

June 10, 1969

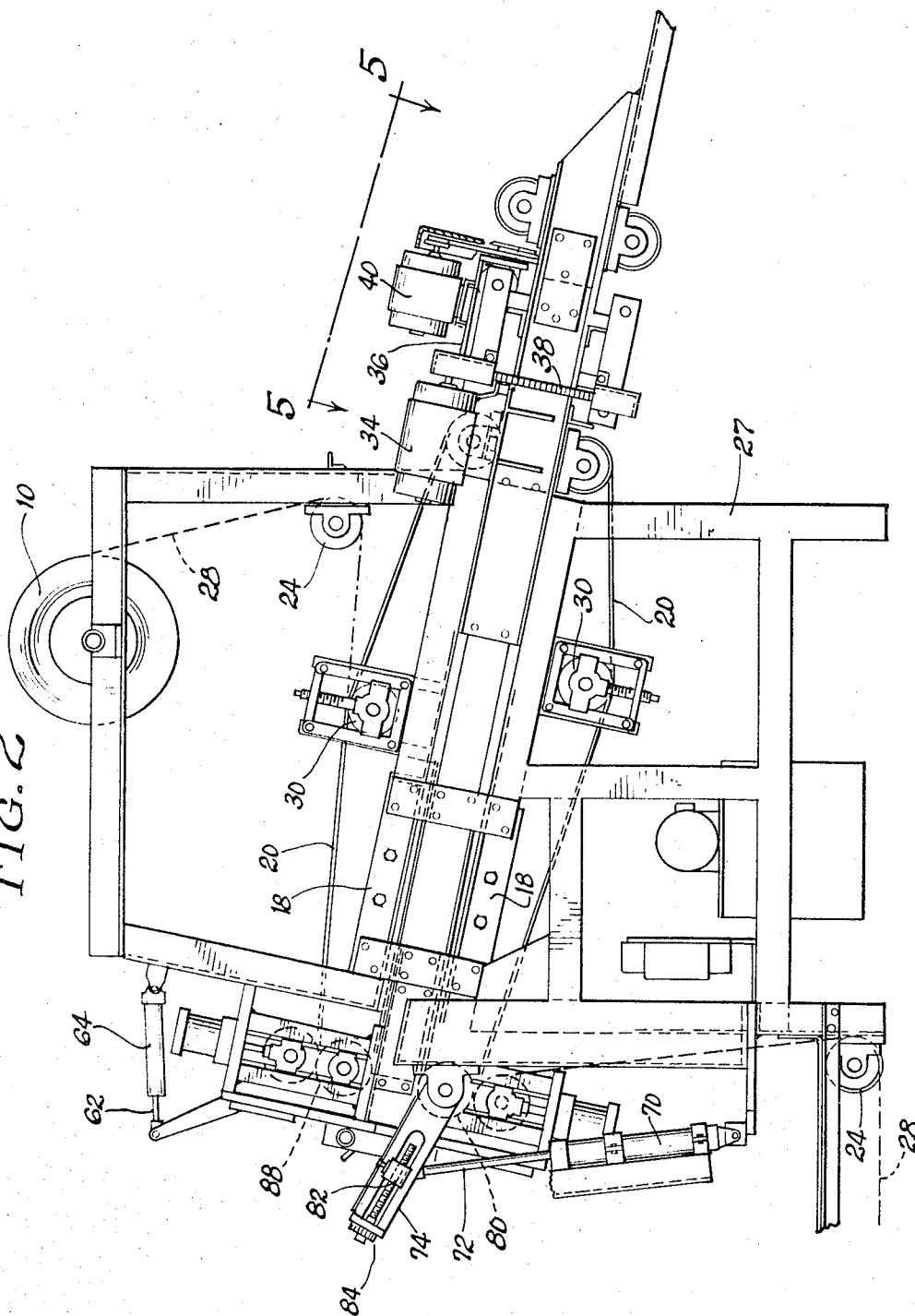
E. L. BRONSTIEN, JR., ET AL
SYSTEM FOR THE PRODUCTION OF MATTRESS
AND CUSHION CONSTRUCTIONS

3,449,190

Filed March 14, 1966

Sheet 2 of 12

FIG. 2



June 10, 1969

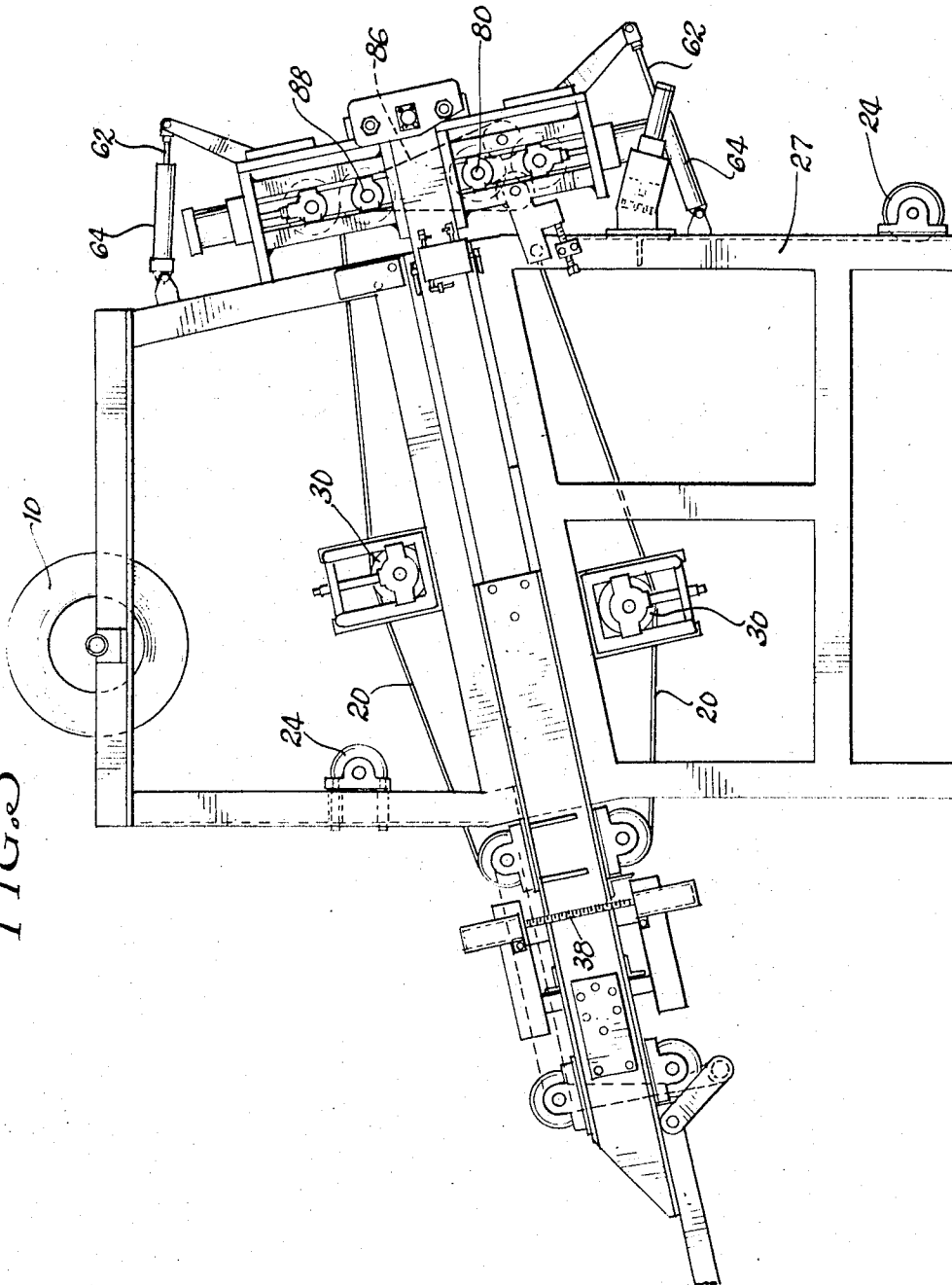
E. L. BRONSTIEN, JR., ETAL
SYSTEM FOR THE PRODUCTION OF MATTRESS
AND CUSHION CONSTRUCTIONS

