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L. HORNOSTEL

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PAPER WINDER

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Fig. 1.

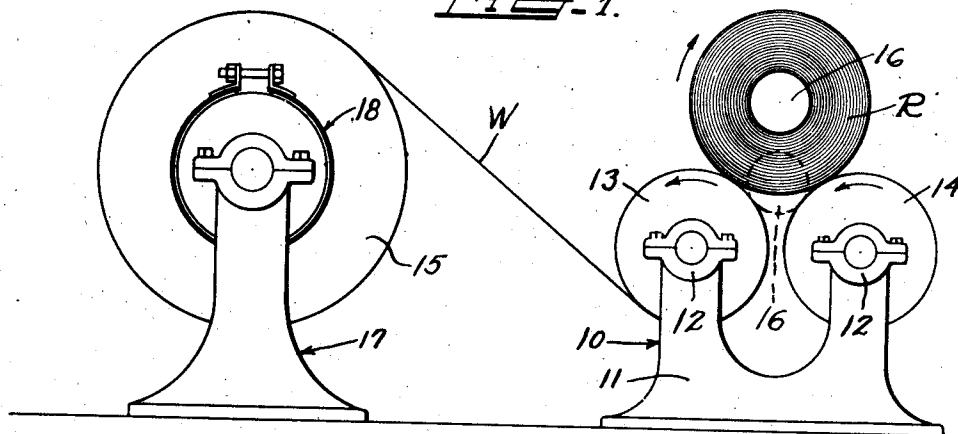


Fig. 2.

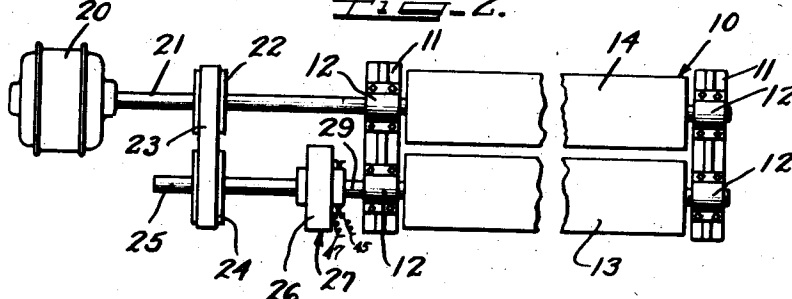


Fig. 3.

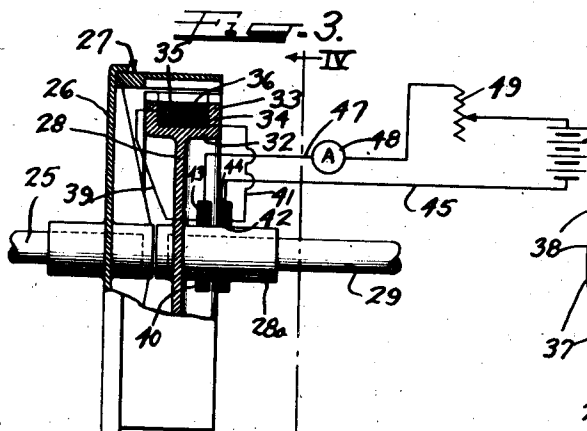


Fig. 4.

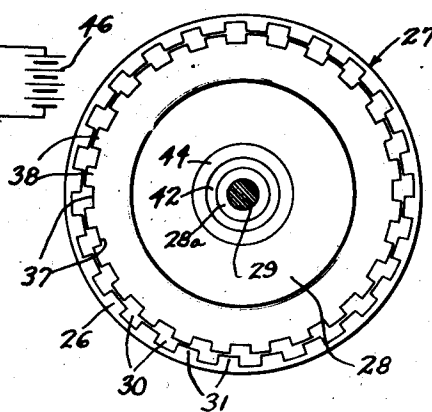
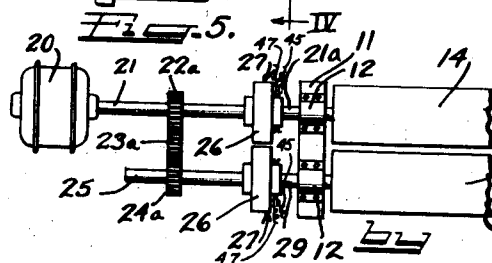


Fig. 5.



