

3,309,037

WEB REWINDER

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2 Sheets-Sheet 1

FIG. 1

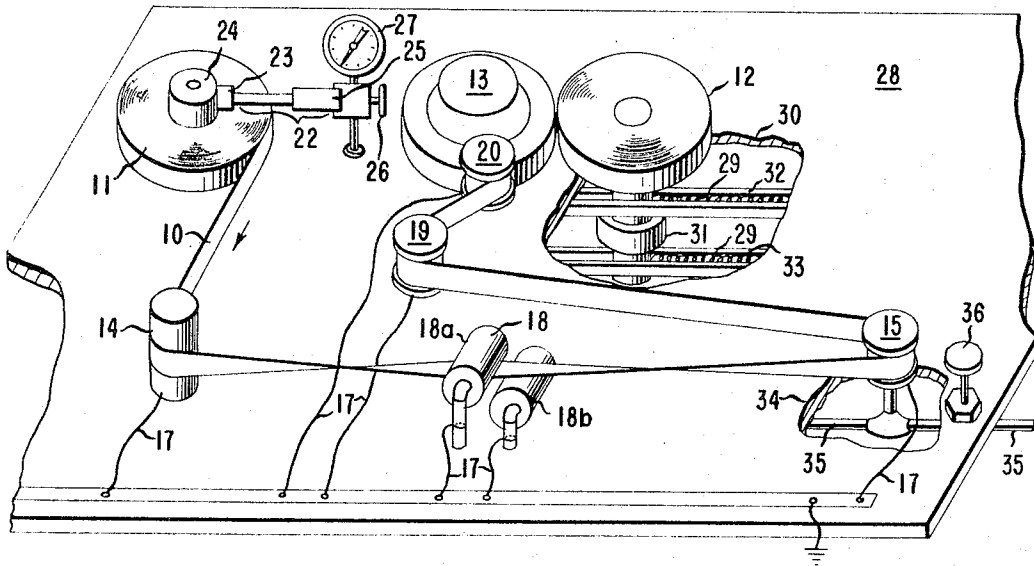
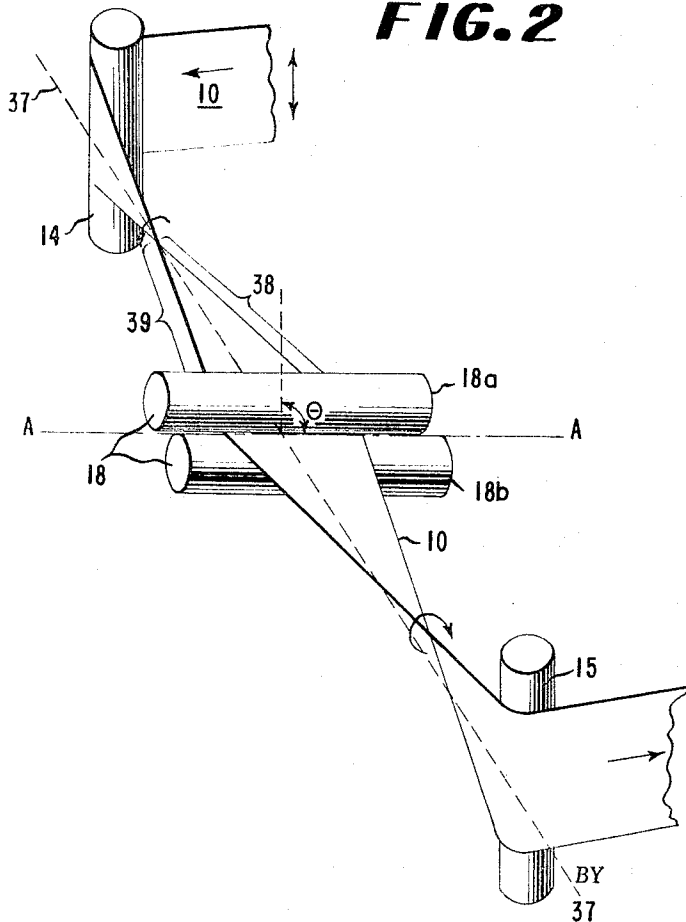


