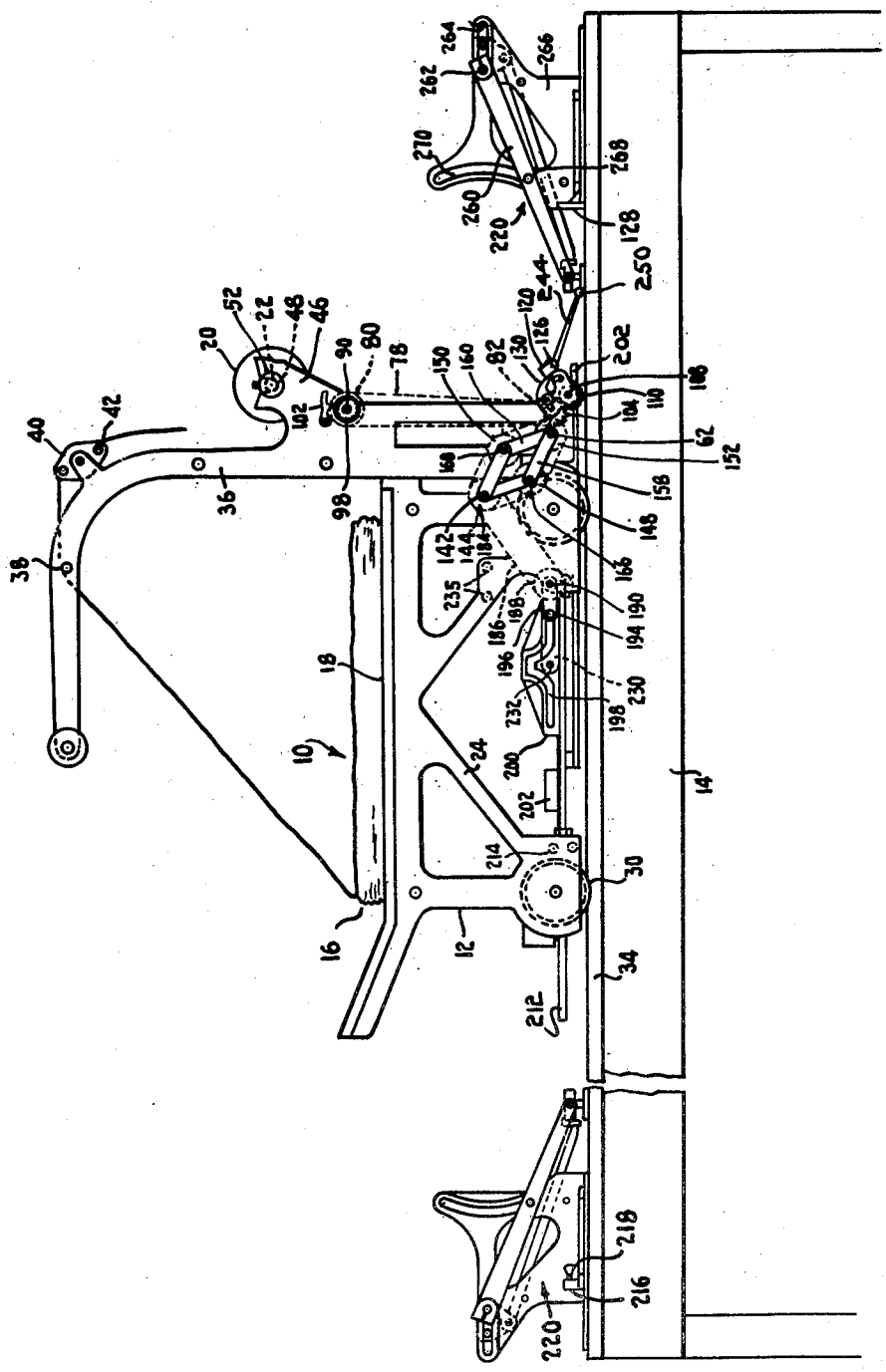
Aug. 29, 1950 H. W. GILBERT ET AL 2,520,895

SHEET MATERIAL SPREADING MACHINE

Filed Dec. 19, 1940 7 Sheets-Sheet 1

FIG. 1



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SHEET MATERIAL SPREADING MACHINE

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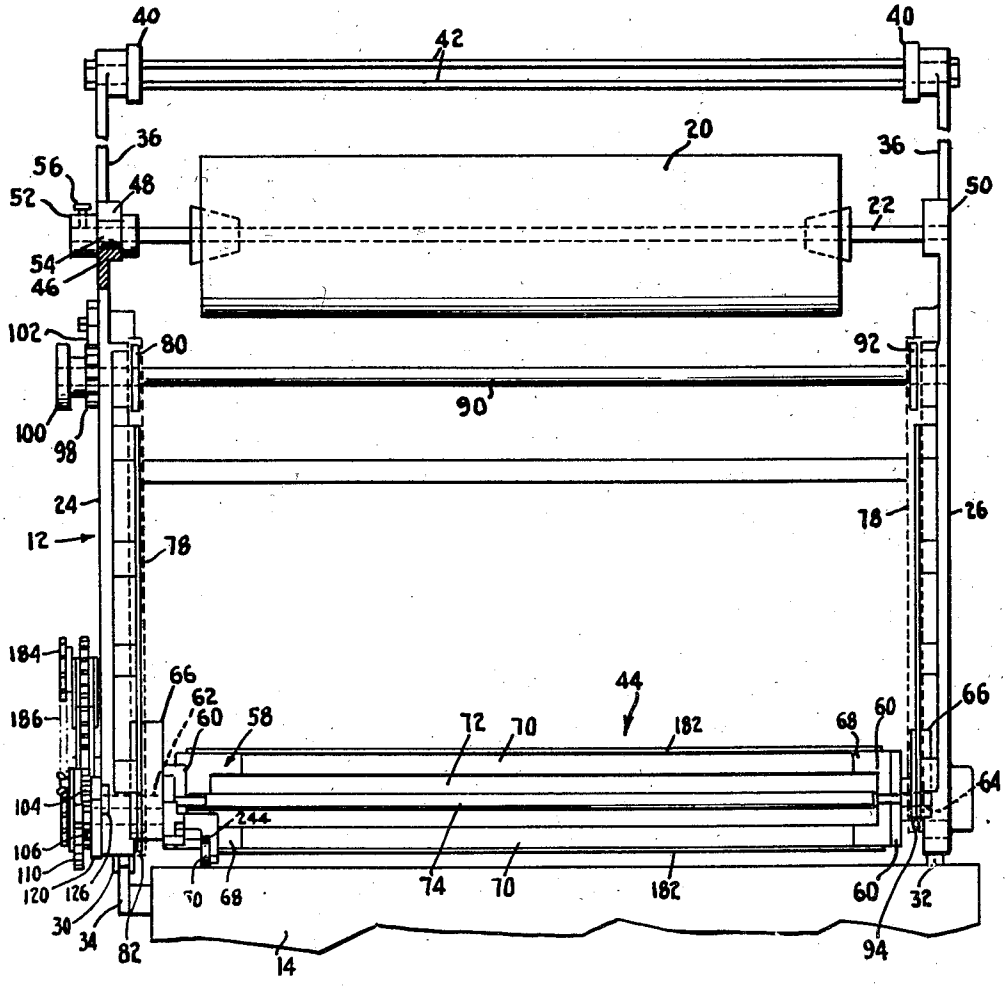


FIG. 2

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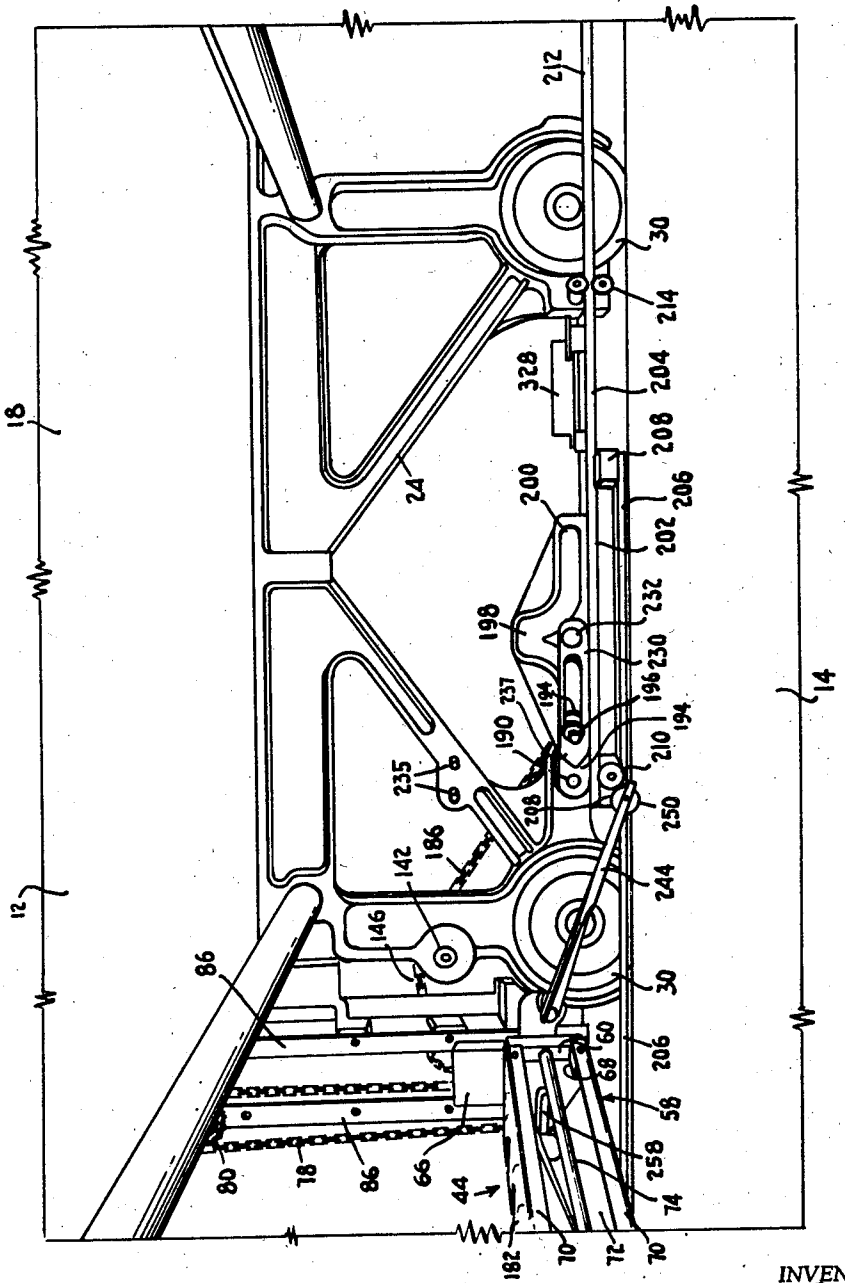
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SHEET MATERIAL SPREADING MACHINE

