Oct. 31, 1967 S. E. AMOS 3,350,026

WEB SLITTING AND REWIND MACHINE

Filed March 15, 1966

FIG. 1

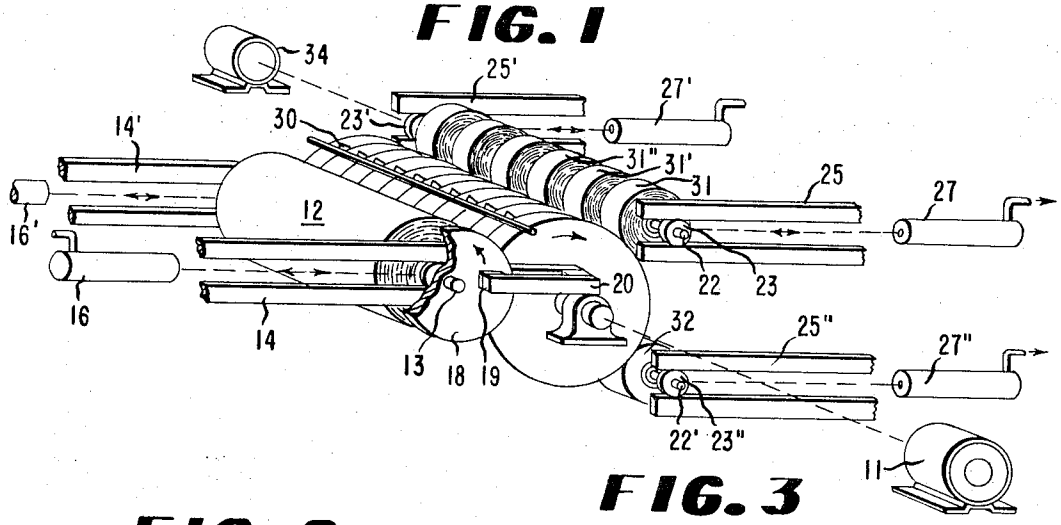


FIG. 2

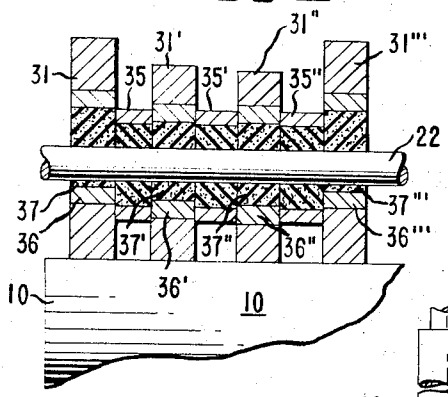


FIG. 3

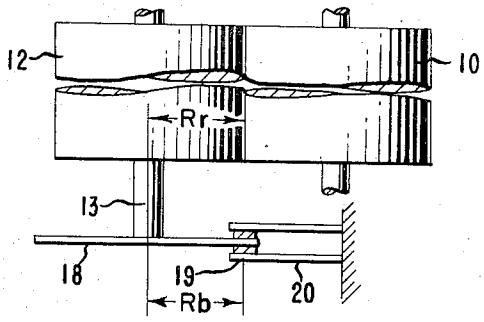


FIG. 3A

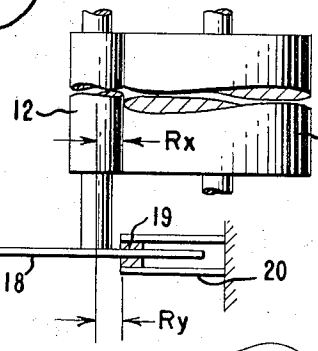
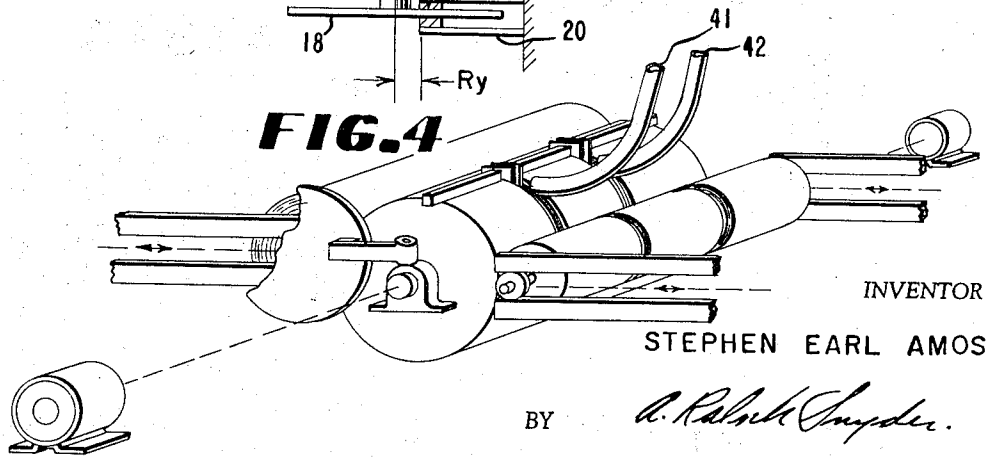


FIG. 4



INVENTOR

STEPHEN EARL AMOS

BY A. Robert Snyder.

