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Lidin

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[54] **ROLLER DEVICE FOR A FLEXIBLE SHEET**

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[52] **U.S. Cl.** **160/319;** 160/236; 160/133; 242/107

[51] **Int. Cl.²** **A47G 5/00;** E06B 3/00

[58] **Field of Search** 160/133, 265, 309, 312, 160/315, 319, 320–326; 242/107

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Assistant Examiner—Victor N. Sakran
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[57] **ABSTRACT**

A roller device for a flexible sheet comprising a rotary unit forming a winding core for the sheet and having at its one end a drum of smaller diameter than the core, around which a pull string for controlling the rotation of the unit is caused to wind up in a helical fashion while always entering near the outer end of the drum, when the unit is rotated in a given direction, a stationary cam moving the loops thus formed by the entering string axially inwards over the drum, whereby the drum may be radially covered by the flexible sheet along at least a part of its axial length.

11 Claims, 13 Drawing Figures

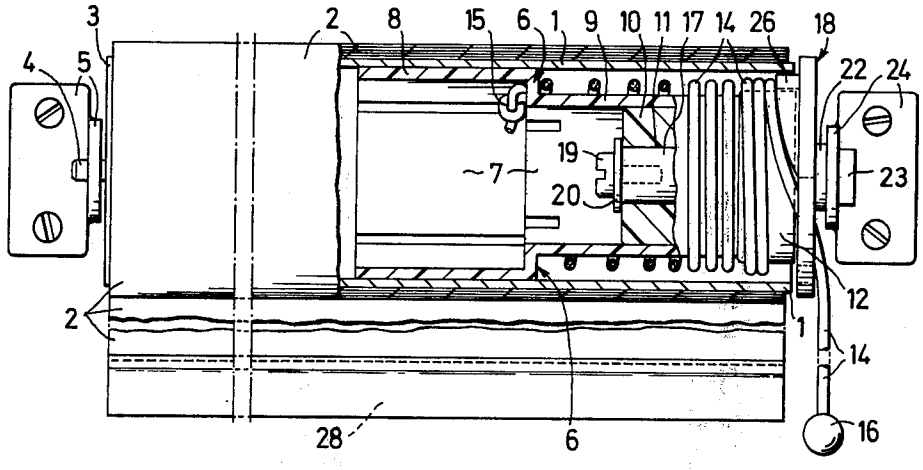


Fig. 1

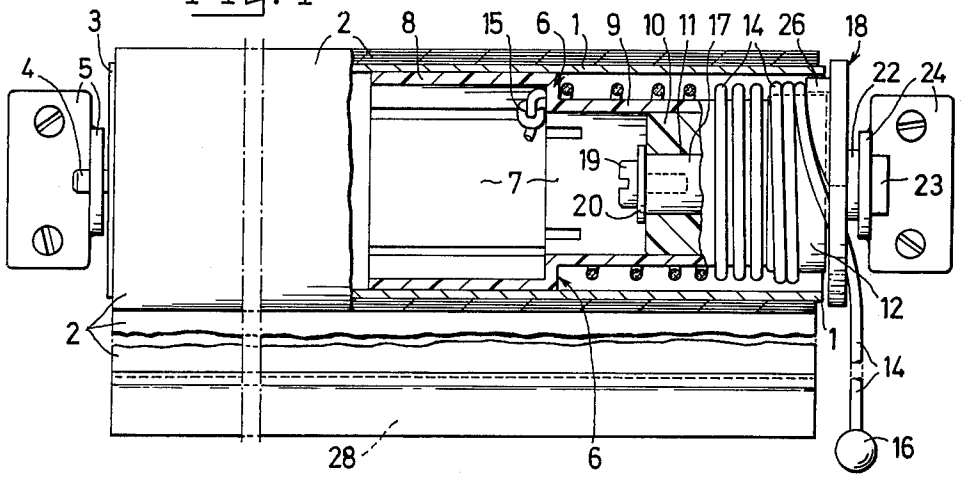


Fig. 3