UNITED STATES PATENT OFFICE

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PAPER WINDER

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10 Claims. (Cl. 242—75)

This invention relates to winding apparatus especially adapted for the winding of flexible webs such as paper into rolls of uniform hardness. More specifically this invention relates to a drive assembly for winding apparatus which automatically maintains the desired drag on the material being wound so as to produce a uniformly hard roll of the material.

The winding apparatus of this invention includes a pair of winding drums or under drums rotatably mounted in horizontally spaced relation for receiving a winder shaft or spool therebetween. One of the winder drums is directly driven by a prime mover and serves to rotate the spool or winder shaft about its own axis for rolling a web of flexible material, such as paper, therearound. The other winder drum serves as a partial support for the winder shaft or spool and serves to feed the flexible material, such as paper, to the shaft or spool at a rate somewhat slower than the rate of rotation imparted to the shaft or spool by the other drum so that the paper will be tightly wound. This material tensioning drum can be conveniently driven from the same prime mover that drives the other drum through reduction pulleys or gears so that it will rotate at a slower rate.

Twin drum winders of this type have heretofore been deficient in that the drums had to be driven at the same speed thereby preventing use of one of the drums as a web tensioner. If only one of the drums was driven, the idler drum was soon brought up to the speed of the driven drum by the roll. If both drums were driven at different rates, the slow drum would not feed enough paper to the roll after its circumference built up to draw greater lengths of paper per revolution of the roll.

In accordance with this invention, however, the slow drum is allowed to speed up as the roll of paper being wound increases in size and weight but is never allowed to reach the speed of the fast drum. This is accomplished by means of a dynamatic clutch or eddy current coupling interposed between the slow drum and the driving mechanism. The coupling is free from rubbing parts and slips to allow increasing speeds of rotation of the slow drum as the roll being wound increases in size without ever approaching the speed of the fast drum. This characteristic is highly desirable in twin drum winders inasmuch as an increase in diameter of the roll being wound normally increases its weight which in turn makes the paper wind tighter due to the heavier roll of paper being held tight against the drums that are running at different speeds. In other words, if

the slow drum were driven at a constant slow rate the paper would be wrapped tighter at the outer portions of the roll than at the inner portions thereof with the resultant production of non-uniformly hard rolls. If, on the other hand, the slow drum was freely rotatable to be driven by the fast drum through the roll of paper being wound it would soon reach the speed of the fast drum and would not act as a tensioning medium.

The initial slippage in the dynamatic clutch or eddy current coupling can be readily set at any desired amount by simple rheostat control of a direct current excitation circuit to the coil in the clutch or coupling.

For example, if the fast drum is driven at 1,000 R. P. M. and the drive to the slow drum is 800 R. P. M. the coupling effect from the fast drum through the spindle and roll on starting may add sufficiently to the speed of the slow drum to bring it up to 900 R. P. M. However, if the direct drive to the slow drum as pointed out is only 800 R. P. M., the clutch must slip 100 R. P. M. at the start of the winding operation. Now, as the roll increases in weight, its coupling effect between the drums increases and may bring the slow drum up to 950 R. P. M. This, of course, increases the slippage of the clutch to 150 R. P. M. As a result, the clutch has a flexible braking effect on the slow drum so that while the slow drum can approach the speed of the fast drum, it is held back from ever reaching this speed and always serves to act as a tensioning medium with varying or decreasing tensioning effect as the weight of the roll increases to more tightly engage the drum. Therefore, the dynamatic clutch or eddy current coupling on the slow drum slips more as the winding operation proceeds.

The increased slippage besides providing the desired flexible braking effect to keep the hardness of the roll the same, also because of its increased slippage delivers more torque to the slow drum thereby automatically taking care of the increased load on the drum due to the increased weight of the roll.

If desired, a second eddy current coupling can be interposed in the drive to the fast drum thereby producing a more flexible drive assembly for the winder in that the speed of the fast drum can be readily varied by variation of the excitation of the clutch.

Therefore, a feature of this invention is to provide a winder drive on a twin drum winder that automatically produces a greater braking effect on the slow drum or tensioning drum of the wind-

er as the roll being wound increases in size to keep a uniform hardness throughout the roll.

