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[54] **AUTOMATIC BAND-WINDING MACHINE**

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[51] **Int. Cl.** **B65h 35/02,** B65h 19/26

[58] **Field of Search** ..... 242/56.2, 56.9, 56.4, 242/76, 56 R, 67.1 R, 67.3 R

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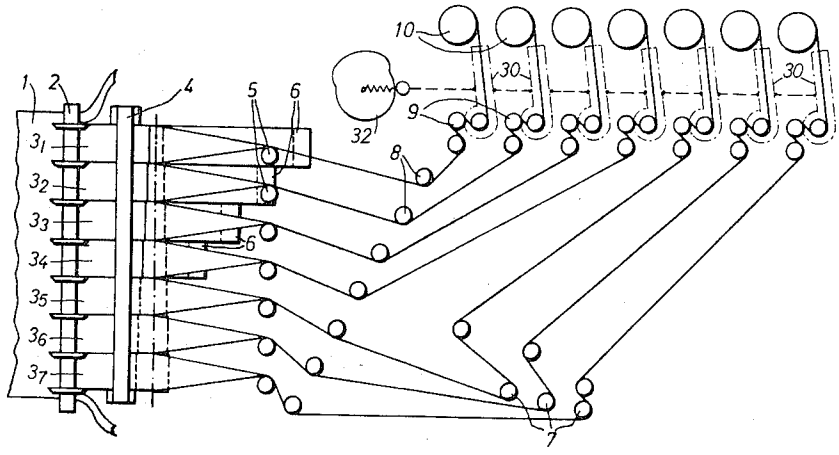
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Assistant Examiner—Edward J. McCarthy
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[57] **ABSTRACT**

An automatic band-winding machine for a plurality of bands comprises winding heads, threading units having cutting blades, prewinding mechanisms, a band-deflecting station and a conveyor belt for carrying away the ready rolls. The winding heads, which are adapted to be driven through bevel gears and friction clutches are arranged opposite one another in one plane about a horizontal axis and are rotatable about this axis through 180°. Gravity clutches are provided for so that only the winding heads above the horizontal plane through the common axis are connected to the drive.

