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[54] **APPARATUS FOR FEEDING STRIP MATERIAL**
10 Claims, 4 Drawing Figs.

[52] U.S. Cl. **242/210,** 242/71.8, 242/76, 242/195
[51] Int. Cl. **G11b15/66,** B65h 17/06
[50] Field of Search 242/195, 192, 197, 198, 210, 74, 74.1, 74.2, 71.8, 76; 352/158, 151

[56] **References Cited**

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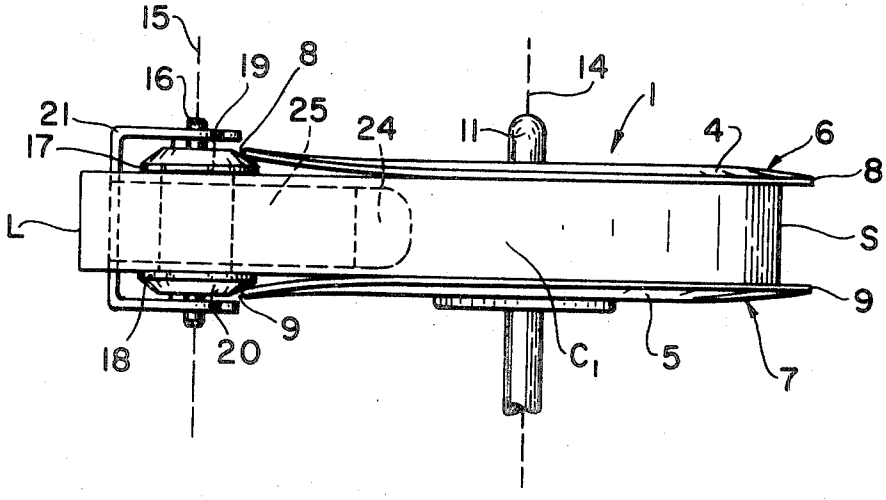
ABSTRACT: The outermost convolution of a roll of strip material is restrained from unwinding by transverse engagement with the opposed flanges of a reel on which such strip is wound. Upon rotation of the reel about the roll axis, a roller arm temporarily flexes successive opposed regions of the flanges away from each other as such regions are respectively rotated therepast. Such local flexing of the flanges releases corresponding successive portions of the outermost convolution of strip material on the reel from transverse engagement therewith and effects, by a strip guider member on the roller arm, separation and feeding of the leading strip end from the rotating roll.



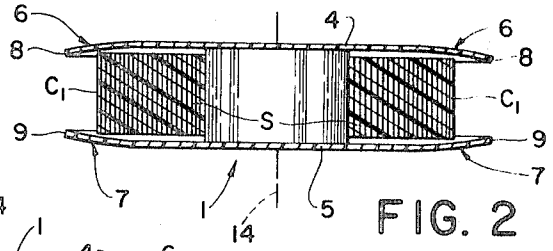


FIG. 2

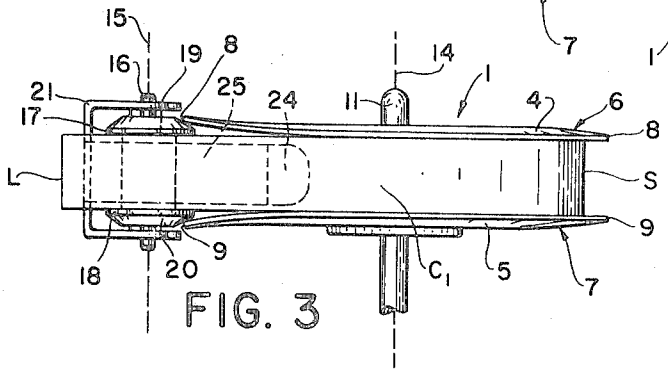
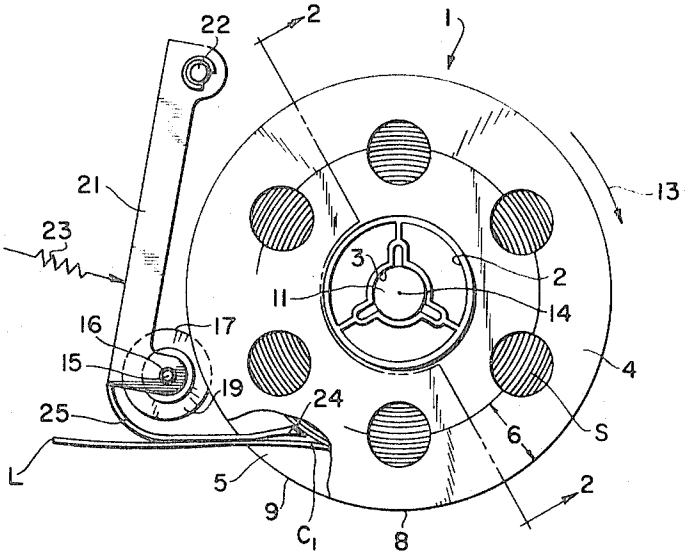


