TUFTING MACHINE PATTERN VARIATION DEVICE

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FIG. 1

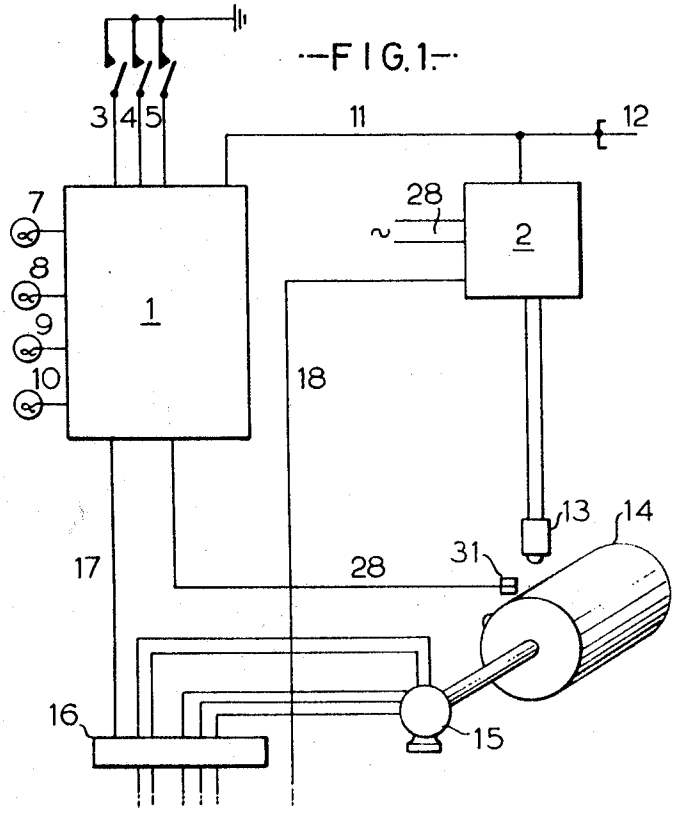
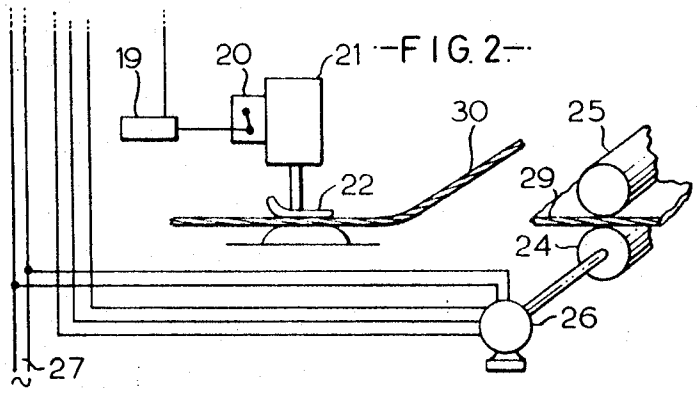


