

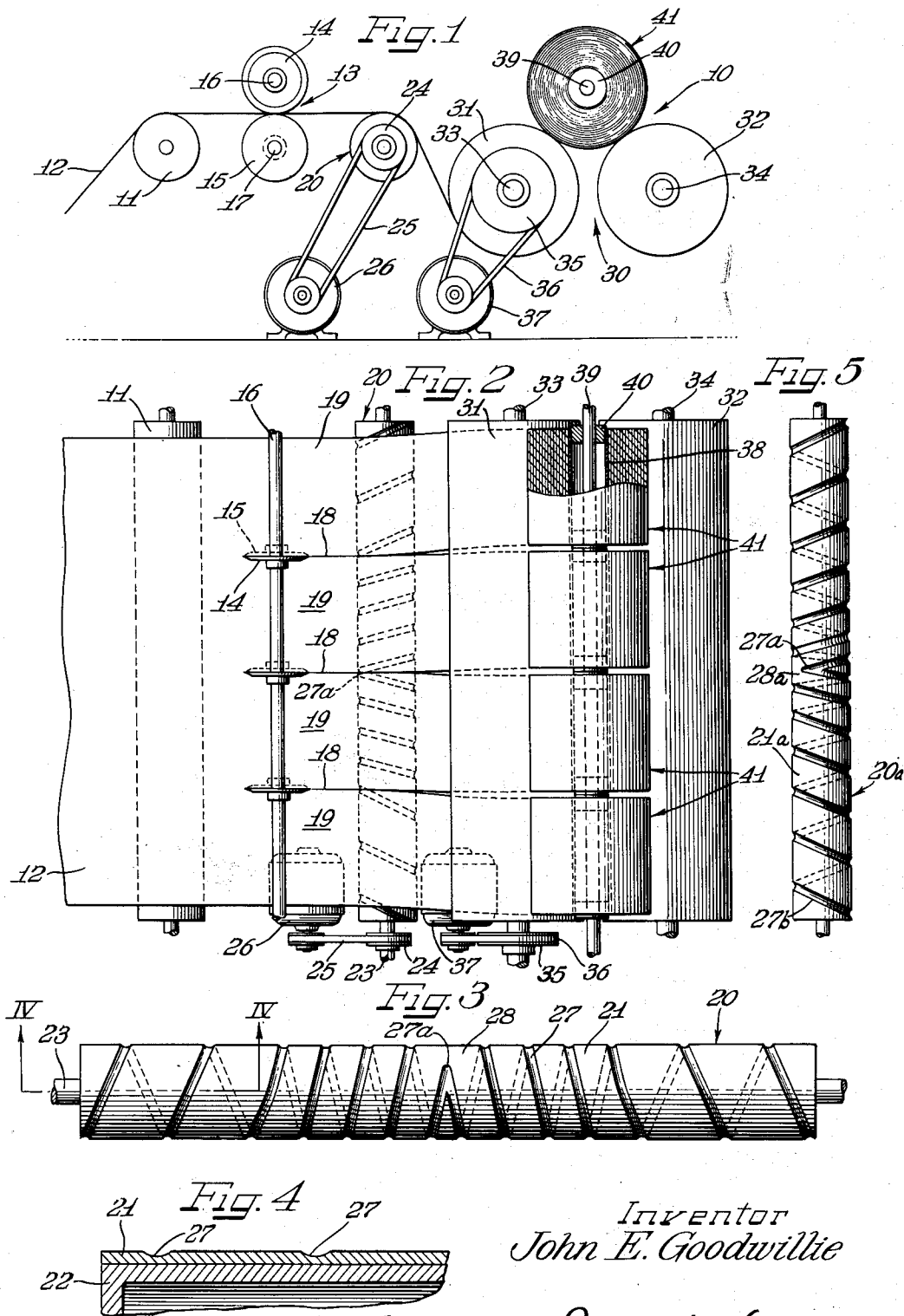
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WINDER AND SHEET SEPARATOR

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WINDER AND SHEET SEPARATOR

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The present invention relates to a winder and sheet separator and more particularly to means for laterally separating a plurality of immediately contiguous, separate elongated webs.

In the manufacture of paper or other elongated webs, the webs are usually initially formed as relatively wide sheets. For example, paper machine forming surfaces or wires are frequently relatively wide, e. g., up to about 300 inches, and the sheet on the forming machine, after drying, is usually slit or scored into a plurality of narrower webs for shipping, storing and use. Generally, in order to carry out the formation of the relatively narrow paper strips or webs, the large sheet as formed is passed through a slitter assembly and finally through a winder in which the separate relatively narrow webs are wound upon a paper or wooden core. The difficulty of accurately separating the separate webs formed from the single large sheet will be appreciated, particularly since such separation must be accurate and accomplished at relatively high speed in order that the commercial production of well formed rolls of strip material may be carried out.

