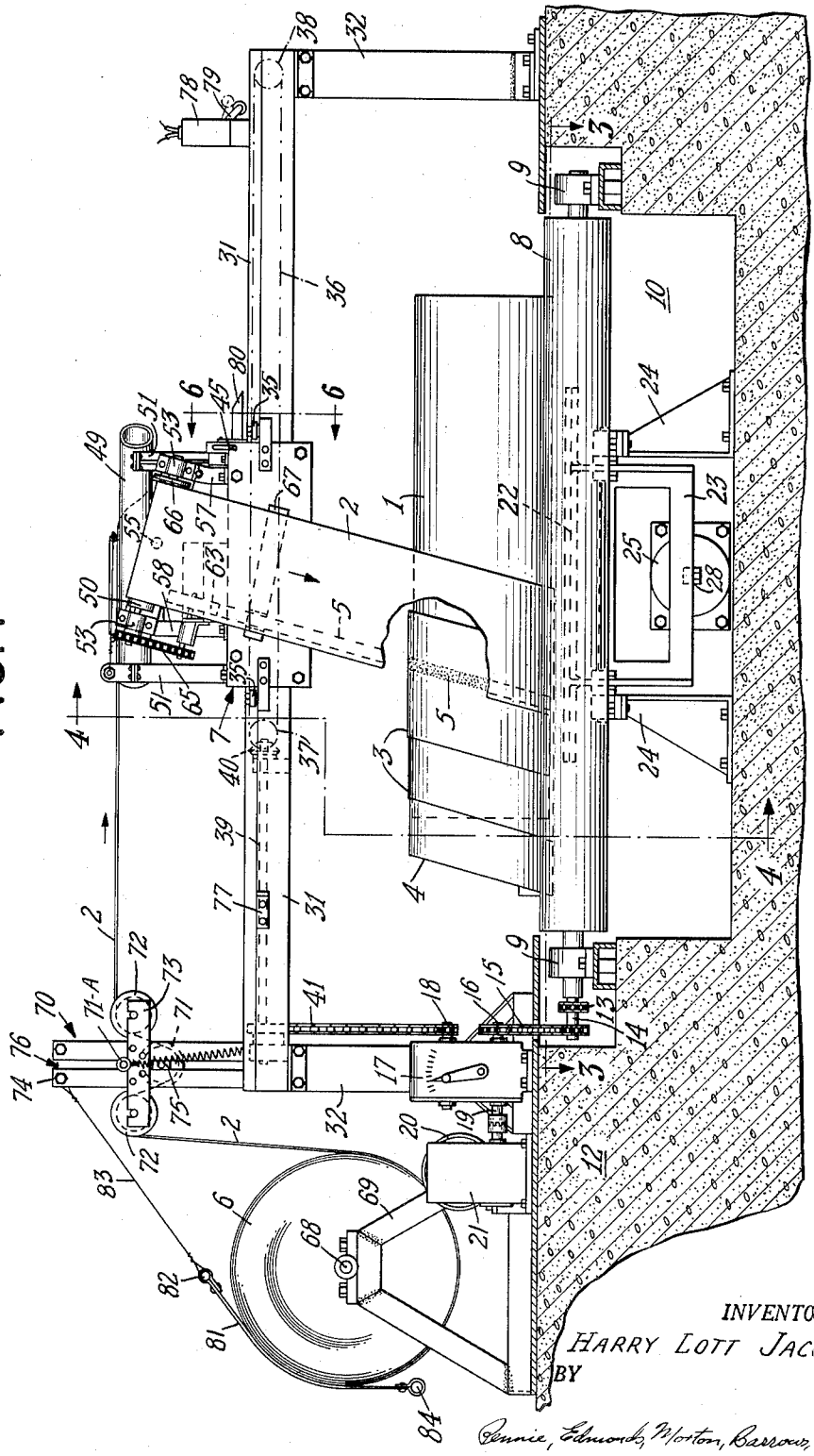
Aug. 30, 1955 H. L. JACOBY 2,716,315

SPIRAL ROLL WRAPPING MACHINE

Filed March 18, 1952 5 Sheets-Sheet 1

FIG. 1



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SPIRAL ROLL WRAPPING MACHINE

