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O'Hara

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[54] **HOSE COILING APPARATUS**

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[51] **Int. Cl.** **B65h 75/38**

[58] **Field of Search** 242/86, 86.2; 137/355.16, 137/355.23, 355.26, 355.27

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[57] **ABSTRACT**

Apparatus for assisting in uncoiling and coiling a flexible hose, cord, or the like, in even layers on a fixed drum. The hose is uncoiled by pulling the free end in a direction more or less parallel to the axis of the drum on which it is coiled as an arm carrying a guide pulley rotates to follow the tangent of hose leaving the coil about the fixed drum. Springs tensioned by the uncoiling movement provide a biasing force for rewinding the hose, rotating the guide pulley and arm in the opposite direction. Novel motion transfer means are disclosed for producing traversing movement of the guide pulley along the length of the fixed drum as the arm carrying the pulley rotates thereby coiling the hose in even layers.

10 Claims, 5 Drawing Figures

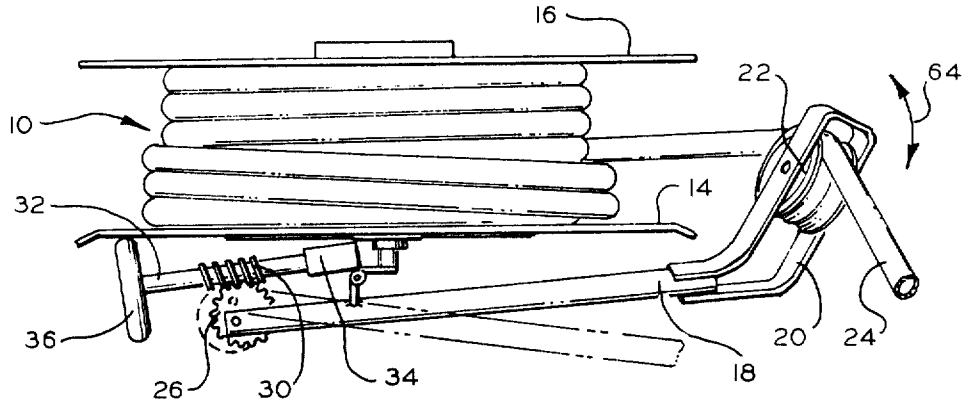
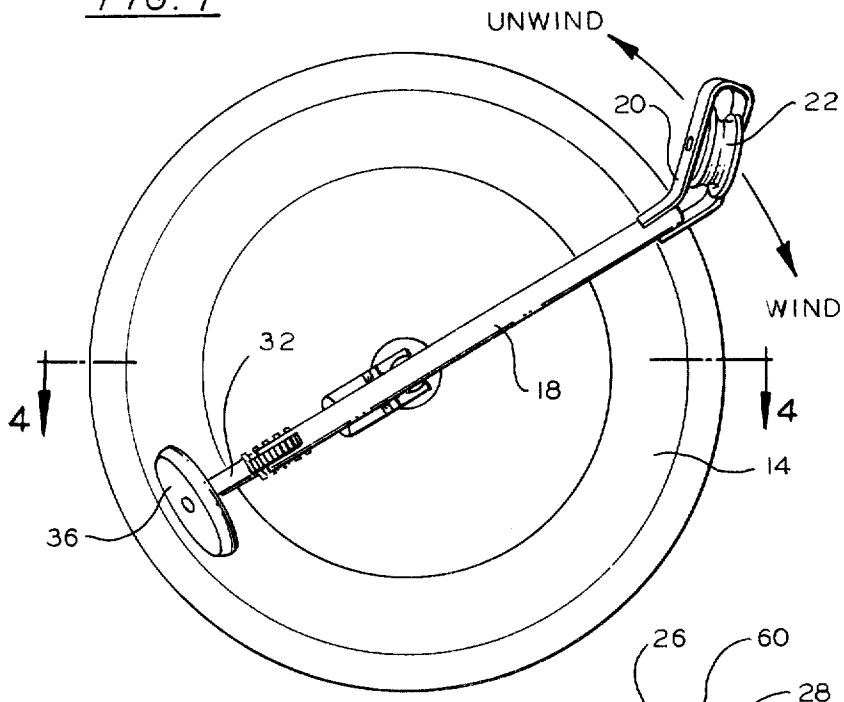


