Feb. 10, 1959 E. W. CLEM 2,872,767

SPIRAL WRAPPING MACHINE

Filed Dec. 1, 1954 3 Sheets-Sheet 1

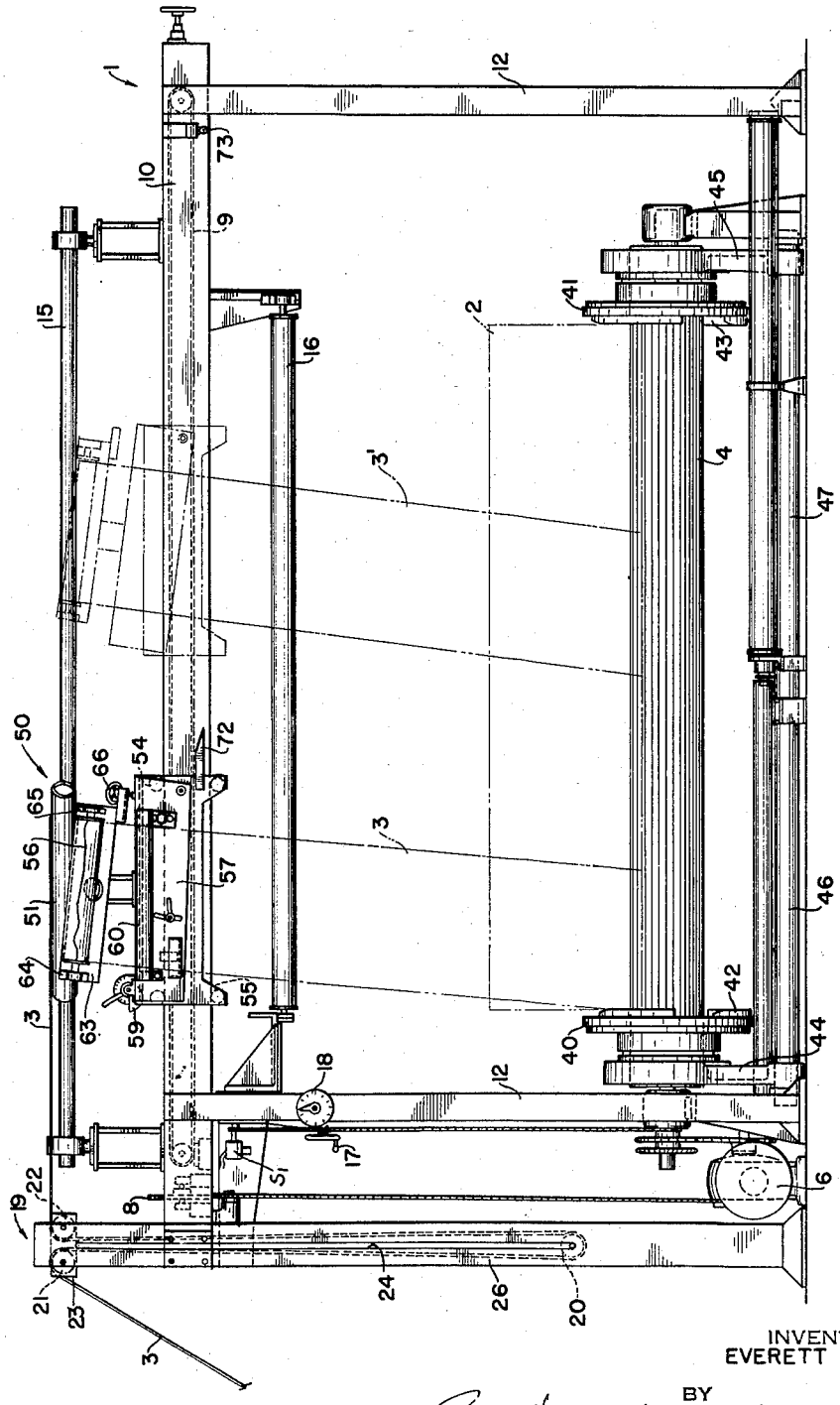


