the latching-notch **39**, in the direction from which the pawl **17** approaches the notch **39** when the sheave rotates in its winding direction **48**. The pawl **17** in solid lines in FIG. 8 shows a suitable location of the pawl in relation to the notch **39** when the cord is fully pulled out and radially taut to the hub **15**. The pawl in dotted lines in FIG. 8 shows another suitable location of the pawl in the same conditions of the cord and sheave.

The cord-winding spring is almost (but not quite) fully wound up when the cord is fully pulled out radially to the hub, so as to provide maximum rotary acceleration of the sheave in its cord-winding direction whenever the cord is pulled out 60° to 90° from any latched position and then quickly released, then the centrifugal force on the pawl will be of the pawl de-activating order when the toe **37** of the pawl first reaches the notch **39**, for any desired cord-winding rotation of the sheave.

When the unwinding speed of the sheave is too great at the very end of the cord-pull-out, the momentum of the sheave will cause it to over-spin a fraction of a revolution, namely, to rotate a fraction of a revolution in the unwinding direction **49** beyond the point at which the cord is radial to the hub.

If the over-spinning is of such an extent as to bring the toe **37** of the pawl into registration with the notch **39** of the ratchet-disc (**20** or **30**), the sheave becomes latched in such over-spin position because the reverse-winding of the cord, while still held taut, acts as a brake on over-spinning and hence quickly reduces the speed of rotation of the sheave below its pawl de-activating speed. When the sheave thus becomes latched in such over-spin position, a subsequent pull on the cord will not unlatch the sheave because the pull then only tends to rotate the sheave in its cord-winding direction **48**, and the pawl-toe **37** then in the notch **39** has previously locked the sheave against any rotation in its cord-winding direction **48**.

This 60° angle (more or less) insures that if the pull on the cord is released while the cord is fully pulled out radially to the hub, the sheave will attain at least its de-activating speed before the toe **37** reaches the notch **39** in the cord-winding direction **48**. The aforementioned 270° angle (or 90° angle, more or less, from the notch **39** in the winding direction **48**) insures against the toe **37** of the pawl latching in the notch **39** on an over-spin of the sheave.

The first of these two angles may be increased if the spring is not sufficiently strong (in its fully-wound condition) or if the inertia of the sheave is too great to permit the sheave to attain its de-activating speed before the pawl-toe **37** reaches the notch **39** in the winding direction **48**. The angular distance of the pawl-toe **37** from the notch **39** in the winding direction (namely, in the aforementioned 90° direction indicated above) may be increased if the inertia of the sheave is greater and if hence the extent of the likely over-spin is greater.

With the above-indicated back-spacing of the pawl **17** in relation to the notch **39** (when the cord is fully pulled out as indicated in FIG. 8), the mere releasing of the cord (by the operator) will at once initiate a rotation of the sheave in the winding direction **48**. As the spring is substantially (although not quite) fully wound when the cord is fully pulled out, such rotation of the sheave in the winding direction **48** will rapidly accelerate so that by the time the toe **37** of the pawl **17** for the first time comes into registration with the notch **39**, the centrifugal force upon the pawl will be sufficient to overcome the inward magnetic pull upon the pawl and thus keep the pawl de-activated and prevent the toe thereof from entering the notch **39**. This de-activated condition of the pawl will persist so long as the cord is permitted to wind onto the hub at or faster than the minimum de-activating speed of the sheave. When it is desired to latch the sheave at any desired extension or pull-out of the cord **46**, it is only necessary to slow down the winding rotation of the sheave by gripping the retracting cord between the fingers, until the rewinding speed has been reduced below the minimum pawl de-activating speed of the sheave; whereupon the next time the toe **37** of the pawl **17** comes into registration with the notch **39** it will enter the notch and thereby latch the sheave against winding rotation.

To unwind the cord it is merely necessary to pull the cord out, whereupon the sheave will be rotated in the unwinding direction **49**, and the surface **50** of the notch **39** will bear against the surface **51** of the toe **37** and the pawl and these two surfaces will have a cam action in relation to each other which will move the toe outwardly and clear of the notch **39**. The cord can be pulled outwardly at any speed, namely, at a speed either below or above the minimum pawl de-activating speed, because during any unwinding the pawl cannot latch the sheave, by reason of the mutual camming action of the surfaces **50** and **51** of the pawl and notch respectively.

A pawl-stop **52** is provided on the pawl-mounting disc **19** at such distance in relation to the periphery of the ratchet-disc (at the toe-entering point thereof adjacent the notch **39**) and in relation to the width of the pawl in a line across the toe thereof that when the back of the pawl is abutted against the stop **52**, the toe thereof will be spaced from the periphery of the ratchet-disc a distance of the general order of thirty-second of an inch (more or less), thereby keeping the toe of the pawl in close proximity to the periphery of the ratchet-disc even when the pawl is de-activated by the centrifugal force thereon.