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FIG. 3



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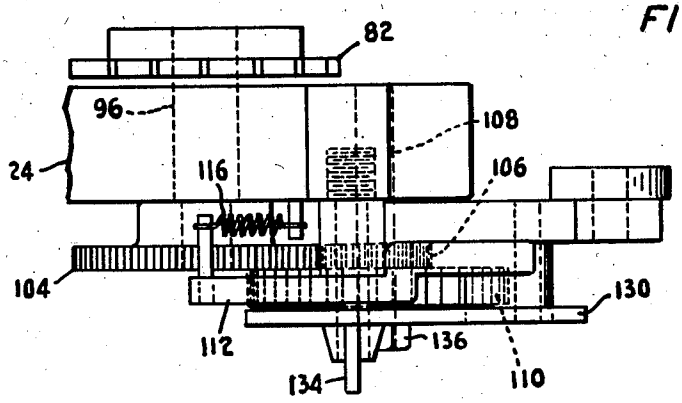
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SHEET MATERIAL SPREADING MACHINE

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FIG. 4



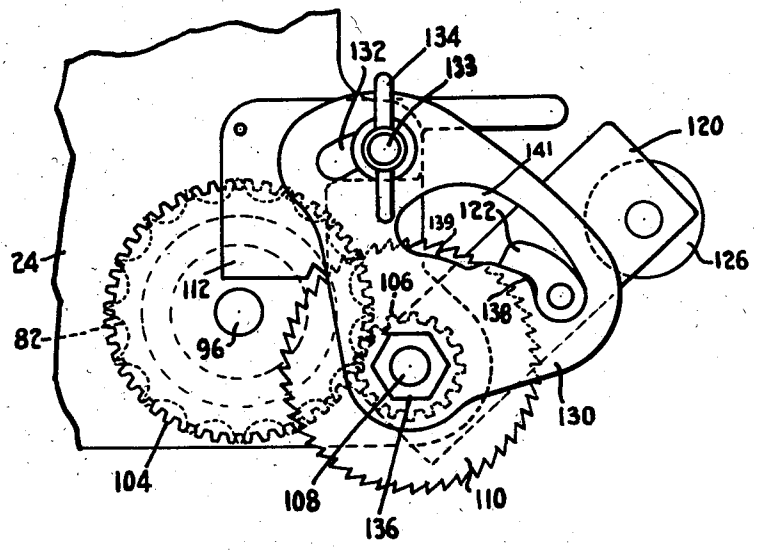


FIG. 5

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SHEET MATERIAL SPREADING MACHINE

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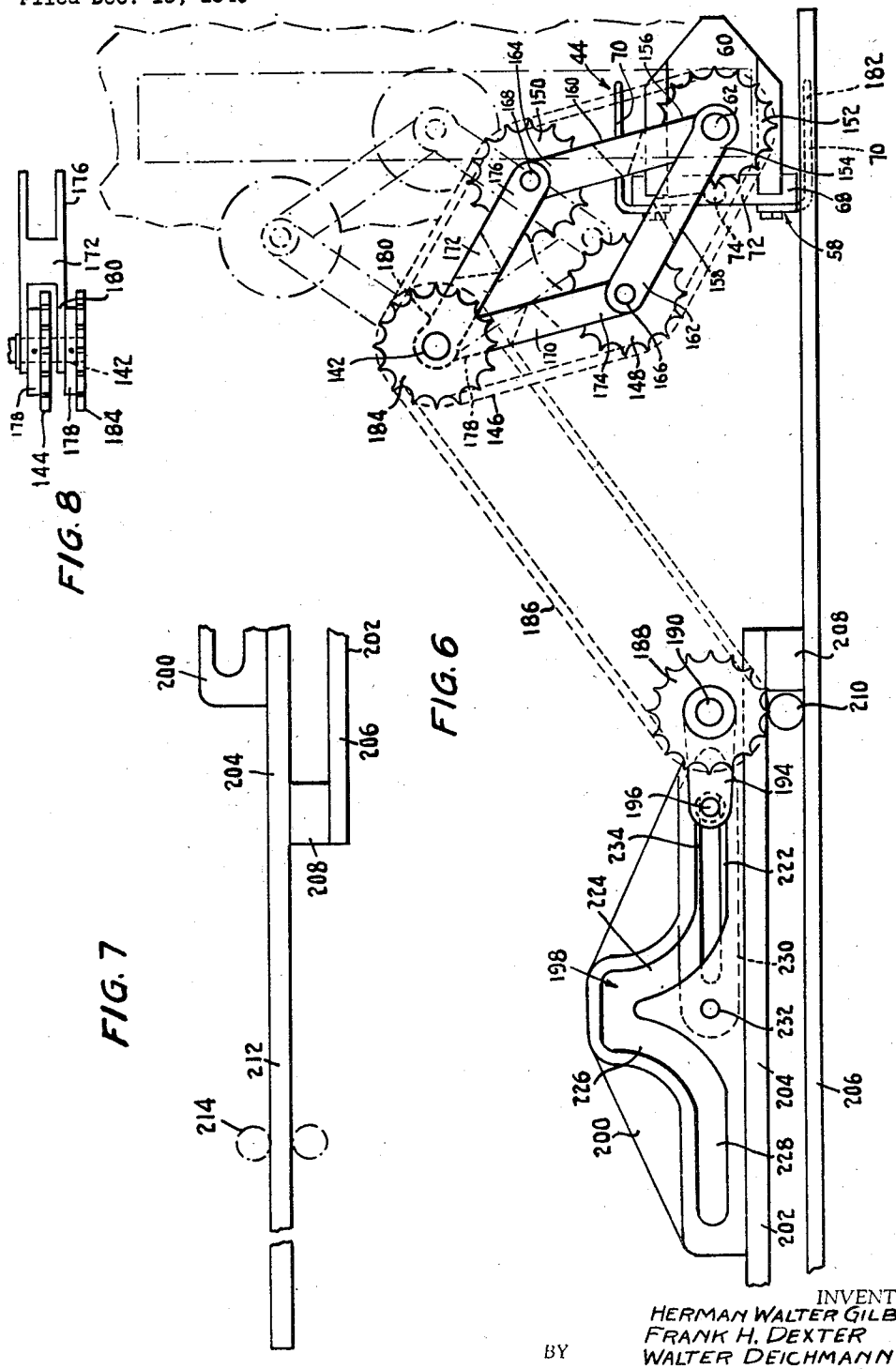


FIG. 8

FIG. 6

FIG. 7

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SHEET MATERIAL SPREADING MACHINE

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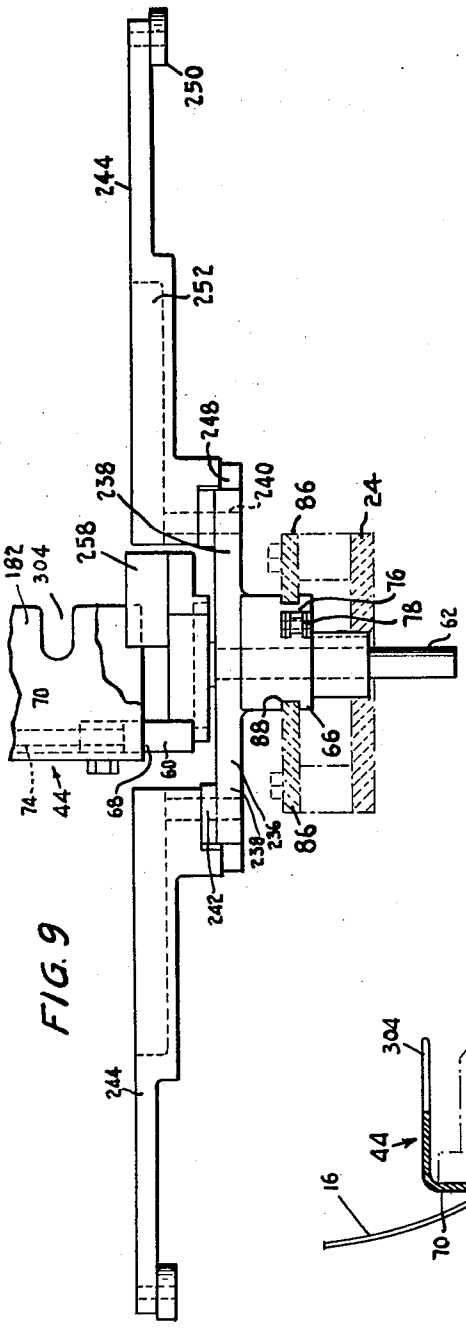