FIG. 2



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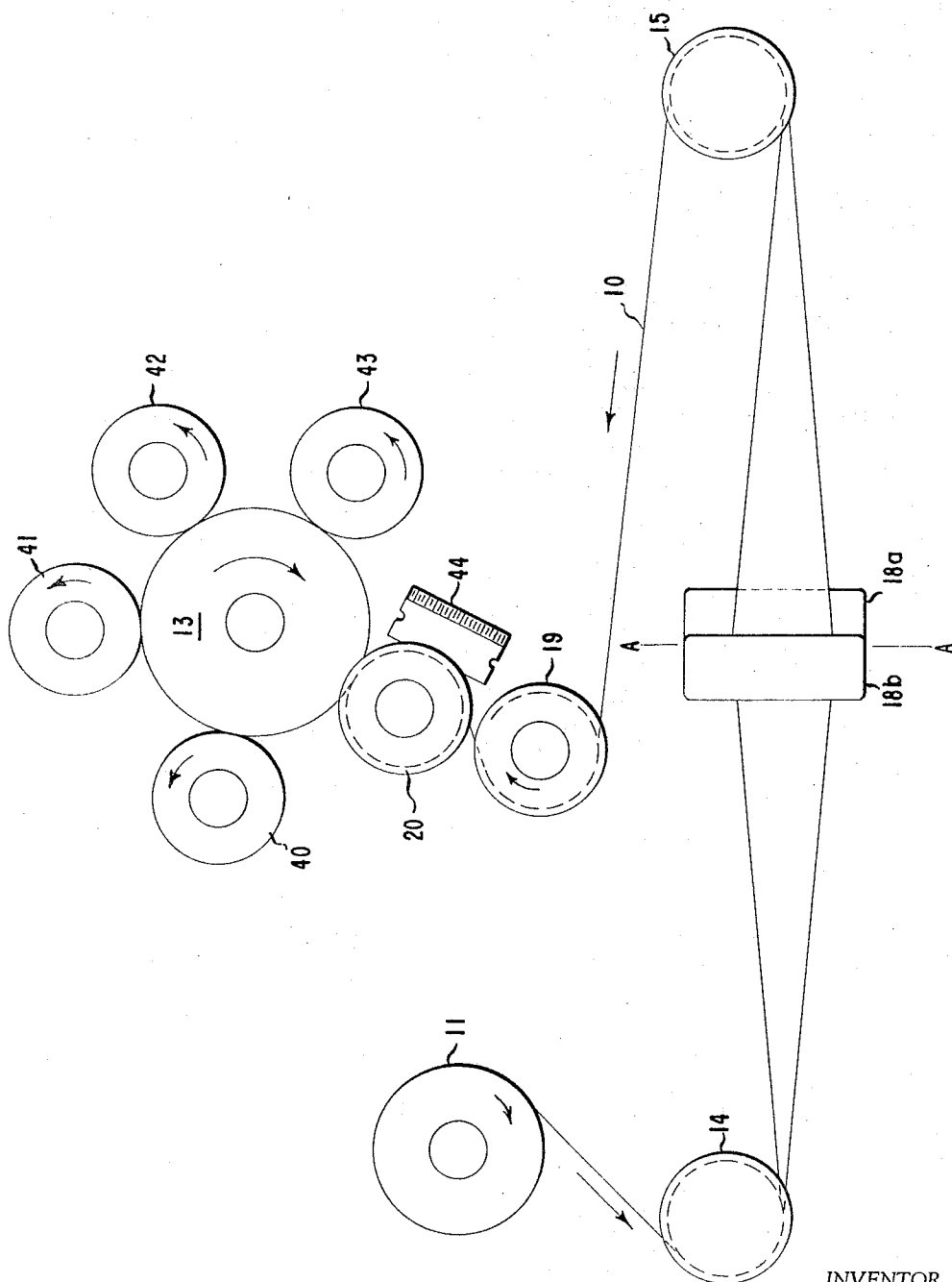
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FIG. 3



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WEB REWINDER

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3 Claims. (Cl. 242-67.3)

This invention relates to web rewinding apparatus and more particularly to web rewinding apparatus which maintains web alignment.

Commonly used web rewinders employ a rewind mandrel driven at a constant number of revolutions per minute and have flanges which are intended to provide smooth ends on the rewound roll. One deficiency in such apparatus is the control of web tension which is accomplished by manually adjusting the braking on the shaft of the unwind mandrel. It is obvious as the windup roll diameter increases, and the linear speed of the web increases, satisfactory control of tension becomes increasingly difficult. Another deficiency is that flanges cannot consistently effect the necessary transverse shifting of the web, especially with the thinner gauge polymer films. The pressure (i.e., force per unit of area) are quite high along the thin edge of the film, especially if the web is under tension sufficient to provide good tightness in the roll. This pressure on the edge of certain tapes can be quite harmful, often initiating delamination of coatings, such as magnetic coatings. In order to avoid these deficiencies, winding speeds are often so slow as to be uneconomical.

It is, therefore, an object of the present invention to provide rewinding apparatus which maintains web alignment and is capable of rewinding a web with substantially uniform tension.

It is another object of the present invention to provide rewinding apparatus capable of elimination of irregularities from the end faces of a roll in rewinding the roll.

It is still another object of the present invention to provide apparatus for the rewinding of webs capable of increased speed rewinding. These and other objects will appear hereinafter.

