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E. L. BRONSTIEN, JR., ET AL

2,920,588

AUTOMATIC TUFTING MACHINE

Filed Dec. 3, 1954

5 Sheets-Sheet 1

FIG. 1

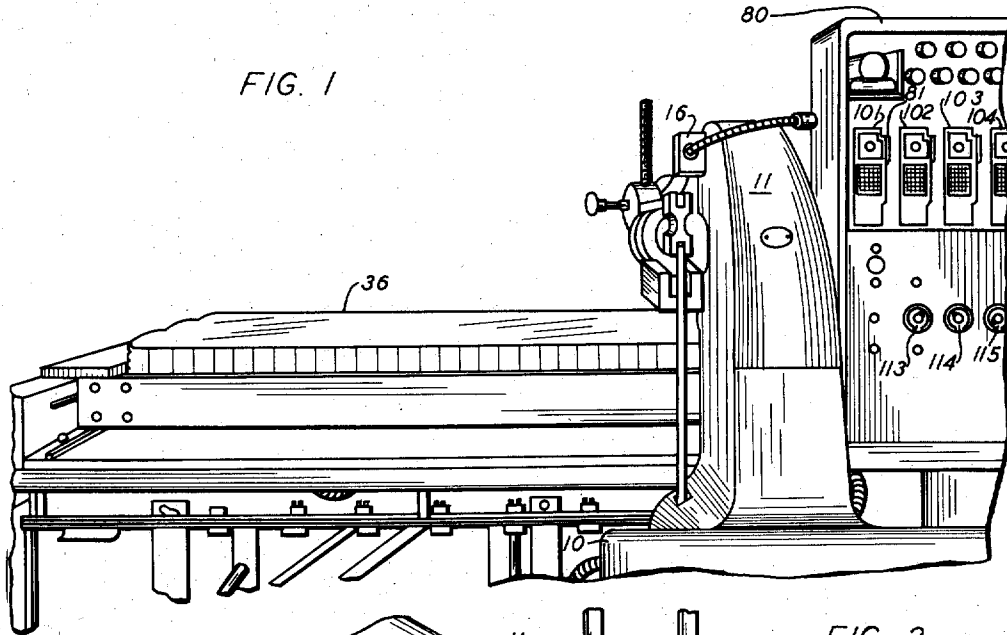
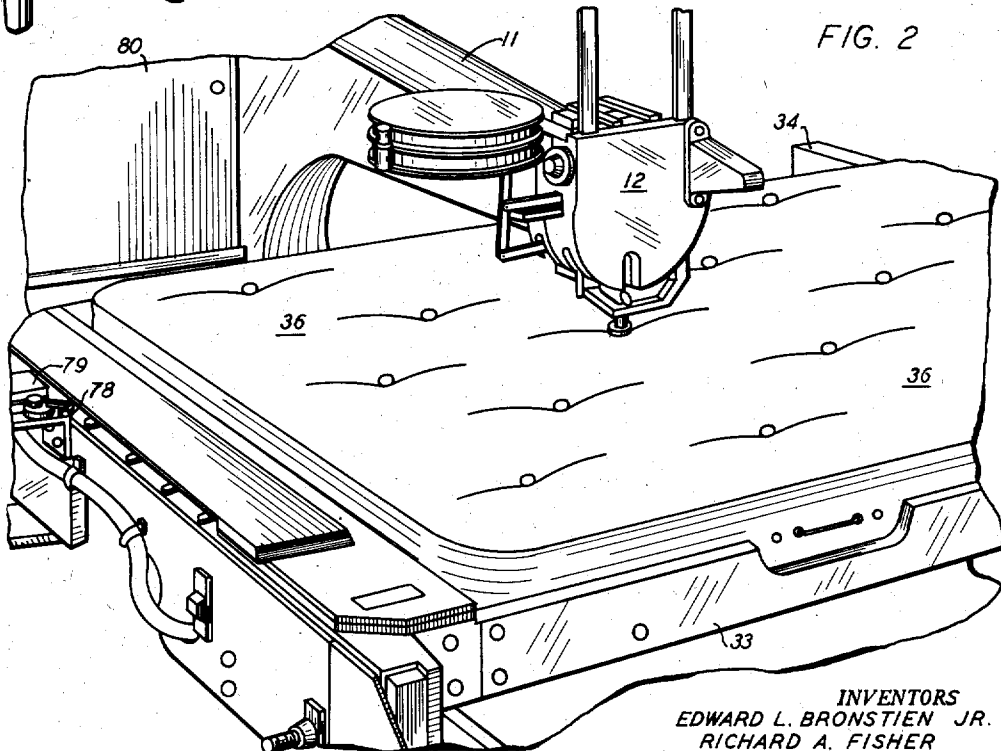