FIG. 9

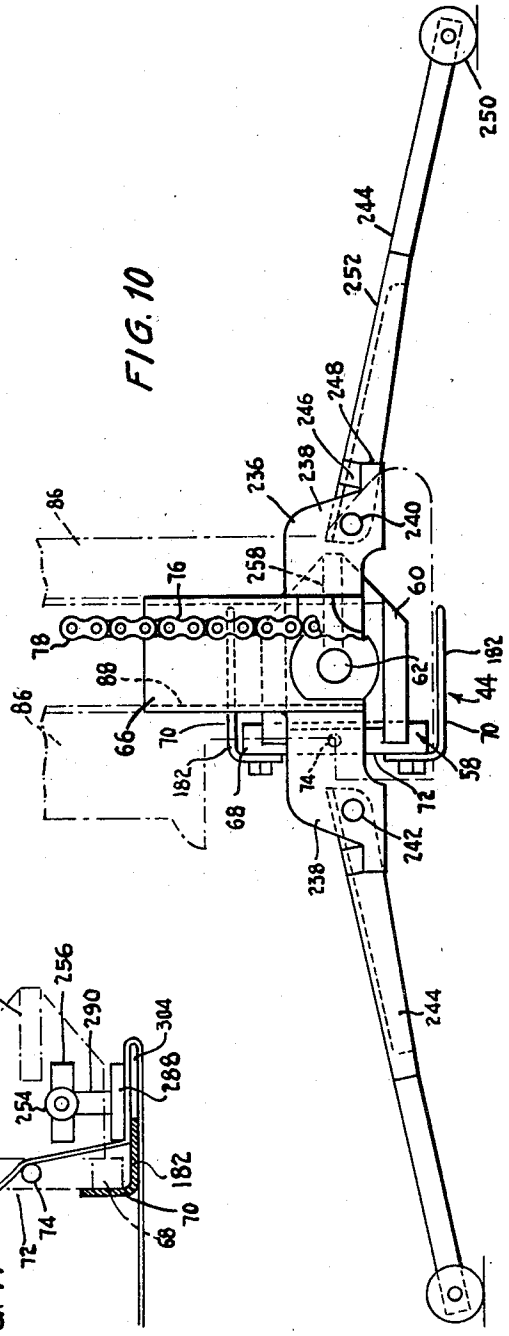


FIG. 10

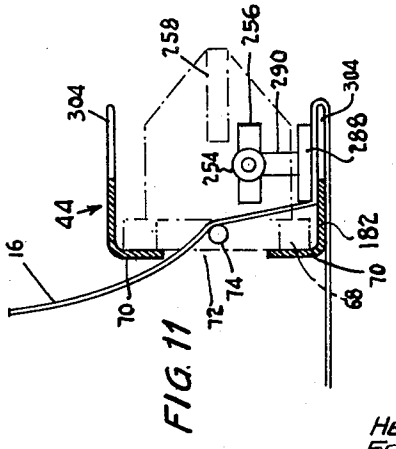


FIG. 11

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SHEET MATERIAL SPREADING MACHINE

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FIG. 12

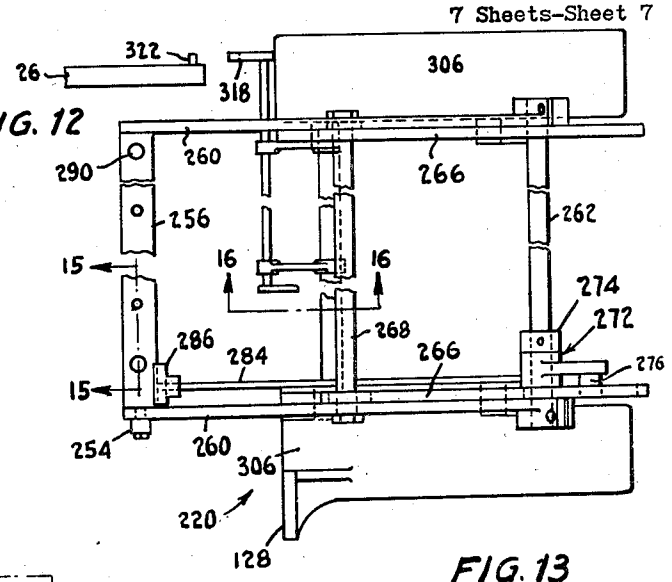


FIG. 16

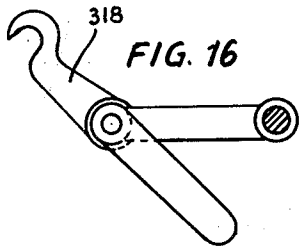


FIG. 15

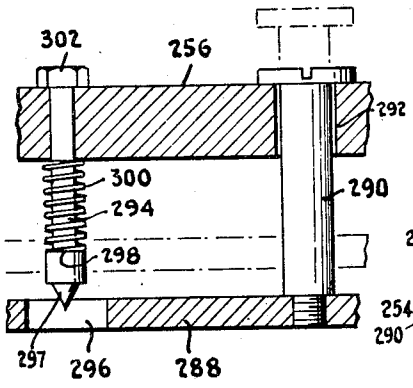


FIG. 13

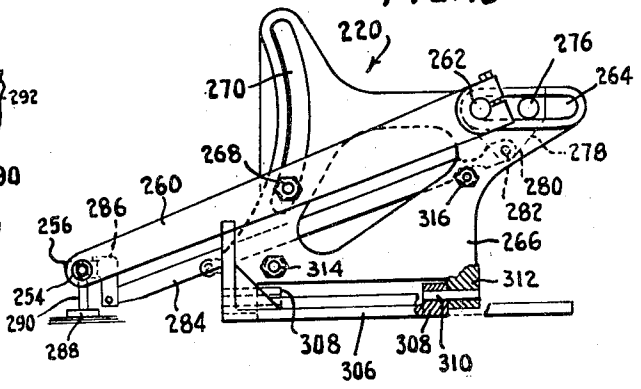
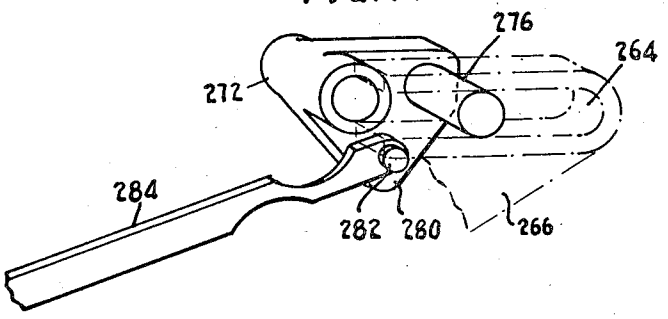


FIG. 14



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Patented Aug. 29, 1950 2,520,895

UNITED STATES PATENT OFFICE

2,520,895

SHEET MATERIAL SPREADING MACHINE

Herman Walter Gilbert, New York, N. Y., Frank H. Dexter, Clifton, N. J., and Walter Deichmann, Elmont, N. Y., assignors to Cutting Room Appliances Corporation, New York, N. Y., a corporation of New York

Application December 19, 1940, Serial No. 370,784

42 Claims. (Cl. 270—31)

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This invention relates to a sheet material spreading machine.

In many shops, as, for instance, where fabric is to be cut for garment manufacture, fabric is arranged in a plurality of superimposed layers so that a plurality of duplicates may be cut at a single operation. For economy of fabric, each layer must be of minimum length, and of uniform length. It is an object of the invention to provide a machine for operating upon sheet material in whatever form it may be, and for spreading it into a plurality of superimposed layers of identical extent, without substantial variation.

Fabric for this purpose may be disposed upon a carrier, movable transversely over a table upon which the layers are to be spread. The carrier is moved back and forth over the table, and automatically measures and spreads the fabric upon the table in layers, uniformly flat and of uniform extent. As the layers pile up, one upon the other, it is essential that no variation in length of the layers occur. It is an object of the invention to provide means for spreading fabric wherein control of the length of layers will be uniformly governed and determined regardless of the height to which the superimposed layers may reach within the limits of the machine.

Both the layers first produced, and those produced intermediately, and those on the highest levels must be uniform in length and in the registry of their edges. It is an object of the invention to provide apparatus by which the spreading means is effective to substantially the same degree for the first layer spread upon the table as for each subsequent layer, to the topmost limit to which layers may be piled.

In order that material be spread flat upon the table, a device, used as a guide for the moving sheet of material, is lifted, step by step, controlled by the movement of the carriage, and the number of layers which already are superimposed. It is an object of the invention to provide mechanism effective as the spreading device is lifted to maintain the spreading device in the same effective position for each layer, and in substantially identically the same relation to the table, so that the arrangement and extent of each layer will be substantially the same in every case.

The matter of forming layers requires a back and forth motion for the spreading device. Necessarily, therefore, in forming the several successive layers, the spreading device in each case must come to an end position from which it must retrace its movement. At the moment of retraction, a fold has been defined by the spreading device. As the spreading device begins to retrace its movement, it must be moved out of that fold, and must leave the fold as the end of the layer which has been spread. It is an object of the invention to provide means for cooperating with the spreading device to relieve the spreading device of the end fold as the device commences to retrace its movement.

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Other objects of this invention will be set forth herein, or will be apparent from the description and the drawings, in which is illustrated an embodiment of apparatus for carrying out the invention.

The invention, however, is not intended to be restricted to any particular construction, or to any particular arrangement of parts, or to any particular application of any such construction or any such arrangement of parts, or to any specific method of operation, or to any of the various details thereof, even where specifically shown and described herein, as the same may be modified in various particulars, or may be applied in many varied relations, without departing from the spirit and scope of the claimed invention, a practical construction embodying certain details of the invention being illustrated and described, but only for the purpose of complying with the requirements of the statutes for disclosure of an operative embodiment, but without attempting to disclose all of the various forms and modifications in which the invention might be embodied.

