

Nov. 29, 1960

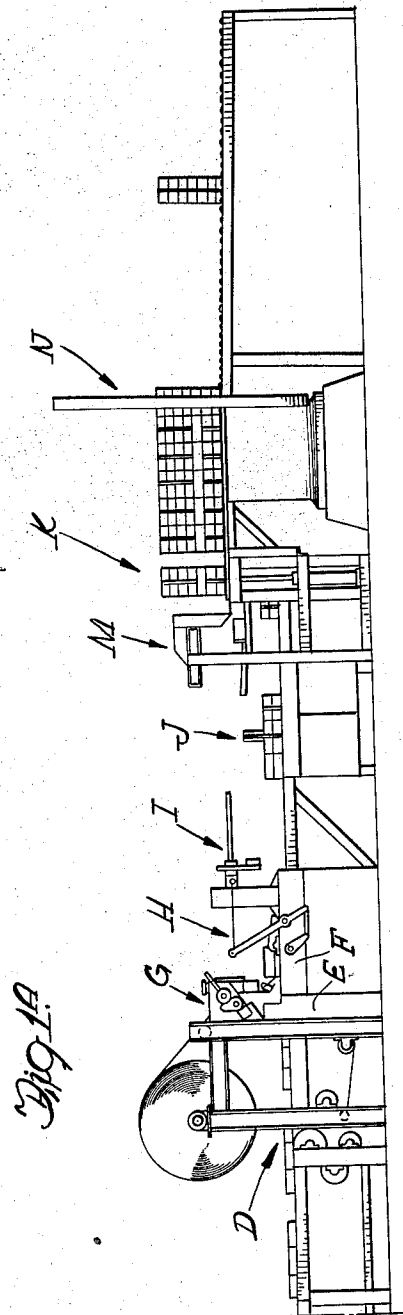
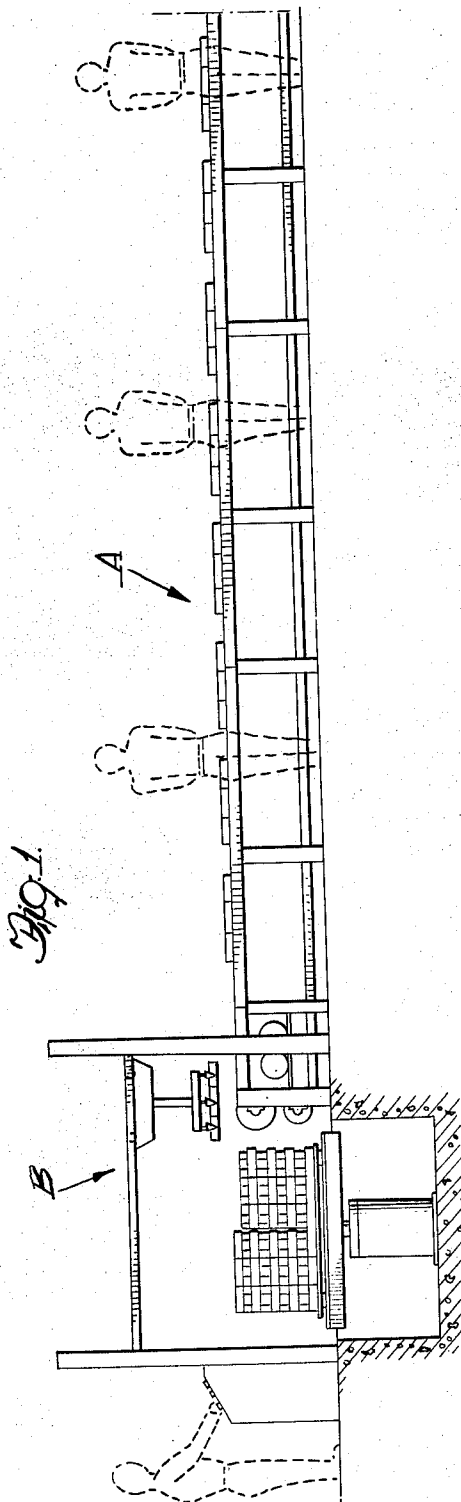
P. V. JOHNSON ET AL

2,961,810

METHOD OF AND APPARATUS FOR COMBINING UNITS TO FORM A PACKAGE

Filed June 19, 1957

20 Sheets-Sheet 1



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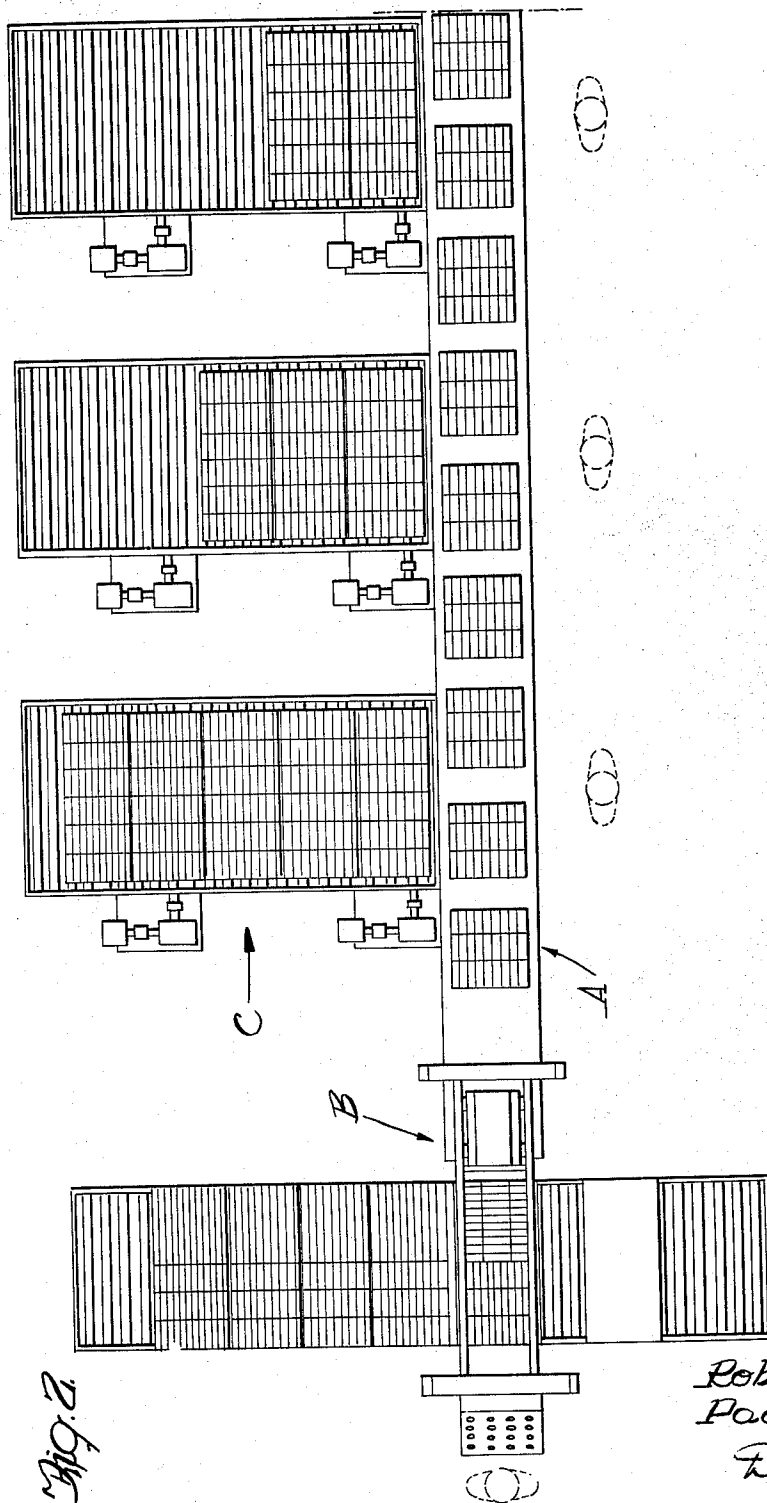
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20 Sheets-Sheet 2