FIG. 2



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FIG. 3

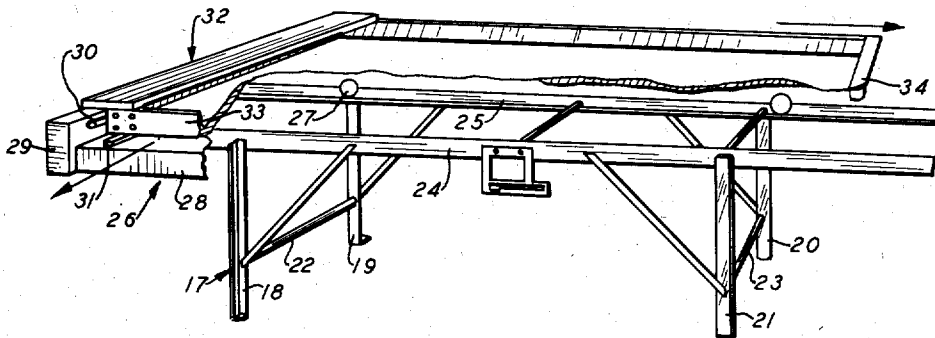


FIG. 4

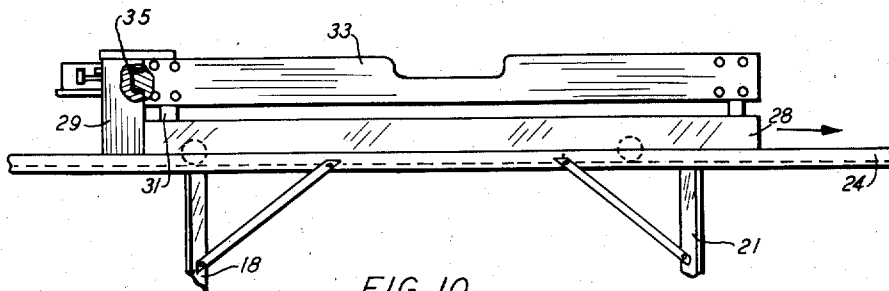
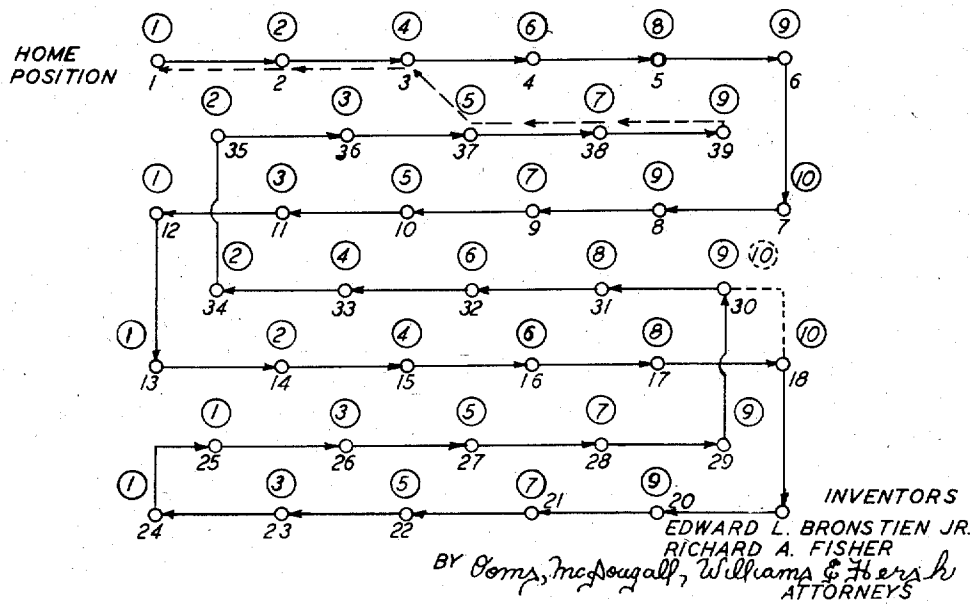


FIG. 10



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FIG. 5

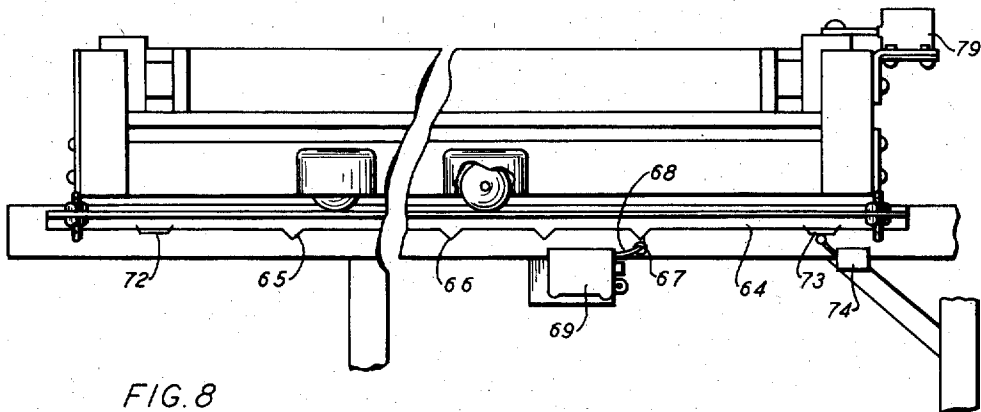


FIG. 8

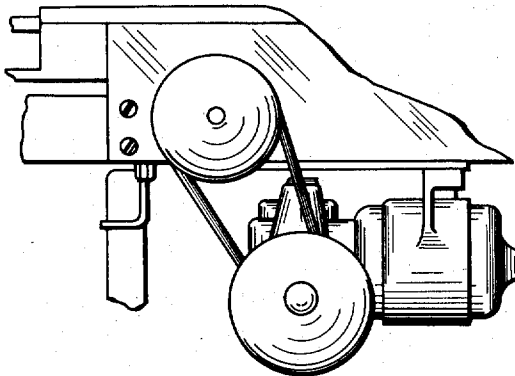
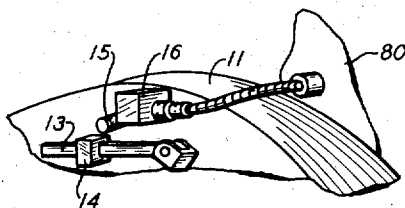


