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J. O. ERWIN, JR., ETAL

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PATTERN CONTROL FOR TUFTING MACHINE ATTACHMENTS

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3 Sheets-Sheet 2

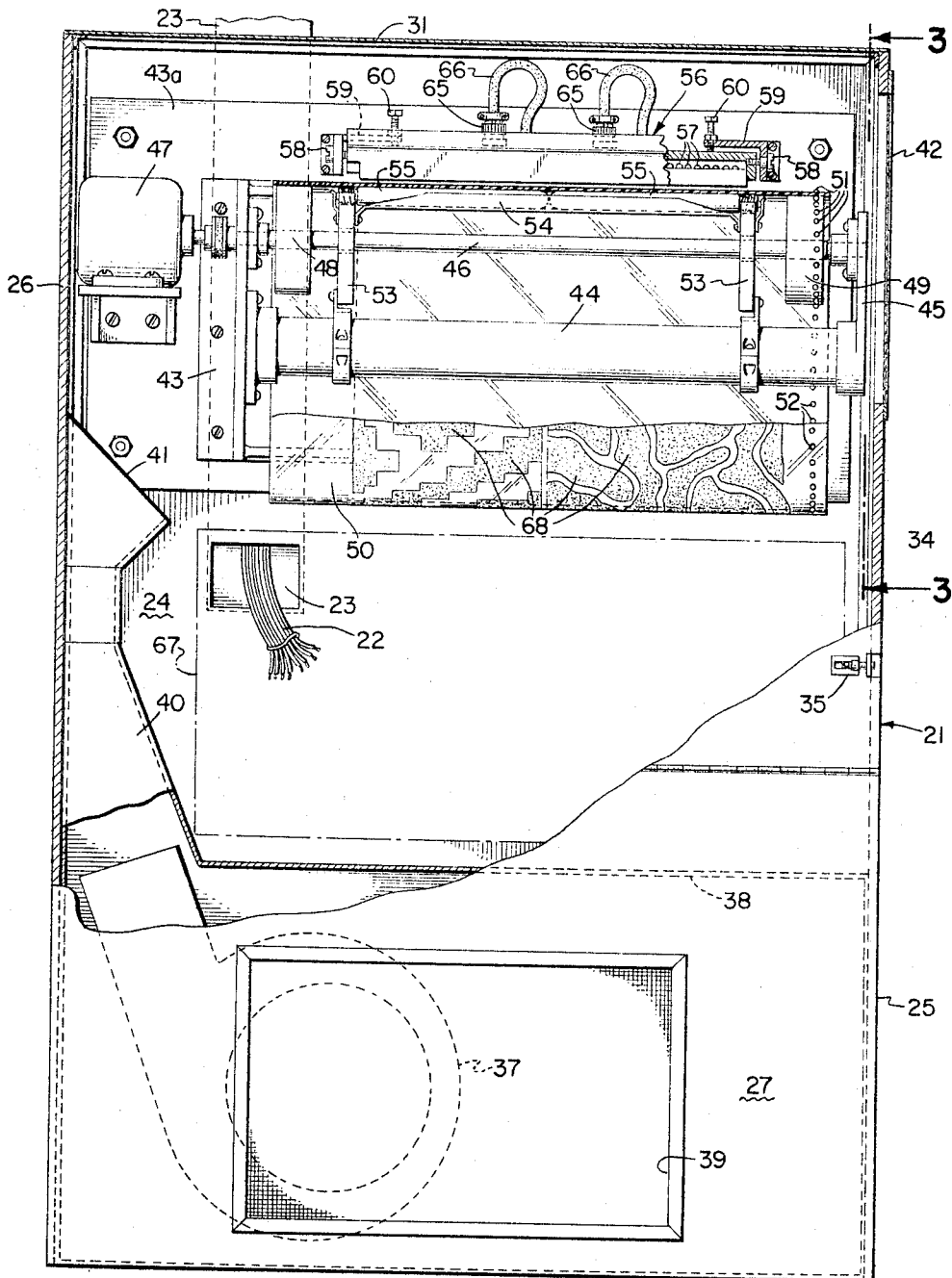


Fig. 2.

INVENTORS.
JOSEPH OTIS ERWIN, JR.
WALLACE WESLEY HAMMEL, JR.

