AUTOMATIC WINDING APPARATUS FOR A STRIP OF MATERIAL

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Filed: July 22, 1974

App. No.: 490,782

Foreign Application Priority Data
July 21, 1973 Japan.............................................. 48-80810
Sept. 12, 1973 Japan.............................................. 48-102621
Sept. 18, 1973 Japan.............................................. 48-108404
Feb. 12, 1974 Japan.............................................. 49-16261
Feb. 11, 1974 Japan.............................................. 49-20401

U.S. Cl.................................. 242/56 R; 242/66
Int. Cl..................... B65H 19/20; B65H 17/08
Field of Search........ 242/56 R, 66: 156/505, 156/506

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ABSTRACT
An automatic winding apparatus for a strip of material comprising a pair of driven under rollers adapted for supporting and driving a bobbin thereon, the under rollers being in spaced parallel arrangement and defining a gap therebetween. A strip of material is fed from one side of the pair of rollers onto the bobbin supported thereon. After the bobbin is full, it is displaced from the under rollers, while rotating onto a receiver disposed at the other side of the under rollers and a supply mechanism acts to supply an empty bobbin on the strip of material now passing over the under rollers to the full bobbin on the receiver. The strip of material is rendered adhesive in two spaced regions on opposite sides of the empty bobbin, and a cutter projects into the gap between the under rollers to cut the strip between the adhesive regions such that the end of the strip is wound on the full bobbin and is adhesively secured thereto while the beginning of the strip is adhesively secured to the empty bobbin.

16 Claims, 20 Drawing Figures
AUTOMATIC WINDING APPARATUS FOR A STRIP OF MATERIAL

FIELD OF THE INVENTION

This invention relates to an apparatus for winding a strip of material such as a strip of paper, film or the like or a narrow strip of material such as tape obtained from a slitter, and is more particularly directed to an apparatus wherein it is automatically and continuously effected that a strip of material wound on a bobbin is cut and sealed at its rear end, and then a fresh bobbin is supplied and the beginning end of the strip of material is fixed thereto and wound thereon.

PRIOR ART

Such a winding apparatus is known in which two under rollers arranged to rotate in the same direction are mounted in parallel one with another, and above the middle of these two under rollers a strip of material supplied from one side thereof is wound on a bobbin. In this known arrangement, when the bobbin is fully loaded, the rotation thereof is stopped and the strip of material is manually cut and sealed at its rear end on the full bobbin and then the beginning end of the strip is fixed to a fresh bobbin. It takes a long time to manually effect such operation.

SUMMARY OF THE INVENTION

An object of this invention is to provide an apparatus wherein such sealing of the rear end and fixing of the beginning end are automatically effected.

Accordingly, in a winding apparatus of the type in which a strip of material supplied from one side is wound on a bobbin on two under rollers arranged to rotate in the same direction and mounted in parallel one with another, it is contemplated according to the invention that a bobbin supply means is provided on one side of the two under rollers and a rotating receiver section for receiving a full bobbin while rotating is provided on the other side thereof, additionally provided is an adhesive application means for rendering adhesive the strip of material in two regions on opposite sides of a fresh bobbin applied on the strip of material above the two under rollers the strip extending to the full bobbin on the rotating receiver means, and a cutter means for cutting the strip of material intermediate the adhesive regions by projecting towards the bobbin through a gap between the two under rollers.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a sectional view taken along line 1 — 1 in FIG. 2 showing a first embodiment according to the invention,

FIG. 2 is a sectional view taken along line 2 — 2 in FIG. 1.

FIG. 3 is an enlarged view of a portion of FIG. 1,

FIGS. 4 to 8 are diagrammatic views showing the operation of the first embodiment,

FIG. 9 is a sectional view taken along line 9 — 9 in FIG. 10 showing a second embodiment according to the invention,

FIG. 10 is a sectional view taken along line 10 — 10 in FIG. 9,

FIG. 11 is a diagrammatic view of a portion of the second embodiment for explaining the operation thereof,

FIG. 12 is a sectional view taken along line 12 — 12 in FIG. 13 showing a third embodiment according to the invention,

FIG. 13 is a sectional view taken along line 13 — 13 in FIG. 12,

FIGS. 14(A)(B)(C) are enlarged views of portions thereof under operating conditions,

FIG. 15 is a sectional view taken along line 15 — 15 in FIG. 16 showing a fourth embodiment according to the invention,

FIG. 16 is a sectional view taken along line 16 — 16 in FIG. 15.

FIG. 17 is an enlarged view of a portion thereof, and

FIG. 18 is a sectional side view of another embodiment according to the invention.