On the drawings, in which the same reference characters refer to the same parts throughout, and in which is disclosed such practical construction:

Fig. 1 is an elevational view of apparatus embodying features of the invention, the table being broken away for convenience in illustration;

Fig. 2 is an end elevational view of the carriage of the apparatus shown in Fig. 1, shown to enlarged scale, the table being broken away, and a part of the frame being broken away in cross-section to illustrate details of the construction;

Fig. 3 is a perspective view of a portion of the apparatus, looking beneath the platform and towards certain of the operating parts of the apparatus, to illustrate clearly the relationship of the different parts, the apparatus being broken away along the edges for convenience in illustration;

Fig. 4 is a plan view of a detail of lifting mechanism for the spreading device, shown to enlarged scale;

Fig. 5 is an elevational view of the apparatus shown in Fig. 4;

Fig. 6 is an elevational view, to enlarged scale,

of certain of the apparatus involved in the reversing of the spreading device;

Fig. 7 is a portion of the apparatus shown in Fig. 6, showing the extent of the apparatus of Fig. 6;

Fig. 8 is a plan view of a detail of the apparatus shown in Fig. 6;

Fig. 9 is a detail plan view of a portion of the apparatus cooperating with the spreading device, a portion of the frame being shown by dot-and-dash lines;

Fig. 10 is an elevational view of the apparatus shown in Fig. 9;

Fig. 11 is a detail of the spreading device, showing the method of cooperation of the clamping device therewith, the spreading device being broken away in section;

Fig. 12 is a plan view of a fabric clamping device for cooperation with the spreading device;

Fig. 13 is an end elevational view of the apparatus shown in Fig. 12, parts being broken away in section to clarify the relationship;

Fig. 14 is an elevational perspective view of a part of the apparatus shown in Figs. 12 and 13, cooperating parts being shown in dot-and-dash lines;

Fig. 15 is a vertical cross-sectional view, substantially on the line 15—15 on Fig. 12, and to an enlarged scale; and

Fig. 16 is a view of the engaging member associated with the apparatus of Fig. 12, as seen from the line 16—16 of Fig. 12.

Machine 10, illustrated on the drawing, is shown as comprising a carriage 12 which may move over a table 14 upon which material 16 is to be spread into superimposed layers. Material 16 may be arranged upon platform 18 of the machine in any desired form, as, for instance, as a roll, or as layers of uniform or other lengths. Material 16 may take the form of a roll 20, carried upon a rod 22.

Carriage 12 may comprise side frames 24 and 26 having bearings for wheels 30 and 32. Wheels 30 may be flanged to be received upon a track 34 which may be affixed at the edge of table 14 in any desired manner. Wheels 32 may be disposed to ride upon the top surface of the table, and, for such purpose, may have a tread of rubber or similar material. The actual width of the table thereby becomes of no material importance as wheels 30 and track 34 cooperate sufficiently accurately to guide the carriage in its spreading movement.

Extending upwardly from frames 24 and 26 are arms 36. Between arms 36 transverse rods 38 extend and provide means over which material 16 may be drawn down to the spreading position, in the manner to be described. A pair of arms 40 may be mounted pivotally on arms 36; a pair of rods 42 may extend between arms 40. Rods 42 may be adjusted with relation to the feed of material 16 by turning arms 40, to control the tension exerted upon the sheet material as it is fed to spreading device 44.

For such cases where the material to be spread is in the original form of roll 20, arms 36 are provided with a pair of extensions 46 in which are upwardly opening sockets 48 and 50. In one socket 50 may rest rod 22 upon which roll 20 is mounted. Rod 22, at the other socket 48, is received in the bore of a bushing 52, as shown in Fig. 2. Bushing 52 has an annular groove 54 formed intermediately of its length. Groove 54 is of sufficient width to receive the thickness of extension 46 at socket 48 to retain the bushing

against movement relative to extension 46. By means of a set-screw 56, rod 22 is retained against movement through the bushing, and provides means for adjusting the roll along the axis of the bushing to determine the position of the layers as they are laid down upon the table, but without interference with the rotaion of bushing and rod as the material is unrolled, as bushing, rod and cloth are free to rotate together in the sockets as the cloth is unrolled.

Spreading device 44 comprises member 58 of substantially U-shaped cross-section. Member 58 may include a pair of end plates 60 in which stub shafts 62 and 64 may be fixed. Shafts 62 and 64 extend beyond plates 60 and through blocks 66 in which they are provided bearings.

End plates 60 are substantially L-shaped in formation. Secured to legs 68 of the L's are a pair of channels 70, the channels extending transversely of the width of the machine and being spaced from each other to provide an opening 72. Also extending between plates 60 is a bar 74, this bar being loosely mounted so as to be capable of rotation freely as material being spread passes over the bar.

As shown in Figs. 9 and 10, each block 66, by means of a groove 76, is affixed to a sprocket chain 78. The sprocket chain adjacent frame 24 is trained over sprockets 80 and 82. Groove 76 is formed in the block and is so shaped that a number of links of the chain may be slid laterally into the recesses and then, by reason of the guiding of block 66 by means of engagement of straps 86 affixed to the frame within slots 88 in the edges of the blocks, and the engagement of chain 78 over sprockets 80 and 82, serves to restrain the chain against movement lengthwise of the groove. In this manner, the chain is locked against movement relative to the block in the direction of movement of the chain over its sprockets.

Sprocket 80 is mounted at the inside face of frame 24 on a bar 90, which extends transversely between the frames and has another sprocket 92 associated therewith at the inside face of frame 26, thereby to drive the associated chain and block at the other side of the machine. Sprocket 82 and its opposed sprocket 94 are mounted on stub shafts 96 which find their bearings in the respective individual frames. Bar 90 extends outside frame 24 to receive a ratchet 98 and a hand wheel 100 associated therewith. A pawl 102 may be pivoted upon frame 24 to fall by gravity into contact with ratchet 98, in order to restrain blocks 66 and the spreading device carried thereby against falling.

A gear 104 is carried by the stub shaft 96 of sprocket 82 at the outside face of frame 24, gear 104 being in driving relationship with another gear 106 mounted upon a pin 108 fixed in the frame. Associated to rotate with gear 106 is a ratchet wheel 110. A pawl 112 is pivotally mounted on the frame to move into engagement with ratchet wheel 110. Pawl 112 is driven into engagement with ratchet wheel 110 by means of a spring 116 anchored on a pin fixed in the frame.

An arm 120 is pivoted on pin 108 and carries a pivoted pawl 122, urged downwardly towards ratchet wheel 110 by suitable means such as a spring. When arm 120 is moved about pin 108 as an axis, pawl 122 engages ratchet wheel 110 and turns it, and thereby rotates sprocket 82 to effect movement of chains 78 for lifting blocks 66 and device 44. Arm 120 is actuated for this purpose when a roller 126 carried by arm 120 engages an end stop 128 as carriage 12

reaches the limit of movement determined by stop 128.

A sector 130 may be carried on pin 108, and may have a slot 132 through which the end of a pin 133 extends to be engaged by a wing nut 134 to retain the sector against rotation. Sector 130 is retained in position on pin 108 by any suitable securing means such as nut 136, and is capable of adjustment around pin 108 by releasing the engagement of wing nut 134 against sector 130 so that it may be turned on pin 108 as an axis. The adjustment of the sector moves a raised portion 138 of an edge 139 of an opening 141 into and out of cooperative relation to the engaging end of pawl 122. In accordance with the position of portion 138, pawl 122 will be made effective for greater or less rotation of sprocket 92. Pawl 112 serves to retain ratchet wheel 110 against back slippage while pawl 122 is not in driving relation to the ratchet wheel.

Stub shaft 142 extends through a suitable bearing on frame 24 to receive a sprocket 144. Over sprocket 144 is trained a belt or chain 146, which is also looped around sprockets 148, 150, and 152. Sprocket 152 is mounted on the extension of stub shaft 62 beyond the block 66 adjacent frame 24, shaft 62 rotating in its bearing in the block. The position of stub shaft 142 and its sprocket 144 remain substantially the same throughout operation. Straddling sprocket 152, and provided bearings on stub shaft 62, are yokes 154 and 156 which are formed as parts of arms 158 and 160, respectively. Arms 158 and 160 extend away from shaft 62, having yokes 162 and 164, respectively, at their ends to receive pins 166 and 168. Sprockets 148 and 150, respectively, are carried on pins 166 and 168, respectively, and are straddled by the respective yokes 162 and 164. In like fashion, arms 170 and 172 have end yokes 174 and 176 through which extend pins 166 and 168, and which straddle sprockets 148 and 150 and yokes 162 and 164 at the ends of arms 158 and 160. Arms 170 and 172 extend to stub shaft 142 which is extended through end yokes 178 and 180 of arms 170 and 172, respectively. The interlocked relationship of a set of yokes is illustrated in Fig. 8, where yokes 178 and 180 receive stub shaft 142 and retain sprocket 144.

Arms 158, 160, 170, and 172, which may be substantially identical in length, are effective to form a parallelogram, to function as a pantograph, so that, no matter what the angular dispositions of these arms with relation to each other, the length of chain belt 146, required to make the complete circuit around these sprockets, is always the same. Thus, if stub shaft 62 remain stationary vertically, all sprockets 144, 148, 150, and 152 will retain fixed axial positions. However, no matter what angular displacement may be imparted to sprocket 144, the same angular displacement will be imparted to a sprocket 152. However, as sprocket 152 is lifted with block 66, as shown by the dot-and-dash lines in Fig. 6, chain 146 will remain stationary at sprocket 144, and thus, although sprocket 152 is revolving around sprocket 144, the effect of the pantograph will be that a neutralizing rotation will be imparted to shaft 62, so that spreading device 44 will not be rotated. By reason of this construction, no matter to what position spreading device 44 may be moved vertically, towards or away from table 14, legs 182, once properly set, will always be disposed substantially parallel to the table.

As the carriage moves back and forth over the table, the fabric moves freely through opening 72 and over bar 76 as it is threaded. Legs 182 will maintain a position away from the direction of movement until the carriage approaches the end of its travel, as, for instance, as shown in Fig. 6, if the direction of travel be from right to left. As the carriage comes to the limit of its movement, the end fold must be formed and extended away from the spreading device 44. Thus the spreading device 44 must be reversed to point legs 182 in the direction in which the carriage is moving. For this purpose, sprocket 184 is carried on stub shaft 142. A chain 186 is extended from sprocket 184 to a sprocket 188, fixed on a shaft 190 which extends transversely through a bearing formed in frame 24.