FIG. 1



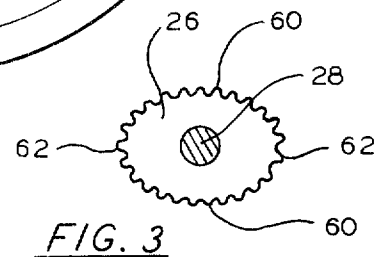


FIG. 3

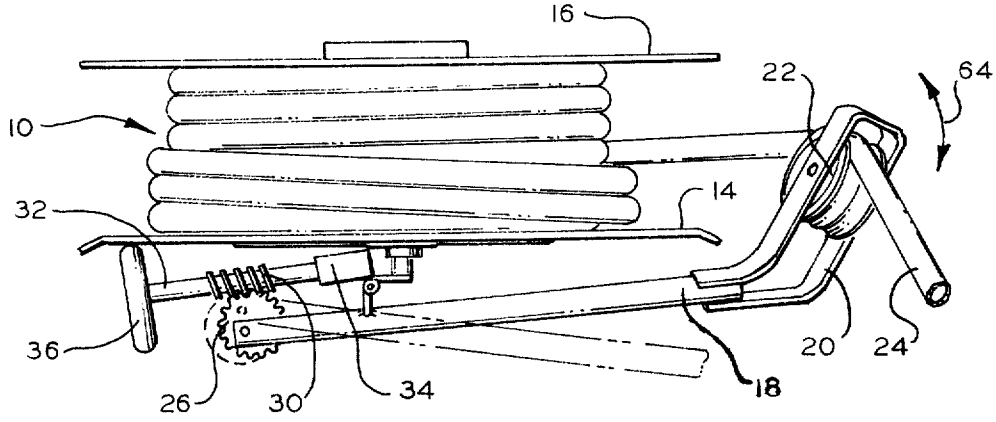


FIG. 2

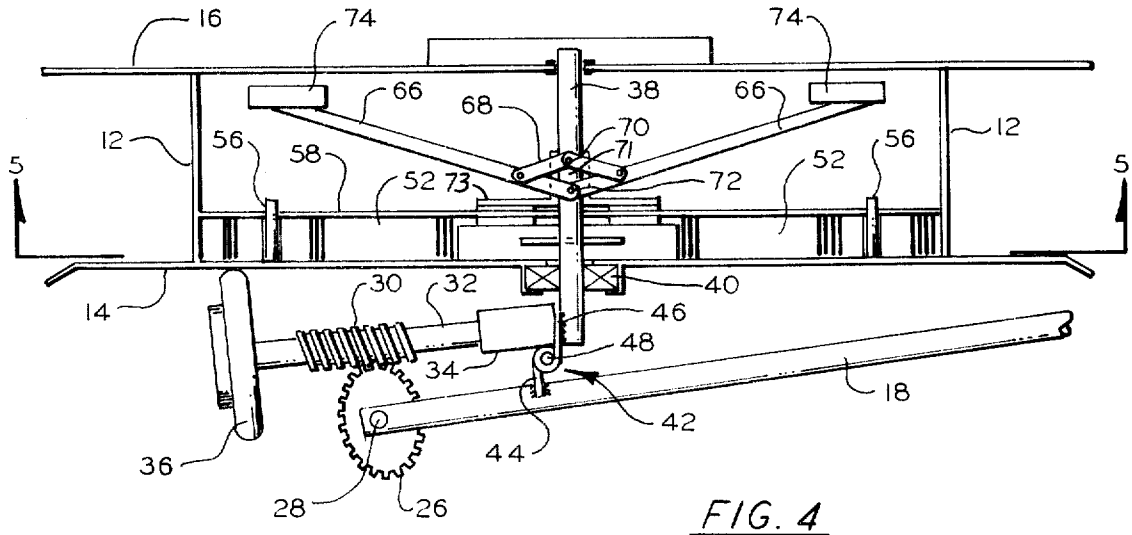

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FIG. 4

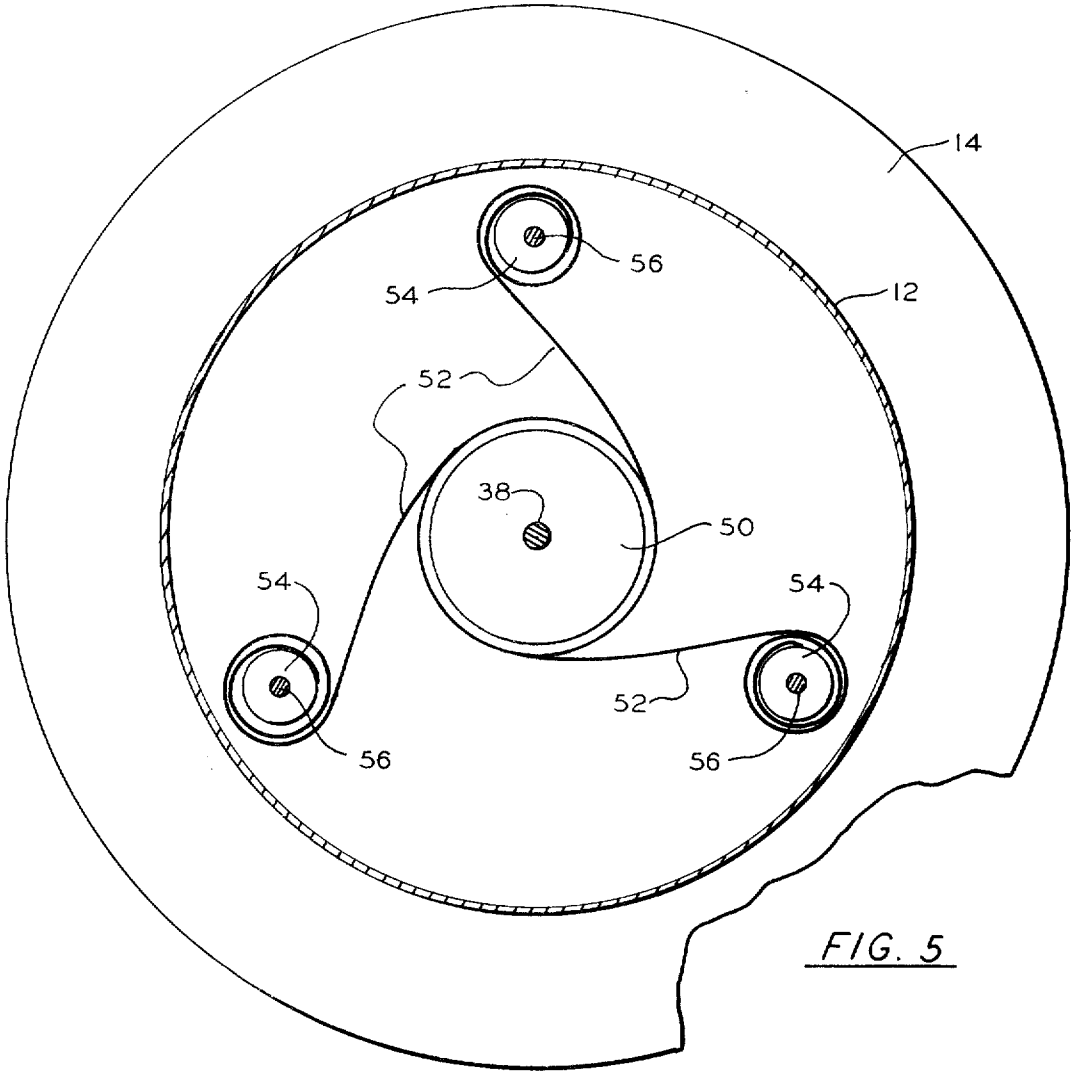

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FIG. 5

HOSE COILING APPARATUS

BACKGROUND OF THE INVENTION

The present invention relates to apparatus for winding and unwinding a flexible hose, rope, or the like on a non-rotating drum and, more specifically, to novel means for laying the flexible element in even layers along the length of the drum.

It is often convenient to provide spring-loaded means for rewinding an elongated, flexible element on a drum or reel where it is normally stored, after it has been unwound therefrom. Electrical cords, ropes for towing and other purposes, and garden hose are among the elements normally stored on drums when not in use and arranged to automatically tension a spring as they are unwound. The energy thus stored in the spring is used to rewind the element after use.

The present invention is illustrated and described in the context of a garden hose reel, although the invention is not limited by the nature of the flexible element used in connection therewith. For convenience, however, the flexible element will hereafter be referred to as hose.