FIG. 1

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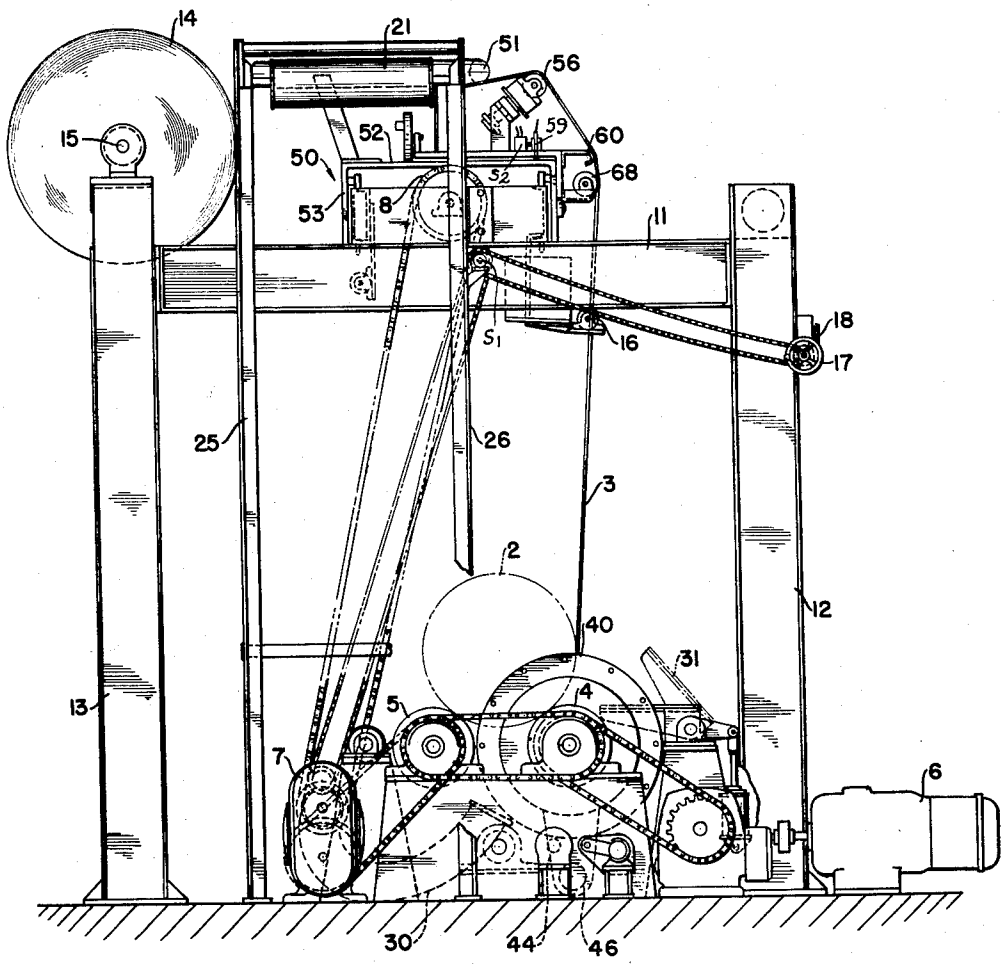


