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Lagergren

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[54] **SELF-THREADING TAKE-UP SPOOL DEVICE**

[75] Inventor: **Richard Edward Lagergren,** Rochester, Minn.

[73] Assignee: **International Business Machines Corporation,** Armonk, N.Y.

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[52] **U.S. Cl.** **242/74,** 242/76

[51] **Int. Cl.** **B65h 75/28**

[58] **Field of Search** ..... 242/67.3 R, 74, 74.1, 76

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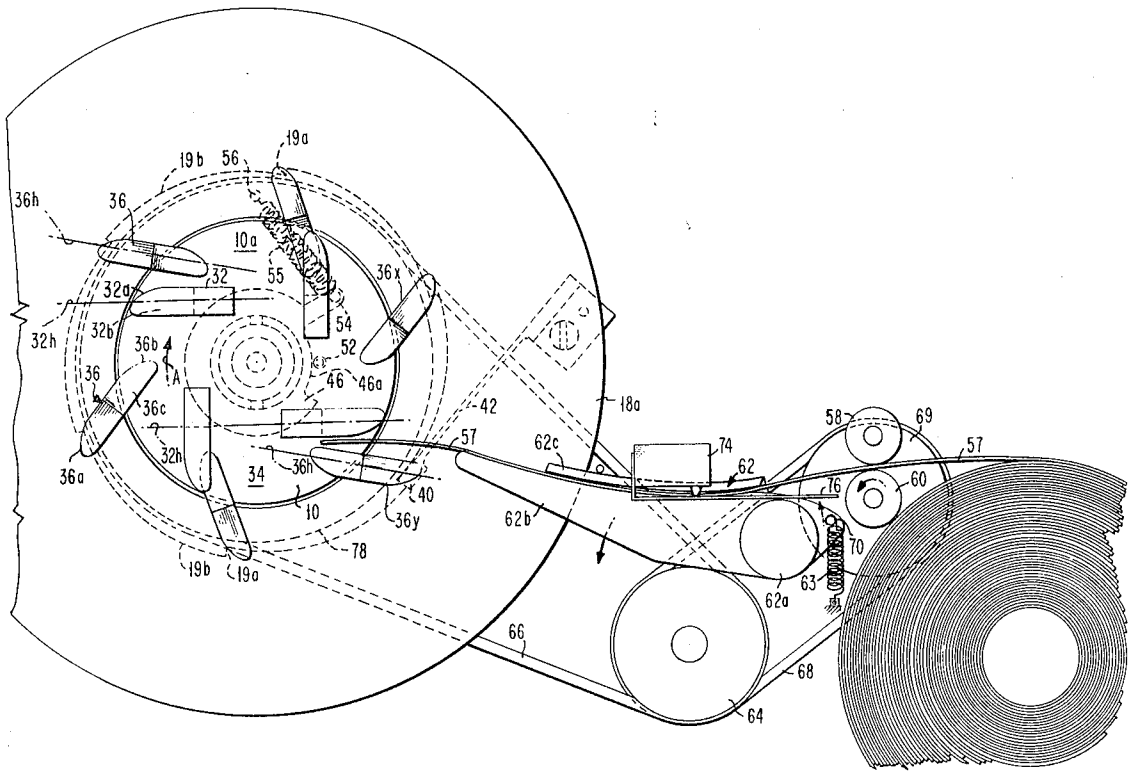
Primary Examiner—John W. Huckert
Assistant Examiner—Edward J. McCarthy
Attorney, Agent, or Firm—Keith T. Bleuer

[57] **ABSTRACT**

A take-up device for a paper web or the like having an inner rotating hub and an outer, initially stationary spool, with the hub and spool carrying vanes between which an advancing paper web may be gripped so that the spool then begins rotation to wind up the web on the outer ends of its vanes. Indexing mechanism for the outer spool is provided so that a web guide directs the advancing paper web between two of the vanes of the initially stationary outer spool, and the indexing mechanism includes a spring for returning the outer spool to this non-blocking position for the web when a completed roll of web is removed from the spool.

