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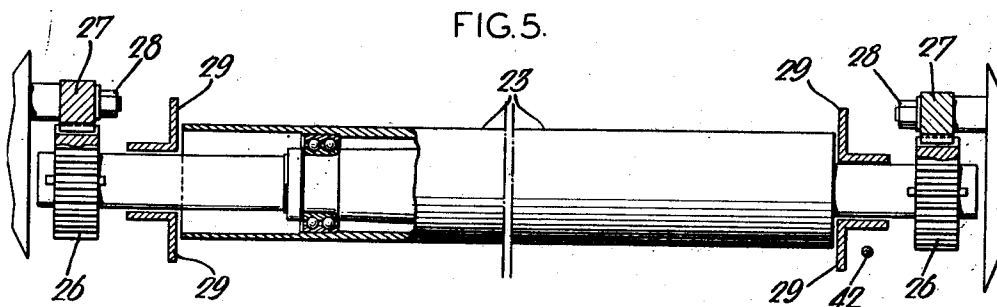
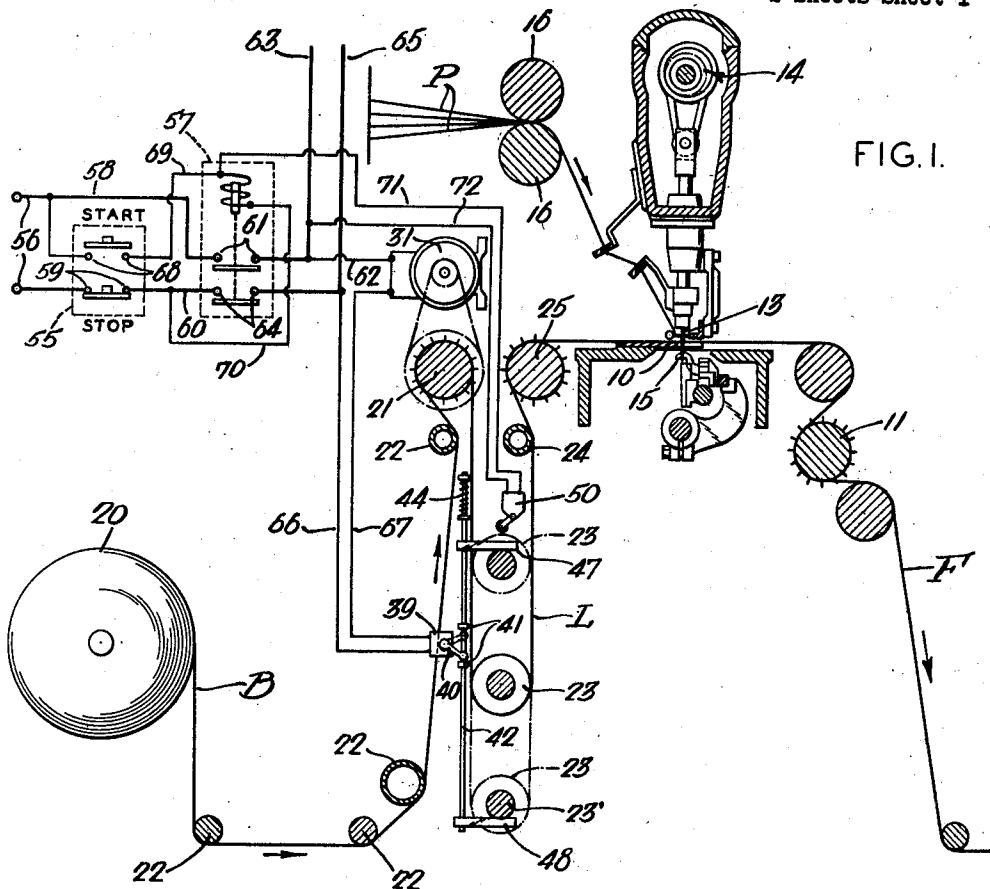
J. McNUTT

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BACKING FABRIC CONTROL MEANS FOR PILE TUFTING MACHINES

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2 Sheets-Sheet 1



INVENTOR:
JOHN McNUTT
BY *Hyde W. Ballard*
ATTY.