FIG. 2

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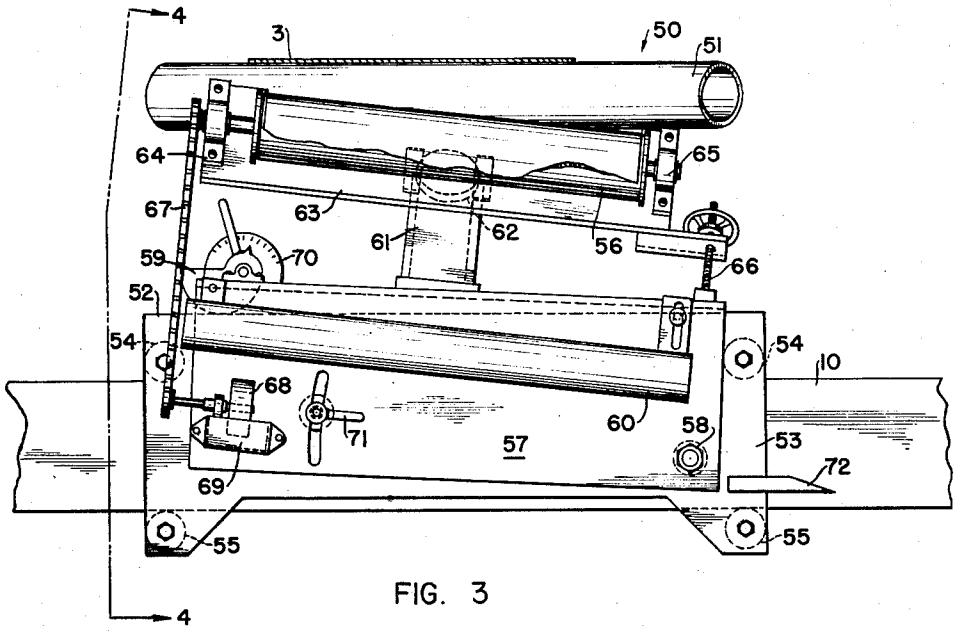


FIG. 3

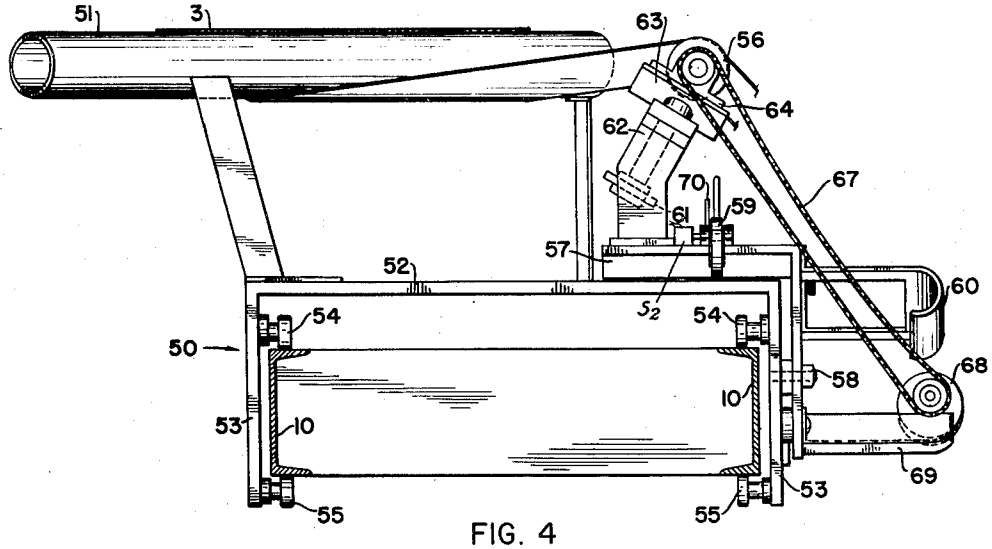


FIG. 4

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2,872,767

SPIRAL WRAPPING MACHINE

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Application December 1, 1954, Serial No. 472,380

5 Claims. (Cl. 53—198)

This invention relates generally to a spiral wrapping machine and more specifically to one which includes means whereby the degree of spiral or amount of overlap of the wrap may be readily changed.

