Oct. 9, 1956 G. H. BROWN 2,765,838

APPARATUS FOR PACKAGING A GROUP OF FIBROUS MATS

Filed May 20, 1952 8 Sheets-Sheet 1

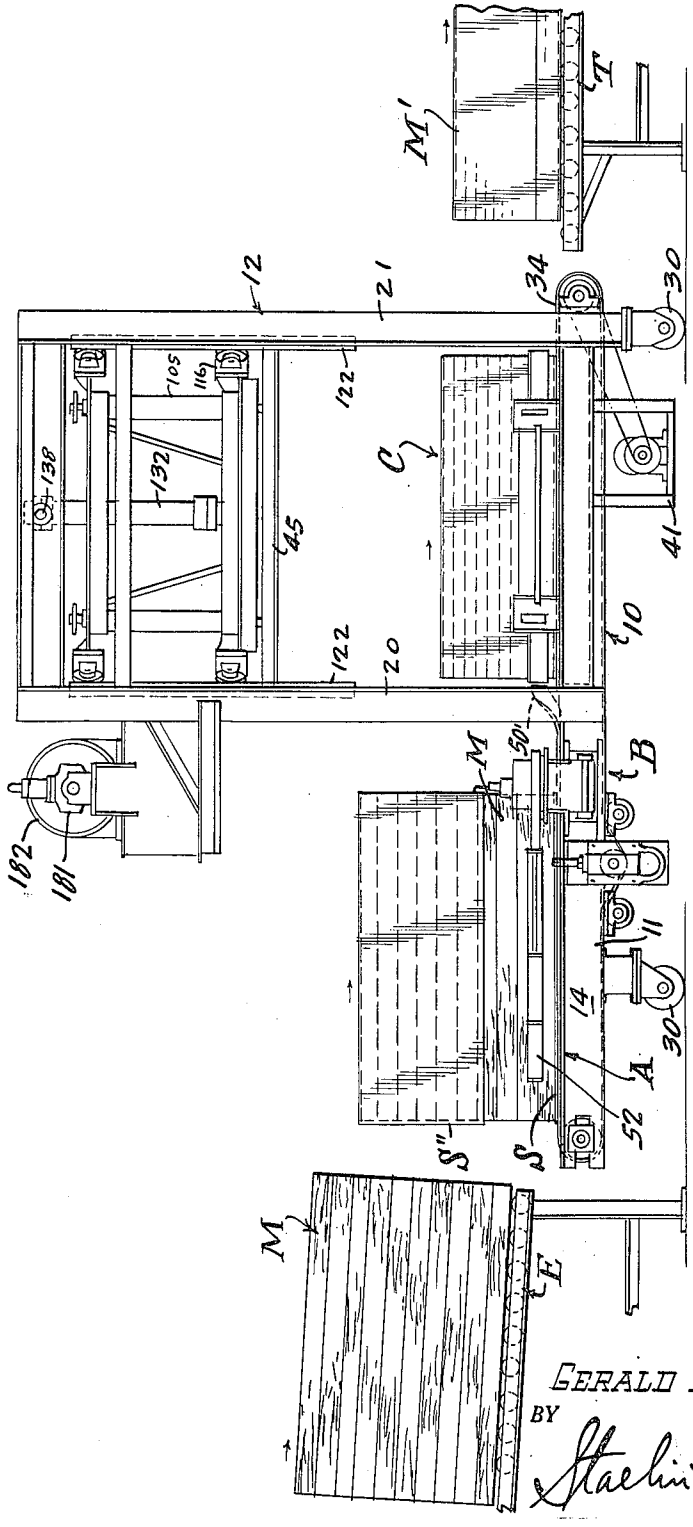


FIG-1-

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Oct. 9, 1956 G. H. BROWN 2,765,838