Dec. 31, 1957

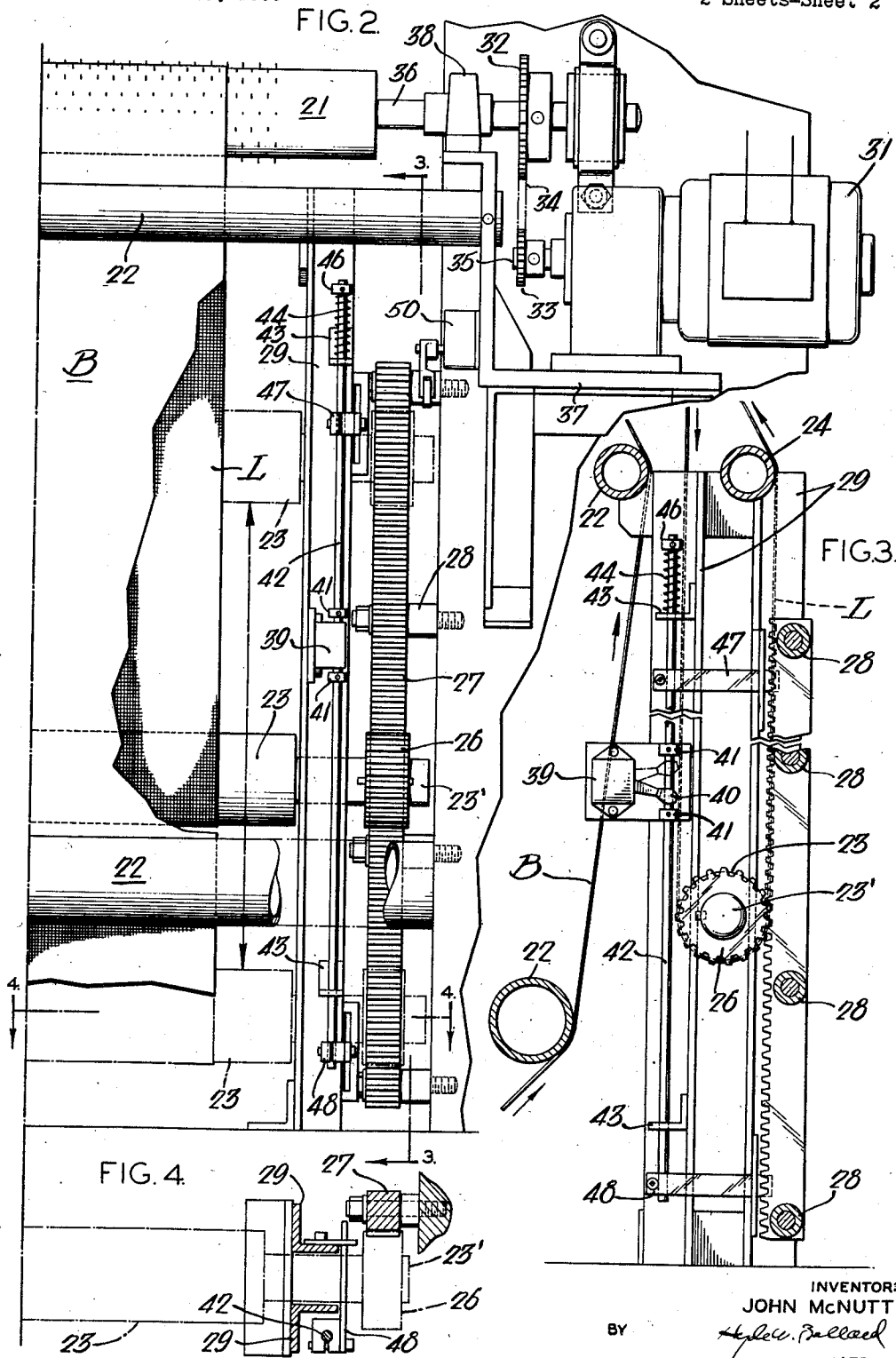
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BACKING FABRIC CONTROL MEANS FOR PILE TUFTING MACHINES

John McNutt, Blue Bell, Pa., assignor to James Lees and Sons Company, Bridgeport, Pa., a corporation of Pennsylvania

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The present invention relates to apparatus for producing tufted pile fabrics, and more particularly to mechanism for controlling the feed of the backing fabric to the tufting machine.