Heretofore, large cylindrical articles such as rolls of paper usually have been wrapped by a protective layer of wrapping paper applied merely by rolling the wrapping paper directly on the roll so that there was no spiral or overlapping. A disadvantage of wrapping in this old manner is that the wrapping material cannot be applied tightly to the roll. Also the wrapping material does not provide longitudinal strength to the roll. By applying the wrapping material in the form of a helix with the successive convolutions overlapping one another, the wrap is able to impart longitudinal strength to the roll and the roll may be wrapped tighter. Another advantage of spiral wrapping is that two or more cylindrical objects such as short rolls of paper may be held end to end by the wrap alone. This results in lower shipping costs, since instead of the inconvenience of handling many small rolls, there is in effect only one large single roll to move about.

It often is desirable when spirally wrapping rolls of paper to employ different degrees of spiral in order to obtain different amounts of overlap and thicknesses of the protective wrapping material. Thus, if it is desired to obtain a relatively thick protective wrap, the degree of spiral should be made small to result in more overlapping layers of wrap. Conversely, if the protective layer of wrap does not have to be thick, then the degree of spiral should be made larger, thus giving a smaller amount of overlap. It is therefore an object of this invention to provide means whereby the degree of spiral and amount of overlap may be readily changed so that one can provide a protective layer of wrap of varying thickness for cylindrical articles.

I propose to provide in a wrapping machine having roller means for supporting and rotating the cylindrical article to be wrapped, a carriage which is movable longitudinally of the article to be wrapped and in timed relation with its rotation. Guide means are provided on the carriage for supporting and guiding the wrapping material over the cylindrical article. Means, for example a cam means, is provided for changing the angle of inclination of the guide means to the cylindrical article in order that the lead of the spiral wrap may be changed. Speed changing means for changing the speed of longitudinal travel of the carriage are also provided so that the speed of the carriage can then be varied in direct proportion to the change of the angle of inclination of the guide means mounted on the carriage. Means are provided for supporting additional rolls of wrapping material in order that the ends of the article to be wrapped, which will be considered a roll of paper, may receive reinforcing wrapping material. This reinforcing material is applied as a straight wrap, that is, one in which there is no lead or angle of spiral.

Crimper means are provided on the machine at the opposite ends of one of the rollers supporting the roll of paper so that part of the wrap overhanging the end of the roll of paper may be pressed or crimped inwards in order to provide a protective layer of wrapping material on the flat ends of the roll.

Since rolls of paper may easily weigh several tons, ejector means are provided for ejecting the roll of paper from the machine after it has been wrapped. Also provided is a tilting table so that the heavy roll of paper may be easily placed in the machine in the position for wrapping.

The invention will more clearly be understood by referring to the accompanying drawings which illustrate, by way of example, a machine for wrapping large rolls of paper, and from the following detailed description of the apparatus. In the drawings:

Figure 1 is a front view of the machine showing a roll of paper in position for wrapping;

Figure 2 is an end view of Figure 1;

Figure 3 is an enlarged view of the carriage as shown in Figure 1; and

Figure 4 is an end view of the carriage as shown in Figure 3.

Referring first to Figure 1, 1 denotes generally a machine for spirally wrapping a heavy roll of paper 2 with a wrapping material 3 which is carried on a supply roll (not shown) at one end of the machine. The supply roll is so positioned that its axis is perpendicular to the axis of the roll 2. The wrapping material is usually of a cheap grade of paper although it may be of a more expensive water-proofing material.

The roll of paper 2 rests upon rollers 4 and 5. Roller 4 is connected by a chain drive (Figure 2) to motor 6 and also by chain drive to the roller 5 so that as the motor 6 rotates roller 4, the latter will cause roller 5 to also rotate. This in turn will cause the heavy roll of paper 2 to rotate about its own axis. The roller 5 is connected by a chain drive to a speed changing unit 7 which drives by means of a still separate chain drive, a sprocket 8. Sprocket 8 drives an endless chain 9 (Figure 1) which engages with carriage 50 for moving the carriage longitudinally of the roll 2. Carriage 50 is mounted on channel bars or tracks 10 which are attached to cross bars 11 which in turn are held up by front supports 12 and rear supports 13. A speed changing handle 17 is attached to support 12 for changing the ratio of gears in speed changing unit 7 in order to vary the speed of longitudinal travel of carriage 50 with respect to rotation of rollers 4 and 5. The handle is provided with an indicator 18 which can be made to read in degrees of overlap or amount of overlap, as will be explained more fully below.