Shaft 190 extends through the frame, and, at the inside face of the frame, carries a crank 194 from which a pin 196 extends laterally into a cam slot 198 in a plate 200. Plate 200 is carried by a bar 202 which may be formed of two members 204 and 206, held together by blocks 208 which may serve as stops to limit movement of bar 202 by engagement with portions of frame 24. These members are positioned on opposite sides of a roller 210 which extends laterally from the frame so that the bar may slide over it. Member 204 extends beyond member 206 into a projection 212 to extend between rollers 214 further to guide the bar in its movement. The bar projects from the frame and is positioned so that, just as the carriage is approaching the limits of its movement, it will engage end stop 128 or end stop 216. The engagement of the bar with end stop 216 is between projection 212 and a cushioned member 218 on one of cloth clamping members 220 hereinafter to be described.

As bar 202 engages stop 128, or as projection 212 engages cushioned member 218, and as the carriage advances, the bar is pushed along its bearings on the rollers, that is, the bar stops, and, as the carriage continues to move, the effect is that the bar moves on the rollers relatively to the frame. The result is that cam slot 198 moves relatively to pin 196. The pin moves in the horizontal sector 222 of the cam slot, then is lifted by rising sector 224 of the cam slot, then passes to the complementary sector 226, and falls to the other horizontal sector 228, completing a 180° turn. When the bar moves in the opposite direction, the sequence is just reversed. In so doing, pin 196 effects rotation of crank 194, and thus effects rotation of sprocket 188, sprocket 184, and the associated chains, and thereby turns spreading device 44. Since sprockets 184 and 188 have the same number of effective teeth, the spreading device will be rotated 180°.

In order to assure that crank 194 complete its rotation as cam slot 198 acts on pin 196, an arm 230 may be mounted on a pivot 232 on plate 200. Arm 230 has a slot 234 in which pin 196 is received. As arm 230 rotates, slot 234 and pin 196 cooperate throughout their rotational movement, and yet the pin is permitted to travel the entire limits of its movement in the horizontal sectors 222 and 228 of cam slot 198. Thus, when bar 202 is stopped by engagement with stop 128 or projection 212, and the carriage continues to move, slot 234 and pin 196 cooperate so that crank 194 is compelled to continue its rotation in the same direction until the movement of the carriage stops or the pin is within the horizontal portion of the

slot on the side opposite the one from which it started its movement. This is facilitated by a pair of pins 235 affixed to frame 24 in a predetermined relation to the path of movement of arm 230. The end 237 of arm 230 is formed with a camming surface, and, as bar 202 and its associated parts move relatively to frame 24, arm 230 rises to present the pointed end of the arm and its camming surface between pins 235. Continued movement of the carriage causes arm 230 to be thrown over, and thus to complete the rotation of crank 194. Thus, for instance, after pin 196 had been lifted by sector 224 to the peak of the slot, it would not be possible for crank 194 to fall back into sector 224, but it would have to pass to sector 226 to complete a 180° turn.

In part 236 of the block 66 adjacent frame 24 are a pair of extensions 238 in which are fixed a pair of pins 240 and 242. Each of these pins provides a mounting for an arm 244 which has a projection 246 to engage extension 238 or a projection 248, for limiting rotation of the arm on its pin. The ends of arms 244, when the spreading device is in its lowermost position, will rest on the table proper, and for that purpose may have a roller 250. The spreading device is lifted in the manner previously described as additional layers of fabric are spread, and the roller will be lifted free of the table; however, arm 244 will function in the same manner regardless of the position to which the spreading device is lifted.

Arm 244 acts as a cam, its top surface 252 engaging, as the carriage advances towards a cloth clamping member 220, under roller 254 carried upon a transverse bar 256. Arm 244, so engaged, lifts transverse bar 256 together with its associated elements, roller 254 riding up on arm 244 and then onto a flat ledge 258 on the inner face of plate 60. This ledge is formed by a rib which, at the limits of rotation of device 44, is presented successively to the ends of arms 244. When the carriage now is advanced to its end position, roller 254 passes beyond and falls over the end edge of ledge 258 so that bar 256 with its associated elements may also drop. At that time, the spreading device has been turned to present a leg 182 towards that bar 256, and has advanced, as shown in Fig. 11, so that the bar is within the cavity of U-shaped member 58.

Bar 256 is carried at the end of a pair of arms 260. Arms 260 pivot with a transverse rod 262 which is received in horizontal slots 264 formed for that purpose in frames 266, arms 260 being fixed to rod 262 in any suitable manner, as, for instance, by means of clevises. A rod 268, fixed to both arms 260, is positioned intermediately of arms 260, and extends tranversely between frames 266 and through arcuate slots 270 in the frames. On rod 262 is mounted a sleeve 272. The rod may rotate in the sleeve, but the sleeve is retained against lateral displacement by a collar 274 fixed on rod 262. Sleeve 272 is retained against rotation by means of a pin 276 extending into slot 264 from an arm 278 integral with sleeve 272, while rod 262 is permitted limited rotation. Sleeve 272, on another integral extension 280, has a pin pivot 282 for an arm 284 which extends forwardly to a lug 286 affixed to bar 256. This linkage of bar 256 with arm 284 and sleeve 272, and the arrangement of arms 260 with the engagement of rod 262 in slot 264 and of rod 268 in the arcuate slots 270 are such that the bottom surface of bar 256 is maintained substantially at all times in a position substantially horizontal, that is, parallel, to the surface of table 14. The radius of arcuate slots 270, and the distances from rod 262 to rod 268, and the length of arms 260 determine vertical straight line movement for bar 256. On the other hand, the distance from the center of rod 262 to the center of pin pivot 282 is the same as the distance between centers of roller 254 at which arm 260 is pivoted and the center of the pivot at which arm 284 is attached to lug 286. The distance between centers of rod 262 and roller 254 is the same as the distance between pivots along arm 284. Thus a parallelogram is produced which will be effective to maintain bars 256 and 288 always in the same vertical relationship to each other. In one construction, arm 260 was 3¾ inches long. The radius of slot 270 was 6⅞ inches, while its center was in a line parallel to the base of frame 266 and in an extension of the center-line of slot 264. Rod 268 was spaced 6⅞ inches along arm 260.

Associated with bar 256 is another bar 288 which is the member which actually falls into contact with the superposed layers of fabric. By means of pins 290, fixed in bar 288 and extending through openings 292 in bar 256, bars 256 and 288 are permitted limited movement with relation to each other. Pins 290 retain the bars substantially parallel to each other at all times, while the heads of the pins serve as stops to limit downward movement of bar 288. Also retained in bar 256 are a plurality of pins 294 which are capable of extension through openings 296 in bar 288. Pins 294 have pointed ends 297, and are intended to engage the fabric to prevent movement of the fabric under certain conditions. These pins are shouldered, as at 298, and have springs 300 engaged between the shoulder and the bottom of bar 256. Suitable means, such as a nut 302 threaded onto the end of pin 294 extending beyond the top face of bar 256, may serve as a stop to limit movement of the pin under the action of spring 300.

As the carriage moves up to an end stop, and arm 244 engages end roller 254, bar 256 is lifted free of the layers of fabric disposed upon the table, and is lifted to a position determined by ledge 258, so that bar 288 is above the level of the top face of a leg 182. As the carriage advances, and roller 254 passes beyond ledge 258 and falls over the end of that portion, bar 288 falls upon that leg 182, and, of course, upon the fabric trained through the opening and over that channel leg, as shown in Fig. 11. The weight of bar 256 is added to the weight of bar 288 in holding the fabric upon the channel leg, but only the weight of bar 256 is effective in driving pins 294 into engagement with the fabric on the channel, as shown in Fig. 15, where the clamping position is shown by dot-and-dash lines. A plurality of slots 304 may be directed inwardly from the edges of the channel leg. Pins 294 are spaced so as to cooperate with slots 304 in producing positive engagement of the pins with the fabric to assure that the fabric retain its position relative to bar 288.

As the carriage is now retracted, pins 294 restrain the fabric against any movement relative to the table, and permit the channel leg to be removed from the fold thus formed. At the final stage, as the channel leg clears bar 256, the bars together will bring the fold immediately into contact with the other folds and retain the folds against retraction and provide the necessary tension as the new layer is being stretched.

Members 220 may be made up so that they

may be adjusted to different positions on the table. For this purpose, each may include a plate 308 having lugs 308 carrying pins 310. Pins 310 provide bearings for lugs 312 on frames 266. In addition to the rods associated with arms 268, a pair of rods 314 and 316 extend transversely over the table between frames 266 and are effective for lining up the frames in substantially vertical relationship, regardless of the contour of the table upon which plates 306 are positioned. A finger 318, which may be carried by a plate 306, may be provided with suitable manipulating means, so that the finger may be brought into engagement with a pin 322 on the main carriage frame so that a set of plates 306 of a member 220 may be moved along the table into a desired position in accordance with the length of a layer which is to be determined. The set of plates of one member 220 may, if desired, be fixed to the table, while the set of plates of the movable member 220 may, after proper location, be clamped to the table by a removable clamp or similar device.

Carried on frame 24 may be a suitable counting device 328, the device having an extending arm for engagement with a cam carried upon bar 202. Thus, as bar 202 moves backward and forward in reversing the spreading device, the cam will be effective to manipulate the counting device and record the number of layers which had been disposed on the table.

Suitable handle means may be attached to frame 24 to facilitate the movement of the carriage back and forth in forming layers. The action of arms 244 is such that, even at the very lowest position, the fabric engaged by pins 284 cannot escape from the spreading device, and such that the travel of bar 288, after release of the folds from the spreading device, is very slight, while the pins are at all times in engagement with the fabric, so that substantially no distortion of the layer is effected as the fabric folds and is clamped into superimposed relation. In any case, pins 284 are assured substantially vertical movement, and thus in no way can distort or stretch the fabric out of the condition in which it was spread by the spreading device. Thus, no tearing can result as the spreading device moves from the engaged relation to the clamped relation.