3,449,190

Filed March 14, 1966

Sheet 3 of 12

FIG. 3



June 10, 1969

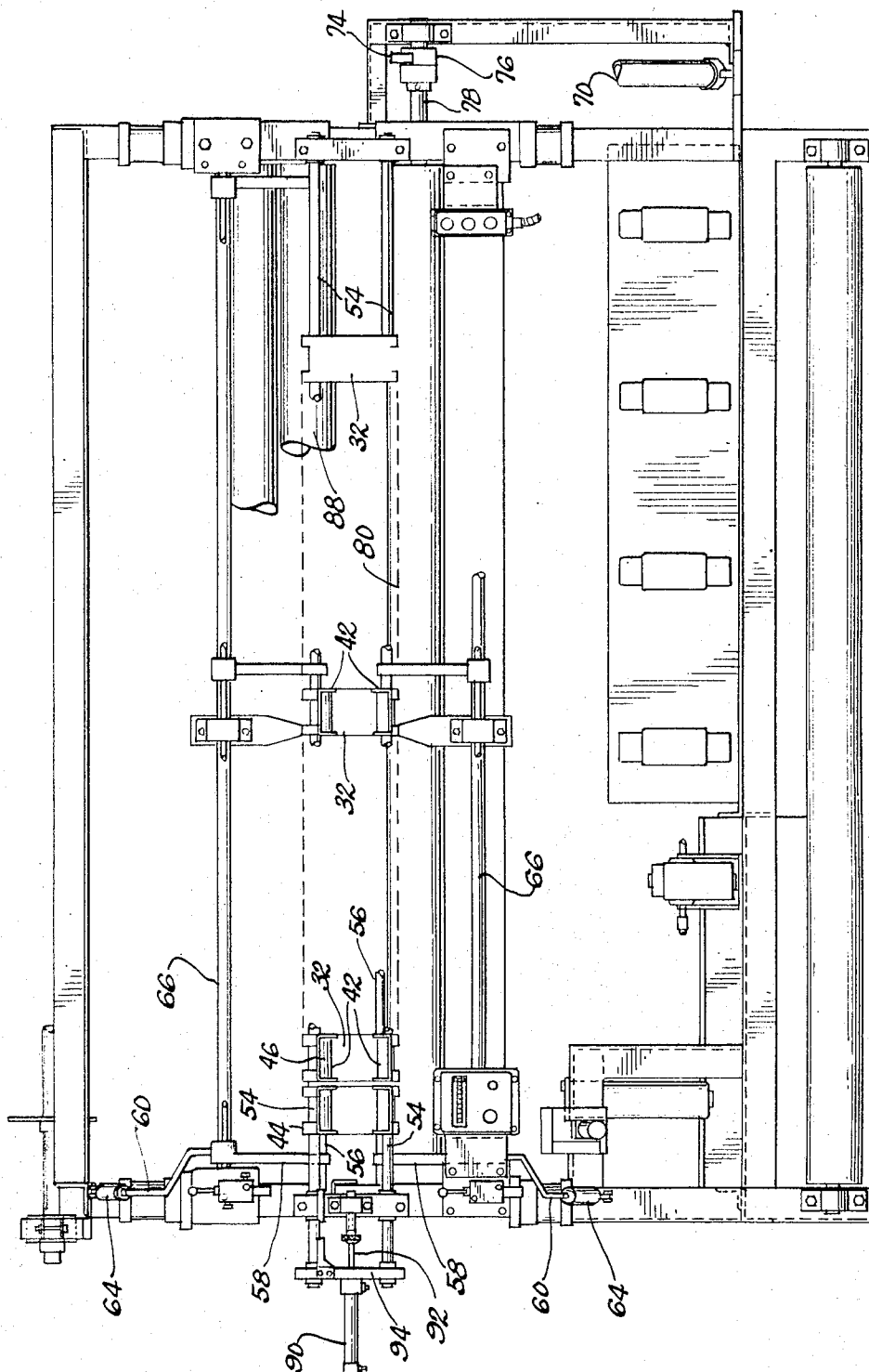
E. L. BRONSTIEN, JR., ET AL
SYSTEM FOR THE PRODUCTION OF MATTRESS
AND CUSHION CONSTRUCTIONS

3,449,190

Filed March 14, 1966

Sheet 4 of 12

FIG. 4



June 10, 1969

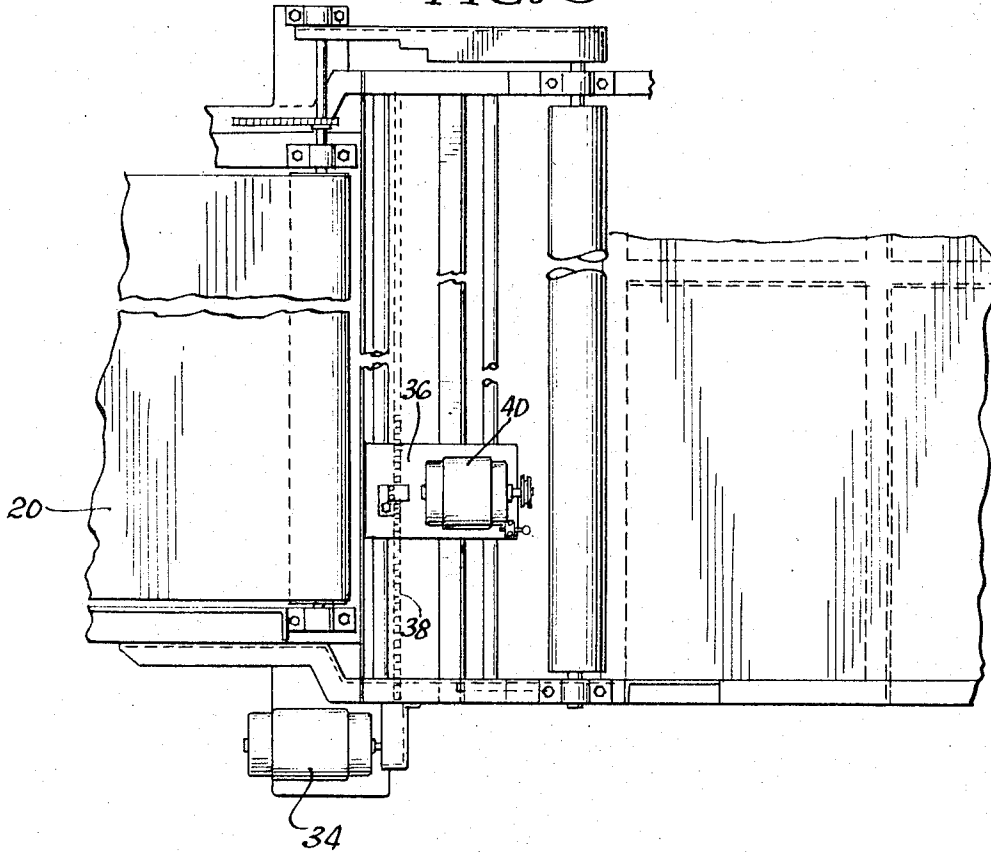
E. L. BRONSTIEN, JR., ET AL
SYSTEM FOR THE PRODUCTION OF MATTRESS
AND CUSHION CONSTRUCTIONS

3,449,190

Filed March 14, 1966

Sheet 5 of 12

FIG. 5



June 10, 1969

E. L. BRONSTIEN, JR., ETAL
SYSTEM FOR THE PRODUCTION OF MATTRESS
AND CUSHION CONSTRUCTIONS

3,449,190

Filed March 14, 1966

Sheet 6 of 12

FIG. 6

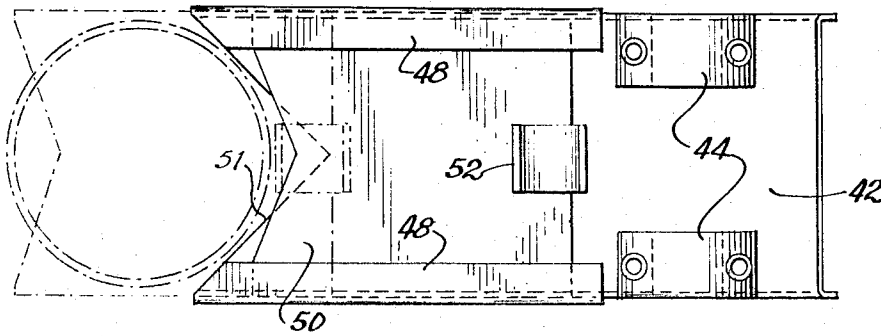


FIG. 7

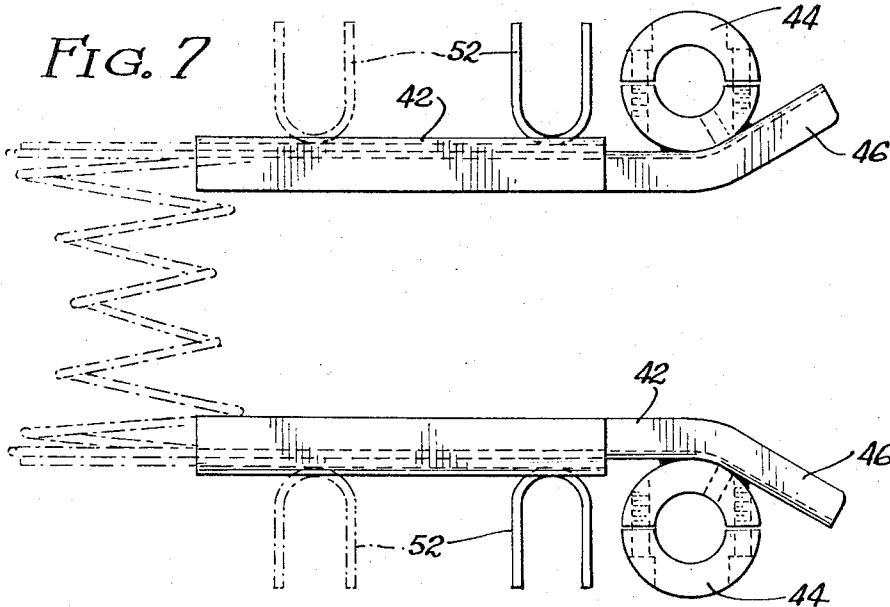


FIG. 9

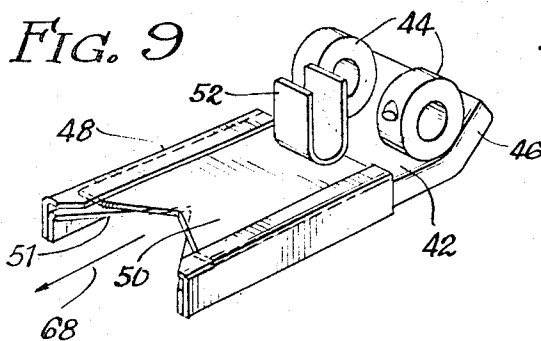
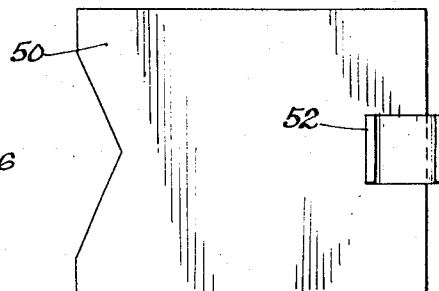


