

Nov. 3, 1970

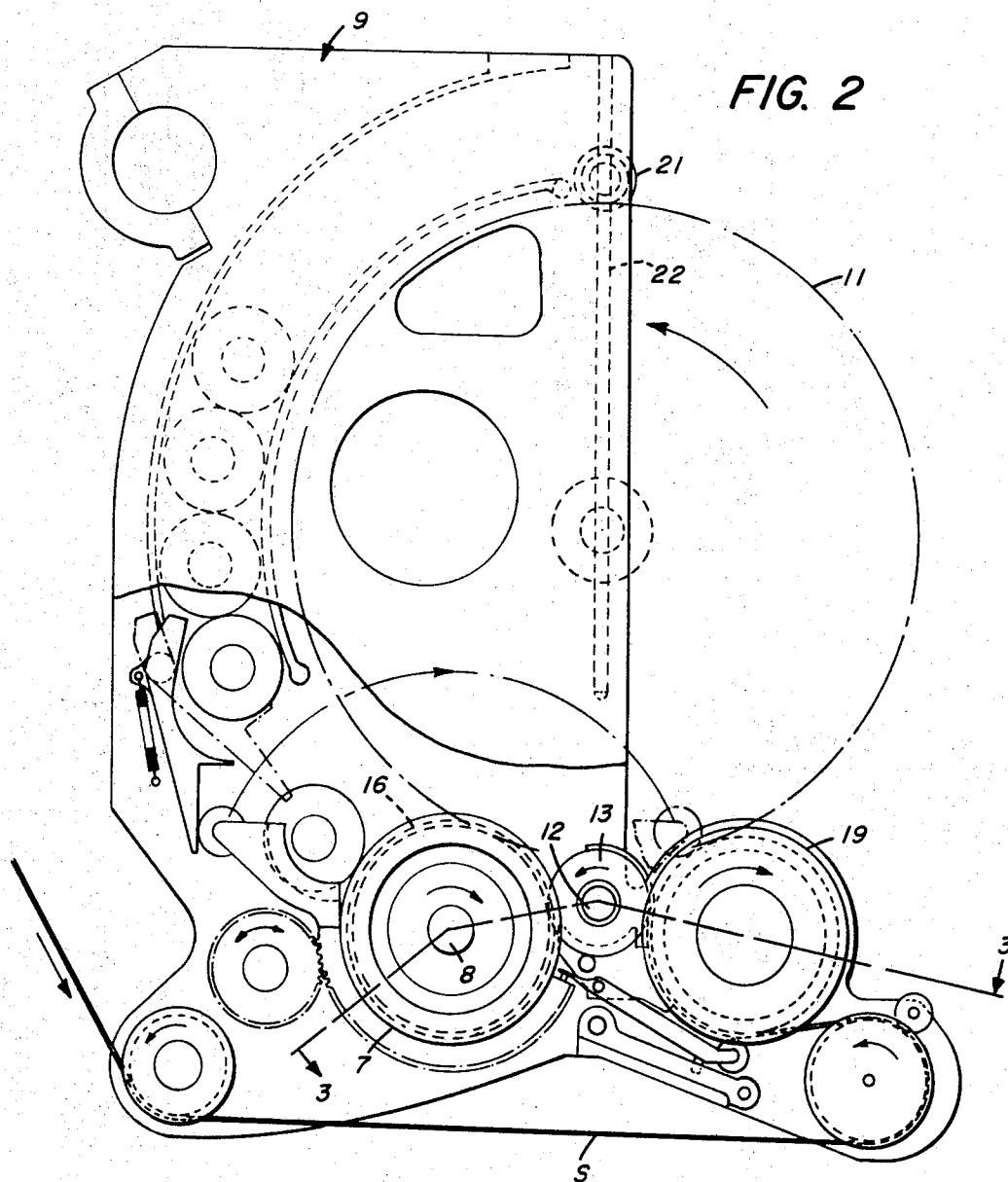
H. R. DE MALLIE ET AL.