FIG. 9



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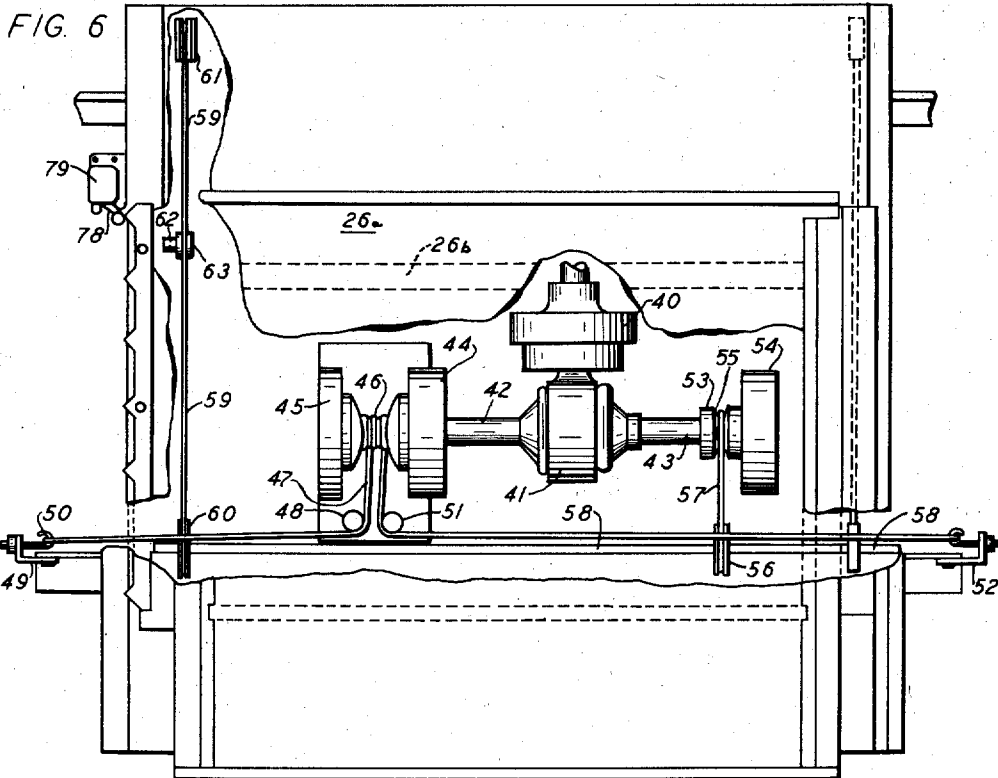
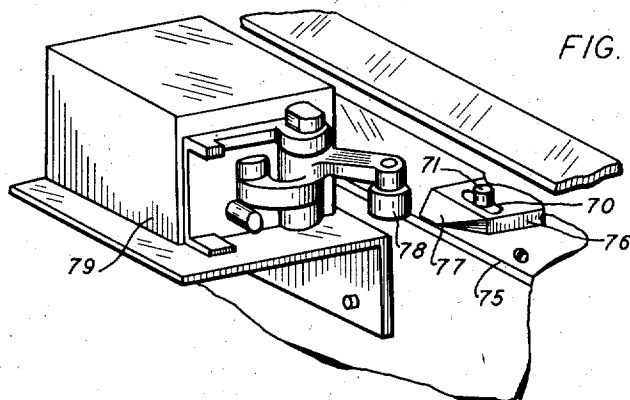
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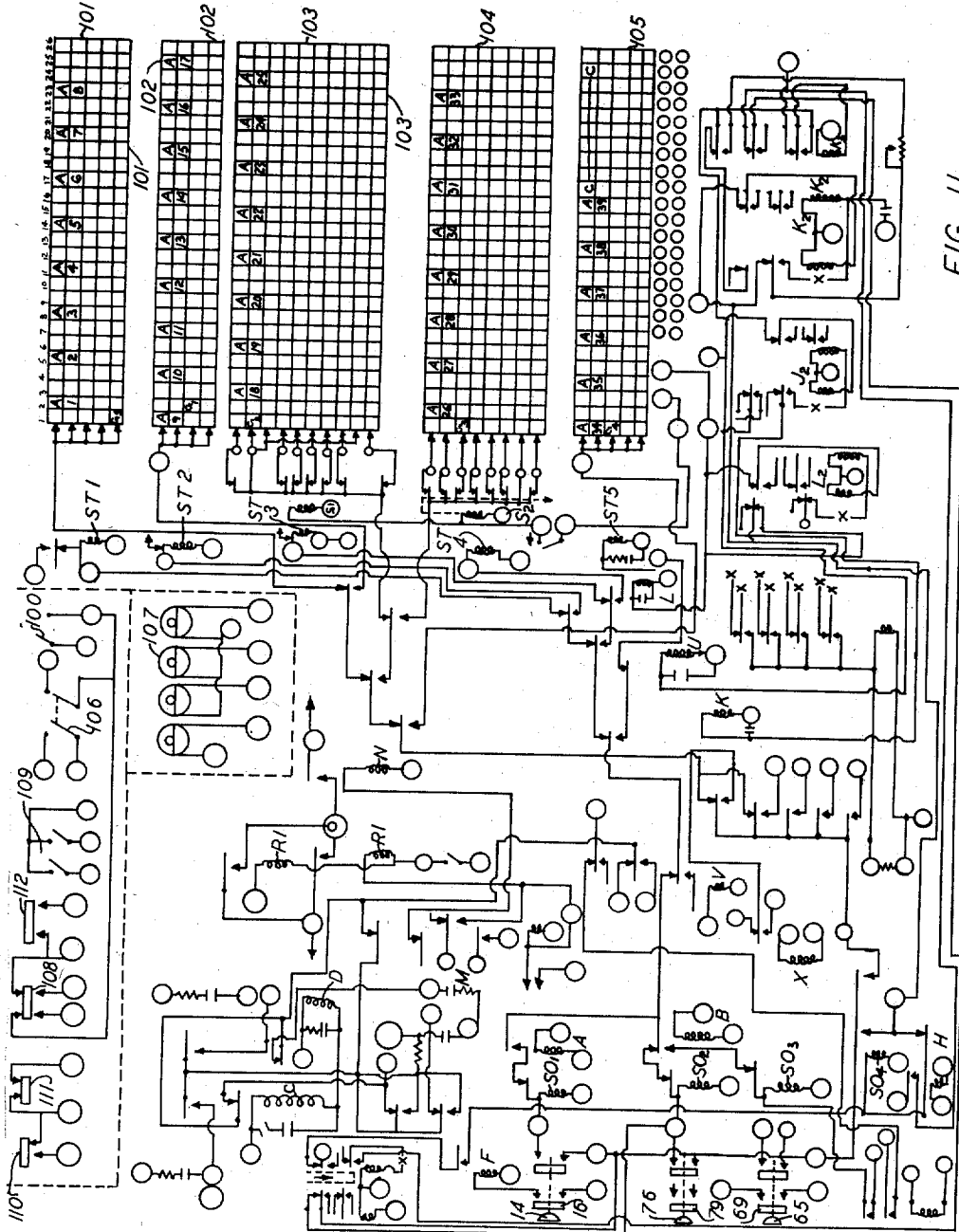
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AUTOMATIC TUFTING MACHINE

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AUTOMATIC TUFTING MACHINE

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Application December 3, 1954, Serial No. 472,876

17 Claims. (Cl. 112—3)

This invention relates to a machine for tufting mattresses and the like, and relates more particularly to a machine of the type described which operates automatically to index the mattress between the tufting heads of a tufting machine for making the desired tufts in the mattress in a predetermined pattern, depending upon the size of the mattress, and without distortion or unbalance in the finished structure.

It is an object of this invention to produce an automatic tufting machine of the type described.

More specifically, it is an object of this invention to produce an automatic mattress tufting machine which, in a sequence of automatic operations, makes a predetermined number of tufts in a mattress; which continuously operates stepwise through a series of functions for registering the mattress between the tufting heads of a tufting machine for making tufts in such predetermined positions, after which the machine automatically returns the indexing members to home or starting position in preparation for another sequence of operations for tufting a mattress when properly positioned in the machine; which embodies means for loading the machine with a mattress which becomes automatically properly positioned for the desired indexing operations; which may be adjusted for effecting tufting operations in a predetermined pattern corresponding to the size of the mattress; which provides for proper balance in the mattress and for uniform tension in the mattress cover; which embodies means for stopping operation of the machine in the event of a malfunction or in the event that an obstruction is encountered during operation; which is capable of conversion to manual control and for operation to correct any errors, difficulties, or obstructions without interrupting the sequence of operations so that the machine can be returned to the operation where it left off in its tufting cycle after the malfunction or obstruction has been corrected; which automatically indexes the mattress between the tufting heads for each tufting operation; eliminates the many variables existing in present systems of manual control in the tufting of mattresses; which materially reduces the amount of labor required and increases the rate of production of tufted mattresses; and which operates entirely by electrical controls thereby to provide a more durable and accurate system for efficient operation of the tufting machine with a minimum amount of maintenance and upkeep.