FIG. 8



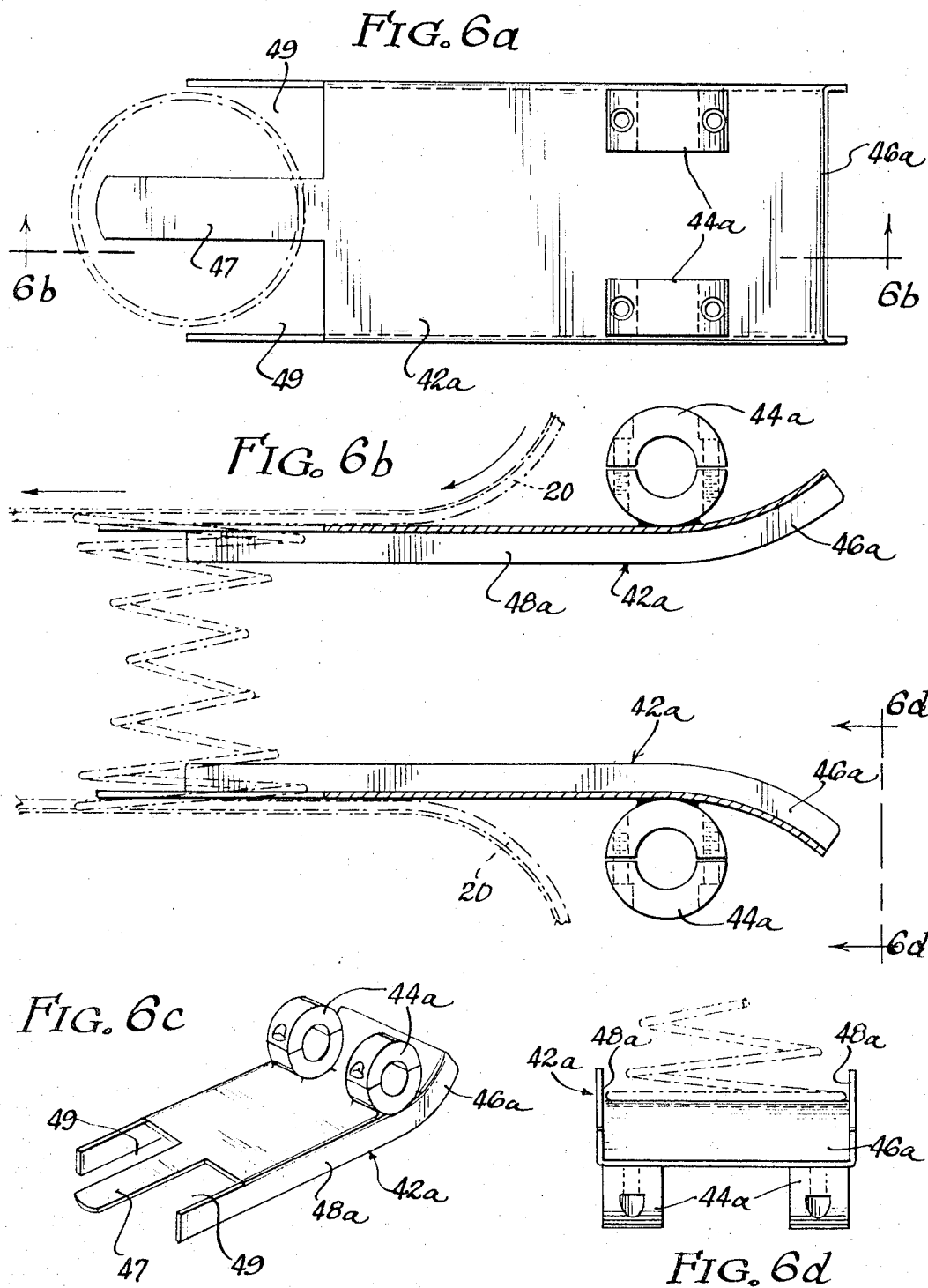
June 10, 1969

E. L. BRONSTIEN, JR., ETAL
SYSTEM FOR THE PRODUCTION OF MATTRESS
AND CUSHION CONSTRUCTIONS

3,449,190

Filed March 14, 1966

Sheet 7 of 12



June 10, 1969

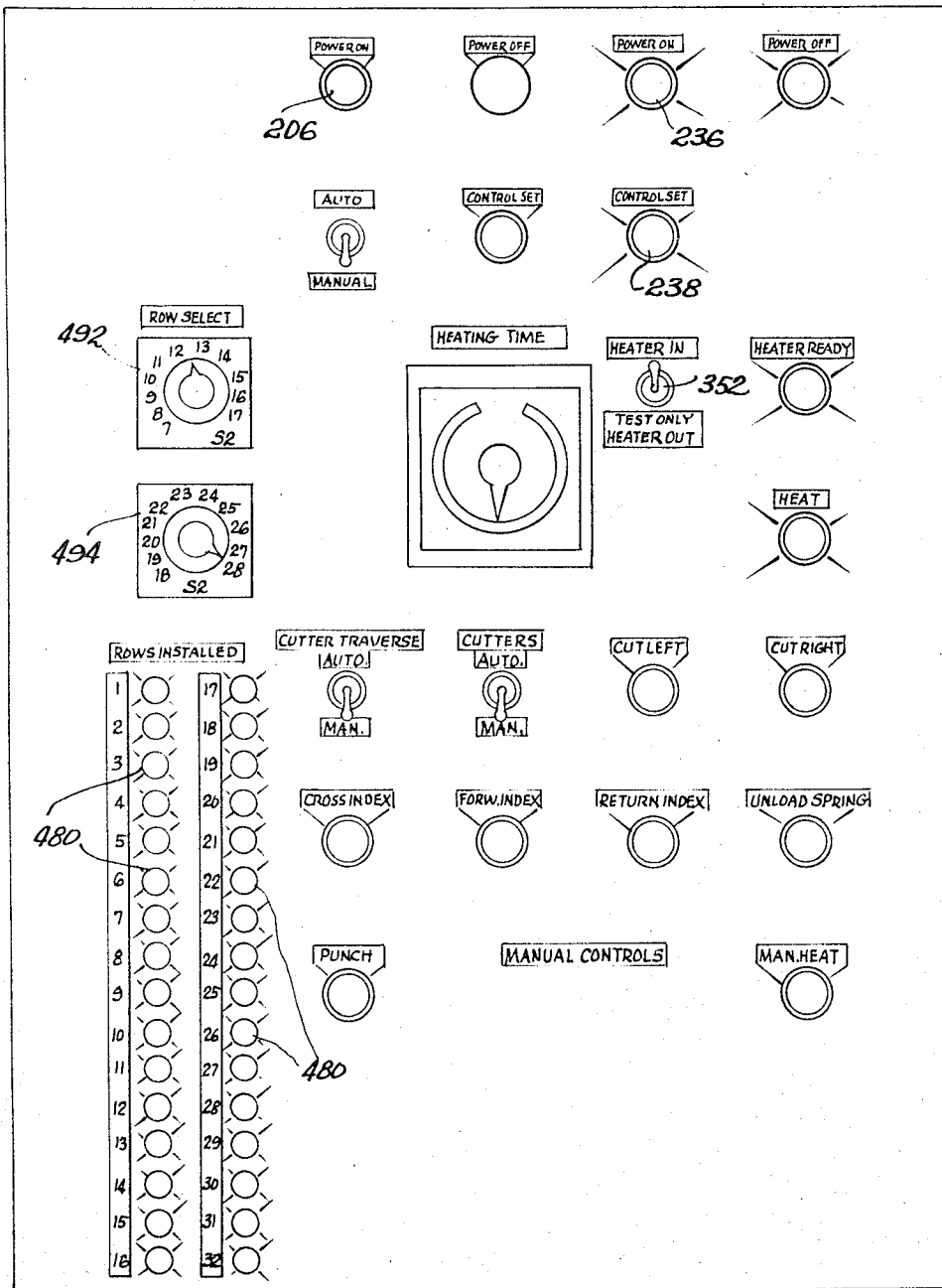
E. L. BRONSTIEN, JR., ETAL
SYSTEM FOR THE PRODUCTION OF MATTRESS
AND CUSHION CONSTRUCTIONS