BY *Edward J. Bell*
ATTORNEY

WITNESS

Nicholas Leszczak

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J. O. ERWIN, JR., ETAL

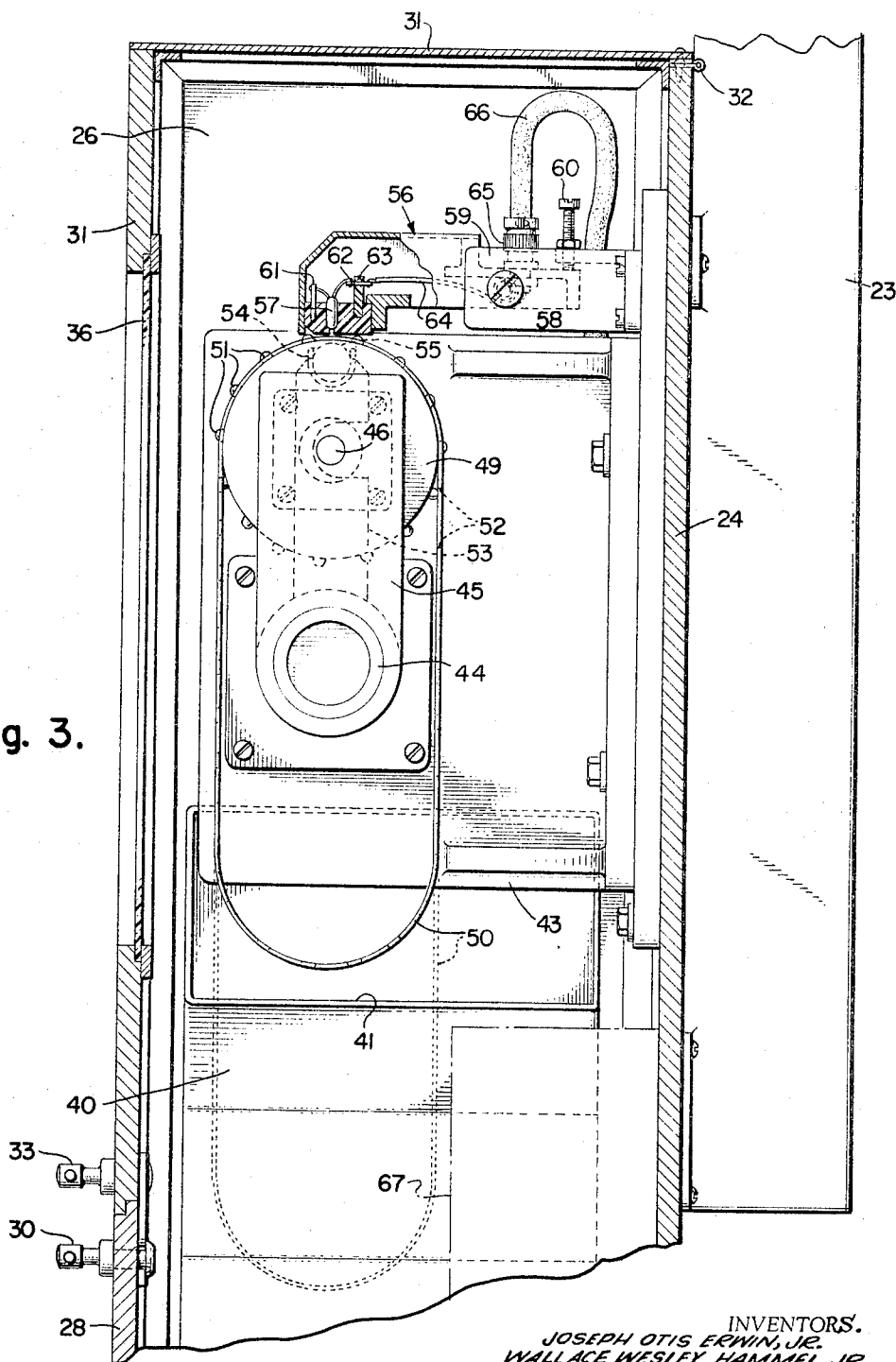
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Fig. 3.



INVENTORS.
JOSEPH OTIS ERWIN, JR.
WALLACE WESLEY HAMMEL, JR.