3,537,664

SURFACE WINDING DEVICE

Filed Oct. 9, 1968

3 Sheets-Sheet 2



HOWARD R. DEMALLIE
THOMAS J. PERCONTI
INVENTORS

INVENTORS
Walter O. L. Loomis
 BY *Paul W. Holmes*
William E. Jackson
 ATTORNEYS & AGENT

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FIG. 3

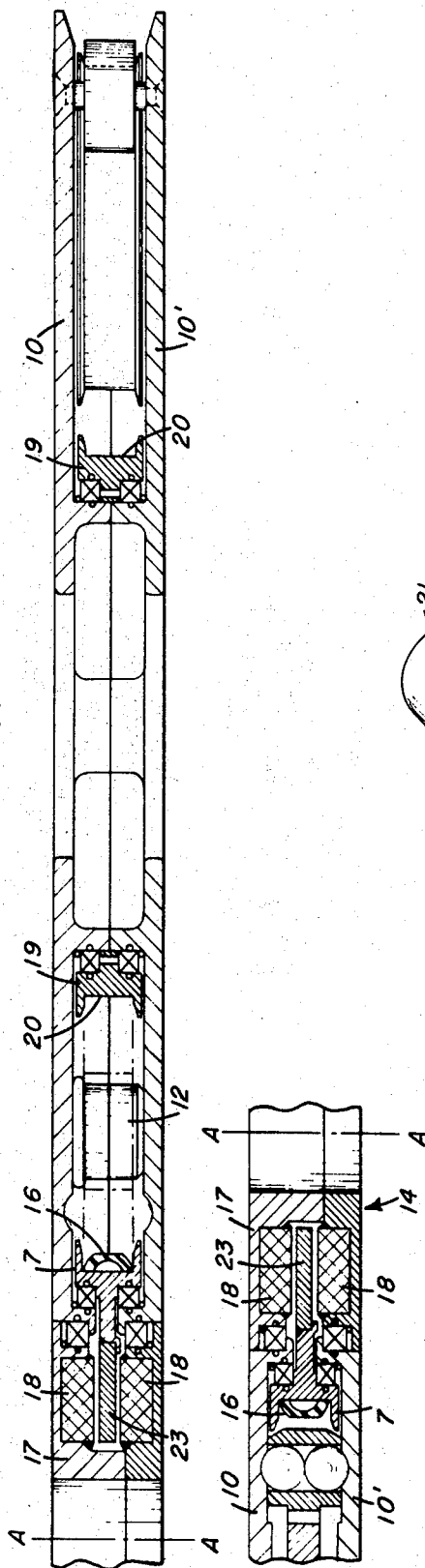
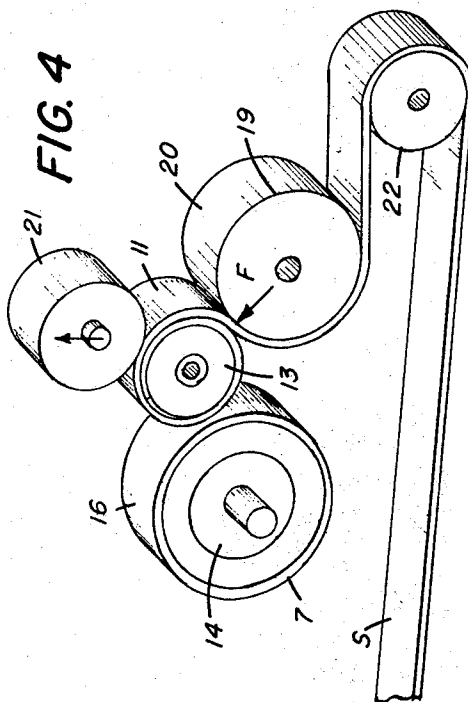


FIG. 4



HOWARD R. DEMALLIE
THOMAS J. PERCONTI
INVENTORS

BY

Paul W. Holmes
William E. Jackson
ATTORNEYS & AGENT

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SURFACE WINDING DEVICE

Howard R. De Mallie and Thomas J. Perconti, Rochester, N.Y., assignors to Eastman Kodak Company, Rochester, N.Y., a corporation of New Jersey

Filed Oct. 9, 1968, Ser. No. 766,241

Int. Cl. B65h 17/12

U.S. Cl. 242—66

2 Claims

ABSTRACT OF THE DISCLOSURE

A surface winding device for winding a narrow strip into a flangeless roll at high speed. The strip comes from a slitter to a roll nested between rotatable drive and idler drums.

The present invention relates to a surface winding device and more particularly to a windup device for high speed winding of flangeless rolls of narrow webs of photographic film.

Surface windup devices have been previously used for the winding of various web materials. For example, wide webs of paper have been wound on devices having spaced drums. The rolls of paper are wound while nested between these drums and it has been found that the rolls can be wound very tightly if one drum is driven at a relatively faster speed than the other so that additional tension is created in the web. While this procedure of surface winding is acceptable in many situations, it creates certain problems when used with narrow webs of photographic film.