FIG. 2



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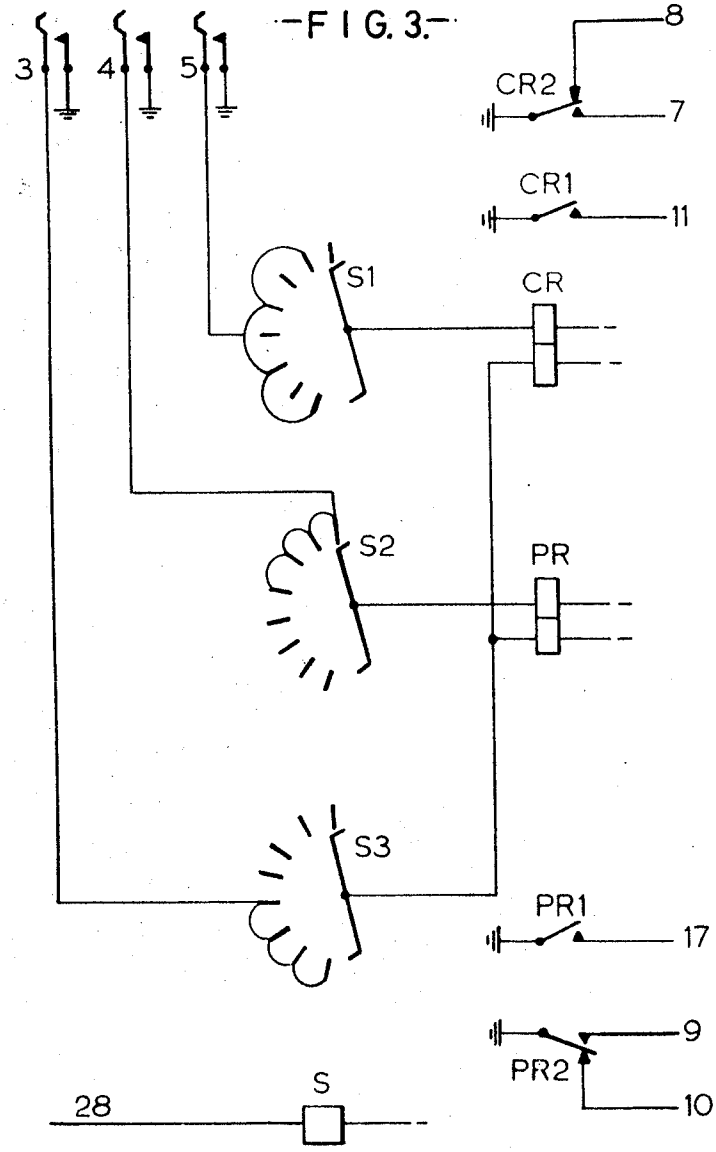
-FIG. 3.-



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TUFTING MACHINE PATTERN VARIATION DEVICE

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U.S. Cl. 112—79 11 Claims

ABSTRACT OF THE DISCLOSURE

A textile tufting machine incorporating means for reversing the effect which signals from a rotating pattern element have on a pile loop height control means, means for reversing the direction of rotation of the pattern element itself, and selectively programmed means (such as a multi-level stepping switch controlled by a punched card) for controlling both of the aforementioned reversing means, so that a single pattern element may be used to provide a wide variety of differing patterns.

The present invention concerns textile tufting machines having pile loop height defining mechanism for the formation of a pattern of pile loops of normal and reduced height on a backing fabric.

An object of the invention is to enable a single patterning element to be utilized not only for production of repeats of the corresponding pattern but also of variations thereof.

According to the present invention at least one electrical connection reversal device is interposed between the source of movement of the patterning element and the pile loop height control mechanism.

The patterning element may be driven electrically by the use of synchros from a rotary spindle adapted to drive the tufting needles. By electrically reversing the connections from the synchro-generator on the rotary spindle to the synchro-motor driving the patterning element an instantaneous reversal of the direction of movement of the patterning element is obtainable. This reversal may be initiated by a signal derived at the end of the pattern, so that on reversal, following one patterning phase in the forward direction, there is another patterning phase in the reverse direction giving what may be termed a longitudinally-reversed pattern repeat in the tufted work.

If electrical signals are derived from the patterning element, e.g. a drum bearing a design, to actuate or control the pile loop height defining mechanism, the inclusion of an electrical connection reversal device in the circuits for these signals makes possible the selection between alternative conditions wherein either the readout signals from the patterning element or the reciprocals of such signals may be passed to the pile loop height defining mechanism. The effect of such signal reversal is to substitute normal pile loops for reduced height pile loops and vice versa, thus causing a colour reversal when loop height selection is used to define the predominant colour with two-colour or multi-colour yarn working.

The electrical connection reversal devices may be in the form of relays or transistor circuits or thermionic

valves; any suitable circuit giving a substantially instantaneous switchover may be used. For certain patterning it may be advantageous to programme the form of each of a sequence of repeats, and a stepping switch or uniselector may be used for this purpose or a punched card reading system. Thus the first phase may be normal pattern, the second longitudinally-reversed pattern, the third colour-reversed pattern and the fourth colour-reversed and longitudinally-reversed pattern.

Reference should now be made to the accompanying drawings in which:

FIGURE 1 is part of a circuit of the pattern control mechanism,

FIGURE 2 shows a further part of this circuit associated with the machine, and

FIGURE 3 shows one form of pattern selecting circuit.

