

Sept. 3, 1957

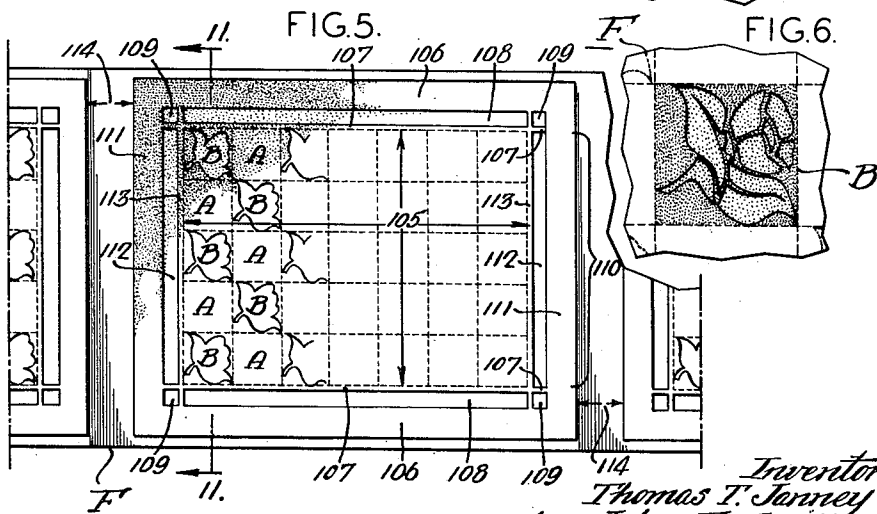
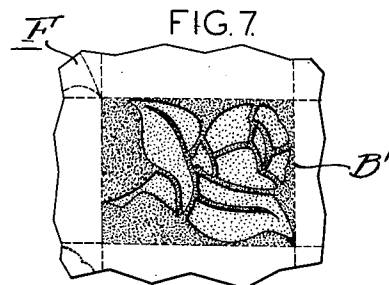
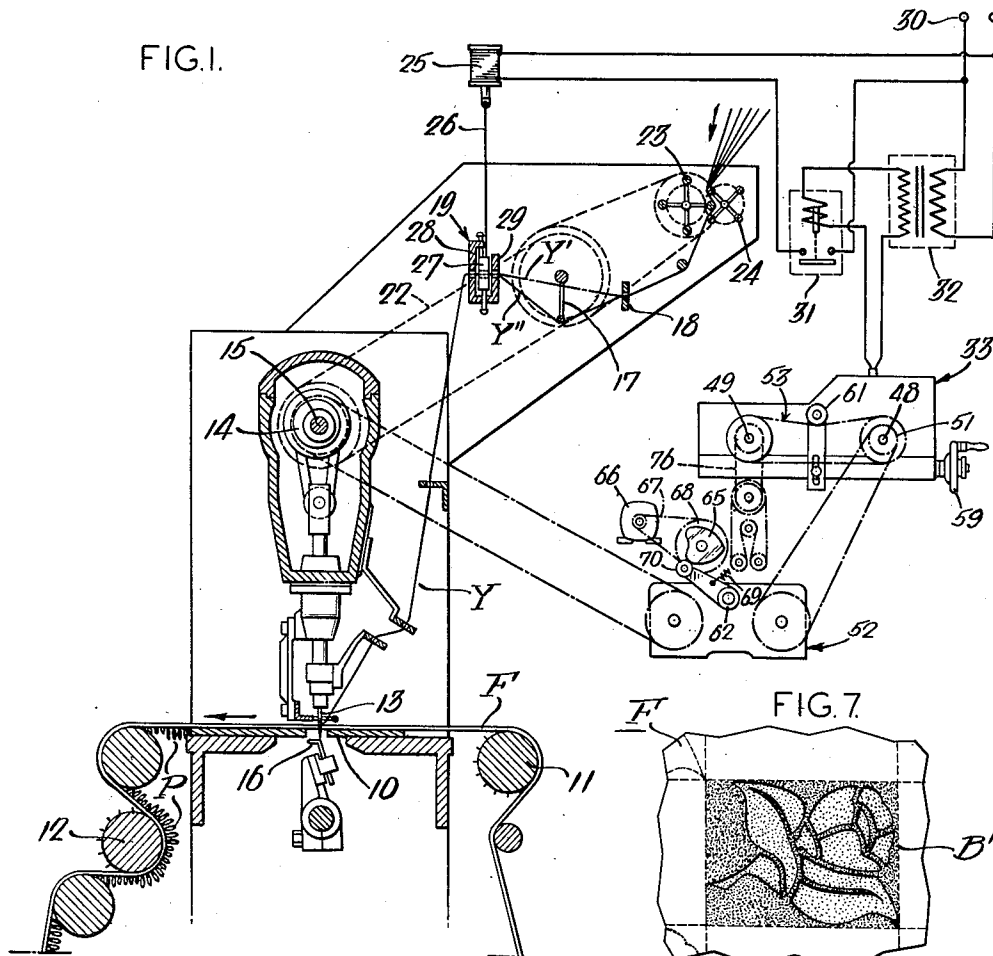
T. T. JANNEY ET AL

