

Nov. 19, 1968

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3,411,732

FULLY AUTOMATIC REEL CHANGER

Filed Sept. 20, 1966

2 Sheets-Sheet 1

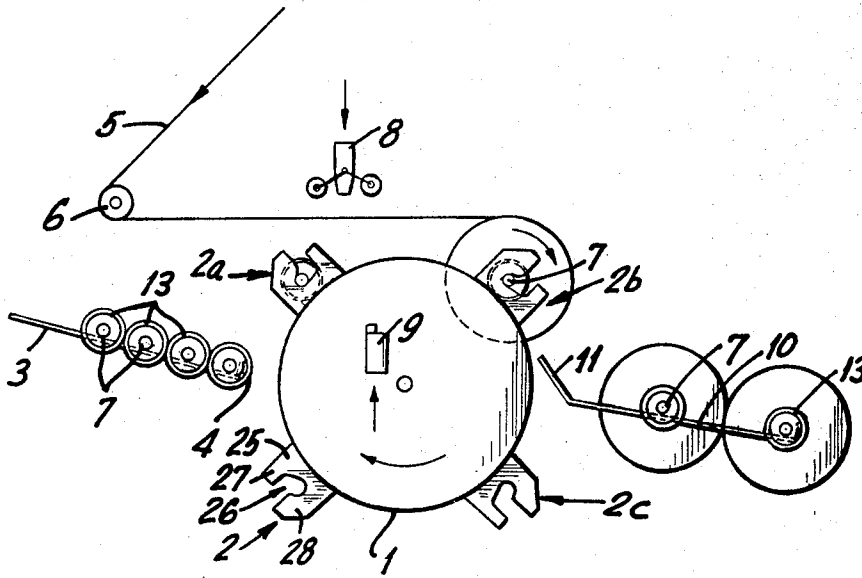


FIG. 1

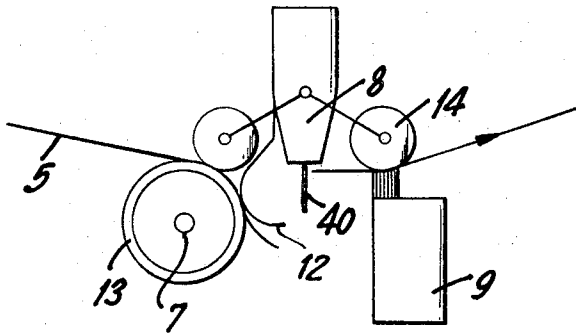


FIG. 2

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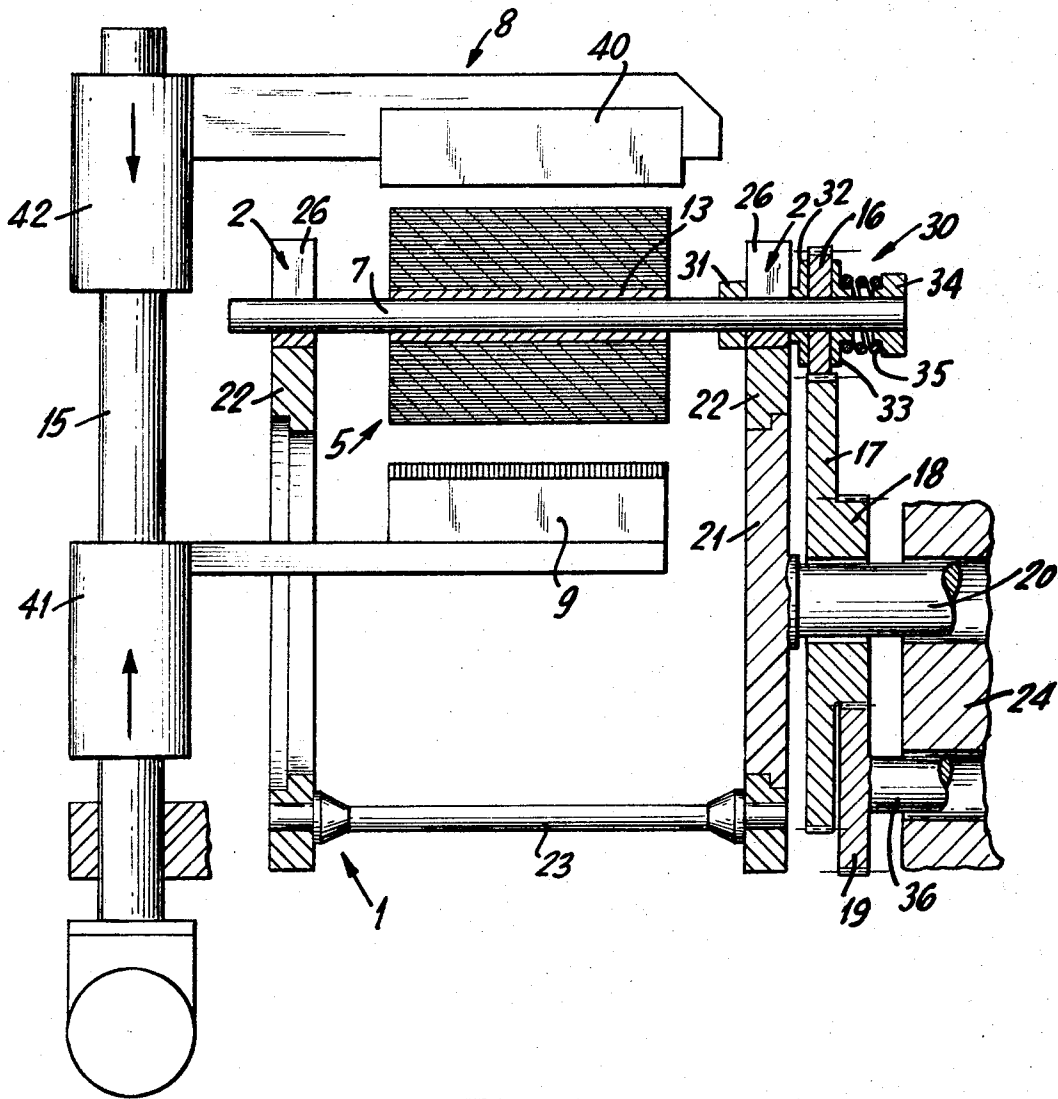


FIG. 3

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3,411,732
FULLY AUTOMATIC REEL CHANGER
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Filed Sept. 20, 1966, Ser. No. 580,718
9 Claims. (Cl. 242—56)

ABSTRACT OF THE DISCLOSURE

Apparatus for continuously winding strip material on reels includes a drum rotatable on a horizontal axis for stepwise angular displacement and carrying a plurality of circumferentially spaced spindle supports arranged to pick up an empty reel from a first magazine and to discharge fully wound reels onto a second magazine. The spindle of each reel has a pinion rotatable thereon and coupled thereto through a slip-type friction clutch. A drive gear rotatable about the horizontal axis of the drum engages the pinion of each reel picked up by a spindle support to rotate the reel. Each reel is moved first to a ready position, at which it is rotated, and then to a winding position in which it wound with tape or the like, after which the wound reel is discharged. Shear means are positioned between the ready position and the winding position to sever the strip or tape from the wound reel and apply the cut end to the reel in the ready position, and end treatment means operate in coordination with the shear means to treat the severed strip material ends.

Background of the invention

This invention relates to apparatus for reeling endlessly processed strip material successively onto reels each having a predetermined length of the material thereon. More particularly, the present invention is directed to novel means for exchanging a completely wound reel, in a reeling position, for an empty reel and without interrupting the continuous processing of the strip material.