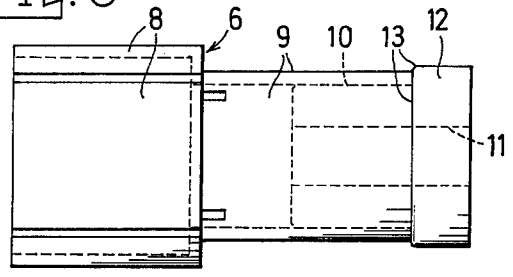


Fig. 2

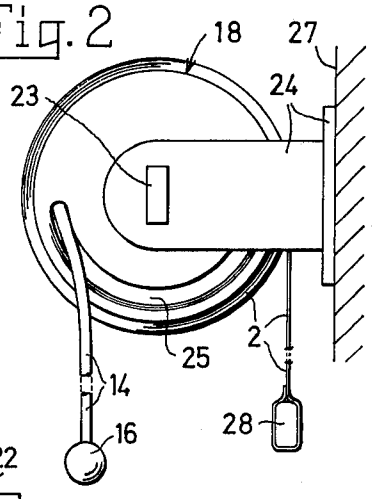


Fig. 4

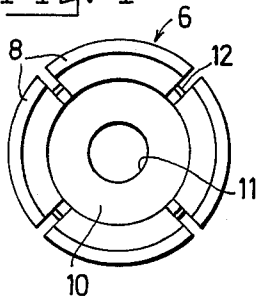


Fig. 5

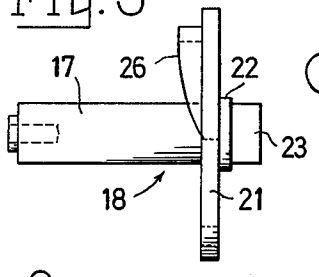


Fig. 6

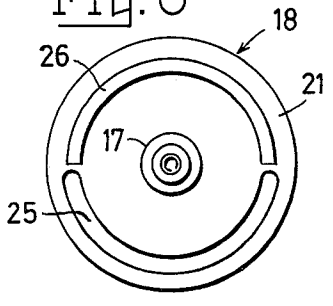


Fig. 7

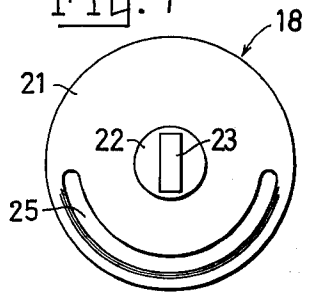


Fig. 8

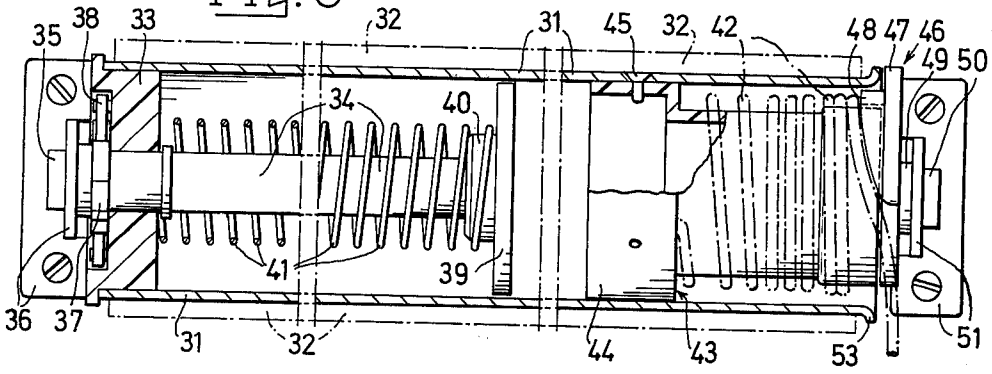


Fig. 10

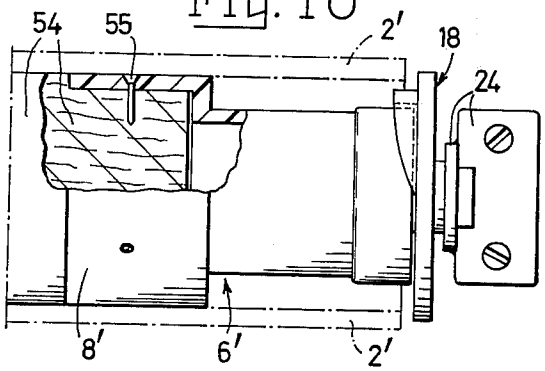


Fig. 9

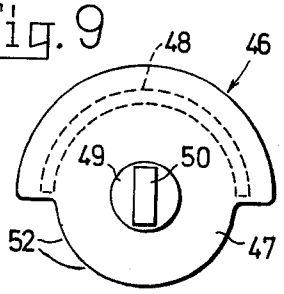


Fig. 11

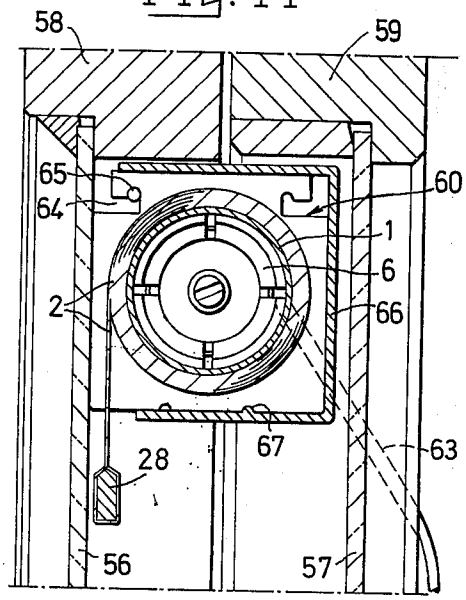


Fig. 12

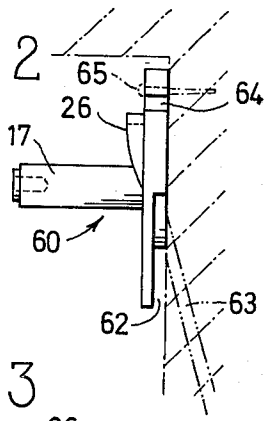
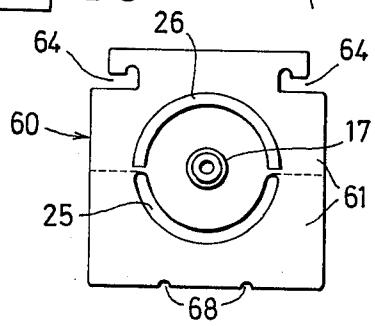


Fig. 13



ROLLER DEVICE FOR A FLEXIBLE SHEET

This invention relates to roller devices for flexible sheets, such as window shades, pictures, maps, projection screens or the like, and more specifically the invention is concerned with a roller device of the kind, in which a winding core for the sheet forms together with a drum at one end thereof a rotatably mounted unit, the rotation of which is controllable by means of a pull string that is caused to wind up around the drum, when the unit is rotated in a given direction. In a very simple form of such a roller device, the winding up of the string on the drum is effected as a result of the flexible sheet being unwound from the core by pulling the free end portion thereof, such as by hand or by gravity. In other, more complex forms of the roller device, the winding up of the string on the drum may be effected by a spring mechanism, which is then commonly housed within the rotary unit itself. In any case the pull string has its one end attached to the rotary unit and a portion of its length available for manual control and possible locking.

In previously known roller devices of the kind referred to hereinbefore, the string-receiving drum is commonly a flanged spool having a diameter, at least at its flanges, that exceeds the diameter of the remainder of the rotary unit, and a moderate axial length, so that the required capacity of the spool can only be achieved by winding up the string in several layers thereon. This necessitates a certain possibility for axial distribution of the various string loops along the length of the spool, which is usually, but in most cases inadequately, provided for by simply exposing at least a part of the spool circumference along the full length of the spool in order to let the entering string sweep back and forth therealong. Accordingly, it is common practice to locate the spool for the string entirely outside that part of the rotary unit, which is useful as a winding core for the flexible sheet.