2,804,835

INDUSTRIAL APPARATUS AND METHOD

Filed March 1, 1956

3 Sheets-Sheet 1



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FIG. 2.

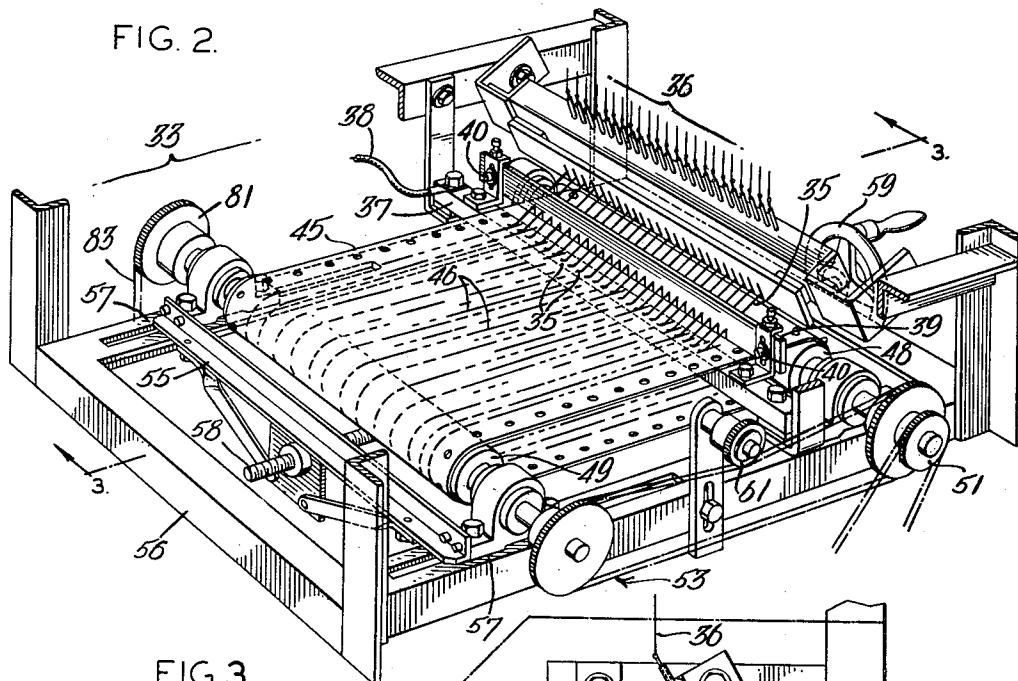


FIG. 3.

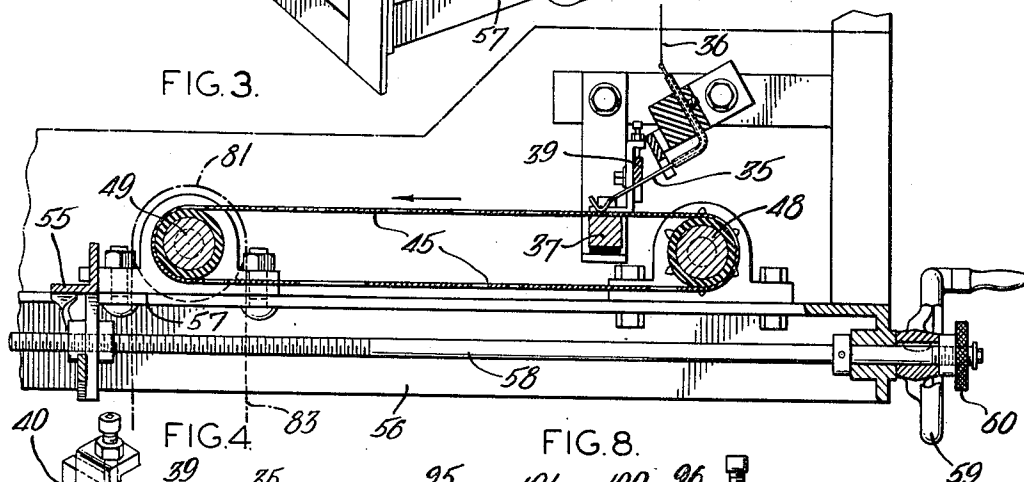


FIG. 4.