APPARATUS FOR PACKAGING A GROUP OF FIBROUS MATS

Filed May 20, 1952 8 Sheets-Sheet 2

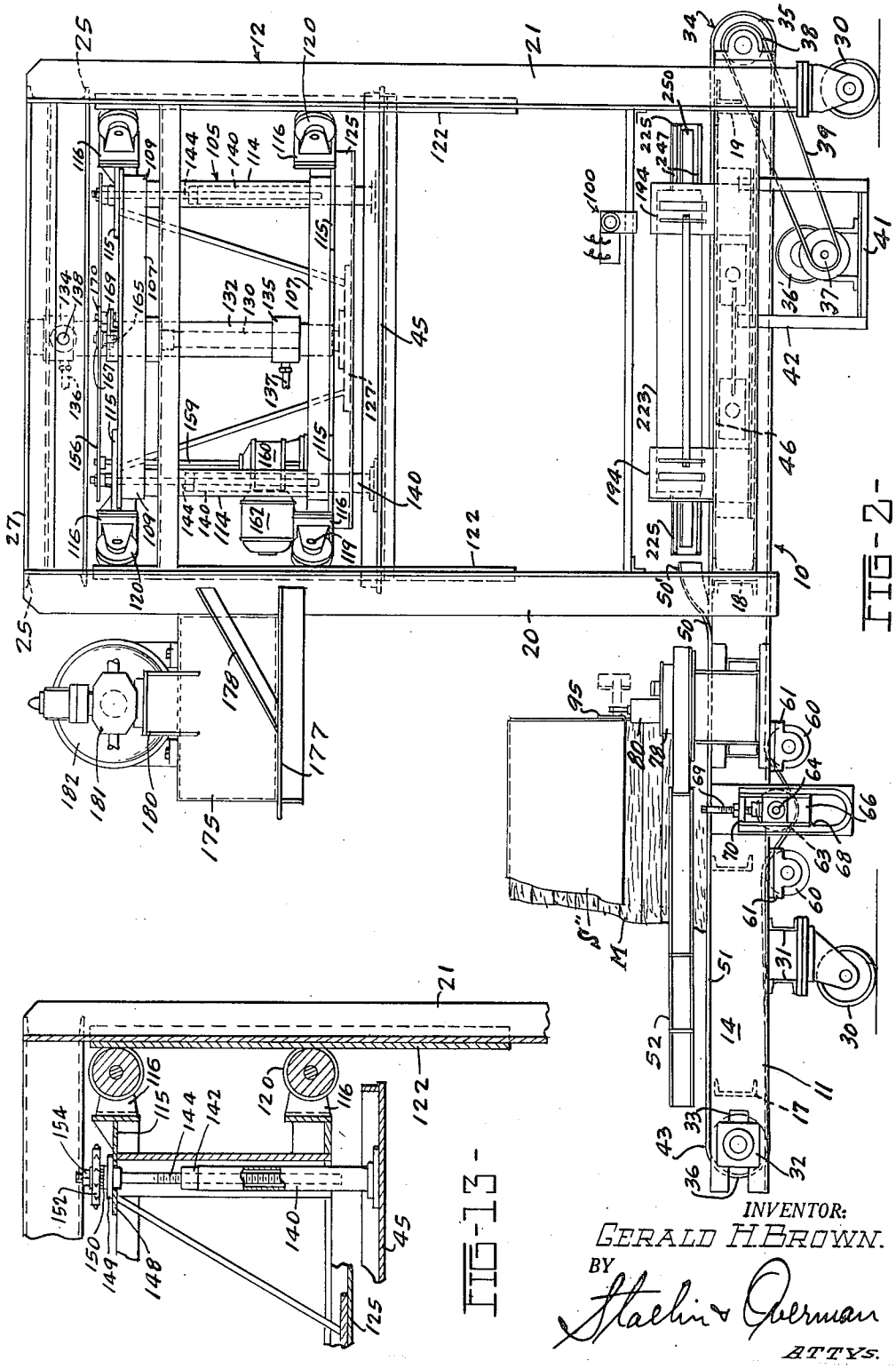


FIG-2-

FIG-13-

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APPARATUS FOR PACKAGING A GROUP OF FIBROUS MATS

Filed May 20, 1952 8 Sheets-Sheet 3

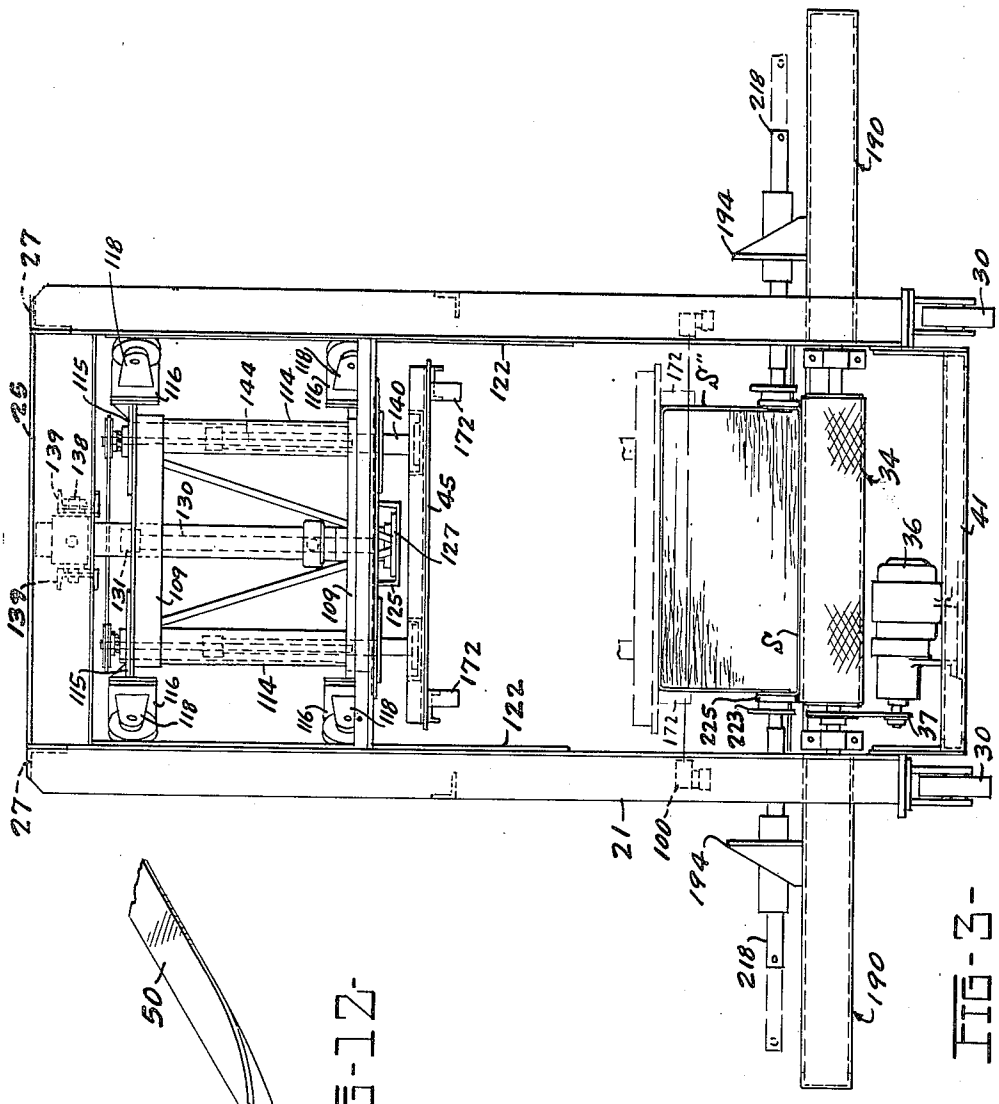


FIG-2-

FIG-12-

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APPARATUS FOR PACKAGING A GROUP OF FIBROUS MATS

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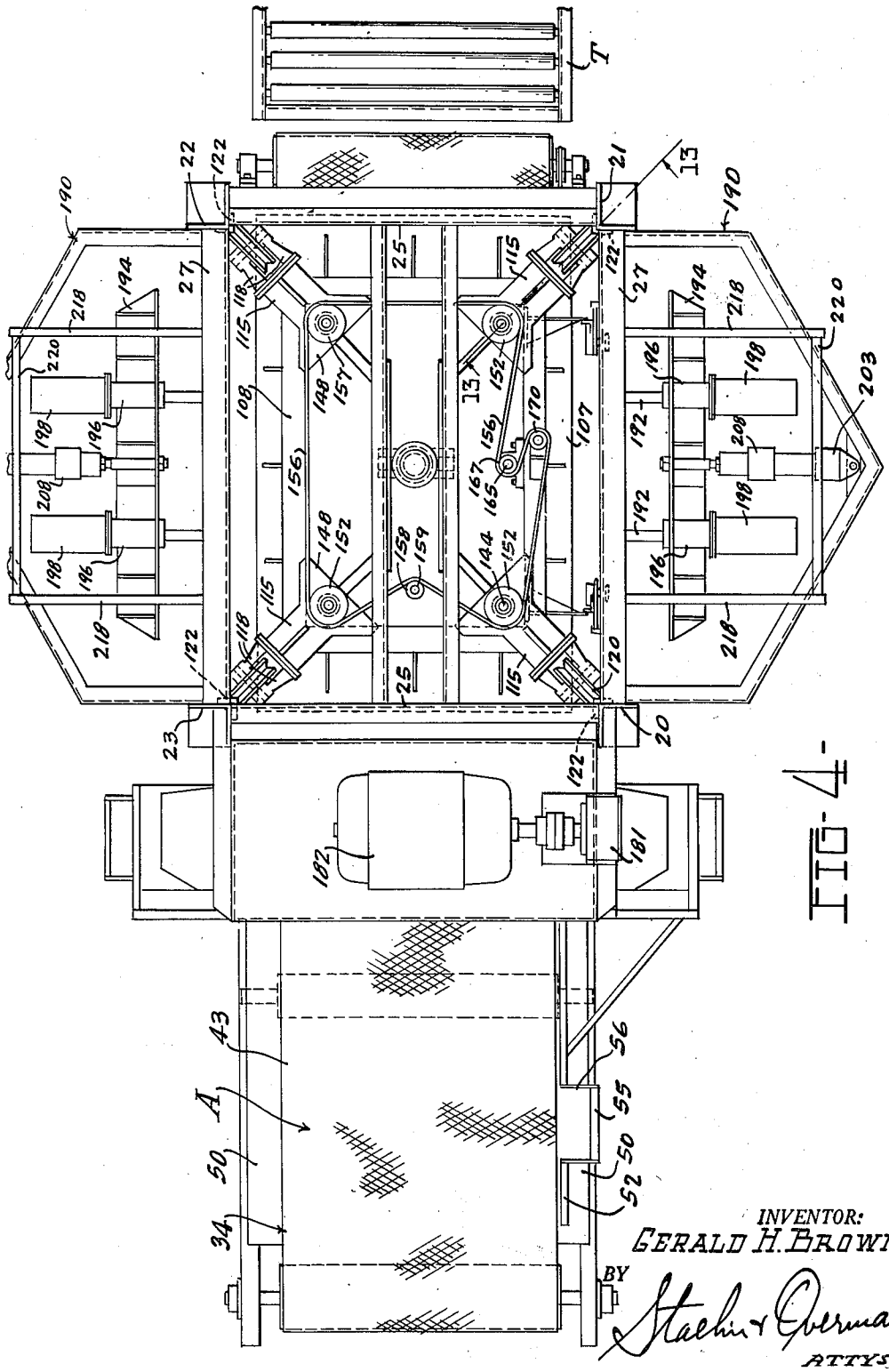


FIG. 4.