These and other objects and advantages of this invention will hereinafter appear and for purposes of illustration, but not of limitation, an embodiment of this invention is shown in the accompanying drawing, in which—

Fig. 1 is a perspective view from the rear of a tufting machine embodying features of this invention;

Fig. 2 is a perspective view taken from the front side of the tufting machine shown in Fig. 1;

Fig. 3 is a perspective view of the tables employed in the tufting machine of Figs. 1 and 2, with sections broken away for better illustration of the arrangement of various parts;

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Fig. 4 is a front elevational view, partially in section, of the tufting tables shown in Fig. 3;

Fig. 5 is a rear elevational view of the tables shown in Figs. 3 and 4, illustrating the location of the longitudinal cams on the outer table;

Fig. 6 is a top plan view of the tables with sections broken away to illustrate the driving mechanism;

Fig. 7 is an enlarged perspective view of the cam-operated switch arrangement employed with the inner table;

Fig. 8 is an enlarged elevational view of the drive mechanism;

Fig. 9 is a fragmentary perspective view showing the pulsing cam and switch mounted for operation in response to movement of the tufting heads;

Fig. 10 is a diagrammatic illustration of the tufting pattern carried out in the sequence of operations of the machine for tufting a mattress for a fullsize bed; and

Fig. 11 is an electrical diagram of the circuits for the machine and its controls.

Invention herein does not reside in the tufting heads or the operation thereof, separate and apart from the automatic indexing means whereby the mattress is located in proper position between the tufting heads for the desired operations. Detailed description of the tufting heads and their operation will not be made herein. For full description of such devices, reference may be had to conventional tufting machines available on the market, such as the United Automatic Button Tufter of the United Mattress Machinery Company of Quincy, Massachusetts.

Suffice it to say, that the tufting machine illustrated in the drawing comprises a frame 10 having an upper goose neck 11 which supports the upper tufting head 12 on the outer end thereof, and a lower section extending forwardly from the frame 10 on which the lower tufting head (not shown) is supported in alignment and in spaced relation beneath the upper head 12 for effecting the desired tufting operations on a mattress located therebetween.

The spindles of the upper and lower tufting heads of the described button-tufting machine are actuated through suitable mechanism by a self-contained motor located within the frame. Mounted on the side of the goose neck 11 for longitudinal displacement in timed relation with the movement of the spindles is an elongate rod 13 having a cam block 14 on an intermediate portion thereof in alignment to engage the end portion of a switch arm 15 extending outwardly in the path thereof from a micro-switch 16 fixed to the side of the goose neck. The switch 16 is made or broken in response to the movement of the spindle in the direction away from and back to normal position clear of the mattress therebetween.

Rigid with the frame 10 of the tufting heads, is a table-supporting frame 17 formed of angle irons or other rigid high strength material, including a plurality of spaced-apart upright legs 18, 19, 20, and 21 interconnected by cross-brace members 22 and 23 to form a rigid structure. Secured to the upper ends of the legs to form an integral part of the frame are a pair of laterally spaced-apart rails 24 and 25 in the form of elongate angle irons extending in the longitudinal direction.

An outer table 26 formed of frame members, dimensioned to be substantially greater in length and width than a standard mattress, is supported on rollers 27 which ride upon the rails 24 and 25 for guiding the table in free longitudinal movement relative the frame in the direction indicated by the arrow in Fig. 4 and by the arrow at the top in Fig. 3. The outer table 26 includes a flat panel 26^a having a narrow slot 26^b extending longitudinally across the panel in alignment with the tufting spindle for passage therethrough. The table is provided with side-boards 28 depending from the outer edges for concealing and protecting the rails and rollers located

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inwardly thereof. The ends of the outer table 26 are provided with upright members 29 which extend above the level of the surface of the table 26. These members are formed with elongate horizontally disposed grooves 30 in the inner wall which extend substantially the entire width of the table, intermediate the table and the upper end of the member 29. Spaced a short distance inwardly from the end members 29, elongate tracks 31 are fixed to the upper surface of the table to extend crosswise thereof for support of an inner table 32 having rollers on the underside of the end wall section 34 operable on the tracks 31 for shifting movement independently crosswise of the outer table 26 in the direction shown by the arrow to the left in Fig. 3.

The inner table is formed of interconnected sideboards and end walls 33 and 34 respectively extending upwardly and spaced one from another by a distance corresponding to the width and length of a mattress to provide a well therebetween for receiving a mattress in fitting relation on the panel of the outer table. The end walls 34 of the inner table extend upright in parallel relation with the walls 29 rigid with the outer table and in side by side relation therewith. The walls are provided with one or more ribs 35 in position to be received within the grooves 30 whereby the inner table is guided in transverse movement relative to the outer table. The length of the grooves 30 and the disposition of the ribs 35 function to control the extent of relative crosswise movement between the inner table and the outer table between limit positions, depending upon the length of the grooves and the location of the ribs.

Thus a mattress 36 positioned within the well formed by the upright walls of the inner table can be shifted lengthwise beneath the tufting heads and crosswise in the direction toward and away from the frame of the tufting machine to locate the tufting heads in alignment with different portions of the mattress. It will be understood that the central portions of the tables are open to enable the spindles of the tufting heads to engage the mattress from the top and bottom to effect the desired button-tufting operations.

The improvement embodying the features of this invention resides in the means for automatically shifting the outer table longitudinally and the inner table crosswise relative thereto, and for controlling the movements of the tables to index the mattress in proper position between the tufting heads whereby the tufting operations are caused to be carried out in a predetermined pattern until the entire mattress has been tufted. Such operations are carried out completely automatically from start to finish, notwithstanding interruptions for repair for the elimination of obstacles and the like which might interfere with the proper operation of the machine, or other stoppages which occur in response to controls by various safety features for protection of the machine or the mattress which is being tufted.

The outer table 26 is adapted to be actuated for movement longitudinally on rails 24 and 25 and the inner table is actuated for sliding movement transversely of the outer table on tracks 31 by means of a reversible driving motor 40 mounted on the underside of the outer table. The driving mechanism includes a transmission gear 41 operated from the drive shaft of the reversible motor and from which driven shafts 42 and 43 extend in both directions longitudinally beneath the outer table.

The driving relationship between the outer table and the driving motor to effect displacement in one direction or the other on the rails, is controlled by means of a brake 44 and a clutch 45 mounted in closely spaced-apart relation on the shaft 42 with a roller portion 46 therebetween which functions as a pulley about which an intermediate portion of a cable 47 is wound. One portion of the cable extends rearwardly from the pulley 46 about an idler roller 48, and then longitudinally in one direction for attachment to a bracket 49 secured to an end portion

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of the rail 24. Conventional means, such as illustrated by the numeral 50, are provided for taking up the slack in the cable. The other portion of the cable 47 extends similarly forwardly about a second idler roller 51 secured to the underside of the outer table, and then longitudinally in the opposite direction for attachment to a bracket 52 fixed to the other end portion of the rail 24. Thus the table will be displaced longitudinally in one direction or the other in response to turning movement of the pulley 46 as controlled by the direction of operation of the reversible motor 40 and the actuation of the clutch 45 to effect movement, or the brake 44 to lock the table in position and prevent movement. A similar brake 53 and clutch 54 assembly is provided on the portion of the shaft 43 extending in the other direction from the gear box 41 for control in movement of the inner table 32. A pulley 55 between the clutch 54 and brake 53 is operatively connected by a belt or chain 57 to a driven pulley 56 on an elongate shaft 58 mounted for free rotational movement in bearing members anchored in the end portions of the outer table. An endless cable 59 operates between a sheave 60 fixed to one end of the shaft 58 and an idler roller 61 secured to a spaced-apart portion of the outer table. An arm or block 62 fixed to an intermediate portion of the upper flight of the cable 59 operatively engages a keeper 63 rigid with the inner table 32 to cause displacement thereof responsive to movement of the cable 59 in one direction or the other.