10 Claims, 5 Drawing Figures



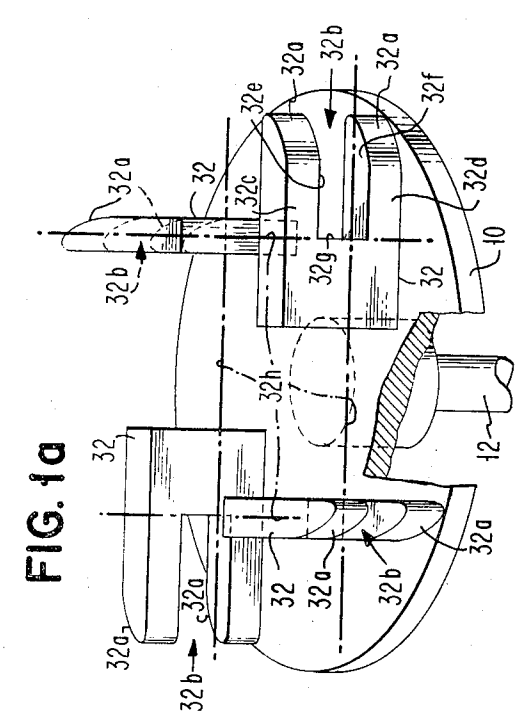


FIG. 1a

FIG. 1

FIG. 2b

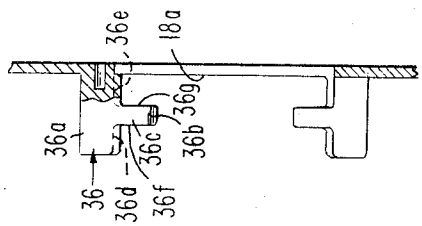


FIG. 2

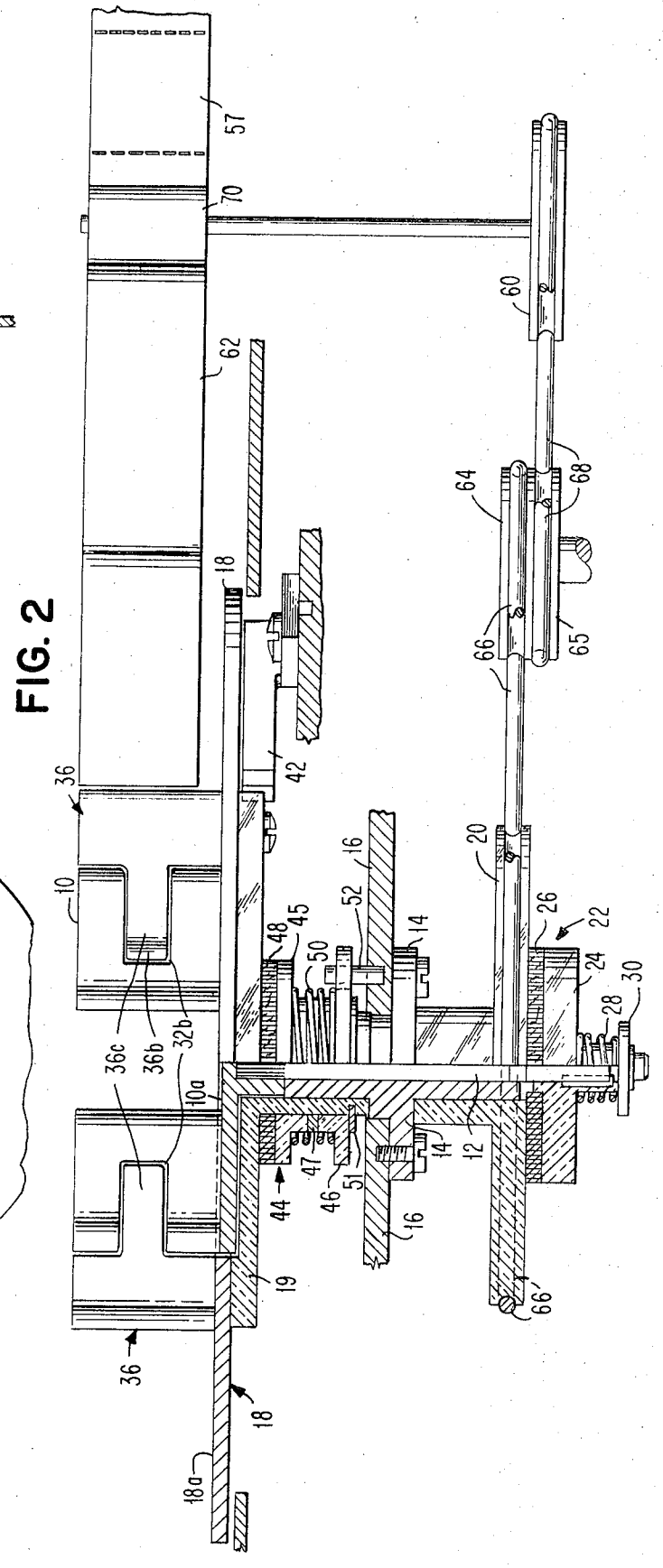
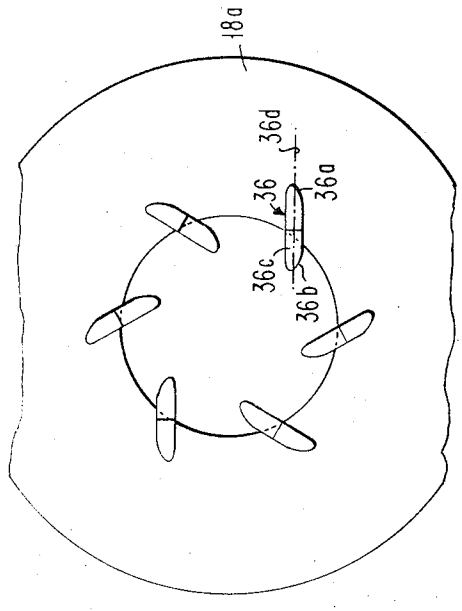


FIG. 2a



SELF-THREADING TAKE-UP SPOOL DEVICE

BACKGROUND OF THE INVENTION

The invention relates to winding devices for paper webs.

Winding devices for webs have previously been suggested in which the leading end of a web is inserted into a groove of the winding device, with a relatively rotatable part of the device subsequently gripping the forward end of the web between it and the grooved part of the device so that winding action may then proceed. Such devices are, for example, disclosed in the U.S. Patents to Morse No. 2,390,894 and Winkel No. 3,201,059. Due to the constructions of such prior devices, it has been necessary for the leading end of the web to be inserted through a groove manually, and operating time is thus lost for this manual operation.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an improved winding device which is self-threading so that the leading end of a web, such as of paper, may simply be thrust into the device; and the forward end of the web will be gripped so that winding action can begin, without a cessation for manually fastening the leading end of the web with respect to the device.

More particularly, it is an object of the invention to provide two relatively rotatable members in such a device, the outer rotatable member or spool being initially stationary and the inner rotatable member or hub being constantly driven, with vanes that are relatively far apart being located on the inner hub and outer spool, so that a web may be thrust between spaced vanes on the outer spool and will be gripped between one of these vanes and a vane on the inner hub to fasten the leading end of the web with respect to the winding device.

It is another object of the invention to provide means for indexing the outer spool so that the vanes on the outer spool are in position such that they will not block an advancing leading end of a web as the web is moved into the winding device.