These and other important objects and advantages of the invention will become apparent as the same is more fully understood from the following description, which, taken in connection with the accompanying drawings, discloses preferred embodiments of the invention wherein:

FIGURE 1 is a view in perspective with the base plate partly cut-away which illustrates the present invention;

FIGURE 2 illustrates the operation of the web alignment element of the present invention; and,

FIGURE 3 schematically illustrates slitting apparatus employing the rewinder of the present invention.

FIGURE 1 illustrates a rewinder constructed according to this invention in which web 10 from supply roll 11 is wound on windup roll 12, driven by surface contact with transport roller 13. In its passage from supply to windup, web 10 passes around guide 14 and guide 15, which are gas permeable sleeves with air emitting from the surface at a rate sufficient to just float the web in spaced relation to the guides. These guides are grounded to an earth ground 16 by low resistance couplers 17, which suffice to reduce static charges to a negligible level.

Interposed between guide 14 and guide 15 are web twisting guides 18. These guides, preferably of porous metal with air emission, are covered with a permeable nylon velvet which serve to twist the web and cause lateral alignment. The use of the nylon velvet coupled with air emission serves to forcibly remove dust without abrasion. Guides 18a and 18b are spaced apart sufficiently to permit web 10 to pass between them free of partial wrap around contact; however, to provide the greatest latitude

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of utility without the necessity of adjustment, guide 18a is in a slightly staggered relationship to guide 18b, i.e., one is positioned farther along in the direction of web motion than the other, which is on the opposite surface of web surface. This arrangement permits a wider gap between the individual elements of this guide while still permitting each element to effectively perform its twisting function.

Continuing in reference to FIGURE 1, web 10, which in the preferred embodiment returns to its initial plane by guide 15, passes successively to guides 19 and 20 which feed it to transport roll 13, about which it partially wraps before passage to windup roll 12. As the diameter of roll 12 increases with web windup, the axis moves along linear track 21 away from transport roller 13. The periphery of roll 12 is urged into contact with roller 13 by spring means 29, which exerts pressure on the axis.

For maintenance of control over supply roll 11 to avoid free-wheeling, or overrunning when stopping, the mandrel of this roll is provided with means for braking. Shown in FIGURE 1 is adjustable compressed air brake 22. Brake shoe 23 presses in frictional contact with cylindrical hub 24 which is co-axially mounted on the shaft of roll 11 so as to engage the core of roll 11 and rotate therewith. Shoe 23 is urged into contact with the hub by compressed air cylinder 25, with pressure of the shoe against the hub controlled by the adjusting of the air, by means of valve 26 the applied pressure is indicated by gauge 27. This braking mechanism is shown above deck 28, which requires that hub 24 be removable and brake 22 be pivoted on deck 28 to swing away to permit roll changes; however, this mechanism can be mounted below the deck if desired. Optionally, in place of an air brake, other types such as an adjustable, spring-loaded brake or a magnetic brake, as is known to those skilled in the art, are satisfactory.

To illustrate elements of the present invention normally positioned below deck 28, cutaway section 30 is provided in the drawing of FIGURE 1. Shown in the cutaway is torque motor 31, which is mounted, preferably with ball-bearing guides on tracks 32 and 33, so that its axis and also that of the windup roll 12 can move away from the axis of transport roller 13 as the diameter of the roll increases. Torque motor 31 drives roll 12, and roller 13 is driven by a separate motor (not shown). The torque of motor 31 is small in comparison to that of the motor which drives roller 13, and is used for its inertial effect to prevent free wheeling of roll 12. This motor supplies a constant torque, independent of speed, and has little tendency to overdrive the roll; thus, the winding torque is supplied in part by surface wind in contact with axially driven roller 13. Peripheral contact between roller 13 and roll 12 has an additional function, however, in supplying ironing action to exclude air between film convolutions in roll formation. Springs 29 are mounted within channel tracks 32 and 33 so as to urge roll 12 in peripheral contact with roller 13. Only light contact is required to effect winding, since roller 13 preferably is equipped with a rubber tire for effective friction.

Shown through cutaway 34 is air line 35 which is coupled to a source of compressed air to provide air to the porous web guides, as shown to guide 15, which is illustrative of the manner of coupling to all of the porous guides. The flow of air through the guides is controlled by needle valve 36, which controls the flow to all guides; optionally individual needle valves can be provided for each guide. Air to brake 22 can be supplied from the same source as for the guides, which is shown as line 35.

An important element of the present invention is that for the rotation of the plane of the web to effect lateral alignment. This is illustrated as the combination of vertical guides 14 and 15 with horizontal guides 18a and 18b.