DETAILED DESCRIPTION

Referring to FIGS. 1 to 3, numerals 1, 1' denote two driven under rollers mounted in parallel one with another, and a bobbin supply means 2 for supplying a bobbin 3 mounted on one side of the under rollers 1, 1' while a rotating receiving section 4 for rotatably supporting a full bobbin 3a mounted on the other side thereof. Numerals 5 denotes a pressing roller for pressing, from above, the bobbin 3 supplied between the two under rollers 1, 1', and roller 5 is so arranged that a strip of material 6 supplied from the right side at a location under roller 1' may be wound on the bobbin 3 in such a way that the bobbin 3 is driven in rotation by the under rollers 1, 1' and the pressing roller 5 under the condition that the bobbin 3 is held by these three rollers 1, 1', 5.

Numerals 7 denotes a cutter means which comprises a cutting tool 8 projecting towards the bobbin 3 through the gap between the under rollers 1, 1' and a hydraulic cylinder 9 for raising and lowering the cutting tool 8.

Numerals 10 denotes a hydraulic cylinder for reciprocating the cutting tool 8 in the lengthwise direction of the cutting edge thereof i.e., transversely of the strip of material so as to effect the cutting operation rapidly.

The bobbin supply means 2 comprises a pair of front and rear supply arms 13, and these arms are provided with recesses 12 for receiving opposite end portions of the bobbin 3 and clamp means 14, for clamping said end portions. Each clamp means 14 comprises a hydraulic cylinder 16, a piston rod 15a projecting towards the front side of the recess 12 and an integral clamp member 16.

Numerals 11 denotes an adhesive application means, which is mounted between the supply arms 13 and on both sides of the bobbin 3 held by the clamp means 14. The adhesive application means 11 comprises a pair of containers 17 and a pair of applying members 18 extending therefrom, and as is conventional a liquid paste, with a sponge 19 or the like impregnated therewith, is disposed in each container 17. However, if the strip of material 6 is one to which a water soluble paste has been previously applied, water is contained in the container.

The rotating receiving section 4 is constituted by a roller 20 free to rotate which cooperates with under roller 1, so that the full bobbin 3a placed between roller 20 and roller 1 continues to rotate for continued winding of the strip of material 6 on bobbin 3a. The roller 20 is rotatably mounted on a swingable arm 21, and the arrangement is such that when the arm is raised, a fresh bobbin 3 laterally pushes the full bobbin 3a from one side by turning of the bobbin supply arms 13, and on
the opposite side thereof the roller 20 receives the full bobbin while rotating, and finally the full bobbin 3a is placed between the roller 20 and the under roller 1.

Numeral 22 denotes a push-up roller for rolling the full bobbin 3a placed on the rotating receiving section 4 to a conveyor 23 provided at the left side thereof. Number 24 denotes a pressing roller provided between arm rods 26 projecting from a supporting shaft 25 of the bobbin supply arms 13, and roller 24 serves to press the strip of material 6 against the under roller 1' when the bobbin supply arms 13 are turned for supplying the bobbin 3.

The operation of the apparatus will next be explained with reference to FIGS. 4 to 8.

It is assumed that, as shown in FIG. 4, the strip of material 6 is being wound on the bobbin 3 and a full bobbin 3a has been formed.

Hereupon, the swingable arms 21 are raised, as shown in dotted lines in FIG. 5 and at the same time the bobbin supply arms 13 of the bobbin supply means 11 are turned, whereby the fresh bobbin 3 held thereon pushes the full bobbin 3a and the roller 20 on the swingable arms 21 is moved downwardly while receiving the bobbin 3a, and the full bobbin 3a is brought into the position in which is is placed on the rotating receiving section 4 as shown in solid lines in FIG. 5. Here, the strip of material 6 extending from the full bobbin 3a is stretched over the under rollers 1, 1'. The bobbin supply arms 13 continue to turn after the full bobbin 3a has been pushed on the receiving section, and by retracting the clamp members 16, caused by the operation of the hydraulic cylinders 15 of the clamp means 14, the bobbin 3 is released onto the strip of material 6 centrally positioned above the under rollers 1, 1', and at the same time the application members 18 of the adhesive means 11 applies paste to the strip of material 6 at locations on opposite sides of the bobbin 3 as shown in FIG. 6.