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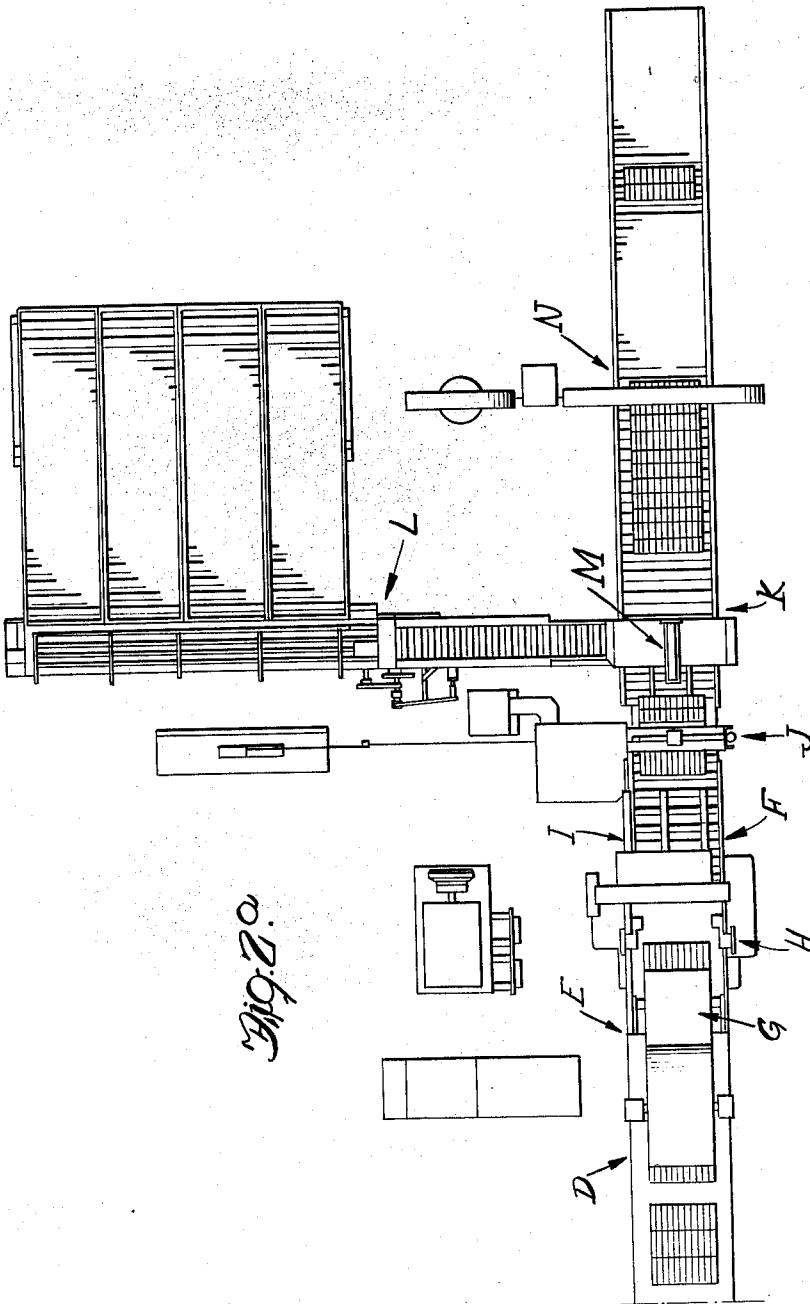
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20 Sheets-Sheet 3



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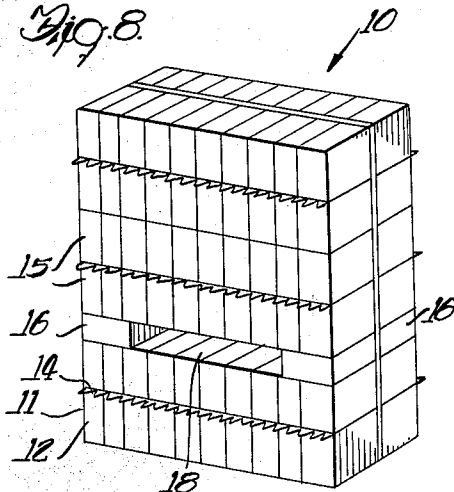
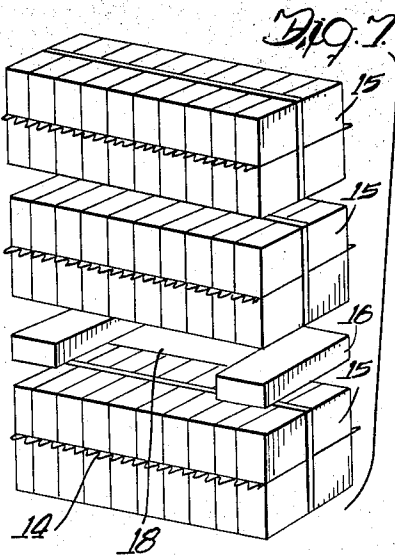
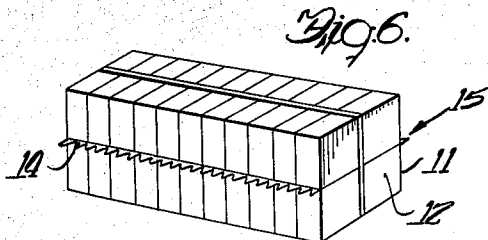
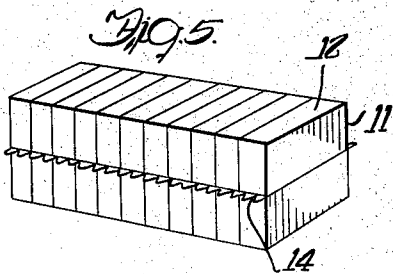
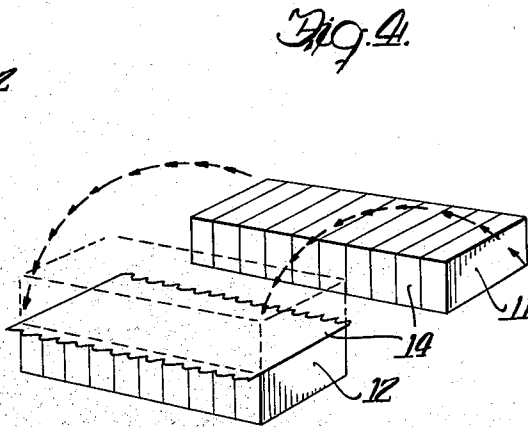
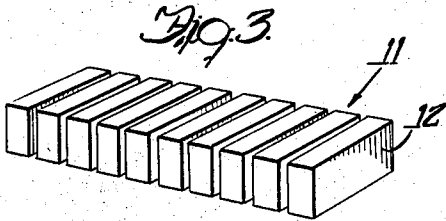
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20 Sheets-Sheet 4