From FIGURE 1 it will be seen that a control box **1** is provided, having a circuit of which one form is shown in FIGURE 3. The machine itself comprises forwarding rollers **24**, **25** (FIG. 2) engaging a strip of backing material **29** and forwarding it to the needles at a predetermined rate. These rollers are driven from the main motor of the machine, and one roller drives a synchro-generator **26**. The machine also comprises a plurality of pneumatic cylinders of which one is shown at **21**, each cylinder having a control valve **20** operated by a solenoid **19**. Each cylinder has a brake shoe **22** engaging one or more yarns **30**, the pressure of the brake shoe on the yarn determining the length of loop formed during each stitch of the needle through which the yarn **30** passes. A synchro-generator **26** is supplied with alternating current from leads **27**, and it is connected by a reversing relay **16** to a synchro-motor **15** driving a pattern drum **14** at a rate determined by the generator **26**.

The pattern drum is associated with a plurality of photo-cell pick-up devices of which one is shown at **13**, this photo-cell having an individual amplifier **2**. The amplifier is supplied with power from leads **28**, and controls the solenoid **19** over lead **18** so as to provide long or short loops as determined by the pattern drum. The amplifier **2** has also a reversing connection **11** which is connected in common via the leads **12** to the other amplifiers, the lead **11** determining whether a lightspot on the pattern produces a long loop or a short loop. The control mechanism **1** is provided with indicating lamps **7** to **10** which show the condition of the pattern control at any time, and the type of pattern produced is determined by switches **3**, **4**, **5**, any one of which may be closed to determine the type of pattern to be produced.

FIGURE 3 shows one form of circuit may be included in the control mechanism **1**. The circuit comprises a stepping switch S having contact banks S1, S2 and S3, The switch S is energised over lead **28** from a pick-up device **31** (FIGURE 1) which is operated at a pre-determined position of the drum **14** relatively to the photo-cells, so that the switch is stepped for example once every revolution of the drum although the switch may be stepped at multiples of this rate of revolution if required.

Each of the contact banks has connections to one of the switches **3**, **4**, **5**, bank S1 being connected to a relay CR, bank S2 to a relay PR and bank S3 to both of these relays. Thus closure of switch **5** operates relay CR on each alternate step of the switch S, relay PR is operated on the first four contacts of bank S2, and released for

the last four, and both relays are operated if switch 3 is closed, on the last four contacts of bank S3. These strappings on the contact banks may of course be varied to suit the type of pattern required, and more than one contact bank may be associated with each relay. Again the switches 3, 4, 5 may be brushes associated with a punched card, the card determining the kind of pattern to be produced.

Relay CR has a contact CR1 which over lead 11 reverses all the photo-cell outputs so that if for example CR1 is open, long loops are produced, and if closed, short loops are produced. Relay PR has a contact PR1 which over lead 17 operates a pattern direction reversing relay 16 to reverse the direction of the synchro-motor 15. Both relays have contacts CH2 and PR2 connected respectively to leads 7, 8 and 9, 10, these leads lighting the similarly numbered lamps shown in FIGURE 1 to indicate the kind of pattern. Closure of switch 3 operates both relays CR and PR when the wiper of bank S3 is on any one of its last four contacts, this causing reversal of both the loop length controlling means and the pattern direction.

By the control means outlined above, it is possible from a single pattern to produce straight repeats of this pattern by leaving all the switches 3, 4, 5 open. The colour of the pattern may be reversed by operating switch 5, the pattern shape may be reversed by closing switch 4, and both the colour and shape may be reversed by closing switch 3. It should of course be understood that the circuit of FIGURE 3 is illustrative only, since a number of variations of bank strapping and switch connections may be employed to produce any desired combination of colour or form of reversal.

We claim:

1. In a textile tufting machine for producing carpets and similarly patterned fabrics comprising pile loops on a backing fabric, the combination of: a pattern control device carrying indicia representing a pattern; first means for scanning said pattern control device to derive an electrical signal having a first state or a second state; second means responsive to said signal for controlling the height of said pile loops to produce loops having a first height during the occurrence of said first state and having a second height during the occurrence of said second state; and third means for reversing the connection of said signal to said second means to cause the first state of said signal to provide loops of said second height and said second state of said signal to provide loops of said first height.