After completion of the application of the paste onto the strip of material, the bobbin supply arms 13 are immediately returned to their initial positions and, as shown in FIG. 7, the pressing roller 5 is then lowered to press against the bobbin 3 while at the same time the cutting means 7 is operated. Thereupon, the cutting tool 8 is advanced towards the bobbin 3 by the operation of the hydraulic cylinder 9 and the cutting tool 8 is transversely reciprocated by the operation of the hydraulic cylinder 10. Thereby the strip of material 6 is cut at a position between the locations where the adhesive has been applied by the applicators.

Thus, as shown in FIG. 8, the rear end portion of the strip of material 6 of the full bobbin 3a, to which adhesive has been applied, is rolled up and adhered against the full bobbin 3e by the rotation of the bobbin 3a, and thus it becomes secured thereunto.

At the same time, the adhesive on the supply side of the strip of material 6 serves to adhere the beginning portion of the strip of material 6 to the empty bobbin 3, and thus by the rotation of the bobbin 3 the strip of material 6 is wound thereonto.

Thus, the bobbin 3 becomes the full bobbin 3a as shown in FIG. 4 by continuation of the winding, and by repeating the foregoing steps it is replaced by a fresh bobbin 3.

In the foregoing operation, there is a time interval between the time when the bobbin supply arms 13 supply a fresh bobbin 3 and are retracted and the time when the pressing roller 5 is lowered to press against the bobbin 3, so that if the feeding speed of the strip of material 6 is comparatively high, there is a danger that the portions with adhesive are too advanced and, for instance, the strip of material 6 is cut upstream of the rear region which has been rendered adhesive. Accordingly, it is necessary either to stop the advance of the strip of material 6 or to lower the speed thereof.

In the embodiment shown in FIGS. 9 to 13, the adhesive application means 11 similar to that shown in FIGS. 1 to 3 is located on both sides of the pressing roller 5 and is attached to piston rods 29a, of hydraulic cylinders 29, mounted on a connecting frame 28 to which is secured supporting frames 27 on both sides of the pressing roller 5. If, in the condition in which a fresh bobbin is supplied, the pressing roller 5 is lowered to press against the bobbin 3, the hydraulic cylinders 29 are operated and thereby the containers 17 of the adhesive means 11 are lowered, as shown in FIG. 11, and the applicator members 18 and the supporting frame 28 is lowered to reach the strip of material 6 to render the same adhesive in regions on both sides of the pressing roller 5. By then raising the cutting tool 8 immediately, it becomes possible for the strip of material 6 to be cut accurately at a predetermined cutting line between the adhesive portions of the strip.

In this case, the bobbin supply means 2 may be constructed as shown in FIGS. 12 to 14 wherein the supporting frames 27 for the pressing roller 5 are provided at their respective inside surfaces with guide grooves 31 which can be in communication with bobbin supply channels 30 at the elevated position of the supporting frames 27 and are open at their lower ends. Additionally, each guide groove 31 is provided therein with a stopper 32 which serves to stop temporarily, below the pressing roller 5, a bobbin 3 supplied from the bobbin supply channels 30. The stopper 32 is arranged, for example, to be urged upwards by a spring 33 as illustrated. Thus, the bobbin 3 supplied into the guide grooves 31 from the bobbin supply channels 30 at the elevated position of the supporting frames 27 is supported below the pressing roller 5 by the stoppers 32 and is lowered with the relative downward movement of the roller 5. Then, as shown in FIGS. 9 to 11, the strip of material 6 is rendered adhesive at regions on both sides of the bobbin 3 and is cut along a predetermined cutting line between the adhesive regions. Hereupon, as shown in FIG. 14(A), the beginning end of the strip of material 6 is fixed to the bobbin 3 and the subsequent winding thereof can be started, and as the diameter thereof increases as shown in FIG. 14(B), the bobbin 3 pushes the stoppers 32 to pivot them against the action of springs 33 and set forth a relative lowering of the bobbin 3 with increase of the diameter thereof, the stoppers 32 finally release the bobbin and then are returned to their initial positions by springs 33. Thereafter, the winding of the strip of material 6 is carried out independently of the stoppers 32. The stopper 32 is not limited to that illustrated and may be of such a type that it is retracted by the pushing force caused by the lowering of the bobbin 3.

The cutting tool 8 of the cutter means 7 is comparatively thin. Accordingly, when it cuts the strip of material 6 during the travel of the latter, the tool is liable to be bent in the travel direction. When such bending is repeated, the cutting tool 8 becomes fatigued and the time for replacement thereof is shortened.