The apparatus of the invention is particularly adaptable to the winding of predetermined lengths of continuously processed tape on reels each containing a predetermined length of the processed tape. In tape processing machines, it is known to provide winding devices wherein a reel core is mounted on a spindle connected with the main drive of the processing machine, with the material arriving from the processing machine being wound on the reel core at a speed corresponding to the processing speed of the machine. However, in these devices the processing machines must be stopped, after a certain length of material has been wound on a reel, the tape must be severed, the core must be removed from the spindle, a new reel core must be mounted onto the spindle and the cut end of the tape must be connected with the new reel core.

The necessary exchange of the reels causes, due to the consequent stopping of the processing machine, an unnecessary time loss. An even greater disadvantage in a tape printing machine is that unprinted areas or faulty printed areas appear on the tape, due to the starting and stopping of the printing press. This is particularly obvious when the printing is effected with fast drying inks, since the ink dries on the matrix roll during the stoppage of the printing machine. A complete print can be insured only after a full revolution of the reel, and this causes a considerable amount of waste resulting from the exchange of reels.

Apart from the loss of frequently valuable material, the first inner turns of each reel are loaded with this amount of waste so that the useable length of the wound

reeled tape is not in agreement with the effective length. In addition, a part of the useable material, contained between the printing mechanism and the winding device when the machine is stopped, cannot generally be used because there is always, between the useable lengths of a reel, the lead or length from the starting operation which either cannot be printed or can be printed only poorly.

The presence of poorly printed tape lengths is of particular disadvantage in the production of numbered labels or of rolls of trading stamps, since these possibly valuable portions of the tape cannot be used and must be discarded. The consequences of this are considerable organizational and economic disadvantages.

There are also known printing machines wherein the printing mechanisms are retracted during stopping of the machine for exchanging the reels, and are moved slowly by means of a servo motor for constant wetting of the matrix roll. However, even with these expensive technical expedients, it is not possible to avoid printing errors and registry differences when the printing mechanisms are again engaged with the tape.

Another known expedient, used to avoid stopping of the machine during exchange of the reels, is to disengage the winding device when a certain amount of material has been wound while letting the machine run slowly during the changing of the reels. During the changing of the reels, the material forms a loop which is wound around the spindle either manually or mechanically before the winding device is again engaged. This method, however, requires fast and accurately working skilled workers, since the loop must not become too long and the machine must not run too slowly if printing errors are to be avoided.

It has also been tried to speed up the exchange of reels by arranging two delivery spindles on an arm pivotally mounted on a shaft. After winding of a reel has been completed, it is merely necessary to turn the spindle carrier arm through 180°, cut off the tape and secure the end toward the machine side on the empty reel core. The fully wound core can then be removed from the spindle, after the machine has been restarted, and another core can be attached to the spindle for the next exchange of reels. This measure, however, does not avoid the necessity of stopping the machine, with the constant production of an unuseable length of tape.

An object of the present invention is to provide a reeling apparatus for reeling continuously processed lengths of material, such as tape, in which the foregoing disadvantages of the prior art are obviated.

Another object of the invention is to provide apparatus for reeling strip material, endlessly processed by a machine, in predetermined lengths on each reel, and with the full reels being exchanged for empty reels, without the necessity of stopping either a reel winding device or the entire machine during exchange of the reels.

A further object of the invention is to provide a reeling arrangement for strip material and which is particularly suitable for use in high speed machines where tapes are produced which are wound on reel cores from material processed in endless lengths, and with each reel having a predetermined length of material wound thereon.

Still another object of the invention is to provide a reeling apparatus of the type mentioned which can be used in machines for producing water soluble or heat sealing adhesive coated tape.

A further object of the invention is to provide a reeling apparatus wherein no manual work during exchange of a fully wound reel for an empty reel is required, and in which there is no necessity for either stopping or slowing down the machine.

Yet another object of the invention is to provide a reeling apparatus of the type mentioned in which there is no

waste of valuable material and no loss of time, due to exchange of a fully wound reel for an empty reel.