Self-winding hose drums may be generally classified by the direction of movement of the hose with respect to the drum as it is wound and unwound. In one common type, the hose is moved tangentially on and off the drum with no significant change in direction, i.e., it is moved substantially transversely to the drum axis. In this case the drum is mounted for rotation about its own axis, and is rotated in one direction by hose removal and in the opposite direction by the spring force as the hose is rewound. In the other type, the drum does not rotate, but rather is fixedly mounted, and the hose passes over a change of direction guide which is itself rotatable about the drum periphery. The hose is moved, after passing over the guide, in a direction generally parallel to the drum axis.

The present invention relates entirely to self-winding drums of the latter type and has as a principal object the provision of novel and improved means for insuring that the hose is wound upon the drum in evenly spaced layers. That is, each revolution of the hose about the drum is guided to lay adjacent the immediately preceding revolution to form even layers with no buildup of the thickness of coiled hose at any point along the drum.

In a more general sense, the object of the invention is to provide an improved, self-winding mechanism for replacing an elongated, flexible element on a cylindrical drum after manual removal of the element from the drum.

Other objects will in part be obvious and will in part appear hereinafter.

SUMMARY OF THE INVENTION

In accordance with the foregoing objects, the invention comprises a fixedly mounted, cylindrical drum having end flanges of considerably larger diameter. A hose, or other flexible element is anchored at one end, wound around the drum between the flanges, and passes over a rotatable guide member, to a free end.

The guide member is in the form of a pulley mounted for rotation about its own axis on one end of an arm which is rotatable about the drum axis to move the pulley about the periphery of the drum, in spaced relation

thereto. A second arm is also rotatable about the drum axis and carries a wheel frictionally engaging an outer surface of one of the end flanges of the drum. As the second arm is rotated, the wheel carried thereby turns, effecting rotation of a worm gear, also carried by the second arm.

The first arm, carrying the pulley guide member at one end, carries at the other end an eccentric gear meshed with the worm gear. As the eccentric gear rotates, the first arm is moved reciprocally about an axis transverse to the drum axis, thereby moving the end carrying the pulley guide transversely and reciprocally with respect to the drum surface. The gear ratios and dimensions of the respective elements are such that the pulley guide moves transversely a distance substantially equal to the diameter of the hose with each revolution about the drum. Also, the direction of traverse of the pulley guide is reversed after each movement thereby of a distance equal to the spacing between the end flanges of the base.

As the drum is unwound from the drum by pulling the free end, the arms are caused to rotate as the pulley guide follows the rotation of the hose. One or more springs are connected at one end to a shaft rotated by the arms. The springs are tensioned by rotation of the shaft in the direction of removal of the hose from the drum. The energy stored in the springs causes counter-rotation of the shaft and arms, thereby moving the pulley guide in the opposite direction about the drum with the same transverse motion. Thus, the hose is wound on the drum in even layers. As a further refinement, the pulley guide may be provided with two grooves to allow the hose to shift from one groove to the other, seeking a lateral position providing a more direct tangential relationship to the diameter of the coil as this diameter varies with the amount of hose wound on the drum.

BRIEF DESCRIPTION OF THE FIGURES

FIG. **1** is a front elevational view of a self-winding mechanism for a hose, or the like, embodying the present invention;

FIG. **2** is a plan view of the mechanism of FIG. **1** with an alternate construction of one element;

FIG. **3** is an elevational view of a gear element of the mechanism of FIGS. **1** and **2**;

FIG. **4** is a plan view in section on the line **4—4** of FIG. **1**; and

FIG. **5** is an elevational view of the interior of the mechanism, taken on the line **5—5** of FIG. **4.**

DETAILED DESCRIPTION

The flexible element to be wound and unwound with the assistance of the present invention is illustrated in FIG. **2** in the form of a common garden hose, denoted generally by reference numeral **10.** Hose **10** extends from a fixed end, connected to a water spigot or faucet (not shown), to wrap around a fixed cylindrical element or drum **12,** seen in section in FIG. **4.** Affixed to each end of drum **12** are front and rear flanges **14** and **16,** respectively, essentially comprising flat, circular plates of somewhat larger diameter than drum **12,** as clearly seen in FIGS. **2** and **4.** Hose **10** is wound upon drum **12** between flanges **14** and **16** which provide lateral constraints for the coil of hose, the difference in diameter between the drum and the flanges being a matter of design in accordance with the amount of hose to be stored thereon. Any convenient means (not

shown) may be provided for mounting the unit to a wall or other support, normally by or through flange **16.**

