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FABRIC FEED DRIVE

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Fig. 1.

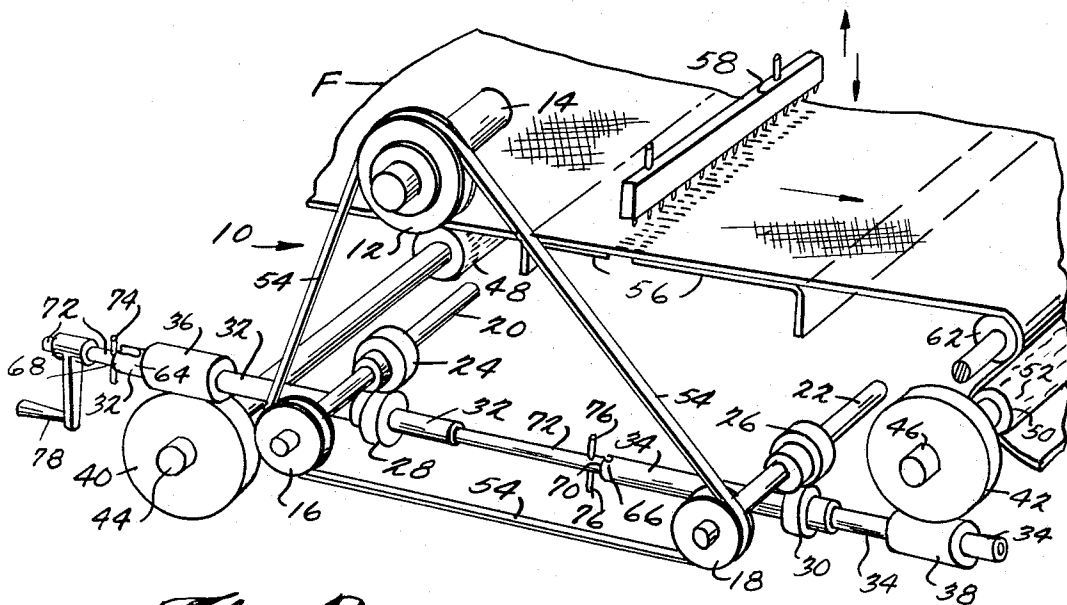
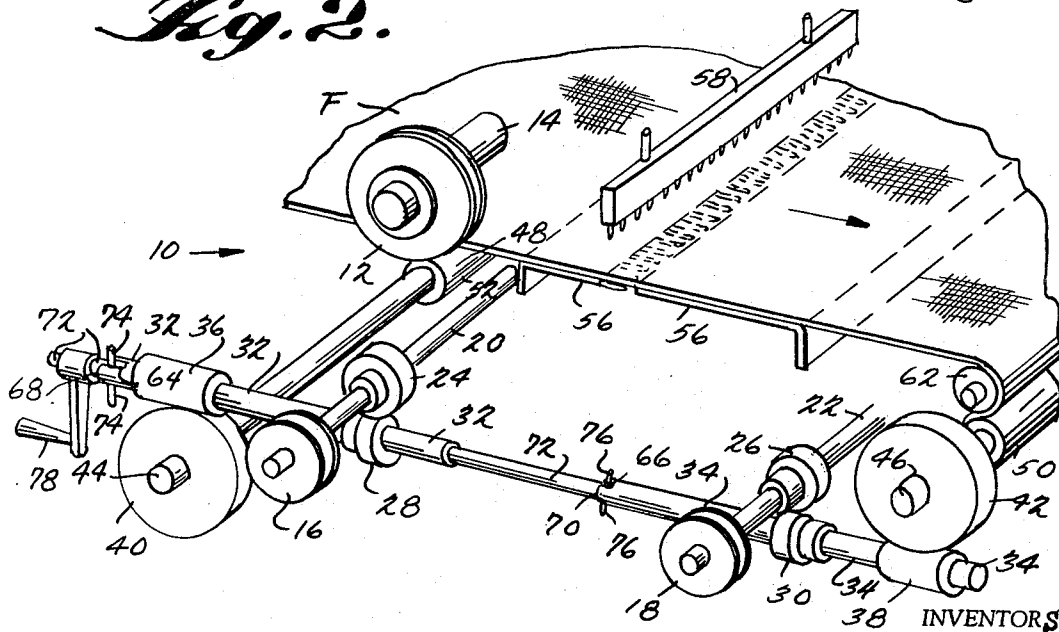


Fig. 2.