Another object of the invention is to provide such a reeling apparatus in which changing of the reels is effected automatically without the necessity for skilled workers and without interrupting the winding process.

For an understanding of the principles of the invention, reference is made to the following description of a typical embodiment thereof as illustrated in the accompanying drawings.

In the drawings:

FIG. 1 is a somewhat schematic longitudinal sectional view through one form of apparatus embodying the invention;

FIG. 2 is a side elevation view of a tape cutter and coating spreader, included in the apparatus shown in FIG. 1, and illustrated, in FIG. 2, in active relation to the tape; and

FIG. 3 is a partial transverse sectional view through the apparatus shown in FIG. 1.

In the drawings, the invention is illustrated as applied to a machine for the continuous production of printed self-adhesive PVC tapes. Thus, and referring to FIG. 1, a machine of this type includes a support element, such as a cylinder or drum 1, supported on a rotatably mounted horizontal shaft 20. The periphery of cylinder 1 has mounted thereon four pairs of spindle bearings 2, 2a, 2b and 2c, the bearings of each pair being axially spaced. The spindle bearings extend perpendicularly to the axis of drum or cylinder 1. On the side of drum 1 toward the printing machine, there is arranged a magazine 3 for receiving the spindles 7 of empty reel cores 13. Magazine 3 is inclined downwardly toward drum 1 in such a manner that its end 4, adjacent drum 1, is arranged midway between two spindle bearings 2 and 2a, in the at-rest or stationary position of drum 1.

The continuously printed tape 5 coming from the printing machine runs over a guiding roller 6 and is wound on the reel core 13 on a spindle 7 then supported in spindle bearings 2b. Above tape 5, between roller 6 and the reel 13 supported on the spindle 7 in spindle bearings 2b, there is arranged a cutting device 8, a device 9, for applying a coating to the underside of the tape, being arranged beneath tape 5. Devices 8 and 9 are arranged so that they can be moved toward each other and toward tape 5. On the side of drum 1 away from the machine, there is a magazine 10 for full reels, magazine 10 sloping downwardly away from drum 1. Magazine 10 is provided with spindle receiving bars 11 which, in the stationary position of the drum 1, are located substantially midway between spindle bearings 2b and 2c.

FIG. 2 shows tape cutting device or shears 8 and spreader 9 in active position relative to tape 5. Cutting device 8 includes a tape pressing plate 12 which, after tape 5 has been severed by the flying shears of cutting device 8, presses tape 5 against the empty reel core 13 on the spindle 7 then positioned in the bearings or spindle supports 2a. Spreader 9, which spreads either silicon or glue against tape 5, operates against a counter pressure roller 14, tape end 5 running beneath this counter pressure roller.

Referring to FIG. 3, drum 1 is supported on horizontal drum shaft 20 which is rotatably mounted in a suitable bearing member 24 and has a circular end plate or disk 21. Drum 1 includes a pair of axially spaced annular rims 22 interconnected by circumferentially spaced tie rods 23. Only one rim 22 of drum 1 is supported on end disk 21, as is indicated in the enlarged cross section of FIG. 3. The drum is thus open on its end remote from disk 21.

Spreader 9 projects through the open end of drum 1 and, together with cutting device 8, is supported on a contra-rotating driving column 15 through the medium of collars 41 and 42, respectively. By virtue of column 15, devices 8 and 9 are moved conjointly either toward tape 5 or away from tape 5.

In FIG. 3, the spindle 7, in which tape 5 is shown

wound on a reel core 13, is arranged in spindle bearings 2. Each of these spindle bearings comprises a bearing plate 25 (FIG. 1) formed with an outwardly opening slot 26 which extends radially inwardly and then substantially tangentially, slot 26 being defined, with respect to the direction of rotation of drum 1, by a leading arm 27 and a trailing arm 28. It will be noted that trailing arm 28 extends radially substantially beyond leading arm 27.

