March 16, 1954 M. G. JONES ET AL 2,672,198

METHOD AND APPARATUS FOR TREATING SHEET MATERIALS

Filed Jan. 28, 1952 4 Sheets-Sheet 1

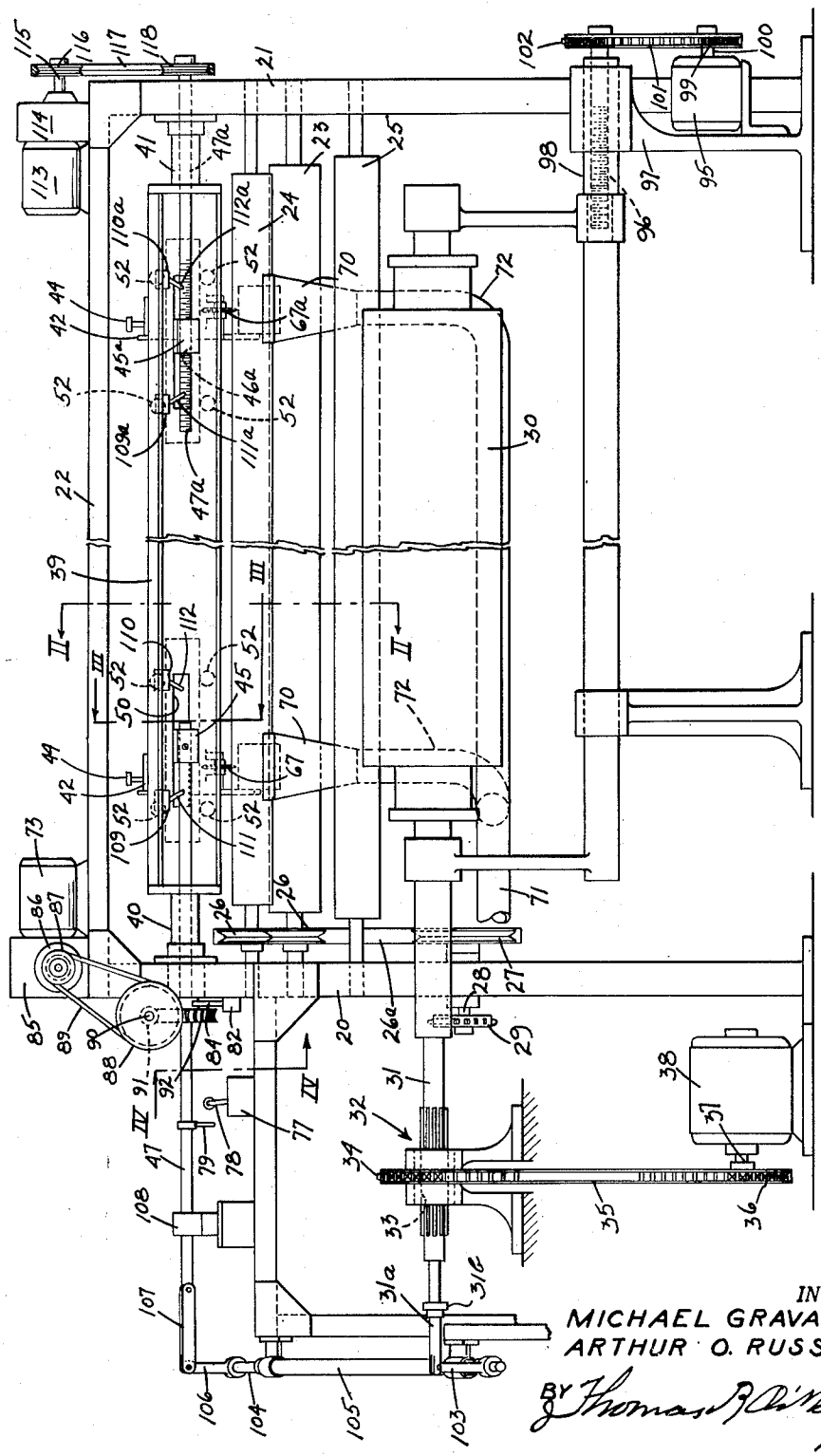


Fig. 1

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METHOD AND APPARATUS FOR TREATING SHEET MATERIALS

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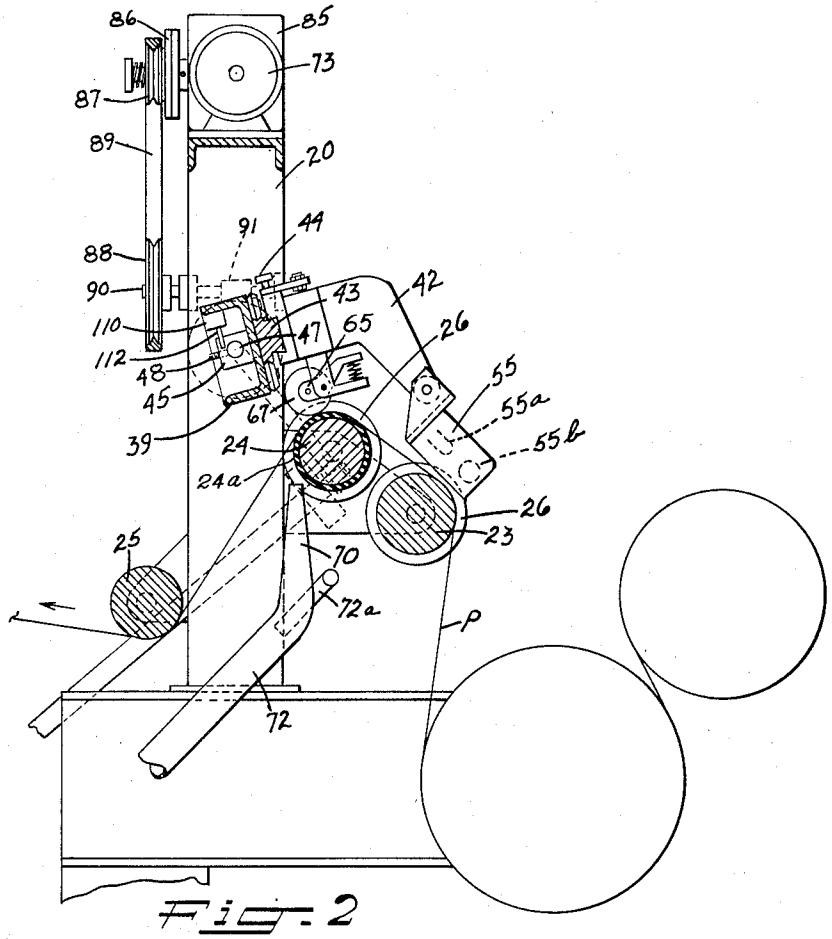