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1

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FABRIC FEED DRIVE

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8 Claims. (Cl. 112—203)

The present invention relates to textile producing machinery and more particularly to a fabric feed drive for multiple needle tufting machinery.

Tufting machines as exemplified in the United States patent to Cobble et al. No. 2,977,905 are usually used to produce tufted fabrics such as bedspreads, towels and carpeting by serially inserting a plurality of loops of yarn through a pre-prepared reticulated backing fabric. In the most widely used tufting machines a row of needles having a length equal to the width of the backing fabric is employed, the needles being reciprocable toward, through, back through and away from the backing fabric. Between each such cycle of the yarn carrying needles, the backing fabric which is usually available on large rolls, is advanced longitudinally by an amount equal to the desired spacing between successive loops of pile. Such advance is continuous in some apparatus and incremental in other apparatus.

In the apparatus described, the backing fabric is transported through the machine using rollers which, by virtue of roughened surfaces, hooks, teeth or a high friction coating, grip the backing fabric. At least two of such rolls are employed, each on opposite sides of the needle assembly, or "upstream" and "downstream" of the point where the tufting occurs.

It has been realized that in order to produce tufted fabric which is uniform in quality and appearance throughout its length, it is desirable to maintain the backing fabric in the region thereof between the two gripping rolls under uniform tension.

In prior art tufting machinery of the character described, the achievement of desired tension in the leading end region of a new roll of backing fabric supplied to the machine, without undue wastage of time and materials, has been a hitherto unsatisfactorily solved problem.

Accordingly, it is an important object of the present invention to provide apparatus in machinery of the type described for achieving and maintaining desired tensioning of backing fabric without undue wastage of labor and materials.

Another object of the invention is the provision of such apparatus that avoids the appearance of stop marks in the finished tufted fabric by precluding relaxation of the tension of the backing fabric between the gripping rolls or individual forward or reverse rotation of either roll upon start-up or shut-down of the machine.

Yet another object of the invention is the provision of apparatus of the type described wherein the rate of rotation of either roll can be separately adjusted to increase and decrease the amount of tension developed in the backing fabric between the gripping rolls and wherein the rate of rotation of both rolls can be simultaneously changed to increase and decrease the rate of travel of the backing fabric through the machine without changing the amount of tension developed in the backing fabric between the gripping rolls.

These and other objects of the present invention as well as the principles and scope thereof will become more clearly apparent during the following detailed discussion relating to a preferred embodiment of the present invention which is illustrated in the attached drawings.

In the drawings:

2

FIGURE 1 is a somewhat schematic perspective view of a fabric feed drive embodying principles of the present invention, the further details of conventional multiple needle tufting machinery having been omitted for clarity;

FIGURE 2 is a somewhat schematic perspective view of the fabric feed drive of FIGURE 1, but shown in a mode thereof for receiving and feeding the forward end of a new roll of backing fabric and establishing the desired tension therein.

The cloth feed drive 10 includes a pulley 12 mounted on the main drive shaft 14 of the tufting machine (not shown). The pulley 12 is positioned to drive pulleys 16 and 18 spaced below the pulley 12 and spaced from one another, longitudinally along the path of travel of the backing fabric F through the machine as indicated by the arrows thereon.

The pulleys 16 and 18 are shown mounted on shafts 20 and 22 which may conveniently extend through and be supported in a leg (not shown) of the machine. Helical gears 24 and 26 are mounted on the shafts 20 and 22 and are drivingly engaged with helical gears 28 and 30 which are mounted on tubular shafts 32 and 34. The shafts 32 and 34 are longitudinally spaced, axially aligned with each other and extend perpendicularly to the shafts 20 and 22. Worm gears 36 and 38 are mounted on the tubular shafts 32 and 34 for driving engagement with relatively large diameter worm wheels 40 and 42 respectively. The worm wheels 40 and 42 are mounted on shafts 44 and 46 upon which the "upstream" and "downstream" fabric gripping rolls 48 and 50 respectively are also mounted.

Preferably the rolls 48 and 50 have their exterior peripheries covered with radially directed pins, spikes or the like 52 as is known in the art. According to the principles of the invention, the surface speed of the roll 48 is slower than that of the roll 50 during the operation of the apparatus 10 in order to develop and maintain tension in the backing fabric F in the region between the rolls 48 and 50.