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APPARATUS FOR PACKAGING A GROUP OF FIBROUS MATS

Filed May 20, 1952 8 Sheets-Sheet 5

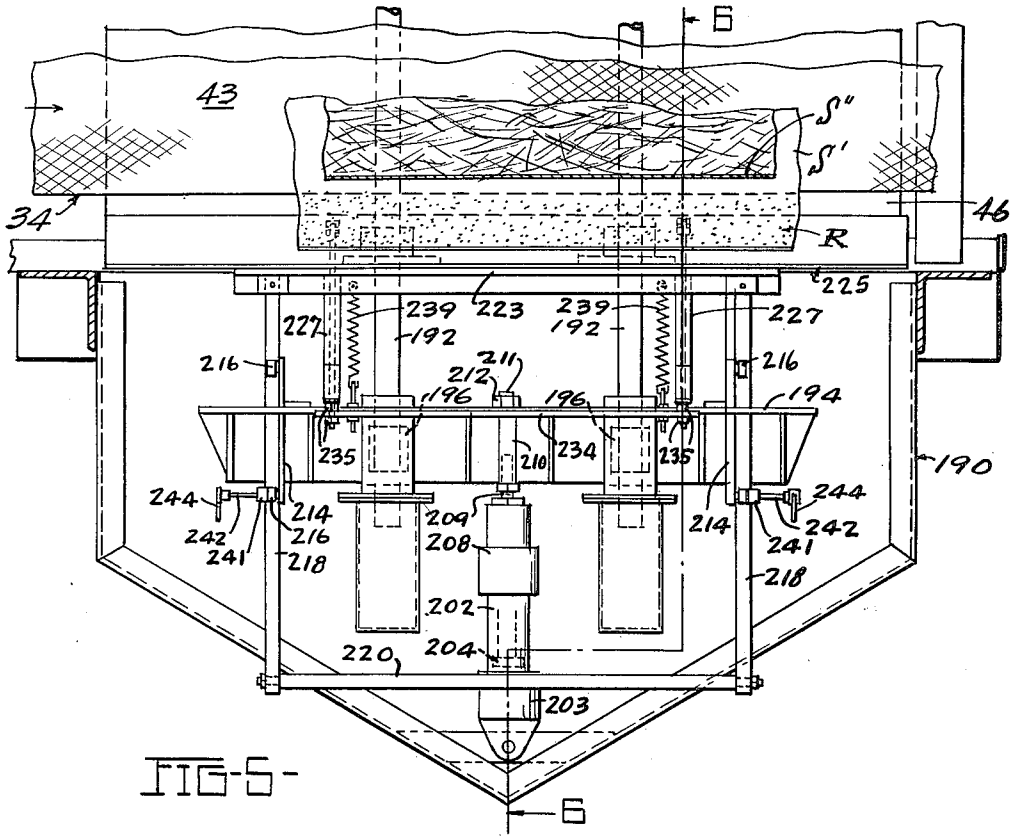


FIG-5-

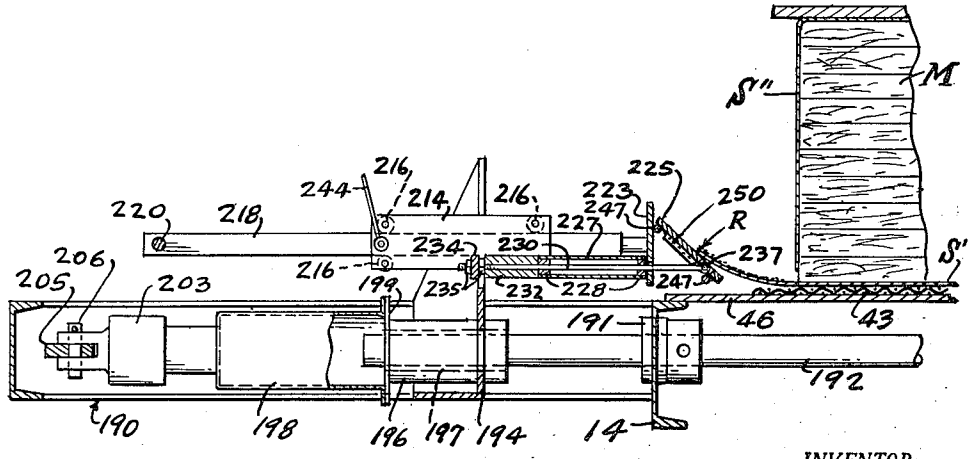


FIG-6-

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APPARATUS FOR PACKAGING A GROUP OF FIBROUS MATS

Filed May 20, 1952 8 Sheets-Sheet 6

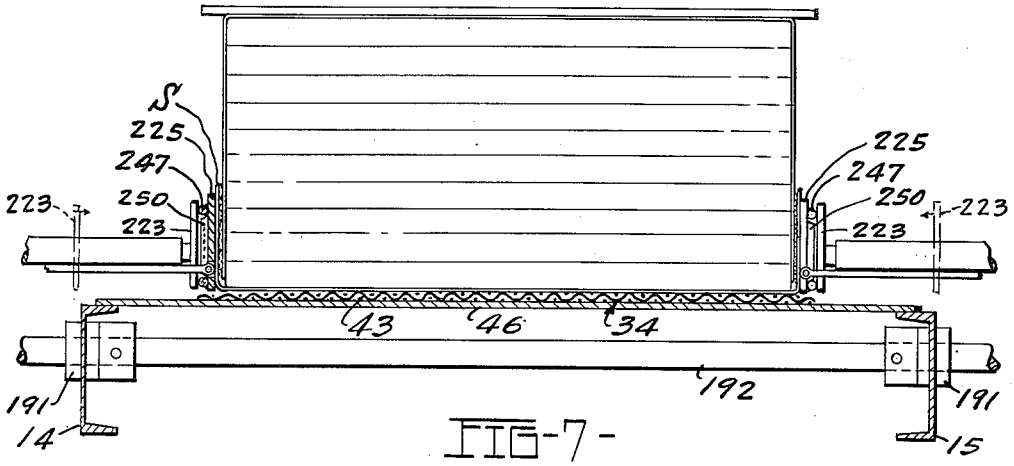


FIG-7-

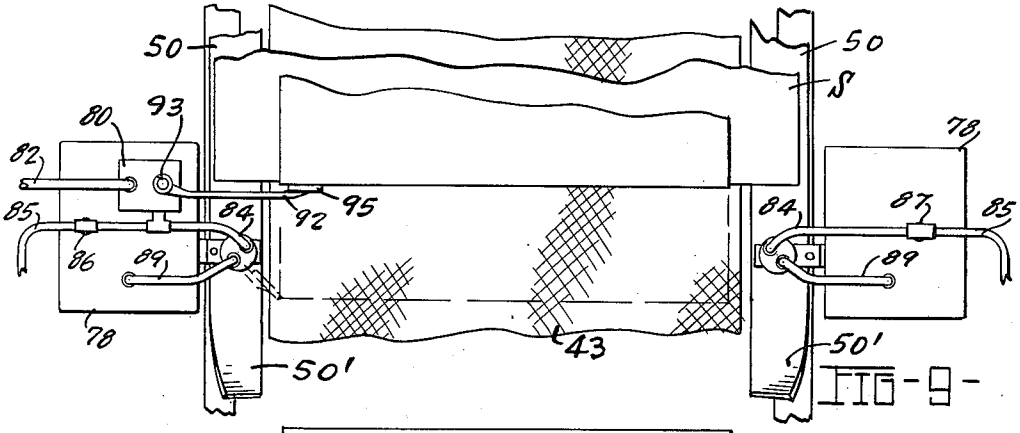


FIG-9-

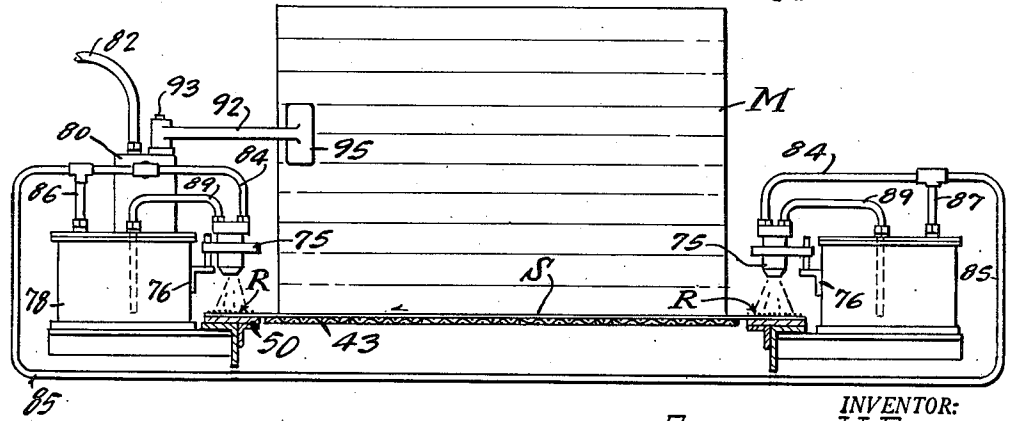


FIG-8-

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Oct. 9, 1956 G. H. BROWN 2,765,838

APPARATUS FOR PACKAGING A GROUP OF FIBROUS MATS

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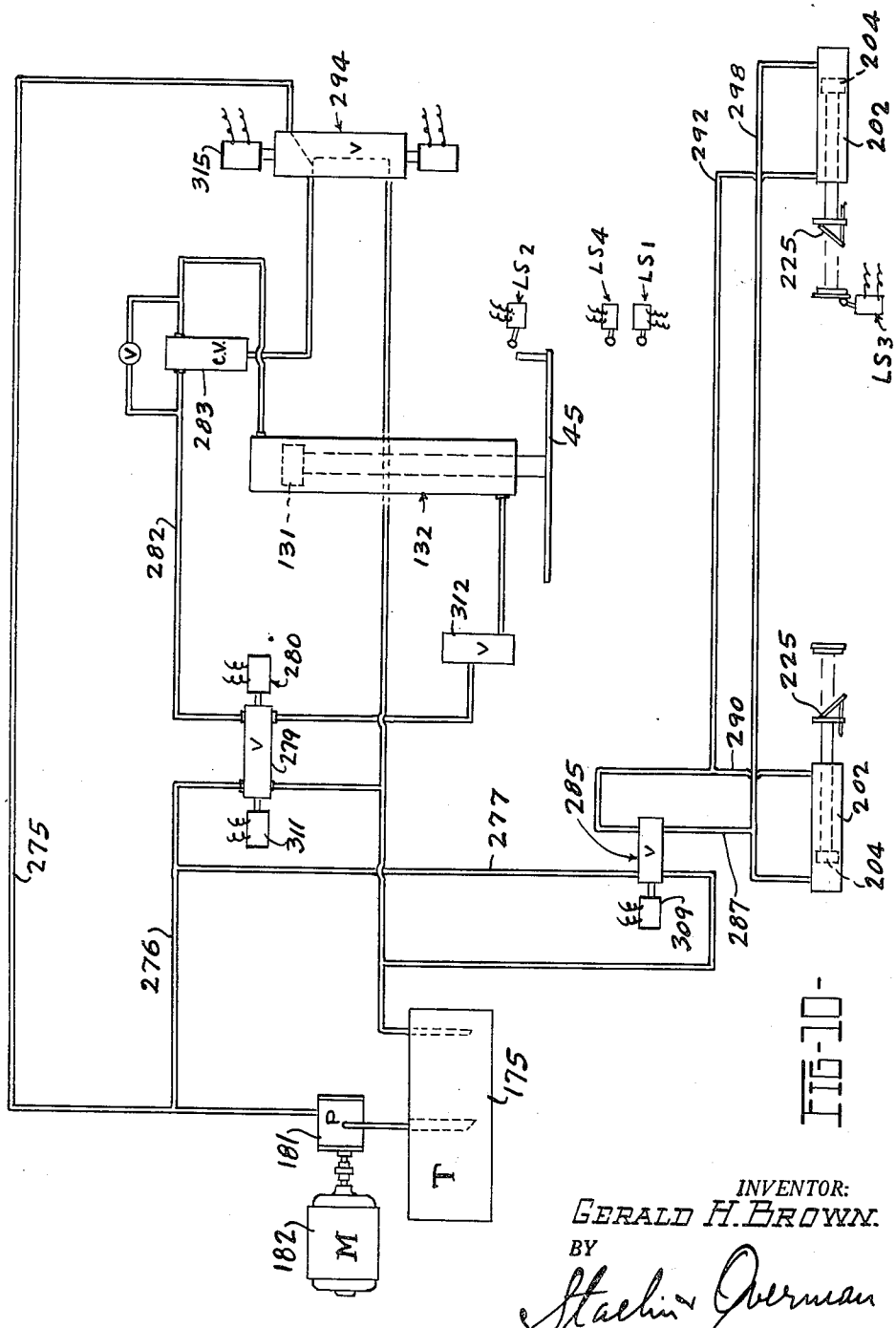