Fixed, as by welding, to the rear wall of the side plate 28 of the outer table for movement therewith in the longitudinal direction is a cam plate 64 in the form of a shelf having a number of cam members 65 adjustably secured to the surface thereof with the tapered cam ends 66 extending into the path of a roller 67 on the end of a pivotally mounted switch arm 68 extending laterally from a microswitch 69 stationarily mounted to the frame supporting the outer table. The cam members 65 are preferably formed with an elongate crosswise slot 70 through which a bolt member 71 extends for securing the cam member in the desired position of adjustment on the cam plate. Instead of providing the cam member with a slot for longitudinal adjustment, the cam plate may be constructed with numerous closely spaced-apart slots for flexibility in adjustment of the cam members in the desired laterally spaced-apart relation.

The number of cam members 65 secured in longitudinal spaced-apart relation on the cam plate 64 is adapted to correspond to the number of positions of longitudinal adjustment for indexing the mattress under the tufting heads and with a similar spaced relation therebetween, as indicated on the tufting diagram of Fig. 10. In addition to the longitudinal indexing cams, the cam plate 64 is provided with cam members 72 and 73 at the extreme end portions. These cam members function as safety devices for operation of a microswitch 74 which functions to set the longitudinal brakes of the driving mechanism in the event that the travel of the outer table is permitted inadvertently to continue beyond predetermined positions and which thereby prevents the table from running off the rails.

Similarly, a horizontally disposed cam plate 75 is fixed to the outer wall 34 of the inner table and cam members 76 are similarly secured to the upper surface thereof in spaced-apart relation with the cam ends 77 of the cam members extending outwardly into the path of a switch arm 78 of a microswitch 79 which is fixed to the end wall of the outer table for movement therewith. The number of cam members secured to the transverse cam plate 75 corresponds to the number of indexing positions for tufts arranged crosswise of a full-size mattress, and similar means of adjusting the location of the cam members are provided for flexibility in indexing the mattress between the tufting heads.

To the present, description has been made to the construction of the tables, their driving mechanism, and

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the controls for indexing the tables in the desired positions relative to the tufting heads. As previously pointed out, the tables are actuated by the reversible motor 40 which operates continuously during the tufting cycle. When the brakes are set, the tables are locked in position. In the event that the brakes are open and the clutches remain disengaged, the tables become free for movement manually in either of their directions. When the transverse brake 53 is set and the longitudinal clutch 45 is engaged with the drive shaft, the table will be actuated longitudinally by the cable 47 in one direction or the other, depending upon the direction of the driving motor until the clutch 45 is released and the brake 44 is set. Similarly, the transverse clutch 54 will cause transverse movement of the inner table until the clutch is released and the brake 53 is set. Because of the co-operative relationship, the control means are adapted by solenoid operation or the like to shift from one position to the other to effect engagement of the clutch and disengagement of the brake, or operation of the brake and disengagement of the clutch, except for the few instances when the operating member is shifted to a neutral position for releasing the table to manual operation, as will hereinafter be pointed out.

The movements of the tables are largely controlled by electrical means located within a control panel 80, including a plurality of stepping switches 81 which are displaced stepwise responsive to momentary actuation of the microswitches 69 or 79 upon engagement with the cam members 65 or 76. Relays are connected to certain of the stepping switches for operation and to the spindle-pulsing switch 16 for actuation of one or the other of the brakes or clutches to enable movement of the table in one direction or the other to a desired indexing position.

Detailed description herein will be made of the elements in the electrical circuit which are controlling in the various operations of the machine rather than to make description of each of the components of the electric circuit which would tend to confuse rather than clarify the description of the operations of the machine. For purposes of complete identification of the elements in the electrical circuit, a photostatic copy of the circuit illustrated in Fig. 11 of the drawing is included herewith as a part of the specification, in which the various elements are numbered and the circuit can be traced by reference to such numerals, symbols and the like, but these numbers should not be confused with the numerals employed in the description of the apparatus as heretofore set forth.

In the electrical diagram, the longitudinally spaced end cams are indicated by the numeral 65 while the numerals 69 indicate the microswitches operated thereby. The side cams are represented in the diagram by numeral 76 and numeral 79 represents the microswitches operated by these cams. The head pulsing cam block is indicated by the numeral 14 and the numeral 16 indicates the microswitch operated thereby.

The operation of the controls depends on the pulses originating from cams 65 and 76 located in positions to operate the microswitches 69 and 79. As the microswitches ride over the cam members, pulses are generated for a duration somewhat longer than that needed to operate the slow acting relays SO_2 and SO_3 . These relays are slug loaded for transmitting a pulse of fixed duration regardless of the length of pulse derived from the actuating cam. The microswitches are closed only when on a cam member. The head pulsing microswitch 16 is normally closed whenever the spindle or head of the tufting machine is clear of the mattress. The latter microswitch generates pulses which feed to relay SO_1 via relay F.

Relay A functions to accept pulses only when the table is stopped and in position to receive a button by

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operation of the tufting head. This relay is closed in advance of the operation of the SO_1 relay.

Relay B operates whenever the inner table moves in a transverse direction and serves to accept pulses from the microswitch 69 operated by the end cams 65 via relay X and relay SO_3 .

Relay SO_4 locks in during the whole tufting cycle and activates the cycle light.

Relay H serves as a brake in the electrical lock of relay SO_4 . This relay functions upon completion of the cycle of operations and upon resetting of the stepping relay 1.

Relay V is used to interrupt the pulse line and also to release the brakes whenever the manual automatic switch 100 is thrown. Relay K forms a part of the expander circuit and serves to transfer both pulse and power between stepper 101 and stepper 105.

Relay K_2 is used to augment operation of relay K. This is a latching relay which trips upon operation of relay K and it holds relay K in until it receives a release pulse.

Relay J forms the second part of the expansion circuit. With relays K and L inoperative, the operation of relay J is between stepper 101 and stepper 104. At all other times this relay passes the pulse line and power to steppers 101, 102, 103, 104 and 105.

Relay J_2 operates for the same reason as relay K_2 . The purpose of this relay is to insure proper transfers between the steppers so that they will transfer in sequence from stepper 101, to stepper 102, etc., and then back to stepper 101.

Relay L is the final part of the pulse and power expander circuit. With the relay K and relay J inoperative, relay L transfers between steppers 101 and 102. With relay J operative and relay K inoperative, relay J transfers between steppers 103 and 104. Relay L_2 is similar in operation to relays J_2 and K_2 .