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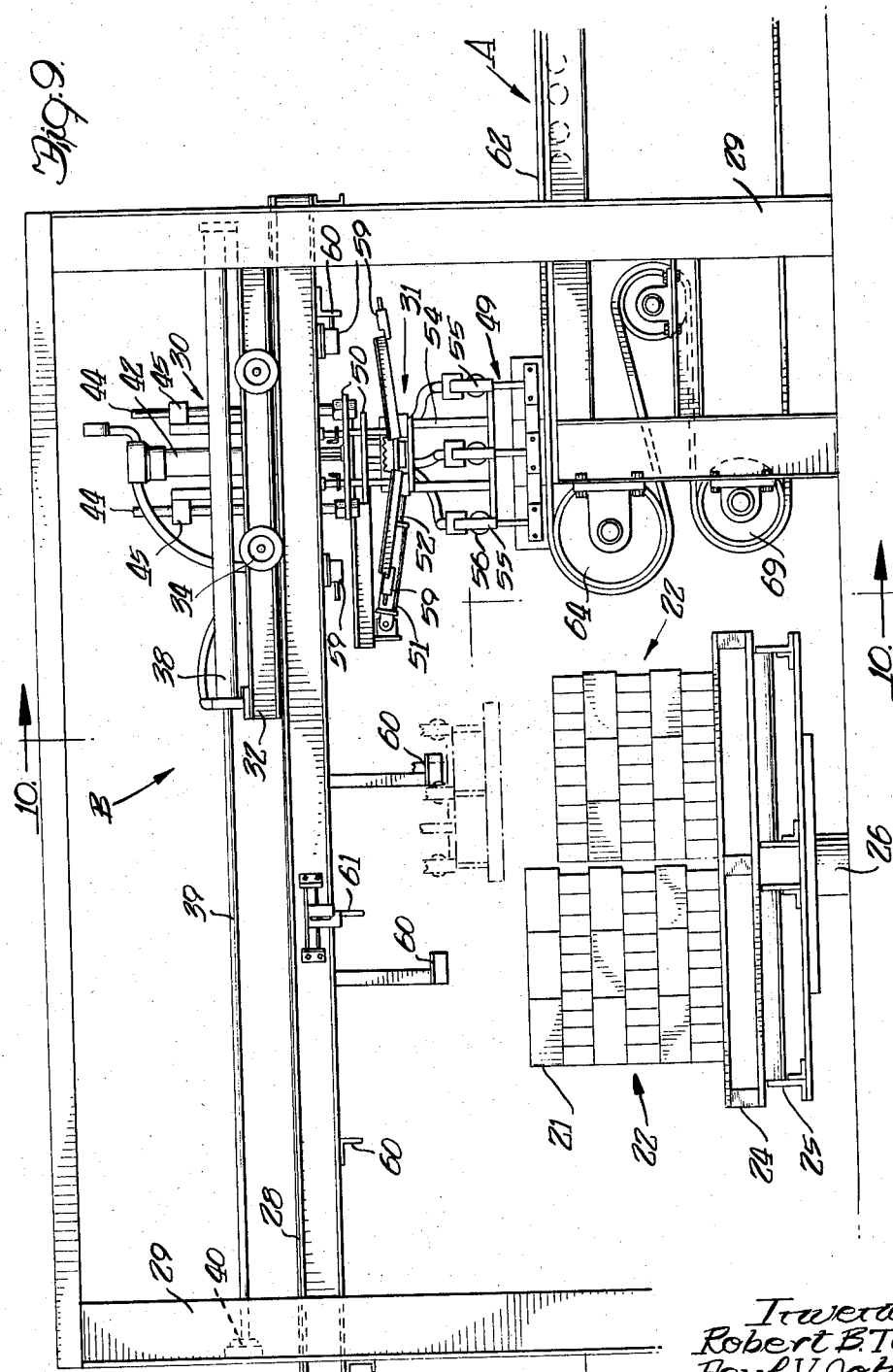
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20 Sheets-Sheet 5