FIG-10-

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APPARATUS FOR PACKAGING A GROUP OF FIBROUS MATS

Filed May 20, 1952 8 Sheets-Sheet 8

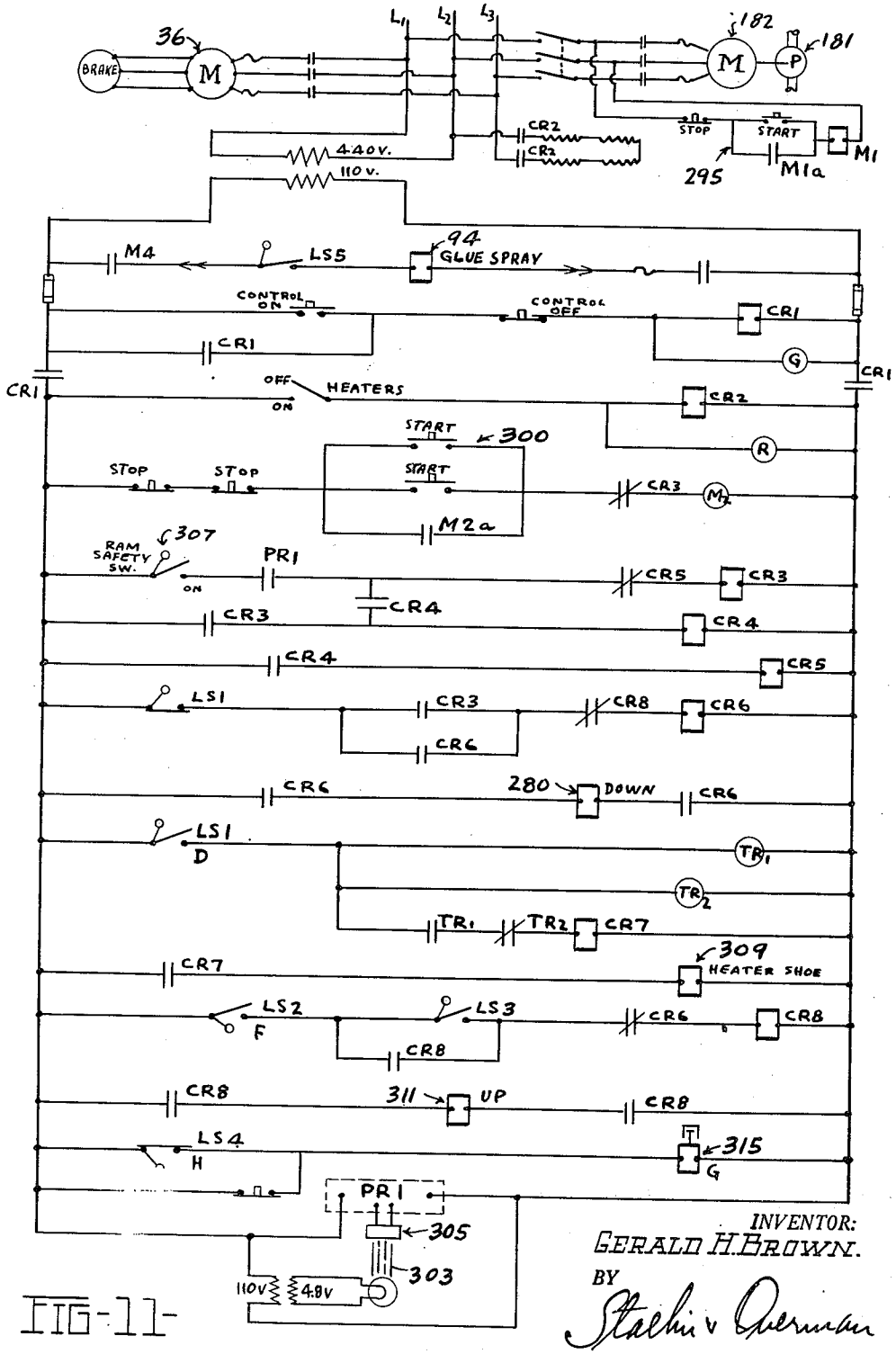


FIG-11-

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United States Patent Office 2,765,838 Patented Oct. 9, 1956

2,765,838

APPARATUS FOR PACKAGING A GROUP OF FIBROUS MATS

Gerald H. Brown, Worthington, Ohio, assignor to Owens-Corning Fiberglas Corporation, a corporation of Delaware

Application May 20, 1952, Serial No. 288,886

7 Claims. (Cl. 154—1.8)

This invention relates to method of packaging mats or sections of fibrous material, to apparatus for carrying out the method and to the package resulting from the use or the method and apparatus.

The present invention relates more especially to compacting and packaging quantities of fibrous material in mass formation or a series of bats or sections of mineral fibers such as fibers formed from glass, slag, fusible rock or the like. The manufacture of mats or bats of fibers formed from mineral material has been carried on for several years, and such mats or bats have been used extensively for heat and accoustic insulation in buildings and as heat insulation in appliances such as refrigerators, freezing units, ranges and water heaters as well as in places where heat loss or heat transfer is to be avoided as far as possible.

Fibrous bats of this character are usually formed by attenuation of fiber-forming material by high-velocity gaseous blasts in a manner wherein the fibers are accumulated in haphazard or random assembly into a mass or mat of substantial thickness. The fact that the mats are necessarily thick in order to obtain high insulating or sound-attenuating efficiency increases the cost of transportation because of the bulk of the fibrous masses or mats. While the mats are comparatively light in weight, they normally occupy a comparatively large volume per unit of weight.

Several methods of packaging have been tried and used with varying degrees of success. One method is to roll the mats into a substantially cylindrical package, but the stacking of cylindrical or roll packages necessarily results in unoccupied space between adjacent packages. Another method has been used which involves the use of a preformed paper bag into which a stack of mat sections is inserted. In this form of packaging, the mats are compressed to a limited degree at the time they are inserted into the bags, but the preformation of the bags involves considerable expense which, to a large extent, offsets the savings that may be gained by more compact stacking for transportation or storage.

An object of the present invention is the provision of a method of compacting a plurality or stack of mat sections or bats, surrounding the compacted mat sections or bats with sheet material and fastening or bonding overlapping portions of the sheet material to form a package of a character maintaining the mats or mat sections in a state of compression.

The method of the invention involves feeding a plurality of mats or bats prearranged in contiguous association to a compressing and package-forming station wherein overlapping sheet material is bonded in a manner whereby the compressed sections or bats are enveloped by the sheet material and maintained in compressed state to provide a compact package of substantially rectangular shape.

Another object of the invention is the provision of a method wherein sheets of packaging material such as kraft paper are disposed adjacent a stack of fibrous bats, both the bats and sheet material being conveyed to a bat-compressing and package-forming station, a bonding material or adhesive applied to the packaging material, the stack of bats compressed and the bonding material or adhesive on the sheet material cured to maintain the stack of bats in a rectangular package wherein the bats are retained in a compressed or compacted condition.

An object of the invention resides in an apparatus for compressing fibrous masses or units and enveloping the fibrous units with sheet material wherein automatic means is utilized for compressing the fibrous units and bonding the enveloping material to form a compressed package.

Another object of the invention is the provision of a package of fibrous material wherein compressed fibrous material is enveloped by sheets of kraft paper or the like in overlapping relation with overlapping portions of the sheets being adhesively joined or secured together to maintain the fibrous material in a state or condition of compression.

Further objects and advantages are within the scope of this invention such as relate to the arrangement, operation and function of the related elements of the structure, to various details of construction and to combination of parts, elements per se, and to economies of manufacture and numerous other features as will be apparent from a consideration of the specification and drawing of a form of the invention, which may be preferred, in which:

Figure 1 is an elevational view of a form of apparatus of the invention illustrating the several stations at which operations or steps of the method are carried out in packaging fibrous material;

Figure 2 is a side elevational view of the packaging apparatus of the invention;

Figure 3 is an end view of the apparatus shown in Figure 2;

Figure 4 is a top plan view of the arrangement shown in Figure 2;

Figure 5 is a plan view illustrating the package-sealing mechanism;

Figure 6 is a sectional view through the package-sealing mechanism, the view being taken substantially on the line 6—6 of Figure 5;

Figure 7 is a vertical transverse sectional view illustrating the package-sealing means in sealing position;

Figure 8 is a vertical transverse sectional view illustrating a form of adhesive-applying means;

Figure 9 is a top plan view of the arrangement illustrated in Figure 8;

Figure 10 is a diagrammatic view illustrating the arrangement of pressure fluid circuits and fluid-operated actuators for carrying out various steps of the method;

Figure 11 is a diagrammatic illustration of the electrical circuits and devices for initiating and controlling the operation of the various mechanisms of the apparatus;

Figure 12 is an isometric view illustrating a portion of one of the guiding means for a packaging sheet, and

Figure 13 is a fragmentary detail sectional view taken substantially on the line 13—13 of Figure 4.

While the drawings illustrate a form of apparatus for carrying out the method of the invention especially adaptable for compressing and packaging mats or bats formed of mineral fibers, it is to be understood that the method and apparatus may be used for packaging other fibrous or compressible materials.