However, for several reasons such a location of the string-receiving drum or spool is objectionable. First, the total axial length of the rotary unit is undesirably increased, and the middle of the width of the flexible sheet is laterally offset in relation to the middle of the length of the rotary unit, which complicates the installation and, for instance, makes it practically impossible to use the known roller devices for shades mounted between the glass panes in double-sash windows. Secondly, a more or less exposed drum or spool is unesthetic, and the possible provision of a special cover for it does not help much and makes the structure more expensive. Thirdly, without adding complex and costly string feeding means to the known spools, it is very difficult to achieve such a satisfactory axial distribution of the string loops along the length thereof as is required for positively preventing the loops from entangling with one another, it being understood that any disturbances in the proper feed of the string may endanger the serviceability of the entire device.

It is an object of this invention to provide an improved roller device of the kind referred to, in which all those inconveniences of the commonly known roller forms are eliminated in a simple and inexpensive manner, and which has further valuable advantages, as will appear from the following.

This is achieved by a roller device for a flexible sheet comprising a rotary unit including means forming a cylindrical winding core for the flexible sheet, and means forming a drum co-axial with and connected to one end portion of said core, said drum having a free outer end and a diameter smaller than that of said core, a string having its one end attached to said rotary unit and a portion of its length available for manual control, said string being adapted to be wound up around said drum, when said unit is rotated in one direction, and to be unwound therefrom, when pulled, to thereby cause said unit to rotate in the opposite direction, and means for rotatably mounting said unit on a supporting structure and comprising an end member having an inner face covering said free end of the drum and extending, at least partially, radially beyond the same, means preventing said end member from partaking in the rotation of said rotary unit, and means on said end member for guiding said string on its way onto said drum in a manner to cause said string to wind up around the same in a helical fashion.

For further elucidation of the invention some embodiments thereof will now be described with reference to the accompanying drawings, in which

FIG. **1** is a shortened front view, partly in section, of a first form of a roller device embodying the invention,

FIG. **2** is an end view of the same roller device as seen from the right in FIG. **1**,

FIG. **3** is a side view of a drum-forming insert included in the roller device of FIGS. **1** and **2**,

FIG. **4** is an end view of the insert as seen from the left in FIG. **3**,

FIG. **5** is a side view of an end member included in the roller device of FIGS. **1** and **2**,

FIG. **6** is an end view showing the inner face of the end member as seen from the left in FIG. **5**,

FIG. **7** is an end view showing the outer face of the same end member,

FIG. **8** is a shortened longitudinal section of a modified form of the roller device,

FIG. **9** is an end view showing the outer face of a modified end member forming part of the roller device of FIG. **8**,

FIG. **10** is a fragmentary front view, partly in section, of a modification of the roller device in FIGS. **1** and **2**,

FIG. **11** is a fragmentary sectional elevation of a double-sash window having a shade mounted between the two glass panes thereof and on a roller device embodying the invention,

FIG. **12** is a side view of a modified end member forming part of the roller installation of FIG. **11**, and

FIG. **13** is an end view showing the inner face of the end member of FIG. **12**.

Referring first to FIGS. **1–7**, numeral **1** designates a cylindrical roller tube, preferably of aluminum, forming a core, around which a flexible sheet **2**, such as a shade or screen, is wound. In the left hand end of the tube **1** there is fastened a plug **3** having a projecting center pin **4** that is rotatably supported by a fixed bracket **5**. Deeply recessed in the right hand end portion of the tube **1** there is a hollow insert **6** preferably made of plastic and comprising a shouldered sleeve member **7**, the innermost, wider portion **8** of which is axially slotted and securely retained in tube **1** by friction and the outermost, narrower portion **9** of which is cylindrical and has an outer diameter that is considerably less than the inner diameter of the tube **1**. The insert **6** also comprises a plug-like member **10** having a central bore **11** therein and being secured in the outer

end of sleeve portion 9. This member 10 forms a cylindrical head 12 having an outer diameter, which is slightly larger than that of portion 9, and merging into portion 9 through a small shoulder 13 with a bevelled or rounded edge. The cylindrical portion 9 has an axial length considerably exceeding that of the head 12, and forms with the head 12 a stepped drum adapted to receive a wound up pull string 14 having its one, inner end attached to the sleeve member 7, such as by a knot 15, and its opposite end portion exposed for manual pulling. A ball 16 or the like may be attached to the free end of the string to facilitate its manipulation.

