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[31] 054,663

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[54] WRAPPING MACHINE
5 Claims, 10 Drawing Figs.

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53/75, 53/198 R, 53/229

[51] Int. Cl. B65b 11/12,

B65b 11/48

[50] Field of Search 53/3, 33,

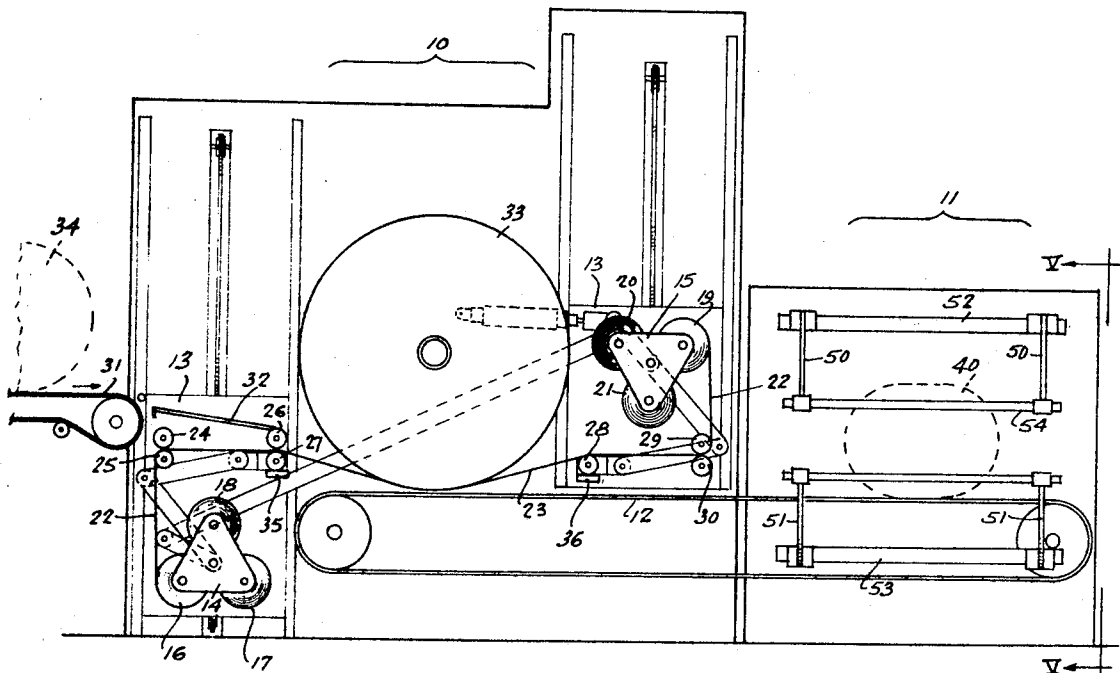
66, 75, 198, 203, 209, 218, 229; 100/7

[56] References Cited

UNITED STATES PATENTS

3,432,981 3/1969 Minten 53/33

ABSTRACT: A bale or roll of textile material is wrapped in a thermoplastic film. At a circumferential wrapping station a frame carrying film is raised to cause a web of film to embrace the sides of the workpiece; rollers which move together at the top of the workpiece carry heat-sealing and severing bars to complete the circumferential wrap and to rejoin the film to form an uninterrupted web for the next workpiece. At a subsequent end-wrapping station, arms bearing heat-sealing and severing bars are closed to complete the wrap. The operations are sequenced to follow automatically upon each other, the circumferential wrapping operation serving to measure the height of the workpiece and store this information for use in adjusting the operation height of the heating bars in the end-wrapping operation.



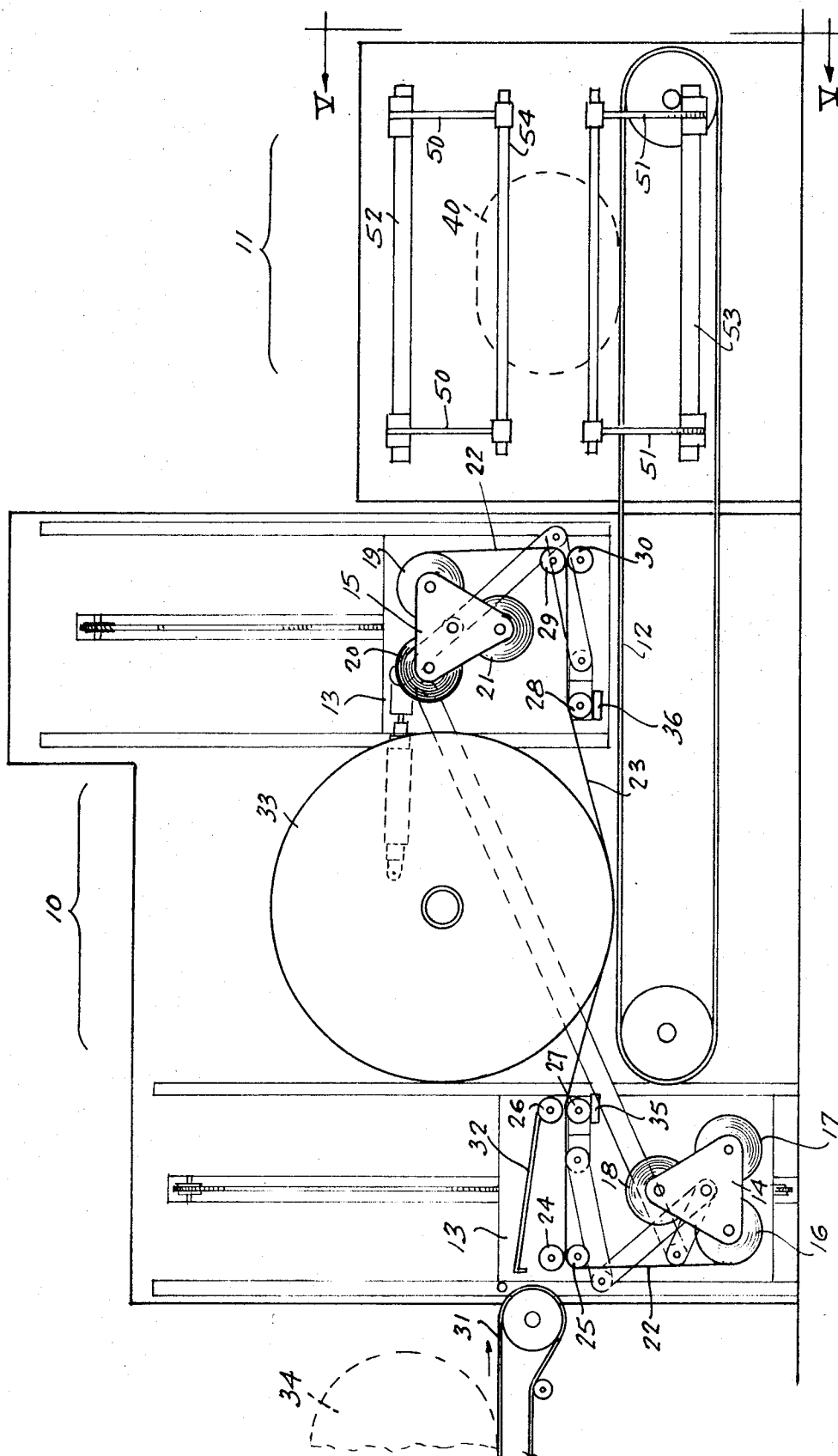


Fig. 1.