FIGS. 15 to 18 show an embodiment in which such fatigue of the cutting tool is substantially eliminated.
shown in FIGS. 15 and 17, the base portion or the cutting tool 8 is placed within a groove 35 provided in the upper surface of a tool supporting frame 34 and having a width larger than the thickness of the tool 6 so that the tool 8 is tiltable forwards and rearwards. The cutting tool 8 is urged by a spring 36 in a direction opposite to the advancing direction of the strip of material 6. Thus, even if the tool supporting frame 34 is elevated and the cutting tool 8 strikes against the bobbin 3, as shown in solid lines in FIG. 17, due to the rotation of the bobbin 3, the cutting tool 8 is inclined in the advancing direction of the strip of material 6 while compressing the spring 36, and during this period the cutting of the strip of material 6 is completed.

As seen in FIGS. 15 and 16, the driving means for the cutting tool 8 comprises a pair of cams 37, 37' provided below the tool supporting frame 34, and bevel gears 41, 41' attached to respective rotating shafts 40, 40' connected to one another through an axle shaft 38 and universal joints 39, 39' on opposite ends thereof. The gears 41, 41' are in mesh with respective bevel gears 42, 42' mounted on respective shafts of the cams 37, 37', and a chain gear 43 attached to the external end of a rotatable shaft 40' is connected to an output gear 46 of a geneva mechanism 45 through a chain 51.

In this embodiment, the adhesive applicator means 11 comprises a paste applying roll 47, which is formed with two ridges for applying adhesive, the space between the ridges defining a transversely extending predetermined cutting portion. The adhesive means further comprises a paste transfer roll 48, a paste container 49, and a chain gear 50 mounted on a shaft of the paste applying roll 47 and is connected to another output gear 52 of the foregoing geneva mechanism 45 through a chain 51.

The geneva mechanism 45 is so constructed that when the strip of material 6 wound on the bobbin 3 reaches a predetermined length, it is driven by an electric motor (not shown) so that first the paste applying roll 47 is rotated to apply paste contained in the paste container 49 onto the strip of material 6 to form two adhesive strips thereon, and then when the predetermined cutting portion therebetween comes to face the cutting tool 8, the pair of cams 37, 37' are rotated to elevate the cutting tool 8.

Numerals 53 denotes a push-out roller for transferring the full bobbin 3a from above the under rollers 1, 1' when the cam 35 is tilted by means of the cam 56 turned by an electric motor 55 as shown in FIGS. 15 and 16, or reciprocation may be effected by an electro-magnetic vibrator 57 as shown in FIG. 18.

Referring to FIGS. 12 and 15, numeral 58 denotes a feeding member for a bobbin 3 provided in the bobbin supply channel 30, and the member 58 serves to feed a bobbin one by one by the reciprocating movement of this member.

In connection with the above, the supporting frames 27, for the pressing roller 5 is mounted on the machine frame 29 so as to be slideable upwards and downwards, and a means (not shown) serves for moving these frames 27, upwards and downwards and for applying pressure and for pushing the bobbin 3 against the roll of the strip of material 6 which is being wound thereon. It is preferable that the pressing roller 5 be rotated in synchronous relation with the under rollers 1, 1'. In the embodiments of FIGS. 1 to 8, FIGS. 15 to FIG. 17, and FIG. 18, the pressing roller may be omitted.

In this case, frames corresponding to the supporting frames 27, for the pressing roller 5 are provided with guide grooves which are in engagement with the bobbin 3 and the foregoing upward and downward moving means and the pressure applying means are provided on the frames.

Thus, according to this invention, an apparatus of the type in which a strip of material supplied from one side is wound on a bobbin above two under rollers arranged in parallel one with another and arranged to rotate in the same direction, a rotating receiving section for rotatably receiving a full bobbin is provided on the other side of the under rollers, and a bobbin supply means for supplying an empty bobbin onto the strip of material leading to the full bobbin, said strip extending over the middle of the two under rollers, an adhesive applicator means being provided for rendering the strip of material adhesive in regions on both sides of the bobbin, and a cutter means for projecting through a gap between the two under rollers for cutting the strip of material at an intermediate position between the adhesive regions, so that automatically the strip of material is cut and sealed and the beginning end thereof is adhered to the empty bobbin.