Into the bore 11 and through the plug-like member 10 extends a pivot pin 17 formed integral with and projecting from one side of an end member 18, this pin being retained in member 10 by means of a screw 19 and a washer 20 in a manner to permit free rotation thereof in the bore 11. The end member 18 further comprises a circular disk 21, from the inner face of which the pin 17 projects centrally, and on its outer face this disk has a central boss 22 terminating in a flattened projection 23 that is detachably received in a corresponding, slot-like opening in a second bracket 24. This will prevent the end member 18 from partaking in any rotary motion of the unit formed by the tube 1 and the insert 6. The disk 21 has a substantially semicircular, slot-like aperture 25 therein for the passage of the pull string 14, and on the outer face of the disk the radially outermost border of this aperture is smoothly rounded to reduce possible wear of the string. Furthermore, the disk 21 has on its inner face a cam-like, arcuate projection 26 that is located diametrically opposite to the aperture 25 and has approximately the same circumferential extend as the latter, both being concentric with the pivot pin 17 and having substantially the same radii. The inner radius and the radial width of the projection 26 are so chosen that the latter can freely pass within but will almost completely fill out the annular interspace between the head 12 and the tube 1, into which it extends axially inwards over a limited circumferential surface area of the head. The height of projection 26 counted axially from the inner face of disk 21 increases gradually from both ends thereof to a maximum at the middle, where it is at least equal to the diameter of the rather thick pull string.

As will be readily understood, the tube 1 with its insert 6 forms a rotary unit that is supported by the two pins 4 and 17 and, hence, by the two brackets 5 and 24, the latter being secured to any suitable supporting structure, such as a wall 27. The flexible sheet 2 has its one end edge attached to the core-forming tube 1 and its opposite end portion folded around a heavy rod 28, the weight of which is sufficient to effect unwinding of the sheet 2 from tube 1. If such unwinding of the sheet is not prevented by pulling or locking the string 14, the rotary unit will be rotated in such a direction that the pull string 14 passing in through the aperture 25 substantially in the longitudinal direction of the rotary unit will be wound up on the drum 9, 12 in a helical fashion. More specifically, as the pull string enters through the aperture 25, it will form loop after loop around the head 12, i.e. the part of the drum having the slightly larger diameter, and by means of the cam-like projection 26 these loops will be successively displaced axially inwards and thus be transferred to the portion 9 having the slightly reduced diameter, because the axial length of the head 12 is only enough to take up a few, say about two or three, loops. The inwardly transferred string loops will, as they were formed around the larger head 12, only loosely surround portion 9, which fact considerably facilitates the proper collection of the string on the drum. When the string 14 is later on pulled to raise the lowered sheet 2, it will pass out in substantially the reverse order, it being understood, however, that the loops of the string around the drum then may become axially extended, particularly when almost the full length of string has been pulled out and unwound from the drum. Practical tests have proved that the operation is surprisingly smooth and that no entanglement occurs in normal use.

It should be understood that the symmetry of the end member 18 is basically a matter of convenience making it possible to use the same type of end member both for left hand and right hand applications and irrespective of whether it is desirable to let the string wind up on the drum during clockwise or counterclockwise rotation of the latter. In each particular case only one half of the projection 26 and the adjacent end portion of the arcuate slot-like aperture 25 will normally be in service. Also it is to be noted that, thanks to the particular cooperation between the string-directing end member and the drum, it is possible to locate the latter entirely inside the tube 1 forming the winding core for the sheet 2. In addition, a favorable transmission ratio is obtained between the flexible sheet and the pull string.

In FIGS. 8 and 9 there is shown a modified form of the roller device that also comprises a tube 31 forming a core for winding up a flexible sheet 32, which is here indicated by dash-and-dot lines only. In this case a spring mechanism of substantially conventional design is provided within the left hand portion of the tube. This mechanism comprises a plug 33 secured in the left hand end of the tube, a rod 34 journalled in the plug and having a flattened outer end portion 35 detachably and unrotatably received in a bracket 36. The rod 34 has a ratchet wheel 37 secured thereon and selectively interlocking with pawls 38 mounted in the recessed plug 33. At the inner end of the long rod 34 there is a centering disk 39 freely rotatable in tube 31, and this disk has a hub portion 40, to which one end of a helical torsion spring 41 is secured, the other end of the spring being secured to the plug 33. When the spring 41, which is usually prestressed, is further tensioned by rotation of the tube 31 in a certain direction, which is either causing unwinding or winding up of the sheet 32, it will strive to rotate the tube in the opposite direction. Whether such rotation occurs or not depends on the position of the releasable pawls 38. Preferably the spring 41 is tensioned, when the pull string 42 of the roller device is pulled to lower or raise the sheet 32, as the case may be.