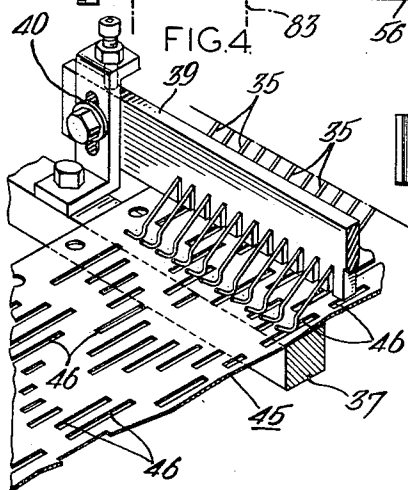
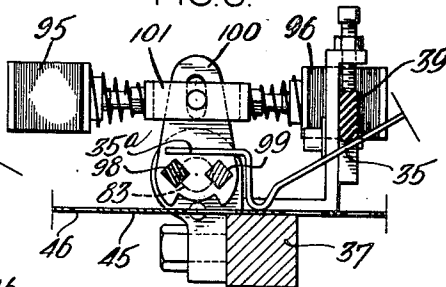


FIG. 8.



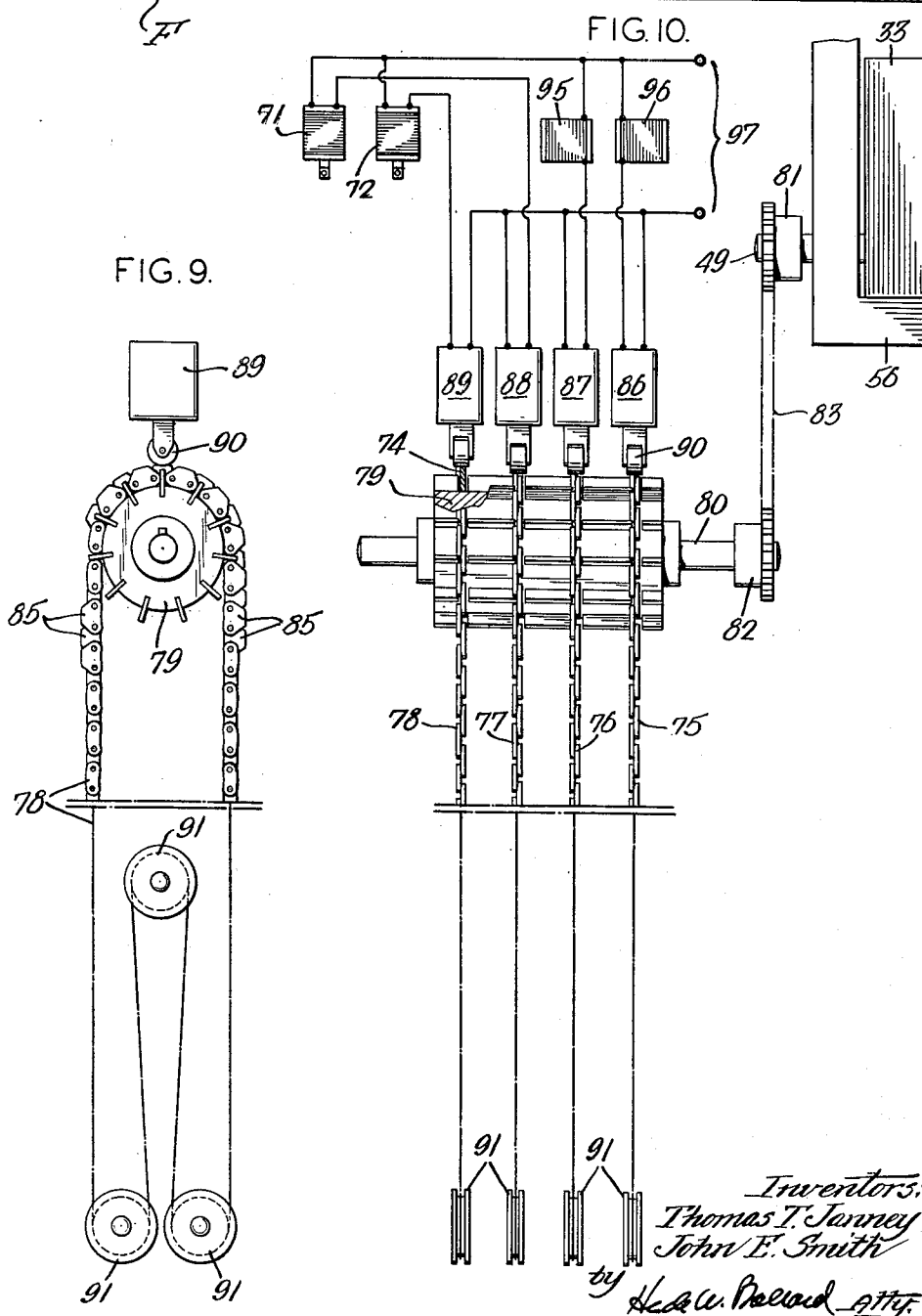
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T. T. JANNEY ET AL
INDUSTRIAL APPARATUS AND METHOD