The strip of wrapping material 3 passes through a take-up mechanism 19 which consists of a festoon roller 20 and two stationary rollers 21 and 22. The two stationary rollers are mounted for rotation on stationary cross bars 23 which are fixed near the upper ends of a pair of slotted upright members 25 and 26. The festoon roller 20 is free to move up and down in slots 24 in members 25 and 26. The strip of wrapping material 3 is threaded through the take-up mechanism so that it passes over roller 21, under roller 20 and then over roller 22 and on to the carriage 50. In this way the festoon roller serves to tension to some extent at least the strip 3 as it will tend to slide down in the slots 24 due to its own weight. As will be hereinafter pointed out, it also serves to return carriage 50 to its initial position after completion of a wrapping operation.

Referring to Figures 3 and 4, it is seen that the strip 3 passes over a turning bar 51 which is mounted at 45 degrees to the longitudinal axis of the roll 2 and parallel to the top surface 52 of the carriage 50. Car-

riage 50 comprises a channel-shaped plate having a top surface 52 and sides 53. Upper wheels 54 and lower wheels 55 are connected to the sides 53 and support the carriage on the tracks 10. Upper wheels 54 carry the weight of the carriage while the lower wheels 55 tend to keep the carriage from tipping.

A roller 56 is carried by an L-shaped plate 57 which in turn is supported by the carriage 50. Plate 57 is pivotally mounted so that it can rotate about a pivot point 58 when moved by a cam 59. Cam 59 is provided with an indicator 70 which is provided with a scale in the same units of measurement as indicator 18. A lock nut 71 is screwed onto a bolt carried by side 53 of the carriage so that the desired change in position of plate 57 resulting from movement of cam 59 may be maintained. Also mounted on plate 57 is a guide bar 60 which serves to guide the wrapping material 2 in a plane substantially vertical to the horizontal axis of the roll 2. Guide bar 60 and roller 56 are mounted in planes which are substantially parallel to the longitudinal axis of the roll 2. Roller 56 is supported on plate 57 by means of a bracket 61 and is journaled in bracket 61 by pin 62 which connects with the backing plate 63 carrying bearings 64 and 65. Roller 56 has its ends journaled in bearings 64 and 65 so that it is easily rotatable therein. Backing plate 63 can be angularly adjusted with respect to plate 57 by means of an adjusting screw 66.

A chain drive 67 connects a glue roller 68 with the roller 56 so that as roller 56 rotates, it will cause glue roller 68 to rotate. Glue roller 68 is placed so that it will at all times dip into glue pot 69 and contact an edge of the wrapping strip 3. The glue roller and glue pot are positioned below the guide bar 60 rather than above it so that the glue will not be wiped off the wrapping material by passage over the guide bar. The glue roller and glue pot are connected to the plate 57 so that as it pivots about point 58, the angular relationship of the glue pot and the wrapping strip will not be changed. The carriage further carries a trigger 72 which activates a limit switch 73 (Figure 1) so that the motor 6 stops when the carriage reaches the outer limit of its travel.