Although the requisite difference in surface speed could be provided by making the circumference of the roll 48 slightly larger than that of the roll 50 or making at least one of the drive train elements 16, 24, 28, 36 or 40 slightly larger in diameter than at least one of the elements 18, 26, 30, 38 or 42. However, in order to achieve the economies flowing from the interchangeability of parts and further to provide for ease of adjustment of the backing fabric tension the difference in surface speed of the rolls 48 and 50 is preferably achieved by making the pulleys 16 and 18 as well as the pulley 12 of a variable pitch type.

As shown in FIGURE 1, the pulleys 12, 16 and 18 are drivingly interconnected by an endless belt 54. During operation of the apparatus as shown in FIGURE 1, the backing fabric F is pulled from a storage roll (not shown) by the spiked roll 48 fed across the bed plate 56 beneath the needle bar 58 and needles 60 which reciprocate in a path normal to the fabric F. To the right of the bed plate in the apparatus as oriented in FIGURE 1, the fabric F passes forwardly and over, then backwardly and under a direction changing idler roll 62. From the latter the fabric F passes backwardly and over then forwardly and under the spiked roll 50 and from there to a collecting station (not shown).

The requisite tension on the fabric F for instance in the production of tufted carpeting is produced by rotating the roll 48 at a surface speed slower than that of the roll 50 by approximately 2-3 percent. This can be accomplished by widening the variable pitch pulley 18 with respect to the width of the variable pitch pulley 16 or narrowing the variable pitch pulley 16 with respect to the width of the variable pitch pulley 18. The backing fabric which is

3

tautened in the region between the two rolls is allowed to relax after passing the roll 50 so that there is no net accumulation of tension between the rolls 48 and 50 which would tend to rend the backing fabric F in the region thereof between the rolls 48 and 50.

The length of the advance of the fabric can be increased by widening the variable pitch pulley 12 and decreased by narrowing the variable pitch pulley 12. In neither case does this adjustment disturb the relationship of the surface speeds of the rolls 48 and 50 with respect to one another.

Looking at FIGURE 2, it should now be noticed that the tubular shafts 32 and 34 are slotted at 64 and 66 respectively adjacent the leftmost ends 68 and 70 of the shafts 32 and 34.

The slots 64 and 66 are shown being of somewhat unequal length, the former having greater longitudinal extent than the latter.

When a roll of backing fabric F has been used up and a new roll is to be fed into the machine, it is no longer necessary according to the present invention to run the machine to feed the leading end of the new fabric roll with resultant wastage of yarn and fabric until the proper tension is achieved as was formerly the case with many prior art machines. Instead a new roll of backing fabric can be fed into the machine and properly tensioned using the apparatus 10 in the mode thereof now to be discussed in regard to FIGURE 2.

To feed and tension the new roll of fabric F, the belt 54 is removed from the pulleys 12, 16 and 18. The shaft 72 which is slidably received in the tubular shafts 32 and 34, is longitudinally advanced from its position in FIGURE 1 wherein neither of the laterally directed pins 74 and 76 thereon are received in the tubular shaft slots 64 and 66, to the position shown in FIGURE 2 wherein the pin 74 is received in the slot 64 and the pin 76 is received in the slot 66. The leading end of the new roll of backing fabric is then placed on the spiked roll 48 and directed onto the bed plate 56.

By manually turning the crank 78 which is secured to the end of the shaft 72 adjacent the pin 74 clockwise, the spike roll 48 is caused to rotate via the gear train including the shaft 72, pin 64, tubular shaft 32, worm gear 36, worm wheel 40, shaft 44 and upstream spiked roll 48 and the spike roll 50 is caused to rotate via the gear train including the shaft 72, pin 66, tubular shaft 34, worm gear 38, worm wheel 42, shaft 46 and downstream spiked roll 50. After the leading end of the backing fabric F has been advanced to the point where it is gripped by the roll 50, the shaft 72 is withdrawn slightly so that the pin 76 is no longer in engagement with the slot 66. By virtue of the greater length of the slot 64, the pin 74 is still engaged in the slot 64 of the hollow shaft 32 in the mode of operation of the apparatus now being described. With the shaft so positioned, the crank 78 is then rotated counter-clockwise whereupon the spiked roll 48 rotates counter-clockwise, i.e. away from the roll 50. By virtue of the disengagement of the pin 76 and slot 66 in this mode of operation, the roll 50 remains stationary and the backing fabric F extending between the rolls 48 and 50 is tautened. When the desired degree of tautness has been reached as measured by conventional means, the belt 54 is replaced on the pulleys 12, 16 and 18 as shown in FIGURE 1 and the shaft 72 withdrawn to the extent shown in FIGURE 1 so that both pins 74 and 76 are disengaged from slots 64 and 66, respectively. Tufting can then be recommenced.