The method of the invention is inclusive of several operations or steps wherein fibrous material is delivered to a receiving station and packaging sheets are disposed adjacent the material, the fibrous material and packaging sheets being conveyed to a zone or station at which an adhesive is applied to at least one of the packaging sheets. The fibrous material and packaging sheets are conveyed

to a station or zone at which the material is compacted or compressed and the packaging sheets brought into lapping relation with the adhesive coating between the lapping portions. Heat is applied to the adhesive-coated zones of the packaging sheets to cure the adhesive forming a seal or fastening means to complete the formation of a package.

Referring to the drawings in detail, the package-forming apparatus illustrated for carrying out the method may be of a portable character so as to facilitate positioning the apparatus in the most convenient location to minimize handling or transporting the mats or bats prior to the packaging operations. The arrangement is inclusive of a sheet-applying and mat or bat-receiving station indicated at A in Figure 1, an adhesive-applying station or zone B and a mat or bat-compressing and package-sealing station or zone C. The apparatus is inclusive of a frame structure 10 comprising a base frame portion 11 and an upwardly extending frame portion 12. The base frame 11 is formed with a pair of transversely spaced parallel side members 14 preferably of channel-shaped cross-section joined by transverse members 17, 18 and 19 as shown in Figure 2.

Mounted upon the base frame 11 is the upwardly extending frame structure 12 which is inclusive of four vertically disposed posts or uprights 20, 21, 22 and 23 which are joined by transversely extending members 25 and longitudinally extending members 27. The upwardly extending frame structure 12 supports a mat or bat-compressing means, a pump for establishing fluid pressure for the hydraulic actuators, a motor for driving the same and a fluid reservoir, these constructions being hereinafter described.

The frame 10 is provided with swivel casters 30 of a conventional type, one pair being secured to transversely extending structural members 31 welded or otherwise secured to the frame side members 14 and 15, the other pair of casters being connected with the posts 21 and 22 of the upwardly extending frame portion 12. By mounting the apparatus upon casters, it is rendered readily portable and may be moved to the most desirable and efficient position of use.

The frame portion 11 supports a movable mat or bat-conveying means which in the embodiment illustrated is in the form of an endless belt 34 which is supported by rollers 35 and 36 journally supported respectively at the ends of the frame side members 14 and 15. The conveyor may be formed of flexible material such as canvas, woven wire or the like. The roller 36 may be journaled in bearing members 32 adjustable in slots 33 in the side members 14 and 15.

The conveyor 34 is driven by a motor 36' through the medium of sprockets 37, 38 and a driving chain 39 as shown in Figure 2. The motor is supported upon a plate 41 suspended from the base frame structure 11 by means of depending members 42.

In order to resist the compression pressure applied to the fibrous material within the zone beneath a platen or mat-compressing member 45, it is imperative that the upper flight 43 of the flexible conveyor be adequately supported at the material-compressing zone to prevent damage to the conveyor. To accomplish this, there is disposed beneath the upper flight 43 of the conveyor within the material-compressing zone C a reinforcing plate or member 46 which is supported by the transversely extending channel members 18 and 19 and other transversely extending frame members (not shown). Thus, while the fibrous material to be compressed is carried by the upper flight of the conveyor, the compression pressure is resisted by the reinforcing member or plate 46.

Means are provided adjacent the transverse edges of the upper flight of the conveyor at the material-receiving station or zone A in advance of the material-compressing station for receiving and positioning a sheet of packaging material such as kraft paper or other sheet material. Disposed adjacent each lateral edge of the upper flight 43 of the conveyor is a longitudinally disposed plate 50 which, together with the upper flight 43 of the conveyor, is adapted to receive and support a sheet of paper S' or other sheet material used in packaging or enveloping the fibrous material. The zone A of the conveyor at the left of the upright frame portion 12, as viewed in Figures 1 and 2, is adapted to receive quantities of fibrous material for packaging, and as illustrated, the material may be in the form of a series of stacked mats or bats M which the operator deposits upon the sheet of paper S' which has been placed upon the conveyor during the period of curing the sealing adhesive at the material-compressing and sealing station C. Mat-guiding means including a member 52 is disposed at one side of and above the conveyor 34 in order to properly direct the stack of mats to the mat-compressing station. The upper flight 43 of the conveyor at the mat-receiving station is supported by a horizontal plate 51 carried by the side members 14 and 15 and transversely extending frame members.

In order to facilitate the manual placement of a stack of fibrous mats upon the sheet of paper S' at the receiving station A, the guide member 52 is formed with an offset 55 providing a clearance space 56 to accommodate the hand of the operator in depositing a stack of fibrous material or mats on the sheet of paper S' adjacent the guide member 52. The guide member 52 serves the purpose of positioning the stack of mats on the sheet of paper and the conveyor so that the stack is properly guided through the adhesive or glue-applying station B to the mat-compressing station C.

The lower flight of the conveyor 34 moves over rollers 60 journaled on brackets 61 carried by the side members 14 and 15. The conveyor is also directed beneath an intermediate roller 63 carried upon a shaft 64 journaled at its ends in fittings 66. Each of the fittings 66 is disposed for vertical adjustment between pairs of ways formed on brackets 68.

A threaded member 69 is disposed above each fitting 66 and is threaded through a member 70 secured to a bracket 68. The tension of the conveyor may be regulated by adjusting the threaded members 69 to vary the relative vertical positions of the fittings 66 and the tension-regulating roller 63, the position of the fittings being maintained by locknuts on the threaded members 69.

Figures 8 and 9 illustrate one form of an adhesive or or glue-applying means disposed at the adhesive-applying station B which is disposed intermediate the mat-receiving station A and the mat-compressing station C. The packaging sheet-supporting members 50 disposed at the sides of the upper flight 43 of the conveyor are substantially in the plane of the conveyor. The lower sheet of paper S' in its position upon the conveyor is of a width to overlay the strips or members 50.

Disposed above each of the strips 50 is a spray gun or adhesive applicator 75 of conventional type utilized for spraying liquids through the medium of compressed air or other pressure fluid. Each of the spray guns is mounted upon a bracket 76 which may be carried by a receptacle or tank 78 containing a supply of heat-curable glue or other suitable adhesive or sealing meidum.

Disposed adjacent and preferably supported by one of the adhesive containers 78 is a casing 80 containing electrically operated valve mechanism for controlling the flow of compressed air or other fluid to the spray guns 75. Connected to the valve casing 80 is a tube 82 through which compressed air is conveyed to the valve mechanism contained within the casing or housing 80. Tubes 84 and 85 convey compressed air to the spray guns 75 while tubes 86 and 87 are arranged to direct compressed air into the receptacle 78. Tubes 89 convey glue or adhesive from the receptacle 78 to the guns 75. The glue or adhesive is sprayed or applied upon the

lateral edge zones of the paper sheet S' extending beyond the stack of mats and overlying the strips 50 as shown in Figure 8. The spray guns are arranged to be operated only during the period that the paper sheet and stack of mats disposed thereon are moving adjacent the adhesive-applying means. The arrangement for dispensing the glue or adhesive during the period that the stack of mats and paper are moving past the spray guns includes a lever 92, pivotally connected as at 93 to the housing 80, adapted to operate a switch designated LS5 in Figure 11 within the housing for energizing a solenoid 94 to operate a valve (not shown) controlling the flow of compressed air to the glue or adhesive applicators.

Secured to the extremity of the arm or lever 92 is a pad or vane 95 which is normally disposed in the position shown in Figures 8 and 9 in the path of the stack of mats or fibrous material. The stack of mats moving toward the mat-compressing station C engages the vane 95 causing the arm 92 to be swung in a clockwise direction as viewed in Figure 9 to the position indicated in broken lines, which movement actuates the switch LS5 energizing the solenoid 94 of an air valve (not shown) to initiate the operation of the spray guns 75 which direct a spray of glue or adhesive upon the lateral edges of the sheet S' until the stack of mats M has moved out of engagement with the vane 95. When this occurs, the lever 92 returns to its normal position as shown in Figure 9 under the influence or bias of suitable spring means (not shown) and opens the switch LS5 to interrupt the operation of the spray guns 75.

Before the stack of mats moves away from the mat-receiving station A, the operator places a second sheet of paper S'' over the stack of mats M with the side zones or portions of the sheet substantially equidistant from the top of the stack. It should be noted, as shown in Figure 1, that the side portions of the sheet S'' extend downwardly a distance less than the total height of the stack of mats in uncompressed or unpackaged condition. When the stack is compressed, the side portions of the sheet are brought to a position adapted to be lapped by the adhesive or glue-bearing zones of the lower sheet S' to form an envelope surrounding the compressed stack of mats. The extent or degree of compression to be imparted to the stack determines the initial size of the upper sheet S'' and the vertical dimension of the portions thereof at the sides of the stack.

The stack of mats and the lower and upper sheets of paper S' and S'' with the layer of glue or adhesive applied to the edge zones of the lower sheet are moved by the conveyor to a position directly beneath the vertically movable platen or ram 45. The stack of mats, upon reaching a position substantially centered beneath the platen, intercepts a light beam projected upon a photosensitive cell arrangement 100 to cause an interruption of the circuit to the conveyor motor 36' and bring the assembly of paper sheets and stack of mats to rest beneath the platen 45.

The platen 45 forms a part of a mat-compressing means and includes a carriage 105 which is movable vertically with respect to the frame uprights or posts 20, 21, 22 and 23. The carriage 105 is inclusive of a frame structure comprising vertically spaced horizontally extending members 107 arranged in parallelism with a second pair of members 108 spaced laterally therefrom which are connected by transverse members 109 forming upper and lower rectangular assemblies, these assemblies being joined by vertical posts or members 114.