Two angular positions of the roller 56 and guide bar 60 with the resulting differences in degree of spiral of the wrap are shown in Figure 1. The degree of spiral of the strip 3' is 6 degrees greater than that of 3. It is obvious from a study of the figure, that for a strip of wrapping material of a given width, a greater degree of spiral will give a corresponding smaller amount of overlap. Thus, overlap of the wrap as shown, for example, could be made still smaller by inclining the guide bar and guide roller more or by decreasing the width of strip 3. Of course, as was pointed out before, a change in inclination of the guide bar and guide roller will call for a corresponding change in longitudinal speed of the carriage for a given rotation of the roller. While in the apparatus illustrated these adjustments may be made independently, except for the relationship between indicators 18 and 70, it will be understood of course that it will be readily within the skill of the art to physically interconnect the cam means 59 and the speed change control 17 so that adjustment of one will effect a simultaneous corresponding adjustment of the other. For example, reference being made to Figs. 1, 2 and 4 of the drawings, a synchrogenerator S_1 may be provided to be driven by one of the shafts of the speed-changing means operated by speed-changing handle 17 and a synchromotor S_2 provided to effect a corresponding, simultaneous change in the position of cam 59 by being operatively connected to the shaft therefor. Such generator and motor may be of the well-known Selsyn type with conventional electrical interconnections, not shown.

A supply of paper for straight wrapping, shown as roll 14 in Figure 2, is carried on a bar 15 which is placed on top of rear supports 13. Bar 15 is equal in length to rollers 4 and 5 so that it may carry a single roll equal in length to roll 2 in order, if it is so desired, to straight wrap all of roll 2. Instead of a single roll 14, two separate rolls could be provided of a comparatively short width which would be used to give a reinforcing straight end wrap to roll 2. A bar 16 equal in length to roll 2 is connected to the front track and guides the supply of straight wrapping material from 14 to the roll 2.

An ejector bar 30 is provided for ejecting the heavy roll of paper 2 from the machine. This bar is of a curved shape and is adapted to pass between rollers 4 and 5 in order to push the roll 2 up and over the roller 5. This bar is actuated by a train of gears which in turn are connected to an electric motor.

A pneumatically operated tilting table 31 serves to move the heavy rolls of paper 2 from a position at the side of roller 4 to the position for wrapping as shown in Figure 2. The table is capable of tilting toward roller 4 so that the heavy rolls of paper are pushed up and over the roller. The table also can tilt up as shown in Figure 2 so that the crimpers 40 and 41 may move under it.

Crimpers 40 and 41 are conventional and of the general type shown in U. S. patent to Hurter et al. 2,638,725 and are provided at either end of the roller 4 for crimping inwardly the overlapping sides of the wrapping material at the end of roll 2 so as to form protective cushions on the ends of the roll. The crimpers are mounted so that they rotate with roller 4 and so that they may be moved axially of it. For crimping the ends of the spiral wrap, the crimpers must be moved axially of roller 4 so that crimper heads 42 and 43 thereon come into contact with the end of roll 2. As the roll 2 and roller 4 are rotated, the crimping ends will bend the wrapping material inwardly with an even crimp. I have found that for completely satisfactory operation of the wrapper, the crimpers should be always in contact with the ends of a roll 2 being wrapped thereby. This is because it has been found that the roll otherwise tends to ride lengthwise during rotation upon rollers 4 and 5. The crimpers thus perform a second function, which is to properly position and maintain in proper position a roll to be wrapped.

The crimpers are connected by brackets 44 and 45 to pistons inside of pneumatic cylinders 46 and 47. Pneumatic means for moving the cylinder are preferred instead of mechanical linkage means such as screws because they give a faster axial movement. Furthermore, because as the paper wrap is crimped it is folded in multiple thicknesses, a resilient pressure applying means such as a pneumatic one which can accommodate different thicknesses is necessary.