In the manufacture of tufted fabrics such as floor coverings the pile surface is formed by a bank of tufting needles which insert and form rows of pile in a base fabric which is advanced across the bed of the tufting machine. The feed of the backing fabric in conventional machines has presented problems since the backing fabric is taken from a large roll, and the tension may vary considerably from one end of the roll to the other. In addition, when the machine is shut down to tie up broken ends and the like, the backing material sometimes continues to feed, and becomes slack across the bed of the machine. This slackness results in uneven length of the stitches which, in turn, requires yarn compensation on the pile surface so that if a long stitch occurs, the corresponding pile will be too short, and if a short stitch on the back of the fabric occurs, the adjacent pile will be too high. These irregularities show up as longitudinal lines extending across the entire width. They are referred to as "machine" or "stop" marks, and their presence mars the uniformity of the pile surface and, therefore, detracts from its value.

With the foregoing in mind, the primary object of the present invention is to provide a novel tensioning means for the backing material of a tufting machine which insures uniform tension of the backing fabric as it is advanced across the bed of the tufting machine.

A further object of the invention is to provide an improved method for controlling the tension and feed of the backing fabric to a carpet tufting machine.

A further object of the invention is to provide an elongated dancer roll for carpet tufting machines and electrical circuits responsive to the position of the dancer roll.

More particularly, the present invention contemplates a positive feeding means which is operated intermittently to advance preselected lengths of the backing material from the supply roll and means between the feed means and the tufting machine to maintain a constant tension on the backing material as the predetermined lengths are taken up by the tufting machine.

The invention also contemplates control means of this type which is of simple construction, yet is fully effective in operation and use.

All of the objects of the invention and the various features and details of the construction and operation thereof are more fully set forth hereinafter with reference to the accompanying drawings in which:

Fig. 1 is a schematic section through a tufting machine showing the electrical controls for the feeding and tensioning means;

Fig. 2 is a fragmentary view in elevation of the control means with portions broken away to more clearly illustrate its operation;

Fig. 3 is a section taken on the line 3—3 of Fig. 2;

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Fig. 4 is a section taken on the line 4—4 of Fig. 2; and Fig. 5 is a horizontal section showing the dancer roll tension device.

The invention comprises a positive feed means which draws the backing material from the supply roll and advances the same to the tufting machine. Between the feed means and the tufting machine, is disposed a dancer roll which applies a uniform tension to the backing material between the pin feed roll and the pin take-up roll. The feed means operates intermittently and is controlled by the dancer roll which moves between a lower and an upper limit position as the pin take-up roll draws the material across the bed. When the dancer roll rises to its upper limit position, the pin feed roll is actuated to withdraw more backing fabric from the supply roll. This supply of fabric causes the dancer roll to drop to its lower limit position, to stop the pin feed roll.

Referring now to the drawings, Fig. 1 illustrates an embodiment of the invention applied to a conventional tufting machine. In the tufting machine, the backing fabric B is drawn across the bed 10 of the machine by a pin take-up roll 11. A pile surface is formed of loops which are inserted into the ground fabric by a bank of needles 13 mounted for vertical oscillation relative to the bed 10. The needles are oscillated by a mechanism indicated generally at 14 and the backing fabric is drawn intermittently by the pin take-up roll 11 so that the needles insert a full transverse row of loops at successive intervals along the length of the fabric. The needles 13 move in unison and penetrate the fabric to a given distance below the bed 10 of the tufting machine, and a looper mechanism 15 is provided to hold the pile yarns. In the present instance, the looper mechanism 15 forms cut pile as the fabric F is drawn from the tufting machine. As shown, the pile yarns P are fed to the tufting machine by conventional let-off rolls, 16, 16 but if desired, a patent control mechanism may be substituted.