11 Claims, 3 Drawing Figures



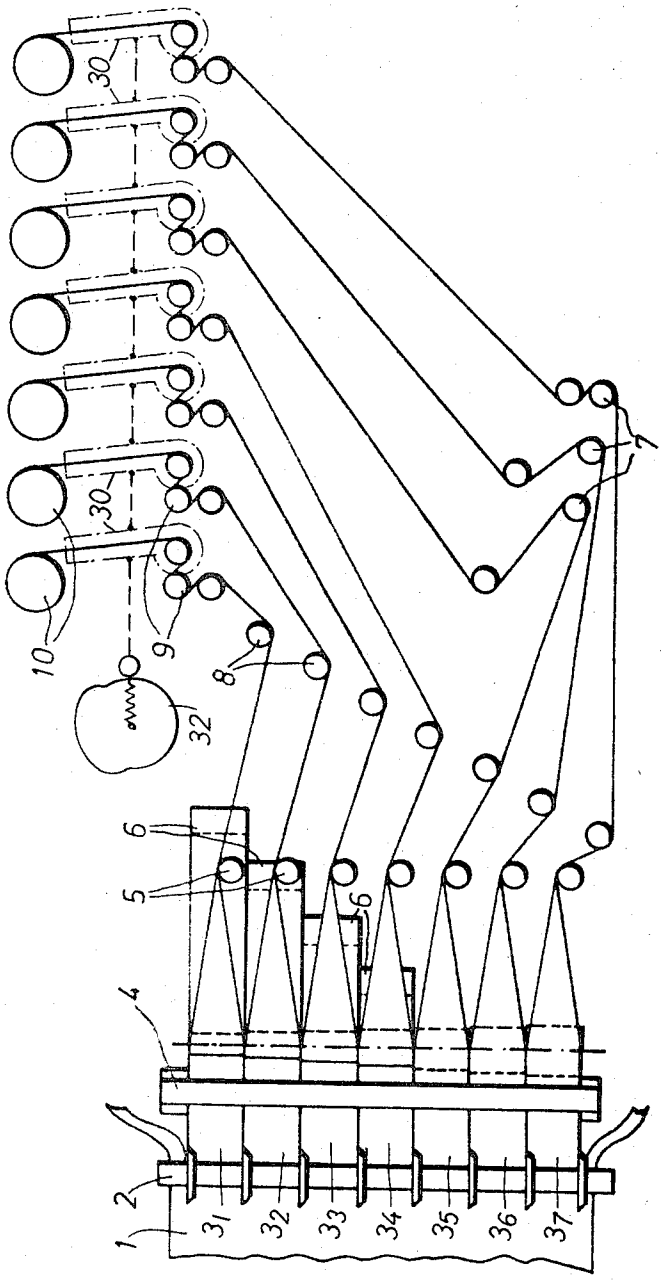


FIG. 1

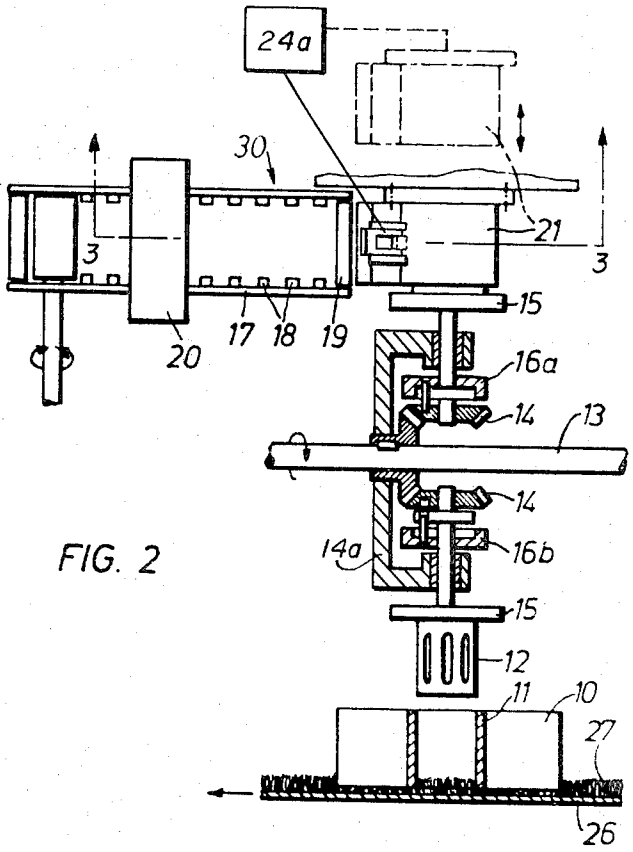

24a
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3
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3
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17
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19
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16a
14
13
14
14a
16b
15
12
11
10
27
26

FIG. 2

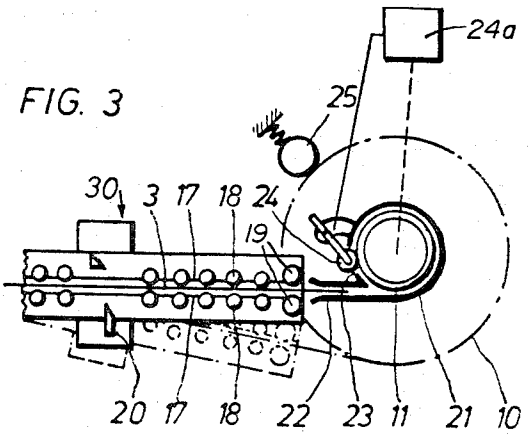

24a
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FIG. 3

AUTOMATIC BAND-WINDING MACHINE

This invention relates to an automatic bandwinding machine for winding a plurality of bands or webs into rolls. Automatic band-winding machines of this kind consist of winding heads, threading units with cutting blades, prewinding mechanisms, a band-length correcting guide, a band-deflecting station and a conveyor belt for carrying away the ready-wound rolls.