FIG. 3

FIG. 1



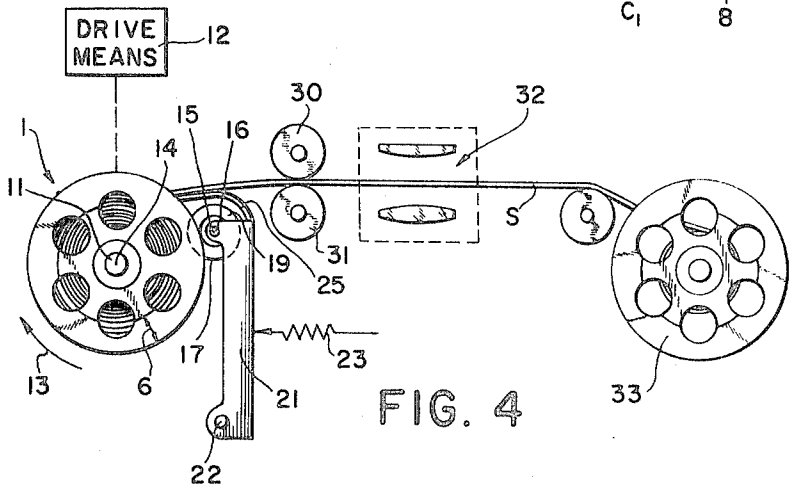


FIG. 4

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APPARATUS FOR FEEDING STRIP MATERIAL

CROSS-REFERENCE TO RELATED APPLICATION

Reference is made to commonly assigned copending U.S. Pat. application, Ser. No. 67,455, entitled STRIP FEEDING APPARATUS AND METHOD filed in the name of Elmer O. Wangerin concurrently herewith on Aug. 27, 1970.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to unwinding of strip material from a reel or other support for use at a predetermined location, and more particularly to an improved apparatus by which the separation and feeding of a leading, i.e., free end portion of strip material from a convoluted roll of such material is facilitated. Moreover, this invention relates to a reel of the kind adapted to restrain the outermost convolution of resilient strip material wound thereon from unwinding, and to a novel flange flexing-strip guiding apparatus used with such reel for automatically feeding the wound strip therefrom.

2. Description of the Prior Art

Sensitized material presently used for the recording and playback of audio and/or visual information frequently takes the form of a weblike strip. Generally, such strip material is of a plasticlike resilient substance, such as for example "Mylar," which has a tendency when coiled to straighten out. Consequently, when a strip of the sensitized resilient material is tightly wound on a reel for storage, as is the common commercial practice, the material's "straightening-out" propensity may induce the leading edge and successive portions of the reeled strip to loosen and spill off the reel in an unwinding manner.

To prevent his undesired spilling of the stored strip off the reel, magazines or other protective containers are often provided to house the reel and secure the material wound thereon; however, a common deficiency of the aforementioned strip securing structures is that each container must be removed before the reel and wound material can be used. During removal from and insertion back into the container, the strip material is no longer secured and therefore subject to unwinding and spillage from the reel. Further, in some instances the strip material on the reel is identified by markings on the particular container therefor so that a separation of the reel from its particular container creates the possibility of a loss of identification of the strip material.