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FIG. 2A

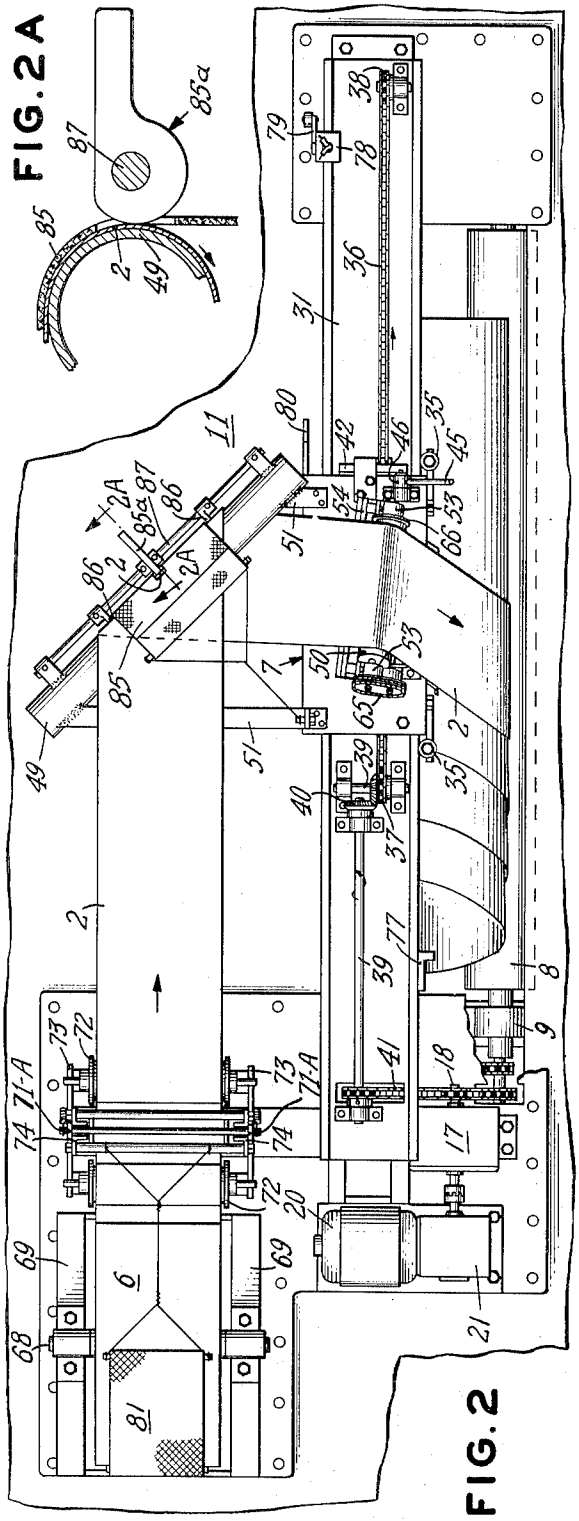

FIG. 2

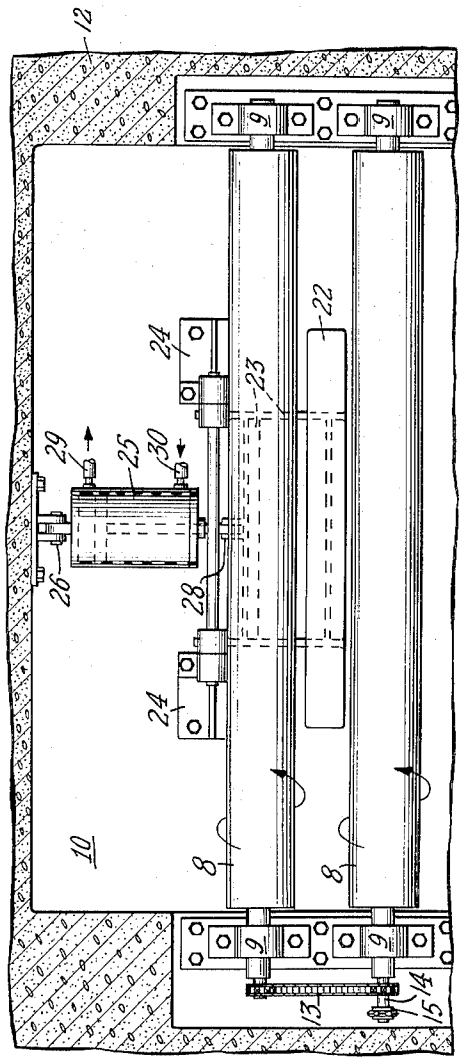

FIG. 3

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FIG. 13

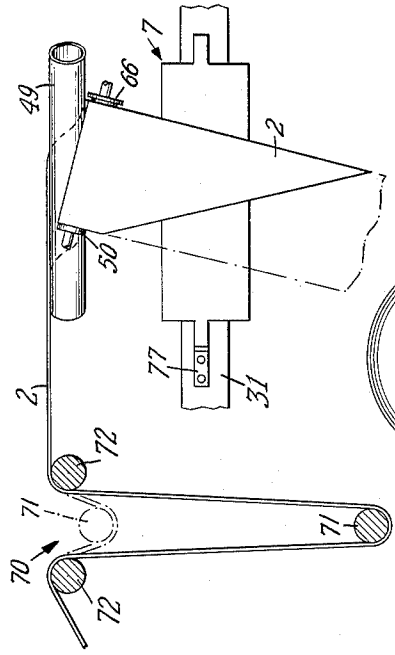


FIG. 5

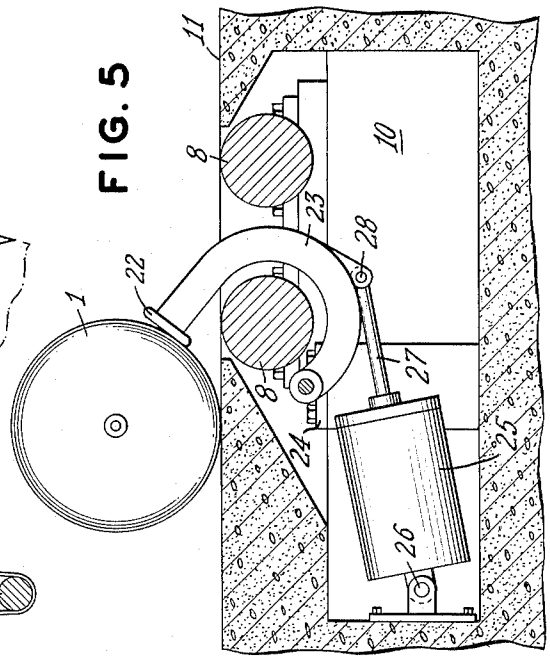
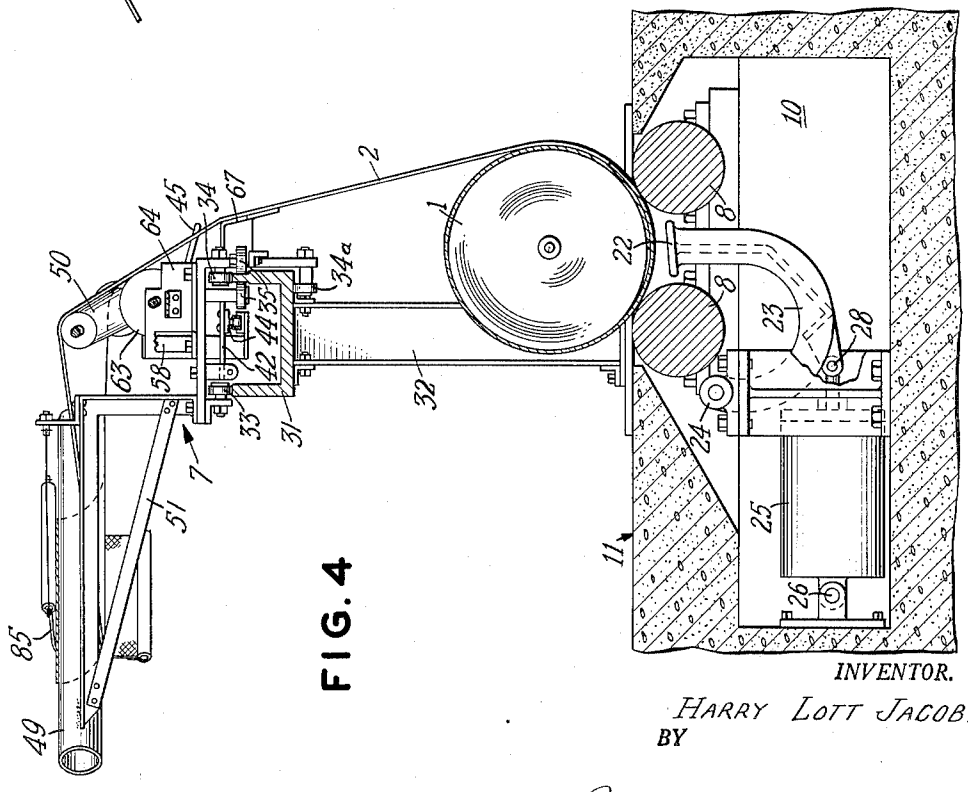