Each spindle 7 is provided with a slipping-type clutch 30 and, for this purpose, has an inboard collar 31 which engages the inner side of the spindle bearing and a collar 34 fixed to the end of the spindle. The clutch 30 couples spindle 7 to a pinion 16 and, for this purpose, includes an axially inner collar 32 which is fixed to spindle 7 and an axially outer collar 33 which is axially movable relative to spindle 7 and is biased, to clamp pinion 16 between itself and collar 32, by a coil spring 35.

Pinion 16 meshes with a spur gear 17 which is part of a dual gear including a spur gear 18, this dual gear being freely rotatably mounted on drum shaft 20. Spur gear 18 is engaged with a drive pinion 19 on a driving shaft 36 which is rotatably mounted in the bearing member 24. The drives of drum shaft 20 and of shaft 36 are connected with the main drive of the printing machine, which has not been illustrated.

The operation of the device, as thus described, is as follows. The self-adhesive tape 5 is conducted from a rotary printing machine designed for the production of printed, self-adhesive PVC tapes, and with the printed and uncoated side of tape 5 engaging guiding roller 6, tape 5 then being lead to the reel core 13 on the spindle 7 supported in the spindle bearings 2a. The tape is wound on reel core 13, in synchronism with printing and cutting of the tape, by driving the reel core spindle clockwise, as viewed in FIG. 1. This is effected by pinion 16, and slipping clutch 30, driven through gears 17 and 18 and drive pinion 19.

As soon as predetermined length of tape has been wound on the then active reel core, the changing of the reels is initiated by an impulse from an electro-mechanical meter-counter which is not shown. Initially, this impulse effects operation of a control mechanism (not shown) to move cutting device 8 and spreader 9, through driving column 15, toward tape 5. The flying shears 40 of cutting device 8 is released, as by means of disengaging a pawl, so as to operate to cut tape 5. The severed end of the tape is immediately pressed by plate 12 onto the reel core 13 positioned on spindle 7 then supported in spindle bearings 2a. The self-adhesive tape 5 is thus immediately wound on this latter reel core, as the spindle thereof is being rotated by the drive 19 since the preceding changing of reels.

At the same time, the end of the roll of tape on the reel core on the spindle 7 supported in bearing 2b is coated with silicon by the pressure of silicon spreader 9 against the coated side of the tape, in cooperation with counter pressure roller 14. The coating of a wound self-adhesive tape with silicon serves to prevent the end thereof from sticking to the roll, and thus to facilitate the unwinding of the tape. The end of the tape is wound on the tape roll by the pressure of a brush (not shown), with the full reel still being turned by driving pinion 19 through gears 18 and 17, and the associated pinion 16 and clutch 30.

Subsequently, cutting device 8 and silicon spreader 9 are retracted by the control mechanism, through driving column 15, into their initial retracted position. Then drum 1 is rotated 90° clockwise, also under the control of the control of the control mechanism. During this rotation of drum 1, spindle 7 supported in spindle bearing 2b is disengaged from gear wheel 17 by the increasing downward inclination of the carrier slot 26, and drops out of slot 26, with further inclination of the latter below the horizontal. The spindle is caught by the receiving bars 11 of reel magazine 10. The empty bearings 2b move

further clockwise until drum 1 comes to a standstill after completion of 90° of rotation.

At the same time, the spindle in bearings 2a has advanced into the position 2b. The increase of the tensile stress in the tape toward the printing apparatus, which is caused by movement of spindle bearing 2a into the position 2b during rotation of drum 1, with simultaneous rotation of the pinion 16 of the spindle by the common drive of the processing machine of the winding device, is compensated by the friction clutch 16 of the spindle in the same manner as an increase of such tension due to an increase in the diameter of the roll is compensated by the slip clutch 16.