Each of the corner zones of both the upper and lower assemblies is provided with a plate 115, each plate supporting a fitting or bracket 116. Each of the brackets is formed with projecting boss portions 118 which are bored to accommodate stub shafts 119, each shaft journally supporting a grooved roller 120. The peripheral groove in each roller is of a nature to fit the apex

of the angle-shaped fittings 122 carried by the posts 20, 21, 22 and 23.

The platen frame or carriage 105 and associated mechanisms are moved in vertical directions through the medium of hydraulically actuated means. As particularly shown in Figures 2 and 3, a channel-shaped ram frame member 125 supports a plate 127 connected with a piston rod 130 having a head portion or piston 131 slidably disposed in a cylinder 132 of the hydraulic ram-actuating means. The cylinder 132 is provided at its upper and lower ends respectively with fittings or heads 134 and 135 respectively connected with tubes or pipes 136 and 137 for conveying fluid into and away from zones in the cylinder 132 at either side of the piston 131.

As particularly shown in Figure 3, the upper fitting 134 is provided with projections 138 for supporting the ram cylinder 132 from channel-shaped frame members 139 forming a part of the upper frame structure 12 of the apparatus. The carriage 105, platen or ram 45 and parts associated therewith are reciprocated vertically by delivering pressure fluid to the cylinder successively through the heads 134 and 135.

The platen 45 which has a uniplanar lower surface for engagement with the upper sheet of paper S'' and a stack of mats or quantity of fibrous material M at the compressing station is adjustably supported by the carriage 105. The purpose of adjustment is to vary the initial relative position of the platen to accommodate stacks of mats of fibrous material of different heights. To this end there are secured to the platen 45 four posts or shafts 140 of tubular construction which project upwardly in juxtaposed relation to the corner posts 114 of the carriage 105. Secured to the upper end of each of the posts is a nut or fitting 142 which is interiorly threaded to accommodate a threaded shaft or screw 144 as shown in Figure 13.

Each of the brackets 115 is formed with a gusset-like plate portion 148, each plate portion being formed with an opening to receive an upper extremity of one of the threaded shafts 144, each shaft having a flange portion 149 secured to a plate portion 148. An antifriction bearing construction 150 preferably of the ball type is disposed above each of the plates 148. Secured to each of the shafts 144 above the bearings 150 is a toothed wheel or sprocket 152, each sprocket being secured to the shaft and the shaft held in its uppermost position by means of a nut 154.

As shown in Figure 4, motion-transmitting means in the form of a chain takes over the four sprockets 152 disposed at the upper ends of the threaded shafts 144. The chain 156 is preferably operated by motor-driven mechanism. In this arrangement, a sprocket 158 is engaged by the chain as shown in Figure 4, the sprocket 158 being mounted upon the upper end of a shaft 159 which projects into a housing 160 containing speed-reducing mechanism (not shown), the latter being driven by means of a motor 162.

By energizing the motor 162, the shaft 159 and drive sprocket 158 are rotated at the comparatively low speed through the reducing mechanism contained in housing 160. As the chain 156 is connected to all four sprockets 152, the shafts 144 will be rotated simultaneously, causing the shafts to be threaded through the nuts 142, hence raising or lowering the initial position of the platen 45 with respect to the carriage 105, dependent upon the direction of rotation of the shafts 144.

Means may be provided for regulating the tension in the chain 156. For this purpose a shaft 165 journaled in suitable bearings carries a sprocket 167 which is engaged by the chain 156. Secured to a bracket 169 mounted upon the carriage frame is an idler sprocket 170 which is engaged by the chain as shown in Figure 4. The bracket 169 is adjustably supported upon the carriage frame in order to regulate the position of the sprocket 170 and in this manner control the tension in

the chain 156. The platen 45 is provided with laterally spaced, parallel members 172 arranged for guiding or preventing displacement of the upper sheet of paper S'' relative to the mats as the platen 45 moves downwardly to compress the fibrous material or stack of mats.

The actuators for operating components of the apparatus are driven by suitable fluid such as oil under pressure. A receptacle or reservoir 175 for containing a supply of oil or other fluid medium for the actuators is supported upon bracket members 177 carried by the frame posts 20 and 23, the brackets being reinforced by bars or struts 178. Mounted upon a bracket 180 carried by the tank or oil reservoir 175 is a fluid pump 181 driven by a motor 182 or other power means. The pump 181 builds up hydraulic pressure in the oil lines or pipes leading to controlling valves and hydraulic actuators for operating various components of the apparatus as hereinafter described.

The apparatus is inclusive of hydraulically operated means for folding one of the packaging sheets into engagement with the other packaging sheet to press the adhesive-coated zone of one sheet into sealing position with the other sheet and applying heat to cure or set the adhesive so as to maintain the compressed fibrous material or stack of mats in compressed condition in the package.

The arrangement for accomplishing the sealing operation or step in applicant's method is disposed adjacent the mat-compressing station. The components of the paper-sealing or package-sealing means are mounted upon supplemental frames 190 which project radially at both sides of the main frame as shown in Figure 4. The structural features of the sealing arrangement are illustrated in detail in Figures 5 and 6. Mounted upon the frame members 14 and 15 are bearing members 191 adapted to support a pair of shafts or rods 192 which form ways or guides to accommodate slidable movement of a pair of members, crossheads or carriers 194 for supporting the paper-folding and sealing means disposed at each side of the main frame.

As the sealing means and actuating devices for sealing the paper sheets at each side of a stack of mats are identical, a description of one will suffice. Each member 194 is provided with sleeves 196 secured to the member and having bearings 197 accommodating the rods or shafts 192 whereby the member 194 is slidable along the rods. Cup-like members or shields 198 are secured to flanges 199 formed on the sleeves 196 and serve as enclosures for the extremities of shafts 192 to prevent ingress of foreign matter into the bearings 197.

Each member or crosshead 194 is automatically actuated by suitable means such as a hydraulic actuator including a cylinder 202 having a head or fitting 203 adjacent one end formed with a clevis configuration adapted to straddle a bar 205 which forms a part of frame 190, the head 203 being pivotally supported upon the bar by means of a clevis pin 206. The opposite end of the cylinder 202 is provided with a head portion 208, a piston (not shown) being reciprocable in the cylinder 202 and connected with a piston rod 209. The piston rod 209 is provided with a tenon which is threaded into a threaded bore in a cylindrical member 210, the latter having a threaded tenon 211 adapted to receive a securing nut 212 for establishing a connection between the piston and the member or crosshead 194. By introducing fluid under pressure alternately in the ends of the cylinder 202, the crosshead 194 may be reciprocated relative to the frame 190.

Supported upon the crosshead 194 are laterally spaced plates or members 214, each plate being equipped with pairs of rollers 216. The pairs of rollers 216 provide supporting and guiding means for rods 218 which are of square cross-section and are connected together at their outer extremities by a tubular member 220. The rollers 216 are preferably formed with knurled peripheral surfaces in order to establish effective frictional connection with the rods 218 and yet permit relative movement of the rods with respect to the rollers.

The ends of rods 218 nearest the mat-compressing station are secured to a pressure pad or plate 223 disposed in parallelism with the path of movement of the conveyor 34 which is movable toward the mat-compressing and paper-sealing station by inward movement of the member or crosshead 194. Means are provided for folding the adhesive-bearing edge zones of the lower paper or packaging sheet S' into contact with the upper packaging sheet and for curing the adhesive to seal the packaging sheets together. Disposed forwardly of the pad or plate 223 is a paper-engaging and sealing member 225 which is normally disposed in an angular position of about 45° with respect to a horizontal plane as shown in Figure 6.

As shown in Figure 12, the ends 50' of the paper-supporting and guiding strips 50 at the sides of the upper flight 43 of the conveyor are curved upwardly to direct the adhesive-coated zones of the paper sheet S' into proper angular relation along the sealing pad 225.

Secured to the plate 223 is a pair of spaced sleeves 227 having bearings 228 disposed therein for slidably supporting and guiding a pair of rods 230 shown in Figure 6. The extremities of the rods 230 pass through sleeves 232 and have threaded portions extending through openings in a connecting bar 234, the rods being secured to the bar 234 by means of securing nuts 235. The forward portions of the rods 230 extend through openings in the plate 223 and are pivoted to the tiltable plate 225 by means of pins 237.

In order to maintain the paper-engaging plate 225 in its angular position, contractiile springs 239 connect the plate 223 with the bar 234 as shown in Figure 5 to bias the bar 234 toward the plate. The relative positions of the plates 223 and 225 may be adjusted with respect to the crosshead 194 by relative movement of the rods 218 with respect thereto. Locking means are provided for securing the rods 218 in relative position. The crosshead 194 supports blocks 241 which are bored and threaded to respectively receive threaded members 242 provided with a manipulating handle 244. When the threaded members 242 are drawn up, they serve to frictionally lock the rods 218 to the fittings or plates 215. By releasing the threaded members 242, the positions of the rods 218, bar 220, plate 223 and associated parts may be initially adjusted by moving the rods 218 relative to the plates 214. This adjustment is provided in order that the machine may satisfactorily accommodate stacks of mats of different widths, the adjustment modifying the initial position of the package-sealing plate 225.