In a preferred form, the winding device includes an inner hub and an outer spool each carrying spaced vanes. These vanes are nearly radially disposed on the hub and spool, are quite widely spaced, and are disposed on chords that are somewhat spaced from the centers of the spool and hub. Therefore, a paper web may be directed from the side over a vane of the spool to be gripped between it and a vane on the hub for thereby completing a self-threading action of the web and initiating rotation of the spool for winding the web on the vanes of the spool. A friction brake and indexing device is provided for the outer spool which allows the spool to rotate indefinitely in the direction of rotation of the hub but which rotates the spool backwardly for a small angle after a completed web roll has been removed from the spool, so that the vanes of the spool again will be in a non-blocking position with respect to the leading end of another length of web that is to be wound up.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevational view of the winding device or take-up reel of the invention and including a constantly rotatable inner vaned hub and an outer, initially stationary vaned spool;

FIG. **1***a* is a perspective view of the vaned hub;

FIG. **2** is a plan, partly sectioned view of the winding device;

FIG. **2***a* is a face view of the outer spool; and

FIG. **2***b* is a side elevational view of the spool, with portions of the spool being shown in section for clarity of illustration.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, the takeup reel illustrated therein may be seen to comprise a hub **10** which is fixed on a shaft **12.** The shaft **12** is rotatably mounted in a bearing **14** which is fixed within a stationary support **16.** A spool **18** is fixed with respect to an intermediate member **19,** and the member **19** is rotatably disposed on the bearing **14** so as to rotatably mount the spool **18.** The hub **10** and the spool **18** respectively have surfaces **10***a* and **18***a* that are in near-alignment, with the surface **10***a* being slightly depressed with respect to the surface **18***a.*

The shaft **12** is driven from a pulley **20** through a slip clutch **22.** The clutch **22** comprises a hub **24** keyed with respect to the shaft **12** and a disk **26** of friction material disposed between the pulley **20** and the hub **24.** A spring **28** disposed between the hub **24** and a retainer washer **30,** which is fixed on the end of shaft **12,** keeps a predetermined pressure on the friction disk **26.**

The hub **10** is provided with four vanes **32,** and the spool **18** is provided with six vanes **36.** Each of the vanes **32** has a rounded end **32***a* and has an inwardly extending slot **32***b* forming spaced lug portions **32***c* and **32***d.* The vanes **32** provide outer edges **32***e*, **32***f* and **32***g* in addition to the outer edges or ends **32***a.* The vanes **32** are approximately radially disposed and, in particular, are disposed on chords **32***h;* and, when a particular vane **32** is in a horizontal position as seen in FIG. **1,** for example, the chord **32***h* is located vertically above or below the center of the hub **10** and shaft **12.** Each of the vanes **36** has rounded ends **36***a* and **36***b* and has inwardly extending, relatively narrow projections **36***c* adapted to enter and to pass through the slots **32***b* of the vanes **32.** The vanes **36** provide inner edges **36***d*, **36***e*, **36***f* and **36***g*, in addition to the inner edges or ends **36***b;* and these edges pass in close proximity to the edges **32***a*, **32***e*, **32***f* and **32***g* as the projections **36***b* pass through the slots **32***b.* The vanes **36** are also approximately radial and are disposed on chords **36***h* spaced with respect to the center of the shaft **12.**

The intermediate member **19** is provided on its outer edge with teeth **19***a* and arc-spaced cam portions **19***b*, and a pawl **40** is adapted to engage with the teeth **19***a* and to ride on the surface portions **19***b.* The pawl **40** is disposed on one end of a resilient strip **42** which has its other end fixed.