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Reference to FIGURE 2, a schematic projection, will facilitate understanding of rotation to effect lateral alignment of the web or the removal of transverse sway. Guide 14 and guide 15, with parallel faces, define a vertical planar path for web 10. Interposed on this path between guides 14 and 15 are guides 18a and 18b, with adjacent faces defining a gap for passage of web 10 therebetween. This gap, shown as substantially at right angles to the plane of the web as defined by guides 14 and 15, is positioned so that its center line 45 and its axis of rotation A—A from the initial plane of the web is along intended center line 37 of web 10. A position of web 10 such that the center line of the web coincides with the intended center line will result in edges 38 and 39 being of equal length; the web in its passage through this alignment element will thus have no lateral motion along guides 14 and 15. On the other hand, if due to improper roll formation with lateral weave, the web rises on guide 14, then the path traversed by edge 39 will be greater than the path traversed by edge 38. The longer path causes greater tension on edge 39, which causes downward motion along guide 14 to restore symmetry of web 10 about center line 37 and pivot axis A—A and achieve equality of forces along the edges of the web. It is apparent that web 10 must be free to move transversely along the face of guide 14 in order to respond to restoring forces and achieve alignment. Flanges on air sleeves 15, 19 and 20 are preferred to prevent transverse motion of the web after passing pivot axis A—A.

Further, it should be observed that guide 15 which serves to restore web 10 to its initial plane, also can effect further alignment where the weave may not be fully removed by passage over the span between guide 14 and guide 18. For example, while the motion of the web is a result of restoring forces arising from the unequal length of edges 38 and 39 has been illustrated as along guide 14, in practice it can be divided between guide 14 and guide 18. Thus, for example, it is possible that only one-half the weave will be removed by the first span; the second span between guide 18 and guide 15 can thus remove the remaining one-half weave. Therefore, it is apparent that the use of film rotation is not restricted to a single station but can be repeated, as often as required to effect proper alignment.

In consideration of the necessity for free lateral motion, transverse to the direction of web motion, it is essential to have friction as low as possible. While driven or idle rolls can be effective for heavy gauge webs, they are not generally suitable for thinner gauges. Thus, to transport thinner gauges at minimum tension, which can not drive idler rollers, and where speed control of driven rollers can be prohibitively difficult, and to provide for the maximum freedom of transverse motion, air guides are essential. These guides, constructed of a porous, sintered metal which is grounded, provide a floating path for the web and also remove static charges and dust while effecting control of the web with a minimum of friction. In FIGURE 1 all guides except 14 are shown as having flanges, while in FIGURE 2, no flanges are shown; generally flanges are optional after guides 18a and 18b, but are preferred if winding is at high speeds. The width of the spool or guide between flanges should be adequate to accommodate web weave of high amplitude without contacting the flanges, which are employed to prevent web spilling under extreme cases.

FIGURE 3 schematically illustrates the rewinder of the present invention adapted to slit and rewind a web

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as a plurality of webs or strips. Shown in the drawing, web 10 is slit into four narrow widths which are wound on four rolls 40, 41, 42 and 43 disposed around, and in contact with transport roller 13, by three parallel knives, of which knife 44 is shown. These edges of these knives are in direct contact with guide 20, which has gas-permeable flanges to prevent misalignment of the web during slitting. Takeup rolls 40, 41, 42 and 43 are provided with appropriate driving means, such as torque motors and ways or tracks as described hereinbefore to permit the rolls to move away from the transport drum as the diameter increases upon winding.

What is claimed is:

1. An apparatus for handling a running web comprising, in combination: a web supply source; a driven transport roller about which said web partially wraps; a windup roll adapted for surface wind having an axis adapted to recede from said transport roller as the diameter of said windup roll increases upon winding, said windup roller being in driven peripheral contact with said transport roller; first web guide means positioned between said web source and said transport roller and intermediate web guide means positioned between said first web guide means each having a gas permeable metal surface coupled to a ground; a source of compressed gas coupled to said web guide means to float said web in spaced relationship thereto, the surface of at least one of said intermediate web guide means positioned at an angle to the surfaces of said first web guide means positioned on each side of said intermediate web guide means, the central axis of said angle being along the intended center line of said web whereby alignment of said running web is maintained.

2. The apparatus of claim 1 wherein said angle is substantially at right angle.

3. An apparatus for handling a running web comprising, in combination: a web supply roll; a windup roll adapted for surface wind; a rubber covered driven transport roller about which said web partially wraps and in peripheral driving contact with said windup roll; means connected to the axis of said windup roll to linearly recede said windup roll from said transport roller as the diameter of said windup roll increases upon winding; first and second spaced apart, gas permeable, metal surface web guides coupled to a ground, positioned between said supply roll and said transport roller; a pair of gas permeable, metal surface web guides positioned between said first and second web guides adapted for passage of said web therebetween free of partial wrap around contact and adapted to rotate said web through a substantially right angle with an axis of rotation coinciding with the intended center line of said web between said first and second web guides; and a source of compressed gas coupled to said web guides to float said web in spaced relationship thereto.

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