The sealing plate 225 is equipped with rods or abutments 247 shown in Figure 6, and disposed between the rods 247 and mounted contiguously with the rear face of plate 225 is an adhesive-curing means 250. The curing means 250 may be in the form of an electrically energizable heating element of the resistance type for the purpose of applying or transmitting heat to the plate 225 thence to the adhesive-coated sheet for setting or curing the glue or other adhesive between adjacent portions of the packaging sheets. The temperature of the sealing plate 225 may be controlled by conventional thermally actuated means (not shown) for maintaining a substantially constant heat factor at the sealing plate.

When the crosshead 194 is moved by the hydraulic means 202 toward the stack of mats at the compressing station, the plate 223 engages the rods 247 on plate 225 to move the sealing plate into vertical sealing position with the mat as shown in Figure 7. By providing the abutments or rods 247, the plate 223 engages the rods and thus avoids engagement of the plate 223 with the electrically energized heating element 250. During the movement of the plate 223 in tilting the sealing plate 225 to a vertical position, the rods 230 are slidable through the sleeves 227 expanding the springs 239, the

latter serving to normally bias the rods 230 and the sealing pads or plates 225 to the positions shown in Figure 6 when the parts are retracted from sealing position.

The hydraulic circuits for controlling the actuator for the crosshead and the sealing actuators are illustrated in Figure 10. The motor-driven pump 181 supplies fluid under pressure in lines 275, 276 and 277. The line 276 is connected with a solenoid-controlled four-way valve 279 which when moved by a solenoid 280 completes a hydraulic circuit by way of line 282 with the upper end of the ram cylinder or actuator 132 through a check valve means 283. In this manner the pressure fluid above the piston 131 forces the platen or ram 45 downwardly compressing the fibrous material or stack of mats disposed beneath the platen 45.

Fluid under pressure is also conducted by the hydraulic line 277 to a solenoid-actuated two-way valve 285 which controls the flow of fluid to the outer ends of the crosshead actuator cylinders 202 through the lines 290 and 292. A solenoid-operated four-way valve 294 is arranged to control the flow of pressure fluid to the lower end of the cylinder of the actuator 132 beneath the piston 131 to retract or elevate the platen 45.

The valve mechanism 294 is controlled by electrical means in a manner whereby the first or initial phase of retractive movement of platen 45 occurs at a comparatively slow speed, the remainder of the upward travel of the platen occurring at a much higher rate of speed. By providing for an initial slow return or retraction of the platen 45 as it moves away from the compressed stack of mats a shock of releasing the compressive pressure on the mats is avoided.

By eliminating a sudden release of compressive pressure on the mats, the liability of fracture of the seal between the paper sheets is largely eliminated. After the ram 45 has moved upward a sufficient distance, depending upon the position of a limit switch LS4 with respect to the ram, the valve 294 is actuated to facilitate rapid flow of fluid into the lower end of the cylinder 132 so as to return the ram through the remainder of its return stroke at a comparatively high rate of speed. The valve mechanism 294 and the check valve 283 are coordinated in order to accomplish this result.

The electrical controls and circuits for performing various operations in proper sequence and for controlling the hydraulic actuators are illustrated in Figure 11. Reference to the various electrical mechanisms, diagrammatically shown in Figure 11, will be referred to in connection with the explanation of the operation of the machine.

A typical cycle of operations of the machine occurs as follows:

A quantity of fibrous material such as a plurality of bats or mats M in stack formation may be delivered adjacent the apparatus by a roller type conveyor E as shown in Figure 1. The operator places a sheet of paper S' of a proper size upon the mat-receiving zone of the upper flight 43 of the conveyor indicated at A. The sheet S' is of a dimension greater than the width of the conveyor means 34 and is sufficiently wide to provide a portion or strip at each side of the mat to receive a coating of adhesive or glue for package-sealing purposes.

The portions of the sheet extending laterally of the stack of mats are supported upon the paper guides or strips 50 disposed at each side of the upper flight of the conveyor. The operator then secures a stack of mats M from the conveyor C illustrated in Figure 1 and deposits them upon the sheet of paper S' at the mat-receiving station A. The deposition of the stack of mats is facilitated by the offset space 56 in the mat-guiding means 52 which accommodates the hand of the operator.

The operator next places a second sheet of paper or packaging envelope S'' over the stack of mats M as illustrated in Figure 1. It should be noted that the sheet S'' superposed upon the plurality or stack of mats extends downwardly throughout only a portion of the height of the stack. When the stack is compressed, the sheet S'' is brought downwardly until the edges thereof are in substantial registration with the lowermost mat of the stack in a position to be engaged and lapped by the adhesive-coated portions R of the lower sheet S'.

The motor 182 is operated by closing the starting switch mechanism 295 illustrated in Figure 11, the conveyor-actuating motor 36 being adapted to be started by means of a manually controlled switch 300 also illustrated in the circuit diagram of Figure 11. The starting switch 300, which may be of the push-button type, initiates a cycle of operations of the various electrical mechanisms, hydraulic actuators and the conveyor-driving means in effecting a complete package-forming and sealing operation.

When the operator closes the starting switch 300, this action energizes the starter coil M2 which is held in by the contact M2*a* and the circuit to the conveyor-drive motor 36 established, the motor moving the conveyor 34 whereby the upper flight 43 thereof moves in a right-hand direction as viewed in Figures 1 and 2. The movement of the conveyor carries the stack of mats M and the sheets of paper S' and S'' toward the mat-compressing station and adjacent the adhesive or glue-applying means or station B.

When the stack of mats approaches the glue-applying zone, the stack engages the pad or vane 95 on the lever 92 illustrated in Figure 8 thereby swinging the lever in a clockwise direction as viewed in Figure 9 which causes switch LS5 to be closed, operating a solenoid-actuated valve. This action directs pressure fluid such as compressed air to the spray guns 75 illustrated in Figure 8 whereby adhesive or glue contained in the receptacle 78 is delivered or sprayed onto the portions of the paper sheet S' projecting at each side of the stack of mats M being moved by the conveyor.

So long as the vane 95 is in engagement with the moving stack of mats M, the valve controlling the compressed air flow will remain in a position whereby sprays of glue are delivered onto the paper or sheet S'. As soon as the stack of mats M moves out of engagement with the vane 95, the arm or lever 92 returns to its normal position as shown in full lines in Figure 9, the switch LS5 is opened causing the air valve to close which interrupts the flow of compressed air to the spray guns 75 and thus terminates the flow of glue or adhesive from the guns. Through this control means the glue is applied only to the edges of the paper strip while they are passing the glue-applying station.

The conveyor continues to move the stack of mats M to a position beneath the platen or ram 45 of the machine. As the sheet of paper S' moves along the guides 50, the extremities 50' of the guides adjacent the glue-applying station are curved upwardly so that as the sheet of paper is conveyed to the compressing station, the lateral zones of the sheet bearing the glue or adhesive are deflected or bent upwardly at an angle of approximately 45° in order that the lateral zones of the paper may properly engage the angularly disposed sealing plates 225 illustrated in Figure 6.

When the stack of mats M approaches a position where the stack is centered under the platen 45, the leading edge portion of the stack intercepts a light beam 303 illustrated diagrammatically in Figure 11. The interception of the beam acting through a light-sensitive cell 305 causes operation of a photoelectric relay PR1 which energizes relay CR3. The normally open contact of CR3 energizes CR4 closing a contact thereof and establishing a circuit through the relay contact PR1 and the ram safety switch 307.

A normally open contact of the relay CR4 closes a circuit-energizing relay CR5 causing a normally closed contact of relay CR5 to open thereby dropping out the

relay CR3. The normally closed contact of relay CR3 is opened dropping out the coil M2 which interrupts the circuit to the conveyor-driving motor 36 thus stopping the conveyor with the stack of mats centered beneath the platen 45 at the compressing station.

A normally open third contact of relay CR3 closes energizing relay CR6. A normally closed contact of CR6 is openend as a safety means in the circuit of relay CR8 and two other normally open contacts of CR6 are closed completing an energizing circuit to the "down" solenoid 280 to operate the fluid-control valve 279 shown in Figure 10 for directing fluid under pressure through line 282 into the upper end of the actuator or cylinder 132 above piston 131. The ram or platen 45 is thus moved downwardly into engagement with the stack of mats M disposed on the conveyor beneath the ram compressing the stack of mats to a predetermined degree dependent upon the extent of vertical downward movement of the ram piston 131.

As the mats are compressed, the side portions of the upper sheet of paper S'' are moved downwardly into a position whereby edge zones of the lower sheet S', when folded, will move into overlapping relation with the lower edge portions of the sheet S''. The ram moves downwardly allowing the ram-operated limit switch LS2 to close, the ram engaging the limit switch LS1 at the bottom of its stroke. The normally closed contact of LS1 opens dropping out or disconnecting relay CR6 causing two contacts of CR6 to open thus interrupting the circuit to the "down" solenoid 280 cutting off or interrupting the delivery of pressure fluid above the piston 131 thereby stopping the downward movement of the ram.

Another contact of relay CR6 is closed by the operation of LS1 making ready a circuit to relay CR8. A normally open contact of limit switch LS1 closes and completes a circuit energizing timer relays TR1 and TR2. At the expiration of the period of energization of the timer relay TR1, a normally open contact of TR1 is closed completing a circuit to energize relay CR7. A normally open contact of relay CR7 closes completing a circuit through the solenoid 309 operating valve 285 (see Figure 10) which establishes flow of pressure fluid through lines 287 and 288 to the outer ends of actuators or cylinders 202 directing pressure fluid against the pistons 204 which move the glue or adhesive-sealing means into operative position aganist the package of compressed mats.