WITNESS

Nicholas Leszcyak

BY

Edward D. Bell

ATTORNEY

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PATTERN CONTROL FOR TUFTING MACHINE ATTACHMENTS

Joseph Otis Erwin, Jr., Hixson, and Wallace Wesley Hammel, Jr., Chattanooga, Tenn., assignors to The Singer Company, New York, N.Y., a corporation of New Jersey

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9 Claims. (Cl. 112—79)

The present invention relates to a control for pattern attachments for tufting machines and more particularly to a photocell type of control such as forming the subject matter of the United States patent of Hammel, No. 3,103,187, September 10, 1963.

A pattern attachment for a tufting machine comprises a controlled yarn feed for feeding different predetermined lengths of yarn to the individual needles on successive stitches, thereby providing in the tufted fabric a pattern defined by pile of different height. One type of machine pattern attachment comprises yarn feed rolls adapted to be driven individually at two or more different speeds, by connecting the feed rolls selectively to different drives, as for example by electrically energized magnetic clutches. Another type of pattern attachment comprises a pair of feed means adapted to feed yarn at different rates together with means for shifting the yarn back and forth between the two feed means. In each case as well as in other specific embodiments, the pattern attachment is controlled by a pattern mechanism which may be of the photoelectric type such as forms the subject matter of the Hammel patent and which, briefly, comprises a transparent pattern drum which carries an endless transparent pattern sheet on which the desired pattern has been painted. The drum is rotated in synchronism with the machine so that the pattern sheet is passed progressively between a light source and a photoelectric unit which includes one photocell for each yarn feed unit to be controlled. As the drum is rotated each photocell traces a path circumferentially of the pattern sheet and acts to control the associated yarn feed unit to effect the feed of different lengths of yarn.

A similar control mechanism may also be used with other tufting machine attachments such as for example, a needle control for throwing a needle into and out of operation upon each stitch. For convenience the following description is directed to a control for a pattern attachment for tufting machines but it will be understood that the control may be used with other attachments and it is intended that such other uses are included within the scope of the appended claims.

The objects of this invention are to provide an improved control mechanism of the type forming the subject matter of the Hammel patent, which mechanism is economical, is not adversely affected by the lint which is inherently present in the vicinity of a tufting machine, is more versatile, and is more durable and trouble-free in operation.

Basically, this invention comprises a pattern element consisting of a flexible transparent sheet, preferably photographic film, mounted in a console removed from the machine.

Having in mind the above and other objects that will be evident from an understanding of this disclosure, the invention comprises the devices, combinations and arrangements of parts as illustrated in the presently preferred embodiment of the invention which is hereinafter set forth in such detail as to enable those skilled in the art readily to understand the function, operation, construction and advantages of it when read in conjunction with the accompanying drawings in which:

FIG. 1 is a composite view partly in vertical section

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and partly in elevation illustrating a tufting machine with a pattern attachment and a control console for the attachment.

FIG. 2 is a front elevation view of the control console of FIG. 1 with parts broken away and in section to illustrate the device.

FIG. 3 is a vertical sectional view taken substantially on the line 3—3 of FIG. 2.

With reference to the drawings, there is illustrated in FIG. 1 a tufting machine having a frame comprising a bed 1 and a head 2 disposed above the bed 1. The bed 1 includes a bed plate 3 across which a fabric F is adapted to be fed by a pair of feed rolls 4 and let-off-rolls 5.

Mounted in the head 2 for vertical reciprocation is a push rod 6 to the lower end of which is received a needle bar 7 which in turn carries a plurality of needles 8 (only one of which is shown) that are adapted to penetrate the fabric F on the bed plate 3 upon reciprocation of the needle bar 7 and to project loops of yarn therethrough. Endwise reciprocation is imparted to the push rod 6 and thus to needle bar 7 and needles 8 by a link 9 which is pivotally connected at its lower end to the push rod 6 and at its upper end to an eccentric 10 on the driven rotary main shaft 11 that is journaled longitudinally of the head 2. While a plurality of the push rods 6, links 9 and eccentrics 10 are normally provided along the main shaft 11, only one set thereof is illustrated in the drawings.

Beneath the bed plate 3 there is journaled an oscillating looper shaft 12 which is arranged parallel to the main shaft 11 and which carries a looper 13. The looper 13 cooperates with the needle 8 to seize the loop of yarn presented thereby and hold the same as the needle is withdrawn on its return stroke, after which the looper retracts to release the loop. While, to simplify the disclosure, only a single looper 13 is shown, it is understood that one looper is provided for each needle in the machine.