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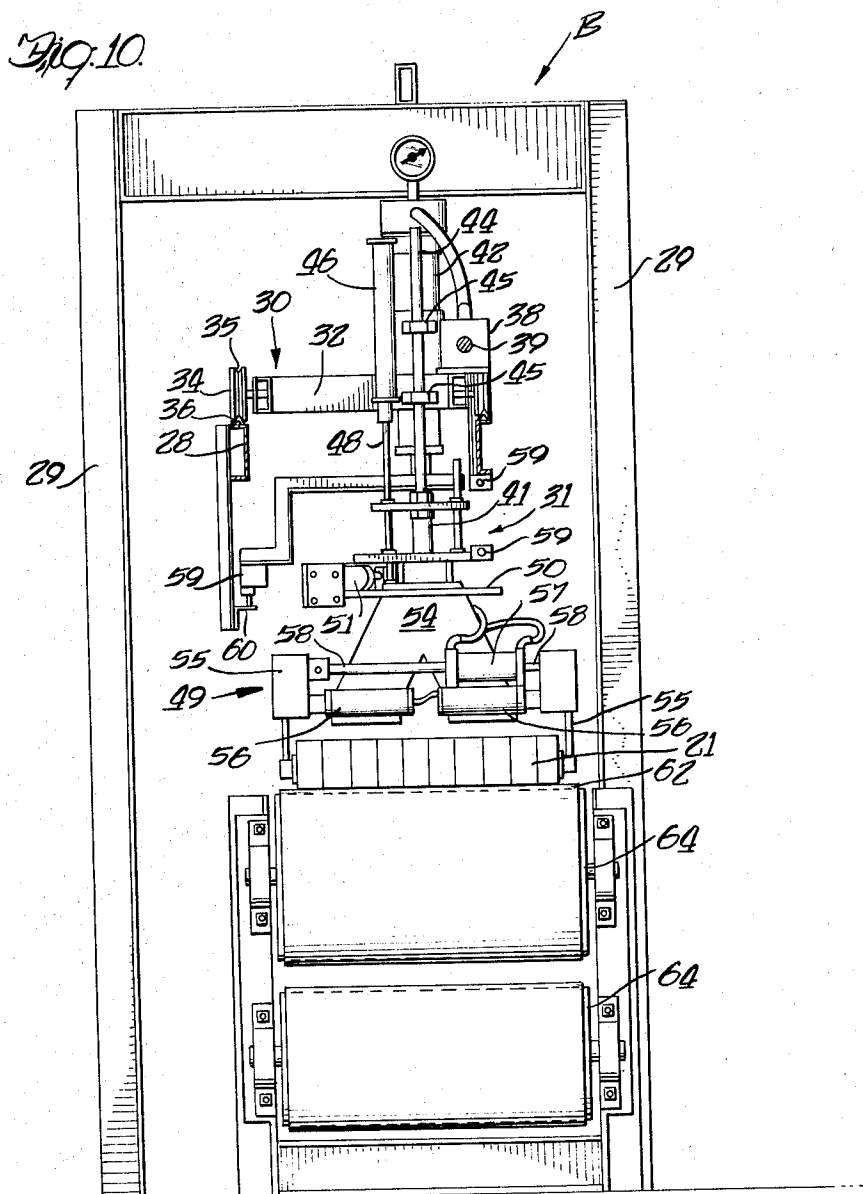
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20 Sheets-Sheet 6



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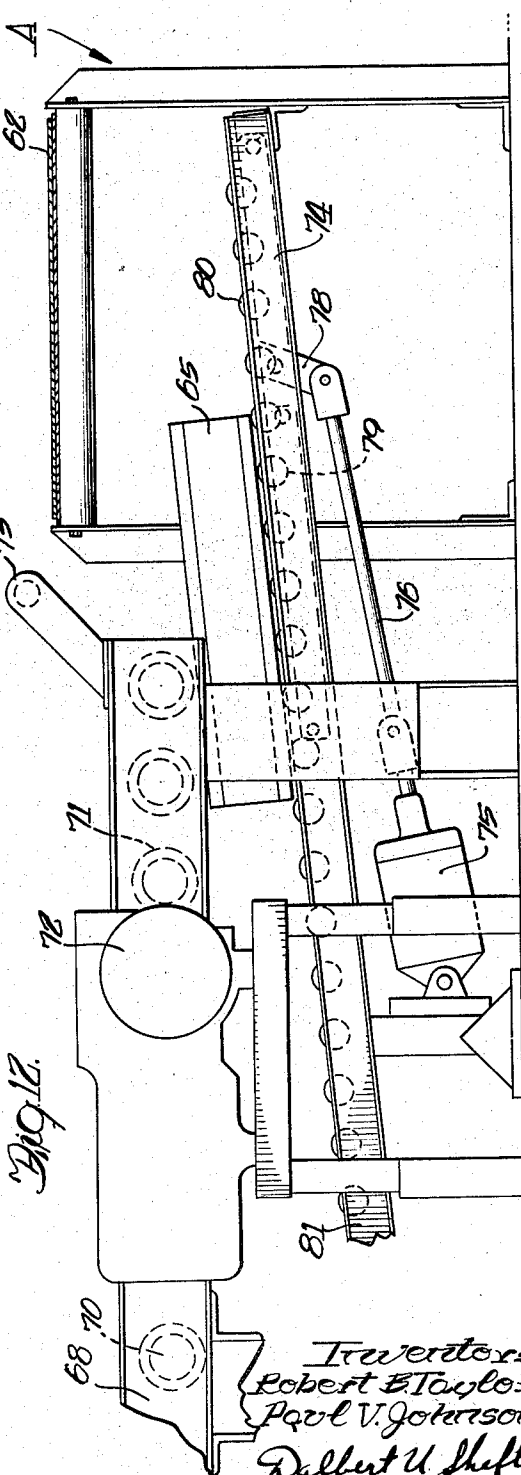
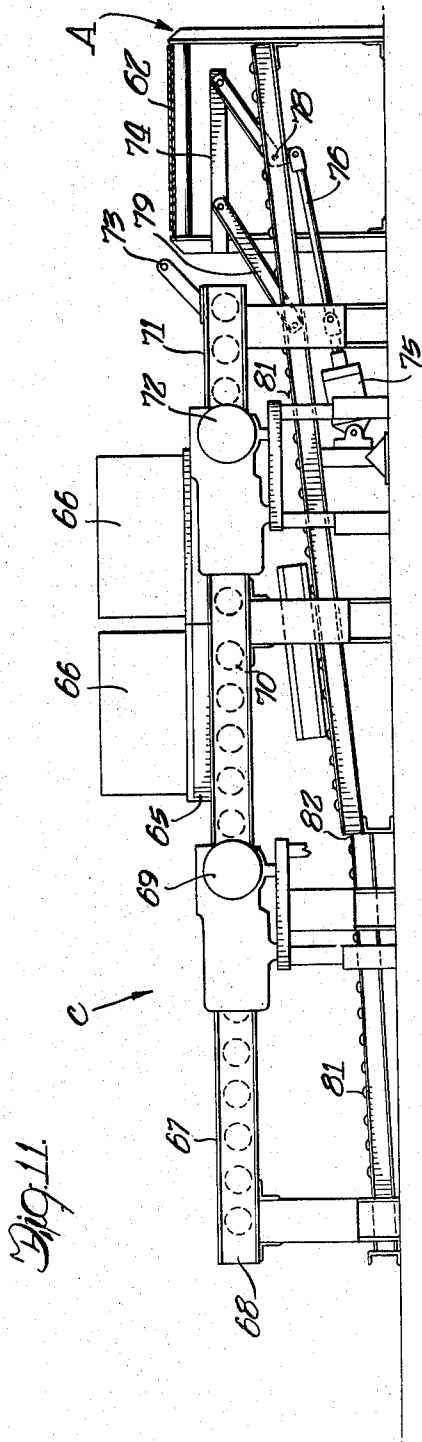
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20 Sheets-Sheet 7