3,449,190

Filed March 14, 1966

Sheet 8 of 12

FIG. 10



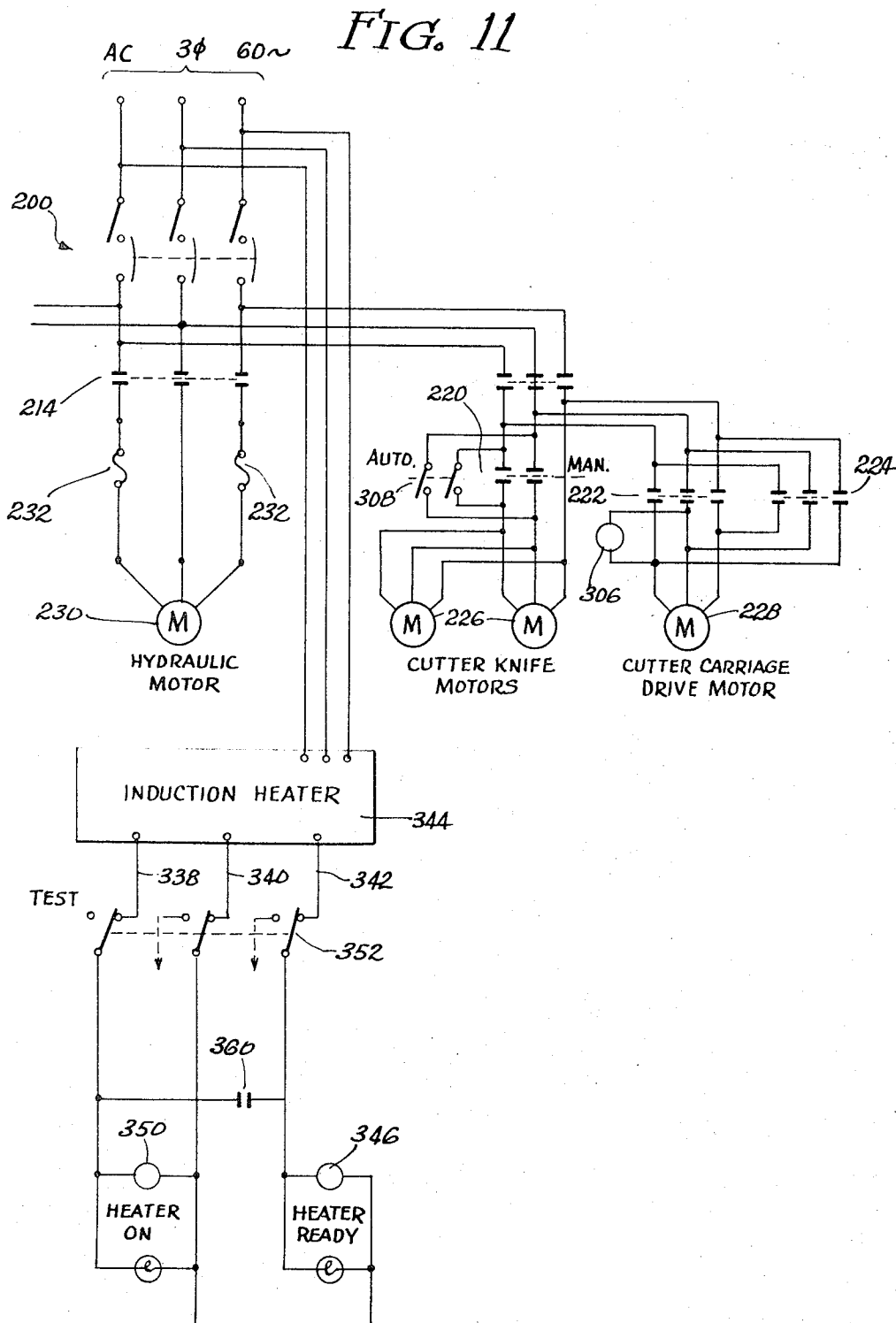
June 10, 1969

E. L. BRONSTIEN, JR., ETAL
SYSTEM FOR THE PRODUCTION OF MATTRESS
AND CUSHION CONSTRUCTIONS

3,449,190

Filed March 14, 1966

Sheet 9 of 12



June 10, 1969

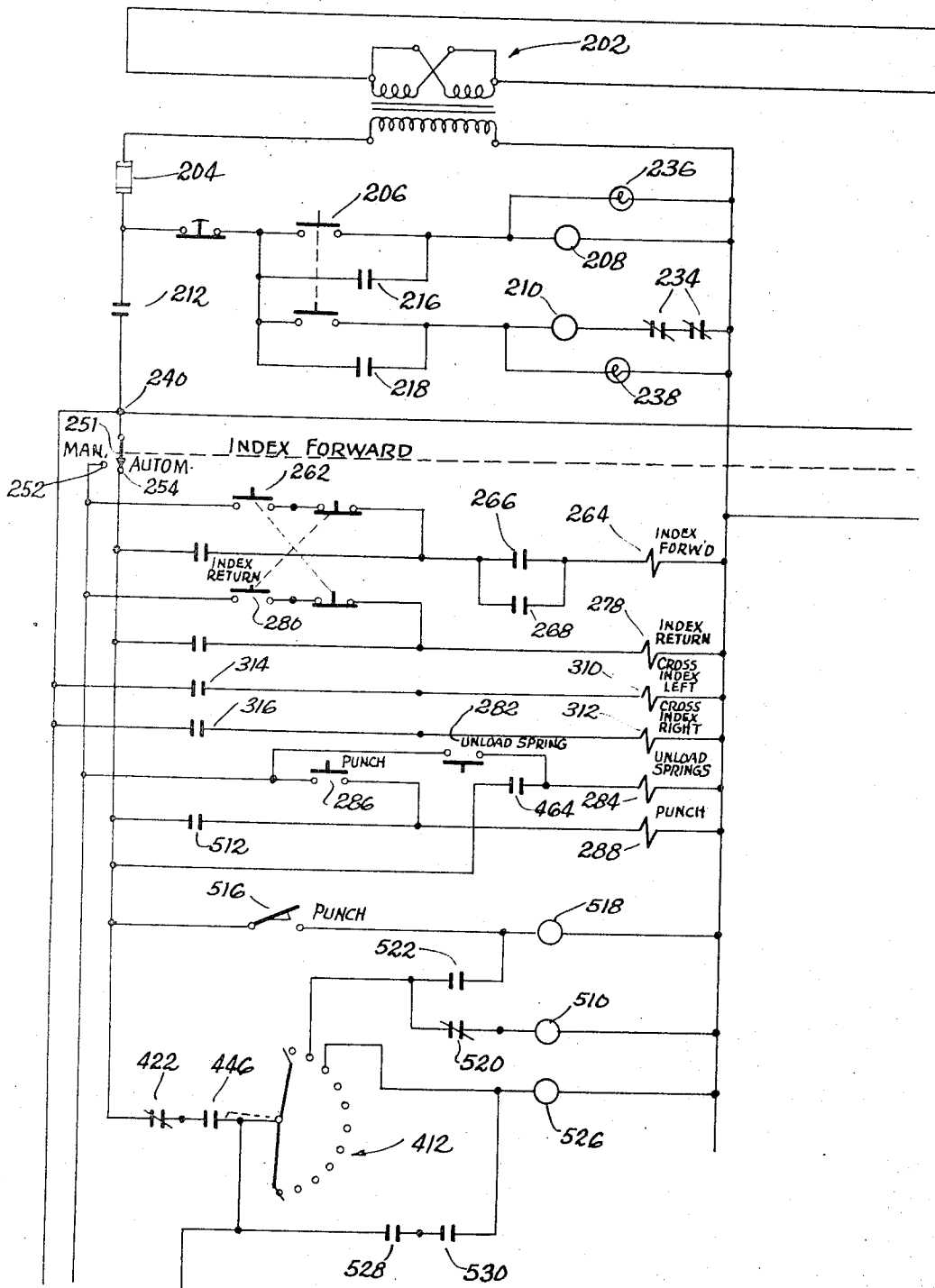
E. L. BRONSTIEN, JR., ETAL
SYSTEM FOR THE PRODUCTION OF MATTRESS
AND CUSHION CONSTRUCTIONS

3,449,190

Filed March 14, 1966

Sheet 10 of 12

FIG. 12



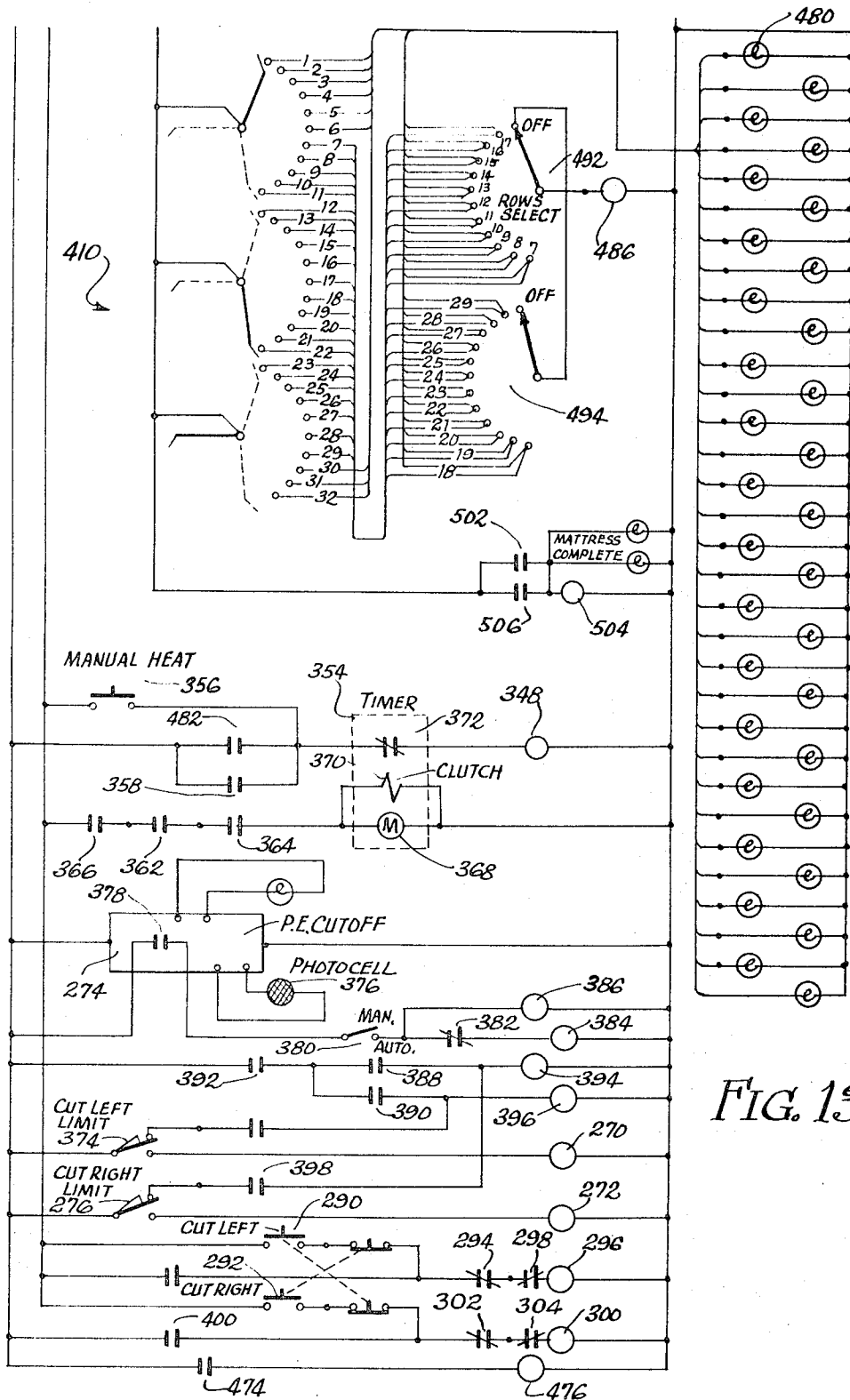
June 10, 1969

E. L. BRONSTIEN, JR., ETAL
SYSTEM FOR THE PRODUCTION OF MATTRESS
AND CUSHION CONSTRUCTIONS

3,449,190

Filed March 14, 1966

Sheet // of 12



Filed March 14, 1966

3,449,190

Sheet 12 of 12

1

2

3,449,190

SYSTEM FOR THE PRODUCTION OF MATTRESS AND CUSHION CONSTRUCTIONS

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U.S. Cl. 156—250

20 Claims

ABSTRACT OF THE DISCLOSURE

A system for producing articles such as cushions and mattresses wherein panels of material are continuously moved adjacent coil holding jaws. The jaws hold a row of coils, and the jaws are adapted to periodically index for exposing the coil ends to contact with the opposed panels of material, and for releasing the coils for attachment of the coils to the panels. An adhesive is located on the panel surfaces to provide gripping relationship between the coils and panels.