Fig. 2

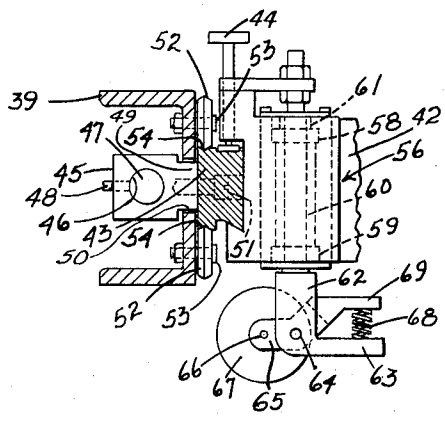


Fig. 3

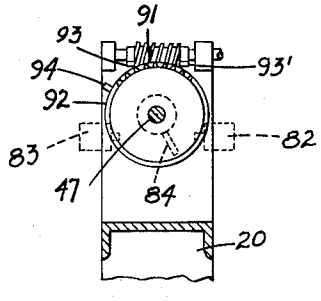


Fig. 4

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METHOD AND APPARATUS FOR TREATING SHEET MATERIALS

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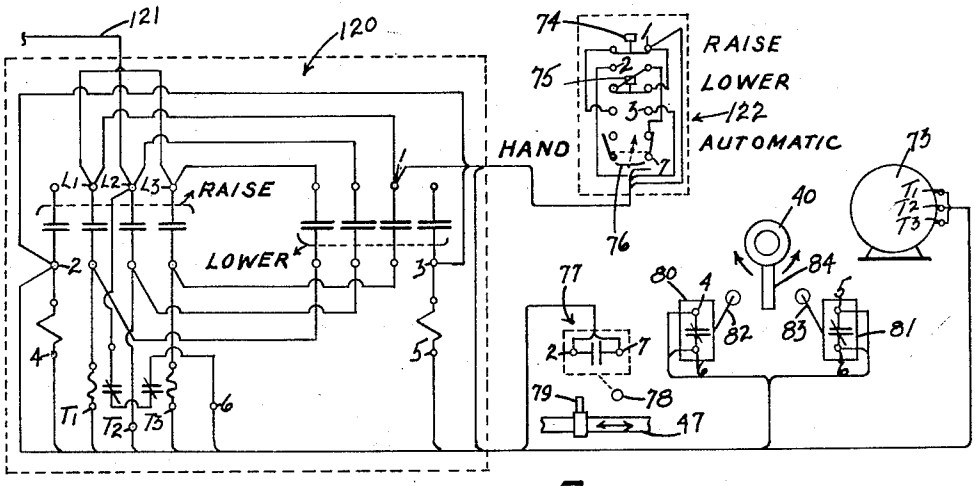