Yarn Y is fed to the needle 8 by a pattern attachment generally indicated at 14. The illustrated pattern attachment is of the type disclosed in the above referred to Hammel patent and is herein described only insofar as it is necessary for an understanding of this invention. Basically this yarn feed mechanism comprises pairs of cooperative yarn feed rolls 15 each pair of which is adapted to feed yarn to certain ones of the needles of the machine which, by virtue of the desired pattern in the tufted fabric, receive the same lengths of yarn upon each stitch—for example, the corresponding needles in each repeat transversely of the carpet. Each pair of feed rolls 15 are adapted to be driven by a shaft 16 which is in turn driven at one of two different speeds by a clutch 17 that couples the same to a high speed chain 18 and by a clutch 19 that couples the same to a low speed chain 20. The clutches 17 and 19 are electromagnetic and are adapted to be energized by a pattern mechanism, which in accordance with this invention, is housed within a console 21 remote from the tufting machine. The clutches are individually connected electrically to the pattern mechanism by wires 22 disposed within a conduit 23.

The console 21 comprises a substantially rectangular sheet metal enclosure including a back wall 24, side walls 25 and 26 and a front wall 27. For convenient access to the interior of the console, the front wall is provided with a panel 28 hinged at 29 and held closed by latches 30. A further panel 31 which defines the upper portion of the front wall 27 and the top of the console is hinged at 32 along a line at the rear of the top and is held closed by latches 33. The side wall 25 is also provided with a hinged access panel 34 held closed by a latch 35. The panel 31 is provided with a window 36, which may be glass or other transparent material

that will provide visual access to the interior of the console while the same remains closed. For ventilation, air is circulated through the console by a blower 37 mounted in the bottom portion of the console and closed from the rest of the console by a partition 38, which bottom portion has a screened intake opening 39. The discharge of the blower 37 is connected to a duct 40 that is arranged against the side wall 26 of the console and has a discharge opening 41 that directs the air past the mechanism in the console and towards a screened discharge opening 42 in the panel 34 of the side wall 25.

Within the console 21 there is provided a bracket 43 mounted on and extending forwardly from the back wall 24 adjacent to one side thereof. For strength a reinforcing plate 43a may be added to the back wall 24. The bracket 43 carries a cantilevered support 44 in the form of a tube disposed transversely of the console and to the free end of which there is secured a bracket 45. A shaft 46 is journaled for rotation in the brackets 43 and 45 and is adapted to be driven in synchronism with the main shaft 11 of the machine for example by a servo system or a stepping system including a motor 47.

A pair of spaced wide-faced collars 48 and 49 are mounted on the shaft 46 between and adjacent to the brackets 43 and 45 and are secured to the shaft 46 for rotation therewith. The collars 48 and 49 are adapted to receive an endless pattern belt 50 which is entrained about the same and which is keyed to the collar 49 by a plurality of pins 51 extending radially from and equally spaced about the periphery of the collar 49 and adapted to be received within holes 52 formed in the belt 50 in a series along the one edge thereof. The belt 50 is thus prevented from slipping relatively to the collar 49 and, thus, through synchronization of the shaft 46 relative to the main shaft of the machine, also synchronized relative to the tufting machine.

The support 44 is also provided with a pair of up-standing brackets 53 between the free ends of which is disposed a light support 54 that receives a pair of elongated incandescent light bulbs 55. The sockets of the bulbs 55 are mounted in the brackets 53 and electrical power is supplied thereto in any convenient manner, for example by electrical leads (not shown) extending through the tube 44 and the brackets 53.

The bulbs 55 are supported by the brackets 53 and support 54 along a line substantially directly above the shaft 46 and closely adjacent and parallel to the uppermost transverse portion of the pattern belt as it passes over the collars 48 and 49. To adjust the bulbs 55 into parallel with the belt 50, the brackets 53 are made endwise adjustable. Disposed above the pattern belt is a photoelectric unit 56 in which is mounted a series of photocells 57 disposed in a line and corresponding in number to the number of pairs of feed rolls 15—one of the photocells being adapted to control one pair of the feed wheels. The unit 56 is pivotally mounted as by pivot screws 58 and brackets 59 secured to the back wall 24 of the console so that the head 58 may be raised for access to the photocells for servicing and then lowered to place the photocells closely adjacent and parallel to the belt 50 along a line parallel to the axis of the bulbs 55. The lowered position of the unit 56 is determined by an adjustable stop in the form of a screw 60 carried by the bracket 59 and adapted to engage a rear portion of the unit 56.