The basic operation of the steppers 101, 102, 103, 104 and 105 and their stepping coils ST_1 , ST_2 , ST_3 , ST_4 and ST_5 is to provide the memory bank which calls off the movements of the table. Power is fed into each of the steppers on a rotor, via expansion relays K, J, L and, as the stepper coil is actuated by the pulses from the cam operated microswitches, power is transmitted from the rotor to certain of the stepper stator contacts and then to the correct relays connected therewith to actuate the clutches and brakes and effect other calculated functions. The distribution of power takes place in the stator where connections come off of the lug points and go to the final activating relays. When the rotor reaches the 25th position of A stepper, the next stepper in sequence is activated by the action of K, J and L relays. In changing to the next stepper, the rotor of the preceding one is moved to position 26, which is the home position clearing the stepper. There are no taps on position 26 so as to prevent the possibility of cross-connections.

Steppers 101, 102 and 105 are similar in operation in that power is delivered to all rotor contacts. In steppers 103 and 104, power is passed also through relays S_1 and S_2 . The reason for this is to provide a means of cancelling out the last two rows of tufts when it is desired to process a mattress for a single size bed as distinguished from a normal mattress for a full size bed. As stepper 103 approaches the last two rows, it cancels out the balance of its steps and power is transferred over to stepper 104 which cancels out approximately one-third of its steps. At this point, relays S_1 and S_2 open, and normal stepping operation is resumed. In order to provide sufficient time for this cycling operation, the tufting heads are momentarily stopped in their operation. The tufting heads are also stopped momentarily while tufting a standard mattress after button 24, corresponding to position A_{24} on the stepper and corresponding to the position 24 on the diagram of Fig. 10 in order to give the drive motor time to reverse, and move the table to button 25 on Fig. 10.

Relays S_1 and S_2 operate, as described, to cut out certain steppers which are not used when the smaller size mattress of a single bed is being tufted. The pilot light 107 becomes illuminated whenever switch 106 is thrown for such operation, though the relays do not operate until stepper 103 has cancelled off its positions.

Located to the left of each stepper is a pair of contacts used to provide a home position. These are off normal contacts. This is normally position 26 on the stepper diagram. At the start of the tufting cycle, stepper 101 is not on position 26 as in the other steppers. Instead, the tufting cycle is started with the rotor on position 1 in stepper 101. As soon as the stepper 101 proceeds through its operation, it stops at position 26 until stepper 105 completes its movement. Stepper 101 is then triggered to the number 1 position where it functions to turn off the controls in preparation of a new cycle of operation.

Essentially, the operation of the steppers is to cause the final three relays C, D and E to activate the clutches, brakes and reverse the motor by selecting the correct time position indicated in the diagram by the letters A with the sub-numerals corresponding to the tufting position to which the table is indexed thereby, as set forth in the diagram of Fig. 10.

Relay C controls the longitudinal movement of the table. This relay applies power to the brake 44 whenever it is not activated and it supplies power to the clutch 45 when it is activated.

Relay D controls the transverse movement of the table. This relay applies power to the brake 53 whenever it is not activated and to the clutch 54 when it is activated.

Relay M is an emergency relay. Its function is to interrupt the operation of relays C and D whenever the thread protector switch (not shown) on the upper and lower tufting heads is tripped or in the event that cams 72 and 73 operate microswitch 74 as the table exceeds its normal travel in one direction or the other.

This relay has the feature of an electrical locking circuit that holds the relay until the fault has been cleared or corrected. For resetting the machine to return to automatic operation, it is necessary to actuate the automatic starting button 108 which interrupts the locking of relay M.

Relay E operates to reverse the driving motor 40. This is accomplished by reversing two of the three motor phases. Relay E is located on the power supply panel illustrated in the attached drawing forming a part of this specification but it is not indicated in the electrical diagram of Fig. 11.

Relay R_1 is an intermediary relay composed of two identical coils operating the same relay contacts. Relay R is tied in with relay M and the stop positions R on the steppers. It actuates the stopping solenoid on the head clutch. In the event that relay M operates, the tufting head is turned off regardless of any other operation.

Relay N operates the tufting head clutch start solenoid for driving the tufting head at the start of the tufting cycle.

Relay P is used whenever it is desired to return the stepping switches to home position. The relay is activated whenever the home button 109 is actuated on the pendant control. When relay P closes, power is interrupted to the stepper rotors and is applied to the G_2 , G_3 , G_4 and G_5 contacts for each stepper. This returns all of the steppers to the 26th position or home position. In the case of stepper 101, power is applied to a special rotor and G_1 contact causing stepper 101 to stop at the No. 1 position instead of the 26th position. The four latching relays, previously pointed out, are returned to normal position.

Relay K_3 serves the function of a delay between the end of steppers 105 and 101. This relay also assures

that relay K_2 is released when the tufting cycle has been completed.

It is desirable to avoid having a cam near the start of the tufting operation and, for this purpose, a special relay is used to serve as a synthetic cam to perform the functions of getting the machine started and preventing erroneous cross-feeds from one relay to another. This relay comes into use only during the first few steps of the first stepping switch and is returned to its normal position for balance of the tufting position.

A pendant (not shown) hangs down over the table within easy reach of the operator. It is provided with buttons for operation of the controls including a button 110 which is depressed to turn the machine on, an off button 111, a cycle starting button 108 and a cycle stopping button 112, a button 109 for returning the steppers and the table to home position, a button 106 which cuts out certain steppers for tufting of mattresses of smaller dimension, a manual button and an automatic button 100. The relays and the steppers for the control are mounted within the housing 80 and pilot lights are provided in the front panel including a light 113 which becomes illuminated when the A.C. current is on, a light 114 for indicating automatic operation, a light 115 for indicating the operation of button 106, and a light (not shown) which is on when the machine is on manual operation.

Operation

At the start, a mattress 36 is placed in position on the inner table 32 and the main power switch 110 on the pendant is turned on. This starts the drive motor which continues to operate throughout the tufting cycle.

The automatic switch 100 in the pendant is then depressed to start the tufting cycle. When the automatic switch is depressed, the longitudinal brake 44 and the transverse brake 53 become set to lock the tables in the home indexed position. As previously pointed out, the longitudinal brake 44 and the longitudinal clutch 45 for controlling the movement of the outer table are thrown in or out by relay C. The transverse brake 53 and the transverse clutch 54 are controlled through relay D.

To start the tufting cycle, the operator pushes the start button 108 on the pendant. This operates relay N which, in turn, operates the start solenoid and throws in the clutch of the tufting head. The tufting heads are then actuated continuously through their cycles of operation to button-tuft a section of the mattress disposed therebetween. The operation of the tufting head continues uninterrupted throughout the entire cycle of operations for tufting a complete mattress except for a short period when the clutch of the tufting head is thrown out when the rotor is on stepper 24 for a full size mattress or on stepper 18 for a small size mattress to enable reversal of the motor of the table drive and to enable the table to move in two separate directions. It is the requirement of the indexing means to cause movement of the table from one indexed position to the other from the time that the tufting heads clear the mattress until the mattress is re-engaged for the next button tufting operation.