Fig. 5

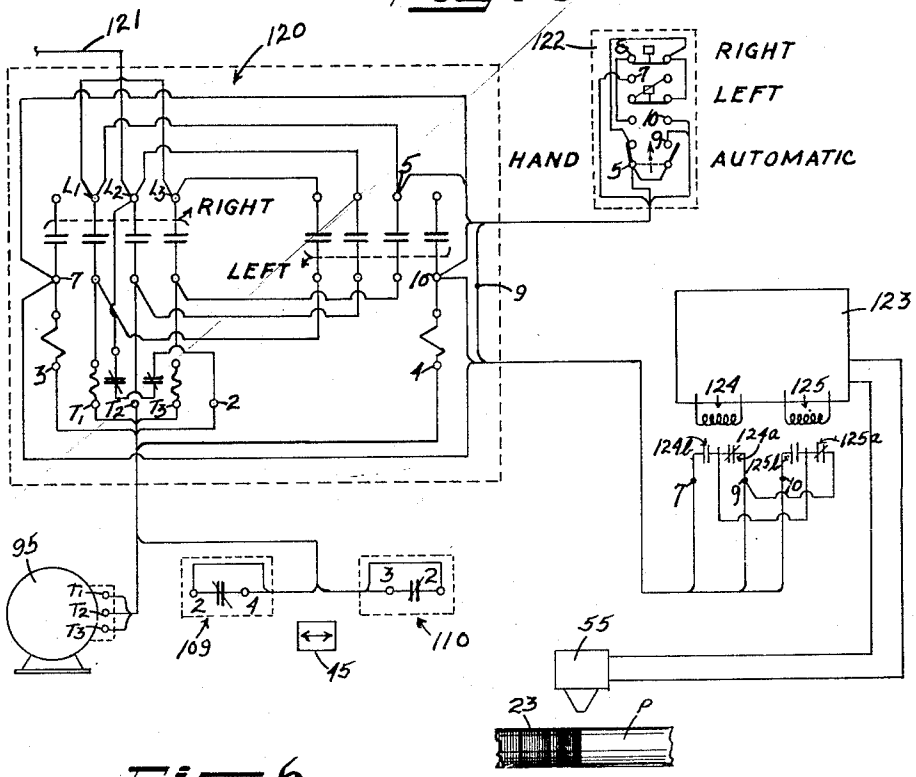


Fig. 6

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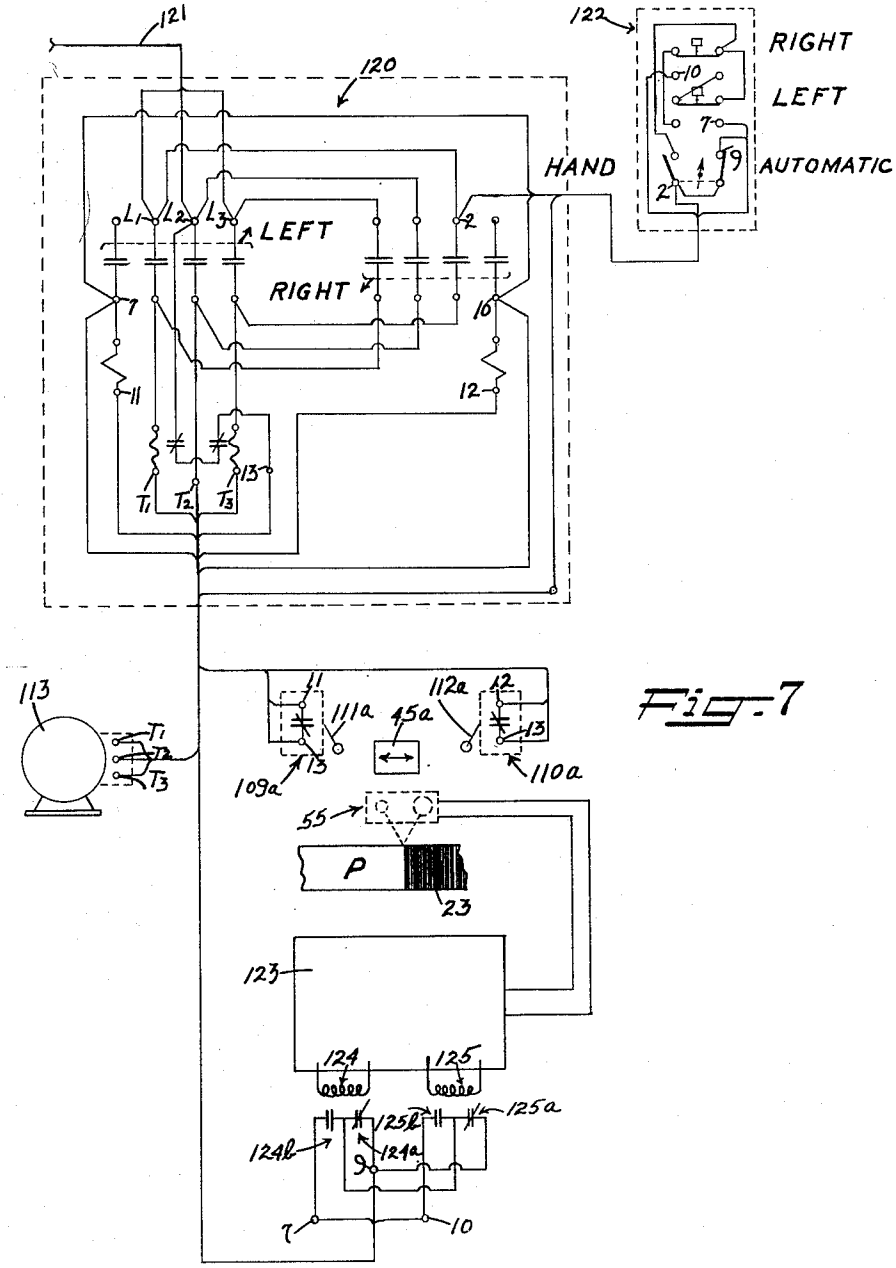


Fig. 7

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Patented Mar. 16, 1954 2,672,198

UNITED STATES PATENT OFFICE

2,672,198

METHOD AND APPARATUS FOR TREATING SHEET MATERIALS

Michael Gravatt Jones and Arthur O. Russell, Fredericksburg, Va.

Application January 28, 1952, Serial No. 268,612

11 Claims. (Cl. 164—65)

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The present invention is concerned with a method and apparatus for collecting sheets, webs, pellicles, films and the like as a wound package, particularly after such web has passed through a treating or handling machine of considerable length wherein there is a tendency or an opportunity for the travelling sheet to weave from side to side because of possible differences in the thickness or strength in different portions of the web taken widthwise of a given section of the web. Such differences may cause one or more of the rollers in such a machine about which the web passes to either grip one side of the web better than the other or for some other reason advance one side of the web a little more than another so that the web in effect weaves from side to side at regular or irregular intervals which may be more or less frequent depending upon the uniformity or non-uniformity of the web.

Heretofore, devices have been provided for detecting a lateral shift of a running web and either shifting the supply, such as an unwinding reel of the web, or compensating for the lateral shift by redirecting the web by means of curved or adjustably inclined rolls or guides. Shifting the supply has the disadvantage that it cannot correct for the material already passed through the machine. The use of inclined or curved rollers or guides to correct the travel of the web has the disadvantage that irregular frictional effects may be exerted upon the web tending to stretch it differently in various parts of its width and also, in a long machine involving a large number of passes about guiding or feeding rollers, detection and compensation must be effected at numerous places along the travel of the web.

A primary object of the present invention is to provide a system for detecting any lateral shifting of the web near the end of its travel through the machine and very shortly before its collection in the form of a wound package and shifting the winding core in response to the lateral motion of the edge of the web so as to form a winding in which at least one edge of the web is flush throughout the convolutions of the winding.

Another object of the invention is to provide a system particularly adapted for the collection of freshly produced films or pellicles formed by the extrusion or casting of a plastic material, such as webs of cellophane, cellulose esters, vinyl resins, condensation polymers of which nylon is an example, and the like, wherein the edges

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or selvages of the pellicle have a bead, that is, somewhat greater thickness than the main body of the pellicle as a result of surface tension forces during the initial setting up of the pellicle. In order to provide a winding which does not have bulged edges or ends because of the beads, the system of the present invention includes the slitting or trimming off of the edges shortly before winding and this slitting is controlled in response to the lateral movement of at least one edge of the web.