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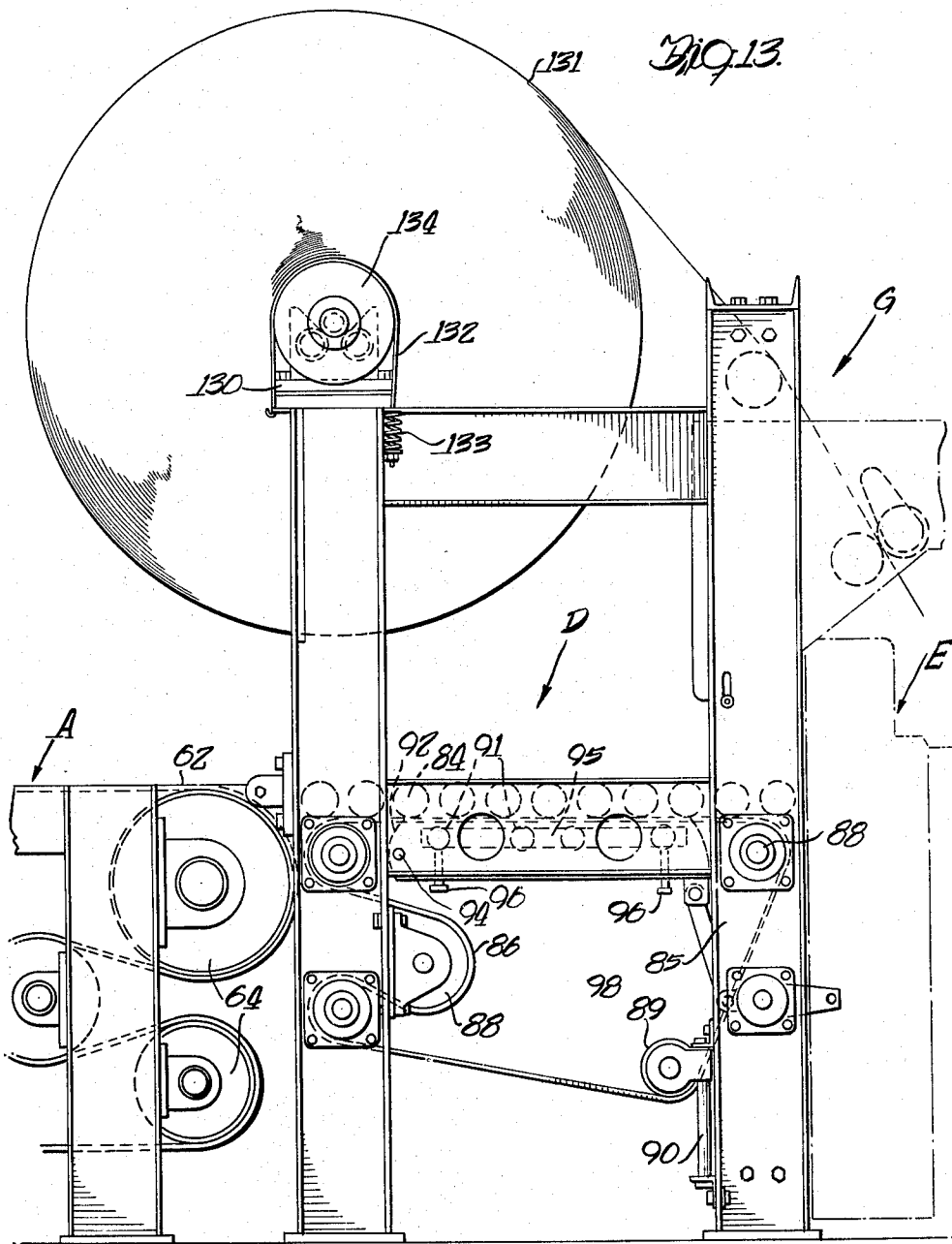
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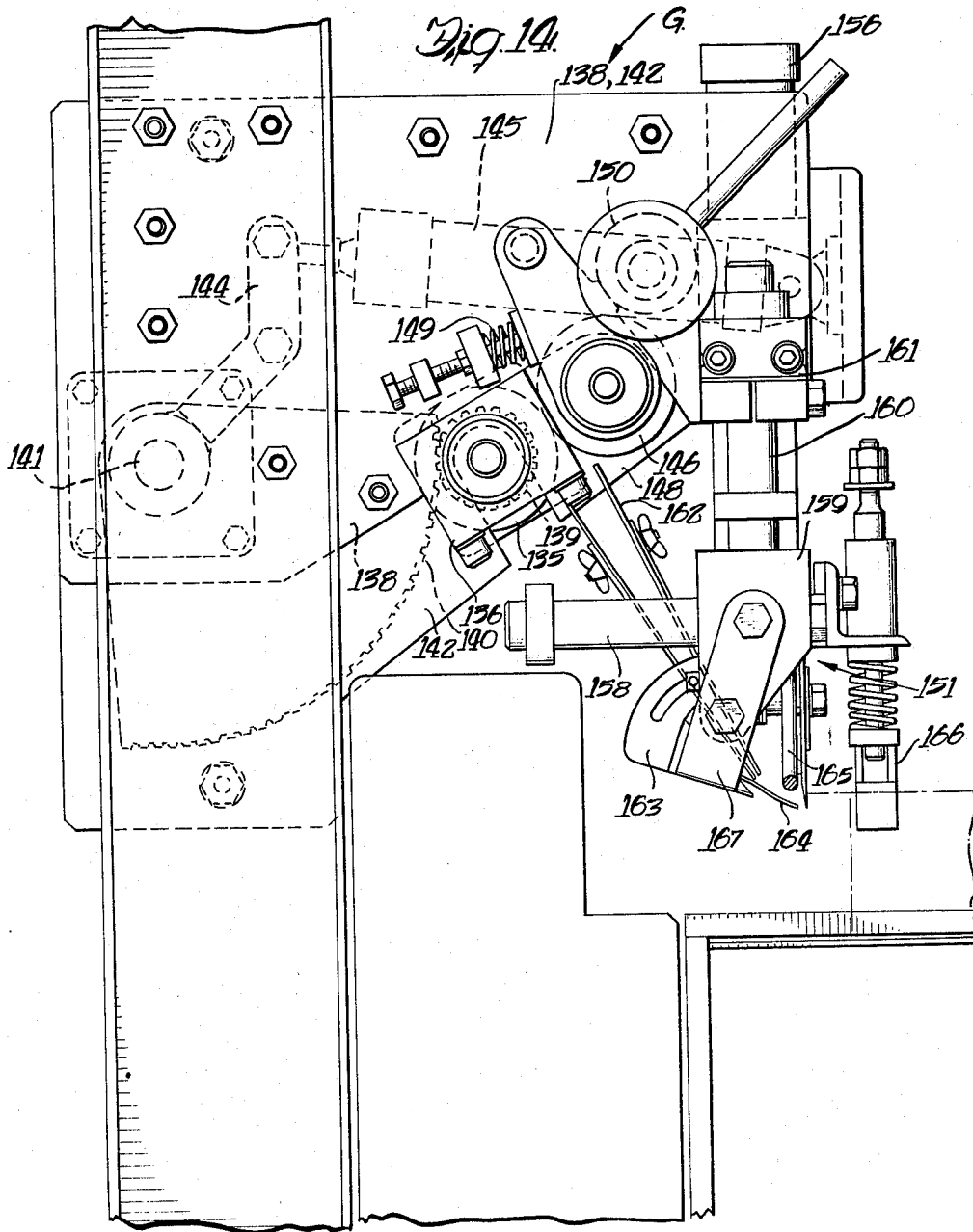
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20 Sheets-Sheet 9