The intermediate member **19** fixed to the spool **18** is effective on a friction device **44.** The device **44** comprises collars **45** and **46** having an interdigitated connection **47** therebetween allowing relative axial movement between the collars **45** and **46** but preventing any relative motion between the collars. A friction disk **48** is disposed between the collar **45** and the intermediate member **19,** and a spring **50** is disposed between collars **45** and **46.** A snap ring **51** holds the collar **46** from axially movement with respect to the intermediate member **19,** and spring **47** thus applies a pre-determined pressure on the friction disk **48.**

The collar **46** has a peripheral slot **46***a* formed therein, and a stud **52** extends into the slot **46***a* and is anchored with respect to the stationary support **16.** The collar **46** is formed with a radially extending arm **54,** and a spring **55** extends between the arm **54** and a fixed pin **56.**

A paper web **57** derived from any suitable source is adapted to be wound on the spool **18.** The web **57** is fed toward the spool **18** by means of a pressure roll **58** having a nip with a drive roll **60** between which the web **57** passes. The web **57** passes through a web guide **62** to the spool **18.** The guide **62** is rotatably mounted at **62***a* and has a relatively elongate lower portion **62***b* and a relatively short upper portion **62***c* between which the web **57** passes. A spring **63** is provided for yieldably holding the guide **62** to the limit of its movement in the clockwise direction as seen in FIG. **1** in which the guide **62** is illustrated in this figure.

The pulley **20** and the feed roll **60** are driven from a common drive, such as pulleys **64** and **65** rotatively driven from any suitable prime mover (not shown). The pulley **64** drives the pulley **20** by means of a belt **66,** and the pulley **65** drives a belt **68** and a pulley **69.** The drive roll **60** is fixed with respect to the pulley **69** and is driven thereby.

The spring **63** is anchored with respect to the guide **62** by means of a pin **70.** An electric switch **74** is located above and to the side of the guide **62** and has an actuating arm **76** located above the pin **70.** The pin **70** is adapted to strike the arm **76** as the guide **62** swings.

In operation, the pulleys **64** and **65** are driven, and the web **57** is propelled by means of the rolls **58** and **60** through the guide **62,** and particularly between its parts **62***b* and **62***c*, toward the spool **18** and hub **10.** The guide **62** is then in its position as illustrated in FIG. **1.** The pulley **20** is driven from the pulley **64** through the belt **66,** and the hub **10** is driven (in direction A) through the shaft **12** and clutch **22** from the indexed to its position as illustrated in FIG. **1** in which two particular vanes **36***x* and **36***y* are located adjacent to the end of the guide **62,** in particular with the vane **36***y* being located at about the same level as the end of the guide **62.** The web **57** is directed upwardly to a slight extent by the guide **62** as illustrated in FIG. **1,** and the web **57** in being propelled forwardly lies over the top of the vane **36***y;* and one of the vanes **32** moves down the top of the web **57** so that the end of the web **57** is gripped between the vane **36***y* and the vane **32** approaching the vane **36***y*. The end of the web **57** is, in particular, gripped between the arm portions **32***c* and **32***d* of this particular vane **32** as the arm portions **32***c* and **32***d* move to pass around the projection **36***c* of the particular vane **36***y*. This passage would actually take place if the end of the web **57** were not lying on top of the vane **36***y*. The web **57** at this time has an edge thereof substantially in contact with the surface **18***a* of the spool **18**; and, since the surface **10***a* is depressed slightly with respect to the surface **18***a*, no binding or impeding action on the web **57** in its forward motion takes place with respect to the surface **10***a*.

The end of the web **57** forms a driving connection between this vane **32** and the vane **36***y*, and the spool **18** thereupon is driven and begins rotation. The intermediate member **19** rotates along with the spool **18** and puts a drive torque on the collars **45** and **46** through the friction drive **44.** The collar **46** has only a limited rotation determined by the arm **54** which strikes the stud **52** after about 45° of rotation of the collars **45** and **46.** This rotation of the collars **45** and **46** is against the action of the spring **55** which elongates at this time. After the arm **54** has struck the stud **52,** the collars **45** and **46** are stationary, and the friction device **44** slips.