An ancillary object is to provide a system for mounting the slitter knives on swivel bearings so that they may be shifted relative to a cooperating guiding member for supporting the web being slit without undue wear and friction.

An ancillary object is to provide a system for withdrawing the selvage at its position of slitting, such as by suction.

Other objects and advantages will be apparent from the drawing and the description thereof hereinafter.

In the drawing, which is illustrative of the the invention,

Figure 1 is a front elevation showing one embodiment for the collection of a web,

Figure 2 is an enlarged sectional detail as seen at II—II of Figure 1 with the web shown threaded through the winding machine,

Figure 3 is an enlarged sectional detail as shown at III—III of Figure 1,

Figure 4 is an enlarged sectional detail as seen at IV—IV of Figure 1,

Figure 5 is a diagrammatic electrical circuit for the motor which raises and lowers the slitter,

Figure 6 is a diagrammatic circuit for the motor which shifts the winding shaft and slitter in response to lateral movement of one of the selvages, and

Figure 7 is a diagrammatic circuit of an independent motor for controlling another selvage slitter.

The embodiment of the invention illustrated in the drawings is particularly adapted to the collection of pellicles, such as of cellophane, in the form of a winding wherein at least one edge of the winding is flush with itself throughout all convolutions and the winding is substantially uniform in thickness throughout as a result of the slitting off of the selvages, thereby eliminating the bead formed during the production of the pellicle. The collecting and slitting system shown in the drawings may receive the pellicle

from the drying rolls of a cellophane producing machine. However, the same embodiment may be employed for the collection of webs or the like which have no edge beads and require selvage removal or trimming, in which event, the slitters may be omitted or raised out of operative position during the collection of the web, unless it is desired to slit the web into smaller widths before collection.

As shown, the system comprises suitable supporting framework having the upright members 20 and 21 held together by suitable cross pieces comprising the channel 22. Between the uprights 20 and 21 or suitable brackets projecting therefrom, rolls 23, 24 and 25 are rotatably supported. Rolls 23 and 24 may be driven by any suitable means such as the pulleys or sprockets 26 and a belt or chain 26a thereabout which engages a pulley or sprocket 27 on a shaft 28 which is driven by a sprocket 29 in synchronism with other rolls, such as the drier rolls from which the pellicle proceeds to the rolls 23 and 24. Roll 25 may be driven or it may be idle as shown.

The pellicle P (see Fig. 2) passes over and about roll 23 and then over 24 and under 25 to the windup core 30 on the shaft 31. The shaft 31 is splined or keyed at 32 so that it may extend through a complementarily splined or keyed hub 33 of a sprocket 34 which is driven by a chain 35 which in turn is driven by a sprocket 36 on the shaft 37 of the driving motor 38. The splined connection between shaft 31 and sprocket 34 allows the motor 38 to rotate the shaft 31 while permitting the shaft 31 to be shifted axially during such rotation.

Above the roll 24, there is mounted a transverse supporting structure comprising a channel member 39 having endwise projecting trunnions 40 and 41 which are mounted rotatably in suitable bearings in the uprights 20 and 21 respectively. Brackets 42 are each secured to a tongued rear projection of a guide block 43, such as by means of a set screw 44. This set screw may be loosened to allow the bracket 42 to be shifted along the tongued projection to any position desired which may then be set with the screw 44. The guide 43 may have any length desired up to the full axial extent of the roll 24 depending on the number of slitters to be supported and their positions. The guide 43 (see particularly Fig. 3) is secured to one or more blocks 45 each provided with a bore 46 which fits about the reduced-diameter end of a rod 47 and is secured thereon by a set screw 48 which permits relative rotation but no relative axial motion between the rod 47 and block 45. The rod 47 extends through the trunnion 40. Each block 45 has a reduced portion 49 which extends through a slot 50 in the channel 39. Suitable cap screws 51 secure the blocks 43 and 45 together. Rollers 52 are rotatably mounted on stub shafts 53 secured to the channel 39 on opposite sides of slot 50 and suitably grooved portions 54 of the block 43 serve as tracks or guideways which receive and cooperate with the peripheries of rollers 52 so that, in effect, the assemblage of blocks 43 and 45 constitutes a carriage on the former of which the bracket 42 is supported. The bracket 42 supports a scanning head 55 comprising a photocell 55a and a source of light 55b arranged to direct the light against the roll 23 and the edge of the web carried thereon so that the light reflected to the photocell is dependent upon the proportion of the photocell field which is occupied by the web. The roll 23 may be provided with a dark light-absorbing coating, such as of slate or other black pigment.