Many other changes could be effected in the particular apparatus designed, and in the methods of operation set forth, and in specific details thereof, without substantially departing from the invention defined in the claims, the specific description being merely of an operative embodiment capable of illustrating certain principles of the invention.

What is claimed as new and useful is:

1. In a machine for laying down upon a surface successive superimposed layers of sheet material of substantially identical extent, means for movement relative to the surface for guiding the sheet material to the surface, end-fold forming means for the guiding means, means for limiting movement of the guiding means relative to the surface, means cooperating with the guiding means and the movement-limiting means for positioning the end-fold forming means to direct the fold in the direction of movement of the guiding means, and a plurality of individually movable pressure-applying means for cooperating with the end-fold forming means to apply gripping pressure simultaneously to the fold at points spaced along the fold at the limit of travel of the guiding means.

2. In a machine for laying down upon a surface successive superimposed layers of sheet material of substantially identical extent, a carriage for movement relative to the surface for guiding the sheet material to the surface, a pair of limits for movement of the carriage to determine uniformly the extent of each of the superimposed layers, end-fold forming means for the carriage, means carried by the carriage for engaging the limits to halt movement of the carriage relative to the surface, the engaging means controlling the position of the end-fold forming means, a plurality of individually actuated means for being brought into cooperation with the end-fold forming means to grip a fold distended by the end-fold forming means and to retain it in the distended form, means for bringing the individually actuated gripping means simultaneously into gripping and retaining position, and means to make the gripping means effective immediately as the movement of the carriage is halted by the limits.

3. Apparatus for disposing sheet material in a plurality of successively superimposed layers of substantially identical extent, which includes a carriage for movement over a surface upon which the layers are to be disposed, means on the carriage for distending the sheet material and forming end folds in the material, the distending means including a member movable to present a fold-forming edge in the direction of travel of the carriage, the carriage and the distending means cooperating to bring the end folds to end positions, means for lifting and lowering the member, and means for turning the member to present a fold-forming edge thereof in the direction of travel of the carriage, the turning means including means to present the fold-forming edge substantially parallel to the surface regardless of the position to which the member may be lifted relatively to the surface, and drive means for the presenting means, the drive means being at all times substantially a constant distance in relation to the surface.

4. Apparatus for disposing sheet material in a plurality of successively superimposed layers of substantially identical extent, which includes a carriage for movement over a surface upon which the layers are to be disposed, means on the carriage for distending the sheet material and forming end folds in the material, the distending means including a member having fold-forming blades and a fabric-guiding slit between the blades, the carriage and the distending means cooperating to bring the end folds to end positions, means for lifting and lowering the member, and means for turning the member to extend a fold-forming blade in the direction of travel of the carriage, the turning means including a driven sprocket mounted on the carriage, the member having a sprocket, the sprockets being mounted so that their axes are substantially parallel, and means to maintain the fold-forming blades substantially parallel to the surface regardless of the position to which the member may be lifted relatively to the surface.

5. Apparatus for disposing sheet material in a plurality of successively superimposed layers of substantially identical extent, which includes a carriage for movement over a surface upon which the layers are to be disposed, means on the carriage for distending the sheet material and forming end folds in the material, the distending means including a member having fold-

forming blades and a fabric-guiding slit between the blades, the carriage and the distending means cooperating to bring the end folds to end positions, means for lifting and lowering the member, and means for turning the member to extend a fold-forming blade in the direction of travel of the carriage, the turning means including a driven shaft mounted on the carriage, a band connection from the shaft to the member, and means cooperating with the band connection to maintain the shaft and member at all times in the same axial relationship regardless of the position to which the member may be lifted relatively to the surface.

6. Apparatus for disposing sheet material in a plurality of successively superimposed layers of substantially identical extent, which includes a carriage for movement over a surface upon which the layers are to be disposed, means on the carriage for distending the sheet material and forming end folds in the material, the distending means including a member having fold-forming blades and a fabric-guiding slit between the blades, the carriage and the distending means cooperating to bring the end folds to end positions, means for lifting and lowering the member, and means for turning the member to extend a fold-forming blade in the direction of travel of the carriage, the turning means including a driven shaft mounted on the carriage, a band connection from the shaft to the member, the distance between the shaft and the member varying as the member is lifted and lowered, and means to maintain the band connection to the member substantially in the form of a parallelogram at all times.

7. Apparatus for disposing sheet material in a plurality of successively superimposed layers of substantially identical extent, which includes a carriage for movement over a surface upon which the layers are to be disposed, means on the carriage for distending the sheet material and forming end folds in the material, the distending means including a member having fold-forming blades and a fabric-guiding slit between the blades, the carriage and the distending means cooperating to bring the end folds to end positions, means for lifting and lowering the member, means for turning the member to extend a fold-forming blade in the direction of travel of the carriage, the turning means including a driven shaft mounted on the carriage, a band connection from the shaft to the member, the distance between the shaft and the member varying as the member is lifted and lowered, and a plurality of links pivotally connected to each other to define a parallelogram at all times, a pair of the links being pivotally mounted on the carriage and a pair of the links being pivotally mounted on the axis of the member, the band connection being distended in drive relation between shaft and member over means at the pivot axes of the links.

8. Apparatus for disposing sheet material in a plurality of successively superimposed layers of substantially identical extent, which includes a carriage for movement over a surface upon which the layers are to be disposed, means on the carriage for distending the sheet material to define end folds in the material, the distending means including a member having a fold-forming edge, means for turning the member to present the fold-forming edge in the direction of travel of the carriage, the turning means including a driven shaft fixedly mounted on the carriage, a crank carried by the shaft, and means for oscillating the crank to rotate the member into position.

9. Apparatus for disposing sheet material in a plurality of successively superimposed layers of substantially identical extent, which includes a carriage for movement over a surface upon which the layers are to be disposed, means on the carriage for distending the sheet material to define end folds in the material, the distending means including a member having a fold-forming edge, means for turning the member to present the fold-forming edge in the direction of travel of the carriage, the turning means including a driven shaft fixedly mounted on the carriage, a crank carried by the shaft, and means for oscillating the crank to rotate the member into position including a bar sliding on the carriage and having sliding engagement with the crank to turn it back and forth.

10. Apparatus for disposing sheet material in a plurality of successively superimposed layers of substantially identical extent, which includes a carriage for movement over a surface upon which the layers are to be disposed, means on the carriage for distending the sheet material to define end folds in the material, the distending means including a member having a fold-forming edge, means for turning the member to present a fold-forming edge in the direction of travel of the carriage, the turning means including a driven shaft mounted on the carriage, a crank carried by the shaft and having a crank pin, and means for oscillating the crank to rotate the member into position, the oscillating means including a bar having a substantially V-shaped cam slot formed therein, the crank pin being engaged in the slot, the bar being slidable on the frame so that the slot turns the crank substantially 180°.

11. Apparatus for disposing sheet material in a plurality of successively superimposed layers of substantially identical extent, which includes a carriage for movement over a surface upon which the layers are to be disposed, means on the carriage for distending the sheet material to define end folds in the material, the distending means including a member having a fold-forming edge, means for turning the member to present the fold-forming edge in the direction of travel of the carriage, the turning means including a driven shaft mounted on the carriage, a crank carried by the shaft and having a crank pin, and means for oscillating the crank to rotate the member into position, the oscillating means including a bar having a cam slot formed therein, the crank pin being engaged in the slot, the bar being slidable on the frame and the slot being shaped and dimensioned to impart arcuate movement to the crank, and an arm pivoted on the bar to compel the crank pin to complete rotation of the crank continuously in one direction as the bar is slid continuously in one direction.

12. Apparatus for disposing sheet material in a plurality of successively superimposed layers of substantially identical extent, which includes a carriage for movement over a surface upon which the layers are to be disposed, means on the carriage for distending the sheet material to define end folds in the material, the distending means including a member having a fold-forming edge, means for turning the member to present the fold-forming edge in the direction of travel of the carriage, the turning means including a

driven shaft mounted on the carriage, a crank carried by the shaft and having a crank pin, and means for oscillating the crank to rotate the member into position, the oscillating means including a bar having a cam slot formed therein, the crank pin being engaged in the slot, the bar being slidable on the frame and the slot being shaped and dimensioned to impart arcuate movement to the crank, and an arm pivoted on the bar and having a slot for receiving the crank pin continuously to guide the crank pin in one direction and to compel the crank pin to complete rotation of the crank coninuously in one direction as the bar is slid continuously in one direction.

13. Apparatus for disposing sheet material in a plurality of successively superimposed layers of substantially identical extent, which includes a carriage for movement over a surface upon which the layers are to be disposed, means on the carriage for distending the sheet material to define end folds in the material, the distending means including a member having a fold-forming blade, means for turning the fold-forming blade to point in the direction of travel of the carriage, means on the surface for retaining formed end folds in position to maintain the layers in formed condition, the retaining means comprising means for coming to rest upon the blade having a fold formed thereon, the retaining means having individually effective members for engaging the fold on the blade to hold the fold against movement with the blade thereafter, the fold-holding means serving to retain the fold as the blade is removed, and means to present the fold-forming blade substantially parallel to the retaining means regardless of the position of the member relative to the surface.

14. Apparatus for disposing sheet material in a plurality of successively superimposed layers of substantially identical extent, which includes a carriage for movement over a surface upon which the layers are to be disposed, means on the carriage for distending the sheet material to define end folds in the material, the distending means including a member having a fold-forming blade, means for turning the fold-forming blade to point in the direction of travel of the carriage and substantially parallel to the surface, means for retaining formed end folds in position to maintain the layers in formed condition on the surface, the retaining means including a bar for coming to rest upon the blade having a fold formed thereon to hold the fold against movement with the blade thereafter, and a plurality of pins individually slidable through the bar for engaging the fabric and retaining it against movement to retain the fold as the blade is removed, and means for positioning the retaining means to present a surface substantially at all times parallel to the fold to be held thereby.