The present invention now provides an improved means for separating a plurality of adjacent ribbons or relatively narrow webs formed from a single paper web. The device of the present invention is particularly adapted for employment with a paper machine slitter and winder assembly including cooperating slitter discs for slitting the web as formed into a plurality of narrow ribbons and a winder such as the under-drum type wherein a plurality of rolls are wound on cores carried by a winder shaft with each roll riding on the driven under drums.

The ribbon separating device of the present invention may suitably comprise an elongated rotatable roll having on its periphery recessed helical grooves extending axially of the roll toward each end thereof from the roll center, the grooves being adapted to receive the paper of the ribbon deflected or deformed thereinto and guide the same laterally outwardly away from the center of the sheet to thereby accomplish the separation of the slit ribbons prior to their passage to the winder mechanism. Preferably, the pitch of the helical grooves increases axially outwardly from the mid-point of the roll, in order that a greater spreading effect is obtained across the face of the spreader roll. The increase in pitch may be constantly progressive or may be coincident with the line of separation of the strips with the pitch in this instance being constant across the width of each strip. The roll thus functions as a spreader screw which is driven at a peripheral surface speed greater or less than the speed of travel of the ribbons, so as to provide a differential speed spreading action. By correlation of the pitch of the helical grooves, the rotational speed of the separator roll, web travel speed, and the distance from the slitter roll to the web cores, it is possible to obtain an accurate winding of separate paper rolls at the winder mechanism. Also, the surface condition of the paper itself is a factor to be considered. Generally, the speed

differential should be increased with sheet smoothness, i. e., a smooth sheet requires a greater spreading roll speed than a rough sheet. Also, it will be seen that the speed differential will affect the tension in the sheet being passed through the slitter and winder assembly, the sheet tension increasing with the speed differential, and since the device is positioned between the cutters and winder a desired condition is obtained to pull the web through the cutters and feed it to the winder. Thus, if it is desirable to produce a tightly wound, very hard finished set of paper rolls, the spreader roll is run slower than the speed of the sheet. On the other hand, if softer finished sets of rolls, the spreader roll is run faster than the sheet, thus increasing tension at the slitter and reducing tension at the winder drum so that a comparatively slack sheet is maintained at the drum.

It is, therefore, an important object of the present invention to provide an improved winder and sheet spreader capable of accurately winding a plurality of separate paper rolls from a single paper web.

Another important object of the present invention is to provide a separator for employment in conjunction with a winder and slitter assembly, the separator receiving slit web ribbons from the slitter and guiding the same to the winder to facilitate the formation of accurate, separate, relatively narrow rolls of paper from a single web sheet.

It is a further important object of the present invention to provide a helically recessed or grooved spreader roll for laterally separating a plurality of immediately contiguous separate paper webs formed from a single relatively wide sheet and guiding the separated webs to a winder assembly.

Still another important object of the present invention is to provide a method of forming and winding separately a plurality of relatively narrow paper webs formed from a relatively wide single sheet, including the steps of slitting the relatively wide web into a plurality of immediately contiguous separate relatively narrow strips, lapping the separate immediately contiguous strips about a roll provided with helical peripheral grooves extending axially toward each end thereof to impart a lateral motion to each strip from the center of the large sheet, and guiding each of the webs to separate axially spaced cores.

A specific object of the present invention is to provide a combined slitter, sheet separator and winder assembly comprising superimposed slitting discs receiving a paper web therethrough, a separator roll having recessed helical grooves extending axially toward each end of the roll from the center thereof and of axially outwardly increasing pitch, the roll receiving the slit web thereabout to direct the same from the center of the single web, and a winding assembly comprising a pair of axially spaced parallel lower winder drums and a plurality of axially spaced and aligned separate cores superimposed above the winder drums and receiving the slit paper webs thereabout.

Other and further important objects of this invention will be apparent from the disclosures in the specification and the accompanying drawings.

On the drawings:

Figure 1 is a schematic side elevational view of a winder and sheet separator of the present invention;

Figure 2 is a schematic plan view of the winder and separator of Figure 1;

Figure 3 is an enlarged elevational view of a separator roll of the present invention;

Figure 4 is an enlarged sectional view taken along the plane IV—IV of Figure 3; and

Figure 5 is an elevational view similar to Figure 3 illustrating a modified form of roll.