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The diagram illustrates a roof truss structure with various tuft heights. It is divided into three sections: 'Fixed Tuft Height.' on the left, 'Variable Tuft Height.' in the center, and 'Fixed Tuft Height.' on the right. The left section shows a truss with tuft heights labeled 106, 107, and 108. The center section shows a truss with tuft heights labeled B, A, B, A, and B. The right section shows a truss with tuft heights labeled 107, 106, and 108. The truss structure is shown in cross-section, with the roofline and internal members visible.



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2,804,835

INDUSTRIAL APPARATUS AND METHOD

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3 Claims. (Cl. 112—79)

The present invention relates to tufted goods, and to a method and apparatus for producing the same on tufting machines, and more particularly on a tufting machine having electrical means for controlling the pattern.

Prior methods and apparatus for producing embossed surface effects on tufted pile fabrics involve the use of complicated mechanisms which are disposed along the feed roll to control the feed of the individual pile yarns. Adjustment of these mechanisms is difficult to obtain the desired pattern effect on the pile surface. This complicates matters for the designer because an intimate knowledge of the operation of the control apparatus is required in order to produce the desired effect.

The present invention provides improved means for controlling a battery of solenoids to produce the desired embossed pattern on the tufted goods.

The conventional pattern tufting machine produces an overall pattern, the repeat of which extends several inches weftwise of the fabric and a like distance warpwise of the fabric. The repeat is small, and it is not commercially practical to vary the basic pattern for a short run of the material. It is impossible to produce bordered pile fabrics on such a conventional machine, so that the usual practice for producing such goods is to tuft the border independently of the central area.

With the foregoing in mind, the present invention provides pattern control mechanism which greatly facilitates the layout and changing of patterns in tufted pile fabrics.

Another object of the present invention is to provide pattern mechanism wherein the designers' draft of the pattern may be transferred directly to the pattern control element of the mechanism.

Still another object of the present invention is to provide a control mechanism which is readily adapted to form patterns having warpwise patterns of differing length.

The invention also provides mechanism for elongating or shortening the repeat without varying the composition of the pattern thereof.

A further object of the present invention is to provide a control mechanism for pile yarns 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 diagrammatic representation of a tufting machine embodying a control mechanism made in accordance with the present invention;

Fig. 2 is a perspective of a portion of the control mechanism;

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

Fig. 4 is an enlarged fragmentary perspective of the device;

Fig. 5 is a plan of a run of tufted goods embodying a pattern formed by control mechanism of the present invention;

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Fig. 6 is an enlarged plan of an element of the pattern shown in Fig. 5;

Fig. 7 is a view similar to Fig. 6 showing the elongation of the pattern element which is possible by a simple adjustment of the mechanism;

Fig. 8 is an enlarged section showing a modification of the mechanism shown in Figs. 2 to 4 to produce the pattern variations shown in Fig. 5;

Fig. 9 is an enlarged view of another portion of the pattern control mechanism shown in Fig. 1;

Fig. 10 is a view in elevation of the mechanism shown in Fig. 9 and showing the electrical connections; and,

Fig. 11 is a section of the fabric shown in Fig. 5, taken on the line 11—11.