This invention is directed to a system designed for the production of constructions of the type including mattresses, box springs, cushions and similar constructions. The invention is particularly directed to the manufacture of constructions of a type including a plurality of coil springs which are arranged between opposed layers of padding.

The invention will be described with reference to the production of mattresses. In such constructions, coil springs are arranged in rows with the vertical axes thereof disposed in substantially parallel relationship. Fabric coverings overlie the opposed ends of the respective springs to form top and bottom surfaces for the mattress. Additional material is applied around the side edges to provide a complete enclosure.

In the production of mattresses, it is desirable to provide a construction which maintains the coil springs in desired positions even after extended periods of use. With such an arrangement, sagging and other undesirable effects of wear can be avoided.

Prior methods generally provided for the use of helical type wires for securing the ends of the coils to thereby prevent permanent relative displacement of the coil springs. In some instances, individual pockets for retaining the coils have been located within the construction so that each coil can be retained within the confines of a given pocket.

Methods of the type described are characterized by certain deficiencies. Sagging still occurs since coil displacement can take place after extended periods of use. The tie wires can slip relative to the coil ends or these wires can break whereby uniform spacing of the coils cannot be maintained. Where pockets are employed, stretching or tearing can occur resulting in displacement of the coils. Finally, equipment utilized for manufacturing mattresses of the type described is relatively complicated and expensive. Automated units have been designed with a view toward increasing efficiency; however, such units are still considered to be objectionable from the standpoint of initial cost and maintenance cost and from the standpoint of the quality of the mattresses produced.

It is a general object of this invention to provide an improved system for producing mattresses whereby highly suitable mattress constructions characterized by many desirable features can be provided.

It is a further object of this invention to provide an apparatus for the production of mattresses which is characterized by a relatively simple operating construction whereby the apparatus can be produced and maintained at relatively low cost.

It is a still further object of this invention to provide improved methods for the production of mattresses whereby novel mattress constructions can be produced rapidly and at a relatively low cost.

These and other objects of this invention will appear hereinafter and for purposes of illustration, but not of limitation, specific embodiments of this invention are shown in the accompanying drawings in which:

FIGURE 1 is a schematic illustration of the machine operation;

FIGURE 2 is a side elevational view of an apparatus characterized by the features of this invention;

FIGURE 3 is a side elevational view of the apparatus taken from the side opposite FIGURE 1;

FIGURE 4 is an end elevational view of the apparatus;

FIGURE 5 is a fragmentary plan view taken about the line 5—5 of FIGURE 2;

FIGURE 6 is a detail plan view of a coil holding jaw element;

FIGURE 6a is a plan view of an alternative form of a coil holding jaw element;

FIGURE 6b is a cross-sectional view taken about the line 6b—6b of FIGURE 6a;

FIGURE 6c is a perspective view of the coil holding jaw element of FIGURE 6a;

FIGURE 6d is an end view of the element taken about the line 6d—6d of FIGURE 6b;

FIGURE 7 is a side elevation of the element shown in FIGURE 6;

FIGURE 8 is a plan view of a retaining plate employed in association with the element of FIGURES 6 and 7;

FIGURE 9 is a perspective view illustrating the combination of the jaw and retaining plate;

FIGURE 10 is an illustration of a control panel utilized in the construction of this invention; and,

FIGURES 11 through 14 illustrate a suitable circuit arrangement for use in conjunction with the construction of this invention.

The system of this invention is characterized by a method for the production of mattresses wherein a plurality of coil springs are arranged with their axes in substantially parallel relationship. The springs are arranged in rows of any desirable pattern between panels of material which overlie the ends of the springs. An adhesive is utilized for securing the panels to the coil ends. The bond between the ends of the coils and the panels serves to maintain the coils in the desired pattern throughout the use of the mattress.

The apparatus of this invention is intended to provide a highly efficient means for joining the panels and coils to achieve the desired mattress construction. The apparatus is designed for rapid operation and is capable of producing mattresses of a wide variety of sizes in a highly economical fashion. The mattresses can be produced at a lower cost and with improved structural characteristics when employing the novel apparatus.

General operation

FIGURE 1 illustrates schematically the manner in which the apparatus of this invention functions to produce mattress constructions. The apparatus includes supply rolls 10 and 12 of material which is to be located in overlying relationship with respect to the ends of the coils 14. These coils are manually fed into coil holder jaws 16. In the usual operation of the apparatus, a row

of the coils is located in the jaws, and then the combination of the coils and the material moves forward. An additional row of coils is then put into place, and a succeeding indexing movement then occurs.

In accordance with one form of the invention, a heat setting adhesive is applied to the material before contact with the coils 14. The material can be supplied from the rolls 10 and 12 with the adhesive already applied. It is contemplated, however, that the material could be provided with an adhesive immediately prior to use in the apparatus of this invention and then fed into the apparatus. In any event, induction heating coils 18 are located adjacent the path of movement of the material whereby the adhesive can be set for securing of the coil ends to the material. It is contemplated that pressure sensitive adhesive and various other forms of adhesive could be utilized with or without means associated with the disclosed apparatus which provide for setting of the adhesive. Induction heating is, however, desirable since the coil ends readily heat up for setting of the adhesive.

Conveyor belts 20 are associated with the apparatus to provide support for the lengths of material having the coils located therebetween. Power driven rolls 22 are provided for driving the conveyor belts whereby the desired indexing movement can be achieved. A plurality of guide rolls 24 are included in the system for guiding the lengths of material as they pass to the entry end of the apparatus.

The construction of this invention also provides for the cutting of the material and coil combination at the exit end of the conveyor belts 20. Cutoff means 26 are adapted to move across the exit end when the desired number of rows of springs have been included between the lengths of material. As will be explained, the operators of the machine avoid including one row between the lengths of material after the desired number of rows has been included. The cutoff is designed to automatically take place when this empty area reaches the exit end of the construction. Slitting knives are also contemplated for use to provide for cutting of the production in a longitudinal direction. Thus, it is possible to provide production of sufficient width whereby longitudinal cutting will divide the production along at least one longitudinal line. Obviously, the longitudinal slitting knife can be conveniently mounted at the exit end of the construction.

It will be apparent that mattresses, cushions or similar constructions of various sizes can be produced with the apparatus of this invention. Thus, the size of the construction produced will depend upon the number of coil springs in a given row and the number of rows which are formed before a cutoff takes place: In the preferred operation of the construction, each row inserted by the operators is intended to correspond with the length of a conventional mattress. The number of rows will vary depending upon the width desired. This represents a highly desirable capability of the machine since most mattresses are of the same length but of varying widths. The same machine can therefore be very efficiently employed for a variety of different sizes where the machine is used in mattress production.

The machine is also quite easily utilized for purposes of developing various coil patterns in a mattress construction. Thus, the manner in which the coils are placed in the jaws during forming of a given row will determine the makeup of that particular row in the resulting construction. By varying the pattern in which coils are placed in the jaws, variations will be achieved in the succeeding rows. Furthermore, as will be explained, the jaws are set for shifting movement whereby the coils in one row will be displaced with respect to the coils in a succeeding row in the final mattress construction.

FIGURES 2 through 9 illustrate one suitable form of the apparatus of this invention. It will be appreciated that a wide variety of mechanical means can be utilized for achieving the functions to be described herein, and the

disclosed construction is provided primarily for purposes of illustration.

The construction includes a frame 27 which is adapted to carry the upper supply roll 10. The material 28 is fed from this supply roll and from the lower supply roll (not shown) over guide rollers 24 to the entry end of the apparatus. Conveyor belts 20 are provided with tensioning rollers 30 to maintain proper tension therein.

As best shown in FIGURE 4, a plurality of coil jaws 32 are located at the entry end of the apparatus. Coils 14 are adapted to be located within each of these jaws. The coils are then adapted to be released from the jaws for purposes of including the coils between the lengths of material being fed into the apparatus.

As noted, the coils are released from the jaws and the lengths of material are indexed forward toward the exit end of the machine. The induction heaters 18 are located in position for securing the coils in the case where a heat setting adhesive is employed.

The cutoff mechanism includes a first motor 34 which drives the carriage 36 through chain belt 38. A second motor 40 is mounted on the carriage, and this unit traverses the construction during operation of the motor 34. The motor 40 drives cutters which operate to slice through the material during traverse of the carriage 36.