2. In a textile tufting machine for producing carpets and similar patterned fabrics comprising pile loops of yarn applied by a plurality of needles to a backing fabric, the combination of: an illuminated pattern device; a plurality of photo-electric sensors; first means for moving said pattern device relative to said photo-electric sensors to provide a plurality of pattern-defining signals each having first and second levels from said sensors; means for feeding a plurality of strands of yarn to said needles; a plurality of braking devices, each adapted to act upon a respective strand of yarn to control the height of the pile loops formed from the strand of yarn, to provide loops of a first height or a second height; means for connecting each of said pattern-defining signals to control a respective one of said braking devices to provide loops of said first and second heights during the occurrence of said first and second levels respectively of said pattern-defining signals; and means for reversing the application of said pattern-defining signals to said braking devices to provide respectively opposite heights during said levels of said pattern-defining signals.

3. In a textile tufting machine for producing carpets and patterned fabrics including needles for applying strands of yarn in loops of varying heights to a backing fabric, the combination of: pattern means comprising an indicia-bearing drum; means for rotating said drum; means for sensing said indicia to provide a plurality of time-varying signals; feed roller means for advancing said backing fabric past said needles at a predetermined speed, the speed of said feed roller means being synchronized with the speed of rotation of said drum; and pattern-reversing means responsive to one of said time-varying signals for reversing the direction of rotation of said drum.

4. Apparatus according to claim 3 including control means responsive to said time-varying signals for controlling said strands of yarn to vary the height of pile loops being formed from said strands of yarn; and loop height-reversing means for reversing the effect of said time-varying signals on said control means to reverse the effect which a given condition of said signals has on the heights of said pile loops.

5. Apparatus according to claim 3 having a synchro-generator connected to be driven in synchronism with said feed rollers and a synchro-motor connected to drive said drum, said synchro-generator being connected to drive said synchro-motor, thereby to synchronize the speed of said feed roller means with the speed of said drum.

6. Apparatus according to claim 3 having control means responsive to said time-varying signals for controlling said strands of yarn to vary the heights of said pile loops being formed from said strands of yarn; loop height-reversing means for reversing the effect of said time-varying signals upon the heights of said pile loops; and selective switching means operable through a plurality of conditions to control said pattern-reversing means and said loop height-reversing means selectively, both singly and in combination.

7. Apparatus according to claim 6 in which operation of said selective switching means is connected to be controlled by a fixed pattern control device.

8. Apparatus according to claim 6 in which said selective switching means is connected to be advanced through said plurality of conditions by a selected one of said time-varying signals.

9. In a textile tufting machine for producing carpets, patterned fabrics and the like, including first means for applying yarn in loops of controlled heights to a backing fabric and feed roller means for advancing said backing fabric past said first means, the combination of: a first pattern device having a first program stored thereon; second means synchronized with said feed roller means for deriving a first plurality of successive control signals from said first pattern device in accordance with said first stored program; a second pattern device having a second stored program; third means synchronized with said feed roller means for sensing said second program stored on said second pattern device at a speed synchronized with said feed roller means and in a selected sequence to derive a second plurality of successive control signals; fourth means for applying said successive control signals of said second plurality to control said first means; and fifth means responsive to certain of said control signals of said first plurality for controlling the application of said control signals of said second plurality thereby to control the execution of said second program.

10. Apparatus according to claim 9 in which said fifth means comprises means for controlling the direction in time in which said second stored program is sensed in order to control the time-direction of said selected sequence.

11. Apparatus according to claim 9 in which said first means is operative during a first condition of said fourth means to control said loops to first and second heights, respectively, upon the occurrence of first and second levels respectively, of said control signals of said second plurality, and operative during a second condition of said fourth means to control said loops to said second and first heights, upon the occurrence of said first and second levels of said control signals, respectively, of said second plurality, and in which said fifth means comprises means for

switching said fourth means between said first and second conditions.

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U.S. Cl. X.R.

112—266; 250—219