The present invention makes possible a tufted pile fabric having a body portion comprising a contoured pattern of small repeats, surrounded by both end borders and side borders having a different contoured pattern. The borders are formed simultaneously with the body portion of the fabric so that the pile projections are all disposed in continuous rows weftwise and warpwise of the fabric, each row preferably containing a full complement of pile projections.

The apparatus of the present invention is particularly adapted to tufting machines having a series of electrical elements, for example solenoids, which are selectively energized to control the individual pile yarns to produce a pattern. The mechanism comprises means for selectively energizing the electrical elements controlling the pile yarns forming the central body portion of the pattern, separate means for selectively controlling electrical elements controlling the pile yarns of the lateral marginal edge portions or side borders of the fabric and other means selectively operable to render the first-named means inoperable and to form the end borders of the fabric. In the preferred form of the mechanism, the first-named means comprises an electrically conductive finger element for each electrical element, a second electrically conductive element underlying all of said finger elements and towards which the finger elements are biased, and a pattern tape of non-conductive material disposed intermediate the finger and second elements and having means for affording electrical contact between selected finger elements and the second element to thereby afford selective energization of the electrical elements controlling the pile yarns. As mentioned hereinafter the contact affording means may take the form of elongated slots or apertures or electrically conducted areas may be provided. The present invention may be applied to form any patterned fabric in which the pile yarn is fed to the base fabric substantially independently of the formation of the base fabric; but, for the purposes of illustration, the invention is described and shown in conjunction with a tufting machine.

Referring more particularly to the drawings, in the tufting machine shown in Fig. 1, the ground fabric F is fed across the bed 10 of the machine by pin rollers 11 and 12. The pile surface is formed by loops P which are inserted into the ground fabric F by a bank of needles 13 mounted for vertical oscillation relative to the bed 10. The needles are oscillated by a crank mechanism indicated generally at 14 and driven by an eccentric shaft 15. The base fabric F is propelled across bed 10 and the bank of needles 13 inserts full rows of loops at successive equally spaced intervals along the length of the fabric. The needles 13 move in unison and penetrate the fabric F to a given distance below the bed 10 of the tufting machine, so that upon each reciprocation of the needles, a row of pile projections or loops having a uniform height is formed in the base fabric F. The latching mechanism for retaining the pile

loops in the fabric F upon withdrawal of the needles 13, is conventional, for example as shown at 16.

In the present embodiment of the invention, the pile yarn Y is fed to the needles by a rotatable yarn puller 17 disposed between yarn guides 18 and the control assembly designated generally at 19. The yarn puller 17 is driven continuously, for example by a chain drive indicated at 22. Rotation of the puller engages and displaces the yarn from the normal path, indicated at Y' to the angular path indicated at Y'', thereby feeding a length of yarn equal to the difference in length between the paths Y' and Y''. The yarn is supplied from a creel (not shown). Since the tension of the yarn at the guide 18 is substantially less than that at the guide 19, the yarn feeds from the creel to the needles 13.

A pair of cooperating yarn pullers 23 and 24 are positioned between the guide 18 and the creel to insure that the yarn is relatively tensionless at the guide 18. Thus, as the puller 17 travels in the lower portion of its path, yarn is withdrawn from the creel. This occurs during the upstroke of the needles 13. During the downstroke of the needles 13, the puller 17 is in the upper portion of its path and disengaged from the yarn Y so that the slack caused by the disengagement of the puller with the yarn may be taken up by the needles as they insert the yarns into the base fabric.

To provide a variation in the pile height of the loops P, the tension at the control assembly 19 is varied. When a minimum tension or drag is applied at the control 19, the needles 13 draw the yarn through the guide 19 to form a series of full loops P. However, when maximum tension is applied to the yarn by the control 19, the needles draw only a portion of the yarn through the control 19, and the remaining length necessary to form loops of maximum height is drawn or robbed from the loops formed in the immediately preceding row of pile in the base fabric F. Thus, one or more loops in the preceding row are shortened to provide a low pile loop.

In the illustrated embodiment of the invention, the tension of the yarn exerted by the control 19 is regulated by energization of a solenoid 25 which through a connector 26, controls a sinker element 27 disposed between spaced plates 28 and 29 of the assembly 19. When the elements are in the position shown in Fig. 1, minimum tension is applied to the yarn, and therefore a loop of maximum height is formed without robbing yarn from the preceding row of loops. When the solenoid is energized, the sinker 27 is raised and maximum tension is exerted on the yarn Y, thereby causing the needles 13 to rob yarn from the loops P in the preceding row of loops in the base fabric F.