After completion of a cutting operation, the assembly comprising the coils and overlying material is carried by suitable conveyor means to a station for completion of the mattress. Where the material is of a type suitable for a finished mattress, the only operations remaining will involve application of material around the side edges. Other operations are, however, contemplated including the addition of border wires and the application of finishing materials of various types.

The following description provides a detailed disclosure of the various elements in the apparatus of this invention.

Coil jaw operation

FIGURES 6 through 9 illustrate the construction employed in forming the coil retaining jaws 32. The construction comprises upper and lower jaw elements 42, and each of these elements carries a bushing 44. The outer ends 46 of the elements are tapered to simplify the introduction of coil springs between the upper and lower elements. In the preferred operation of the invention, the jaws are spaced apart whereby the coil springs must be pressed therebetween when inserted between the jaws, and the taper provided by the ends 46 is therefore quite desirable.

The jaw elements each include flange portions 48 which form channels on the backs thereof. Sliding jaw elements 50 are adapted to be received in these channels for sliding movement along the length of the jaws. A U-shaped element 52 is secured to the sliding plates 50 for purposes of imparting movement to the plates.

As best shown in FIGURE 4, the upper and lower jaw elements 42 are disposed in opposed relationship across the entry end of the construction. Support rods 54 pass through the bushings 44 for purposes of holding the jaws in position. Additional bars 56 extend across the apparatus, and these bars are received in the U-shaped members 52 of the respective sliding plates 50. Each of the bars 56 is connected to one of the rocker arms 58, and the respective rocker arms are connected to arms 60 which are connected to the pistons 62 of fluid cylinders 64. A pivot bar 66 is provided for each of the rockers whereby operation of the cylinders 64 results in movement of the rockers 58 and corresponding sliding movement of the plates 50.

In the operation of the construction, the plates 50 are moved forwardly in the direction indicated by the arrow 68 (FIGURE 9). Coil springs are moved into the jaws whereby the ends of the springs are engaged between the plates 50. When the plates 50 are retracted through the action of the cylinders 64, the springs will be released

5

whereby they will expand and press against the material located adjacent the jaws. The coil ends will abut the edges 51 of the jaw elements 42 when the plates are retracted whereby the coil springs in a row will be properly aligned. When driving action is imparted to the material, the coil springs are carried along with the material.

An alternative form of coil retaining jaws is illustrated in FIGURES 6a through 6d. The alternative jaws include upper and lower elements 42a with each element being provided with bushings 44a. As in the previously described embodiment, the ends 46a of the jaws are tapered to simplify the introduction of coil springs. These jaws are also preferably positioned whereby coil springs inserted between the jaws are held under compression.

Flange portions 48a form channels to retain the coil springs in the desired position. An elongated finger 47 is formed at the exit end of each of the jaws, and spaces 49 are defined on either side of this finger between the flanges 48.

The jaws are adapted to be supported by rods 54 in the same manner as described with reference to the jaws 32. This alternative arrangement represents a simpler construction, however, since the coil springs will engage the conveyor belts 20 when they are positioned in engagement with the fingers 47. Thus, the openings 49 provide for sufficient release of the coil ends whereby portions of the coils will press against the conveyor belts. When indexing of the belts takes place, the coils will be carried forward whereby the next row of coils can be positioned between the jaw elements.

Indexing mechanism

The apparatus of this invention is designed to index a distance corresponding to a row of coils as each row is released by the retaining plates. The indexing action is accomplished through the operation of the cylinder 70 (FIGURES 2 and 4). The piston 72 of this cylinder is connected to a lever 74, and this lever is in turn secured at 76 to the shaft 78 of drive roller 80. A standard clutch arrangement is included in the connection between the lever and shaft whereby the drive roller will be rotated on the upward stroke of the piston while no rotation occurs during the downward stroke of the piston. The lever 74 includes an adjustable connection 82 and an adjusting knob 84 whereby the point of connection between the piston and the lever can be varied, depending upon the amount of indexing movement desired.

A chain drive 86 (FIGURE 3) interconnects the drive roller 80 with the upper roller 88 whereby driving action during indexing is also imparted to this upper roller.

Cross-index mechanism

As previously noted, the apparatus of this invention is designed to provide for the manufacture of mattresses wherein the coil springs can be arranged in a variety of patterns. The illustrated construction provides a means whereby the coil holding jaws 32 can be shifted back and forth between coil loading operations whereby the coils will be located in the mattress in a staggered fashion.

The cross indexing operation is accomplished through the action of fluid operated cylinder 90 (FIGURE 4). The piston of this cylinder engages plate 94 which is secured to the jaw supporting rods 54. When movement is imparted to the plate, the jaws shift from left to right and vice versa. In the usual operation, one shifting action is undertaken between each row to achieve the desired staggered relationship.

Circuit operation

An understanding of the capabilities of the construction of this invention can be achieved when considering the operation of the circuit illustrated in FIGURES 11 through 14. Generally speaking, the circuit includes a first stepping switch 408 (FIGURE 14) which consists of upper and lower banks. The lower bank controls the oper-

6

ations which take place during a typical operating sequence. The first contact on the lower bank operates a coil 452 which, when energized, functions to operate the unload springs solenoid 284 (FIGURE 12). This solenoid operates the fluid operated cylinders 64 which release to move the sliding retaining plates for releasing the coil springs.

The second and third contacts of the lower bank operate the index forward and index return solenoids 264 and 278, respectively. These solenoids control the forward and retracting strokes of the fluid operated cylinder 70 to achieve indexing movement after a new row of coil springs has been placed between the lengths of material.

The third contact also operates cross index coils 326 and 332 which, when energized, operate solenoids 310 and 312. These solenoids act in alternating fashion to operate cylinder 90 which shifts the coil retaining jaws 32 back and forth.

The upper bank of the stepping switch 408 is provided for detecting the completion of an operation whereby the next operation can proceed. Limit switches 468 and 470 comprise mechanical switches which are opened by the sliding plates 50 to indicate that the coils have been released. Mechanical switch 482 is situated whereby it will be opened when the lever 74 drives the conveyor belts to the completion of the forward indexing movement. Mechanical switch 488 is operated when the lever 74 is retracted.

Stepping switch 412 (FIGURE 12) controls the operations taking place at the completion of a mattress. The second contact of this switch operates relay 510 which closes the circuit to solenoid 288 whereby a hole can be punched in the material so that the subsequent cutting operation will take place when the hole is detected by photocell 376. It will be noted in this connection that the use of the hole punch and electric eye provides for cut-off which is independent of the stepper operation.

The circuit also includes stepping switches illustrated in FIGURE 13 and generally designated by the numeral 410. These stepping switches operate the series of lights 480 which appear on the control panel of the machine (FIGURE 10). Row selection elements 492 and 494 are provided whereby the operator can set dials depending upon the number of rows desired in a given mattress. As each row is included, the light 480 for that row will operate. When the desired number of rows has been reached, a circuit will be completed through coil 486 whereby the cutter motors 34 and 40 will be operated. The lights on the panel will operate and indicate to the operator that an empty row is to be provided whereby a cutting operation can take place. It will be appreciated that when an empty row is formed at the entry end, the empty row previously formed will at the same time be in position adjacent the cutting means.

The above general description of the circuit highlights the desired operating characteristics. The following detailed description of the circuit indicates one suitable manner in which the operation can be accomplished in either a manual or automatic fashion.

The automatic machine operation is begun by closing circuit breaker 200 (FIGURE 11) to energize control transformer 202 (FIGURE 12) and thereby provides 115 v. AC through fuse 204 to the power on pushbutton switch 206.

Operation of switch 206 closes 115 v. AC to coils 208 and 210 which operate to close switches 212 and 214, respectively. Lock-in switches 216 and 218 are also closed by these coils. Switch 212 closes power to the entire control system and the relays 220, 222 and 224 (FIGURE 11) which control the cutter knife drive motors 226 and cutter carriage drive motor 228, respectively.

Switch 214 (FIGURE 11) closes power to the hydraulic pump motor 230 through overload heat coils 232.

Normally closed contacts 234, in series with coil 210, open when an overload condition occurs thereby disconnecting the hydraulic motor. Pilot lamps 236 and 238 are employed to indicate an "on" condition for the coils 208 and 210.

115 v. AC is also applied through bus 240 and through fuses 242 and 244 to rectifier 246 (FIGURE 14) which provides approximately 105 v. DC between buses 248 and 250. This DC voltage is used for that part of the control system utilizing DC energized coils.

The 115 v. AC bus 240 is switched by means of switch 251 to either bus 252 or bus 254, the manual and automatic buses, respectively. Interconnected switch 256 (FIGURE 14) correspondingly places the DC output of rectifier 246 to buses 258 and 260. Machine operation with switches 251 and 256 in the manual position will first be examined.

To achieve index forward and return, pushbutton switch 262 (FIGURE 12) is operated closing 115 v. AC to solenoid 264 through contacts 266 or 268 which causes the index forward cylinder to operate. The valving of this solenoid is such that the index travel will stop at the position reached when switch 262 is released. One of the switches 266 and 268 must be closed before the index forward can move, and one of the relays 270 or 272 (FIGURE 13) must be operated to achieve this. These relays are the cutter traverse relays indicating left limit and right limit travel of the cutoff knives. When the cutoff knives are at the limit of travel, either the switch 274 or the switch 276 is operated to energize one of the relays. This interlock insures that no movement of the mattress can take place unless the cutoff knives are out of the way, that is, at their extreme end travel limit.

To return the index mechanism to its normal condition, the index return solenoid 278 is energized by operation of pushbutton switch 280.

Manual operations of the unload spring pushbutton 282 actuates solenoid 284 causing the spring retaining plates to be retracted. When solenoid 284 is de-energized, the retaining plates returns to their normal position.

Operation of pushbutton 286 energizes solenoid 288 which causes the die cutting punch mechanism to operate. Release of this solenoid causes the punch to retract.