Simultaneously, spindle bearings 2 pick up, from magazine 3, the spindle 7 then resting against stop 4 and having an empty reel core 13. As the drum continues to rotate, the slots 26 of bearings 2 move toward a vertical orientation so that this spindle drops fully into the open bearings 2 and its pinion 16 engages gear 17 so that the rotation of the spindle is started.

Due to the inclination of magazine 3 and 10 toward and away from drum 1, respectively, an additional spindle 7 having an empty roll core 13 advances to stop 4, while the loaded spindle picked off drum 1 by arms 11 rolls off along these arms and along magazine releasing the spindle bearings 2b. With the completion of the exchange operation, the device is ready for the next change of reels.

The device according to the invention which, in the embodiment illustrated, serves to exchange reels in the case of tape rolls having an inwardly direct self-adhesive coat, can be used, by inverse attachment of drum 1 to disk 21, and by corresponding mirror-image displacement of all units in mountings provided for such purpose, for winding and changing rolls of self-adhesive tapes whose self-adhesive coating is oriented toward the exterior.

If the device is to be used for the winding unit of non-sticking tapes, silicon spreader 9 can be replaced by a gluing fixture for gluing the end of the roll of tape in order to avoid opening of the turns of the roll due to the tape not being firmly secured on the roll. In order to glue the tape end toward the printing apparatus to an empty roll core 13, by pressing the tape with pressure plate 12, the roll cores can be provided with a self-adhesive material before they are mounted in magazine 13. However, if the device is used for non-adhesive tapes, the gluing fixture beneath the tape, which is controlled in synchronism with the overall device, can be started immediately before operation of cutting device 8 so that part of the undersurface of the tape is coated with glue on both sides of the severed tape ends.

The control mechanism can be operated in a known manner either mechanically, hydraulically, pneumatically, or electromagnetically. Likewise, the impulse transmitter can act in a known manner either mechanically, electro-mechanically, or electronically. The electromagnetic meter-counter can be replaced, for example, by a scanning pawl which acts on the roll which is increasing in diameter and which initiates the change of reels mechanically when a certain radius of the wound tape has been attained. The changing of the reels can also be effected by an impulse from a photocell counter, as in the manufacture of label tapes or trading strips.

Depending on the number of spindle bearings on the drum, it is of advantage to arrange the bearing slots radially-tangentially curved, or tangentially uncurved, in order to permit the movements of the spindles into and out of the spindle bearings during rotation of the drum. The invention device can be used for winding and reel changing in processing machines for any type of band-shaped material such as, for example, printed or unprinted webs of paper, plastic, textile, metal foils, films, cords, threads, ropes, etc. The device can also be used

independently of a processing machine by providing it with a separate drive.

The invention apparatus is particularly suitable for winding self-adhesive label tapes and plastic self-adhesive tapes. Machines for the production of these tapes now work with tape velocities of 50 to 150 m. and more per minute. Since commercial roll lengths are on the average 60 cm., a change of reels is effected in the conventional arrangement by stopping the machine for about the same period as used for printing process. A change of reels takes about 1 minute. Thus, the effective machine capacity is only 1/2 the potential capacity. Furthermore, due to the waste of several meters of material per roll, caused by the stoppage of the machines, the conventional method is uneconomical.

On the other hand, with the present invention it is not necessary to stop the printing apparatus for changing of the rolls. This has the advantage, for example, that it is possible to avoid drying of the ink on the matrix roll, which latter is not constantly wetted during a stoppage of the printing machine. This is particularly true when aniline printing mechanisms are used, and thus a poor print is obtained. In addition, the invention apparatus provides for a better utilization of the capacity of these printing machines.

While specific embodiments of the invention have been shown and described in detail to illustrate the application of the principles of the invention, it will be understood that the invention may be embodied otherwise without departing from these principles.