Automatic band-winding machines are required to wind a number of bands or webs simultaneously into rolls with a certain final diameter. The basic component of a machine such as this are the rotating winding heads. The winding heads are preceded by threading units by which the bands are brought up to the winding cores or winding tubes fitted onto the winding heads. The cutting blades are also arranged in the vicinity of the threading units, cutting through the bands when the roll or package reaches its required diameter. The prewinding mechanisms provide for satisfactory winding of the initial turns onto the winding core or winding tube. A length-correcting means is provided in the band guide so that the tapes have travelled the same distance by the time they reach the winding stations. A band-deflecting station turns the bands out of the horizontal plane into the vertical plane. Finally, the ready-wound rolls are carried away on a conveyor belt.

Roll-cutting and winding machines are known in which the cut bands are wound onto two horizontally superposed winding shafts fitted with cardboard tubes. The arrangement of these winding shafts has the disadvantage that it takes as long to equip the shafts as it does to cut and wind an approximately 100-metre long band roll. In addition, the individual bands have to be stuck with adhesive strips to the cardboard tubes during prewinding. During prewinding of the paper rolls, the bands have to be checked for edge-true prewinding, the bands of the completed rolls have to be cut through by hand and the rolls removed by hand, for which purpose they have to be pushed individually over the winding shaft.

In other known automatic roll-cutting and winding machines, the cardboard tubes are automatically deposited, the bands automatically stuck on, the rolls automatically wound and cut. Unfortunately, machines of this kind are not suitable for winding sensitive papers, for example photographic paper, because hot glue is used to stick the bands to the cardboard tubes. Finally, there are also roll-cutting and winding machines which function on the principle of supporting or contact rollers. The cardboard tubes are picked up unsupported by shafts by two rocker arms and driven through contact rollers. The disadvantage of this arrangement lies in the drive of the rolls. Since in this case the drive is transmitted directly from the contact roller to the roll or package, there is a danger of scratching and kinking so that, in the case of photographic papers, wastage is excessive.

The object of the invention is to construct an automatic band-winding machine which is particularly suitable for winding photographic papers and which functions reliably at a high work rate. More particularly, the machine according to the invention is intended to obviate the disadvantages referred to above.

According to the invention, the object is achieved by virtue of the fact that, in an automatic band-winding machine of the kind referred to above, the winding heads, driven through bevel gears and friction contact,

are arranged opposite one another in one plane along a horizontal axis rotatable through 180°.

The bevel gears used to drive the winding heads are advantageously provided with a gravity clutch so that only the upper winding heads are linked to the drive.

In one particular embodiment of the invention, the threading units are pivotal in the horizontal plane and are provided with a common cam drive so that, as the diameter of the package increases, they are always directed tangentially of the package diameter. The threading units are adjoined by specially designed prewinding mechanisms. According to a further development of the invention, they consist of a hollow cylinder with a threading slot and pressure roller opening which is vertically displaceable, the arrangement being such that in the working position the hollow cylinder is inverted over a cardboard tube acting as winding core onto the winding head and in the rest position is removed from the winding heads.

The conveyor belt used to carry away the ready-wound rolls is advantageously coated on one side with a velours into which the deposited rolls sink. This prevents the rolls from being unwound again.

One embodiment of the invention is described by way of example in the following with reference to the accompanying drawings, wherein:

FIG. 1 diagrammatically illustrates the guide of the bands between a length cutting unit and the winding heads.

FIG. 2 is a side elevation of the winding heads, the threading unit and the prewinding mechanism.

FIG. 3 is a cross-sectional plan view taken through FIG. 2 along the line 3—3.

A horizontally orientated web **1** coming from an off-winding station (not shown) is cut by a conventional longitudinal sheet cutter **2** into a plurality of bands **3**. The bands are then turned from the horizontal plane into the vertical plane between horizontally arranged roller **4** and vertically arranged rollers **5** (band-deflecting station). A length correcting means **6** is provided between the roller **4** and the rollers **5** for bands 3_1 to 3_4. A length correcting means **7** is provided for the bands 3_5 to 3_7 and is arranged behind guide rollers **8**. The length correcting means **6** and **7** ensure that the bands 3_{1-7} travel substantially the same distance from the longitudinal sheet cutter **2** to the winding heads. The ready-wound rolls of one batch thus come from the same length of the web **1**. This is important when it comes to the removal of quality samples because, in this way, any given roll from one batch is representative of a certain length of the web **1**. In addition, the band-length correcting means ensure that glueing points in the web **1** reach the winding heads at the same time and are also simultaneously wound up. The band is then guided over drafting rollers **9** and through threading units (not shown) to rolls **10**. After a certain diameter has been reached, winding is stopped and the rolls **10** are deposited.