As seen in FIG. 4 each of the photocells 57 is received within a bore in the frame portion of the unit 56, the bottom of the bore being partially closed to provide a pin point light source for the photocells as well as to provide a shoulder for supporting the photocell. One lead from the photocell 57 is connected to a common or ground bar 61 while the other head is connected to a connector 62 carried by a supporting bar 63 of insulating material and connected by a lead 64 to a connector 65. The leads 64 from each of the photocells are con-

nected to individual terminals in the connector 65 and are then connected individually by leads in a bundle 66 of wires to amplifiers, which may be mounted in an enclosure or control box 67 secured to the rear wall 24 of the console. The amplifiers are provided to boost the relatively low control voltage developed by the photocells 57 to sufficient value for actuation of the clutches 17 and 19 to which they are connected.

The pattern belt 50 is formed of transparent material on which there are arranged opaque areas such as at 68, FIG. 2. As the shaft 46 is driven, the collar 49 moves the belt 50 between the light source defined by the bulbs 55 and the photocells 57 each of which track a path longitudinally of the belt. All of the photocells will track individual paths spaced transversely of the belt 50 and parallel to each other longitudinally of the belt. Each of the photocells will respond to light passing through the transparent areas of the belt 50 in the path tracked thereby and will be shielded from the light by the opaque areas in that path. The opaque areas on the belt 50 may be arranged in any desired fashion so that any particular photocell can be energized in any desired sequence and the feed rolls 15 controlled thereby can be driven at high speed or low speed in the desired sequence—thereby providing high and low pile in the tufted fabric in any desired pattern.

The pattern belt 50 in the illustrated embodiment of the invention is placed on the collars 48-49 of the console 21 by inserting the same over the free end of the cantilevered support 44 and the elements supported thereby, with a portion of the belt passing between the light bulbs 55 and the photocells 57. To couple the belt to the collars for rotation, it is necessary only to seat the pins 51 of the collars 49 in the holes 52 of the belt. To change the pattern in the fabric being tufted, the belt 50 can be removed and replaced by a different belt 50 with desired new pattern. The panel 34 which can be swung open to expose the free end of the support 44 provides for inserting the belt 50 over and removing it from the free end of the support 44. To insure that the photocells will individually track the path in the belt 50 that they were designed to track, the pins 51 are spaced in a direction axially of the shaft 46 from the nearest one of the photocells 57 a distance which is made equal to the spacing of the holes 52 in the belt from the first path in the pattern area of the belt—which is the path tracked by the first photocell.

In the preferred form of the invention, the belt 50 is formed as a photographic negative. The pattern is initially painted on a master in reverse, that is, with the areas that are to be transparent on the final belt painted in rather than the areas that are to be opaque. The film which is to form the belt 50 is exposed, for example, by a contact process and thereafter is developed. The ends of the film are connected together to form an endless belt. One of the advantages of such a belt is that it is durable in that the opaque areas do not chip or flake and cannot be readily scraped off during use or handling. A further advantage is that duplicates can be economically provided in that as many belts as desired can be made from the master which can safely be stored indefinitely.

Another feature of the pattern belt 50 is that it can be produced in lengths which can readily and economically be varied. As illustrated by the phantom lines in 3, the length of the belt may be increased from that of the belt 50. To accommodate any additional length of the belt, the control box 67 is kept shallow so that there is a spacing between the front wall of the control box and the front wall 27 of the console. Inasmuch as the length of the belt 50 in effect determines the number of switches in the fabric in each longitudinal repeat, increasing the length of the belt 50 increases the length of the repeat longitudinally in the fabric.

Another feature of the invention is that it permits the use of relatively wide pattern belts which provides

for wider transverse repeats in the fabric, or alternately wider paths for each photocell to track, thus making the pattern less critical.

Between the collars 48 and 49, the belt 50 is self-supporting. Thus, the light source can be located very close to the belt and there would be a minimum dissipation of the light passing from the source through the belt to the photocells. Since smaller light sources can be used, there is less heat generated. With a pattern mechanism wherein the pattern element is supported by a drum, the drum, itself requires a spacing of the light source from the photocells and at the same time acts to diffuse the light—thus requiring larger light sources that generates more heat and which tends to cause the drum to warp.