Recently, magazine-reel units have been devised, such as disclosed in commonly assigned U.S. Pat. No. 3,467,340, in which a strip bearing reel is rotatably mounted and retained within a protective magazine during storage and feeding of strip material from the reel to a location outside the magazine for use. In the aforementioned U.S. patent, the leading end of resilient strip material wound on the reel is caused to separate from the strip roll and enter a guide channel by flexing successive regions of the reel flanges toward one another as the reel is rotated in an unwinding direction and, thereby, transversely pinching successive portions of the outermost convolutions of the roll. Since the resilient strip material resists being longitudinally flexed or bowed in transverse opposed directions, the leading end of the moving strip is caused to move tangentially outwardly from the strip roll and into contact with a generally cylindrical internal guide surface defined by a peripheral guide member substantially surrounding the roll, whereby the leading end of the strip is directed into the previously mentioned guide channel. Although this strip storing and feeding apparatus is very reliable, it is generally necessary to first orient the magazine in the strip feeding station before feeding the strip material from the reel to a location outside the magazine for use, and to hold the magazine in such an oriented position during the strip feeding. Moreover, the requirement of the specially formed magazine adds to production time and costs.

Other known devices which prevent the undesired spilling of wound strip material from a reel, include a reel having

resiliently flexible flange members normally disposed in an inwardly concave manner with respect to each other, such as disclosed in U.S. Pat. No. 2,005,405. In such a reel, the peripheral edges of the flange members are spaced apart a distance slightly less than the width of the wound strip to frictionally engage the opposite longitudinal edges of the outermost strip convolution, thereby restraining the leading end portion of the wound strip from unwinding off the reel. However, reels of this kind, as previously used for winding and unwinding of strip material therefrom, have definite limitations as they constantly exert transverse pressure on the opposite edges of the strip convolutions as such convolutions are successively wound onto and off the reel.

Accordingly, it can be seen that a need exists for a reel which, without the assistance of a magazine, selectively restrains the outermost convolution of strip material wound thereon from unwinding and spilling off such reel, and which can be used in combination with means to facilitate automatic feeding of the leading strip end from the reel.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide an improved combination strip storage and feed apparatus for supporting a roll of strip material and for feeding a leading strip end from a roll supported by such apparatus.

It is a further object of the present invention to provide a novel combination strip storage and feed apparatus for releasably securing the leading end of a stored roll of strip material and for feeding such a released strip end from the roll.

Another important object of the present invention is to provide an improved strip feed apparatus for separating the leading strip end from a roll of convoluted strip material.

Still another object of the present invention is to provide a storage reel adapted to restrain the outermost convolution of strip material wound thereon from unwinding and spilling off such reel, and to provide novel strip releasing apparatus operable with the reel to feed the outermost strip convolution from the reel for use at a predetermined location.

In accordance with a preferred embodiment of the present invention the outermost convolution of a supported roll of strip material is transversely engaged between force applying members, such as the opposed flanges of a reel on which such strip is wound, whereby the outermost strip convolution is restrained from unwinding off the reel and is held for rotation therewith. Upon rotation of the reel about the roll axis, a flange flexing assembly located adjacent the rotating reel temporarily flexes successive opposed regions of the flanges away from each other as those regions are respectively rotated therepast. Such local flexing of the flanges, in turn, temporarily releases corresponding successive portions of the outermost convolution of strip material on the reel from transverse engagement therewith and effects, by a strip guide element, separation and feeding of the leading strip end from the rotating roll at a location rearward, in the direction of unwinding, from the flange flexing assembly. This separation and feeding of the leading end of the outermost convolution is facilitated by the transverse frictional contact of trailing portions of that convolution with reel flanges, whereby those portions rotate with the reel and drive the released leading end along the strip guide member in an outward direction away from the rotating reel.

BRIEF DESCRIPTION OF THE DRAWINGS

The above-mentioned and other features and objects of the present invention and the manner of obtaining them will become more apparent by reference to the following detailed description of the preferred embodiment of such invention taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a perspective view of a reel of the type on which the outermost convolution of wound strip material is transver-

sely engaged by the reel flanges, and novel flange flexing-strip guiding apparatus in accordance with a preferred embodiment of the present invention, showing a portion of the reel removed for the purpose of illustrating the manner in which the leading strip end is fed from such reel;

FIG. 2 is a section of the reel and wound strip material as viewed along the line 2—2 in FIG. 1;