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As shown on the drawings:

In Figure 1 reference numeral 10 refers generally to a combined winder and sheet separator of the present invention. The winder and sheet separator 10 includes a guide roll 11 receiving a paper web or sheet 12 lapped thereabout, the web 12 being in substantially dry, finished condition as received from a paper making machine, or from an earlier formed stock roll. The web 12 is passed from the guide roll 11 between the slitter assembly 13 including vertically aligned peripherally lapping upper slitter discs 14 and lower slitter discs 15. The upper slitter discs 14 are axially spaced on a shaft 16 extending transversely across the width of the web 12 and the lower slitter discs 15 are similarly mounted on a shaft 17 in alignment with and vertically spaced beneath the shaft 16 of the upper discs 14. The discs 14—15 are each provided with a sharpened periphery which overlaps slightly in the plane of the web 12 with the periphery of the aligned discs 14—15 to slit the web as is well understood in the art.

From the slitter assembly 13, the web 12 is trained about a separator roll 20, best illustrated in Figures 3 and 4. The roll 20 includes an outer circumferential sleeve 21 mounted on an interior roll 22 having an axially projecting shaft 23 which carries a pulley 24. Alternatively, the sleeve may be omitted, with the roll 22 itself being recessed, as hereinafter described. The roll 20 is driven by suitable means such as the belt 25 operatively connected to a motor 26, or by means of a mechanical linkage, such as a V-belt or the like, to the main slitter or winder drive. Alternatively, an adjustable speed drive may be used for the roll 20. As particularly illustrated in Figure 3, the roll sleeve 21 is provided with helical radially recessed grooves 27 which extend axially outwardly toward each end of the roll from a central apex 27a at the central portion 28 of the roll. The grooves 27 thus present a helically recessed periphery threaded outwardly from the center of the roll. The pitch of the grooves 27 increases axially outwardly from the central portion 28 of the roll. In that embodiment of the invention shown in Figures 2 and 3, the pitch increases sharply at the line of separation of the strips 19, with the groove pitch being constant across the width of each strip. In the modified form of roll 20a shown in Figure 5, the roll sleeve 21a has a groove 27b with a pitch that changes constantly along the axial length of the roll outwardly from the central portion 28a of the roll. The groove 27b has the same central apex 27a as the groove 27.

The web 12 is trained about the periphery of the roll 20 to a winder assembly 30 including a pair of spaced, axially parallel winder drums 31 and 32, respectively. The drums 31 and 32 are rotatably supported in shafts 33 and 34 respectively and the shaft 33 carries a pulley 35 connected by a driving means, such as a V-belt 36, to a source of power such as an electric motor 37. The webs or strips 19 are each lapped about the winder drum 31 and are each led to one of a plurality of cores 38 mounted on a core shaft or winder shaft 39 parallel to and displaced above the winder drum shafts 33 and 34, respectively. The cores 38 are secured to the core shaft 39 by suitable means, as by the use of core plugs 40 driven in each end of the cores and removably affixing the cores 38 to the core shaft for rotation therewith. The plugs 40 not only serve to retain the cores 38 on the coreshaft, but also retain the cores in axially spaced, separated relation. Of course it will be appreciated that any desired type of core and shaft construction, or an expandable coreless shaft, may be employed.

It will be understood by those versed in the art that upon initially starting the web 19 on the cores 38, the cores ride on the surfaces of the winder drums and as layers of the web 19 are built up on the cores, the wound web serves to establish a driving relation between the winder drums and the roll 41 built up on the cores 38.

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From Figure 2 of the drawings, it will be seen that the web 12 is fed by suitable means, as by the guide roll 11 to the slitter assembly 13 and that the slitter discs 14 and 15 serve to slit, as at 18, the web or sheet 12 into a plurality of relatively narrow immediately contiguous webs or strips 19. The webs 19 are then lapped about the periphery of the roll 20 which serves to separate the webs 18 axially outwardly from the center of the roll 20, or in other words, from the center of the sheet 12. Sheet tension at the roll 20 serves to deform or deflect portions of the sheet into the grooves 24, thus causing lateral spreading of the several strips 19. The varying pitch of the helical roll grooves 27 results in the greater spreading of the outer strips 19, as is desired, since these outer strips must be laterally shifted a greater distance to create the spaced relation with the adjacent rolls in view of the lateral shifting of the inner strips to create the space between the adjacent inner rolls. Thus if a $\frac{1}{16}$ inch separation is desired between the four rolls on the winder shaft, the two outer strips must each be shifted $\frac{3}{32}$ inch while each of the two inner rolls need only be shifted $\frac{1}{32}$ inch. In this manner, the webs 19 are separated for later introduction about the periphery of the winder drum 31 onto the separate cores 38 mounted on the core shaft 39.

In this manner, the assembly 10 serves first to slit the web 12 into immediately contiguous separate relatively narrow strips 19; secondly, to separate the strips laterally from the center of the initial web 12 and thirdly, to wind the separate strips 19 on individual, axially spaced cores 38. This slitting, separating and winding has been carried out as a single continuous process, with the separate strips being accurately separated and guided positively onto the individual cores.