FIG. 4



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Aug. 30, 1955 H. L. JACOBY 2,716,315

SPIRAL ROLL WRAPPING MACHINE

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FIG. 12

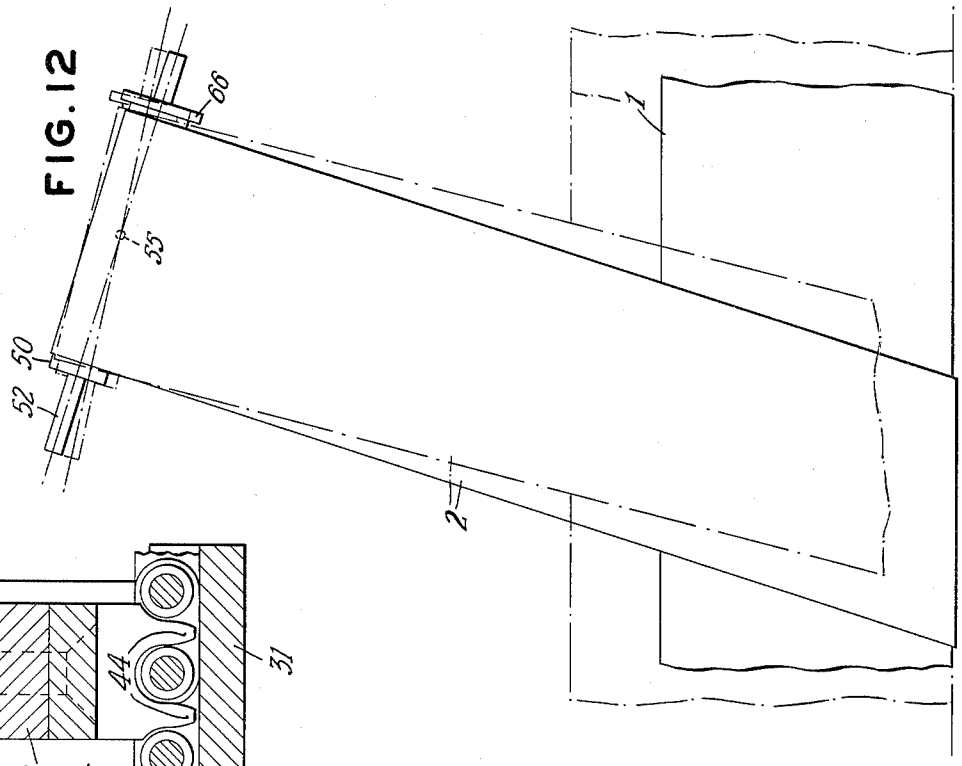


FIG. 7

FIG. 6

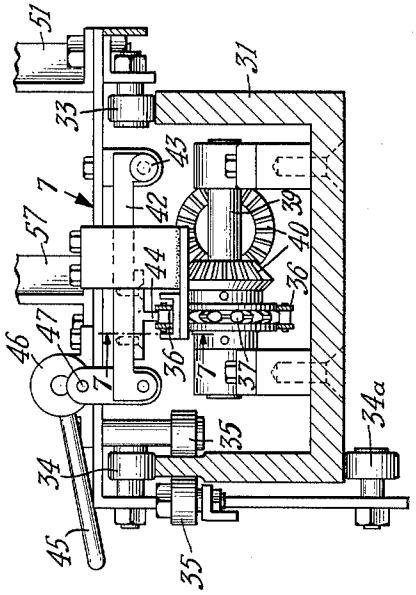
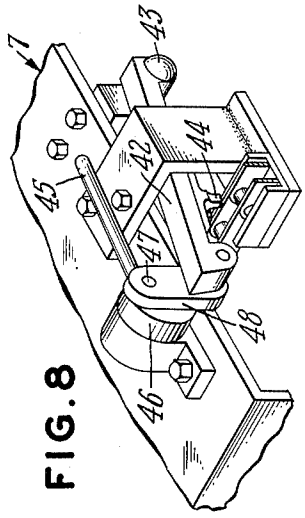