While in home position, the tufting head goes down once and returns to starting position. During this period, the heads operate in the normal manner to make a button tuft in the mattress. As the head 12 clears the mattress, the cam block 14 on link 13 is displaced to engage microswitch 16 which generates a pulse that feeds to relay SO_1 via relay F and releases the longitudinal brake 46 and throws in the clutch 45 as controlled by the stepping switches. This causes the driving motor 40, through the cable 47 and connections to the ends of the rail 24, to displace the table in the direction to the right in Fig. 1 and to the left in Fig. 6 and in the tufting pattern diagram of Fig. 10. Each time that the arm 68 of the microswitch 69 rides over a cam 65, a pulse is generated which causes the rotor of the stepper

101 or the rotors of the other steppers which are then in operation to advance to the next stepper contact. Thus the table will travel longitudinally and engage cams which click off the steps until an "A" contact is reached, such as contact A₂, wherein the power flows through the rotor to the contact of A₂. The relay C releases the clutch 45 and sets the transverse brake 44 for locking the table in the indexed position. These indexing movements are achieved before operation of the tufting head in its next cycle with the result that the mattress has become indexed in its second position for the next button tufting operation.

Again, as the tufting head clears the mattress, the cam 14 operates microswitch 16. This operates relay C to release the brake 44 and throw in the longitudinal clutch 45 to effect further table movement in the longitudinal direction. Similarly, the steppers are clicked off as the microswitch is engaged by the cam member 65 until the rotor reaches stepper A₃. This releases relay C for releasing the clutch and setting the brake to lock the table in position No. 3. By way of explanation, it has been found that in order to effect uniform tension in the mattress cover and uniform distribution of forces within the mattress, it is desirable to button tuft a mattress in spaced apart portions in various rows differing between themselves and the spaced relation between cams and to fill in the space in other rows. Therefore, the number of cam members provided in the longitudinal and transverse cam plates is adapted to equal the number of tufting positions longitudinally and transversely but some will be passed by for effecting tufts in one row but will be active for indexing the table to effect tufts in intermediate rows for developing the desired pattern. As a result, the steppers are advanced by cam engagement, but only certain of the steppers operate to lock the table in the indexed position in one row of tufts while other steppers operate to lock the table in indexed positions corresponding to the other cams in intermediate rows. The numerals in the circles in the tufting diagram will correspond to the cam positions in the transverse and longitudinal rows. The numerals outside the circles in the tufting diagram indicate the tufting positions and they correspond with the numerals of the operative lugs A in the steppers. Whenever the stepper rotor reaches an A lug of that number, it is intended that the table will be indexed in the corresponding position in the mattress diagram.

The sequence of operations described continues until the table reaches cam 3 and the rotor has been displaced to stepper A₆. At this point, when the tufting head clears the mattress, microswitch 16 operates to activate relay D and release the transverse brake 53 and throw in the clutch 54. As a consequence, with the longitudinal brake set, the inner table travels crosswise. As the cams 76 engage the microswitch 79, the stepper rotor continues to count off its impulses until it reaches stepper A₇. Relay D is then released to release the clutch and set the brake for locking the table in the indexed position beneath the tufting head in position 7 of the diagram. Upon engagement with contact A₇, the motor 40 reverses and, as the tufting head clears the mattress, the relay C is again operated to release the longitudinal brake 44 and throw in the clutch 45 whereby the table is carried longitudinally back towards the first indexing position but in the next crosswise row of the tufting pattern.

This sequence of operations for displacing the table back and forth and crosswise between indexing positions continues in the manner described, as controlled by the steppers, until the table is indexed in the upper corner of the mattress in position 24 with the stepper on contact A₂₄ in stepper 103. When the microswitch 16 is operated when the tufting head clears the mattress, the table is required to move first in the crosswise direction and then in the reverse direction, as controlled by the steppers. Since these combinations of movements require more time than heretofore available between the cycles

of the tufting head, the clutch of the tufting head is thrown out, as previously described, until the table becomes indexed in position 25. The cycle then continues in the manner described to fill in the positions between the tufts previously applied, as indicated by the tufting diagram in Fig. 10.

When the final button tuft is made in the mattress, the tagle is away from home by nine cams in the longitudinal cam plate and one cam in the crosswise cam plate. When cam 9 is engaged to advance the stepper to A₃₉ whereby the table is locked in its indexed position for taking the 39th tuft, operation of the microswitch 16 functions to cut off the power for the tufting head. Relays C and D are operated and all of the brakes are released and relay E is operated to reverse the motor with the result that the table wanders longitudinally and crosswise with the clutches thrown in back toward starting position, clicking off the steppers as the cams are engaged until the proper number of steps have been counted off for return of the table to home indexing position. The table will take the path shown by the broken lines in the tufting diagram. When the stepper rotor reaches the 1 position in stepper 101, the table will be home and the relays C and D will become inactivated to set the brakes and lock the table in home position.

By way of safety features, there is provided a manual throw-out clutch in the tufting head. The clutch throws out whenever a knot has been improperly tied. In accordance with the further practice of this invention, a safety microswitch is provided both in the upper head and in the lower head for actuation by throw-out of the clutch. This microswitch operates relay R which throws out the clutch of the tufting head and interrupts the tufting cycle—leaving the cycle in the position in which it was interrupted.

Similarly, safety switches are provided for actuation by the needle of the tufting head in the event that an obstruction is encountered. As previously described, microswitches 74 also operate similarly to cut off the clutch of the tufting head, temporarily to stop operation until the defect has been corrected.

When any of the safety switches are activated to stop the tufting cycle, the operator presses the manual button on the pendant which operates relay V. This interrupts power to relays C and D placing them in an inactive position in which neither of the brakes or clutches are effective. The tables can be freely moved in any direction to get at the difficulty or repair the cord on the tufting head or the like. When it is desired to resume the tufting cycle, the table can be indexed manually to the position where it left off and automatic operation continued in sequence by pressing the automatic button and then the automatic start button.

When a mattress of lesser width is to be tufted, it is advisable to make use of an adjustable end wall for providing the desired spaced relation properly to seat the mattress on the inner table. When button 106 is depressed, the stepper contacts from A₁₉ to A₂₉ in steppers 103 and 104 will be cut out by relays S₁ and S₂, as previously described, so that the table will skip the last two rows of indexing positions illustrated in the diagram. Under such circumstances, the tufting clutch will be thrown out when the table has been indexed to position 18 so as to enable the table to shift transversely and then longitudinally for travel from position 18 directly to position 30 in the tufting diagram.