Operation

A roll of paper is taken from the source of supply and rolled up to the tilting table 31 where it is then pushed over roller 4 into the position as shown in Figure 2. A strip of wrapping material is threaded from the supply roll through the take-up mechanism 19, over turning bar 51 and so over roller 56 and guide bar 60 until it is brought into contact with the roll of paper 2. The end of the strip is then glued or pasted to the roll so that as the roll rotates, it will pull the strip 3 from the supply roll. The ultimate tension of the wrap is set by a brake which can be fixed to the supply roll so that if a tight wrap is desired, the brake is tightened up. Of course, as previously mentioned, the festoon roll 20 exerts at all times a minimum tension on wrapping strip 3. Depending upon the amount of overlap desired, the speed indicator 18 and cam indicator 70 are set to read the same. If it is desired to have a small overlap (a high degree of spiral) then the speed changing unit 18 is set so that the carriage 50 moves at a relatively higher longitudinal speed with respect to the rotation of roll 2 than if a large amount of overlap (small amount of spiral) were desired. At the same time, cam 59 is moved so that there is a greater degree of inclination of guide bar 60 and roller 56. The

reason that the angle of inclination of the guide bar 60 and roller 56 must be changed is that, if they were not, the paper would tend to stretch on one side and to crumple on the other because of the different rates of speed of the carriage.

By making indicators 18 and 70 read the same, it is possible to easily set the correct amount of inclination for any amount of speed of travel of the carriage. The indicators can be made to read in speed of travel of the carriage, degrees of inclination of the guide roller and guide bar, amount of overlap, degree of spiral or any arbitrary figure, provided both indicators use the same dimensional units. The only requirement is that for a particular degree of inclination there be one corresponding position of the speed indicator that would indicate the proper speed of the carriage for that degree of inclination. As previously indicated, it is contemplated that if desirable the cam means and the speed change control can be physically interconnected for simultaneous adjustment, as by synchrogenerator S_1 and synchromoter S_2.

The roller 56, as was pointed out before, is adjustable by screw means 66. This adjustment is, however, made infrequently and does not have to be changed with the different degrees of overlap. It is usually set for different kinds of wrapping material so that the proper tension on all parts of the wrapping material will be maintained as it passes over the turning bar 51.

When the indicators 18 and 70 are set to give the desired overlap or degree of spiral, the motor 6 is started so that it rotates the roll 2 and causes the carriage 50 to move longitudinally of the roller. This movement will cause a precise, even spiral wrap to be made on the roll which can be made as tight as the strength of the wrapping strip will allow before tearing. The strip 3 is usually positioned so that there will be initially an overhang of approximately 6–8 inches at the end of the roll. The carriage 50 is allowed to run on beyond roll 2 so that there is a corresponding amount of overhang on the opposite end of the roll. As the carriage 50 reaches the end of its run, the limit switch 73 is activated by trigger 72 which stops the electric motor 6. The strip 3 is then cut and the carriage 50 disengaged from the driving chain 9. The carriage will then automatically return to its starting position because of the weight of festoon roll 20 acting to pull on strip 3. Brakes, not shown, are provided on the turning bar 51 so that the strip may pass freely over the bar only when the strip is pulled towards the roll 2. The brakes engage to prevent the strip from unthreading when the strip is pulled in the opposite direction.

Reinforcing end wrapping strips may then be applied by a straight wrap on either end of the roll 2 if desired. This is done by threading a strip of wrapping material from supply roll 14 over guide bar 15 and pasting or gluing one end of the strip onto the roll. Here also 6–8 inches of the end wrap are allowed to overlap the end of the roll. The motor 6 is again turned on causing the roll 2 to rotate about its axis. As many layers of end wrap can be put on as desired, the number of layers depending upon the number of complete revolutions of the roll 2. Instead of two separate reinforcing end wraps, there could be a single straight wrap covering the entire length of the roll 2. The supply roll 14 would then be chosen to be of the same length as the roll to be wrapped, or longer if it were desired to fold the ends over the end of this roll.