FIG. 8



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SPIRAL ROLL WRAPPING MACHINE

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FIG. 9

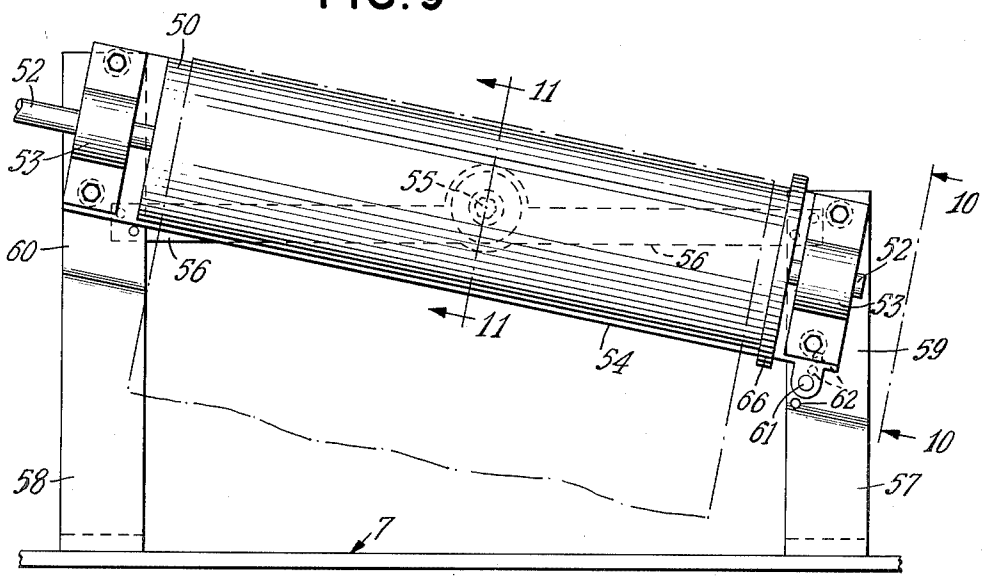


FIG. 10

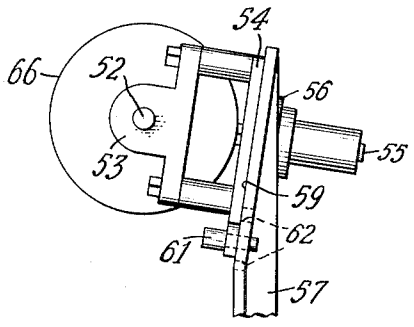
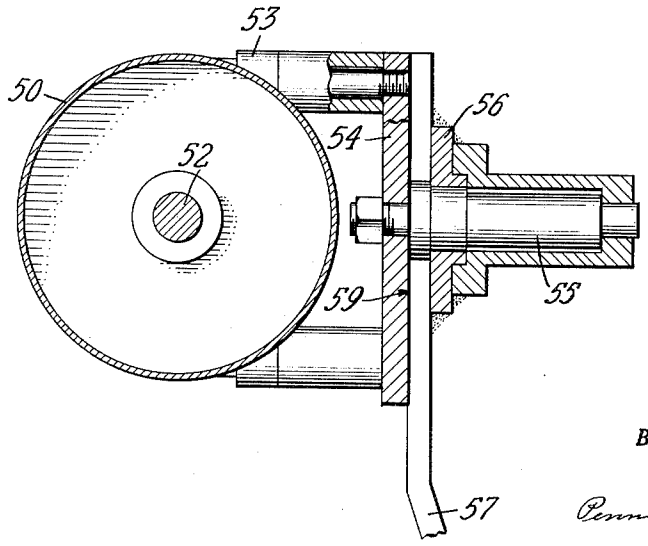


FIG. 11



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United States Patent Office

2,716,315

Patented Aug. 30, 1955

2,716,315

SPIRAL ROLL WRAPPING MACHINE

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Application March 18, 1952, Serial No. 277,119

9 Claims. (Cl. 53—98)

This invention relates to wrapping machines, and, more particularly, to machines which are sometimes known as spiral wrapping machines for wrapping heavy cylindrical articles, for example rolls of paper as they leave the paper machine preparatory to shipment, such machines operating to wind a strip or web of wrapping material, such as paper, in the form of a helix with the successive convolutions overlapping one another.

The primary object of the invention is to provide a machine of this type by means of which the so called "spiral wrap," perhaps more accurately helical, can be applied to heavy cylindrical articles quickly and with a minimum of effort on the part of the operator of the machine.

Another object of the invention is to provide such a wrapping machine in which the starting of the wrapping operation is easily accomplished.

Another object of the invention is the provision of a machine of this kind which is readily adjustable to helically wrap articles of different diameters as well as of different lengths.