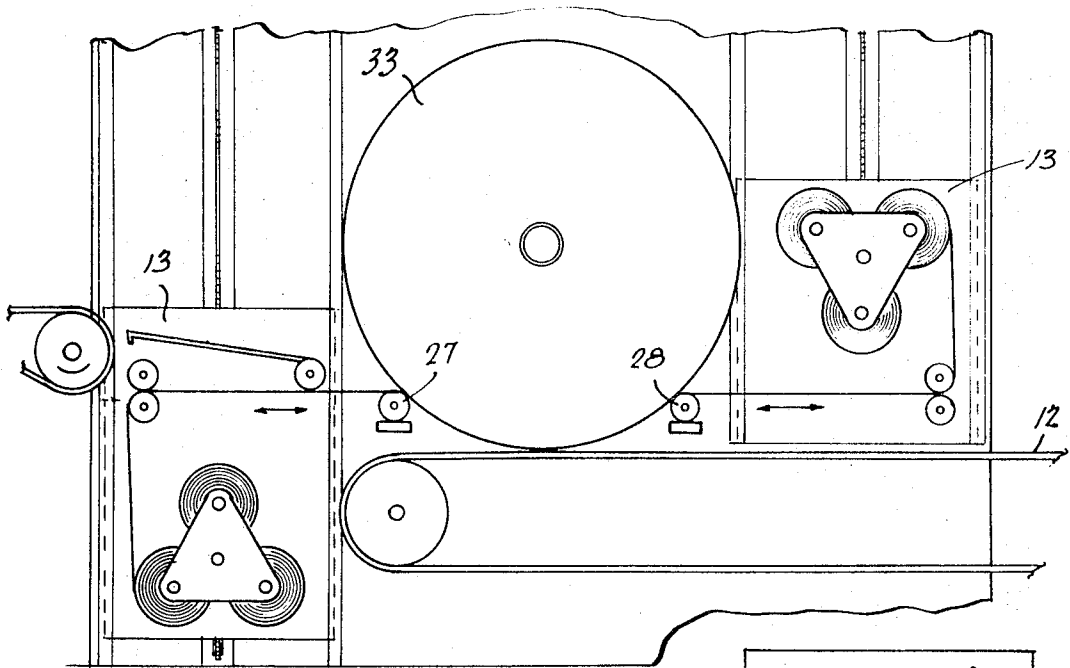


Fig. 2.

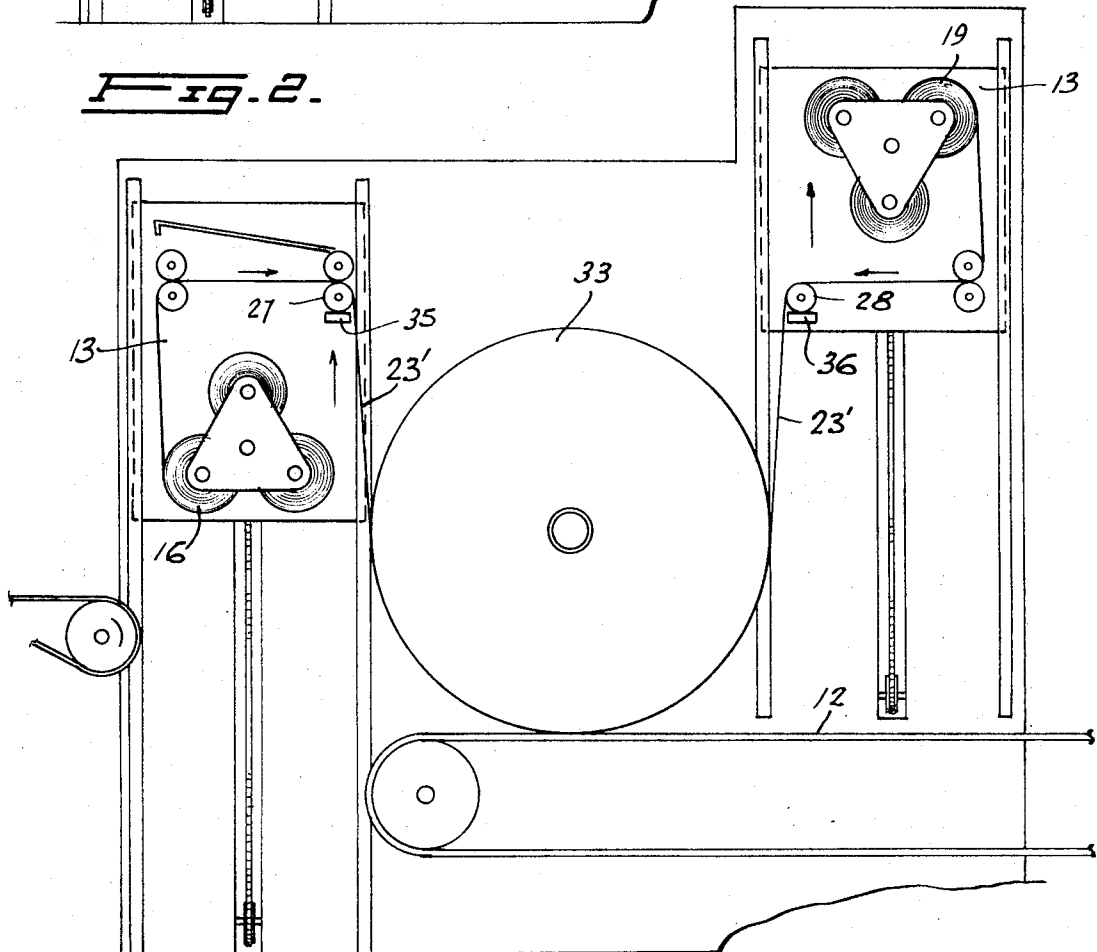


Fig. 3.

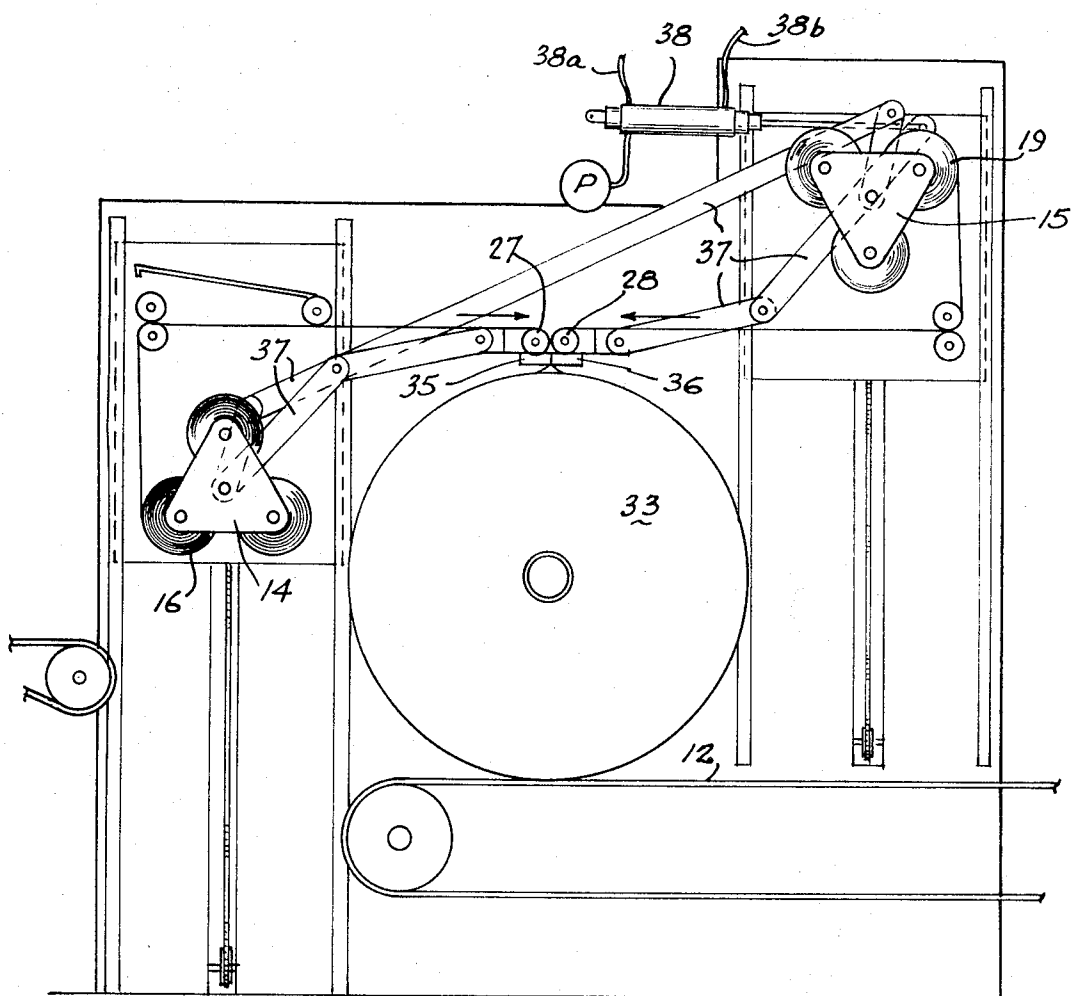


Fig. 4.

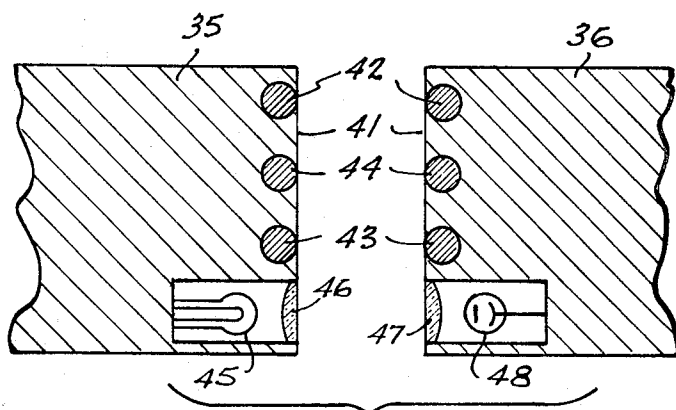


Fig. 4a.

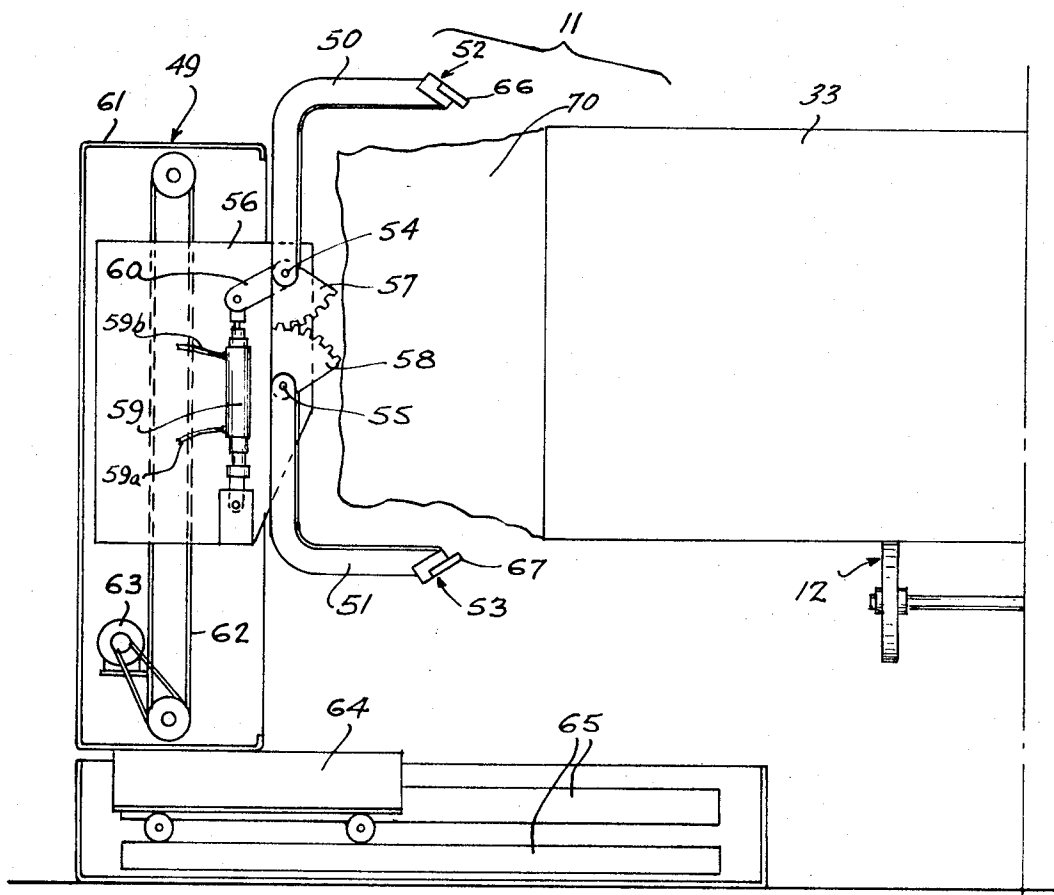


Fig. 5.

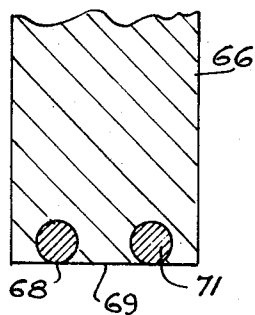


Fig. 5a.

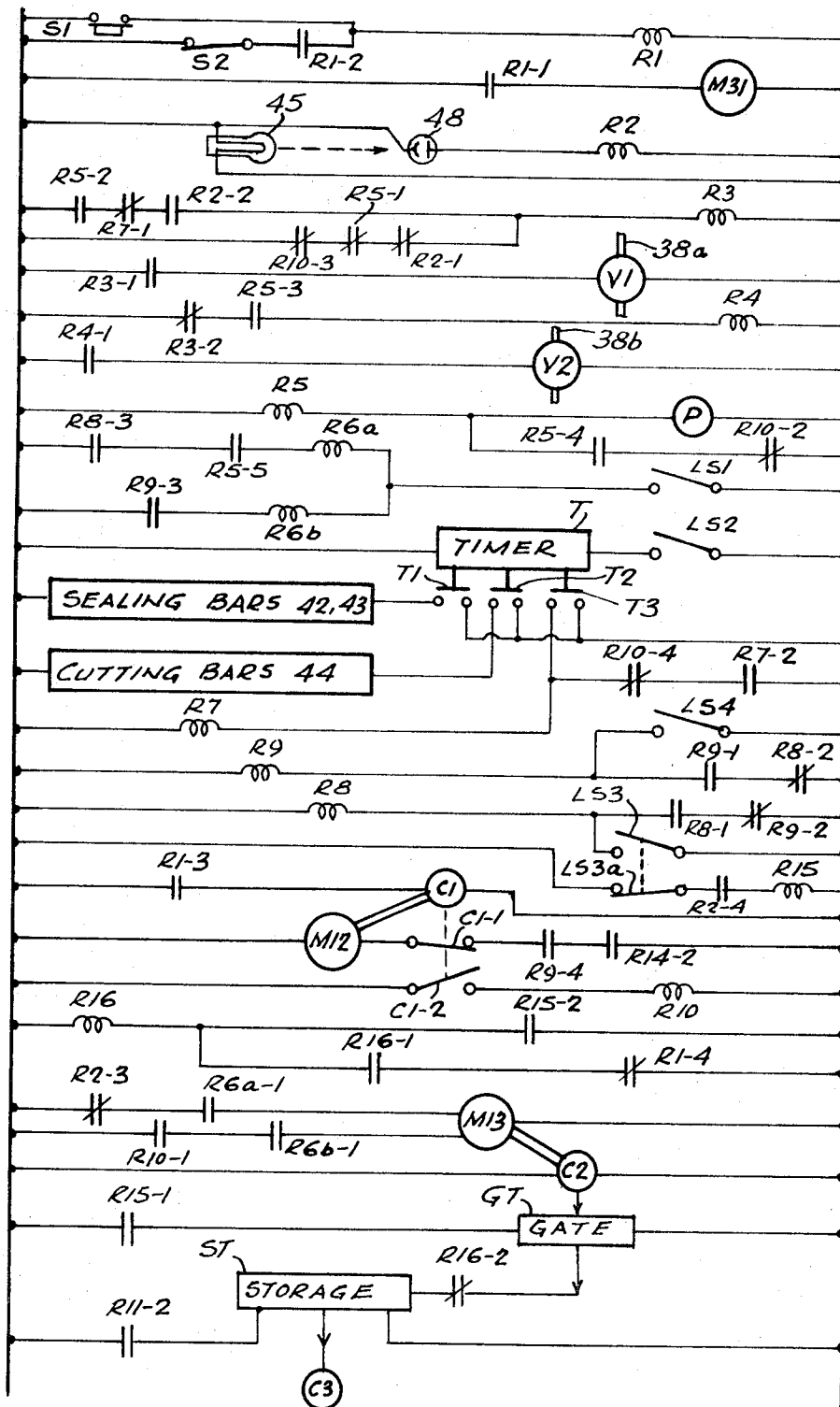


Fig-7.

WRAPPING MACHINE

This invention relates to apparatus for wrapping a workpiece in plastic film.

More particularly, it is concerned with such apparatus when designed for wrapping a workpiece in the form of a roll or bale of textile material. It has now become common to wrap such goods for shipping and/or for display in one of the well-known thermoplastic films, such as PVC, polyethylene or propylene or the like.

As indicated, such methods of packaging textile materials are already broadly known. In a typical first stage the textile material is wrapped comparatively loosely in the film, while in a second stage the wrapped workpiece is passed through a shrinking tunnel. Heat in the tunnel causes the film to shrink and conform tightly to the workpiece.

The purpose of the present invention is to provide improvements in the first stage of such equipment, namely the apparatus that serves for the initial wrapping of the workpiece in the film, the object of the invention being to provide apparatus that will perform this function in a manner improved in relation to prior art machines.

More particularly, it is an object of the present invention to provide apparatus that can quickly adapt to the handling of workpieces of different sizes, more particularly to those of different diameters.

In the textile industry it is common to encounter comparatively short runs of a given size of roll or bale. While the roll length may remain fixed for a comparatively long run, the diameter may change almost from each roll to the next, and it is therefore impracticable to set a wrapping machine for a given size of roll and just allow it to operate hour after hour without stopping for adjustment. In prior art machines for wrapping such workpieces in plastic film, it has been necessary to stop the machine and make adjustments to it each time a workpiece of significantly different diameter is encountered and this requirement is obviously time consuming.

An important object of the present invention is to provide apparatus that can readily accommodate itself to workpieces of varying dimensions, more particularly to the diameter dimension, without a need to stop the operation of the machine for adjustment purposes.

One example of a machine constructed in accordance with the present invention is illustrated diagrammatically in the accompanying drawings. It is to be understood that this machine is illustrated by way of example only, and not by way of limitation of the broad features of the invention, which latter are defined in the appended claims.

In the drawings:

FIG. 1 is a diagrammatic side view of the apparatus;

FIG. 2 is a similar diagrammatic side view of a first station of the apparatus of Figure 1 showing the parts in a different position;

FIG. 3 is a view similar to Figure 2, showing the parts in yet another position;

FIG. 4 is a further view similar to Figures 2 and 3 and showing the parts in a still further position;

FIG. 4a is a separated view of a cooperating pair of sealing elements forming part of FIGS. 1 to 4.

FIG. 5 is an end view of a second station of the apparatus, taken on the line V-V in FIG. 1;

FIG. 5a is a fragmentary section of a sealing element forming part of FIG. 5;

FIG. 6 is a view generally similar to Figure 5 but showing operation of the parts under different conditions; and

FIGS. 7 and 8 shown the control equipment in schematic circuits. FIG. 8 being with FIG. 6.

FIG. 1 shows the apparatus composed of a first station 10 and a second station 11 interconnected by means of a shuttle conveyor 12 which can be intermittently driven by conventional power means (not shown).

Circumferential Wrapping Station 10 (FIGS. 1 to 4a)

At the first station 10, which is the circumferential wrapping station, there is provided a wrapping frame 13 on which are mounted roll-supporting assemblies 14 and 15, each of which carries three rolls of plastic film 16, 17 and 18; and 19, 20 and 21, respectively. These rolls of film differ from one another in their width, that is to say the dimension extended transversely to the plane in which FIG. 1 is drawn, and only one roll on each of the assemblies 14, 15, will be used at any given time. FIG. 1 assumes that the rolls 16 and 19 are in use and it will be convenient further to assume that these rolls provide wide film used for wrapping workpieces having the maximum length dimension for which the apparatus is constructed.

A web of thermoplastic film 22 extends from the roll 16 to the roll 19, such web including a central, substantially horizontal span 23 that lies immediately superjacent the conveyor 12. This web 22, in extending from the roll 16 to the roll 19, passes through a first pair of guide rollers 24, 25; through a second pair of guide rollers 26, 27; over a further guide roller 28; and finally through another pair of guide rollers 29 and 30. All the guide rollers are pivotally mounted on the frame 13.

A feed conveyor 31 is provided for moving each workpiece to the circumferential wrapping station 10. During transit from conveyor 31 to conveyor 12, each workpiece passes over a feed plate 32 that can pivot about the axis of guide roller 26 and the function of which will be described below.

FIGS. 1 to 4 show a large workpiece in the form of a large diameter roll 33 of textile material already in place at the circumferentially wrapping station 10, it being assumed that this roll has been brought to this location by the agency of the conveyor 31, on which a second roll 34 has been shown in broken lines, as illustrative of the important fact that rolls of different diameter can readily be handled by the present apparatus one after the other without the need for readjustment of the settings of the machine by the operator. During the circumferential wrapping operation, the conveyor 12 is stationary.

Centering and Wrapping Action

To cater for the possibility that the roll 33, which has rolled down onto the conveyor 12 from the conveyor 31 will not be located centrally of the station 10, the mechanism provides for the rollers 27 and 28 to carry out an initial centering operation, as illustrated in Figure 2. These rollers are moved towards one another until the resistance that they encounter against further movement is equal. They are then returned to their initial positions as shown in FIG. 1. It will be appreciated that this type of centering operation acts independently of the diameter of the workpiece and serves to center the workpiece regardless of whether it is a circular roll or a bale of material. The shape of a typical bale in end view can be roughly described as an elongated ellipse, an example of which has been shown at 40 in FIG. 1 at the end-wrapping station 11.

After the rollers 27 and 28 have been returned to their initial positions as shown in FIG. 1, the entire frame 13 is moved upwardly, in the manner shown in FIG. 3, which movement has the effect of pulling film off the rolls 16 and 19, so that the previously generally horizontal span 23 of film is now drawn up, as shown at 23', around the sides as well as around the bottom of the workpiece 33.

Action of Sealing Elements

The next stage in the operation is for the rollers 27 and 28 to be moved together, in the manner shown in FIG. 4, which action completes the circumferential wrapping of the workpiece 33 by film web. It also serves to bring together the sealing elements 35 and 36 which are mounted immediately beneath the rollers 27, 28 respectively. The inward and outward movement of the rollers 27, 28 is controlled by a linkage mechanism that is conventional in itself and which is shown generally at 37. It is operated by an hydraulic cylinder 38 mounted on the frame 13, the two main fulcrum points of the linkage 37 being defined by the center points of the assemblies 14 and 15 respectively.

Portions of the sealing elements 35 and 36 are shown in section and on a much enlarged scale in Figure 4a. It will be seen that embedded closely beneath each of the surfaces 41 of

these elements that contact the thermoplastic film are three heating bars, 42 and 43 near the top and bottom of each element, and 44 centrally of the bars 42, 43. The top and bottom bars are electrically energized to reach a temperature in the time of operation sufficient merely to soften the two layers of film when these are pressed between the elements 35, 36, as in the FIG. 4 position. Such energization of the bars 42, 43 is momentary and, as soon as it terminates, the softened portions of the film reharden to unite and form a pair of spaced-apart seals extending along the workpiece. Heating of the bars 44 is more intense, so as to soften the film to such an extent that, when the elements 35 and 36 are moved apart again by their associated rollers 27 and 28, the web is effectively cut along the line that the bats 44 engaged. The portion of the film now wrapped around the workpiece 33 will be connected by the seal formed by the bats 43 to complete the circumferential wrapping, while the bars 42 will have served to join together the otherwise free ends of film extending from the rolls 16, 19 and thus maintain a continuous web of film between such rolls.

As is also shown in FIG. 4a, the element 35 is provided with a lamp 45 and lens 46 for directing a beam of light through a further lens 47 in the element 36 to energize a photoelectric cell 48. During the upward travel of the frame 13 towards the position shown in FIG. 3, this beam of light will have been interrupted by the workpiece 33. It will only have been reestablished at the moment that FIG. 3 illustrates, namely when the beam becomes tangential to the upper surface of the workpiece 33. It is the reestablishment of this beam to energize the cell 48 that halts further upward movement of the frame 13 and then initiates the inward movement of the rollers 27, 28 to the position shown in FIG. 4, as is more fully described below in connection with the control mechanism.

The circumferentially wrapped workpiece is now separated from the reformed film web and, while the frame 13 remains in its elevated position, the shuttle conveyor 12 is driven to move the workpiece 33 from the circumferential wrapping station 10 to the end-wrapping station 11.

End-Wrapping Station (FIGS. 1, 5 and 6)

The instrumentalities at the station 11 are illustrated in FIGS. 1, 5 and 6. Arms 50, 51 are joined at their free ends by bars 52 and 53, respectively, the arms 50, 51 being pivoted at 54, 55 respectively, on a carriage 56. These arms include meshing gear segments 57, 58 that ensure synchronous rotation of the arms 50, 51 at all times, such rotation being produced by an hydraulic cylinder 59 the piston rod of which is connected through a link 60 to the arm 50.

The carriage 56 is vertically movable in a frame 61 by means of a chain 62 driven from a motor 63. The frame 61 is mounted on a wheeled carriage 64 that is movable along fixed rails 65 in the horizontal direction transverse to the direction of travel of the conveyor 12, that is towards and away from the end of a workpiece. Each of the bars 52, 53 carries a sealing element 66, 67, of which a representative 66 is shown in FIG. 5a. Each such element carries a sealing heating bar 71 and a cutting heater bar 68 embedded closely beneath the surface 69. These elements contact the film in the manner illustrated in broken lines in FIG. 6.

While only one end-sealing mechanism has been illustrated, it will be understood that a similar mechanism will operate simultaneously at the rear of the machine, i.e. at the other end of the workpiece 33.

FIG. 5 shows the workpiece 33 at station 11 and shows diagrammatically how the end portion 70 of the film projects beyond the end of the workpiece 33 itself, the width of the film web having been suitably chosen to ensure the existence of this end portion 70. As will be apparent from FIG. 5, when the cylinder 59 is energized to rotate the arms 50, 51 to bring the sealing elements 66 and 67 together, the film portion 70 will be squeezed inwardly and the top and bottom layers of it brought together, so that a horizontally extending seal is formed by the heating bars 71 to close this end of the package. The cutting bars 68 will ensure that the residue of film is cut

off to fall downwardly into suitable means for its removal. Such means have not been shown, because they will be conventional, and may, for example, consist of a suitable located suction tube into which all loose pieces of film will be drawn.

FIG. 6 has been provided to illustrate further how the end-sealing mechanism is adapted for operation with a smaller workpiece, which in this case is assumed to be the bale 40. In this case the carriage 56 has been lowered to bring the horizontal plane equidistant between the pivots 54, 55 into alignment with the axis of the workpiece 40. Additionally, in this example the carriage 64 has been moved inwardly by the operator to accommodate the mechanism to the fact that the bale 40 is shorter than the roll 33. The sealing and cutting operation of the element 66, 67 nevertheless remains essentially the same, as FIG. 6 demonstrates.

Conveyor Operation

After each workpiece has been moved from the circumferential wrapping station 10 to the end-wrapping station 11, the frame 13 of the station 10 immediately returns to its lower position and the feed conveyor 31 is reenergized to move a new workpiece to the station 10. This action takes place while the end-wrapping operation is in progress at station 11, the shuttle conveyor 12 being stationary at this time. Stations 10 and 11 thus operate simultaneously with the shuttle conveyor stopped. When the conveyor 12 is next driven, both the workpiece at station 10 and the workpiece at station 11 will be ready to be fed forward, the former moving into station 11, while the latter moves to a further conveyor (not shown) for transportation of the now fully wrapped workpiece to a shrinking tunnel (not shown).

The feed plate 32 is used to detect the feeding-in of a new workpiece from the conveyor 31 and to set in motion a fresh cycle of operation.

Variations in Workpiece Dimensions

As already explained, elevation of the frame 13 to wrap the film web around a fresh workpiece is halted by the light beam, the height that such frame achieves representing information about the workpiece diameter that is momentarily stored and passed to station 11 immediately upon completion of the cycle and reenergization of the shuttle conveyor 12. Such information is used to drive the motors 63 in each of the end-wrapping mechanisms located at respective ends of the workpiece, so as automatically to center the carriage 56 on such workpiece. In this way, the equipment is able to accept workpieces of varying dimensions in the vertical direction (diameter in the case of a roll; height in the case of a bale) without requiring any manual resetting between workpieces. In a like manner the centering action already described in relation to rollers 27, 28 accommodates the apparatus to variations in the horizontal width dimension of the workpieces.

To accommodate different lengths of workpiece it is necessary, however, to stop the machine briefly and make two manual adjustments. Firstly assemblies 14 and 15 must be rotated to bring into use a different pair of rolls, for example the rolls 17 and 20 carrying film of a different width. The end of the webs of film from these rolls must be joined together to start a run. Also the carriages 64 of the end sealing mechanisms 49 on respective sides of the conveyor 12 must be moved into new positions, for example from that of FIG. 5 to that of FIG. 6.

Control Equipment for the Circumferential Wrapping Station 10 (FIG. 7)

The sequence of operations at the first station 10 will now be described with reference to FIG. 7 which shows a detached-contact schematic circuit.

It is assumed that the parts are initially in the position shown in FIG. 1, except that the roll 33 is in standby position on the feed conveyor 31.

Operation is commenced by manual depression of a start switch S1 to energize a relay R1. Normally open contacts R1-1 are closed to energize a motor M31 to drive the feed conveyor 31 and thus move the roll 33 towards the first station 10. Contacts R1-2 are also closed to hold the relay R1 ener-

gized after release of the switch S1. The feed plate 32 acts as a treadle to open a switch S2 as the roll 33 passes over it, thus interrupting the circuit to the relay R1 and terminating drive of the conveyor 31. The roll 33 continues under gravity until it takes up a position on the conveyor 12, approximately as shown in FIG. 1.

It is, however, first necessary to carry out the centering action above referred to, in order to ensure correct positioning of the roll 33, this action being illustrated in FIG. 2, and being performed by a relay R2 which is energized whenever the light beam from the lamp 45 energizes the photoelectric cell 48. Movement of the roll 33 on to the conveyor 12 interrupts this beam, thus deenergizing the relay R2 to allow "normally closed" contacts R2-1 to close. Since relays R5 and R10 that will be further described below are also deenergized at this time, their normally closed contacts R5-1 and R10-3 will also be closed, with the result that a relay R3 is energized to close its contacts R3-1 and actuate a first valve V1 for feeding hydraulic pressure to a line 38a (FIG. 4) leading to the end of the hydraulic cylinder 38 for causing the same to extend its piston and thus move the centering rollers 27 and 28 towards one another. This same end of the cylinder 38 is connected to a pressure-sensitive device P that will be energized by a build-up of pressure after the rollers 27 and 28 have centered the roll 33 and can move no further together. The device P completes a circuit to the relay R5 which now acts to open its contacts R5-1 and thus deenergize the relay R3. Contacts R5-2 will also be closed at this time, in an alternative energizing circuit to the relay R3, but this alternative circuit remains incomplete because contacts R2-2 will be open, the relay R2 having been deenergized by interruption of the light beam by the roll 33.

At the same time relay contacts R5-3 will be closed to complete a circuit through normally closed contacts R3-2 to a relay R4, contacts R4-1 of which now close to energize a valve V2 which controls supply of hydraulic fluid to a line 38b feeding the other end of the hydraulic cylinder 38. In this way, the rollers 27 and 28 are retracted to their original fully spread-apart position shown in FIG. 1. Relay R5 remains closed through its own holding contacts R5-4, even though pressure behind the piston of the cylinder 38 was removed by deenergization of relay R3, it being assumed that when valve V1 is released it allows the line 38a to be vented.

Movement of the rollers 27, 28 to their fully open position is detected by a limit switch LS1 associated with the piston of the cylinder 38. As will be seen from FIG. 7, closure of the switch LS1 enables either of two relays R6a or R6b to be closed. In the present instance, it is the relay R6a that is closed through now closed contacts R5-5 and a set of contacts R8-3 associated with a relay R8 that is energized whenever a further limit switch LS3 is closed. The limit switch LS3 is associated with the frame 13 and is closed when this frame is in the fully lowered position shown in FIG. 1. A corresponding limit switch LS4 is closed whenever the frame 13 is in its fully upward position to energize a relay R9. Relay R8 includes self-holding contacts R8-1 in series with normally closed contacts R9-2, while the relay R9 has self-holding contacts R9-1 in series with normally closed contacts R8-2. Thus, starting with the frame 13 in its lower position and thus the limit switch LS3 closed, the relay R8 will be energized and will remain so energized, even when the frame 13 starts to move upwards and the limit switch LS3 is opened. This condition remains until the frame 13 reaches its fully upper position, when the limit switch LS4 will be closed to energize the relay R9 and thus deenergize the relay R8 through contacts R9-2. Similarly, the relay R9 will stay energized, even when the frame 13 starts FIG. move down again, until the frame reaches its lower most position to reclose the limit switch LS3 and again reverse the conditions.

In the present condition of the apparatus, with the frame 13 in its lower position, contacts R8-3 are closed and contacts R9-3 are open, so it is the relay R6a that is energized. This action serves to close contacts R6a-1 which completes a first

circuit to one set of terminals of a motor M13 for raising the frame 13. Series contacts R2-3 are closed, because relay 2 is still deenergized. The parts thus start to move towards the position shown in FIG. 3. When they reach this position, the light beam is reestablished, thus reenergizing the relay R2 to open the contacts R2-3 in the supply to the motor M13. The frame is thus stopped.

Reenergization of the relay R2 has also served to close contacts R2-2. These are in series with contacts R5-2 which are now closed, since the relay R5 remains energized, and with contacts R7-1 which are closed at this time. Thus the relay R3 is energized to operate the valve V1 again and move the sealing elements 35, 36 together. When these elements have come fully together, this fact is detected by a second limit switch LS2 associated with the piston of the cylinder 38, to operate a timer T. The timer R immediately closes a first pair of contacts T1 to energize the sealing bars 42 and 43 for approximately 2 seconds, whereupon a second pair of timer contacts T2 close to energize the cutting bars 44 for a further 2 seconds. After this lapse of 4 seconds a third set of timer contacts T3 closes to energize the relay R7 and open contacts R7-1 to deenergize the relay R3. Relay R7 is held energized by self-holding contacts R7-2. Contacts R3-2 will then close and, in conjunction with closed contacts R5-3 will again energize the relay R4 to admit hydraulic pressure to the valve V2 to move the sealing elements 35 and 36 apart to their fully open position. When they reach their fully open position, the limit switch LS1 is reclosed to energize the relay R6a again and continue operation of the motor M13 until the frame 13 reaches its upper most position. This continued upward movement of the frame is carried out in order to ensure that the frame is well clear of the roll 33 before the conveyor 12 is moved.

As soon as the frame 13 reaches its uppermost position, it closes the limit switch LS4 to energize the relay R9 and deenergize the relay R8, closing contacts R9-3 and thus energizing relay R6b whose contacts are R6b-1 close. Before describing the effect of this action, it is pertinent to note that a further pair of contacts R9-4 will also have been closed when the frame 13 reached its uppermost position to energize a further motor M12 for driving the conveyor 12, assuming contacts R14-2 are closed, for reasons discussed below. The motor M12 operate includes a pair of series contacts C1-1 operated by a counter C1 associated with the motor M12. The counter C1 counts the number of revolutions of the motor shaft and is set to actuate the contacts C1-1 and hence stop the motor after the necessary number of revolutions to move the roll 33 from the centerline of the first station 10 to the centerline of the second (end-wrapping) station 11. Thus the roll 33 is moved to the center of this second station and accurately positioned centrally therein.

The counter C1 at the same time serves to close a second set of contacts C1-2 to energize a relay R10 having contacts R10-1 that are needed to complete a circuit to the motor M13 to drive it in the downward direction to lower the frame 13. The relay R10 also includes a pair of contacts R10-2 in the holding circuit of the relay R5 which is now released; a pair of contacts R10-3 in one of the energizing circuits to the relay R3 to prevent its reenergization; and a pair of contacts R10-4 for releasing the relay R7. When the frame 13 reaches its lowermost position again, the relay R8 is reenergized and the relay R9 deenergized, so that the relay R6b and hence the motor M13 is again deenergized.

Conditions in this circuit are now substantially the same as they were at the beginning of the cycle and they remain quiescent until the start switch S1 is again pressed to reenergize the relay R1 and again drive the feed motor M31. At this time the counter C1 is reset by means of a pair of contacts R1-3.

Should the light beam be accidentally interrupted at any time before a fresh roll 33 or 34 is fed to the first station 10, i.e. before actuation of the switch S1, the roll-centering relay R3 will not reclose to move the centering rollers together,

because the contacts R10-3 are held open by the still-energized relay R10 until the counter C1 is reset.

A counter C2 associated with the motor M13 will have recorded the height to which the frame 13 moved during its first upward movement, the reading recorded by the counter C2 having been transferred to a storage ST by closure of contacts R2-4 immediately the beam was reestablished over the top of the roll 33 (FIG. 3). Contacts R2-4 close a circuit to a relay R15 having contacts R15-1 for operating a gate GT between the counter C2 and the storage ST. False operation of this circuit while the frame was in its initial lower position was prevented by contacts LS3a that are open when the limit switch LS3 is closed. The relay R15 also has contacts R15-2 for energizing a relay R16 having self-holding contacts R16-1, and delay-action contacts R16-2 for opening the connection between the gate GT and the storage ST, after the information concerning the height of the roll 33 has been passed to the storage ST. This latter system is reset on initiation of a new cycle by contacts R1-4.

Control Equipment for the End-wrapping Station 11 (FIGS. 7 and 8)

When the start button S1 is again depressed to feed a further roll, e.g. the roll 34, to the first station 10, the roll now in position at the second station 11, e.g. the roll 33, is not acted upon until the cycle at the first station has reached the stage at which the relay R5 is energized, i.e. the new roll has been centered. At this time contacts R5-6 are closed to energize a relay R11 having self-holding contacts R11-1. Contacts R11-2 are also closed to transfer the information in the storage ST to a counter C3 associated with the motor 63 simultaneously reset the storage ST. At the same time the motor 63 is operated through contacts R11-3 in the direction to raise the carriage 56. When the correct number of revolutions of the motor 63 has occurred to equal the setting on the counter C3, the latter opens its contacts C3-1 to stop the motor 63. This action serves to position the carriage 56 at the correct height to center the sealing bars 52, 53 on the centerline of the workpiece. Operation of the counter C3 also closes contacts C3-2 to energize a valve V3 for admitting hydraulic fluid to a line 59a leading to the lower end of the cylinder 59 to close the arms 50, 51, i.e. move them from the position of FIG. 5 to that of FIG. 6. A further limit switch LS5 detects the fully projecting condition of the piston of the cylinder 59 and hence contact between the sealing bars 52 and 53. This limit switch LS5 energizes a second timer T' having a first set of contacts T'1 for energizing the sealing elements 71, second contacts T'2 that operate a few moments later to energize the cutting elements 68 and finally third contacts T'3 operated a short time still later to energize a relay R12. Energization of this relay R12 serves through its contacts R12-1 to open the circuit to the valve V3, while contacts R12-2 close a circuit to a valve V4 for supplying pressure fluid to line 59b for retracting the cylinder 59 to spread apart the arms 50 and 51 again. Relay R12 is self-holding by virtue of contacts R12-3.

A limit switch LS6 that is closed when the cylinder 59 again reaches its fully retracted condition energizes through contacts R12-4 which are now closed a relay R13 having contacts R13-1 for driving the motor 63 backwards to return the carriage 56 to its lowermost position, and contacts R13-2 for deenergizing the relay R11. When the carriage 56 reaches its lowermost position it closes a limit switch LS7 which completes a circuit to a relay R14, provided that the relay R5 at the first station 10 has by now been deenergized to signal the conclusion of the cycle by closure of contacts R5-7. When relay R14 is energized in this way it deenergizes relay R13 at contacts R14-1 so that the motor 63 is deenergized at contacts R13-1 and the relay R11 stands ready to be reactuated through contacts R13-2 the next time the relay R5 is energized during a subsequent cycle.

The relay R14 also has contacts R14-2 in the circuit to the motor M12 to ensure that the conveyor 12 cannot operate until the end-wrapping station is ready. Contacts R14-3 also open the supply to the relay R12 to deenergize it. Relay R14

remains energized until at the commencement of the next cycle the contacts R5-7 are opened. When this happens, the deenergization of the relay R14 does not cause reenergization of the relay R13 because the contacts R12-4 are now open.

We claim:

1. In apparatus for wrapping an elongated workpiece in flexible film,

a. at a first station, a wrapping frame including means for mounting a pair of rolls of said film with a web thereof extending between said rolls, and spaced-apart guide means for locating a span of said web so as to extend substantially horizontally,

b. a horizontally extending conveyor located immediately beneath said span for supporting a said workpiece with said span lying between the the workpiece and the conveyor,

c. means for moving said wrapping frame upwardly relatively to said conveyor while the latter is stationary to wrap said span of film around the sides of said workpiece,

d. means for moving said guide means inwardly towards each other above said workpiece to complete a film wrap around the workpiece,

e. a pair of spaced-apart sealing means and cutting means between said sealing means mounted to move inwardly with said guide means for sealing together the wrapped-around ends of film across the width thereof at a pair of spaced-apart locations to form a pair of seals, the first of which seals closes the film wrap around said workpiece and the second of which seals joins the otherwise free film ends together to maintain a continuous film web between said rolls, said cutting means being effective between such spaced sealing means to separate the seals formed thereby and thus separate the wrapped workpiece from the newly rejoined film web extending across the elevated wrapping frame,

f. means for driving said conveyor to move said workpiece to a second station and to leave said first station free for said wrapping frame to descent to bring said newly rejoined film web to film web to lie closely superjacent said conveyor at the first station for receipt of a second workpiece and repetition of the foregoing wrapping action,

g. and means at said second station for closing and sealing portions of film projecting beyond the ends of such workpiece to complete the end wrapping thereof.

2. Apparatus according to claim 1 for wrapping generally cylindrical workpieces of varying size, including means for detecting the height of said workpiece when lying on a side thereof on said conveyor and for accordingly stopping operation of said means (c) for moving the wrapping frame upwardly when said guide means have reached a level just above the upper surface of said workpiece.

3. Apparatus according to claim 2, including

h. centering means at the second station for moving said end-wrapping means (g) to a location in which said means (g) is vertically centered on the workpiece,

i. and means connected to said workpiece-height-detecting means at the first station for moving said centering means (h) at the second station to its correct location, upon operation of said conveyor to transfer the workpiece from the first to the second station.

4. Apparatus according to claim 1 wherein said end-wrapping means (g) comprise, at each end of the workpiece,

i. a pair of arms and means for moving said arms together to clamp between them the portions of film projecting beyond the workpiece end, and

ii. sealing and cutting means mounted on said arms to move together therewith for sealing together said film portions across the width of the workpiece end and for cutting off any film portions projecting beyond the seal so formed.

5. Apparatus for wrapping elongated, generally cylindrical workpieces in the form of rolls or bolts of textile material of varying diameters in flexible film, comprising a first station, a

second station and an horizontal conveyor extending between said stations;

- i. said first station comprising
 - a. a wrapping frame including means for mounting a pair of rolls of said film with a web thereof extending between said rolls, and spaced-apart guide means for locating a span of said web to extend substantially horizontally just above a first location on said conveyor, 5
 - b. means for feeding a first said workpiece onto the conveyor at said first location with the span of film lying between the workpiece and the conveyor, 10
 - c. means for moving said spaced-apart guide means towards each other to engage said workpiece and center the same at the first station, 15
 - d. means for subsequently retracting said guide means beyond the sides of the workpiece,
 - e. means for moving said wrapping frame vertically upwardly relatively to said conveyor to wrap said span of film around the sides of the workpiece, 20
 - f. spaced-apart sealing and cutting means on said frame,
 - g. means for detecting when said sealing and cutting means have reached a level above the upper surface of the workpiece, 25
 - h. means connected to said detecting means for moving said sealing and cutting means together for sealing together the wrapped-around ends of film across the width thereof at a pair of spaced-apart locations to form a pair of seals, the first of which seals closes the film wrap around the workpiece and the second of which seals joins the otherwise free film ends together 30

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to maintain a continuous film web between said rolls, said cutting means being effective between such spaced sealing means to separate the seals formed thereby and thus separate the wrapped workpiece from the newly rejoined film web extending across the elevated wrapping frame,

- i. means for driving said conveyor to move the wrapped workpiece to the second station,
- j. and means for returning the wrapping frame to its lower position to bring the newly rejoined film web again to lie closely superjacent the conveyor in readiness for receipt of a second said workpiece and repetition of the circumferential wrapping procedure;
- ii. and said second station comprising end-wrapping means at each end of the workpiece, each such end-wrapping means comprising
 - k. a vertically movable carriage,
 - l. spaced-apart sealing and cutting means on said carriage,
 - m. means connected to said detecting means (g) for moving said carriage to a location in which said sealing and cutting means (l) are vertically centered on said first workpiece upon conveyance thereof to the second station by said conveyor,
 - n. and means on said carriage for moving together said sealing and cutting means for sealing together portions of film projecting beyond the workpiece end across the width of the workpiece end across the width of the workpiece end and for cutting off any film portions projecting beyond the seal so formed.