The winding heads, the threading unit and the prewinding mechanism are shown in FIGs. **2** and **3**. The rolls **10** are wound onto cardboard tubes **11** which act as winding cores and which can be pushed onto a winding head **12**. The winding head **12** is provided with a pneumatic retaining mechanism (not shown) for holding the cardboard tubes **11**. All the winding heads **12** are arranged opposite one another in one plane along a main winding shaft **13** and can be turned through

180° about this axis. The drive by which the winding heads are rotated is central, being transmitted through bevel gears 14 mounted on differential gear cages **14***a*, and friction clutches **15** to the upper and lower winding heads. The bevel gears **14** are equipped with gravity clutches **16** so that only the upper winding heads can be driven. The principle of these gravity clutches **16** is based on the fact that the flow of power from the drive is guided through iron wheels which can be axially displaced under their own weight along the winding headshafts. At the centre they are joined to these shafts by tongue and groove joints. Small pins are arranged on the plane surfaces of these iron wheels, being designed to engage in elongated holes in other wheels fixedly connected to the drive. If then the differential gear cages **14***a* and winding heads **12** are turned through 180°, the iron wheels are axially displaced under the effect of gravity and the pins release or engage the drive wheels (**16***a* engaged, **16***b* released).

The threading unit **30** is shown in FIG. **2** (side elevation) and FIG. **3** (plan view). It consists essentially of upper and lower guide rails **17** forming upper and lower boundaries to the band guide, and of small rollers **18** which rest on the plane surfaces of the bands **3.** At one end of the threading unit are two full-length rubber rollers **19,** at the other is a band cutter **20** which cuts through the bands **3** after the required roll diameter has been reached.

All the threading units are pivotal in the horizontal plane and are controlled by a common cam drive **32** in such a way that, as the diameter of the package increases, they are always directed tangentially of the package diameter. In this way, the bands can be delivered exactly to the package.

Before the bands **3** are prewound onto the winding heads **12** which are fitted with cardboard tubes **11,** the so-called prewinding mechanisms are brought from the rest position into the working position. In the working position, the prewinding mechanisms are inverted over the upper winding heads **12.** In the rest position, they lie outside the turning range of the winding heads **12.** The prewinding mechansim consists essentially of a hollow cylinder **21** comprising a threading slot **22** and a pressure roller opening **23.** The internal diameter of the hollow cylinder **21** is approximately 6 mm greater than the external diameter of the cardboard tubes **11.** In the opening **23,** a feeler pressure roller **24** rests on the still thin package.

During prewinding, the ends of the threading units are situated exactly in front of the threading slots **22.** When the ends of the bands **3,** initially situated in the cutters **20,** are moved forward by the delivery rollers, they are pushed through the threading unit into the hollow cylinder **21.** Here they are deflected in such a way that they turn around the rotating cardboard tubes **11** and are pushed by the feeler pressure rollers **24** between the cardboard tubes **11** and the oncoming end. After three to five turns, the bands are firmly prewound onto the cardboard tubes **11.** The feeler pressure rollers **24** which are now driven by the hands **3** probe the diameter of the package which at this stage is still small and, after about five to eight turns, cause the prewinding mechanisms to be returned electropneumatically by device **24***a* to their rest position. As winding continues, the roll **10** increases its diameter until it reaches the required end value. At the same time, the threading unit follows up continuously through the cam drive in such a way that the bands run onto the rolls **10** without any kinks. The object of the band-end pressure rollers **25** is to ensure that the ends of the bands are held firmly on the completed package.