One or more slitters may be attached to the bracket 42 for the purpose of trimming off one or both marginal edges of the web and, if desired, to slit the web into one or more widths having any predetermined size. The bracket assemblies 42 may be used in pairs, individually, or in any greater number if desired. As shown in the drawings, there are two such assemblies and the reference characters used on each assembly denote identical parts. The slitter associated with each bracket assembly is supported in a housing 56 by bearings 58 and 59 on which the slitter post 60 is journaled. The post 60 may be provided with an enlarged split snap ring collar 61 to prevent its dropping out of the housing. The lower end of the post 60 is provided with a yoke or bifurcated arm 62, the two branches of which terminate in a laterally extending transverse connecting plate 63. A pivot shaft 64 extends between the two branches of the yoke 62 and supports the bifurcated member or lever arm 65 between the two legs of which a shaft or pin 66 extends and rotatably supports a slitter knife 67. A spring 68 bears against the plate 63 and the interconnecting plate 69 of the bifurcated member 65. The spring 68 normally pivots arm 69 away from plate 63, thereby urging the knife 67 into engagement with the cooperating roll 24 which may comprise an outer resilient cover 24a of rubber or the like. A hopper 70 is placed below each slitter and is connected to a main suction duct 71 by suitable branch ducts 72. The duct 71 may be connected to a suction fan or pump or an air injection device may be provided in the branch ducts 72 near each hopper 70, as at 72a, to create suction therein. This system serves to withdraw the selvages trimmed by the slitter knives.

The edge slitter on the right side (as viewed in Fig. 1) of the web may be controlled independently. Independent control is shown in Figure 1. The structure comprising bracket 42, and guide block 43 for supporting the separate scanning head and slitter (designated 67a) is the same in this case but the block 45 has a threaded bore 46a which engages a threaded rod 47a which extends through the trunnion 41 and carries fixedly on its end a sprocket or pulley 118 driven by a chain or belt 117 which in turn is driven by a sprocket or pulley 116 on shaft 115 of the gear reducer 114 driven by the reversible motor 113 as more particularly explained hereinbelow.

The support 39 may be rotated or oscillated to and from its normal operating position in which the photocell scanning head or heads 55 are disposed in proximity to the roll 23. This rotation is effected by the reversible motor 73. The motor 73 drives the output shaft of a reducing gear 85 to which shaft there is secured one member of a friction clutch 86, the other member of which is connected to the sprocket or pulley 87 which drives a sprocket or pulley 88 by means of a belt or chain 89. Pulley 88 is secured to a shaft 90 which fixedly carries a worm 91 which drives a worm wheel 92, the hub of which is secured to the trunnion 40.

Support 39 is rotated in one direction by motor 73 to raise the scanning head when push button 74 (see Fig. 5) is pressed, lowered to operative position when push button 75 is pressed, and may be automatically controlled by the two-bladed switch 76 (shown in automatic position). This automatic control involves the raising of the scanner head or heads, and the slitters when such

are used, away from the roll 23 when the switch 77 having the feeler or finger 78 is closed by the detent 79 fixedly secured to the rod 47. Detent 79 and switch 77 serve to raise the slitters when excessive lateral motion of the web occurs which would be indicative of a serious tearing of the web, and particularly a complete transverse rupture thereof. Of course, if the machine were operating on a web which did not require slitting and the knives were omitted or not positioned in operative relation to the roll 24, the automatic circuit involving switch 76, switch 77 and detent 79 could be omitted.

Normally closed switches 30 and 31 provided with detector fingers 32 and 33 respectively are disposed as shown in Figures 4 and 5 in such position as to be operated by a projection 34 from the trunnion 40. These switches control the limit of lowering or raising when push buttons 75 and 74 respectively are pressed down.

As shown in Figure 4, the worm 91 is provided with projections 93 and 93' at each end thereof which selectively engage a lug 94 on the worm wheel 92 thereby providing an additional stopping means to mechanically limit the rotation of trunnion 40 to less than one complete turn when it is rotated in the direction to lower the scanning head or heads and slitting knives into operative position. The friction clutch 36 permits the worm wheel to be mechanically locked in this fashion without damage to the mechanism even though the circuit to the motor 73 is closed.