Two solenoids 310 and 312 are used to control the position of the loading jaw cross-index mechanism. As in the case of the index forward and return, the cross-index will remain in whatever position it is at when both solenoids are de-energized. The mechanism will move to its extreme end position against stops, provided either solenoid is energized sufficiently long. Control of these solenoids is through normally open contacts 314 and 316 which are controlled by relays 318 and 320, respectively (FIGURE 14). Control of these relays originates from the DC bus 322 through the cross index pushbutton switch 324. This pushbutton, when operated, causes the cross-index to move in the opposite direction from its last operation. This is accomplished by the use of a two-stage relay 326 whose contacts 328 and 330 change position each time the coil is energized, and remain in that position after the coil is de-energized. Thus, when pushbutton 324 is operated, relay 326 reverses its contact condition relative to relays 318 and 320. Time delay relay 332 is energized in parallel with relay 326 to allow time for this contact reversal, before allowing operating voltages to pass through the normally open contact 334 of the time relay to either relay 318 or 320. As mentioned above when either relay 318 or relay 320 are operated, the corresponding cross-index solenoids 310 or 312 is energized thus causing cross-index movement. When the cross-index pushbutton 324 is operated, a pair of normally closed contacts 336 on the pushbutton open the circuit back from relay 326 to the automatic portion of the circuit, to prevent false operation of any of the other parts of the system.

Cutting across the mattress, either to the left or right, is accomplished by operation of the pushbutton switches 290 and 292, respectively. As previously noted, limit switches 274 and 276 are mounted at the extreme travel limits of the cutoff knives. Thus, if the top carriage is at the extreme left position, switch 274 will be operated closing the circuit to relay 270 which operates to open switch 294 in the circuit to coil 296 thereby preventing operation of this coil which controls operation of the cutter traverse motor 228 through reversing contacts 222, 224. If relay 270 is not operated, actuation of pushbutton switch 290 will energize coil 296 through normally closed contacts 298. Coil 296 operates to apply the correct phasing to three phase motor 228 to cause the upper carriage to cut to the left. When the end limit is encountered, operation of switch 294 will release the coil 296 stopping travel. Correspondingly, operation of cut right pushbutton 292 will energize the coil 300 through switches 302 and 304, reversing motor 228, and causing the upper cutoff knife to move to the right. The normally closed back contacts of limit switches 274 and 276 are used as part of the automatic sequence control circuit.

Whenever the cutter traverse motor 228 is energized, power relay 306, connected across two of the motor leads, operates. Operation of this relay closed power to the cutter knife motors 226 through switches 220. This prevents the possibility of a cutting traverse without these knife motors operating and also insures that the cutoff knives are inoperative during the mattress cutoff operations. A switch 308 permits operation of the cutoff knife motors for sharpening purposes, when the traverse motor is at rest.

The leads 338, 340 and 342 from the induction heater 344 allow both monitoring and control of this unit. When the unit is warmed up, 115 v. AC appears on leads 340 and 342 operating relay 346 (heater ready). When 115 v. AC is closed from lead 342 to 338, the unit is turned "on" in that it then applies induction heating current to the heating coils. Leads 338 and 342 are connected together by the operation of the heater start relay 348 (FIGURE 13). The on condition is monitored by relay 350. When it is desired to operate the machine control system without actually going through the heating unit, a test switch 352 is thrown to the test position. This operates the relay 346 from the control panel 115 v. AC voltage and disconnects the input "on" signal from the unit.

In either case, whether operating in the actual heating or test mode, the heater start relay 348 is controlled by timer 354 which may be adjusted for the heating time required. When the manual heat pushbutton 356 is operated, relay 348 is energized in series with a timed normally closed contact of the timer 354. Relay 348 locks itself up by its own contacts 358 across the pushbutton 356. Relay 348 closes contacts 360 to provide for operation of the heater. When the heater ready relay 346 and the relay 350 operate, contacts 362 and 364, respectively, are closed (FIGURE 13). Another pair of contacts 366 are closed by relay 348 and this brings 115 v. AC to the motor 368 and clutch 370 of timer 354. Relay 348 stays operated until the timing period elapses, at which time the closed contacts 372 of the timer open releasing the relay which releases relay 350 and the timer clutch and motor. If, during either an automatic or manual heating cycle, the heating unit cuts out, relay 346 will release opening the clutch and motor of the timer. The timer will reset back to its full timing period, but relay 348 will remain operated. When the unit again operates relay 346, the full timing period will be restarted.

The construction of this invention is provided with automatic means for carrying out the above described operations in desired sequence.

A part of the automatic system is independent of the automatic cycling sequence and will be discussed first. When a mattress is completed during an automatic cycle, an identifying hole is punched near the edge of one layer of the bonding material. As this hole is later encountered

by an electric eye system, this serves to mark the point where the completed mattress is to be cut off. By close position control of the punch, electric eye, and cutter traverse line, the completed mattresses are accurately cut off as they pass through the machine.

Photorelay unit 374 provides power to a light source and accepts the input from a photo cell unit 376 looking at the light source beam. When this beam is interrupted by the mattress material, as is normally the case with the machine, the relay contacts 378 in the unit 374 are open. However, when the punched hole is encountered, these normally open contacts close, placing 115 v. AC through the auto-man switch 380 (closed on automatic) through normally closed switch 382 to relay 384. Relay 386 is also energized by this signal, but this is a time delay relay which does not operate immediately. As part of the automatic cycle, the cutter traverse heads must be at one end or the other, having either limit switch 274 or 276 operated. Thus, either of relays 270 or 272 would be operated, and these relays close switches 388 and 390, respectively. When relay 384 operates, switch 392 is closed and 115 v. AC is closed through either switch 388 or switch 390 contacts, to either relay 394 or relay 396, respectively. Assuming switch 274 is operated, with the top head to the extreme left position, relay 270 will be operated, thus causing operation of relay 394. Relay 394 will lock itself up through contact 398 and the normally closed contact of nonoperated limit switch 276.

Contact 400 is also operated by relay 394 and this closes 115 v. AC to coil 300 of the reversing contactor causing the traverse motor to move to the right. Shortly after relay 384 operates, relay 386 operates, opening switch 382 thereby releasing relay 384. This insures only a single cutoff trip after detection of a punched hole. When the traveling head reaches the extreme right portion switch 276 will be operated, releasing relay 394 and operating relay 272. The release of relay 394 and the operation of relay 272 opens the circuit to coil 300 stopping the motor drive. The next time a cutoff is required, the operation will be similar, except relays 396 and 270 will function to cause cutting from right to left.

During the time cutoff was made, end limit switches 274 and 276 are released, thereby releasing both coils 394 and 396. As mentioned previously, this opens the circuit to the index forward solenoid 264 to prevent mattress movement when the cutoff is made.

With the switch 280 set at "auto," the system is prepared for automatic operation by momentarily depressing the control set pushbutton 402 (FIGURE 14). This operates relay 404 which locks up through its own contact 406 and any of the off normal springs 407, 409 and 411 of the three stepping switches 408 (FIGURE 14), 410 (FIGURE 13) and 412 (FIGURE 12).

Other functions of the relay 404 are as follows:

(1) Closes circuit through switch 413 to relay 414 which locks up through its own switch 416 and remains operated until control is transferred back to manual at some later time or if power is interrupted.

(2) Opens voltage circuit to wipers of stepping switches during stepper "homing" by opening contacts 418, 420 and 422 thereby preventing short duration false signals being placed on bank contacts as the wipers are stepped to their home position.

(3) Closes operating voltage to the stepping switch homing circuits by closing switches 424 and 426. The homing action of all three stepping switches is the same. If any stepping switch is not at home, its off normal contacts 428, 430 and 432, respectively, are closed. Thus, operating voltage through the respective contacts 424 and 426 pass through closed contacts to the closed interrupter springs 434, 436 and 438 of each stepper, and thence to the stepping switch coils 440, 442 and 444, respectively. The stepper thus operates, loading its stepping spring, and the action of self-interrupting continues until the off-normal switches open indicating the stepper is at home. When

the steppers are all homed, relay 404 releases, as mentioned above.

Operation of coil 414 operates contacts 416 and 446 which close power to the stepping switch wipers upon release of coil 404.

Operation of either of the two index pushbuttons 448 or 450 closes an operating voltage to the coil stepping switch 440 through switches 452, 454 and 456. The latter are normally closed and heater relay 346 operates when the heater temperature is proper to close switch 452. This prevents starting an index unless the heater has finished its last heating cycle and is ready for its next.

The wiper of stepping switch 408 (lower bank) first closes operating voltage to relay 452 which operates and locks itself up through its own contact 460 and normally closed contact 462. Relay 452 also closes contact 464 (FIGURE 12) which operates solenoid 284 to unload the mattress springs previously loaded. Another pair of contacts 466 closes a circuit to the stepping switch coil 442 which operates, preparing for its first step.

The wiper of stepping switch 408 (upper bank) connects operating voltage to the stepping switch coil 440. Thus, coil 408 is loaded preparatory to the next step. When the retaining plates have been fully retracted at both the top and bottom of the springs, both limit switches 468 and 470 are operated, opening the circuit to the coil 440 which releases, moving the wipers to the #2 contacts of the switch.

The lower bank wiper energizes relay 472 whose contacts operate solenoid 264 (FIGURE 12) to cause index forward movement. Contacts 474 (FIGURE 13) operate adjustable time double relay 476 which operates to release previously operated relay 458 which in turn opens solenoid 284 allowing the spring retaining plates to restore to normal. Thus, by proper adjustment of this time delay, the retaining plates can be made to quickly restore and allow operator feeding of the next row of springs, just as the forward index clears the last row. Another set of normally closed contacts 478 open, breaking the circuit to the previously energized stepping switch coil 442 which then steps to its first bank position. The wiper of this coil places operating voltage to the "row 1" lamp 480 (FIGURE 13) indicating this row installed.