The hub **10** and spool **18** continue rotation as the web **57** is fed by the rolls **58** and **60** through the guide **62,** and the web **57** rolls up on the outer ends **36***a* of the vanes **36.** The web **57** is moved by the rolls **58** and **60** initially into the vanes **32** and **36** at about the same speed as the peripheral speed of the vane ends **36***a;* however, as the roll of web **57** on the outer ends **36***a* of the vanes **36** increases in diameter, the peripheral speed of the web in roll form tends to be greater than the longitudinal speed of the web **57** as propelled by the rolls **58** and **60;** so therefore, at this time, the clutch **22** slips. The arm **54,** during this winding action, remains in contact with the stud **52,** with the spring **55** in an elongated condition.

As the roll of web **57** winds up on the outer ends **36***a* of the vanes **36,** the end of the guide **62** contacts the roll of web on the spool **18** and rotates the guide **62** downwardly as seen in FIG. **1,** elongating the return spring **63.** Eventually, when the guide **62** has been rotated at a sufficient angle corresponding to a large diameter of web **57** on the spool **18,** the guide **62** will have rotated sufficiently so that its pin **70** strikes the arm **76** of the switch **74.** Shortly thereafter, the roll of web **57** on the spool **18** will have increased sufficiently so that the switch **74** is actuated. This indicates that the roll of web **57** on the spool **18** has reached such a diameter that it should be removed from the spool **18,** and the switch **74** may be used for shutting off the machine and in particular de-conditioning the prime mover for the pulleys **64** and **65** from operation. When the hub **10** and spool **18** are stationary, the roll of web **57** on the outer ends of the vanes **36** may be simply removed from the spool **18** by drawing the roll of web upwardly off of the vanes **36,** away from the surface **18***a* of the spool **18.** The vane **36***y* and the vane **32** cooperating with the vane **36***y* for gripping the leading end of the web **57** have no particular impeding action with respect to this withdrawal of the completed roll, since the arms **32***c* and **32***d* of this vane **32** have been prevented by the leading end of the web **57** from embracing the projection **36***c* of the vane **36***y*.

With no connection between the vane **36***y* and the cooperating vane **32,** the spool **18** again is free with respect to the hub **10,** and the spring **55** at this time has the action of rotating the spool **18** slightly in the reverse direction. The spring **55** is effective through the collars **45** and **46** and through the friction device **44.** This rotation continues until the pawl **40** strikes a tooth **19***a* of the member **19** and prevents any additional reverse rotation of the spool **18.** The teeth **19***a* are so located with respect to the vanes **36** that the vanes **36** will then be in their positions as illustrated in FIG. **1,** with one of the vanes, such as the vane **36***y*, being located at about the same level as the end of the guide **62** so that a succeeding length of web **57** is directed over the top of a vane **36,** such as the vane **36***y*.

When the prime mover is again put into operation, the succeeding length of web **57** feeds over the top of a stationary vane **36** so that the leading end of the web **57** is again gripped between this particular vane **36** and a vane **32** that is at the time moving toward this vane

36. The winding action then takes place again for forming another roll of web on the spool **18,** exactly in the manner just described.