Whilst the rolls **10** are being formed at the upper winding heads **12,** the ready-wound rolls **10** on the lower winding heads are deposited onto a conveyor belt **26.** Deposition is carried out by releasing the pneumatic retaining means in the winding heads. To prevent the rolls **10** from being damaged during deposition, the conveyor belt **26** is raised beforehand to just beneath the rolls. Thereafter the conveyor belt **26** is lowered to its original position and the lower winding heads re-equipped with new cardboard tubes **11.**

The conveyor belt **26** is coated on one side with a velours **27** of such a texture that the deposited rolls **10** sink in to an extent which stops them from unrolling.

What we claim is:

1. An automatic machine for providing a plurality of rolls of wound bands comprising a supply of relatively wide band material, a row of parallel cutters operatively associated with said supply and engaged with said relatively wide band for slitting it into a plurality of relatively narrow bands, an array of winding devices corresponding in number to said narrow bands, a movable threading and guiding unit operatively engaged with each of said winding devices for threading and guiding the end of a narrow band onto each of said winding devices, a cutter on each of said threading and guiding units for severing said band after a predetermined length has been wound onto a roll upon said winding device, an array of supporting and deflecting rollers between said rollers and each of said threading and guiding units for supporting and guiding a predetermined length of said narrow bands from said feed rollers to each of said threading and guiding units, each of said winding device having a motion-transmitting device, a pair of heads for carrying roll cores extending from opposite sides of said motion-transmitting device for alternate disposition in alignment with said threading and guiding unit and a discharge station, said motion-transmitting device having drive means for rotating said winding heads when disposed in line with said threading and guiding units, indexing means on said motion transmitting device for successively rotating said heads from alignment with said threading and guiding unit to said discharge station, a winding starting casing operatively arranged for disposition about each of said winding heads when they are aligned with said threading and guiding units for guiding the starting end of said bands upon said cores when disposed upon said winding head, translating means connected to each of said winding starting casings for engaging them about said winding heads carrying a core to start the end of a band to be wound on said core and for removing said winding starting casing after a winding has been securely started upon said spool, and said threading and guiding unit being movably mounted to freely guide said winding upon said core in an increasing diameter.

2. A machine according to claim **1,** wherein the threading and guiding units are pivotal in the horizontal plane and are pivoted so that they are always directed tangentially of the roll diameter, whatever the diameter of the roll.

3. A machine according to claim **1** wherein each of the rolls has a tubular core each winding starting casing comprises a vertically displaceable hollow cylinder

having a threading slot and a pressure roller opening therein, the cylinder being inverted over the tubular core disposed upon the winding head in the working position and being removed from the winding head in the rest position at said discharge station.

4. A machine according to claim 1 wherein a conveyor belt is arranged at said discharge station and said conveyor belt is coated on one side with a velours into which deposited rolls are adapted to sink.

5. A machine according to claim 1 wherein the threading and guiding units are disposed vertically over the winding heads, said motion-transmitting means comprising a differential gear the pair of winding heads being mounted on opposite sides of the differential gear disposed below the threading and guiding unit, rotating means connected to the differential gear for disposing one of the winding heads operatively adjacent the threading and guiding unit and the other below, a gravity clutch connected between each winding head and the differential gear whereby the winding head disposed above the differential gear and operatively adjacent the threading and guiding unit is operatively connected for transmitting rotation between the differential gear and the upper winding head and for disconnecting the lower winding head from the differential gear drive.

6. A machine according to claim 5 wherein each of the rolls have tubular cores and each of the winding heads includes a releasable clutch for engaging the cores to wind the bands or webs about them in the upper position and for releasing them in the lower position to discharge the wound rolls.

7. A machine according to claim 3 wherein the pressure roller includes automatic means for actuating the axial removal of the hollow cylinder from the winding head and partially wound rolls to permit the rolls to be subsequently wound to a final size larger than the hollow cylinder.

8. A machine according to claim 5; wherein each of the threading units includes guiding rollers and friction drive rollers.

9. A machine according to claim 1 wherein the motion-transmitting means are each connected on a common shaft.

10. A machine according to claim 9 wherein said motion transmitting means each comprise a differential gear.

11. A machine according to claim 1 wherein said arrays of supporting and guiding rollers are constructed and arranged to substantially balance the paths of groups of said bands supplied to said threading and guiding units.

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