The wiper of stepping switch 408 on the second step connects the coil 440 to operating voltage through the normally closed contacts 482 which is opened after the full forward index travel. When this occurs, the coil is released causing a step to the #3 contact.

Lower bank wiper closes power at the third contact to relay 484 and relays 326 and 332, the latter two through normally closed contacts 336. Relay 472 releases de-energizing the index forward solenoid 264 while relay 484 energizes solenoid 278 causing index return. At the same time the index return is taking place, a cross-index is accomplished by the same action as described for manual operation of the cross index pushbutton 324 except in this case the operating voltage is derived from the wiper instead of the pushbutton.

In addition to operating solenoid 278, relay 478 energizes relay 348 by closing contacts 482 (FIGURE 13), starting the heating cycle, as explained under the manual operation of this function. Relay 478 also closes contact 483 (FIGURE 14) to cause stepping of the row skip stepping switch 412 when required at the last row installation. Until relay 486 (FIGURE 13) is operated at a later time, marking the end of a mattress, this has no effect.

The upper bank wiper on the third step energizes the coil 440 through the limit switch 488, which is operated on the index full return, thus causing a step to the #4 position of the stepping switch 408.

In the fourth position, the lower bank wiper is not connected while the upper bank wiper is connected to the coil 440 through contact 490. Relay 348 (FIGURE 13) holds this contact closed. When the heating cycle is completed,

relay 348 will release, breaking the circuit to coil 440 causing a step to the #5 position. The #5 through #12 bank positions are jumpered and connected to lead 116, and through the self-interrupting circuit previously described, the stepping switch self-interrupts to its home position, thus completing the first row installation cycle. Subsequent indexing cycles are similarly made, with each index advancing the stepping switch row counter 410 one step, thus lighting the proper row installed lamp.

Prior to beginning of a mattress assembly, a preset count will be set on the row select switches 492 and 494 (FIGURE 13). These switches connect relay 486 to a particular bank contact of stepping switch 410. Provision is made for selecting numbers of rows from 7 to 29. When the row counter wiper reaches the preset number, upon operation of relay 484 of the last row to be installed, relay 486 will operate. Contacts of relay 486 perform the following functions:

(1) Normally closed contacts 496 (FIGURE 14) open the row counter coil 442 to stop any further row counting.

(2) Normally open contacts 498 close, preparing a circuit to the row skip stepping switch coil 444.

(3) Normally closed contacts 336 open to prevent cross indexing on the last row. This is necessary as the cross index position for the beginning of the next mattress is the same as the end of the mattress being completed.

(4) Normally closed contacts 500 open to isolate the circuit of stepping switch 412.

(5) Normally open contacts 502 (FIGURE 13) close to operate the mattresses completed counter coil 504 which has lock-in contact 506 and to light the mattress complete lamp to signal the operator.

(6) Normally open contacts 508 close across the index start pushbutton.

When coil 484 operates during the last row sequence, the coil 444 of stepping switch 412 is thus energized. Upon release of coil 484, stepping switch 412 steps to its first bank contact. As no connection is made to this bank contact, there is no effect from this. At the end of the heating cycle, coil 440 homes as it normally does, but upon reaching its home position finds the contact 508 closed across the index start pushbutton. Thus, the next cycle is started the same as if the operator had pushed the index pushbutton. As the operator was warned by the mattress complete signal lamp, no springs will have been placed in the jaws and an empty row will be indexed. At the release of coil 484 at the end of this empty row cycle, the stepping switch 412 will move to its #2 contact. This operates relay 510. Normally open contacts 512 of the relay 510 close the circuit to solenoid 288 causing a hole to be punched in the material. Another set of normally open contacts 514 (FIGURE 14) close again energizing the coil 444. When the punch has reached its full travel, limit switch 516 (FIGURE 12) operates, energizing relay 518 which operates to open switch 520 releasing relay 510. Relay 518 locks itself to the #2 contact of stepping switch 412 by closing switch 522. Relay 518 also breaks the circuit to the coil 444 by opening switch 524, causing switch 412 to step to its #3 contact.

On release of coil 510 solenoid 288 is de-energized releasing the punch cylinder. On step 3 of switch 412, relay 526 (cycle complete) operates and locks operated through the normally open contact 528 (closed by relay 348 at this time) and its own locking contact 530 as the heating cycle is taking place. Relay 526 also closes contacts 532 (FIGURE 14) which provides a self-interrupting homing circuit to stepping switch coils 410 and 412 which immediately step to their home position. At the end of the heating cycle, coil 408 steps to its home position, and coil 486 has now been released, will remain at home. Also at the time the heating cycle ends, relay 348 releases thereby releasing coil 526 extinguishing the mattress complete lamp and thereby returning the circuit to its original starting state.

It will be understood that various changes and modifications may be made in the above described system which provide the characteristics of this invention without departing from the spirit thereof particularly as defined in the following claims.

That which is claimed is:

1. An apparatus for the production of articles comprising cushions and mattresses wherein a plurality of coil springs are arranged with their vertical axes in substantially parallel relationship, and including panels of material on at least one side overlying ends of said coil springs, said material being characterized by the presence of adhesive on the surface overlying said coil ends, said apparatus comprising means extending transversely across the apparatus for holding rows of said coils, means for releasing said rows of coils one row at a time from said holding means whereby said ends of the coils in the released row engage said one surface of said material, and means for moving said material forwardly in said apparatus as said rows are released.

2. An apparatus in accordance with claim 1 wherein said moving means comprise indexing means, said material being held stationary during release of a row of coils, said indexing means thereafter operating to position the material for engagement by the next row of coils.

3. An apparatus in accordance with claim 1 wherein said holding means are mounted for shifting movement transversely of said apparatus, and means for shifting said holding means whereby said rows of coils are adapted to be staggered relative to each other.

4. An apparatus in accordance with claim 1 wherein the adhesive applied to said material comprises a heat setting adhesive, and including heating means in said apparatus adapted to heat the adhesive after engagement of the material by said coil ends for setting of said adhesive whereby the coils are secured to the material before leaving said apparatus.

5. An apparatus in accordance with claim 1 including conveyor means moving adjacent said coil holding means and defining a path on both sides thereof whereby rows of coils applied to said material are carried with said material by the conveyor means through said apparatus, and wherein separate lengths of said material move on opposite sides of said coil holding means whereby both ends of each coil are secured to the opposed lengths of material.

6. An apparatus in accordance with claim 5 including cutoff means located at the end of said conveyors whereby separate assemblies comprising said rows of coils and said material can be cut off in predetermined sizes.

7. An apparatus in accordance with claim 6 wherein said rows include the number of coils necessary for forming the length of a mattress, and wherein said cutoff means operates at predetermined intervals to secure mattresses of desired width.

8. An apparatus in accordance with claim 1 wherein said holding means comprise individual jaws having movable coil retaining plates associated therewith, and means for simultaneously moving each of the plates associated with said jaws for simultaneously releasing each of the coils in a row.

9. An apparatus in accordance with claim 8 wherein said jaws are spaced apart by an amount less than the normal extension of said coils whereby coils inserted in the jaws are pressed between the retaining plates thereof, said lengths of material passing over the outside surfaces of said retaining plates, said retaining plates comprising slideable members which release said coils whereby the coil ends press against the lengths of material located adjacent the jaws.

10. An apparatus in accordance with claim 6 including a punch mechanism adapted to form a hole in said material, and including photosensitive means in the operating circuit for said cutting means whereby said cutting means

13

is adapted to automatically operate when said photosensitive means detects the presence of a hole.

11. An apparatus in accordance with claim 1 wherein said moving means comprise indexing means, said material being held stationary during release of a row of coils, said indexing means thereafter operating to position the material for engagement by the next row of coils and including automatic controls whereby said indexing means operate automatically as soon as said holding means release a row of coils.

12. An apparatus in accordance with claim 11 including conveyor means adapted to carry separate lengths of material on opposite sides of said holding means whereby the opposite ends of said coils are secured to a length of material, drive rollers for said conveyor belts, said indexing means including a fluid operated cylinder adapted to impart rotation to said drive rollers.

13. An apparatus in accordance with claim 10 wherein said holding means are mounted for shifting movement transversely of said apparatus, and means for shifting said holding means whereby said rows of coils are adapted to be staggered relative to each other and wherein said controls automatically shift said holding means after the release of each row.

14. An apparatus in accordance with claim 10 including means for counting each row released by said holding means, cutting means for providing assemblies comprising coils and said material having a predetermined size, said controls operating to automatically initiate operation of said cutting means upon counting of a predetermined number of rows.

15. An apparatus in accordance with claim 14 including lights adapted to be operated as each row is counted whereby the operator of the apparatus can leave an empty row between the lengths of material so that the cutting means can cut across the material.

16. A method for the production of articles comprising cushions and mattresses which include a plurality of coil springs with their vertical axes arranged in substantially parallel relationship, and which include panels of material adhesively secured to the ends of the coil springs, said method comprising the steps of forming a plurality of rows of coil springs with the coils in each row being

14

held in alignment by means of coil holding jaws, moving said panels of material with adhesive applied thereto adjacent said jaws, releasing an entire row of coils for engagement with said material, indexing the material along with the released row of coils, thereafter releasing successive rows of coils while alternately indexing the material, and setting the adhesive for securing the rows of coils to the material.

17. A method in accordance with claim 16 including the step of shifting said coil jaws transversely of the apparatus after the release of each row whereby the coils in adjacent rows are staggered with respect to each other.

18. A method in accordance with claim 16 including the step of counting the number of rows released and cutting transversely across the assembly comprising the coils and material to secure separate assemblies of predetermined size.

19. A method in accordance with claim 18 including the step of forming an empty row at each point which is to be severed by said cutting means.

20. A method in accordance with claim 16 wherein a heat setting adhesive is formed on the material and including the step of heating the material for setting of the adhesive after the coils have been associated with the material.

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