FIG. 3 is a partial elevated view as seen from the lower side of FIG. 1; and

FIG. 4 is a plan view of the reel and flange flexing-strip guiding apparatus disposed in one schematically illustrated embodiment in which they can be used.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings and in particular to FIGS. 1 and 2, there is shown a reel 1 of the type having an inner cylindrical hub member 2 of appropriate width to accommodate the desired width of strip material and of sufficient diameter to provide means, such as for example a spindle bore 3, for the rotatable mounting of the reel. Suitable structure (not shown) may be provided at the reel hub for facilitating attachment thereto of the trailing end of an elongate, resilient strip of web material S wound on the reel in a convoluted roll or coil. Preferably, such material S has a resilient tendency to uncurl, i.e., assume a substantially linear disposition when not held in a curved shape. With reference to FIG. 2, it can be seen that the reel has a pair of opposed, circular flanges or guide surfaces 4 and 5 which extend radially outwardly in uniform spaced relation from the reel hub to inclined flange portions or sections 6 and 7. Likewise, the spacing between such flange portions gradually diminishes in a radial outward direction to a dimension slightly less than the width of strip S. Consequently, the outermost convolution, i.e., the peripheral winding, C1 of the wound strip S is transversely engaged by the inclined flange portions 6 and 7 at the longitudinal edges of such strip convolution; and in such way, the outermost convolution of the wound strip S is restrained from unwinding off the reel and frictionally held for rotation therewith.

Although in the illustrated embodiment of the reel 1, only the outermost convolution C1 of the wound strip S is transversely engaged by the flanges 4 and 5 as shown in FIG. 2, it will be appreciated that further strip convolutions contiguously succeeding inwardly from the outermost convolution can be similarly engaged. Moreover it will be appreciated, as will become apparent hereinafter, that other reel flange configurations are suitable for use with the present invention. For example, the reel flanges could be disk-shaped or inwardly concave as disclosed in U.S. Pat. No. 2,005,405.

The reel 1 may be formed of any suitable material; however, a material which permits easy flexure away from each other of successive opposed peripheral regions of the inclined flange portions 6 and 7 has been found to be particularly desirable. The reel flanges 4 and 5 shown in FIGS. 1–3 are constructed of a resiliently flexible plastic material and, because of the dimension between the outer portions 6 and 7 thereof, will be inherently biased toward and transversely hold therebetween the outermost convolution C1 of the wound strip roll S which has a greater width dimension than the space between such outer flange portions.

A preferred embodiment of the apparatus used with the reel 1 to effect feeding of the wound strip S from the reel for use, is shown in FIGS. 1, 3 and 4. The spindle bore 3 of the reel can be mounted on a driven spindle of the conventional type or the reel can be mounted on other suitable holding and positioning structure. With respect to the embodiment illustrated in FIGS. 1, 3 and 4, the strip feeding operation will be described with the reel mounted on a spindle 11 which is rotated by drive means 12. Such drive means is adapted to rotate the reel in a strip unwinding direction 13, i.e. clockwise as viewed in FIGS. 1 and 4, about the axis 14 of the wound strip roll. Located adjacent the reel on an axis of rotation 15 parallel to the rotational axis 14 of the reel is a shaft 16 having mounted thereon in spaced relation a pair of circular rollers 17 and 18 respectively with inwardly beveled edges 19 and 20, see FIG. 3. The shaft 16 is mounted for rotation on an arm 21 which is pivotally mounted on shaft 22 and urged towards the reel 1 by a spring 23 or other such means. The rollers 17 and 18 are apaced apart on the shaft 16 a distance greater than the width of the wound strip S; accordingly, upon pivoting of the arm 21 about the shaft 22 towards the reel, the tapered roller edges 19 and 20 respectively contact opposed, outer peripheral regions or areas of the inclined flange portions 6 and 7 and, as most clearly shown in FIG. 3, flex those regions of the flange portions away from each other to release from transverse engagement the corresponding portion of the outermost strip convolution C1 located therebetween. Although in the illustrated embodiment, the rollers 17 and 18 are not driven and merely idle on the reel flanges, it will be readily apparent that suitable drive means can be imparted to the shaft 16 so as to drive the reel by this means rather than by the drive spindle 11 which engages the reel as shown in FIG. 3 for example.