Advantageously, the winding device including the vaned hub **10** and vaned spool **18** is self-threading, and it is only necessary for the web **57** to be thrust inwardly, generally toward the center of the shaft **12,** in order to cause the leading end of the web **57** to be gripped by the device so that subsequent winding may take place. This self-threading action is due to the fact that the vanes **36** are quite widely spaced on the spool **18,** and the vanes **32** are quite widely spaced on the hub **10,** with both vanes **32** and **36** being relatively narrow and extending generally in the radial direction. Considering both of the hub **10** and spool **18,** the thicknesses of the vanes on cylinders of the greatest diameters passing through the full widths of the vanes take up only 1/10 to 1/12 of the circumferences of these cylinders. Such a cylinder **78** is shown for the spool **18** in FIG. **1** in dotted lines. The vanes **32** and **36** are disposed on the chords **32***h* and **36***h* so that, as the web winds up on the outer edges of the vanes **36,** less than a right angle of bend is put into the web **57** between its gripped leading end and its first contact with the outer edge of a vane **36.** For this purpose, the chords **32***h* and **36***h* slant in a direction rearwards with respect to the direction A, looking at the vanes from their inner ends to their outer ends. The curved ends **32***a* of the vanes **32** also maintain this angle less than a right angle. The curved ends **32***a* of vanes **32** and the curved ends **36***a* and **36***b* of vanes **36** also help to assure that there shall be no butt ending of the forward end of the web **57** with any of the vanes when the web **57** is fed into the vanes **36** and **32.** In this connection, it will be noted that the hub **10** is unencumbered at its center; and only the vanes **32** are on the surface **10***a*. Occasionally, the web **57** will pass completely through the center of the hub **10,** and this passage is therefore not prevented by any such central obstruction on the surface **10***a*. The indexing mechanism comprising the spring **55** and the pawl **40** assures that after a wound web is removed from the spool **18,** sufficient rotative movement of the spool **18** occurs so that the space between adjacent vanes of the spool **18** (for example the vanes **36***x* and **36***y*) lies directly in front of the web exit end of the guide **62** defined by the end of the guide to assure that butt ending of the forward end of the web **57** does not occur on the vanes **36.**

I claim:

1. A winder for a sheet material web comprising:

a hub carrying a plurality of spaced outwardly extending vanes;

means for drivingly rotating said hub; and

a rotatable spool carrying a plurality of spaced outwardly extending vanes and disposed so that, as said hub rotates, the outer edges of the vanes thereof pass in close proximity to inner edges of the vanes of said spool, whereby a web thrust between the vanes of said spool is gripped between a vane of said spool and a vane of said hub and the spool is thereby driven to wind the web on the outer ends of the vanes of said spool.

2. A winder as set forth in claim **1,** the thicknesses of said vanes of said hub and spool taking up 1/10 or less of the circumferences of the greatest diameter cylinders passing through the full widths of said vanes of said hub and spool.

3. A winder as set forth in claim **1,** said inner edges of the vanes of said spool defined by inwardly extending projections on the vanes and the outer edges of the vanes of said hub being defined by a pair of outwardly extending lug portions on each of the vanes embracing said projections as said hub rotates with respect to said spool.

4. A winder as set forth in claim **1,** said vanes being disposed on chords that are slanted from the inner edges to the outer edges of the vanes in a direction reverse to the direction of rotation of said hub.

5. A winder as set forth in claim **1,** the outer edges of the vanes of said hub and both the inner and outer edges of the vanes of said spool being curved in cross section.

6. A winder as set forth in claim **1** and including means for driving said web between vanes of said spool and synchronized with said means for drivingly rotating said hub.

7. A winder as set forth in claim **1** and including means for rotating said spool reversely through a small angle and for indexing the spool in a pre-determined position after a roll of the web has been removed from the spool, said reverse driving and indexing means including a frictional connection between said spool and a stationary member with an element of the connection having a pre-determined limited rotation with respect to the stationary member, a spring connected to said limited rotation element and which is stressed as the spool winds the web thereon and which rotates the spool for said small angle in the reverse direction when a wound web is removed from the spool, and pawl means effective on said spool for limiting the reverse rotation of the spool to said small angle.

8. A winder as set forth in claim **1** and including means for drivingly rotating said spool through a small angle in the reverse direction and for indexing the spool at the end of this small angular rotation when a wound web roll is removed from said spool whereby to position said vanes of said spool at pre-determined positions.

9. A winder as set forth in claim **8** and including a guide for directing the web inwardly of said spool and hub and positioned to direct the web between adjacent ones of said spool vanes when the spool is in one of its indexed positions.

10. A winder as set forth in claim **9,** said guide being swingably mounted and being adapted to be contacted by the web as wound on said spool vanes so as to swing the guide, and a control member actuated by said guide as the guide is swung with an increasing diameter of wound web on said spool.

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