A further feature of the invention is to provide an eddy current clutch in the drive to the slow drum of a twin drum winder for automatically taking care of the greater torque effort in the drive between the drums as the roll being wound increases in weight to make the slow drum run enough slower for winding the paper tight and thereby produce the uniformly hard roll.

It is then an object of this invention to provide a winder apparatus for flexible materials such as paper webs which automatically winds the material into uniformly hard rolls.

Another object of the invention is to provide a twin drum winder machine for rolling web materials into uniformly hard rolls.

Another object of this invention is to provide a positively driven twin drum paper winder.

Another specific object of this invention is to provide a drive assembly for a twin drum winder machine which automatically compensates for changes in winding conditions produced as the result of the increasing diameter and weight of the roll being wound.

Other and further objects and features of the invention will become apparent to those skilled in the art from the following detailed description of the annexed sheet of drawings which illustrates two embodiments of the invention as examples of the invention.

On the drawing:

Figure 1 is a side elevational view of a paper winder embodying the features of this invention.

Figure 2 is a broken top plan view of the twin drum winder unit shown in Figure 1 and illustrating the drive for the drums.

Figure 3 is an enlarged side elevational view, with parts broken away and shown in vertical cross section illustrating a dynamatic clutch used in the drive assembly for the winder and showing an electric excitation circuit for the clutch.

Figure 4 is a view taken along the lines IV—IV of Figure 3, and

Figure 5 is a view similar to Figure 2 but illustrating a modified gear reduction drive with a dynamatic clutch in the drive to each drum.

As shown on the drawing:

In Figure 1 the reference numeral 10 designates generally a twin drum winder unit according to this invention. The unit is composed of side frames 11 carrying bearings 12 for drums 13 and 14. The drums 13 and 14 are horizontally mounted in spaced relation between the frames 11. Web material W such as paper is fed from a roll 15 under the drum 13 to a winder shaft 16 positioned between the drums 13 and 14 for receiving the web therearound. The roll of paper 15 is rotatably mounted on a reel 17 preferably equipped with a brake 18 to prevent free rotation of the roll 15 so that the roll will not keep rotating to unwind the web W after the drums 13 and 14 have been stopped.

As best shown in Figure 2, the drum 14 is directly driven from a motor 20 through a shaft 21. As will be hereinafter more fully explained, this drum 14 is the fast drum or winder drum.

A pulley 22 is fixed on the shaft 21 and drives a belt 23 which belt in turn drives a larger pulley 24 on a shaft 25. The shaft 25 is thus turned at a slower rate than the shaft 21.

The shaft 25 turns the iron or steel armature drum 26 of a dynamatic clutch or eddy current coupling 27.

As best shown in Figure 3, the dynamatic

clutch 27 includes a magnetic spider 28 mounted in the armature drum 26 on a shaft 29 which directly drives the slow drum 13.

As shown in Figure 4, the interior of the armature drum 26 is grooved around the periphery thereof as at 30 to provide a plurality of transverse teeth 31 surrounding the spider 28.

The spider 28 has a rim portion with radially extending side flanges 33 defining an annular channel 34 in which is wound an annular wire coil 35. A plate 36 of non-magnetic material covers the coil 35, and the plate and flanges 33 are grooved as at 37 to provide a plurality of radially extending transverse teeth 38 around the periphery of the spider. The teeth 38, as shown in Figure 4, do not contact the teeth 31 and are never fully aligned therewith. Thus the spider has more or less teeth than the drum so that the teeth 31 and 38 will never be fully aligned. As shown in Figure 3, one end of the coil 35 is connected through a wire 39 with a slip ring 40 fixedly mounted on the hub 28a of the spider. The other end of the coil 35 is connected through a wire 41 with a second slip ring 42 also fixedly mounted on the hub 28a but in insulated relation thereto and to the other ring 40.

Brushes 43 and 44 contact the slip rings 40 and 42, respectively. A wire 45 connects the brush 44 to a source 46 of direct current such as a battery or the like. The brush 43 is connected to the source of direct current 46 through a wire 47, and an ammeter 48 and a rheostat 49 are interposed between the brush 43 and the source of current.