In accordance with the invention, the backing fabric B is fed from a supply roll 20 to the tufting machine by an intermittently driven pin feed roll 21. The backing is laced from the roll 20 over guide rollers indicated at 22, 22. From the pin feed roll 21, the fabric is looped under a dancer roll 23 and thence carried to pin feed roll 25 over guide roll 24.

The dancer roll 23 is journaled on shaft 23' to which a pinion 26 is keyed at each end thereof. The pinions 26 mesh with racks 27, 27 mounted on the frame of the tufting machine as indicated at 28, 28. The pinions 26 of the dancer roll shaft 23 are free to travel along the racks 27 and are retained in engagement therewith by a pair of spaced vertical tracks 29, 29 at each end of the roll 23. As shown in Fig. 5, the rack 27 and pinion 26 at each end of the dancer roll shaft 23 maintain the roll 23 horizontal and insure uniform tension of the backing fabric across its full width. The provision of the controlled dancer roll enables several desirable results to be accomplished. As indicated above, the fixed tension applied by the weight of the dancer roll and its associated shaft and gears prevents creeping of the backing material B across the bed 10 of the tufting machine. This creeping takes place to a certain extent even though the pins on the feed roll 25 are provided to reduce this undesirable feature. If there is sufficient weight to the dancer roll 23, it might be possible or desirable under certain conditions to employ a smooth roll in place of the pin feed roll 25. The important feature, however, is to prevent creeping or stretching of the material across the bed 10 when the machine is stopped, which would lengthen the stitches in a transverse row and thus cause a machine mark when the machine is started. The use of the controlled dancer roll prevents variations in tension which might otherwise

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occur, and it also assists in spreading and aligning the backing material as it feeds to the roll 25 and the tufting needles. The racks and pinions permit free vertical movement of the dancer roll but positively prevent tilting of the roll which would cause uneven tension and/or misalignment.

In the operation of the tufting machine, the pin take-up roll 11 draws the fabric across the bed 10 of the machine from the loop L passing around the dancer roll 23. The pin feed roll 21 is intermittently turned so that rotation of the backing B by the pin take-up roll 11 shortens the loop L. As this occurs, the dancer roll 23 and shaft 23' move upwardly as guided by the tracks 29, 29. During this movement the roll is maintained horizontal by the racks 27 and pinions 26 on the roll shaft 23'. When the loop L is shortened to such an extent that the dancer roll 23 reaches its upper limit position, indicated by the broken lines in Fig. 1, the pin feed roll 21 is started to withdraw backing material B from the roll 20. This feeding of the backing material B by the pin roll 21 elongates the loop L and allows the dancer roll 23 to fall under its own weight to its lower limit, at which point the pin feed roll 21 is stopped.

The dancer roll, in addition to the above advantages, serves another important function, in that it controls the feed or supply of backing material B. As shown in Figs. 1 and 2, the feed roll 21 is driven by motor 31 through driving connections 32, 33, and 34 keyed to the motor shaft 35 and to the roll shaft 36. Motor 31 is supported in a mounting 37 and the roll shaft 36 is journaled in a pair of pillow blocks, one of which is shown at 38. A limit switch 39 is provided with an actuating arm 40 which is in turn controlled by adjustable stops 41, 41 on vertical reciprocating rod 42. This rod is mounted in brackets 43, 43 and is provided at its upper end with a compression spring 44 retained between upper bracket 43 and adjustable collar 46. Spring 44 may be set to counteract the weight of the rod 42 and its associated structure. The rod 42 is provided with an upper adjustable limit stop 47 and a lower adjustable limit stop 48 which extends across the path of the dancer roll shaft 23' as shown in Fig. 3. As the backing material B is fed under the needles, the loop L gradually shortens to raise the dancer roll 23 until it contacts the upper limit stop 47. This serves to throw switch 39 to start motor 31. The backing fabric continues to be fed from roll 20 by pin feed roll 21 until the dancer roll 23 falls to the lowermost broken line position shown in Figs. 1 and 2 at which point roll shaft 23' strikes the lower limit stop 48 to throw switch 39 and stop motor 31 and roll 21. It will thus be apparent that the dancer roll assembly oscillates vertically from its upper broken line position to the lower position as may be required by the rate of feed of take-up roll 11. A safety switch 50 is positioned adjacent the uppermost position of the dancer roll 23 so that in the event the limit stop 47 is improperly adjusted or motor 31 fails to stop for any other reason, a holding circuit for the motor is opened.