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

Fig. 1 is a front elevation of the apparatus, with the supporting foundation shown in longitudinal vertical section;

Fig. 2 is a plan view of the apparatus;

Fig. 2*a* is a detailed section taken on line 2*a*—2*a* of Fig. 2;

Fig. 3 is a plan view of that part of the apparatus which is below the operating floor level;

Fig. 4 is a vertical section of the apparatus taken on line 4—4 of Fig. 1 looking towards the right;

Fig. 5 is a view similar to Fig. 4 of only the lower portion thereof but with parts in different positions;

Fig. 6 is a fragmentary vertical section taken on line 6—6 of Fig. 1 looking toward the left and drawn to an enlarged scale;

Fig. 7 is a detail section taken on line 7—7 of Fig. 6 and drawn to a still larger scale;

Fig. 8 is a perspective view of certain of the parts shown in Figs. 6 and 7;

Fig. 9 is a fragmentary enlarged elevation of the angularly adjustable guide roll for adjusting the "pitch lead" of the wrapping web to suit different diameters of the roll of paper to be wrapped, this guide roll also being shown in Fig. 1;

Fig. 10 is a partial end view of the parts shown in Fig. 9 looking from the right as shown by the arrows 10—10 and drawn to the same scale;

Fig. 11 is a transverse section taken on line 11—11 of Fig. 9 looking toward the left;

Fig. 12 is a diagrammatic front elevation illustrating a change in lead angle; and

Fig. 13 is a schematic view showing the take-up of the slack in the web of wrapping paper at the commencement of a wrapping operation.

By means of this apparatus a heavy roll 1 of paper, which may weigh from several hundred pounds to as much as a ton or more is wrapped continuously from end to end with a strip or web 2 of wrapping material, usually paper. The web is wound about the roll 1 in a series of overlapping helical convolutions 3 leaving portions of the wrapping extending beyond each end, such as portion 4 shown at the left. These projecting portions are folded down against the ends of the roll so as to cover or partially cover them.

The web 2 is usually overlapped one-half of its width resulting in the application of the two protecting layers or thicknesses of the wrapping material. It will be understood, however, that the pitch of the helical wrapping can be varied, if desired. Although the wrapping may be applied without adhesively securing the contiguous turns together, preferably a narrow stripe 5 of adhesive is applied to the underside of the web in such a way as to cause the overlapping layers to be glued together. Preferably also the outside edge of this adhesive is spaced somewhat from the edge of the winding web as shown in Fig. 1 so as to prevent adhesive from being squeezed out onto the surface of the wrapping and also to provide an unglued margin which facilitates the later removal of the covering.

The winding of the web 2 is commenced at the left end of the roll of paper 1, and the web is drawn from a magazine or supply roll 6 by the combined rotation of roll 1 about its own axis by mechanism to be described and the simultaneous travel of a carriage 7 from the left toward the right as viewed in Fig. 1 away from supply roll 6. The supply roll 6 being located at one side of roll 1, and its own axis being at right angles to the axis of roll 1, the traveling carriage 7 is provided with suitable devices for redirecting web 2 laterally and then downwardly at the proper pitch lead angle to produce the desired overlap of the consecutive layers, preferably a one-half overlap as previously referred to.

For the purpose of supporting and turning the roll of paper 1 a pair of drum rolls 8 are provided. These rolls are mounted to rotate in journal bearings 9 at their opposite ends which are arranged within a pit 10 below the operating floor 11. Pit 10 is formed in a suitable foundation 12, for example, of poured concrete. The upper surfaces of rolls 8 are arranged at the level of operating floor 11 so that the heavy rolls of paper 1 to be wrapped can be rolled into position as shown in Figs. 1, 2 and 4 without lifting.

The drum rolls 8 are driven both in the same direction of rotation as indicated in Fig. 3, one of the rolls being driven from the other by means of an endless chain 13, the driving sprocket for this chain being secured to shaft 14 of the front drum roll 8. Shaft 14 is in turn driven by a second endless chain 15 which is driven from a sprocket on an output shaft 16 of a speed reducer 17. This speed reducer has a second output shaft 18 which may rotate at a different speed from shaft 16. Also the speed of this shaft may be varied by gearing within the speed reducer, the purpose of shaft 18 being to impart movement to the traveling carriage 7, as will be later described. The input shaft 19 of speed reducer 17 is driven from any suitable power source such as the electric motor 20 through a second speed reducing gearing 21.

When the roll of paper to be wrapped rests on drum rolls 8, the bottom is somewhat below the level of the operating floor 11, as can be seen by comparing Figs. 4 and 5. Hence, when the wrapping has been completed it is necessary to raise the roll up to the floor surface and

at the same time move it away from the drum rolls 8. This is done by means of a power-operated ejector 22. The ejector has an elongated face to engage the roll 1 throughout a substantial portion of its length, and a suitable U-shaped supporting frame 23 which is pivotally mounted on brackets 24 arranged somewhat to the rear of the rear drum rolls 8.

The ejector 22 is actuated by means of a pressure fluid cylinder 25 which is pivoted at 26 to an appropriate support within pit 10. The piston rod 27 of this cylinder is pivotally connected at 28 to a cross member of frame 23. When pressure fluid is admitted to the rear end of cylinder 25 through pipe 29, the ejector 22 is operated to eject the wrapped roll 1 as shown in Fig. 5. The admission of pressure fluid to the opposite end of the cylinder through pipe 30 returns the ejector to the position shown in Fig. 4. It will be understood that the air or other pressure fluid is controlled by an appropriate valve mechanism (not shown) which is located at a convenient operating point.

The support for the traveling carriage 7 comprises a steel channel member 31 which is somewhat longer than the pit 10 and the drum rolls 8 and rests at its opposite ends on a pair of uprights 32 forming a bridge between them. The elevation of channel 31 is sufficient to permit the web 2 of wrapping paper to be conveniently led in a downward direction at the proper lead angle to produce the desired overlap. Channel 31 is arranged with its legs facing upward so as to constitute a pair of rails for the traveling carriage 7.