The coil 35 is energized with direct current from the source 46 through the brushes and rotating slip rings 40 and 42 which are in electrical contact with the brushes to create a magnetic field around the coil. This magnetic field induces eddy currents in the spider and the armature drum which act as a coupling for driving the spider with the drum. However a locked condition between the spider and the armature drum can never occur and the spider will always slip relative to the drum. The amount of slippage is readily controlled by the rheostat 49 which controls the excitation of the coil.

When the coil is not excited or energized with direct current the drum 26 will rotate freely around the spider without driving the spider. However, even when the coil is fully energized with direct current some slippage between the armature drum and the coupling will occur.

The shaft 25 is driven at a slower speed than the shaft 21 which in turn means that with no slip in the clutch 27 the drum 13 will run slower than the drum 14. The rheostat 49 of the dynamatic clutch 27 is next set so that the desired initial slow speed of the drum will be obtained. The winder shaft 16 is then rotated by the drums 13 and 14 and the web W is trained under the drum 13 and over the shaft 16 so that the web will be rolled around the shaft. As a roll R builds up on the winder shaft 16 it serves as a coupling between the drums 13 and 14 causing the clutch 27 to slip more and tending to increase the speed of the drum 13 to the speed of the drum 14. However, at the same time the increased slippage in the clutch 27 tends to keep the drum 13 running slower than drum 14. This increase in speed of the drum 13 in relation to the speed of the drum 14 as the roll gets larger and heavier is highly desirable for when the roll is heavier it bears harder against the drums 13 and 14 and the speed difference between the

drums need not be as great to produce a roll of proper uniform hardness.

While the drum 13 can approach the speed of the drum 14 it can never reach this speed since the clutch 27 produces a flexible braking effect when the driven member of the clutch or shaft 29 tries to run faster than the driving member of the clutch or shaft 25 due to the increasing coupling effect of the roll R tending to speed up the drum 13. Since the armature drum 26 of the clutch 27 is then driven at a slower rate, it will create a drag on the drum 13 allowing it to approach but never reach the speed of the drum 14. In other words, the clutch never acts as a free wheeling clutch and will actually hold down the speed of the drum 13 to less than the speed of the drum 14.

In the modification shown in Figure 5 parts identical with parts shown and described in Figure 2 have been marked with the same reference numerals. In Figure 5, the shaft 21 has a gear 22a thereon replacing the pulley 22 in Figure 2. This gear 22a drives an idler gear 23a replacing the belt 23 shown in Figure 2. The idler gear in turn drives a gear 24a on the shaft 25. The gear 24a replaces the pulley 24. The gear 22a has fewer teeth than the gear 24a and for example, the gear 22a may have 20 teeth while the gear 24a may have 25 teeth. As a result, the shaft 25 is driven slower than the shaft 21.

As shown, a dynamic clutch or eddy current coupling 27 is also interposed in the drive shaft 21 to the fast drum 14. The drive shaft 21 rotates the armature drum 26 of this clutch 27 and the spider of the clutch in turn drives the shaft portion 21a to the drum 14.

This arrangement including a slip coupling in the drive to each drum increases the flexibility of the drive assembly since the speed of the drum 14 can readily be regulated by regulation of the excitation of the coil in the clutch on the drive shaft to the drum 14. Furthermore, the driving effort or torque distribution to the drum can be readily varied.

From the above descriptions it will be understood that the dynamic clutch or eddy current slip coupling drive for twin drum winders now makes possible the driving of the drum at different rates and automatically allows the drums to approach but never reach the same speed. As a result, twin drum winders can now automatically produce the uniformly hard roll.

A further result of the use of the eddy current slip coupling in the drive assembly for twin drum winders is that the faster the coupling slips, the more driving torque is applied to the drums so that the driving effort supplied to the drums automatically increases as the load on the drums increases.

It will, of course, be understood that various details of construction may be varied through a wide range without departing from the principles of this invention and it is, therefore, not the purpose to limit the patent granted hereon otherwise than necessitated by the scope of the appended claims.

I claim as my invention:

1. In a twin under drum paper winder including a pair of spaced horizontally aligned winder drums, the improvement which comprises a main drive shaft for directly driving one of said drums, a secondary drive shaft driven from said main drive shaft at a slower rate of speed, an armature drum driven by said secondary drive shaft, a magnetic spider and coil mounted within said

armature drum, a shaft coupling said spider to the other of said winder drums, means for electrically exciting said coil to induce eddy currents between the spider and armature drum for rotating the spider, and means for varying the degree of excitation of said coil to determine the minimum speed of said other winder drum.