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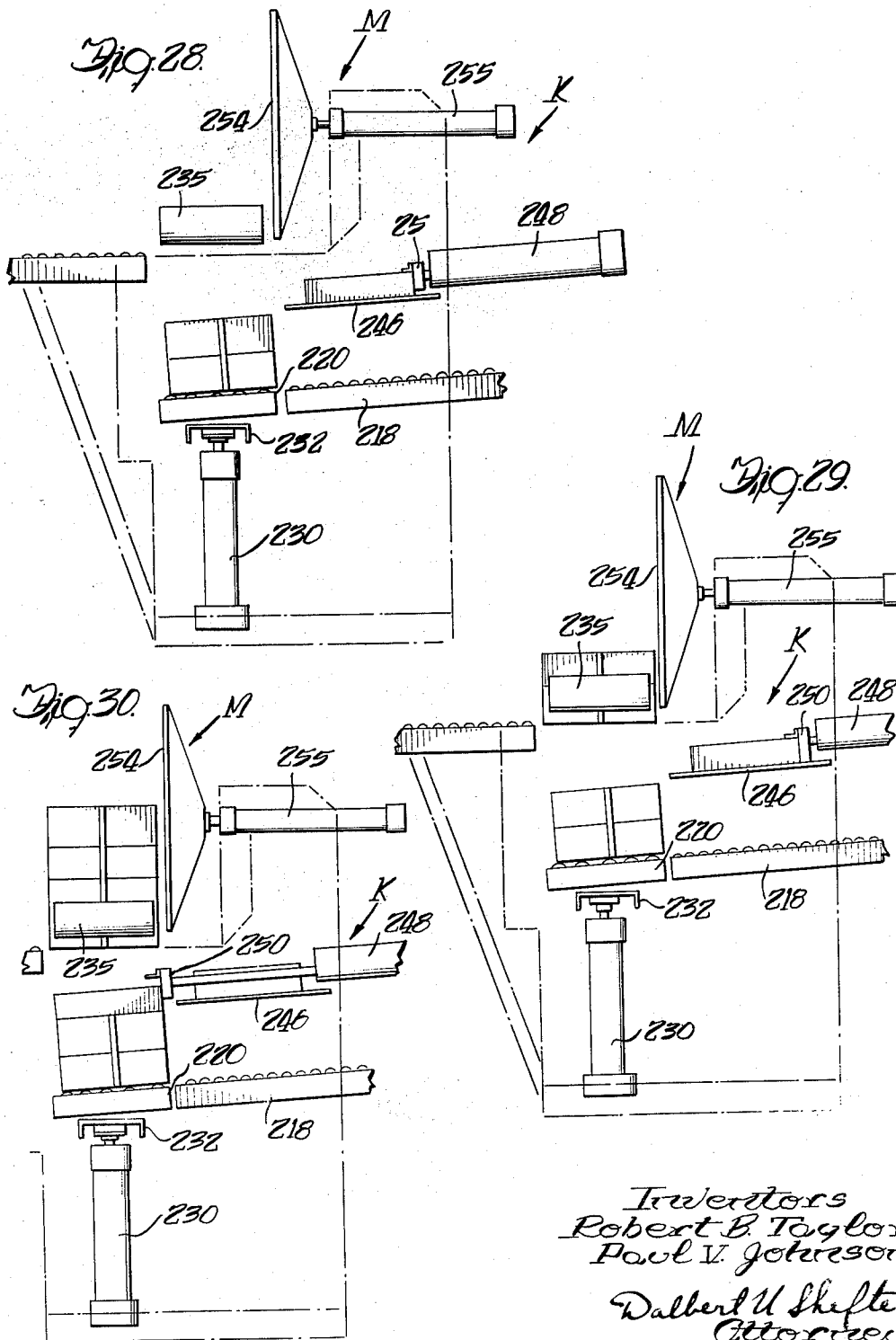
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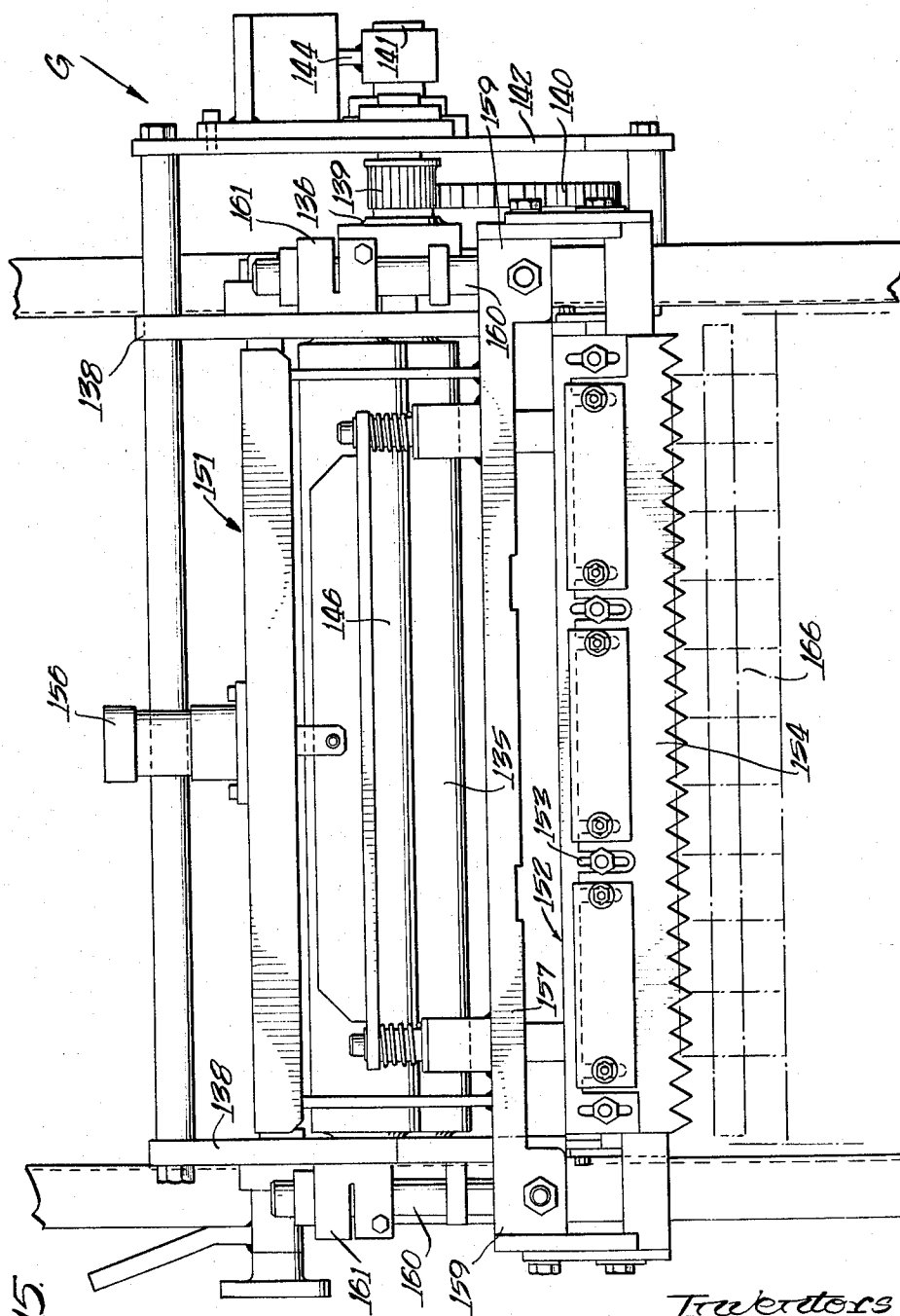