As illustrated in Figures 6 and 7, the plates 223 and rods 230, under the influence of the biasing pressure of springs 239, move the sealing plates 225 toward the stack of mats M folding up or bending the adhesive-coated side zones of the lower sheet S' and moving same into overlapping contacting relation with the upper sheet S''. The forward edges of angularly disposed plates 225 contact the stack of mats and upon further forward movement of plates 223, the lower edges of plates 225 form fulcrums about which the plates 225 are moved into vertical sheet-sealing position as shown in Figure 7.

The timer relay TR2 provides a delay period while the plates 225 are in sheet-sealing position during which period heat transferred to the plates or heating shoes 225 from the heating means 250 cures or sets the adhesive or glue between the overlapping portions of the packaging material or sheets of paper S' and S''. Upon expiration of the time period of TR2, a normally closed contact of TR2 is opened which de-energizes or drops out relay CR7. A contact of CR7 opens de-energizing solenoid 309 thus moving the fluid-control valve 285 to a position directing fluid under pressure through lines 290 and 292 into the innermost ends of the actuator cylinders 202 causing the pistons 204 to move outwardly and retract the package-sealing shoes or plates 225 to their initial positions out of engagement with the packaged mats. After the heater shoes retract, the limit switch LS3 is closed, momentarily energizing relay CR8.

Normally open contacts of relay CR8 are closed, completing an energizing circuit to the "up" solenoid 311 operating the valve 279 directing fluid under pressure to flow to the lower end of the ram cylinder 132 beneath the piston 131, a counterbalancing valve 312 being intercalated in the pressure fluid line for regulating or controlling the pressure differential in the fluid circuit for actuating the ram. As the ram initiates its return or upward stroke, a normally closed contact of limit switch LS1, which was opened by the ram at its lowermost position, is closed making ready a circuit to CR6 and causing a normally open contact of LS1 to open which drops out timer relays TR1 and TR2.

As the ram starts its upward or retractile stroke, limit switch LS4 is closed which completes a circuit energizing the slow-return solenoid 315 actuating valve mechanism 294 which, through the medium of the check valve 283, causes very slow return movement of the ram at the first phase of its return movement. The ram 45 continues its slow upward movement until the ram is disengaged from limit switch LS4 which opens, interrupting the circuit to the slow-return solenoid 315 and shifting the position of the valve 294 and the check valve 283 to increase the flow of fluid from the space in cylinder 132 above the piston 131. This increases the speed of the ram during the remainder of its return stroke to its initial uppermost position. The purpose of the slow return movement of the ram 45 for a short distance is to avoid a sudden expansion of the forces of compression in the stack of mats M thereby minimizing the liability of fracturing the newly set adhesive bond between the paper sheets S' and S''.

When the ram 45 reaches its uppermost limit of movement, it contacts limit switch LS2 opening the same which drops out the contact relay CR8. Two contacts of the relay CR8 are opened interrupting the circuit to the "up" solenoid 311 which actuates valve 279 interrupting the flow of pressure fluid beneath the piston 131, thus bringing the ram to rest. Another contact of the relay CR8 closes making ready a circuit to contact relay CR6.

While the compressing and sealing operation for producing the package is being carried on with one stack of mats, the operator places a sheet of paper S'' upon the conveyor at the station A, deposits the succeeding stack of mats being delivered by the roller conveyor E onto the sheet of paper S' and superposes the second sheet S'' upon the stack at the receiving-station A. After the automatic operations of compressing one group or stack of mats and sealing the packaging sheets about the stack of compressed mats and the ram and sealing shoes have been retracted, the operator again initiates the operation of the machine by closing the manual starter switch 300.

The initial action of closing the switch 300 is to energize the conveyor motor 36 causing the conveyor to move the packaged group of mats M' from the compressing station to a package-receiving conveyor T shown in Figure 1, the conveyor concomitantly moving the stack of mats at the receiving station past the glue-applying station to the mat-compressing station. The completed package of compressed mats being conveyed away from the mat-compressing station eventually travels out of the path of the light beam 303 permitting the light beam to again project on the photosensitive cell or tube 305, opening the contact of the relay PR1 which drops out the relay CR4. One of the contacts CR4 opens dropping out the contact relay CR5. One of the contacts of the relay CR5 closes, making ready a circuit to the contact relay CR3. The succeeding stack of mats moving into position beneath the ram 45 intercepts the light beam which action initiates the above-described automatic operations in their proper sequence for compressing and packaging the stack of mats at the compressing station.

What I claim is:

1. Apparatus of the character disclosed including, in combination, a mat-receiving station; a mat-compressing

station; means including a movable conveyor for supporting a sheet of packaging material adjacent a group of mats; means for actuating the conveyor to move groups of mats from the mat-receiving station to the mat-compressing station; an adhesive-applying means; means for actuating the adhesive-applying means to deposit adhesive on the sheet of packaging material; said compressing station including a movable ram; photo-actuated, electrically energized means at the compressing station for initiating movement of the ram to compress the mats to reduced thickness, and means including a plate adapted to engage the sheet of packaging material for joining the adhesive on said sheet with another sheet of packaging material to envelop the mats to form a package.

2. Apparatus of the character disclosed including, in combination, a frame; a movable conveyor supported upon the frame; means for actuating the conveyor; said conveyor adapted to support a sheet of packaging material and a quantity of compressible fibrous material; an applicator adapted to apply a fastening material to the packaging sheet; a ram supported upon the frame for compressing the fibrous material; means supported by the frame and movable to a position overlapping the sheet of packaging material carried by the conveyor with another sheet of packaging material superposed on the compressed fibrous material for joining the overlapping portions together through the fastening material; fluid-actuated means for moving the material-compressing ram; fluid-actuated means for operating the sheet-joining means and electrically actuated means for initiating the operation of both fluid actuated means.

3. Apparatus for packaging mats of fibrous material including, in combination, a frame; a movable conveyor supported upon the frame; means for actuating the conveyor; said conveyor adapted to support a sheet of packaging material and a group of mats of fibrous material; means including an applicator adapted to deposit an adhesive on portions of the packaging sheet; a mat-compressing means supported upon the frame; means for actuating the mat-compressing means to compress a group of mats conveyed to a zone beneath the compressing means by the conveyor; means supported by the frame and movable to a position overlapping the sheet of packaging material carried by the conveyor with a second sheet of packaging material superposed on the group of mats for joining the adhesive-coated portions of one sheet with the other; fluid-actuated means for moving the mat-compressing means; fluid-actuated means for operating the sheet-joining means, and electrically actuated means for initiating the operation of both said fluid actuated means.

4. Apparatus for packaging stacks of fibrous mats including, in combination, a frame; a movable conveyor supported upon the frame; said conveyor adapted to support a sheet of packaging material and a stack of mats disposed on the sheet; means for actuating the conveyor; means including an applicator arranged for applying a heat-curable adhesive to zones of the packaging sheet at each side of the group of mats; means supported upon the frame for compressing the stack of mats; means supported by the frame and movable to a position folding the adhesive-coated zones of the sheet of packaging material carried by the conveyor into overlapping relation with portions of another sheet of packaging material superposed on the stack of mats; means for applying heat to the overlapping portions of the sheets to cure the adhesive; fluid-actuated means for moving the mat-compressing means; fluid-actuated means for operating the sheet-folding means, and electrically actuated means for initiating the operation of both said fluid-actuated means.

5. Apparatus of the character disclosed including, in combination, a mat reeciving station, a mat compressing station, means for positioning a sheet of packaging material in contact with a group of mats at the mat receiving station, an adhesive-appiying means disposed adjacent the mat receiving station, a valve member associated with the adhesive-applying means adapted to be actuated by contact with the group of mats whereby the adhesive-applying means deposits adhesive on spaced zones of the sheet of packaging material, said compressing station including a movable ram, means for actuating the ram, said ram actuating means being operated by a group of mats disposed adjacent the ram for moving the ram to compress the group of mats, a sealing member, and means for moving the sealing member into engagement with the sheet of packaging material for joining the adhesive-coated zones thereof with another sheet of packaging material to form an envelope surrounding the group of mats.

6. Apparatus of the character disclosed including, in combination, a mat receiving station, a mat compressing station, means for positioning a sheet of packaging material adjacent and beneath a group of mats, an adhesive-applying means disposed intermediate the mat receiving and mat compressing stations, valve means for the adhesive-applying means, a control member actuated by contact with the moving group of mats adapted to operate the valve means and deposit adhesive on spaced zones of the packaging sheet, a movable ram at the compressing station, means for moving the ram to compress the group of mats, means for folding the adhesively coated zones of the packaging sheet of material into engagement with another sheet of packaging material to form an envelope surrounding the group of mats, and means for applying heat to the adhesively coated zones of the sheet for establishing a bond between the sheets.

7. Apparatus for packaging a group of stacked fibrous mats in sheet material including, in combination, a frame; a conveyor carried by the frame; means for applying adhesive to an area of the sheet material; mat-compressing means supported upon the frame; fluid-operated means for actuating the mat-compressing means; means for actuating the conveyor to move a group of mats and sheet material to the mat-compressing means; means for concomitantly compressing the group of mats to reduced volume and moving the adhesive coated area of the sheet material into overlapping relation with another portion of the sheet material, and means rendering the adhesive on the sheet material effective to bond the overlapping portions of the sheet material together to form an envelop surrounding the group of mats.

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