A significant problem encountered in the surface winding of photographic film is abrasion or similar damage of the film base or its sensitized coatings. In the surface winding techniques of the above prior art, one winding drum is intentionally driven at a speed relatively faster than the other so that tension is produced on the web. When this technique is used on photographic film the slip between the drum and nested roll introduces an undesirable frictional abrasion to the film. Another similar problem encountered in the surface winding of photographic film is that, at high winding speeds, the hard nested rolls being wound may bounce or vibrate against one or both of the driving drums. This condition may cause damage to photographic film, especially to the sensitized coatings which are easily damaged by abnormal pressures and tensions created during vibrations. Bouncing of the web roll also introduces variations in winding tension and, consequently, variations in the hardness of the wound roll. A further problem created by surface winding results when narrow webs are wound into flangeless rolls. Under these circumstances the rolls tend to display uneven side walls. For instance, when rolls of narrow webs are surface wound to any substantial diameter, their sides tend to dish.

An object of the present invention is to provide a surface windup device which does not subject the nested roll to slip and the resulting damage therefrom.

Another object of the invention is to provide a high-speed surface windup device which produces a hard roll without subjecting the nested roll to undesirable rebound forces.

Still another object of the invention is to provide a surface windup device which can produce a flangeless wound roll from a narrow web without undesirable non-uniformities in the side walls of the roll.

A further object of the invention is to provide a surface windup device for winding photographic film strip.

Other objects and advantages of the present invention will be apparent to those skilled in the art by the descrip-

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tion of a preferred embodiment of the invention which follows.

The above objects are accomplished by winding a web roll between a compliant-surfaced drive drum and a relatively hard-surfaced idler drum. Further, during winding, the web roll is provided with lateral support and the peripheral velocities of the web roll and the drums are equalized.

Reference is now made to the accompanying drawings wherein like reference numerals and characters designate like parts and wherein:

FIG. 1 is a schematic view showing the arrangement of a plurality of surface windup devices in conjunction with a slitting machine.

FIG. 2 is a side view, with portions broken away, of a single surface windup device.

FIG. 3 is a sectional view along line 3—3 of the surface windup device of FIG. 2.

FIG. 4 is a schematic view of a windup device showing a web being wound into a nested web roll.

FIG. 1 shows a schematic of a preferred embodiment of the present invention. Windup devices 1, 1' are supplied with strips S from a slitting machine 2. A plurality of windup devices 1, 1' can be mounted on the top and bottom banks, respectively, on a suitable frame (not shown). The slitting machine 2 takes a wide web W from roll R and slits it into narrow strips S which are supplied to the windup devices. Slitting machine 2 includes a splice board 3, slitter knives 4, and metering drive roll 5. Rolls 6, 6' are used to equalize the strip lengths between upper and lower banks. The strips S are fed to upper and lower windup units 1, 1' which have drive drums 7, 7'. These drums are driven from the main drive of the slitting machine (not shown). A drive shaft is inserted through the center 8, 8' of the drive drums. Two of these shafts span the width of the windup assembly and drive the plurality of windup devices in each bank. The drive shafts for the drive drums 7, 7' are connected thereto through magnetic hysteresis couplings which are described in more detail in a further paragraph. The drive shafts 8, 8' are driven through gearing (not shown) such that they produce an approximate 7% overdrive tendency to the surface of the drive drums 7, 7'. The slip associated with this overdrive occurs in the magnetic hysteresis coupling.

FIGS. 2 and 3 show more details of the individual windup devices referred to above in connection with FIG. 1. The windup device has a housing 9 which consists of two cast and machined aluminum plates 10, 10' bolted together. All of the component parts for the windup device are carried between, and supported by the cast housing. As best seen in FIG. 2, the roll 11 being wound is rotated in a semicircular cavity cast in the housing side plate 9. The roll 11, as it is wound, is prevented from leaning and rubbing against the housing sides by a hub 12 inserted in the core 13. The hub 12 projects beyond the width of the core 13 and strip and spans the width of the housing cavity to provide central support to the roll 11, as shown in FIG. 3.

The drive drum 7 rotates the roll 11 being wound by surface contact with the strip S. The drive drum 7 is driven through a magnetic hysteresis coupling 14. The drive drum 7 is covered with a molded tire 16 which is made of a suitable shock-absorbing material having a relatively high coefficient of friction, such as polyurethane. The action of tire 16 is to absorb shock, to reduce rebound and vibration, and to maintain frictional driving contact with the winding roll 11, even during vibration periods. The magnetic coupling includes an inner member 17 which is rotated at a higher speed than the drive drum 7 during winding. Permanent magnets 18 on the inner member 17 create a tendency drive for the

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drive drum 7 which is connected to the magnetic hysteresis member 23. As described above, the drive drum 7 matches the speed of the strip through the slit 2. Therefore, the overdrive of the inner member 17 creates slip in the coupling between the drive drum 7 and the inner member 17. The amount of torque in the coupling can be adjusted by changing the relationship of the poles of magnets 18, as is well known in the art.