Fig. 15.

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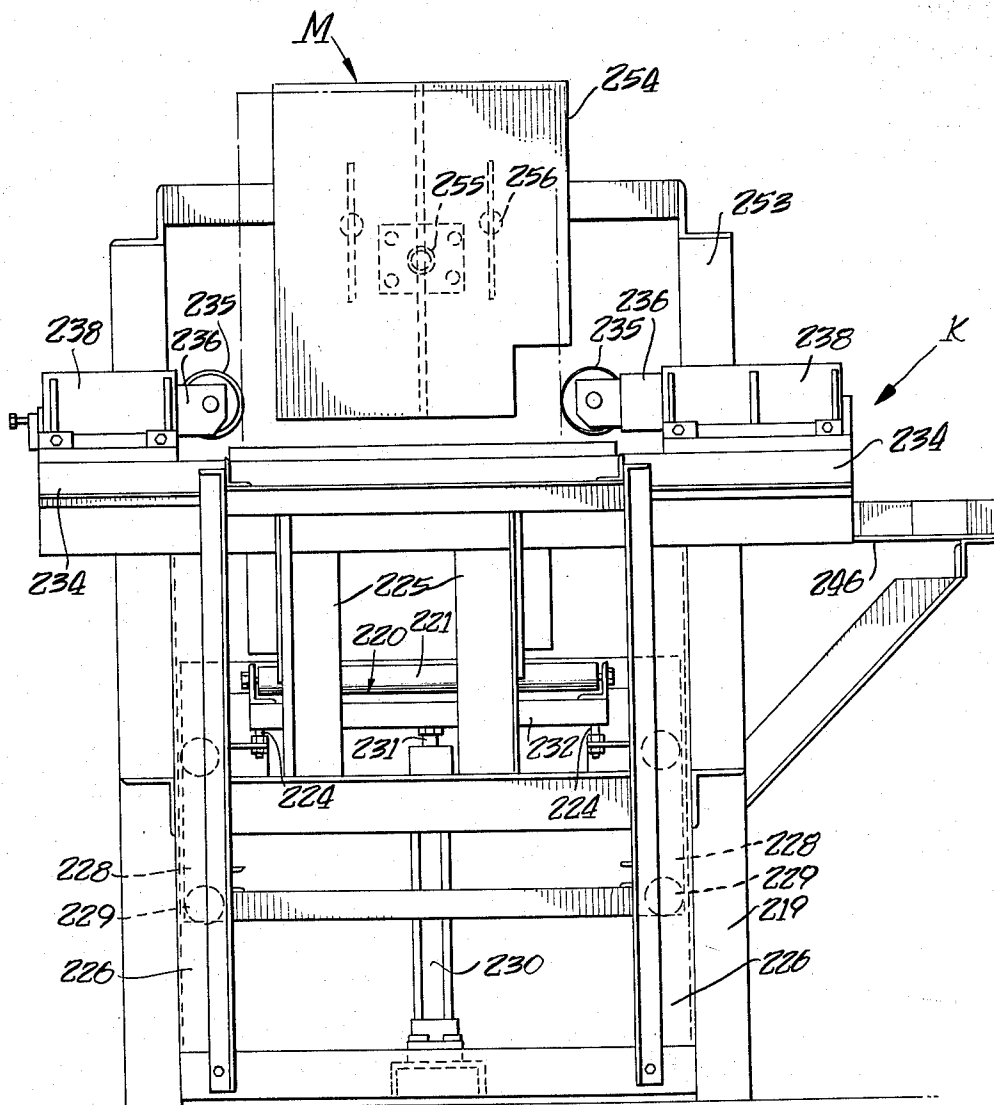
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Fig. 21