The scanning head 55 at the left of the machine is normally positioned during operation of the system adjacent the edge of the web going about the blackened surface roller 23. It is connected by any suitable circuit, such as that shown in Figure 6, to a reversible motor 95 which drives a screw 96 in one direction or the other to shift the support 97 for the winding shaft 31. For this purpose, the support 97 may have an extension 98 provided with an internally threaded bore to engage the screw 96. The screw 96 is driven from the motor 95 by suitable means comprising a sprocket 99 on the motor shaft 100 which drives a chain 101 which in turn drives a sprocket 102 on the threaded rod 96. The axial motion of shaft 31 imparted to it by the motor 95 is transmitted to the rod 47 through the lever or arm 103 which is fixedly secured to a shaft 104 rotatably mounted in a fixed sleeve 105. Shaft 31 is rotatable with respect to yoke 31*a* but axial movement of shaft 31 is transmitted to yoke 31*a* by means of a coupling 31*b*. Shaft 104 has fixed to it a lever or arm 106 which is connected to the rod 47 by means of the link 107. The rod 47 may slide through suitable bearings such as that at 108. Limit switches 109 and 110 may be mounted on the support 39 so that their fingers 111 and 112 respectively may be actuated by the block 45 when the rod 47 undergoes an excessive lateral motion which occasionally may occur such as when the web ruptures.

As stated hereinabove, the support 39 may carry a plurality of slitters each connected to the rod 47 to divide the web into a number of widths and/or to sever or trim off the other selvage so that the coils of the web wound on the winding core would consist either of (1) a single winding having uniform width from which the beaded edges have been trimmed or (2) a plurality of windings each of desired width which would be uniform in each of the individual windings. When all of the slitters are controlled by rod 47, a single scanning head associated with one edge of the sheet may be used but as shown, the rod 47 actuates only a single slitter to trim off one of the edges of a sheet in response to the signal derived from a scanning head associated with that edge just before slitting and the other edge is trimmed independently by a slitter knife controlled by a separate scanning head.

When the slitter knife 67*a* is independently controlled as shown, limit switches 109*a* and 110*a* having feelers 111*a* and 112*a* respectively are mounted on the support 39 and cooperate with one of the blocks 45 closest to knife 67*a* in a fashion similar to the limit switches 109 and 110 at the other side of the support 39 and serve to stop the operation of the motor 113 when excessive lateral motion of the web occurs.

Any suitable circuit may be employed for connecting the several control switches with the respective motors. In the several circuits shown in Figures 5 to 7 respectively, conventional representation is utilized and the various junctions or terminals bearing given numbers are connected by the conductors extending from such terminals to the terminals at the other ends of the conductors bearing corresponding reference numerals. In these several views, the starting switch box is represented in the dotted outline bearing reference character 120, and the master switches connecting the line 121 to the starting box 120 are not shown. The control switches are shown in the dotted outline 122 and legends are applied adjacent the push buttons of the control switch to indicate the effect of the several buttons. The dotted line shown between the two contactor blades of the hand-automatic switch represents merely a mechanical interlock, not an electrical connection. These switches are shown in "automatic" position in Figures 5 and 7 and in "hand" position in Figure 6.

In Figures 6 and 7, the scanning heads are diagrammatically shown and designated by reference character 55. Each is connected through a suitable amplifier 123 to a pair of relays each of which is actuated by one of the coils 124 and 125 respectively. The first relay when coil 124 is energized opens the normally closed contacts at 124*a* and closes the normally open contacts at 124*b* whereas energization of 125 opens the normally closed contacts 125*a* and closes simultaneously the normally open contacts 125*b*. The coils 124 and 125 are selectively operated depending upon whether the light reflected to the photocell increases or decreases from the value corresponding to that of the position where the edge of the sheet is substantially half-way into the visual field of the photocell. Any suitable electronic circuit may be employed for causing an increase in light reflected to energize coil 125 and a decrease in light reflected to energize coil 124. One such circuit is shown in Figure 5 of a copending patent application of Michael Gravatt Jones, Serial No. 222,461, filed April 23, 1951, wherein coils 198 and 199 correspond to the coils 124 and 125. The circuit should be adjusted to minimize hunting in conventional fashion.

In Figure 6, energization of coil 125 causes the motor 95 to move the winding core 39 and the slitters on brackets 42, 42 to the left as viewed in Figure 1. Conversely, when a decrease in light reflected is caused by the shift of the web to the right, coil 124 will be energized and its relay will cause motor 95 to move the core 39 and the slitter 67 to the right. Similarly, in Figure 7, when an independent control for the selvage slitter on the right is used, the scanning

head is similarly connected through the amplifier 123 to coils 124 and 125 which are selectively operated to drive the motor 113 in the proper direction to move the slitter on the right to compensate for the lateral movement of the edge of the web. Of course, if all of the slitters are controlled by the rod 47, the motor 113 and the scanning head on the right side of the equipment as viewed in Figure 1 along with the circuit shown in Figure 7 can be omitted or rendered inoperative.