In the preferred form of the invention, a pattern repeat extends for only a portion of the width of the fabric. For example, as shown in Fig. 5, the central portion of the pattern is repeated two and one half times across the width of the central portion. The repeat consists of a diagonally-disposed floral element B and a solid block A. There is a solenoid for each differently acting yarn in the repeat, and the yarns in the adjacent repeats are controlled by the same solenoids.

In accordance with the present invention, a pattern control mechanism is provided to selectively energize the solenoids 25. To this end, each solenoid 25 is connected to a source of current indicated at 30 through the contacts of a relay 31. Energization of the relay 31 closes the contacts thereof and energized the solenoid 25 to tension the yarn Y at the control assembly 19. De-energization of the relay 31 releases the solenoid 25 and places minimum tension on the yarn at control 19. The relay 31 is energized from a transformer 32 connected to the source 30; selective energization being provided by the control mechanism indicated generally at 33.

As shown in Fig. 2, the control mechanism 33 consists of a plurality of electrically-conductive fingers 35, each connected through a lead 36 to the relay 31. The

fingers 35 are preferably formed of spring steel and are biased downwardly against an electrically conductive bus bar 37 which is connected by a lead 38 to the transformer 32. To space the fingers 35 and provide the proper bias, each finger is passed through a slot in a non-conductive guide member 39. The guide member 39 is adjustably mounted on the bus bar as indicated at 40 so that by vertically adjusting the guide bar, the downward bias on the fingers 35 may be varied.

In accordance with the invention, a pattern tape 45 is advanced across the bus bar 37 and the tape 45 is provided with means affording selective electrical connection between the fingers and the bus bar. In the present instance, the tape has a series of slots, for example as indicated at 46 in Fig. 4, which permit the fingers 35 to contact the bus bar 37. Of course, means other than perforations may be employed. For example, it may be found possible to selectively impregnate the tape with a suitable conductive material to afford the desired electrical contact between the fingers 35 and the bus bar 37.

By employing a pattern tape of the above-described character, the transfer of the pattern from the designing board to the machine is greatly simplified. In the preferred form of the invention, the tape 45 is proportioned in length and width to the proportions of the pattern repeat. In preparing the tape to produce the desired pattern, the pattern is drafted on a sheet corresponding in size to the tape. The pattern draft is then superimposed on the tape, and the tape is cut out where the design calls for low pile, and is left blank where the draft calls for high pile. To give the tape sufficient strength, it may be reinforced between the fingers or in any nonperforated areas.

The tape is advanced across the bus bar 37 by a sprocketed roll 48, suitable tension being applied by a smooth roll 49. The roll 48 is driven in synchronism with the tufting machine by the sprocket 51 which is driven from the eccentric shaft 15 of the tufting machine through a variable speed transmission 52, as indicated in Fig. 1. To reduce the drag on the tape 45, the roll 49 is drivingly connected to the shaft of roll 48 through the chain and sprockets indicated generally at 53.

The number of solenoids 25 and fingers 35 determines the width of the pattern repeat in accordance with the number of differently acting yarns in each repeat, and the length of the tape 45 determines the length of the pattern repeat. Since the lengths of individual repeats in different patterns are not identical, means is provided to adjust the mechanism 33 to accommodate different lengths of tapes 45. To this end, the roll 49 is mounted on a yoke 55 slidably mounted on the frame 56 as indicated at 57, 57'. The yoke is advanced and retracted by a threaded shaft 58 which is rotated by a hand wheel 59. A suitable lock nut is provided at 60 (see Fig. 3). In addition an idler sprocket 61 is provided in the chain and sprocket connections 53 to compensate for slack in the chain according to the variously adjusted spacing between the rolls 48 and 49. When changing the pattern, a new pattern tape is mounted on the rolls 48 and 49, and the hand wheel 59 is rotated to slide the bearings mounting roll 49 until the proper tension on the tape is achieved. The lock nut 60 is then tightened, the sprocket 61 is adjusted, and the pattern mechanism is ready for operation. When making an overall pattern in which there are no borders, no other control mechanism is necessary and the solenoids for controlling the pile yarn Y are all controlled by the fingers 35.

In accordance with the invention, means is provided to elongate or shorten the pattern design without the necessity for cutting or otherwise preparing a new pattern tape. To this end, the variable speed drive mechanism 52 is provided with a speed control 62. By increasing the speed of the output of the transmission 52, the speed of the tape is increased relative to the travel of the base fabric F, so that the longitudinal dimension of the repeat is shortened.