To facilitate the separation, the roll 20 is driven at a speed different from the speed of web travel, so that the full separating effect of the helical periphery of the roll 20 is utilized and the tensioning of the wound rolls may be controlled. This difference in speed has been indicated schematically in Figure 1 by the employment of differently sized pulleys 24 and 35 on the roll 20 and the winder drum 31 respectively. It will be appreciated that this differential speed may be accomplished in any desired manner, as by separate roll drives, as illustrated, or by means of suitable gearing from a common power source.

Also, if the spreader roll speed is less than that of the sheet, the central apex 27a of the grooves (as illustrated in Figure 2) should be toward the slitter assembly 13, and, if the roll speed is in excess of that of the sheet, the roll should be reversed end-for-end so that the apex extends toward the winder drum.

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention.

I claim as my invention:

1. In a slitting, separating, and winding assembly for fibrous web material moving in a given line of travel including superimposed overlapping slitter disks adapted to receive a fibrous sheet therethrough for slitting the sheet into a plurality of relatively narrow strips and a winding mechanism positioned thereafter in said line of web travel having separate coaxial individual cores for each receiving a strip, the improvement of a separator roll positioned in the line of web travel between the winding mechanism and the slitter disks having a helical screw periphery for guiding the strips laterally outward from the center of the fibrous web to separate the strips, and means for driving said separator roll independently of said winding and slitting apparatus and at a speed different from the speed of travel of the fibrous web, said separator roll extending laterally substantially the distance between the outer ends of the outermost cores of the winding mechanism.

2. In a slitter, separator, and winder apparatus for a paper web moving in a given line of travel including

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superimposed slitter disks having overlapping cutting edges receiving the traveling paper web therethrough for slitting the web into a plurality of immediately contiguous separate sheets, a winder positioned thereafter in said line of web travel having a core shaft with a plurality of separate axially spaced cores for each receiving a strip from the cutter disks and means for driving said winder to wind separate rolls on each core, the improvement of a separate roll positioned in the line of web travel between the winding mechanism and the slitter disks and receiving the strips directly from the slitter disks and having helical radially recessed grooves extending axially toward each end of the roll from the center thereof with the pitch of said grooves increasing axially outwardly from the roll center to laterally separate the paper strips and direct the separated strips to the winding mechanism, and means for driving said separator roll at a speed different from the speed of travel of said web, said separator roll extending laterally substantially the distance between the outer ends of the outermost cores of the winder.

3. In a paper machine winder assembly for handling a paper web moving in a given line of travel, a slitter of substantially the web width providing a plurality of slitting means in the web line of travel for longitudinally slitting the web into a plurality of strips, a separator roll in said line of travel behind the slitter and of the same width for engaging the strips passing thereover and effecting lateral separation thereof, said roll having an exterior periphery provided with helically recessed grooves extending axially toward each end of the roll from the center thereof, a winder in said line of travel behind the separator roll and of the same width rotatably mounting across its width a plurality of axially aligned cores for receiving the strips, drive means for rotating said cores, and drive means separate and apart from said core drive means for rotating said roll at a surface speed different from the speed of the traveling web.

4. In a paper machine winder assembly for handling a plurality of uniplanar contiguous travelling paper strips departing from a slitter in a given line of travel, a separator roll having an exterior cylindrical periphery of the full width of said strips provided with helically recessed grooves extending axially toward each end of the roll from the center thereof, the pitch of said grooves increasing uniformly axially outwardly from the roll center to give a greater spreading effect at the roll ends, said separator roll being positioned in said line of travel to frictionally engage the strips passing thereover and effect lateral separation thereof, drive means for rotating said

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roll at a surface speed different from the speed of the travelling strips, a winder in said line of travel behind the separator roll and rotatably mounting a plurality of axially aligned cores across the width of said roll and said strips for receiving each of said strips, and drive means independent of said roll drive means for rotating said cores.

5. In a paper machine winder assembly for handling a plurality of uniplanar contiguous travelling paper strips departing from a slitter in a given line of travel, a separator roll having an exterior cylindrical periphery of the full width of said strips provided with helically recessed grooves extending axially toward each end of the roll from the center thereof, the pitch of said grooves being constant across the width of each strip, but increasing axially outwardly from the center at the line of slitting between adjacent strips, said separator roll being positioned in said line of travel to frictionally engage the strips passing thereover and effect lateral separation thereof, drive means for rotating said roll at a surface speed different from the speed of the travelling strips, a winder in said line of travel behind the separator roll and rotatably mounting a plurality of axially aligned cores across the width of said roll and said strips for receiving each of said strips, and drive means independent of said roll drive means for rotating said cores.

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