15. Apparatus for disposing sheet material in a plurality of successively superimposed layers of substantially identical extent, which includes a carriage for movement over a surface upon which the layers are to be disposed, means on the carriage for distending the sheet material to define end folds in the material, the distending means including a member having a fold-forming blade, means for turning the fold-forming blade point in the direction of travel of the carriage and substantially parallel to the surface, means for retaining formed end folds in position to maintain the layers in formed condition on the surface, the retaining means including a bar for coming to rest upon the blade having a fold formed thereon to hold the fold against movement with the blade thereafter, and a plurality of pins individually spring-pressed to project through the bar to engage the fabric and retain it against movement to retain the fold as the blade is removed, and means for positioning the retaining means to present a surface substantially at all times parallel to the fold to be held thereby.

16. Apparatus for disposing sheet material in a plurality of successively superimposed layers of substantially identical extent, which includes a carriage for movement over a surface upon which the layers are to be disposed, means on the carriage for distending the sheet material to define end folds in the material, the distending means including a member having a fold-forming blade, the free fold-forming edge of the blade having a plurality of open portions, means for turning the fold-forming edge to point in the direction of travel of the carriage, means for retaining formed end folds in position to maintain the layers in formed condition on the surface, the retaining means including a bar for coming to rest upon the blade having a fold formed thereon to hold the fold against movement with the blade thereafter, and a plurality of pins individually slidable through the bar to cooperate with the open portions of the blade for engaging the fabric and retaining it against movement as the blade is removed from the fold, and means to present the fold-forming blade substantially parallel to the retaining means regardless of the position of the member relative to the surface.

17. In apparatus for spreading sheet material upon a surface into a plurality of superimposed layers of substantially identical extent, which comprises a carriage for movement over the surface, a U-shaped member supported on the carriage, means to position the member and to retain the member positioned so that the arms of the U are extended substantially parallel to the surface, a bar located on the surface and positioned to extend substantially parallel to the member, means for pivoting the bar to a position above the lowermost arm of the U as the carriage approaches the bar, the pivoting means including a moving pivot to maintain the bar substantially parallel to the arms of the U at all times, and means for releasing the bar to fall on the lowermost arm of the U when the carriage reaches a predetermined end position of movement towards the bar.

18. In apparatus for spreading sheet material upon a surface into a plurality of superimposed layers of substantially identical extent, which comprises a carriage for movement over the surface, a U-shaped member supported on the carriage, means to position the member and to retain the member positioned so that the arms of the U are extended substantially parallel to the surface, a clamping device located on the surface, the clamping device including a pair of bars, means for maintaining the bars substantially parallel to each other but movable a limited degree relatively to each other, resilient engaging devices carried by the uppermost bar for projection by the weight of the uppermost bar through the lowermost bar to engage material on the surface on which the lowermost bar comes to rest, and means for pivoting the clamping device to a position above the lowermost arm

of the U when the carriage is within a predetermined distance from the clamping device, the pivoting means including means to maintain the clamping device substantially parallel to the arms of the U at all times.

19. Fabric clamping means for apparatus for disposed sheet material in a plurality of successively superimposed layers, the clamping means comprising a clamp plate having a flat bottom surface, and means for lifting and lowering the clamp plate so that the bottom face maintains a position in which said face is always in a plane parallel to every other plane in which the face may be disposed, the lifting and lowering means including an upright, a bar carrying the clamp plate, and means for limiting two spaced apart points on the bar to oscillating movement relative to the upright, the clamp plate being positioned at a third point along the bar removed from the two spaced apart points.

20. Fabric clamping means for apparatus for disposing sheet material in a plurality of successively superimposed layers, the clamping means comprising a clamp plate having a flat bottom surface, and means for lifting and lowering the clamp plate so that the bottom face maintains a position in which said face is always in a plane parallel to every other plane in which the face may be disposed, the lifting and lowering means including an upright, two bars carrying the clamp plate, and means for limiting two spaced apart points on one of the bars to oscillating movement relative to the upright, the clamp plate being positioned at a third point along the same bar removed from the two spaced apart points.

21. Fabric clamping means for apparatus for disposing sheet material in a plurality of successively superimposed layers, the clamping means comprising a clamp plate having a flat bottom surface, and means for lifting and lowering the clamp plate so that the bottom face maintains a position in which said face is always in a plane parallel to every other plane in which the face may be disposed, the lifting and lowering means including an upright, a pair of bars carrying the clamp plate, the bars having pivotal connection to the clamp plate, a pivotal connection between each of the bars and the upright, the pivotal connections being mounted to move parallel to the surface, and means to limit a point in one of the bars to movement along an arc.

22. Fabric clamping means for apparatus for disposing sheet material in a plurality of successively superimposed layers, the clamping means comprising a clamp plate having a flat bottom surface, and means for lifting and lowering the clamp plate so that the bottom face maintains a position in which said face is always in a plane parallel to every other plane in which the face may be disposed, the lifting and lowering means including an upright, a bar carrying the clamp plate, a pivotal connection between the bar and the upright, the pivotal connection being mounted to move parallel to the surface, and means to limit movement of a point in the bar so that the clamp plate will move substantially in a vertical plane.

23. Fabric clamping means for apparatus for disposing sheet material in a plurality of successively superimposed layers, the clamping means comprising a clamp plate having a flat bottom surface, and means for lifting and lowering the clamp plate so that the bottom face maintains a position in which said face is always in a plane parallel to every other plane in which the face may be disposed, the lifting and lowering means including an upright, a bar carrying the clamp plate, a pivotal connection between the bar and the upright, the pivotal connection being mounted to move parallel to the surface, and means to limit movement of a point in the bar to movement along an arc of the radius of the distance between the pivotal connection and the point of connection of the clamp plate to the bar.

24. Fabric clamping means for apparatus for disposing sheet material in a plurality of successively superimposed layers, the clamping means comprising a clamp plate having a flat bottom surface, and means for lifting and lowering the clamp plate so that the bottom face maintains a position in which said face is always in a plane parallel to every other plane in which the face may be disposed, the lifting and lowering means including an upright, a bar carrying the clamp plate, a pivotal connection between the bar and the upright, the pivotal connection being mounted to move parallel to the surface, and means to limit movement of a point in the bar to movement along an arc of the radius of the distance between the pivotal connection and the point of connection of the clamp plate to the bar, the center of the arc lying in a line parallel to the surface and passing through the pivotal connection.

25. Fabric clamping means for apparatus for disposing sheet material in a plurality of successively superimposed layers, the clamping means comprising a clamp plate having a flat bottom surface, and means for lifting and lowering the clamp plate so that the bottom face maintains a position in which said face is always in a plane parallel to every other plane in which the face may be disposed, the lifting and lowering means including an upright, a bar having a pivotal connection with the clamp plate, a pivotal connection between the bar and the upright, the pivotal connection being mounted to move parallel to the surface, means to limit movement of a point in the bar so that the clamp plate will move substantially in a vertical plane, and a compensating member pivotally engaging the clamp plate to fix the position of the face parallel to the surface.

26. Fabric clamping means for apparatus for disposing sheet material in a plurality of successively superimposed layers, the clamping means comprising a clamp plate having a flat bottom surface, and means for lifting and lowering the clamp plate, the lifting and lowering means including a bar disposed substantially parallel to the clamp plate, means engaging the clamp plate and slidably retained by the bar to support the clamp plate, the clamp plate having a plurality of openings therethrough, and a plurality of fabric-engaging members carried by the bar, each of the fabric-engaging members being in line with an opening for projection through the opening on movement of the bar and the clamp plate towards each other.

27. Fabric clamping means for apparatus for disposing sheet material in a plurality of successively superimposed layers, the clamping means comprising a clamp plate having a flat bottom surface, and means for lifting and lowering the clamp plate, the lifting and lowering means including a bar disposed substantially parallel to the clamp plate, means for supporting

the clamp plate for limited movement with relation to the bar, the clamp plate having a plurality of openings therethrough, and a plurality of fabric-engaging members carried by the bar, each of the fabric-engaging members being in line with an opening for projection through the opening on movement of the bar and the clamp plate towards each other.

28. Fabric clamping means for apparatus for disposing sheet material in a plurality of successively superimposed layers, the clamping means comprising a clamp plate having a flat bottom surface, and means for lifting and lowering the clamp plate, the lifting and lowering means including a bar disposed substantially parallel to the clamp plate, means for supporting the clamp plate for limited movement with relation to the bar, the clamp plate having a plurality of openings therethrough, and a plurality of fabric-engaging members carried by the bar, each of the fabric-engaging members being in line with an opening for projection through the opening on movement of the bar and the clamp plate towards each other and each of the fabric-engaging members being mounted for movement relative to the bar.

29. Clamping means for successively superimposed layers of sheet material, comprising a plurality of uprights, a clamp plate, a plurality of bars, a plurality of rods interconnecting the bars to cause the bars to move together, means acting upon at least one of the bars to limit an intermediate portion of the bar to movement along an arcuate path, means acting upon at least one of the bars to limit an end portion of that bar to movement along a substantially rectilinear path, the clamp plate being pivotally carried by the bars at a position removed from both bar portions, and means between the clamp plate and one of the portions for restraining the clamp plate so that its bottom face is at all times in parallel relation to any of its other positions.

30. Clamping means for successively superimposed layers of sheet material, comprising a plurality of uprights, a clamp plate, a plurality of bars, a plurality of rods interconnecting the bars to cause the bars to move together, an arcuate slot in one of the uprights, means extending into the slot from an intermediate portion of one of the bars, means acting upon at least one of the bars to limit an end portion of that bar to movement along a substantially rectilinear path, the clamp plate being pivotally carried by the bars at a position removed from both bar portions, and means between the clamp plate and one of the portions for restraining the clamp plate so that its bottom face is at all times in parallel relation to any of its other positions.