This carriage is provided with wheels or rollers 33 which travel upon the upper edge of the back channel leg and wheels 34 rolling upon the top of the front channel leg. Pairs of guiding rollers 35 also engage the opposite faces of the front leg of channel 31 and serve to maintain the supporting wheels 33 and 34 on the upper edges of their respective tracks. One or more rollers 34*a* engage the bottom of channel 31 in order positively to maintain carriage 7 in operative position. Rollers 35 and 34*a* also operate to take the side or twisting thrust which is imparted to the carriage by its redirecting and guiding action upon web 2.

Carriage 7 is moved towards the right as viewed in Fig. 1 during each wrapping operation by means of an endless chain 36. This chain is carried on a driving sprocket 37 at the left (Figs. 1 and 2) and an idler sprocket 38 at the right. Driving sprocket 37 is rotated by means of a shaft 39 through beveled gearing 40, shaft 39 being in turn driven by an endless chain 41 from the second output shaft 18 of speed reducer 17. In this way the advance of carriage 7 is timed with the rotation of the roll 1 which is being wrapped.

Carriage 7 after the completion of a wrapping operation is returned manually from the extreme right hand position to the left end of the supporting channel 31, and for this reason a device is provided to engage and disengage the carriage with respect to chain 36 at will. This device is shown more particularly in Figs. 6, 7 and 8 and comprises a pivoted member 42 which is pivoted at 43 to carriage 7 and is provided with a pair of teeth 44 on its lower surface which are arranged to enter two adjacent links of chain 36.

In the raised position of member 42 teeth 44 are withdrawn from the chain, and in the lowered position they are engaged with the chain. Member 42 is actuated from one position to the other by means of a handle 45 which projects from the edge of a small crank disk 46 on the face of which there is a crank pin 47. This is connected by a link 48 to member 42. Handle 45 is conviently reached from the front of the apparatus and when in the forward position as shown in Figs. 1, 2 and 6 the carriage is connected to chain 36.

The guiding and directing devices for the paper web 2 consist of a turning bar 49 and a guide roll 50. Turning bar 49 is stationary, that is it does not rotate, but

is secured, as by welding, to a pair of brackets 51 which are mounted on carriage 7 and project to the rear thereof, one of these brackets being short and the other much longer as shown in Fig. 2 so as to support the turning bar at an angle of about 45° to the axis of the roll 1 of paper to be wrapped. The purpose of turning bar 49 is to turn and redirect the web 2 of winding strip from a direction parallel with the axis of roll 1 as shown in Fig. 2 to a direction which is nearly, but not quite, at right angles to such former direction. Turning bar 49 is a horizontal tubular member some three or more inches in diameter having a smooth exterior surface over which the web 2 slides.

Guiding roll 50, on the other hand, is arranged to turn freely about its axis and for this purpose is provided with a shaft 52 which rotates in bearing brackets 53 arranged at its opposite ends (Figs. 9–11). The axis of guide roll 50 lies in an operating plane which is parallel to a plane passing through the axis of roll 1 to be wrapped, in order to guide the web 2 towards roll 1 at the correct lead angle. Bearing brackets 53 for roll 50 are supported upon a frame plate 54 that is pivotally mounted at its center by means of a pivot bearing 55 which is supported on a horizontal cross bar 56. This permits the axis of roll 50 to be adjusted in its operating plane in order to change the lead angle. Cross bar 56 is carried upon two upright brackets 57 and 58, of unequal height, and bar 56 is secured to the rear of these brackets as shown in Fig. 11. The rear surface of frame plate 54 rests against two parallel flat surfaces 59 and 60 provided on the upper ends of brackets 57 and 58 respectively and which lie in a common tilted plane which determines the operating plane of roll 50.

The pivot bearing 55 is provided with an extended surface so as to prevent the downward tilting of frame plate 54 away from uniform contact with flat surfaces 59 and 60. In order to adjust the angle of the axis of guide roll 50 to give the proper lead angle, e. g. for the particular size of roll 1 to be wrapped (Fig. 12) frame plate 54 is rotated slightly on pivot 55, in one direction or the other. The frame plate is held in adjusted position by means of a removable headed pin 61 which fits into any one of a series of apertures 62 in one of the supporting brackets, for example bracket 57. It will be understood that when any change is made which requires a change in the lead angle, a change in the rate of travel of carriage 7 for each revolution of roll 1 is also required, and such change is effected by adjusting the variable speed output shaft 18 of gearing 17.

The stripe 5 of adhesive is applied to the underside of web 2 after it leaves guide roll 50 by means of an adhesive applying roll 63 (Fig. 4) the lower portion of which dips into an adhesive receptacle 64. Roller 63 is rotated from guide roll 50 by means of an endless chain 65 and suitable sprockets respectively on shaft 52 and the shaft of roller 63. Guide roll 50, is desired, may be provided with a flange 66 at its right hand or lower end in order to restrain the web 2 from working off of the roll. As shown in the drawings a stationary guide bar 67 is provided on carriage 7 below the adhesive applying mechanism to control the pressure of web 2 against the adhesive applying roller 63 and to provide uniform support for the web across its width.

The supply or magazine roll 6 of the winding paper strip or web 2 turns on trunnion bearings 68 (Figs. 1 and 2) which are mounted at the top of a support 69 secured to the floor at the rear of the apparatus and toward the left. Web 2 in leaving roll 6 travels upwardly through a take-up mechanism 70 and thence in a substantially horizontal path to turning bar 49 on traveling carriage 7. Take-up mechanism 70 comprises a festoon roll 71 and two stationary rolls 72. These stationary rolls are mounted for rotation on two stationary cross bars 73 which are fixed near the upper ends of a pair of slotted upright members 74 which rest upon or are se-

cured to the floor back of the left hand support 32 for the bridge channel member 31. Festoon roll 71 is provided with pivoted bearings at its opposite ends which turn in bearing blocks 75 arranged to slide in the vertical slots 76 of the slotted uprights 74. The purpose of this take-up or festoon roll mechanism will be explained in connection with the description of the operation of the apparatus.