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By decreasing the output speed of the variable transmission 52, the speed of the tape is slowed relative to the speed of the base fabric so that the longitudinal dimension of the repeat is lengthened. For example, if the basic repeat is a flower such as shown at B, the slowing of the variable speed transmission causes the pattern to elongate as shown at B' in Fig. 7 to provide a slightly different pattern effect within the basic design. Thus, by the variable transmission 52, the same pattern tape may be employed to produce a wide variety of pattern effects within a given basic design. Furthermore, the variable speed transmission 52 may in turn be cyclically controlled by means of a pattern cam 65 driven from motor 66, chain 67, and sprocket 68. Cam 65 actuates the control arm 62 which may be spring loaded at 69 and provided with a cam follower 70. In the event that no variation during operation of the speed mechanism is desired, cam 65 will be disengaged from contact with cam follower 70 and the speed control arm 62 may be locked in any desired adjusted position.

The present invention also provides means for tufting bordered goods. To this end, the marginal pile yarns are controlled by solenoids operated independently of the fingers 35. In the drawings, Fig. 10 shows the electrical connections to solenoids 71 and 72 which affect the height of the pile projections formed by the yarns at the margins of the fabric. Since the repeat of the border is normally quite a bit longer than the repeat of the central patterned area, we prefer to employ pattern chains for controlling the solenoids 71 and 72, although it would be possible to employ tapes and fingers similar to the tape 45 and the fingers 35. Figs. 9 and 10 show the pattern chain mechanism by which both the longitudinal and transverse borders of the fabric of Fig. 5 may be provided. A series of pattern chains 75, 76, 77, and 78 are driven by a cylindrical sprocket 79 keyed to shaft 80 which is in turn driven from idler roll 49 of control assembly 33 through sprockets 81, 82, and chain 83 (Fig. 10). Each of the chains 75-78 has a series of raised or enlarged links 85, 85 (Fig. 9) which are adequate to actuate the relays or switches 86, 87, 88, and 89 associated with chains 75-79 respectively. The relays are provided with suitable rollers or followers 90, 90 which are biased against their respective pattern chains. The chains may be carried around a series of pulleys 91, 91 to enable sufficient length of pattern chain to be stored in a limited space.

As shown in the wiring diagram of Fig. 10, relay or switch 89 is connected by suitable electrical leads to solenoid 72, relay or switch 88 energizes solenoid 71, relay or switch 87 energizes solenoid 95, and relay or switch 86 energizes solenoid 96. Current for the solenoids is supplied from a suitable source 97 which may be the same as or separate from source 30.

In order to disconnect the pattern forming fingers so that they will not control the pile height when the end or transverse borders of the fabric are being formed, means is provided to retain all or a selected number of the fingers 35 in an elevated or inoperative position. Solenoids 95 and 96 effect this result in accordance with the control provided by pattern chains 75 and 76. Referring to Fig. 8, an extension 35A is added to each of the fingers 35 and these extensions 35A, 35A are selectively engaged by either of a pair of bars or shafts 98 and 99 mounted on a rocking member 100. When it is desired to form all low loops, solenoid 95 is energized to throw spring loaded linkage 101 to the left as seen in Fig. 8. This in turn pivots bar 99 to a position in electrical contact with all of the extensions 35A, thereby energizing each of the solenoids 25. In the event that the border requires a series of high loops, solenoid 96 is energized to throw linkage 101 to the right, thus raising the fingers 35 and preventing the completion of any circuit to the solenoids 25, 25. For this purpose it will be understood that bar 98 is made of electrically nonconductive material so that no solenoid is energized through the fingers in contact with bar 98.

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It will be understood that bar 99 is an electrical conductor.