31. Clamping means for successively superimposed layers of sheet material, comprising a plurality of uprights, a clamp plate, a plurality of bars, a plurality of rods interconnecting the bars to cause the bars to move together, means acting upon at least one of the bars to limit an intermediate portion of the bar to movement along an arcuate path, a member carried by one of the uprights and guided for substantially rectilinear movement, an end portion of one of the bars being pivotally mounted upon the member, the clamp plate being pivotally carried by the bars at a position removed from both bar portions, and means between the clamp plate and the member for restraining the clamp plate so that its bottom face is at all times in parallel relation to any of its other positions.

32. Clamping means for successively superimposed layers of sheet material, comprising a plurality of uprights, a clamp plate, a plurality of bars, a plurality of rods interconnecting the bars to cause the bars to move together, an arcuate slot in one of the uprights, means extending into the slot from an intermediate portion of one of the bars, a member carried by one of the uprights and guided for substantially rectilinear movement, an end portion of one of the bars being pivotally mounted upon the member, the clamp plate being pivotally carried by the bars at a position removed from both bar portions, and means between the clamp plate and the member for restraining the clamp plate so that its bottom face is at all times in parallel relation to any of its other positions.

33. Clamping means for successively superimposed layers of sheet material, comprising a plurality of uprights, a clamp plate, a plurality of bars, a plurality of rods interconnecting the bars to cause the bars to move together, an arcuate slot in one of the uprights, means extending into the slot from an intermediate portion of one of the bars, a member carried by one of the uprights and guided for substantially horizontal movement, an end portion of one of the bars being pivotally mounted upon the member, the clamp plate being pivotally carried by the bars at a position removed from both bar portions, and means between the clamp plate and the member for restraining the clamp plate so that its bottom face is at all times in parallel relation to any of its other positions.

34. Apparatus for disposing sheet material in a plurality of successively superimposed layers of substantially identical extent, which includes a carriage for movement over a surface upon which the layers are to be disposed, limits for the movement of the carriage over the surface, means on the carriage for distending the sheet material to dfine end folds in th material, means disposed at the limits of travel of the carriage for receiving and restraining the end folds, the carriage and the distending means cooperating to distend the end folds into cooperation with the receiving and retaining means, means carried by the carriage for positioning and retaining means to receive the distending means in fold-inserting relation between the surface and the retaining means when the distending means approaches a limit, and means to release the retaining means into engagement with the end fold on the distending means when the carriage reaches the limit, the retaining means including a plurality of members for retaining the end fold stationary relatively to the surface while the distending means is retracted from the retained fold, each of the members being constructed to be effective upon the end fold independently of the effectiveness of the other members.

35. In a machine for laying down upon a surface successive superimposed layers of sheet material of substantially identical extent, means for movement relative to the surface for guiding the sheet material to the surface, end-fold forming means for the guiding means, the end-fold forming means comprising means for directing a fold in the direction of movement of the guiding means, and a plurality of individually movable pressure-applying means for cooperating with the end-fold forming means to apply gripping pressure simultaneously to the fold at points spaced along the fold at the end of the layer.

36. In a machine for laying down upon a surface successive superimposed layers of sheet ma-

terial of substantially identical extent, a carriage for movement relative to the surface for guiding the sheet material to the surface, end-fold forming means for the carriage, the end-fold forming means comprising means for directing a fold in the direction of movement of the carriage, and a plurality of individually actuated means for being brought into cooperation with the end-fold forming means to grip a fold distended by the end-fold forming means and to retain the fold in the distended form, and means for bringing the individually actuated gripping means simultaneously into gripping and retaining position.

37. In a machine for laying down upon a surface successive superimposed layers of sheet material, a carriage for movement back and forth relative to the surface, the carriage having means for guiding fabric into position upon the surface and for forming the end folds of the layers during such movement of the carriage both back and forth over the surface, the guiding and forming means comprising a single U-shaped member, means for limiting movement of the carriage in both directions relative to the surface, means for gripping a fold distended by the member to retain it in distended form, and means for lifting the gripping means free of the surface and superimposed folded layers already formed and disposed on the surface as the carriage approaches either of the movement limits, the means being carried with the member and extending lengthwise of the carriage beyond the free ends of the arms of the member, and having a fixd relation at all times to the member, said lifting means comprising means for guiding the gripping means between the arms of the U at the carriage movement limit and for retaining the gripping means out of contact with the arms of the U until the carriage reaches a limit of its movement.

38. In a machine for laying down upon a surface successive superimposed layers of sheet material, a carriage for movement back and forth relative to the surface, the carriage having means for guiding fabric into position upon the surface and for forming the end folds of the layers during such movement of the carriage both back and forth over the surface, the guiding and forming means comprising a single U-shaped member, means for limiting movement of the carriage in both directions relative to the surface, means for gripping a fold distended by the member to retain it in distended form, and means pivotally mounted substantially medially of the extent of and extending lengthwise of the carriage beyond the free ends of the arms of the member, and movable at all times with the member, for engaging the gripping means at a limit of movement of the carriage as the carriage approaches that limit of movement and for lifting that gripping means free of the surface and superimposed layers already formed and disposed on the surface, said engaging and lifting means comprising means for guiding the gripping means between and free of the arms of the U at the carriage movement limit and for retaining the gripping means free of the arms of the U until the carriage reaches that limit of its movement.

39. In a machine for laying down upon a surface successive superimposed layers of sheet material, a carriage for movement back and forth relative to the surface, the carriage having a single member constituting means for guiding fabric into position upon the surface and for forming the end folds of the layers during such movement of the carriage both back and forth over the surface, means for limiting movement of the carriage in both directions relative to the surface, means for gripping a fold distended by the end-fold forming means to retain it in distended form, and a pair of arms pivotally mounted upon and retained to extend longitudinally in opposite directions from the fabric guiding means, the arms forming means for engaging the gripping means at a limit of movement of the carriage as the carriage approaches that limit of movement and for lifting that gripping means free of the surface and superimposed layers already formed and disposed on the surface, said arms comprising means for guiding the gripping means into the end-fold forming means at the carriage movement limit, the fabric guiding means being reversible to form folds in either direction of carriage movement, the arms retaining a fixed relation to the fabric guiding means for each position of the fabric guiding means.

40. In a machine for laying down upon a surface successive superimposed layers of sheet material, a carriage for movement back and forth relative to the surface, the carriage having a single member constituting means for guiding fabric into position upon the surface and for forming the end folds of the layers during such movement of the carriage both back and forth over the surface, means for limiting movement of the carriage in both directions relative to the surface, means for gripping a fold distended by the end-fold forming means to retain it in distended form, and a pair of arms pivotally mounted upon and retained to extend longitudinally in opposite directions from the fabric guiding means, the arms forming means for engaging the gripping means at a limit of movement of the carriage as the carriage approaches that limit of movement and for lifting that gripping means free of the surface and superimposed layers already formed and disposed on the surface, said arms comprising means for guiding the gripping means into the end-fold forming means at the carriage movement limit, the fabric guiding means being reversible to form folds in either direction of carriage movement, and means for elevating the end-fold forming means, the arms being assembled with the end-fold forming means to remain in a constant operative relation to the fabric guiding means for every position of the fabric guiding means.

41. A machine for spreading sheet material to form successive superimposed layers of sheet material of substantially identical extent, the machine including means for guiding the sheet material to the position where the layers are to be formed, means for spreading the material and for forming end-folds therein, the spreading-and-end-fold-forming means comprising a mounting, and a substantially U-shaped member having a pair of substantially parallel arms, means for lifting and lowering the mounting and the U-shaped member, the lifting-and-lowering means including a band anchored to the mounting, the member being pivoted on the mounting for movement in either direction, means for limiting pivoting movement of the member so that, at either of the limits, both arms are parallel to the superimposed layers, rotatable members spaced apart and located substantially in the same plane, the band being trained around the rotatable members, means for imparting rotation to one of the rotatable members, the rotation-imparting means being disposed substantially in the same plane as said rotatable member, and means movable in a plane substantially parallel to said plane of said

member for energizing the rotation-imparting means to impart step-by-step motion to said rotatable member.

42. Apparatus for disposing sheet material upon a surface in successive superimposed layers, the apparatus comprising a carriage movable over the surface for supporting the material, a reversible guiding device on the carriage for guiding sheet material from the carriage to the surface to form the successive superimposed layers, the guiding means being positionable to form layers during movement of the carriage in either direction, a limit for the carriage movement in either direction, means at each limit for receiving and retaining the ends of the formed superimposed layers, means to position the guiding means for directing the formed end of a layer in the direction the carriage is moving toward that limit, the positioning means including means including the limit for actuating the positioning means and lost motion means for completing the positioning of the guiding means facing toward the limit as the carriage approaches and before the carriage reaches that limit, and means for bringing the receiving and retaining means into engagement with the formed ends of the

superimposed layers after the positioning means has completed the positioning of the guiding means and the lost motion means is effective to permit the carriage to complete its movement to the limit.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
819,548	Isaacs et al.	May 1, 1906
1,061,914	Isaacs	May 13, 1913
1,102,555	Sussman	July 7, 1914
1,257,421	Sussman et al.	Feb. 26, 1918
1,338,570	Isaacs	Apr. 27, 1920
1,793,180	Latham	Feb. 17, 1931
1,803,180	Gargolinski	Apr. 28, 1931
1,866,088	Cutter	July 5, 1932
2,046,639	Lindholm	July 7, 1936
2,157,270	Schade	May 9, 1939
2,203,970	Schneider	June 11, 1940

Certificate of Correction

Patent No. 2,520,895 August 29, 1950

HERMAN WALTER GILBERT ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 4, line 7, for "rotaion" read *rotation*; column 5, line 54, for the word "positions" read *position*; column 13, line 13, for "coninuously" read *continuously*; line 72, after "blade" insert *to*; column 15, line 7, for "disposed" read *disposing*; column 18, line 41, for "dfine" read *define*; same line, for "th" read *the*; line 43, for "restraining" read *retaining*; line 47, for "and" read *the*; column 19, line 33, for "fixd" read *fixed*;

and that the said Letters Patent should be read as corrected above, so that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 19th day of December, A. D. 1950.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.