A stop member 77 is mounted on one side of channel 31 to limit the leftward movement of carriage 7 so as to place the carriage in the proper position for commencing the wrapping of paper roll 1. Near the right end of channel 31 there is a limit switch mechanism 78 arranged in the circuit in the driving motor 20 and operated by a roller tipped lever 79. In the full line position of Fig. 1 switch 78 is closed, while in the dotted position the switch is open, to which position lever 79 is raised by means of an actuating cam 80 mounted on the forward side of carriage 7.

In operating the apparatus to wrap the paper roll 1, if we assume that the wrapping has been partly completed (Figs. 1 and 2), the apparatus continues to operate, roll 1 being rotated and traveling carriage 7 being advanced toward the right by the operation of driving motor 20. As will be understood, a certain amount of winding tension is applied to web 2 by both the friction of the paper in traveling around the turning bar 49 and by the weight of festoon roll 71, whose weight is supported by the web 2 as will be understood. The principal winding tension, however, to cause close and tight wrapping, is produced by means of a friction drag or brake 81.

This comprises a friction sheet 81 of heavy fabric such as canvas having a width approximately that of supply roll 6 and arranged to be suspended in frictional engagement with the outside or left hand surface of this roll. This may be done by means of a cross bar 82 extending across the width of the friction sheet and supported by means of a cable 83 from the top of the slotted uprights 74. At the lower end of the friction sheet a weight 84 is placed, and the amount of winding tension can be selected and varied by changing the size of this weight.

A friction device 85 which is somewhat similar to the tension drag sheet 81 but smaller operates to press the paper web against the surface of turning bar 49. The purpose is to add tension and prevent web 2 from sagging between turning bar 49 and the festoon rolls when wrapping rolls of extreme lengths. In order to maintain drag device 85 in contact with web 2 edge guides 86 are provided and mounted on a rod 87 which is supported at its ends adjacent the opposite ends of turning bar 49 (Fig. 2).

When roll 1 is completely wrapped from end to end the final turn of web 2 extends beyond the right hand end of the roll in a manner similar to the extended portion 4 at the left hand end. As this point is reached cam 80 actuates switch lever 79 opening switch 78 and stopping motor 20 and consequently the entire apparatus. The operator of the machine now severs web 2, preferably on a line as nearly vertical as possible extending from the left to right edge of the web (Fig. 13). He then folds in the portions 4 at each end of roll 1 by hand, which completes the wrapping, and operates the ejector 22 which raises roll 1 from its position between the two drum rolls 8. The momentum applied is sufficient to take roll 1 away from the winding apparatus, for example to a conveyer.

Upon the severing of web 2 if the weight of the festoon roll 71 is sufficient to overcome the friction of the web around turning bar 49 it will cause the withdrawal of the end portion of the web from carriage 7. This would necessitate rethreading around the turning bar 49 and guide roll 50 before the succeeding roll of paper could be wrapped. Such withdrawal of the web is prevented by an eccentric cam 85*a* mounted on rod 87 which contacts web 2 through an opening in drag sheet 81 (Fig. 2*a*). The weighted arm which is part of cam 85*a* urges the cam against the web permitting the web to be drawn forward but automatically gripping the web whenever there is tendency for it to be drawn backwards. It will be understood, therefore, that the severed end of the web 2 remains suspended from guide roll 50 approximately as indicated in Fig. 13.

After severing the web and ejecting the wrapped roll 1 the operator then throws handle 45 to the rear (Fig. 8) so as to disconnect carriage 7 from its operating chain 36. The operator then manually returns carriage 7 along the channel 31 to its left hand position against stop 77 and throws connecting handle 45 back to its forward position so as to reconnect the cariage with chain 36.

The function of the take-up device or festoon mechanism 70 is apparent during this return movement of carriage 7. This movement brings the carriage closer to the supply roll 6 and produces a slack in web 2. This slack is formed into a vertical loop in web 2 by the take-up mechanism, and is taken up by the descent of festoon roll 71 which drops to the position shown in Fig. 13 maintaining the loop in stretched condition and preventing twisting or kinking of the web.

After the operator has moved the next roll 1 to be wrapped into position on the drum rolls 8 he takes hold of the suspended end of web 2 and manually wraps the first turn of the web about the end portion of the new roll 1. The stripe of adhesive will serve to hold this first turn of the web in position. In winding such first turn the slack or loop of paper formed by festoon roll 71 may or may not entirely be used up, depending upon the size of the roll 1 being wrapped, but the presence of this loop enables the initial turn of the wrapping to be accomplished under the very moderate tension produced by the weight of festoon roll 71. That is to say, the presence of this festoon roll mechanism eliminates the necessity of wrapping the first turn under the heavy tension produced by the drag device 81.

Upon completing the first turn of the new wrapping the opeartor closes the starting switch (not shown) for motor 20 and the wrapping of the new roll 1 proceeds as before.

While a single embodiment of the present invention has been illustrated and described for the purpose of setting forth the invention, it will be understood that changes may be made both in the construction and operation of this apparatus without exceeding the scope of the invention as set forth in the appended claims.