2. The method of winding flexible material into rolls which comprises rotating a winder shaft against a rotating surface at a higher speed than the speed of said surface for receiving flexible material therearound held in tense condition by said rotatable surface, continuing the winding of flexible material around the winder shaft to build up a wound roll in contact with rotating surface, increasing the speed of the rotating surface as the roll increases in size and weight, and simultaneously applying an increasing braking effect to said rotating surface to prevent the rotating surface from ever reaching the speed of the roll.

3. The method of winding paper into uniformly hard rolls on a twin drum paper winder which comprises driving one drum slower than the other drum, feeding paper around the slow drum to a spindle rotating between the drums for wrapping the paper around the spindle, automatically increasing the speed of the slow drum in proportion to the increase in the weight of the roll being wound while increasingly braking the slow drum to always hold it below the speed of the other drum, and increasing the torque effort delivered to the slow drum in proportion to the load carried thereby.

4. A winder comprising a pair of winding drums arranged to simultaneously bear upon and support a roll of paper being wound, means for rotating said drums at different speeds, and an eddy current clutch interposed in the driving means to the slower drum, said clutch allowing the speed of the slower drum to increase as a roll of material being wound on the drums increases in size and weight while automatically applying a flexible braking effect on the slower drum to prevent it from ever reaching the speed of the other drum.

5. A winder device comprising a pair of horizontally aligned drums adapted to receive a winder shaft therebetween for rolling web material around the shaft, means for driving the drums at different speeds, and an electric slip coupling controlling the speed of the slower drum, said coupling having an automatically increasing braking effect on the slower drum as the driving effort applied from the faster drum through the winder shaft and rolled web material thereon increases whereby said slower drum can approach but never reach the speed of the other drum.

6. A winder device comprising a pair of winder drums arranged to simultaneously bear upon and support a roll of material being wound, a prime mover directly coupled to one of said drums for rotating the same, an armature drum driven by said prime mover at a slower rate than said winder drum, a magnetic spider and coil within the armature drum, means connecting the magnetic spider to the other of said winder drums, a direct current excitation circuit for fixedly energizing said coil to electrically slip-couple the spider with the armature drum for rotating the other winder drum at a slower rate than the armature drum, and said slip couple between the armature drum and spider providing an automatically increasing braking effect on the winder

drum driven by the spider as the driving couple from the other winder drum applied to said spider-driven winder drum through the roll of material being wound increases whereby the spider-driven winder drum can approach but never reach the speed of the other winder drum.

7. A winder comprising a pair of spaced horizontal winder drums, means supported in the nip between the drums, driving means for driving the drums at different speeds, said means supported in the nip between the drums creating a driving couple between the drums effective to increase the speed of the slow drum beyond the speed imparted thereto by the driving means, and an eddy current slip means interposed between the driving means and the slow drum adapted to slip faster to allow increased speed of the slow drum as the driving couple created by said means in the nip between the drums increases, and said faster slipping of the slip means applying an increased braking effect and an increased driving torque on the slow drum to maintain the speed of the slow drum always below the speed of the other drum.

8. A winder comprising a pair of winding drums arranged to simultaneously bear upon and support a roll of material being wound, a drive for said drums, and eddy current slip clutches in the drive to each drum for automatically vary-

ing the driving torque effort to each drum in accordance with the weight of the roll being wound thereon.

9. A winder comprising a pair of winder drums arranged to simultaneously bear upon and support a roll of material being wound, a single drive means for said drums, and an eddy current slip clutch interposed in the drive to one of said drums to apply an automatically increasing braking effect and an automatically increasing torque effort on said one drum as the driving couple from the other drum applied through the roll of material being wound increases.

10. A paper winder comprising a first winder drum and a second winder drum in spaced horizontal relation adapted to receive a winder shaft therebetween for rolling a web of paper around the shaft, means for driving the first and second drums at different rates with the second drum rotating faster than the first drum, an electric slip clutch on the drive to said first drum for allowing, by means of increased slippage therein, the first drum to pick up speed from the second drum through the roll of paper being wound, and said increased slippage in the clutch imparting an increased braking effect on the first drum whereby the speed of the first drum can never reach the speed of the second drum.

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