Referring now to Fig. 1 the electrical circuit for controlling motor 31, and consequently the feed of backing material B comprises a start and stop switch 55 connected across a source of electrical current 56. A relay 57 is connected around switch 55 through lead 58. The relay is also connected to the electrical supply 56 through the stop button 59 by means of lead 60. The upper contacts 61 of relay 57 close a direct circuit to motor 31 through lead 62 and to the main tufting machine motor (not shown) through lead 63. The lower contacts 64 of relay 57 connect the opposite side of the line to the tufting machine motor through lead 65 and also close the circuit to motor 31 through leads 66, 67, and switch 39. When the tufting machine is started the operator presses the start button 68 of switch 55 to energize relay 57 through leads 69 and 70 to close contacts 61 and 64. Relay 57 remains

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energized by means of a holding circuit through leads 71, 72, and switch 50 which is normally closed. Assuming that limit switch 39 is opened, which would be the case when dancer roll 23 is in a substantially mid-position shown in full lines in Fig. 1, the loop L gradually shortens as the completed fabric F is formed. When the dancer roll rises sufficiently to contact the upper limit arm 47, lower collar 41 closes switch 39 by moving arm 40 to its upper position. This closes the circuit to motor 31 through lead 60, contacts 64, leads 66, 67, 62, contacts 61, and lead 58. Normally the relay 57 is held energized because switch 50 is closed. However, should the dancer roll 23 be carried too high, it will strike switch 50 thus opening the holding circuit for relay 57 and stopping the motor 31 and the tufting machine motor.

When motor 31 starts, the backing material is fed around roll 21 to increase the length of loop L and thus permit the roll 23 to fall due to its own weight. When the roll drops sufficiently, shaft 23' strikes lower limit arm 48 to open switch 39 when upper collar 41 throws the arm 40 to its lower position. This cycle of operation repeats itself indefinitely as long as the machine is running. The operator may stop the machine at any time by pressing the stop button 59, thus opening the circuit to the relay.

Thus, applicant has invented a device for controlling the feed of a backing fabric which provides uniform tension on the backing fabric across its width and longitudinally thereof as the latter is drawn across the bed of a tufting machine. By reason of the uniform tension, the fabric has relatively no tendency to creep to one side or the other of the tufting machine and thereby insures proper alignment of the fabric with the needles. The apparatus of the present invention greatly reduces the frequency of shut-downs for adjustment of the backing fabric, and eliminates "machine marks" in the finished goods.

While a particular embodiment of the present invention has been herein illustrated and described, it is not intended to limit the invention to such a disclosure, but changes and modifications may be made therein and thereto within the scope of the following claims.

Having described my invention, I claim:

1. In a machine for tufting a backing fabric, the combination which comprises a plurality of tufting needles, a bed over which the backing fabric is drawn under the tufting needles, means including a take-up roll for positively gripping the backing fabric and drawing it under the needles, means for positively gripping the backing fabric including a feed roll over which said backing fabric is adapted to be wound, means adapted to form a loop in the backing fabric between the feed roll and the needles, a dancer roll adapted to be supported by said loop in a manner to permit vertical travel of the dancer roll in accordance with the rise and fall of the loop extremity, guide means for the dancer roll, means for positively maintaining the dancer roll in a substantially horizontal position at all times during its travel, means for intermittently driving the feed roll, and means responsive to the position of the dancer roll for stopping and starting said drive means.

2. Apparatus in accordance with claim 1 in which the means for positively maintaining the dancer roll comprises a sleeve journaled on a shaft, a pinion at each end of the shaft, and a rack meshing with each of said pinions.