The pawl-stop **52** may be made in the form of a tang pressed out of the disc **39** and bent at a right angle thereto. Instead of such pawl-stop tang **52**, the inner diameter of the flange **27** of the cap-member **25** may be so selected that it will similarly stop the outward swinging of the pawl **17** at a point where the toe thereof is in like close proximity to the periphery of the ratchet-disc when the pawl is centrifugally de-activated.

The outer periphery of the ratchet-disc may be provided with slight cam-like rise along a portion thereof which is traversed by the toe **37** of the pawl just before it reaches the notch **39** in the winding direction of the sheave. Thus, from any suitable point **53**, to the point **54** at the notch-entrance, the radius of the periphery of the ratchet-disc may be gradually increased so that as the pawl traverses the periphery of the ratchet-disc from the point **53** to the point **54** (in the winding direction of the sheave), the clearance between the periphery of the disc and the juxtaposed point of the toe **37** of the pawl will gradually decrease thereby gradually increasing the magnetic pull of the disc upon the pawl and insuring entrance of the toe **37** into the notch **39**; though always maintaining a slight clearance so that there will be no binding between the point **54** of the periphery of the disc and the toe **37** of the pawl.

Having shown and described embodiments of the present invention, the following is claimed:

1. A spring-wound cord-reel including a revolvably mounted sheave having a hub, a cord having an inner end anchored to said hub and adapted to be wound thereon, a disc member having a notch therein and stationarily mounted generally coaxially with said sheave, a pawl of magnetically attractable material pivoted to said sheave and arranged to orbit around said disc member with the rotation of said sheave said pawl including a latching toe shaped complementarily to said notch, said notched disc member being made of soft steel, and a permanently magnetized disc adjacent said notched disc member forming a magnetic circuit therewith so that said pawl member will be magnetically attracted by and will pivot towards said notched disc member and said latching toe will enter said notch when the speed of rotation of said sheave is less than a pre-selected value and said pawl will pivot away from said notched disc member when said pre-selected sheave speed of rotation is exceeded, the shapes of said toe and notch being such that said sheave will be latched against rotation in its cord-winding direction and said toe of said pawl member will be cammingly expelled from said notch when said sheave rotates in its cord-unwinding direction.

2. A cord-reel according to claim **1**, in which said disc member and magnetized disc creates a magnetic field along the periphery of the notched disc member and in which the pawl member is of a magnetically attractable material which will not take a significant permanent magnetic set.

3. A cord-reel according to claim **1**, in which the notched-disc member is formed of at least two adjacent sheets, at least one of which is of soft steel and at least one of which is of permanently magnetized material forming a magnetic circuit with the soft steel sheet.

4. A cord-reel according to claim **2**, in which the notched-disc member is formed of two outer sheets of soft steel and an intermediate sheet of permanently magnetized material forming a magnetic circuit with the two outer soft steel sheets.

5. A cord-reel according to claim **1**, in which the notched-disc is of permanently magnetized material.

6. A cord-reel according to claim **2**, in which the notched-disc is of permanently magnetized material.

7. A cord-reel according to claim **1**, in which the magnetic disc is magnetized crosswise of its thickness.

8. A cord-reel according to claim **2**, in which the apertured magnetic disc is permanently magnetized crosswise of its thickness.

9. A cord-reel according to claim **3**, in which the magnetic sheet is permanently magnetized crosswise of its thickness.

10. A cord-reel according to claim **4**, in which the magnetic sheet is permanently magnetized crosswise of its thickness.

11. A cord-reel according to claim **5**, in which the notched-disc is permanently magnetized crosswise of its thickness.

12. A cord-reel according to claim **6**, in which the notched-disc is permanently magnetized crosswise of its thickness.

13. A spring-powered reel revolvably mounted on a stationary arbor, including a stationarily mounted magnetically-charged pawl-engaging ratchet, a magnetically responsive pivotally mounted pawl carried by the revolvable reel and orbiting about said magnetically-charged

ratchet with its free end in a restricted orbital path limiting its outward position thereof to a sufficiently close proximity of the ratchet to be within its effective magnetic field so as to insure the magnetic attraction of the pawl into locking engagement with a notch of the magnetic ratchet, said pawl being held in its outer most deactivated position by a counteracting centrifugal force thereon greater than said magnetic attraction, developed by the rotation of the revolvable reel at a sufficiently high speed, the magnetic charge of the ratchet being crosswise of its thickness and its pawl-attracting force being generally uniform around its periphery.