ATTORNEY

United States Patent Office 3,350,026 Patented Oct. 31, 1967

3,350,026

WEB SLITTING AND REWIND MACHINE

Stephen Earl Amos, Circleville, Ohio, assignor to E. I. du Pont de Nemours and Company, Wilmington, Del., a corporation of Delaware

Filed Mar. 15, 1966, Ser. No. 534,389
2 Claims. (Cl. 242—56.9)

This invention relates to web-winding machines and more particularly to improved web-slitting and rewinding machines.

A principal object of this invention is to provide improved web-winding machinery operative to rewind slit rolls of uniform quality despite wide variations in gauge across the web to be slit and rewound. The foregoing and additional objects will more clearly appear in the detailed description to follow.

These objects are fully realized in the present invention which, briefly stated, comprises in a continuous web slitting and rewind machine, the combination of a driven transport roller mounted for rotation on a fixed horizontal axis, means for driving said roller, an unwind mandrel adapted to support a web supply (i.e. mill) roll, the axis of said mandrel being parallel to the axis of said roller and mounted for straight line movement toward and away from said roller, means for constantly urging said mandrel toward said roller whereby the web supply roll supported thereon is maintained in contact with said roller, means for retarding the rotation of said mandrel, at least one driven rewind mandrel adapted to support a plurality of rolls of slit web, the axis of said rewind mandrel being parallel to the axis of said roller and mounted for straight line movement toward and away from said roller, means for constantly urging said rewind mandrel toward said roller, means for driving said rewind mandrel at constant torque, and a plurality of slit roll cores mounted in spaced relationship on said mandrel, and a resilient bushing between each core and the windup mandrel in frictional driving contact with said core and said mandrel.

An understanding of my invention will be facilitated by reference to the accompanying drawing wherein:

FIG. 1 is a schematic representation, in perspective, of a preferred embodiment of my invention employing a plurality of rewind mandrels;

FIG. 2 is a schematic view illustrating the resilient sleeves disposed in spaced relationship on the rewind mandrel;

FIG. 3 is a view partially in section which illustrates a retarding means with parts as disposed at the beginning of the slitting operation;

FIG. 3A is a view partially in section which illustrates the disposition of the parts of the retarding means of FIG. 3 near the end of the slitting operation; and

FIG. 4 is a schematic perspective view of an alternative embodiment of the apparatus of the present invention.

Referring to FIG. 1, the relationship of the various elements can be seen. Driven transport roller **10**, driven by motor **11**, frictionally engages supply roll **12** which contains the web to be slit. Roller **10** rotates in the clockwise direction, thus the web unwinds from roll **12** onto the upper side of the roller **10**, as shown. Roll **12** is mounted on mandrel **13** which in turn is moveably mounted on straight line guide ways **14** and **14'** and is urged by pneumatic means **16** and **16'** to maintain supply roll **12** in frictional engagement with roller **10**. Rotation retarding means is provided in order to maintain tension on the web; in the preferred embodiment mandrel **13** is extended and fitted with a disc brake, having disc **18** which engages brake shoe **19** on a fixed mount **20** so that as the radius of the supply roll decreases with the unwinding

of the web, the disc moves inward toward roller **10** and decreases the radius arm of the disc brake (FIGS. 3 and 3A.). The braking force is thus proportional to the torque applied to the supply roll as it is driven by surface contact with roller **10**, facilitating the maintenance of constant tension. While the means to urge the supply roll is illustrated as a pneumatic cylinder, which is coupled to a source of compressed air, which optionally may be equipped with conventional adjustable diaphragm valve (not shown), it is understood that springs or other pressure means may be employed.

Referring again to FIG. 1, in the preferred embodiment, the web receiving means comprises tandem windup mandrels **22** and **22'**. These are respectively moveably mounted with bearings **23**, **23'** and **23''** respectively, in guide tracks **25**, **25'** and **25''** respectively, with pneumatic means **27**, **27'** and **27''** respectively (optionally these may be springs on other than pneumatic cylinders), to urge slit web windup rolls **31**, **31'**, **31''**, etc., on mandrel **22** and similar rolls **32**, **32'**, **32''**, etc., on mandrel **22'** into frictional engagement with transport roller **10**. Each windup mandrel is driven by a motor **34**, which is preferably a torque motor so as to provide constant torque independent of speed to assist surface drive of windup rolls. A plurality of slitting knives **30** supported across transport roller **10** are positioned so that the knives engages the web and slit it into narrow widths. These are wound on spaced apart rolls **31**, **31'**, **31''**, etc., and **32**, **32'**, **32''**, etc., on mandrels **22** and **22'**, respectively. Transport roller **10** preferably has a plurality of circumferential grooves into which the slitting knives fit, the groove is found to increase the useful life of the cutting edge of the knives over the life of the edges of the knives that ride on the solid surface of the roller as they cut through the web.