One of the problems encountered in the use of a remote pattern element is in maintaining the timing relation of the pattern element relatively to the machine—which timing relation is critical and is difficult to maintain because of the forces involved in the rapid acceleration and deceleration of the pattern elements as the machine is jogged. In accordance with this invention, because the belt 50 is relatively light and has a low inertia, the pattern element can be accurately driven in timed relation with respect to the machine by a simple and economical drive system, for example, by a servo or stepping system.

With a pattern mechanism adapted to be driven by a servo-mechanism, it will be seen that the pattern device can be disposed in a console remote from the machine. The pattern mechanism can thus be isolated from the vibration which is inherently associated with the operation of a tufting machine and which, among the other things, destroys the light bulb 55 and thus shuts the machine down. At the same time, the pattern mechanism is removed from the vicinity of the tufting machine where there is a considerable amount of lint in the atmosphere, and the lint that is present at the console is isolated from the interior thereof since the air for ventilating the console is filtered. The lint of course tends to clog the space about the photocells 57 and thus interferes with their operation. A further advantage of having the console removed from the vicinity of the machine is that the space about the machine is kept clear for the convenience of those operating the machine and for manipulation of the work.

A further feature of the invention is that the only power that is transmitted between the pattern mechanism and the machine is the control voltage of the clutches. The minute voltage of the photocells is conducted only through a minimum of leads and thus electrical interference is minimized.

Numerous alterations of the structure herein disclosed will suggest themselves to those skilled in the art. However, it is to be understood that the present disclosure relates to a preferred embodiment of my invention which is for purposes of illustration only and not to be construed as a limitation of the invention. All such modifications which do not depart from the spirit of the invention are intended to be included within the scope of the appended claims.

Having thus described the nature of the invention, what we claim herein is:

1. In a tufting machine having a pattern controlled yarn feeding mechanism for feeding yarn at different rates to the individual needles of the tufting machine and comprising an electrically-actuated control means for controlling the rate of yarn feed and a pattern mechanism for actuating said control means, said pattern mechanism comprising a console remote from the machine, a shaft jour-

naled in said console, means electrically connected to the machine for driving said shaft in synchronism with the operation of the tufting machine, a pattern element comprising an endless belt of flexible transparent material means for mounting said belt in said console for advancing said belt endlessly and for flexing said belt longitudinally as it is advanced, means coupling said belt to said shaft for advancing said belt in timed relation with said shaft upon rotation of said shaft, said belt having opaque areas defining a desired pattern, photoelectric means disposed in operative relation with respect to said belt to respond to light transmitted through the transparent areas of said belt, and means electrically connecting said photoelectric means to said control means for actuation of said control means by said photoelectric means as the transparent and opaque areas of said belt are moved into operative relation with said photoelectric means.

2. In a tufting machine in accordance with claim 1 in which the means for mounting the belt in the console comprises a cantilevered support whereby said belt may be inserted over the free end of the support.

3. In a tufting machine in accordance with claim 1 in which said belt encircles the shaft and the means for journaling the shaft in the console comprises a cantilevered support whereby the belt may be inserted over the free end of the support and of the shaft.

4. In a tufting machine in accordance with claim 1 in which the means for mounting the belt comprises a pair of collars secured to the shaft and carrying the belt.

5. In a tufting machine in accordance with claim 4 in which the means for coupling the belt to the shaft for unitary rotation comprises a series of holes in the belt and a series of radial projections on one of the collars and adapted to penetrate the holes in the belt.

6. In a tufting machine in accordance with claim 1 in which the console is closed and means is provided for ventilating the same comprising a blower having a screened inlet and a discharge within said console, and an exhaust opening in the console.

7. In a tufting machine in accordance with claim 1 in which the belt comprises a transparent plastic film and the opaque area thereof is formed photographically.

8. A control mechanism for pattern attachments for tufting machines comprising a console, a cantilevered support in said console, a shaft journaled in said support, synchronous means for driving said shaft, and a pattern element mounted on said shaft for rotation therewith and comprising an endless belt of flexible transparent material having opaque areas defining a desired pattern, and photoelectric means disposed in operative relation with respect to said belt to respond to light transmitted through the transparent areas of said belt, for generating a control voltage.

9. In a control mechanism in accordance with claim 8 in which there is provided with said console means for amplifying the control voltage generated by said photoelectric means.

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JORDAN FRANKLIN, *Primary Examiner*.

M. J. COLITZ, *Assistant Examiner*.