Within the right hand end portion of tube 31 there is secured a drum-forming insert 43 substantially similar to that shown and described in connection with FIGS. 1–7, the only difference being that the wider, innermost portion 44 thereof is attached to the tube 31 by a number of pins or rivets 45. The outer end of the drum-forming portion of the insert 43 is journalled on a pivot pin, not shown but similar to pin 17 in FIGS. 1, 5 and 6 and projecting from the inner face of an end member 46 that further comprises a disk-like body portion 47 having a cam-like, arcuate projection 48 on its inner face and a boss 49 terminating in a flattened projection 50 on its outer face. As before, the flattened end pro-

jection detachably engages a corresponding slot opening in a bracket **51** to prevent the end member from partaking in the rotation of the core-forming unit. In fact, the end member **46** is in all essential respects similar to the end member **18** of FIGS. **1** and **5** to **6** with the only exception that there is no arcuate aperture in it. Instead, the radial extent of the disk-like body portion **47** is considerably reduced within the lower half thereof at **52** to let the pull string **42** pass in to the drum and the cam **48** without any obstruction, it being understood that the pull string will then slidingly engage the outer opening edge **53** of the tube **31**, which is therefore outwardly flanged to reduce the possible wear on the passing string. The winding up of the string around the drum as well as the unwinding thereof will take place in the same manner as described in connection with FIGS. **1–7**.

In FIG. **10** there is shown a modification of the roller device in FIGS. **1** and **2**, where the sheet **2'**, indicated by dash-and-dot lines only, is wound up around a core that for its main part is formed by a solid wooden rod **54** having an end portion of reduced diameter, on which the wider innermost portion **8'** of a drum-forming attachment member **6'** resembling the insert **6** in FIG. **1** is seated and secured by nails **55**. The outermost end portion of the drum-forming member **6'** cooperates with and is supported by a stationary end member **18** detachably connected to a bracket **24** exactly as in FIG. **1**. Although there is no tube covering the string-receiving drum in this case, the flexible sheet **2'** may well extend almost all the way out to the end member **18** as shown, provided that the sheet material is not too limp, because the tubular shape imparted to the sheet will assist in preventing it from flexing and interfering with the string winding procedure, which is, of course, the same as described before in connection with FIGS. **1–7**.

In FIG. **11** there is shown a roller device for a window shade mounted between two glass panes **56** and **57** in a double-sash window comprising an outer sash **58** and an inner sash **59**, which are detachably held together in a conventional manner. The rotary unit of the roller device is of the same design as in FIG. **1** comprising the tube **1** with the drum-forming insert **6** in its one end, the tube forming a winding core for the flexible sheet **2** having the heavy rod **28** attached to its free end. However, in this case the end member **60**, which is more closely illustrated in FIGS. **12** and **13**, is of a slightly modified design comprising a substantially square, plate-like body portion **61**, from the inner face of which the usual pivot pin **17** and cam **26** project and in which the usual arcuate aperture **25** is provided. The back or outer face of the body **61** is substantially flat but slightly recessed at its lower end, radially outwards from aperture **25**, as at **62**, in order to give the pull string **14** a certain freedom of adjustment, when it passes between the aperture **25** and the inner end of a oblique hole **63** drilled through the inner sash **59**, usually free-hand.

One of a pair of hook-like incuts **64** at the upper corners of the plate-like body portion **61** makes it possible to attach the end member **60** to a nail or pin **65** driven into the inner lateral face of the outer sash **58**. Although not shown, it should be understood that at the opposite end of the roller device there is provided a bracket plate having the very same outline as the body portion **61** of end member **60** but only a simple socket hole therein for accommodating the centre pin at that end of the rotary unit, and that this bracket plate is suspended in a similar manner on the opposite side member of the sash **58**. To protect the shade, and to prevent the end member **60** and the opposite bracket plate from inadvertant unhooking, a channel-like cover **66** is pushed in over the roller device to extend between the end member and the bracket plate, this cover having a ridge **67** on its inside engaging with one of a pair of small incuts **68** in the bottom side of the plate-like body portion **61** and in the bracket plate at the opposite end to keep the cover in place. Again the symmetry of the end member **60** makes the latter useful for slightly different installations.