What is claimed is:

1. Apparatus for continuously winding strip material on reels, with a preselected length of material wound on each reel, and for exchanging a fully wound reel for an empty reel without interrupting the continuous winding, said apparatus comprising, in combination, a support element rotatable on a horizontal axis for step-wise angular displacement through equal angular distances; a plurality of spindle supports positioned on said support element at equal distances from said axis and at equal angular spacings equal to said angular distances; a first magazine, for empty reels, sloping downwardly toward said support element; stop means at the lower end of said first magazine positioned, in the stationary state of said support element, angularly intermediate a pair of circumferentially adjacent spindle supports and in the path of movement of said spindle supports; a second magazine, for fully wound reels, sloping downwardly away from said support element substantially opposite said first magazine, and having spindle receiving means extending into the path of said spindle supports; said support element, during each angular displacement, picking up an empty reel from said first magazine, for rotation in a pair of spindle supports, and moving the picked-up reel to a ready position, moving the reel then at such ready position to a reel winding position, and discharging a fully wound reel to said second magazine; driving means operatively engaging each reel supported in said spindle supports and rotating each such reel in a winding direction; means feeding strip material to the reel then at the reel winding position; shear means positioned between said ready and winding positions and operable, when activated responsive to a predetermined length of strip material wound on the reel then at the winding position, to sever the strip material in advance of the reel being wound and to press the leading end of the strip material onto the already rotating reel at the ready position; material end treatment means, operable in coordinated relation with said shear means, to treat the severed strip material ends; said support element comprising a drum having open annular ends; a horizontal shaft extending along said horizontal axis; and a disk secured on the end of said shaft and interlockingly engageable with either annular end of said drum, whereby the other annular end of the drum remains open for access to the interior of the drum.

2. Apparatus, as claimed in claim 1, in which said spindle supports are arranged in pairs and each supported on the periphery of an annular end of said drum; said spindle supports having radially extending outwardly opening slots to receive the spindles of empty reels at said first magazine and to release the spindles of fully wound reels at said second magazine.

3. Apparatus, as claimed in claim 1, in which said driving means comprises a relatively large diameter gear rotatably mounted on said shaft; means for driving said gear at a relatively high velocity; and a relatively small diameter pinion secured to the spindle of each reel and engageable with said relatively large diameter gear when said spindle is supported in a pair of spindle supports.

4. Apparatus, as claimed in claim 3, in which each pinion is rotatable relative to its supporting spindle; and friction clutch means operatively connecting each pinion to its associated spindle.

5. Apparatus, as claimed in claim 1, in which said shear means is normally retracted above the tape moving to the reel then at the winding position; said shear means, when activated, moving downwardly toward the material to sever the same; and a pressure plate movable with said shear means and engaging said leading end of the severed strip material to press the same against the already rotating reel at the ready position.

6. Apparatus, as claimed in claim 1, in which said strip material is a tape having its undersurface coated with a self-adhesive material said material end treatment means applying a non-adhesive coating to the self-adhesive material on the undersurface of the trailing end of the severed tape.

7. Apparatus, as claimed in claim 1, in which said strip

material comprises a non-adhesive tape; said material end treatment means applying adhesive to the undersurface of the tape and the severed ends thereof.

8. Apparatus, as claimed in claim 1, wherein said drum can be interchangeably mounted with either annular end engaging said support disk; the magazines, shear means, and material and treatment means being then re-arranged for winding of the strip material in the opposite direction.

9. Apparatus, as claimed in claim 2, in which said slots extend both radially and tangentially, the tangential extent being in the trailing direction, and the radial slot portion being defined by a pair of spaced legs of said spindle supports, the trailing leg, considered from the direction of angular displacement of said drum, extending radially outwardly beyond the leading leg for engagement with the spindles of empty reels on said first magazine.

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WILLIAM S. BURDEN, *Primary Examiner.*

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,411,732 Dated November 19, 1968

Inventor(s) Ebnetter Markus

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

The Assignee should read:

-- Ferd Ruesch, Maschinenfabrik, Saint Galen, Switzerland --.

Signed and Sealed this

Twenty-eighth **Day of** June 1977

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks