Dec. 31, 1963 F. B. ROBERTS 3,116,032

WEB FEEDING SYSTEM

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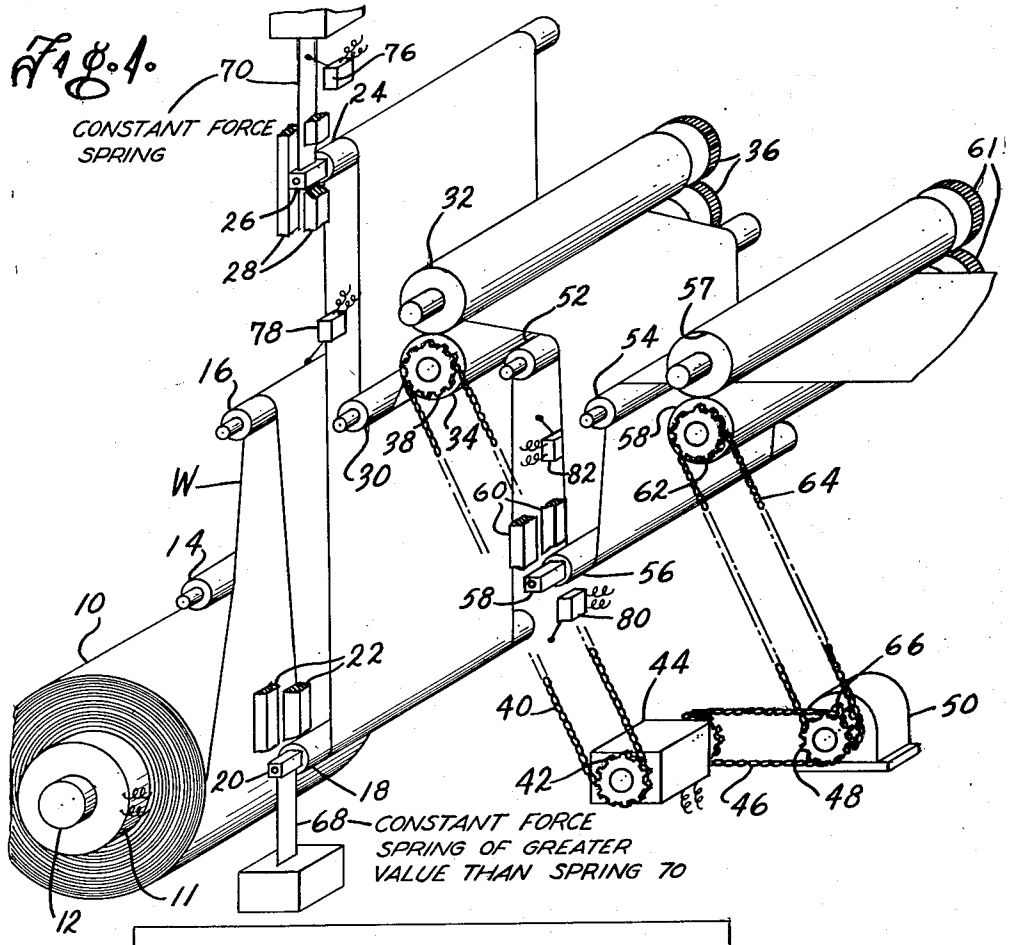
Fig. 1.



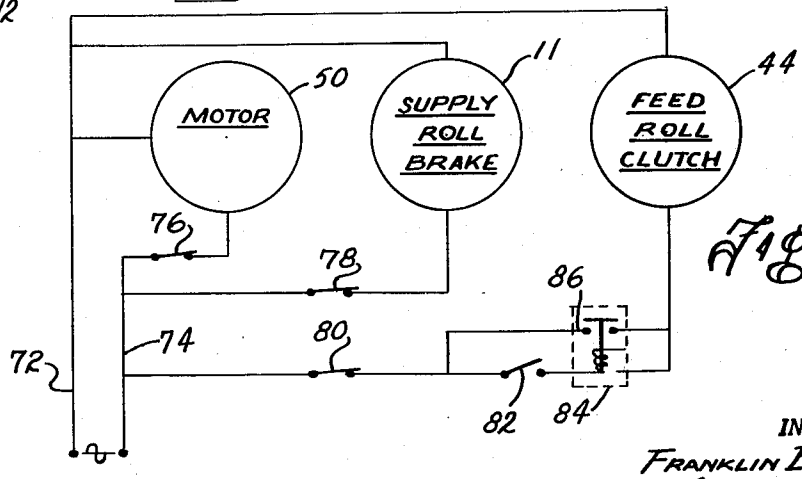


Fig. 2.

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WEB FEEDING SYSTEM

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The present invention relates to improvements in feeding webs of sheet material drawn from a supply roll.

The use of polyethylene films as a packaging or wrapping material has caused substantial problems in registering printed panels relative to the products being packaged or wrapped. With prior sheet materials, registration of printed panels had reached a very high standard of accuracy which has been difficult, and many times impossible, to match when using polyethylene and other similar films. The reason for these registration problems is due primarily to the ease with which polyethylene is stretched. If stretched beyond its yield point, the printed panels become too long. If stretched to any substantial degree below its yield point, the panels may shrink after tension is removed, so as to cause faulty registration.

This problem is increased by the fact that the paper feeds for many packaging and wrapping machines are either intermittent or must be shut down fairly frequently, which results in a non-uniform tension on the web and a lack of any uniformity or predictability in the amount of stretch which will occur. Further complicating the situation is the need for using larger diameter supply rolls of the film in order to accommodate increased rates of machine operation. The inertia of the larger rolls increases the stretch induced in a web as it is drawn from the roll and the roll accelerated.

The general object of the invention is to minimize, if not eliminate, the problems which result from stretching of a web as it is fed from a supply roll.

Another object of the invention is to control rotation of a supply roll of sheet material in such a manner that a web intermittently drawn therefrom is at all times maintained in a controlled path and never tensioned beyond its yield point and thus never permanently stretched.

A further object of the invention is to feed a web under a minimum, substantially constant tension so that panels printed thereon may be accurately registered on products being wrapped or packaged.

The invention is characterized by a rotatably mounted supply roll of sheet material, means for advancing a web drawn therefrom, and loop forming means therebetween. The loop forming means comprise a pair of slackener rolls each movable to form separate loops of varying length. One slackener exerts a weaker force on the web than the other. The brake means are energized whenever the loop around the weaker slackener exceeds a given minimum. Preferably the slackener exerting the stronger force on the web is controlled by constant force spring means which limit the pull on the web to a force approximating, but less than, what would permanently stretch on the web.

The means for advancing the web may preferably comprise a first intermittently operated pair of feed rolls and a second pair of feed rolls. A loop is formed around a slackener roll between the two pairs of feed rolls. The first pair of feed rolls advance the web at a faster rate than the second pair. Means are provided for controlling operation of the first pair of feed rolls to maintain the length of the loop around the slackener within given limits. Preferably, the slackener is of a minimum weight sufficient to properly track the web, so that the web, as it is advanced by the second pair of feed rolls is under a minimum substantially uniform tension.

The above and other related objects and features of the invention will be apparent from a reading of the following description of the disclosure found in the accompanying drawing and the novelty thereof pointed out in the appended claims.

In the drawing:

FIG. 1 is a perspective view diagrammatically showing a feed system embodying the present invention; and

FIG. 2 is a view of a simplified electrical circuit employed herein.

In FIG. 1 the various parts have been diagrammatically shown for the sake of simplicity and clarity since they are individually known in the prior art but not, however, in the present combination.

A supply roll 10 of polyethylene or like film is mounted on a suitably journaled shaft 12. An electromagnetic brake 11 is provided to stop rotation of the supply roll 10 during operation of the apparatus as is later described. A web W is drawn from the supply roll 10 and trained about suitably journaled, fixed rolls 14 and 16. The web W next passes around a first slackener roll 18. The roll 18 is journaled at each end in a block 20 which is guided for vertical sliding movement between rails 22. The web W is next looped over a second slackener roll 24 which is rotatably mounted at each end in a block 26. The blocks 26 are slidably mounted between rails 28 for vertical reciprocation of the roll 24.

The web W is trained around a suitably journaled, fixed roll 30 and then is caught between a pair of feed rolls 32, 34. The feed rolls 32, 34 are suitably journaled and are interconnected by a pair of gears 36 for rotation at the same rate at all times. The rolls 32, 34 are of the same diameter so that the web W will be fed without any slippage as sufficient pressure is provided against the web. A sprocket 38 is secured to the shaft for roll 34 and a chain 40 is trained therearound. The chain 40 is driven by a sprocket 42 secured to the output shaft of an electromagnetic clutch 44. The clutch 44 is driven by a chain 46 trained around a sprocket 48 which is secured to the shaft of a motor 50. The feed rolls 32, 34 are driven whenever the clutch 44 is energized. The clutch 44 also comprises a spring loaded brake which automatically prevents rotation of sprocket 42 and feed rolls 32, 34 when the clutch 44 is de-energized.

After passing from the feed rolls 32, 34, the web W is looped around rotatable, fixed rolls 52, 54 and a third slackener roll 56. The slackener roll 56 is mounted in the same fashion as the other slackener rolls with blocks 58 being guided for sliding movement between rails 60.

If desired, pinions may be secured to each end of the shafts for the slackener rolls 18, 24 and 56. These pinions would mesh with fixed racks to prevent the slackener rolls from cocking as they ride up and down. Such a use of racks and pinions is well known and not shown herein.

From the roll 54, the web W extends between a second pair of feed rolls 57, 58. The rolls 57, 58 are suitably journaled and have the same diameter and are connected by gears 61 for rotation at the same rate. A sprocket 62 is secured to the shaft for roll 58. A chain 64 is trained around the sprocket 62 and around a sprocket 66 also secured to the shaft of motor 50.

The first slackener roll 18 is preferably urged downward by spring means attached to the blocks 20. Preferably the spring means take the form of constant force springs 68 of the type disclosed in U.S. Patent No. 2,609,192. It is also preferable to attach constant force springs 70 to the blocks 26 to urge the second slackener roll 24 upwardly.

The circuit diagram of FIG. 2 is limited to those portions of the machine circuit which are pertinent to the present inventive concepts and also has been simplified

for purposes of clarity and ease of description. Lines 72, 74 are connected across a source of electrical current. A circuit is completed through a limit switch 76 to actuate the motor 50. Other motor controls, including the on-off switch, have been omitted. The switch 76 is mounted on one of the rails 28 and is opened when the slackener roll 24 reaches a given upper height. The circuit through the brake 11 is completed through a switch 78 which is opened when the slackener roll 24 reaches a given lower position.

The circuit for energizing the clutch 44 includes switches 80, 82 which are connected in series with the coil of a relay 84. The contacts 86 of relay 84 provide a hold-in circuit by-passing switch 82 once it has been momentarily closed. Physically, the switches 80, 82 are mounted to detect the lower and upper positions respectively of the slackener roll 56.

In operation, the feed rolls 57, 58 rotate continuously and at a constant rate so long as the switch 76 is closed (presuming the other controls therefor are properly energized). The feed roll clutch 44 is energized so long as switch 80 and either switch 82 or contacts 86 are closed. With clutch 44 energized, the web will be advanced by the first feed rolls 32, 34 at a slightly faster rate than it is being advanced by the rolls 57, 58. This results in the length of loop around slackener roll 56 increasing so that the slackener 56 will be lowered until switch 80 is contacted and opened, thus de-energizing switch 80. Clutch 44 will now be de-energized and rotation of the rolls 32, 34 stopped. The web will continue to be advanced by rolls 57, 58 causing the slackener 56 to rise, first permitting the switch 80 to close and then closing switch 82 when the slackener 56 reaches its upper limit. The clutch 44 is energized and the web again advanced by the rolls 32, 34.