It will be apparent from the foregoing that description is made to a new and improved machine for automatically indexing mattresses in position for engagement by tufting heads automatically to tuft an entire mattress in a simple and efficient manner with considerable savings in time and labor and with considerable improvement in the quality of the mattress that is tufted. It will be apparent that various means are provided for adjusting the location of the tufts that are taken to comply with

various requirements and patterns in tufting a mattress and that means are described wherein any predetermined sequence of operations may be carried out to cause a button tufting to take place in a predetermined pattern and in a predetermined sequence.

The concepts of this invention also embody means whereby the device may be returned to manual operation for repair and means for discontinuing the cycle of operations in the event of error in the operation of the machine or engagement with various types of obstructions.

It will be understood that changes may be made in the details of construction, arrangement and operation without departing from the spirit of the invention, especially as defined in the following claims.

We claim:

1. In a mattress tufting machine including upper and lower tufting heads for engagement to tuft a mattress located therebetween, the improvement which comprises means for automatically registering the mattress intermittently in a desired sequence of tufting positions between the tufting heads, comprising a rigid frame, an outer table mounted on said frame for horizontal movement in a longitudinal direction between the tufting heads, an inner mattress supporting frame mounted on the outer table for horizontal movement relative to the outer table and in an opposite direction between the tufting heads, said outer table having an elongate slot extending longitudinally in the direction of movement in alignment with the tufting heads for enabling operation of the heads therethrough to engage the mattress for tufting, driving means operatively engaging said outer table and inner frame for displacing the outer table in the longitudinal direction and for displacing the inner frame in the crosswise direction, and means operative intermittently upon completion of a tufting cycle for rendering said driving means effective for displacing the table and frame members in the direction to position the mattress in the next of the desired positions of registry in sequence between the tufting heads.

2. An automatic tufting machine as claimed in claim 1 in which the inner frame member is open at the top and at the bottom for enabling engagement between the tufting heads and the mattress in its various positions of registry between the tufting heads.

3. In a tufting machine including upper and lower tufting heads for engagement to tuft a mattress located therebetween in a predetermined pattern, the improvement which comprises means for automatically registering the mattress in a desired sequence of tufting positions between the tufting heads including a rigid frame, an outer table mounted on the frame for horizontal shifting movement in the longitudinal direction, an inner table mounted for horizontal movement relative to the outer table in a substantially crosswise direction and having means for receiving the mattress to be tufted thereon, driving means operatively connected with said outer and inner tables to effect displacement thereof in the desired directions when effective, locking means for holding the tables against movement, and means for rendering said driving means and locking means effective and ineffective in a sequence of operations responsive to the completion of each tufting cycle for causing displacement of the tables to predetermined positions for registry of the mattress between the tufting heads in the desired positions for tufting.

4. A tufting machine as claimed in claim 3 which includes means for limiting movement of the inner table relative to the outer table between two limit positions.

5. A tufting machine as claimed in claim 3 which includes manually operated means for rendering said driving means and said locking means ineffective to control movements of the tables thereby to enable movement of said tables in any direction within limit positions.

6. A tufting machine as claimed in claim 3 which in-

cludes electrical controlling means for rendering said driving means and locking means selectively effective and ineffective to cause stepwise movements of the tables for positioning the mattress between the tufting heads in a predetermined sequence of tufting positions.

7. A tufting machine as claimed in claim 6 in which the electrical control means includes stepping switches some of which are connected for operation of means for rendering said driving means and locking means effective and ineffective and means responsive to movement of the tables for advancing said stepping switches.

8. A tufting machine as claimed in claim 7 in which the means responsive to the movement of the tables for advancing said stepping switches comprises a switch operating member mounted on one of said members including the outer table and supporting frame and a plurality of cam members mounted in longitudinally spaced apart relation on said other member with portions thereof lying in the path of the switch operating means for actuation thereof upon engagement, and a connection between said switch operating means and the steppers for advancement thereof upon operation.

9. A tufting machine as claimed in claim 7 in which the means responsive to movement of the table for advancing said stepping switches includes a switch means mounted on one of said members including the outer table and the inner table and cam means mounted on the other in laterally spaced apart relation with portions thereof in the path of the switch operating means for effecting operation thereof upon engagement and a connection between said switch and the steppers for advancement thereof upon operation.

10. A tufting machine as claimed in claim 7 including means for automatically returning all of the elements including the tables and the stepping switches to starting position.

11. A tufting machine as claimed in claim 8 in which the cam members are rigid with the outer table and located thereon in longitudinally spaced apart relation in alignment with the registry positions of the tables.

12. A tufting machine as claimed in claim 3 which includes means for rendering said driving means ineffective in response to interference with the tufting heads during tufting operations.

13. In a tufting machine including upper and lower tufting heads for engagement to tuft a mattress located therebetween in a predetermined pattern, the improvement which comprises means for automatically registering the mattress in a desired sequence of tufting positions between the tufting heads including a rigid frame, an outer table mounted on the frame for horizontal shifting movement in the longitudinal direction, an inner table mounted for horizontal movement relative to the outer table in a substantially crosswise direction and having means for receiving the mattress to be tufted thereon, driving means operatively connected with said outer and inner tables to effect displacement thereof in the desired directions when effective, locking means for holding the tables against movement, means for selectively rendering said driving means and locking means effective and ineffective in a sequence of operations for causing displacement of the tables to predetermined positions for registry of the mattress between the tufting heads in the desired positions for tufting, means responsive to completion of a tufting operation for selectively rendering a locking means ineffective and concurrently rendering the corresponding driving means effective for movement of said tables in a desired direction to displace the mattress to the next position of registry between the tufting heads before start of the next tufting cycle, and including means responsive to the movement of the tables to the position for registry of the mattress in its next tufting position for rendering said driving means ineffective for movement of the table and concurrently render-

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ing said locking means effective to hold the mattress in the registered position.

14. A tufting machine as claimed in claim 13 which includes means for limiting movement of the outer table between two limit positions.

15. A tufting machine as claimed in claim 14 which includes means responsive to movement of the table to either of said limit positions for rendering said driving means ineffective to cause displacement of the tables.

16. A tufting machine as claimed in claim 13 in which the means responsive to the completion of the tufting cycle for rendering said driving means selectively effective and said locking means selectively ineffective comprises a switch and means operable with the tufting heads for engagement of the switch when the tufting heads clear the mattress.

17. In combination with a machine for tufting mattresses and like articles having a tufting mechanism operable to insert a tuft through the article, an article supporting table assembly including diversely movable supports on which the article is movable in diverse directions with relation to the tufting mechanism for the in-

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section of tufts in adjacent rows over the length and width of the article, means for actuating the tufting mechanism in a series of tuft inserting operations, means acting automatically after each tuft inserting operation for imparting stepped movements to said supports of said table assembly in said diverse directions from one to an adjacent tufting position, and control means for effecting said successive stepping movements in accordance with a pattern.

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