Because the outermost convolution C1 of the wound strip roll S is frictionally held by the reel flanges 4 and 5 as shown in FIG. 2, such convolution will be supported for rotation with reel 1. Upon rotation of the reel about the roll axis 14 as previously described, the opposed rollers 17 and 18 temporarily flex successive opposed regions or areas of the inclined flange portions 6 and 7 away from each other as those regions are respectively rotated past the rollers. This local flexing of opposed regions of the flange portions, in turn, temporarily releases corresponding successive portions of the outermost strip convolution C1 from transverse engagement therewith, see FIGS. 1 and 3. When the leading edge portion L on the outermost convolution of the wound strip S is rotated with the reel in the direction 13 of unwinding to a location immediately preceding the rollers 17 and 18, the opposed regions of the flange portions 6 and 7 alongside the rollers will be flexed apart; whereupon, the leading edge is released by such flexed regions and, because of the aforestated resilient inclination of the wound strip to uncurl when released, the leading edge slightly separates from the next inwardly succeeding convolution of the strip. Since the successive portions of the outermost convolution C1 which trail the leading edge L are frictionally held by corresponding successive regions of the flange portions 6 and 7, such convolution portions rotate with the reel to drive the released leading edge over a beveled end 24 of strip guide member 25 on the arm 21, see FIG. 1. Therefore, in accordance with the present invention, the leading strip portion L and successive trailing portions of the outermost convolution C1 of the wound strip S are fed, toward the outer peripheral flange edges 8 and 9, along the guide member 25 and thus from the rotating reel.

The strip guide member 25 is preferably formed of an appropriate resiliently flexible material and is urged by the spring 23 to a position at which the beveled end 24 of such member is disposed interjacent the inclined flange portions 6 and 7, see FIG. 1. As the member 25 is so formed, it is suited for use with various amounts of strip material S wound on the reel 1.

With reference to FIG. 1, it can be seen that the beveled end 24 of strip guide member 25 is located rearward in the direction 13 of unwinding from the rollers 17 and 18 at a site therebelow; however, it should be appreciated that such member end can be similarly positioned at other sites. For example, the member end 24 can be located rearward in the direction of unwinding from the rollers 17 and 18 at a site thereabove.

FIG. 4 schematically illustrates the reel 1 and the flange flexing-strip guiding apparatus 16–25 of the present invention as it can be utilized with a system in which a strip feed path is provided for feeding of the strip material S which is, in this instance, photographic film having images thereon to be projected by a projection viewing system. If the reel is mounted on the drive spindle 11 as described hereinbefore, it will be

rotated by the drive means 12 in the direction 13 to effect feeding of the wound strip from the reel. The strip is then fed along a path between suitable drive and idler rollers 30 and 31, past the optical system 32 and onto a takeup reel 33.

From the description hereinbefore, it will now be appreciated by those skilled in the art that a simple and effective system for storing and easily utilizing strip material of the type adapted to be wound on reels is provided by the present invention. Moreover, it will be further appreciated that a novel feeding procedure has been described for effecting feed of strip material wound on a reel to a predetermined location adjacent the reel for subsequent use, and that such procedure need not necessarily incorporate the reel and flange flexing-strip guiding apparatus specifically disclosed herein.

The present invention has been described in detail with particular reference to a preferred embodiment thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention.

I claim:

1. For use with a reel of the type having two spaced flange members which straddle a convoluted roll of strip material wound thereon, wherein at least one flange member is biased toward the other flange member to transversely hold therebetween the outermost convolution of such a wound roll, and wherein regions of the one flange member are each resiliently flexible away from the other flange member to release respectively adjacent portions of the outermost convolution of the wound roll, apparatus for feeding strip material from such reel which comprises:

means for rotating such reel in an unwinding direction;

means positioned with respect to said rotating means for flexing, in turn, successive regions of the one flange member away from the other flange member of such reel as those regions are respectively rotated past a predetermined location along the path of rotation of such reel; and

means for defining a strip feed path between a location interjacent the flange members of such reel and a location spaced from such reel.

2. Apparatus for feeding a leading end of an elongate strip of web material from a convoluted roll of such material wound on a reel between two opposed flange members thereof, wherein at least one flange member is biased toward the other flange member to transversely hold therebetween the outermost convolution of such a wound roll, and wherein successive regions of the one flange member are each resiliently flexible away from the other flange member to respectively release corresponding portions of the outermost convolution of the wound roll, said apparatus comprising:

means for rotating such reel and wound roll in an unwinding direction;

means for flexing, in turn, the successive regions of the one flange member away from the other flange member of such reel as those regions are respectively rotated past said flexing means in the unwinding direction by said rotating means; and

means for defining a strip feed path between first and second predetermined locations as the successive regions of the one flange member are respectively flexed away from the other flange member of such reel by said flexing means, said first predetermined location being interjacent a flexed one of the successive regions and the other flange member, and said second predetermined location being spaced from such reel.