First arm **18** carries at one end a generally U-shaped bracket **20,** fixedly attached to arm **18** and bent at an angle from the axis thereof. Pulley **22** is rotatably mounted on an axle carried by the spaced sides of U-bracket **20.** As seen in FIG. **2,** hose **10** extends tangentially outward from the portion wound on drum **12,** thence over pulley **22,** to a free end (not shown), the fragment of hose extending past the pulley toward the free end being denoted by reference numeral **24.**

At the end opposite bracket **20,** arm **18** carries gear element **26,** mounted for free rotation about axle **28.** The end of arm **18** carrying gear **26** may be split or notched to accomodate the gear and provide a mounting for the axle. Gear **26** is meshed with worm gear **30,** carried by or formed integrally with second arm **32.** The latter is journaled at one end in bearing support **34** for rotation about its own axis and carries at the other end wheel **36,** mounted coaxially with arm **32.** Wheel **36** is fixedly attached to arm **32,** whereby rotation of the wheel is transmitted to the arm.

Shaft **38** is rotatably mounted on the axis of drum **12,** extending at opposite ends through the centers of both flanges **14** and **16.** Suitable bearings, such as diagrammatically indicated at **40,** may be provided as required to assist proper rotation of shaft **38.** Both arms **18** and **32** are connected to shaft **38** for rotation therewith. Arm **32** is connected to the shaft by fixed mounting of bearing support **34** directly thereon, while arm **18** is connected through hinge element **42,** having legs **44** and **46** affixed to arm **18** and shaft **38,** respectively. The legs are relatively movable about pin **48,** whereby arm **18** is rotatable both about the axis of shaft **38** and the axis of pin **48.**

Referring particularly to FIG. **5,** shaft **38** is affixed to central spring drum **50.** One end of each of springs **52** is attached to central spring drum **50** and the other end to respective ones of individual spring drums **54,** each rotatably mounted upon one of spindles **56.** All of drums **50** and **54,** and springs **52** are mounted within drum **12,** spindles **56** being supported between flange **14** and plate **58** (FIG. **4**), also mounted within drum **12** and supported thereby in spaced relation to flange **14.** As shaft **38** rotates, central drum **50** rotates therewith. Springs **52** are of the "negator" type, being so formed that they are naturally biased toward coiling in a particular direction. In the illustrated embodiment, springs **52** are biased toward coiling about individual drums **54,** i.e., in a clockwise direction about drums **54** as seen in FIG. **5.** Rotation of central dum **50** in a clockwise direction causes counterclockwise rotation of individual drums **54,** due to the reverse connection of springs **52,** thus tensioning the springs. The natural bias of the springs toward coiling in a clockwise direction about drums **54** produces a force tending to rotate central drum **50** in a counterclockwise direction.

Operation of the above-described mechanism will now be explained. When hose is to be unwound from drum **12,** the free end is grasped and pulled manually away from the drum in a direction generally parallel to the drum axis. As the hose is pulled and unwound from the drum, pulley **22** tends to follow the rotating tangential position of the hose. Thus, arm **18** is caused to rotate about the axis of drum **12,** thereby rotating shaft **38** to which arm **18** is attached through hinge **42.** Shaft **38** in turn rotates arm **32** and central drum **50** about the shaft axis, which is coaxial with drum **12,** the direction of rotation of drum **50** being such as to tension springs **52** as the hose is unwound.

The elements are so constructed and arranged that wheel **36** remains in frictional engagement with the outer surface of flange **14** as arm **32** rotates about the shaft axis. This engagement causes wheel **36** to turn about its own axis with revolution of arm **32** about the axis of shaft **38.** Since wheel **36** is fixedly connected to arm **32,** rotation of the wheel produces rotation of arm **32** and worm gear **30** about the axis of the arm as the latter rotates about the axis of shaft **38.** This, in turn, will produce rotation of gear **26** by a distance equal to the pitch of worm gear **30** with each revolution thereof.