To illustrate the operation of the present invention in conjunction with a specific pattern having a border, reference may be had to Fig. 5 which shows a series of tufted pile carpets produced on a continuous web of the ground fabric F. The design of the central area 105 is controlled by a tape mechanism such as described and shown in conjunction with Figs. 1 and 2, whereas the transverse and longitudinal border areas of the carpets are controlled by a series of pattern chains 75-78 as previously described. Pattern chain 78 and its associated solenoid 72 are connected to control the pile tufts in the longitudinal outer border area 106, 106 and, also, the narrow inner strips 107, 107 which are formed with high pile throughout the length of each carpet. It will be noted that there is no low pile in either of the border areas 106 and 107. The border areas 108, 108 have portions of both high and low pile within the carpet which form the corner squares 109, 109. The pile in these two longitudinal strips or areas is controlled by pattern chain 77 and its associated solenoid 71. Since the bars 98 and 99 do not extend entirely across the width of the carpet but control the pile between the inner edges of strips 107, 107, they act upon and tend to override the same pile ends that are controlled by the tape. Therefore, to form the transverse borders extending between the strips 107, 107 as shown by the bracket 110, pattern chain 75 would energize solenoid 96 to lift all of the fingers 35 by means of non-conductive bar 98, thus forming the transverse high pile borders 111, 111. Then pattern chain 76 would take over to energize solenoid 95 to raise bar 99 which energizes all of the solenoids 25, 25 to provide low pile in the transverse border areas 112, 112. Continuing the sequence of operations through the machine, chains 75 and 76 again reverse solenoids 95 and 96 to raise bar 98, thus de-energizing all of the solenoids 25, 25 to form the transverse high pile strips 113, 113. The ground fabric area 114 between adjacent ends of each carpet is provided with low pile to conserve the yarn. In this area solenoid 95 will be energized by pattern chain 76 to in turn energize all of the solenoids 25 through bar 99. Likewise, both solenoids 71 and 72 will be energized by chains 77 and 78 to provide low pile in line with the border areas 106 and 107 but between successive carpets.

In this manner a combination of pattern chains and solenoids can be used to provide a succession of bordered carpets along a continuous web of the ground fabric F. Should the particular design not require the borders shown in Fig. 5, then the overriding bars of Fig. 8 are not needed, and the tape control of Fig. 2 may be used to provide the pattern completely across the carpet. It will be clear then that the overriding control provided by chains 75, 76, and the oscillating bars 98 and 99 amounts to an accessory which may be added to the primary control to provide selective and simultaneous control of a relatively large number of the pile yarns.

Thus, the present invention provides means for producing bordered patterns in tufted goods, and by proper arrangement of the various pattern chains and pattern tapes, many interesting effects may be obtained.

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

We claim:

1. For a machine for producing pile fabric having a ground fabric and a series of parallel pile yarns disposed transversely of said ground fabric and projecting through said ground fabric to form pile projections and comprising a plurality of solenoids selectively energizable to control the individual pile yarns of said series to produce a pattern; control apparatus for selectively energizing the

solenoids controlling the pile yarns of said series to form a pattern comprising a series of aligned electrical conductive finger elements each connected to one of said solenoids, a second electrical element mounted in registry with said finger elements and electrically connected to said plurality of solenoids, circuit means including a source of voltage operable upon electric communication between said finger elements and said second element to energize said solenoids, a tape affording electric communication between said second element and selected finger elements, drive means operable in timed relation to said machine to advance said tape intermediate said finger elements and said second element, a non-conductive bar adapted to engage said finger elements to de-energize all of said solenoids, a conductive bar electrically connected to said second element and adapted to engage said finger elements to energize all of said solenoids, and means to effect selective alternate engagement of said non-conductive and said conductive bars with said finger elements.

2. A device according to claim 1 wherein said bars are mounted on a common rocking lever and intermediate said finger elements and said second element, and wherein further said means to effect selective alternate engagement comprises means pivotally mounting said lever intermediate said bars, an operator for said rocking lever and selectively operable means to displace said operator.

3. For a machine for producing pile fabric having a ground fabric and a series of parallel pile yarns disposed transversely of said ground fabric and projecting through said ground fabric to form pile projections and comprising a plurality of solenoids selectively energizable to control the individual pile yarns of said series to produce a pattern; control apparatus for selectively energizing the solenoids controlling the pile yarns of said series to form a pattern comprising a series of aligned electrically conductive finger elements respectively connected to the solenoids controlling the pile yarns of said series, a second electrical element mounted in registry with said finger

elements and electrically connected to said solenoids, circuit means including a source of voltage operable upon electric communication between said finger elements and said second element to energize said selected solenoids, a tape affording electric communication between said second element and selected finger elements, drive means operable in timed relation to said machine to advance said tape intermediate said finger elements and said second element to form a body pattern, means selectively operable to render said tape inoperable comprising a non-conductive bar adapted to engage said finger elements and disengage the same from the tape to de-energize all of said solenoids, a conductive bar electrically connected to said second element and adapted to engage said finger elements to energize all of said solenoids, and means operable in timed relation to said machine to effect selective alternate engagement of said non-conductive and said conductive bars with said finger elements to form end border patterns at each end of a body pattern formed by said yarns controlled by said solenoids.

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