The present invention provides a simple and effective system for winding a continuously moving web at the completion of some stage of processing or handling, such as in a film-producing machine, a liquid-treating machine, a dyeing machine, a coating machine, a drying machine, or the like. As stated hereinabove, the invention involves the shifting of the winding core axially in accordance with any lateral movement of the edge of the web being wound so that at least one edge of the wound package is flush and even throughout the windings or convolutions thereof. When a material having a rough edge, or an edge of irregular form, either in contour or thickness, is handled, the system of the present invention trims either one or both edges prior to winding and the width of the sheet wound may be uniform throughout the winding or, if desired, an independent slitter provided at one edge or selvage may control the trimming of that selvage so as to take off a definite width irrespective of whether the web proceeding to the trimming station is initially uniform in width or not. The mounting of the slitter knives so that they are individually swivelly mounted allows them to be shifted axially of the cooperating roll against which they bear during cutting of the web without being dragged across the surface of the roll or its roll covering. This not only reduces the wear on the knife or knives but also on the roll surface or its roll cover, thereby prolonging the useful life and efficient operation of the knives and associated roll.

It is to be understood that changes and variations may be made without departing from the spirit and scope of the invention as defined in the appended claims.

We claim:

1. A method of winding pellicles, films and the like comprising the steps of guiding the pellicle to a winding core, trimming at least one edge of the pellicle as it proceeds to the winding core, detecting lateral movement of said edge of the pellicle as it proceeds to the winding core, and shifting the trimming line, the detecting line, and the winding core axially in response to the lateral movement of said edge.

2. Means for collecting a continuously travelling web of indefinite length comprising a winding core, means for rotating the core, means for removing a marginal portion of the web along an edge thereof, means for detecting lateral movement of the edge of the web, and means operatively connected to the detecting means for shifting the removing means and the winding core axially in response to lateral movement of the web.

3. Apparatus for collecting a continuously travelling web of indefinite length comprising a winding core, means for rotating the winding core, means for shifting the winding core axially, means adjacent an edge of the web shortly in advance of the winding core for detecting lateral movement of the web, slitting means adjacent the detecting means for trimming off the edges of the web, means for shifting the slitting means, and means interconnecting the detector means with the shifting means to actuate the means for shifting both the winding core and the slitting means.

4. The method of claim 1 in which the three shifting steps are performed simultaneously.

5. The method of claim 1 in which the trimming line, the detecting line and the winding core are shifted in the same direction in equal increments.

6. The method of claim 1 in which the trimming line, the detecting line and the winding core are simultaneously shifted in the same direction in equal increments.

7. In sheet winding apparatus of the type having a frame, a winding core journaled in said frame, means for both turning and shifting the winding core on its axis, and sheet edge detecting means, the sub-combination which comprises a roll over which the sheet is fed prior to being wound on the winding core, a cross member mounted in the frame and extending transversely of the sheet in spaced relation to said roll, at least one bracket slidably mounted on said cross member, sheet slitting means mounted on said bracket, sheet edge detecting means mounted on said bracket, means responsive to the sheet edge detecting means for sliding the bracket in the supporting member, and means interconnected with said last-named means for simultaneously moving the winding core axially in increments corresponding to movement of the bracket.

8. Apparatus as defined in claim 7 in which the web edge detecting means is a photoelectric cell and the roll is provided with a relatively dark light-absorbing material.

9. Apparatus as defined in claim 7 in which the slitting means comprises a roller journaled on a post in the bracket and the post being loosely journaled in the bracket to permit automatic transverse movement of the slitting roller while the sheet is being fed over the roll at high speed.

10. Apparatus as defined in claim 7 having an electrical circuit for actuating the sliding means and a pair of limit switches mounted on the cross member to open said circuit upon predetermined maximum travel of the bracket in the cross member.

11. Apparatus as defined in claim 10 having a friction clutch in the interconnecting means for moving the winding core.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
341,895	Edmunds	May 18, 1886
1,062,423	Steber	May 20, 1913
1,333,588	Lewis	Mar. 9, 1920
1,741,520	Jagenberg	Dec. 31, 1929
2,082,635	Johnstone	June 1, 1937
2,088,473	Gulliksen	July 27, 1937
2,212,457	Schrier	Aug. 20, 1940
2,281,965	Wylie	May 5, 1942
2,428,430	Mong	Oct. 7, 1947
2,434,128	Stanford	Jan. 6, 1948