14. A spring-powered reel according to claim **13**, in which the ratchet has a slight gradual camlike rise along a portion of its periphery adjacent the notch thereof in the direction from which the pawl approaches the notch in the rewinding direction.

15. In combination with a housing having a cord-passage opening, a spring-wound cord-reel including a sheave revolvably mounted in said housing and having a hub and spaced-apart flanges extending radially outwardly therefrom, a cord extending through said cord-passage opening and having its inner end anchored to said hub and adapted to be spring-wound thereon, a stationarily mounted notched disc in operative juxtaposition to said sheave and generally co-axial therewith, a sheave-latching pawl pivotally mounted to said sheave in operative juxtaposition to said disc and arranged to orbit about the disc with the rotation of the sheave and arranged to move radially outwardly and inwardly in relation to the sheave and in relation to the stationary disc, means continuously urging said pawl in the direction of the disc, whereby the pawl will enter the notch of the disc when the speed of rotation of the sheave is significantly less than a suitable pre-selected latching-and-unlatching speed and so that the pawl will be de-activated by the centrifugal force thereon when the speed of rotation of the sheave is significantly greater than such speed, the notch in said disc and said pawl being so complementarily shaped that when the toe of the pawl is nested in the notch it will hookingly latch the sheave against rotation in its cord-winding direction and will be cammingly expelled from the notch when the sheave is rotated in its unwinding direction, and the cord-anchorage point on the hub of the sheave and said cord-passage opening of said housing and the position of the pawl on the sheave and the location of the notch of the disc being so angularly spaced in relation to each other that when the cord is fully unwound and pulled radially taut to the hub, the angular spacing of the pawl from the notch of the disc will be such that upon releasing the cord from its fully pulled out radially-taut extension, the sheave will rotate such substantial part of a revolution in its cord-winding direction before the pawl reaches a notch-entering position for the first time, that the centrifugal force upon the pawl will keep the pawl in its radially outward de-activated position and will overbalance the force of said pawl-urging means and that upon over-spinning the sheave in its unwinding direction past such radially-taut condition of the cord, the pawl will not reach the notch in such over-spin, thereby to prevent the non-releasable latching of the sheave when the cord is fully pulled out.

16. In combination with a housing having a cord-passage opening, a spring-powered cord-reel including a sheave revolvably mounted in said housing and having a hub and spaced-apart flanges extending radially outwardly therefrom, a cord extending through said cord-passage opening and having its inner end anchored to said hub adapted to be spring-wound thereon, a stationarily mounted notched disc in operative juxtaposition to said sheave and generally co-axial therewith, a pawl pivotally mounted to said sheave in operative alignment with said disc and having a sheave-latching toe facing the disc and arranged to orbit around the disc with the rotation of the sheave, means urging said pawl in the direction of the disc and tending to move the pawl about its pivot to nest the toe thereof in said notch, whereby the toe of the pawl will enter and nest in the notch of the disc when the speed of rotation of the sheave is significantly less than a suitable preselected latching-and-unlatching speed and so that pawl will be de-activated by the centrifugal force thereon when speed of rotation of the sheave is significantly greater than such speed, the notch in said disc and the toe of said pawl being so complementarily shaped that when the toe of the pawl is nested in said notch it will hookingly latch the sheave against rotation in its cord-winding direction and will be cammingly expelled from the notch when the sheave is rotated in its unwinding direction, and the cord-anchorage point on the hub of the sheave and the cord-passage opening of the housing and the pawl-pivoting point on the sheave and the notch of the disc being so angularly spaced in relation to each other that when the cord is fully unwound and pulled radially taut from the hub, the angular spacing of the toe of the pawl from the notch of the disc will be such that upon releasing the cord from its fully pulled-out taut extension the sheave will rotate such substantial part of a revolution in its cord-winding direction before the toe of the pawl reaches a notch-entering position that the centrifugal force upon the pawl will keep the pawl in its radially de-activated position and will overbalance the force of said resilient pawl-urging means and that upon over-spinning the sheave in its un-winding direction past such radially-taut condition of the cord, the toe of the pawl will not reach the notch in such over-spin, thereby to prevent the non-releasable latching of the sheave when the cord is fully pulled out.

References Cited

UNITED STATES PATENTS

3,081,044	3/1963	Keith	242—18
3,137,883	6/1964	Descarries	191—12.2 XR
3,182,139	5/1965	Meletti	242—107.4 XR
3,378,214	4/1968	Hilsinger	242—107.7
3,430,885	3/1969	Holmberg	242—107.4

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