What is claimed is:

1. An automatic winding apparatus for a strip of material comprising a pair of driven under rollers adapted for supporting and driving a bobbin thereon, said under rollers being in spaced parallel arrangement and defining a gap therebetween, feed means for feeding a strip of material from one side of said pair of under rollers onto the bobbin supported thereon and on which the strip of material is wound, means for removing a full bobbin from said under rollers after said strip has been wound on said bobbin to a predetermined extent, receiver means disposed on the side of the pair of under rollers opposite said feed means for receiving the full bobbin from said under rollers after removal therefrom and for continuing the drive of the full bobbin, said strip of material being fed from the feed means over the under rollers and the gap therebetween to the still driven full bobbin, means for supplying an empty bobbin on the now vacant under rollers above said strip, means for rendering said strip of material adhesive in two spaced regions on opposite sides of said empty bobbin, and cutter means for projecting in said gap to cut said strip between said adhesive regions such that the end of the strip is wound on said full bobbin and is adhesively secured thereto while the beginning of the strip is adhesively secured to the empty bobbin, said cutter means comprising a frame mounted beneath said under rollers, and a cutting tool carried by said frame and being raisable to a position within said gap to cut the strip passing on said under rollers.
2. An automatic winding apparatus as claimed in claim 1, wherein said cutting tool is mounted in a groove provided in said frame so that the tool is tiltable forwards and rearwards, and resilient means urging the cutting tool in a direction reverse to the advancing direction of the strip of material.

3. An apparatus as claimed in claim 2, comprising means for reciprocating the cutting tool in transverse direction of the strip of material.

4. An apparatus as claimed in claim 3, wherein said cutting tool has an edge provided with an indentation.

5. An apparatus as claimed in claim 1, wherein said means for supplying an empty bobbin to said under rollers comprises a pair of swingable arms disposed laterally of one under roller, clamp means on said arms for detachably clamping an empty bobbin supplied from one side thereof, and means for turning the swingable arms and operating the clamp means to supply the empty bobbin onto said under rollers.

6. An apparatus as claimed in claim 5 wherein the adhesive rendering means comprises containers with applicator members projecting therefrom mounted on both sides of a bobbin held by said clamp means and arranged so that at the same time as the empty bobbin is supplied to the under rollers the strip of material is rendered adhesive at said regions on both sides of the bobbin by said applicator members.

7. An apparatus as claimed in claim 5 wherein the means for removing a full bobbin is constituted by said inclined arms and said clamping means such that by inclining said arms with their clamping means the full bobbin on the under rollers is transferred to the receiver means by the empty bobbin held on the arms by said clamp means.

8. An apparatus as claimed in claim 1 comprising a pressing roller mounted above said under rollers for pressing downwards the bobbin placed on the under rollers, the adhesive rendering means comprising containers with applicator members projecting downwards therefrom mounted on both sides of said pressing roller so as to be movable upwards and downwards and arranged so that on pushing of the bobbin by the pressing roller the containers are further moved downwards and the regions of the strip of material on both sides of the bobbin is rendered adhesive.

9. An apparatus as claimed in claim 8 wherein the means for supplying an empty bobbin comprises supporting frames on both sides of the pressing roller, said frames having inner surfaces with guide grooves for guiding opposite end portions of a bobbin supplied thereto, and stop means for supporting the bobbin below the pressing roller and including means for releasing the bobbin when the winding diameter of the bobbin is increased to a predetermined value.

10. An apparatus as claimed in claim 9 wherein said stop means comprises pivotal stoppers, springs urging said stoppers upwards, so that an empty bobbin is held by the stoppers and by lowering movement of the bobbin with increase of the winding diameter, the stoppers are inclined against the action of said springs, and by further increase of the winding diameter the bobbin is released therefrom.

11. An apparatus as claimed in claim 1, wherein the adhesive rendering means comprises a roller having two spaced ridges for forming two strips of adhesive portions on said regions on both sides of the strip of material, said roller being mounted upstream of the location where the strip of material is wound on the bobbin.

12. An apparatus as claimed in claim 1 wherein said receiver means comprises a further roller, and a pair of yieldable, swingable arms supporting said further roller on the other side of the under rollers and arranged so that by raising the swingable arms the full bobbin which is being transferred from the under rollers causes the arms to lower while the bobbin remains in contact with said further roller all while the full bobbin is being rotated by said further roller and the adjacent under rollers.

13. An apparatus as claimed in claim 12 comprising means for driving said further roller at the same speed as the travel speed of the strip of material.

14. An apparatus as claimed in claim 13 wherein said means for removing a full bobbin further comprises a push-out roller so positioned that the full bobbin is held between the further roller supported on said swingable arms and said push-out roller, and by the cooperation of these rollers the full bobbin is transferred, while being rotated, to said receiver means.

15. An apparatus as claimed in claim 1 comprising means for reciprocally moving said cutter means vertically with respect to said strip between a raised operative position in which the cutting tool protrudes in said gap and cuts said strip, and a lowered inoperative position.

16. An apparatus as claimed in claim 15 comprising axles supporting said under rollers in said parallel arrangement in fixed relation.

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