3. Apparatus for feeding a leading end of an elongate strip of web material from a convoluted roll of such material wound on a reel between two opposed flange members thereof, wherein the flange members are inherently biased towards each other to transversely engage therebetween the outermost convolution of such a wound roll and restrain that convolution from unwinding off the reel, and wherein successively opposed regions of the flange members are resiliently flexible away from each other to respectively release corresponding portions of the outermost convolution of the wound roll, said apparatus comprising:

means for supporting such reel and wound roll for rotation about the axis of the roll;

means for rotating such reel and wound roll in an unwinding direction about the roll axis;

flexing means, respectively engageable with the opposed regions of the flange members as such reel and wound roll are so rotated past said flexing means by said rotating means, for successively flexing the opposed regions of the flange members away from each other and out of transverse engagement with the corresponding portions of the outermost convolution of such wound roll; and

means, disposed adjacent said flexing means, for guiding strip material off such wound roll and to a predetermined location spaced from such reel as the reel and wound roll are so rotated past said flexing means by said rotating means.

4. Apparatus as recited in claim 3, wherein said guiding means comprises:

an elongate strip guide member extending successively from between the opposed regions of the flange members and to said predetermined location as such reel and wound roll are so rotated past flexing means by said rotating means.

5. Apparatus as recited in claim 3, wherein said guiding means comprises:

a resiliently flexible strip guide member mounted for movement between an idle position spaced from such reel and wound roll and a strip guiding position extending successively from between the opposed regions of the flange members and to said predetermined location as such reel and wound roll are so rotated past said flexing means by said rotating means; and

means biasing said strip guide member towards said strip guide position.

6. Apparatus as recited in claim 5, wherein said flexing means comprises:

a roller member;

bearing means supporting said roller member in radial alignment with such reel for rotation about a roller axis parallel to the rotational axis of the reel; and

means defining on said roller member two opposed conical surfaces coaxial with said roller axis and engageable with opposed peripheral sections of the respective flange members to successively flex the opposed regions thereof away from each other as such reel is rotated past said flexing means by said rotating means.

7. Apparatus for feeding a leading end of an elongated strip of web material from a convoluted roll of such material, said apparatus comprising:

means for supporting a roll of convoluted strip material for rotation about the roll axis;

drive means for rotating said supporting means and a roll supported thereby in an unwinding direction about the roll axis;

means, attached to said supporting means, for removably applying a transverse edge-restraining force to the outermost convolution of a supported roll to prevent such convolution from unwinding off the supported roll;

means, cooperable with said force applying means, for locally releasing said force from successive edge portions of the outermost convolution of a supported roll as such edge portions are respectively rotated alongside said force releasing means in the unwinding direction by said drive means; and

means, disposed adjacent said force releasing means, for guiding a leading end of a supported roll therefrom and past said force releasing means as the supported roll is rotated in the unwinding direction by said drive means.

8. Apparatus for supporting a convoluted roll of strip material and for feeding a leading strip portion from a roll so supported said apparatus comprising:

a hub member for supporting a roll of convoluted strip material wound thereon;

first and second means mounted on said hub member in spaced, opposed relation for transversely holding therebetween the outermost convolution of a roll supported by said hub member;

said first and second holding means having successively opposed regions thereof which are resiliently flexible away from each other to separate from corresponding portions of the outermost convolution of a supported roll;

means for rotating said hub member, said first and second holding means and a supported roll in an unwinding direction;

means spaced from said hub member for successively flexing said opposed regions of said first and second holding means away from each other as those regions are respectively rotated past said flexing means; and

means for defining a strip guide path between first and second predetermined locations as said opposed regions of said first and second holding means are successively

flexed away from each other by said flexing means, said first predetermined location being interjacent flexed opposed regions of said first and second holding means, and said second predetermined location being spaced from a supported roll.

9. Apparatus as recited in claim 8, wherein said first and second holding means respectively comprise generally circular flange members radially disposed about the axis of rotation of said hub member, and wherein said flexing means if mounted for movement between an idle position spaced from said flange members and a flange flexing position interjacent opposed regions of said flange members.

10. Apparatus as recited in claim 8, wherein said opposed regions of said first and second holding means are respectively spaced apart a distance slightly less than the width of the outermost convolution of a supported roll to frictionally restrain opposite longitudinal edges of such convolution from movement relative to said first and second holding means.

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