It should be noted that relaxation of tension in the region of the backing fabric F extending between the two rolls is effectively precluded by the ratios of the worm gears 36 and 38 and worm wheels 40 and 42 as is known in the gear art. Accordingly, when tufting is recommenced after the apparatus has been stopped for instance for repair or at the change of a work shift stop marks due to uneven tension will not be apparent in the tufted product.

4

From the foregoing detailed discussion it should now be readily apparent that the apparatus disclosed efficiently accomplishes each of the objects of the invention and clearly illustrates the principles thereof, but because the embodiment shown can be considerably modified without departing from these principles, the present invention should be understood to encompass all such modifications as are within the spirit and scope of the following claims.

We claim:

1. A fabric feed drive including a first fabric gripping roll; a second fabric gripping roll having the longitudinal axis thereof generally parallel to the longitudinal axis of said first fabric gripping roll, said first and second fabric gripping rolls being generally coextensive and laterally spaced from one another; a first drive train for driving said first fabric gripping roll; a second drive train for driving said second fabric gripping roll; a main drive shaft; disengageable means drivingly interconnecting said main drive shaft and said first and second drive trains for driving said first and second fabric gripping rolls in a first direction; means independent of said main drive shaft operable in a first mode thereof when said disengageable means is disengaged, for driving said first and second fabric gripping rolls in said first direction and operable in a second mode thereof, when said disengageable means is disengaged to drive only said first roll in a second direction opposite from said first direction to thereby apply tension to fabric gripped between said first and second fabric gripping rolls.

2. Apparatus as set forth in claim 1 wherein each drive train includes a first shaft on which the respective of said first and second fabric gripping rolls is mounted, a worm wheel mounted on said first shaft; a worm gear drivingly interengaged with said worm wheel, the pitch ratio of said worm wheel to said worm gear being relatively high to avert backlash in said drive trains; a tubular shaft, said worm gear being mounted on said tubular shaft; a first helical gear mounted on said tubular shaft; a second helical gear drivingly engaged with said first helical gear; a third shaft, said second helical gear being mounted on said third shaft; and a pulley mounted on said third shaft.

3. Apparatus as set forth in claim 2 wherein said pulley is a variable pitch pulley.

4. Apparatus as set forth in claim 2 further including a pulley mounted on said main drive shaft and means drivingly interconnecting said main drive shaft pulley and said third shaft mounted pulley of each of said drive trains.

5. Apparatus as set forth in claim 4 wherein said drivingly interengaging means is an endless belt.

6. Apparatus as set forth in claim 5 wherein said main drive shaft pulley and both third shaft mounted pulleys are variable pitch pulleys.

7. Apparatus as set forth in claim 5 wherein the third shaft mounted pulley of said first drive train has a larger effective diameter than the third shaft mounted pulley of said second drive train whereby said first fabric gripping roll is driven by said main drive shaft pulley and endless belt at a lower surface speed than said second fabric gripping roll.

8. Apparatus as set forth in claim 2 further comprising means defining a first longitudinally extending slot in one end of the hollow shaft of the drive train of said first fabric gripping roll; means defining a second longitudinally extending slot in one end of the hollow shaft of the drive train of said second fabric gripping roll; said means independent of said main drive shaft operable for driving said first and second fabric gripping rolls comprising: a shaft slidably received within said hollow shafts of the drive trains of said first and second fabric gripping rolls; a first pin mounted on the last-mentioned shaft extending laterally therefrom adjacent said first longitudinally extending slot; a second pin mounted on the last-mentioned shaft extending laterally therefrom adjacent said second longitudinally extending slot; and cranking means on said last-mentioned shaft; said last-mentioned

5

shaft being longitudinally slidable between a first position wherein said first and second pins are respectively engaged in said first and second slots whereby said cranking means is actuatable to rotate said first and second fabric gripping rolls in said first direction; a second position wherein said first pin is engaged in said first slot and said second pin is disengaged from said second slot whereby said cranking means is actuatable to rotate said first and second fabric gripping rolls in said first direction; a second position wherein said first pin is engaged in said first slot and said second pin is disengaged from said second slot whereby said cranking means is actuatable to rotate said first fabric gripping roll in said second direction independently of said second fabric gripping roll, and a third

5

10

6

position wherein said first and second pins are respectively disengaged from said first and second slots.

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