It will be noted particularly from FIG. **3** that gear **26** is essentially elliptical in shape, having "low" sides **60** and "High" sides **62.** Although suitable spring biasing means (not shown) may be provided if desired, gear **26** will remain meshed with worm gear **30** as hose is removed due to the force of the hose on pulley **22** tending to rotate arm **18** about pin **48** in a clockwise direction as seen in FIG. **4.** As the portion of gear **26** which is meshed with worm gear **30** changes between the high and low sides, the eccentric shape of the gear produces rotation of arm **18** about pin **48,** thereby causing traversing movement of pulley **22** with respect to the surface of drum **12,** as indicated in FIG. **2** by arrow **64.** The pitch of worm gear **30,** and dimensions, location of axes, etc., of other elements, is such, that one revolution of arm **18** produces traversing movement of pulley **22** by a distance substantially equal to the diameter of hose **10.** Also, gear **26** is so dimensioned and arranged with respect to arm **18** that movement of the portion of the gear meshed with worm gear **30** from the center of one of low sides **60** to the center of one of high sides **62** produces traversing movement of pulley **22** by a distance substantially equal to the length of drum **12,** i.e., to the distance between flanges **14** and **16.** The direction of traverse automatically changes each time the portion of the gear meshed with the worm changes from high toward low to low toward high, and vice versa. Thus, as hose **10** is unwound, pulley **22** moves to remain substantially on a line perpendicular to the axis of drum **12** and tangent to the point on the periphery of the hose coil from which the hose is being removed.

As previously explained, unwinding of the hose produces rotation of shaft **38** and central drum **50** in a clockwise direction as seen in FIG. **5** in order to tension springs **52** during the unwinding. Since the elements are seen in FIG. **1** from the side opposite that shown in FIG. **5,** unwinding produces counterclockwise rotation, as indicated by the arrow. In other words, hose **10** is initially placed on drum **12** by winding it in a clockwise direction as viewed from the front. The energy thus stored in springs **52** will serve to counter-rotate the elements upon release of the free end of the hose, as springs **52** coil about individual drums **54.** The spring movement rotates drum **50** and shaft **38** in a counterclockwise direction as seen in FIG. **5,** the rotation of shaft **38** being transmitted to arms **18** and **32** to produce rotation thereof in a clockwise direction as seen in FIG. **1.** The hose is drawn over pulley **22,** as the latter rotates about the periphery of drum **12,** in a direction rewinding the hose on the drum. Traversing movement of pulley **22** in the direction of arrow **64** is the same as when the hose was unwound. Thus, since hose **10** is laid on drum **12** (or on preceding layers of itself)

directly from pulley **22**, the hose will be wound in even layers with each revolution lying immediately adjacent the preceding revolution. A new layer is started only when one layer has been wound completely to the end flange.

An additional feature, shown in FIG. **4**, which may be utilized if desired, is a centrifugal brake or governor. Arms **66** are pivotally connected to one another by linkage **68** which is pinned at **70** to sleeve **71**. The latter is mounted for freely sliding movement on shaft **38**, and includes a slot or other appropriate opening to allow pin **72** to pivotally attach arms **66** directly to shaft **38** and allow limited longitudinal movement thereon of sleeve **71**. Disc **73** is carried by sleeve **71** and has a brake surface opposing plate **58**. Weights **74** are attached to the ends of each of arms **66**. When shaft **38** is at rest, the brake surface of disc **73** is spaced from plate **58**. Centrifugal force produced by rotation of shaft **38** causes weights **74** to tend to move outwardly, thereby moving arms **66** about their pivotal connection with the shaft and moving sleeve **71** and disc **73** toward plate **58**. When rotation of shaft **38** reaches a predetermined limit, disc **73** contacts the surface of plate **58** and acts as a friction brake inhibiting further increase in the rotational speed of shaft **38**. The braking force increases proportionately to the rotational speed, effectively prohibiting speeds above a desired limit. It is anticipated that the braking effect would be applied only in certain instances on rewinding of the hose, to prevent operation at speeds higher than the limit at which the mechanism can properly function to coil the hose in even layers.