I claim:

1. In a machine for helically wrapping heavy cylindrical articles, means for supporting the article to be wrapped for rotation about its own axis, a track disposed above and parallel with the axis of said supporting means, a carriage arranged to travel upon said track, stationary means for rotatably supporting a supply roll of wrapping material arranged to deliver the web from said roll to said carriage, said carriage having mounted thereon direction-changing means for guiding and directing the web from said supply roll to said article, means for rotating said article, means operating simultaneously therewith for moving said carriage along said track to wind the web helically about said article, means for disconnecting said carriage from said moving means at the completion of its travel to permit the carriage to be returned along said track, to start winding a successive article, and a festoon roll web take-up mechanism arranged in the path of the web between the supply roll and said movable carriage to take up the slack in the web as the carriage is returned to starting position after severance of the web from the completed wrapping and provide sufficient length of web for making the first turn about such successive article.

2. A machine for wrapping heavy articles as set forth in claim 1 wherein a friction device is provided on the

traveling carriage to frictionally engage the web and prevent its withdrawal from the carriage by the weight of the festoon roll after severance of the web.

3. A machine for wrapping heavy articles as set forth in claim 1 in which a friction drag device is arranged to operate on the supply roll to provide the principal winding tension for the web as it is wound about the article, the tension applied to the web by the festoon roll being substantially less than that produced by said friction drag device.

4. In a machine for helically wrapping heavy cylindrical articles, means for supporting the article to be wrapped for rotation about its own axis, means for rotating said supporting means, a track disposed parallel with the axis of said supporting means, a carriage arranged to travel upon said track, stationary means for rotatably supporting a supply roll of wrapping material arranged to deliver the web therefrom to said carriage, said carriage having mounted thereon direction-changing means for guiding and directing the web from said supply roll to said article, and means operating simultaneously with the rotation of said article for moving said carriage along said track, said means comprising an endless chain and a device on said carriage operable to selectively engage or disengage said chain.

5. In a machine for helically wrapping heavy cylindrical articles, means for supporting the article to be wrapped for rotation about its own axis, a track disposed parallel with the axis of said supporting means, a carriage arranged to travel upon said track, means for rotatably supporting a supply roll of wrapping material arranged to deliver the web therefrom to said carriage, said carriage having mounted thereon direction-changing means for guiding and directing the web from said supply roll to said article, means operating simultaneously with the rotation of said article for moving said carriage along said track, said means comprising an endless chain and a device on said carriage operable to selectively engage or disengage said chain, said direction-changing means comprising a smooth web-turning bar mounted in fixed position on said carriage, and a guide roll arranged to turn freely on its axis to receive the web from said turning bar and direct it at the proper lead angle to the article to be wrapped.

6. In a machine for helically wrapping heavy cylindrical articles, means for supporting the article to be wrapped for rotation about its own axis, means for rotating said supporting means, a track disposed parallel with the axis of said supporting means, a carriage arranged to travel upon said track, stationary means for rotatably supporting a supply roll of wrapping material arranged to deliver the web therefrom to said carriage, said carriage having mounted thereon direction-changing means and a rotatable guide roll for guiding and directing the web from said supply roll to said article, means operating simultaneously with the rotation of said article for moving said carriage along said track, and a support for said guide roll, said support being pivotally mounted on said carriage transversely to the axis of said guide roll, and means for holding said support in angularly adjusted position to cause the web to be directed to the article at the proper lead angle.

7. In a machine for helically wrapping heavy cylindrical articles, a pair of parallel spaced driven rollers for supporting and rotating about its own axis the article to be wrapped, a track disposed parallel with the axes of said rollers, a carriage arranged to travel upon said track, power means for rotating said article supporting rollers and for simultaneously moving said carriage along said track throughout the length of said article, stationary means for rotatably supporting a supply roll of wrapping material to rotate on an axis substantially at right angles to the axis of said article, direction-changing means positioned on said carriage substantially in alignment with said supply roll and the path of the web coming from said roll, and a web guiding means mounted on said carriage and disposed to receive the web from said direction-changing means and direct the web onto said article so as to cause the rotation of said article to draw the web from the stationary supply roll and wind the web helically about said article during the travel of the carriage along said track.

8. In a machine for helically wrapping heavy cylindrical articles, a pair of parallel spaced driven rollers for supporting and rotating about its own axis the article to be wrapped, a track disposed parallel with the axes of said rollers, a carriage arranged to travel upon said track, power means for rotating said supporting rollers and for simultaneously moving said carriage along said track throughout the length of said article, stationary means for rotatably supporting a supply roll of wrapping material to rotate on an axis substantially at right angles to the axis of said article, web guiding means for directing the web of wrapping material from said supply roll in a direction parallel to the axis of said article, direction-changing means positioned on said carriage substantially in alignment with said web guiding means, and a second web guiding means mounted on said carriage and disposed to receive the web from said direction-changing means and to direct the web onto said article so as to cause the rotation of said article to draw the web from the stationary supply roll and wind the web helically about said article during the travel of the carriage along said track.

9. In a machine for helically wrapping heavy cylindrical articles, a pair of parallel spaced driven rollers for supporting and rotating about its own axis the article to be wrapped, a track disposed parallel with the axes of said rollers, a carriage arranged to travel upon said track, power means for rotating said article supporting rollers and for simultaneously moving said carriage along said track throughout the length of said article, stationary means for rotatably supporting a supply roll of wrapping material arranged to deliver the web therefrom to said carriage, said carriage having mounted thereon direction-changing means and a rotatable guide roll to guide and direct the web onto said article so as to cause the rotation of said article to draw the web from the stationary supply roll and wind the web helically about said article during the travel of the carriage along said track, an adhesive applying roll mounted on said carriage adjacent said rotatable guide roll and disposed to engage the under surface of the web as it leaves said guide roll and apply a stripe of adhesive to the web, and driving means interconnecting said rolls to drive the adhesive roll by said guide roll.

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