As heretofore mentioned, I have found that the crimpers should be in contact with the ends of the roll being wrapped at all times during the wrapping thereof. This includes the time during which, as mentioned in the preceding paragraph, the end or straight wrapping material is being applied. Hence the overlap of the straight or end wrap material is formed into folds as applied. It may be noted that these folds as well as those formed at the ends of the roll from the spiral wrap material act as cushions to protect the ends of the roll in subsequent shipment. Loss from damage to roll ends has heretofore been significant. Decreasing and even eliminating such loss is therefore of importance. After the end wrap has been crimped, the crimpers and crimping heads may be withdrawn from contact with the ends of the roll. The ejector bar 30 then is actuated to force the roll 2 up and over roller 5 and onto the next stage of operation. The machine is then ready to receive a new roll to be wrapped.

It is obvious that there are many combinations of wrap that can be had with this machine. The roll can be completely straight wrapped first and then a spiral wrap put on over instead of applying the spiral first followed by the straight as described above. Also, different layers of different wrapping material can be applied. Supply rolls of wrap of the different wrapping materials can be placed so that their axes are at right angles to each other. The different layers can then be threaded as one layer through the take-up mechanism and over the guide means on the carriage. This can also be done with the strips of reinforcing end wrap. Instead of providing one bar 15 on which the rolls of straight wrap are mounted, more bars could be placed above or below roll 14 on which other rolls could be mounted. All of the strips would then be threaded over guide bar 15 so that in effect, when they were attached to the roll 2, they could be considered as one strip made up of different layers of material.

I claim:

1. In a machine for helically wrapping cylindrical articles with a webbed wrapping material, roller means for supporting and rotating the cylindrical article to be wrapped, a carriage movable longitudinally of said cylindrical article and in timed relation with the rotation thereof, guide means on said carriage for guiding said webbed wrapping material over said cylindrical article, cam means on said carriage for changing the angle of inclination of said guide means to said cylindrical article in order to vary the lead of the helical wrap, speed changing means for varying the speed of longitudinal travel of said carriage in direct proportion to the change of said angle of inclination, and means interconnecting said cam means and said speed-changing means so that adjustment of one will effect a simultaneous corresponding adjustment of the other.

2. In a machine for helically wrapping a cylindrical article with a webbed wrapping material of the type wherein said wrapping material is fed from a supply roll whose axis is perpendicular to the axis of said cylindrical article, said machine having roller means rotatably supporting said article, means for rotating said roller means so that said article is caused to rotate about its axis, carriage means adapted to travel longitudinally of said article at a uniform speed and in direct proportion to the rotation of said article, said carriage means supporting a pivoted plate, a turning bar over which said webbed material passes, said turning bar being mounted on said carriage in a substantially horizontal plane and at about 45 degrees to the axis of said article, a rotatable guide roller and a fixed guide bar for guiding said webbed material, said guide roller and guide bar being mounted on said plate in planes which are substantially parallel to the axis of said article, cam means including an eccentrically mounted cam positioned between the carriage and said plate for moving said plate about its pivot, and speed changing means for varying the longitudinal speed of travel of said carriage in relation to the pivoted position of said plate when said article is rotated at a fixed speed.

3. A machine according to claim 2 wherein said cam means and speed changing means are each provided with indicators marked with the same units of measurement.

4. In a machine for helically wrapping cylindrical articles with a webbed wrapping material, roller means for supporting and rotating the cylindrical article to be wrapped, a carriage movable longitudinally of said cylindrical article and in timed relation with the rotation thereof, guide means on said carriage for guiding said webbed wrapping material over said cylindrical article, means on said carriage for changing the angle of inclina-

tion of said guide means to said cylindrical article in order to vary the lead of the helical wrap, speed-changing means for varying the speed of longitudinal travel of said carriage in direct proportion to the change of said angle of inclination, and means physically interconnecting the means on the carriage for changing the angle of inclination of the guide means and said speed-changing means so that adjustment of one will effect a simultaneous corresponding adjustment of the other.

5. A machine according to claim 4 which includes means for preventing lengthwise movement of said cylindrical article on said roller means during rotation thereof for wrapping.

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