It will be noted that pulley **22** is shown in FIG. **1** as having a single groove and in FIG. **3** as having two, side-by-side grooves. Although satisfactory operation according to the principles of the invention is provided by the single groove, the frictional or binding forces on the hose which must be overcome manually as the hose is unwound, and by the spring force as it is rewound, are decreased by use of the double groove pulley. That is, since the manual force is applied longitudinally in a direction substantially transverse to the tangential direction of removal of the hose from the coil, a portion of the force is transmitted to the pulley in effecting rotation of arm **18**. The point along the axis of pulley **22** at which such force is optimally transmitted varies as the total diameter of the hose coil varies, since this changes the position of a tangential line from the periphery of the coil. It will be found that the hose automatically moves from one groove to the other as the total diameter of the coil changes without requiring manual adjustment.

Many constructional variations may be practised within the scope of the invention. For example, rather than the illustrated hinged connection between arm **18** and shaft **38**, the two may be directly joined (e.g., by providing a fixed extension from arm **18** at 90° thereto, or bending arm **18** 90° and connecting the end directly to the shaft or using the bent portion as the shaft) and providing sufficient flexibility in the shaft, and/or mounting means therefor, to allow for the traversing movement of pulley **22**. Suitable means for transmitting to arm **18** the required movement for reciprocating traverse of the pulley could still, of course, be provided substantially in the manner disclosed. Also, plate **58** need not be attached to drum **12**, but instead be a thin, floating plate mounted on spindles **56** to serve as a guide for the springs and provide double braking action.

It should also be noted that an arrangement of arm **32** such as shown in FIG. **2** is preferred over that shown in FIG. **4**. That is, the axis of arm **32** should intersect the axis of shaft **38** substantially at the plane of the surface of flange **14** upon which wheel **36** rotates. Also, attachment of bearing support **34** to shaft **38** by a hinged connection will allow compensating movement of arm **32** due to wear or other facts affecting the diameter of wheel **36**, thus reducing twisting forces on shaft **38** and the bearing supports therefor.

What is claimed is:

1. Apparatus for assisting in the coiling and uncoiling of an elongated, flexible element in a plurality of layers of side-by-side revolutions of the element, said apparatus comprising, in combination:

a. a fixed cylindrical element for receiving the coiled element on the outer periphery thereof;

b. an elongated arm mounted for rotation about the central axis of said cylindrical element and arranged with its own axis transverse to said central axis;

c. pulley means carried by said elongated arm and spaced radially from said outer periphery of said cylindrical element, and having an axis of rotation transverse to both said central axis and said arm axis, whereby the flexible element may extend tangentially from the coil, over said pulley means and substantially parallel to said central axis;

d. spring means constructed and arranged to be tensioned by rotation of said arm in a first direction to exert a biasing force tending to rotate said arm in the opposite direction;

e. mounting means allowing reciprocating traversing movement of said pulley means between positions radially spaced from each end of said cylindrical element; and

f. motion transfer means for imparting a predetermined increment of said traversing movement to said pulley means in response to each revolution of said arm in either direction about said central axis.

2. The invention according to claim **1** and further including a shaft mounted concentrically with and rotatable about said central axis, and means connecting said shaft and said arm to transmit rotation about said central axis from one to the other.

3. The invention according to claim **2** and further including means connecting said shaft to said spring means to transmit rotation of said arm in said first direction, through said shaft, to tensioning movement of said spring means, and to transmit the biasing force of said spring means through said shaft to tend to rotate said arm in said opposite direction.

4. The invention according to claim **3** wherein said mounting means comprises a hinged connection between said arm and said shaft allowing pivotal movement of said arm about an axis closely adjacent and transverse to said central axis.

5. The invention according to claim **4** wherein said motion transfer means comprises mechanism responsive to rotation of said arm in either direction to transmit motion thereto about the axis of said hinged connection.

6. The invention according to claim **5** wherein said mechanism comprises an eccentric member rotatable

about an axis substantially parallel to the axis of said hinged connection.

7. The invention according to claim **2** and further including a second arm connected to said shaft for rotation therewith, said motion transfer means being connected between said second arm and said elongated arm to impart to the latter movement providing said traversing movement of said pulley means carried thereby.

8. The invention according to claim **7** wherein said second arm is mounted for rotation about its own axis in response to rotation about said central axis.

9. The invention according to claim **8** wherein said motion transfer means comprises a worm gear carried by said second arm and rotatable about the axis thereof, and said elongated arm carries an eccentric gear meshed with said worm gear and rotatable thereby to impart said movement to said elongated arm.

10. The invention according to claim **1** wherein said pulley means comprises a pulley wheel having two grooves arranged side-by-side.

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