A flanged idler drum 19, together with the drive drum 7 forms the roll nest in which the core 13 and the winding roll 11 are carried. As best seen in FIG. 2, the flanged idler drum 19 transports the strip S around its lower circumference, and guides the strip onto the winding roll 11. The winding roll 11 is embraced by the flanges of the drive and idler drums, 7 and 19 respectively, with a slight amount of clearance. The closeness of the fit between the strip and the flanges contributes to the evenness of the wound roll's side surfaces. The hardness of the wound roll has been found to be a function of the force component between the roll and the flanged idler's surface 20.

The flanged follower roll 21 rides the periphery of the winding roll 11. The follower roll 21 is guided by tracks 22 machined in the cast aluminum housing 9 and rises vertically as the roll 11 grows in diameter. The follower roll 21, together with the flanged idler and drive drums, and core hub 12, establishes a plane in which the roll 11 winds without dishing.

As an example of the present invention, a wide web of photographic film has been slit to 16 mm. width and wound into a multiplicity of 18" diameter flangeless rolls at the speed of 500 feet per minute. The completed rolls had substantially even sides, were hard enough to stay wound during further handling, and the photographic sensitivity of the film was not adversely affected by any undue tensions or abrasions created during winding. It should be apparent to those persons skilled in the art that other widths and kinds of strips or webs are suited for winding according to the present invention.

FIG. 4 is a schematic view illustrating some of the principles involved in the present invention. Strip S is directed onto the lower portion of idler drum 19 by a roller 22 or other suitable guide means. The strip S then is wound onto a roll 11 nested between drive drum 7 and idler drum 19. The roll 11 is built up after the leading end of strip S is cinched onto a core 13. As the roll 11 increases in diameter, it lifts a movable follower roll 21. Drive drum 7 is covered with a compliant, frictional tire 16 which effectively "locks" the drive drum to the surface of the winding roll 11. Idler drum 19 has a relatively hard surface 20 such as polished steel, although it may be covered with a thin layer of plastic to reduce the possibility of scratching the surface of the strip S.

Drive drum 7 transmits winding torque to the roll 11 during winding. The torque is supplied from a central shaft which is coupled to the drive drum 7 by a tendency coupling shown schematically at 14. The tendency coupling insures that the drive drum 7 will have a peripheral velocity the same as that of the roll 11. Idler drum 19 is freely rotatable and follows the velocity of the winding roll at their point of contact. Since the peripheral velocities of the drive and idler drums are equalized with the roll's, there is practically no relative slip between the roll and the drums over the range of speeds at which

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winding is accomplished. This eliminates frictional damage to the surface of the strip.

The hardness of the wound roll is a function of force F and has been found to be relatively independent of the tension in the strip S upstream from the windup device.

The invention has been described in detail with particular reference to preferred embodiments thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention as described hereinabove and as defined in the appended claims.

We claim:

1. In an apparatus for winding web material supplied thereto at a given rate into a roll thereof, and which apparatus includes:

(a) a housing (10),

(b) first (19) and second (7) spaced-apart drums supported by said housing (10) and adapted for rotation in substantially the same plane, said first drum (19) being adapted for free rotation thereof, and said first (19) and second (7) drums being adapted to have nested therebetween, and in contact therewith, a core (13) upon which the said roll of web material is to be formed,

the improvement wherein said second drum (7) comprises:

(a) first and second parts adapted for relative rotation in substantially the same plane, said first part supporting about its periphery a friction member (16), and supporting within said periphery an hysteretic element (23),

(b) magnetic means (18), and

(c) a drive shaft (8) adapted for rotation, said second relatively rotatable part being secured to said drive shaft (8) for rotation thereby, and said secured relatively rotatable part being adapted to support the said magnetic means (18) for magnetic coupling with the said hysteretic element (23).

2. The apparatus of claim 1 including a follower roll (21) and means for supporting said follower roll (21) in substantially the same plane as said first and second drums, and said first drum and said follower roll having peripheral flanges for guiding said web, said first part of said second drum also having peripheral flanges for guiding said web, and said friction member of said first part of said second drum being of a shock-absorbing resilient material.

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STANLEY N. GILREATH, Primary Examiner

W. H. SCHROEDER, Assistant Examiner

U.S. Cl. X.R.

242—75.5