FIG. 2 illustrates two essential features of the present invention: resilient (e.g. sponge rubber) bushings intermediate the windup roll cores and the mandrel and in frictional driving contact with both the core and mandrel, and spacers between the windup rolls permitting some independence of rotation to allow slightly different angular velocities by virtue of winding rolls of slit web in which slight variations in gauge cumulatively can result in differences in circumference among various rolls. Shown in the figure is a portion of mandrel **22**. Rolls **31**, **31'**, **31''**, **31'''**, etc., are positioned on this mandrel with spacers **35**, **35'**, **35''** between rolls. These spacers prevent lateral contact between rolls to permit independent rotation. Each roll is wound on a core **36**, **36'**, **36''**, **36'''**, etc., and between each core and the mandrel is a resilient bushing **37**, **37'**, **37''**, **37'''**, etc., to allow slight radial movement of the roll in response to variations in diameter caused by gauge differences. Due to the force exerted by urging means **27** of FIG. 1 (and the corresponding elements of a second mandrel), resilient bushings **37**, **37'**, **37''**, **37'''**, etc., are distorted so that the periphery of each slit roll is held in frictional contact or engagement with roller **10**, thus uniform contact of the periphery of each slit roll with the transport roller is maintained. The bushings are of a resilient sponge rubber, sufficient to permit a radial distortion of approximately $\pm 5\%$ of the diameter of a finished roll (e.g. 10 inches) under a pressure of 5 p.s.i. As shown in FIG. 2, the spacers may also comprise a resilient bushing; conveniently one may employ, as the spacers, empty cores and their associated resilient bushings.

The action of the disc brake is illustrated in FIGS. 3 and 3A. Shown in the figures is supply roll **12** engaging driven transport roller **10** with mandrel shaft **13** extended, and having mounted thereon disc **18** having a diameter substantially the same as the initial diameter of the supply roll, which frictionally engages brake shoe **19** mounted on support **20**. In FIG. 3, supply roll **12** has

radius R_r with braking radius R_b; FIG. 3A shows substantially expended supply roll **12**, with radius R_x and braking radius R_y. This braking apparatus, thus provides uniform reduction of the braking force as the supply roll is expended:

$$\frac{R_r}{R_b}=\frac{R_x}{R_y}$$

The brake disc and the supply roll core are fixed to the shaft so that they rotate togther. The disc may be of any suitable metal, e.g., steel, aluminum, aluminum alloy, brass and the like; the brake shoe is of a fibrous non-metallic material commonly used for brakes, such as compositions containing asbestos.

The surface of transport roller **10** is preferably covered with rubber, of a moderate density, e.g. a 30–40 Shore A, finished to a fine pebbly surface. The thickness should be sufficient to accommodate slits by the slitting knives, which are allowed to cut through the coating on their initial contact. The grooves may be as close together as 1/16 inch and still provide good support for the web during slitting, so the coating need not be replaced after each use.

Referring to FIG. 2, windup rolls are spaced apart by cylindrical spacers **35**, **35'**, **35''**, **35'''**, etc.; these may be of nylon or other plastic material to allow freedom of rotation of separate rolls, or as stated above they may be made up of the cylindrical slit roll core material and the resilient bushing. It is important, however, to have the width of the spacer precisely the same as the desired spacing, such as the width of the adjacent slit width of web wound on the second tandem mandrel.

FIG. 4 illustrates the present invention adapted to the vacuum withdrawing system of U.S. Patent 3,144,216. Shown in this figure are basically the same elements of FIG. 1, but instead of tandem windup mandrels a single mandrel is employed, with dual slitting knives which slit a very narrow width of web which is withdrawn by vacuum ducts **41** and **42**. This arrangement is particularly useful for slitting a wider web into two or more wide widths, and for slitting capacitor film from metallized film having an unmetallized margin on the capacitor film.

What is claimed is:

1. In a continuous web slitting and rewind machine, the combination of a transport roller mounted for rotation on a fixed horizontal axis, means for driving said roller, and unwind mandrel adapted to support a web supply roll the axis of said mandrel being parallel to the axis of said roller and mounted for straight line movement toward and away from said roller, means for constantly urging said mandrel toward said roller whereby the web supply roll is maintained in contact with said roller, means for retarding the rotation of said mandrel, at least one driven rewind mandrel adapted to support a plurality of rolls of slit web on cylindrical cores, the axis of said rewind mandrel being parallel to the axis of said roller and mounted for straight line movement toward and away from said roller, means for constantly urging said rewind mandrel toward said roller, means for driving said rewind mandrel at constant torque, a plurality of cylindrical slit roll cores mounted in spaced relationship on said rewind mandrel, and a resilient bushing between each core and the rewind mandrel in frictional driving contact with the core and the rewind mandrel.

2. The machine of claim **1** wherein the means for retarding the rotation of said mandrel comprises a disc mounted at one end of said mandrel for rotation therewith, and a stationary brake shoe in contact with the face of said disc.

References Cited

UNITED STATES PATENTS

2,984,427	5/1961	Rockstrom	242—65
2,985,398	5/1961	Rockstrom et al.	242—65
3,144,216	8/1964	Billingsley	242—56.4

LEONARD D. CHRISTIAN, *Primary Examiner.*