The web is therefore intermittently drawn from the supply roll 10. When the rolls 32, 34 first advance the web (with the rolls in the position of FIG. 1), the brake 11 will be energized and the slackener 26 will be lowered as the web is drawn from the loop therearound. The slackener roll 18 remains stationary inasmuch as the force which it exerts on the web is substantially greater than the pull exerted by the slackener roll 26. When the slackener roll 26 engages stops defining its lower position, the switch 78 is opened and brake 11 de-energized. The supply roll is accelerated as the slackener roll 18 rises. Preferably the slackener roll 18 is made as light as possible to minimize its inertia and then the springs 68 are provided to obtain a force on the web which approximates but is insufficient to impart a permanent stretch to the web. That is, the yield point of the web is not exceeded. This force depends upon the width and thickness of the web and upon the grade and type of polyethylene which can readily be determined by simple experimentation or, in most cases, routine calculations. Thus the maximum permissible force is exerted on the web to accelerate the supply roll without permanently stretching the web.

The force of springs 70 is just slightly greater than what is needed to counterbalance the weight of roll 24. The forces and proportions may be so calculated that the roll 18 will ascend as inertia continues rotation of the supply roll 10 until an upper limit is reached whereupon the roll 26 will move upwardly. The brake 11 will be energized and further ascent of the slackener 24 halted before the switch 76 is opened. The slackener 24 will rise sufficiently to open switch 76 only when the web W is broken or the supply roll 10 exhausted.

The force of slackener roll 56 is the minimum necessary to obtain proper tracking of the web. It will be noted that the brake elements of clutch 44 prevent reverse rotation of the rolls 32, 34 so that the web W can at no time be retracted by slackener roll 18 which exerts a greater pull on the web W than slackener 56.

The loop around slackener roll 56 is always under a minimum constant tension so that there will be a minimum constant stretch in the web advanced by the feed rolls 57, 58 and the web itself will not have been permanently stretched in being drawn from the supply roll. Many of the advantages of the present invention may also be enjoyed where the second feed rolls 57, 58 are, more or less, intermittently operated.

Having thus described the invention, what is claimed as novel and desired to be secured by Letters Patent of the United States is:

1. A web feeding system comprising a supply roll of sheet material, means for rotatably mounting the supply roll, brake means for controlling rotation of the supply roll, a pair of feed rolls for drawing a web from said supply roll, loop forming means between said supply roll and said feed rolls, said loop forming means comprising first and second slackener rolls, each movable to form loops of varying length, one of said slackener rolls exerting a weaker pull on the web than the other slackener roll, means for energizing said brake means when the length of loop around said one slackener roll exceeds a given minimum and de-energizing said brake means when the length of loop therearound reaches the specified minimum.

2. A web feeding system comprising a supply roll of polyethylene or like sheet material, means for rotatably mounting the supply roll, brake means for controlling rotation of the supply roll, intermittently operating feed rolls for drawing a web from said supply roll, loop forming means between said supply roll and said feed rolls, said loop forming means comprising first and second slackener rolls each movable to form loops of varying length, one of said slackener rolls exerting a weaker pull on the web than the other slackener roll, constant force spring means connected to the other of said slackener rolls and exerting a pull on said web approximating, but less than, the force required to permanently stretch the web, means for energizing said brake means when the length of loop around said one slackener roll exceeds a given minimum and de-energizing said brake means when the length of loop therearound reaches the specified minimum.