3. In a machine for tufting a backing fabric, the combination which comprises a plurality of tufting needles, a bed over which the backing fabric is drawn under the tufting needles, means including a take-up roll for positively gripping the backing fabric and drawing it under the needles, means for positively gripping the backing fabric including a feed roll over which said backing fabric is adapted to be wound, a dancer roll adapted to be supported in a loop in the fabric between the feed roll and the needles in a manner to permit movement

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of the dancer roll in accordance with the rise and fall of the loop, and means including a rack and pinion for maintaining the dancer roll in a substantially horizontal position during its travel.

4. In a machine for tufting a backing fabric, the combination which comprises a plurality of tufting needles, a bed over which the backing fabric is drawn under the tufting needles, means including a take-up roll for positively gripping the backing fabric and drawing it under the needles, means for positively gripping the backing fabric including a feed roll over which said backing fabric is adapted to be wound, a dancer roll adapted to be supported in a loop of the fabric between the feed roll and the needles in a manner to permit movement of the dancer roll in accordance with the rise and fall of the loop, means including a pinion on each end of the dancer roll and a pair of cooperating racks for maintaining the dancer roll in a substantially horizontal position during its travel, and a plurality of spaced guides at each end of the dancer roll for retaining the meshing contact between the pinion and the rack.

5. In a machine for tufting a backing fabric, the combination which comprises a plurality of tufting needles, a bed over which the backing fabric is drawn under the tufting needles, means including a take-up roll for positively gripping the backing fabric and drawing it under the needles, means for positively gripping the backing fabric including a feed roll over which said backing fabric is adapted to be wound, a motor for driving said feed roll, a dancer roll adapted to be supported by a loop in the backing fabric between the feed roll and the needles, a shaft extending beyond the edges of the fabric and on which the dancer roll is journaled, a vertical guide at each end of said shaft, a pinion on each end of said shaft, a rack meshing with each of said pinions for maintaining the dancer roll in a horizontal position during its rise and fall in accordance with the length of said loop, and means responsive to the position of the dancer roll for stopping and starting the motor.

6. In a machine for tufting a backing fabric, the combination which comprises a plurality of tufting needles, a bed over which the backing fabric is drawn under the tufting needles, means including a take-up roll for positively gripping the backing fabric and drawing it under the needles, means for positively gripping the backing fabric including a feed roll over which said backing fabric is adapted to be wound, a motor for driving said feed roll, a dancer roll adapted to be supported by a loop in the backing fabric between the feed roll and the

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needles, a shaft extending beyond the edges of the fabric and on which the dancer roll is journaled, a vertical guide at each end of said shaft, a pinion on each end of said shaft, a rack meshing with each of said pinions for maintaining the dancer roll in a horizontal position during its rise and fall in accordance with the length of said loop, an upper limit arm positioned to contact said shaft at its upper limit of travel, a lower limit arm positioned to contact said shaft at its lower position of travel, electrical leads for supplying current to said motor, and a switch controlled by said limit arms for stopping and starting said motor.

7. In a machine for tufting a backing fabric, the combination which comprises a plurality of tufting needles, a bed over which the backing fabric is drawn under the tufting needles, means including a take-up roll for positively gripping the backing fabric and drawing it under the needles, means for positively gripping the backing fabric including a feed roll over which said backing fabric is adapted to be wound, a motor for driving said feed roll, a dancer roll adapted to be supported by a loop in the backing fabric between the feed roll and the needles, a shaft extending beyond the edges of the fabric and on which the dancer roll is journaled, a vertical guide at each end of said shaft, a pinion on each end of said shaft, a rack meshing with each of said pinions for maintaining the dancer roll in a horizontal position during its rise and fall in accordance with the length of said loop, an upper limit arm positioned to contact said shaft at its upper limit of travel, a lower limit arm positioned to contact said shaft at its lower position of travel, electrical leads for supplying current to said motor, a switch controlled by said limit arms for stopping and starting said motor, a relay in said electrical connections, a holding circuit for said relay, and a switch in said holding circuit positioned to be opened by the dancer roll upon reaching a predetermined point in its upward travel.

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