I claim:

1. A roller device for a flexible sheet comprising

a. a rotary unit including

1. means forming a cylindrical winding core for the flexible sheet, and

2. means forming a drum co-axial with and connected to one end portion of said core, said drum having an inner end, a free outer end and a diameter smaller than that of said core,

b. a string having its one end attached to said rotary unit adjacent the inner end of said drum and a portion of its length available for manual control, said string being adapted to be wound up around said drum in a helical fashion, when said unit is rotated in one direction, and to be unwound therefrom, when pulled to thereby cause said unit to rotate in the opposite direction,

c. means for rotatably mounting said unit on a supporting structure and

d. string guiding means forming an opening for the string to pass when entering and leaving the drum, said string guiding means comprising

1. a plate-like end member facing said free outer end of the drum and extending, at least partially, radially beyond said drum end, and

2. means preventing said plate-like end member from partaking in the rotation of said rotary unit,

wherein said string guiding means further comprise means restricting and locating said opening for the string to pass to a region adjacent the outer end of the drum and, hence, axially remote from the inner end of the drum,

wherein said plate-like end member is operative to cause the loops or coils successively formed by the string, when the latter is entering the drum, to move axially inwards over the drum towards the inner end thereof, and

wherein said means for rotatably mounting said rotary unit and said means preventing rotation of said plate-like end member extend axially outside said rotary unit

whereby the flexible sheet may extend a considerable distance axially beyond said inner end of the drum and, when wound up, enclose a considerable part of the total length of the drum without in any way interfering with the string.

2. A roller device according to claim **1**, wherein said plate-like end member of said string-guiding means has a cam-like arcuate projection thereon extending axially inwards over a limited circumferential surface area of said drum.

3. A roller device according to claim **1**, wherein said drum has an axially inner portion and an axially outer

end portion, both of which are generally cylindrical, the inner one of said two portions having an axial extent capable of accommodating a considerable number of helical loops or coils formed by said string, and the outer one of said two portions having a slightly larger diameter than the inner one and an axial extent capable of accommodating only a few loops or coils of the string.

4. A roller device as claimed in claim **3,** wherein said outer end portion of the drum merges into said axially inner portion thereof through a shoulder having a slanting edge.

5. A roller device according to claim **1,** wherein said plate-like end member has a pin projecting from its inner face, said pin entering a central bore in said drum and forming a pivot for one end of said rotary unit.

6. A roller device according to claim **1,** wherein said means forming the cylindrical core comprises a tubular member having an open end, anc wherein said means forming the drum comprises an attachment portion rigidly connected to the inner end of said drum, said attachment portion being received and retained in said tubular member.

7. A roller device as claimed in claim **6,** wherein said tubular member has an inner diameter exceeding the diameter of said drum and extends radially outside said drum along substantially the full axial length thereof.

8. A roller device according to claim **1,** wherein said means preventing said plate-like end member from partaking in the rotation of said rotary unit comprises a bracket member, to which said end member is detachably connected.

9. A roller device according to claim **1,** wherein said plate-like end member has an aperture therein forming said opening for the string to pass, said aperture letting the string out on the outer face of said end member.

10. A roller device as claimed in claim **9,** wherein said aperture is arcuate and slot-like and extends along a substantial part of the circumference of the outer free end of said drum to permit said string to enter said drum without obstruction irrespective of the direction of rotation of the rotary unit and the drum.

11. A roller device according to claim **1,** wherein said core-forming means comprises a tubular member having an open end with a smoothly rounded circumferentially extending edge, and said drum forming means comprises an insert arranged within said tube, and wherein said plate-like end member leaves a marginal portion of said tube end free to permit said string to pass in and out in sliding engagement with said rounded end edge of the tube.

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