3. A web feeding system comprising a supply roll of sheet material, means for rotatably mounting the supply roll, brake means for controlling rotation of the supply roll, a pair of feed rolls for drawing a web from said supply roll, loop forming means between said supply roll and said feed rolls, said loop forming means comprising first and second slackener rolls, each movable in opposite directions to form two loops of varying length, said web being trained directly from one slackener roll to the other, one of said slackener rolls exerting a weaker pull on the web than the other slackener roll, means for energizing said brake means when the length of loop around the weaker slackener roll exceeds a given minimum and de-energizing said brake means when the length of loop therearound reaches the specified minimum.

4. A web feeding system comprising a supply roll of sheet material, means for rotatably mounting the supply roll, brake means for controlling rotation of the supply roll, feed roll means for feeding a web drawn from said supply roll, loop forming means between said feed roll means and said supply roll, said loop forming means comprising first and second slackener rolls each movable to form two loops of varying length, one of said slackener rolls exerting a weaker pull on the web than the other slackener roll, means for energizing said brake means when the length of loop around said one slackener roll exceeds a given minimum and de-energizing said brake means when the length of loop around said one slackener roll reaches said given minimum, said feed roll means comprising a first and a second pair of feed rolls, means for forming a third loop in said web between said pairs of feed rolls, means for rotating said second pair of feed rolls, means for intermittently rotating said first pair of feed rolls at a rate of feed greater than that of the second

pair of said rolls, and means responsive to the length of said third loop for actuating and stopping the rotating means for said first pair of feed rolls and maintaining the length of the third loop with the given limits.

5. A web feeding system comprising a supply roll of polyethylene or like sheet material, means for rotatably mounting the supply roll, brake means for controlling rotation of the supply roll, feed roll means for advancing a web drawn from said supply roll, loop forming means between said feed roll means and said supply roll, said loop forming means comprising first and second slackener rolls, each movable to form loops of varying length, one of said slackener rolls exerting a weaker pull on the web than the other slackener roll, constant force spring means connected to the other of said slackener rolls for exerting a pull on said web which approximates but is less than the force which would permanently stretch the web, means for energizing said brake means when the length of the loop around said one slackener roll exceeds a given minimum and deenergizing said brake means when the length of loop around said one slackener roll reaches said given minimum, said feed roll means comprising a first and a second pair of feed rolls, means including a third slackener roll for forming a third loop in said web between said pairs of feed rolls, said third slackener roll maintaining a minimum pull on said web sufficient to properly track it as it is advanced, means for rotating said second pair of feed rolls at a constant rate, means for intermittently rotating said first pair of said rolls at a rate of feed greater than that of the second pair of feed rolls, means for preventing reverse rotation of said first pair of feed rolls and means responsive to the length of said third loop for actuating and stopping the rotating means for said first pair of feed rolls to maintain the length of said third loop within given limits.

6. The method of feeding a polyethylene or like sheet material web from a rotatably mounted supply roll, wherein an intermittently operated pair of feed rolls draw the web from the supply roll and feed it to a constantly rotating pair of feed rolls, said method comprising the steps of forming two loops in the web between the first named feed rolls and the supply roll, exerting a constant force on one of said loops which approximates, but is less than, the force which would permanently stretch the web, exerting a weaker force on the other of said loops, controlling rotation of the supply roll in accordance with the length of the other loop, forming a third loop in said web between the two pairs of feed rolls, exerting a minimum pull on said third loop sufficient to properly track the web, and controlling operation of the intermittently operated feed rolls in response to the length of the third loop to maintain the length of said third loop within given limits.

7. A web feeding system wherein intermittently operating means are provided for drawing a web from a supply roll of polyethylene or like sheet material, a slackener roll around which the web is trained between the supply roll and the drawing means, and guideways mounting the slackener roll for movement to form a loop of varying length in said web, in combination with constant force spring means connected to said slackener roll and urging it to form a loop of maximum length, the force of said spring means being related to the strength of the web in such proportion that the pull of the slackener roll on the web approximates but does not exceed a pull which would permanently stretch the web, whereby a maximum permissible pull on the web will be available to accelerate the supply roll upon actuation of the drawing means.

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