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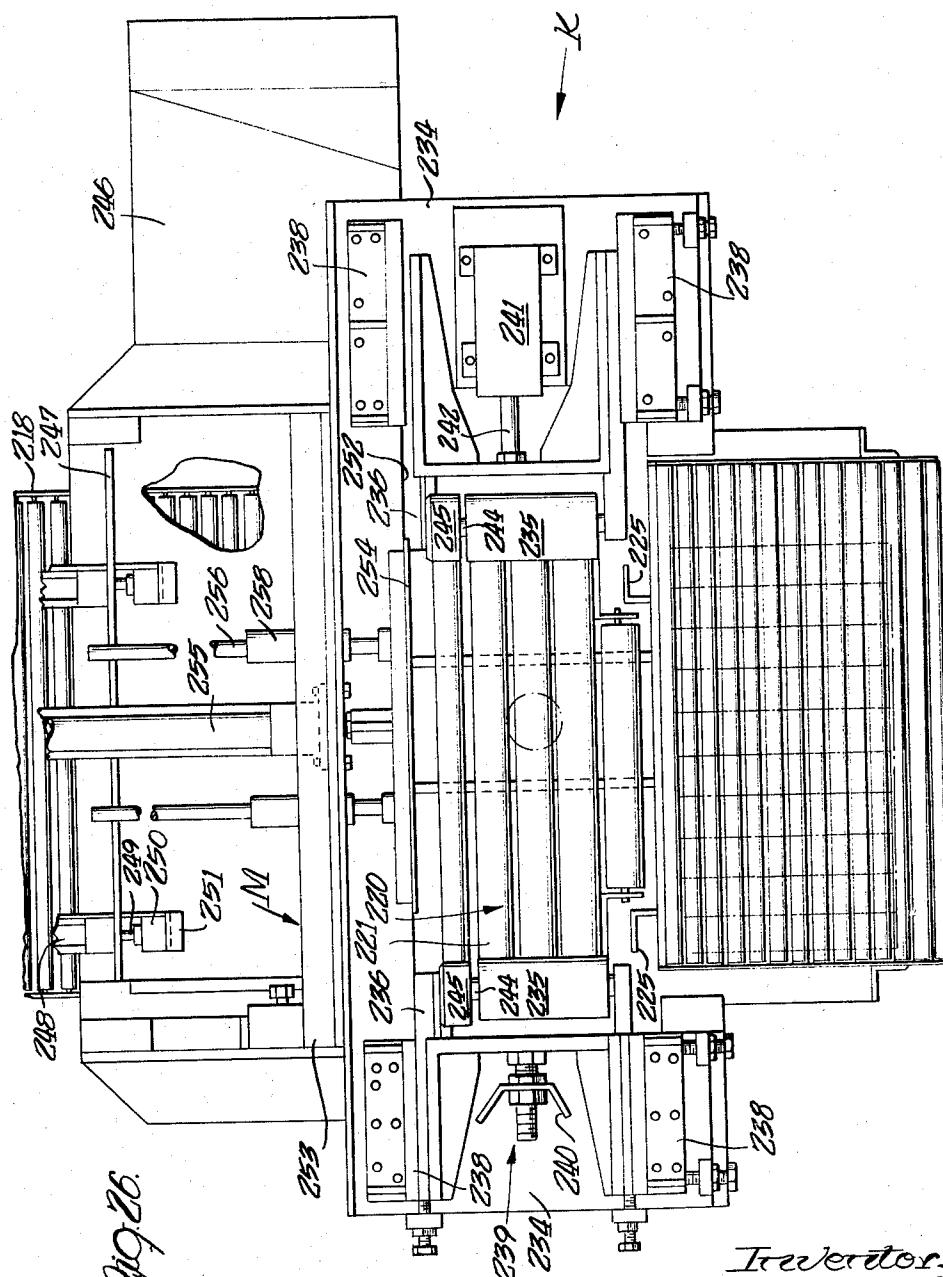
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20 Sheets-Sheet 13



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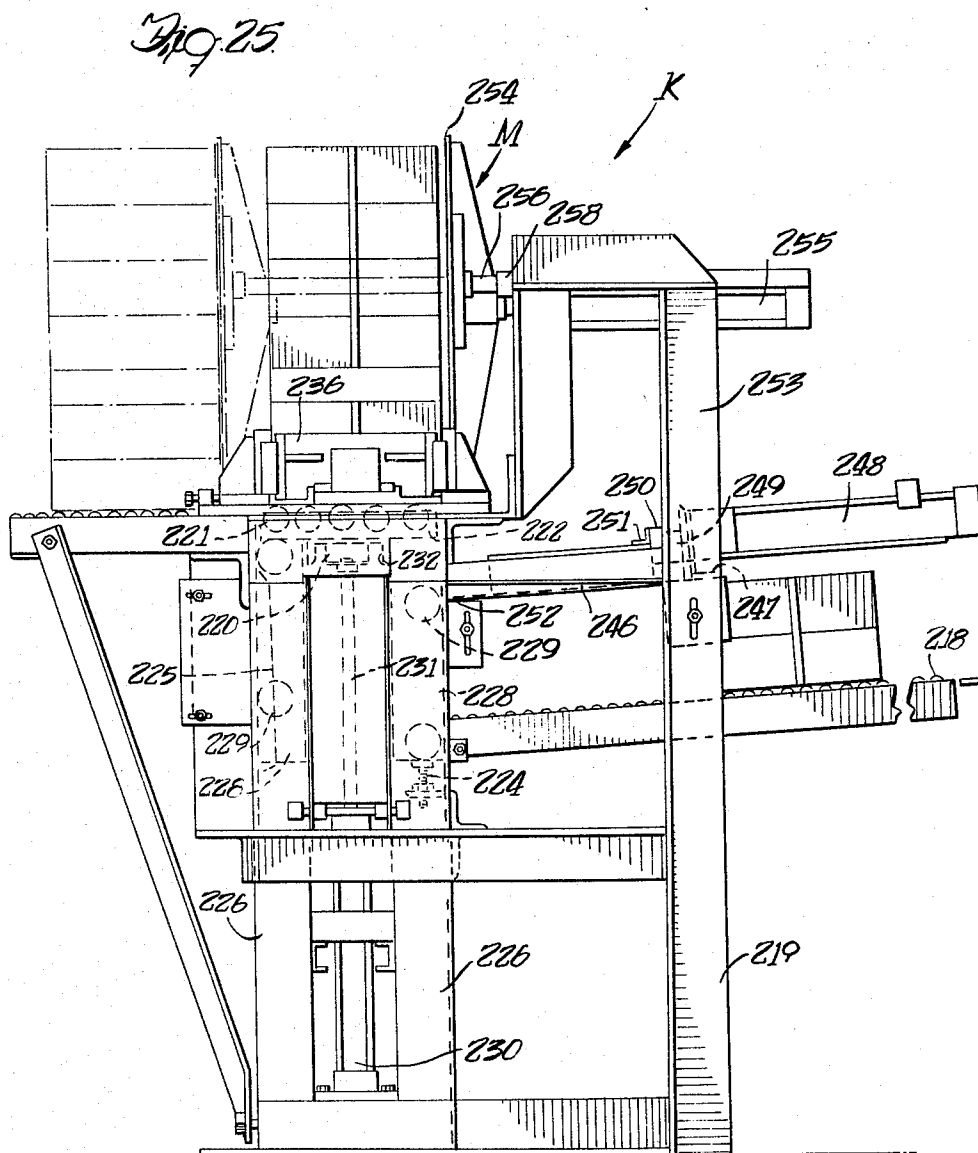
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20 Sheets-Sheet 14



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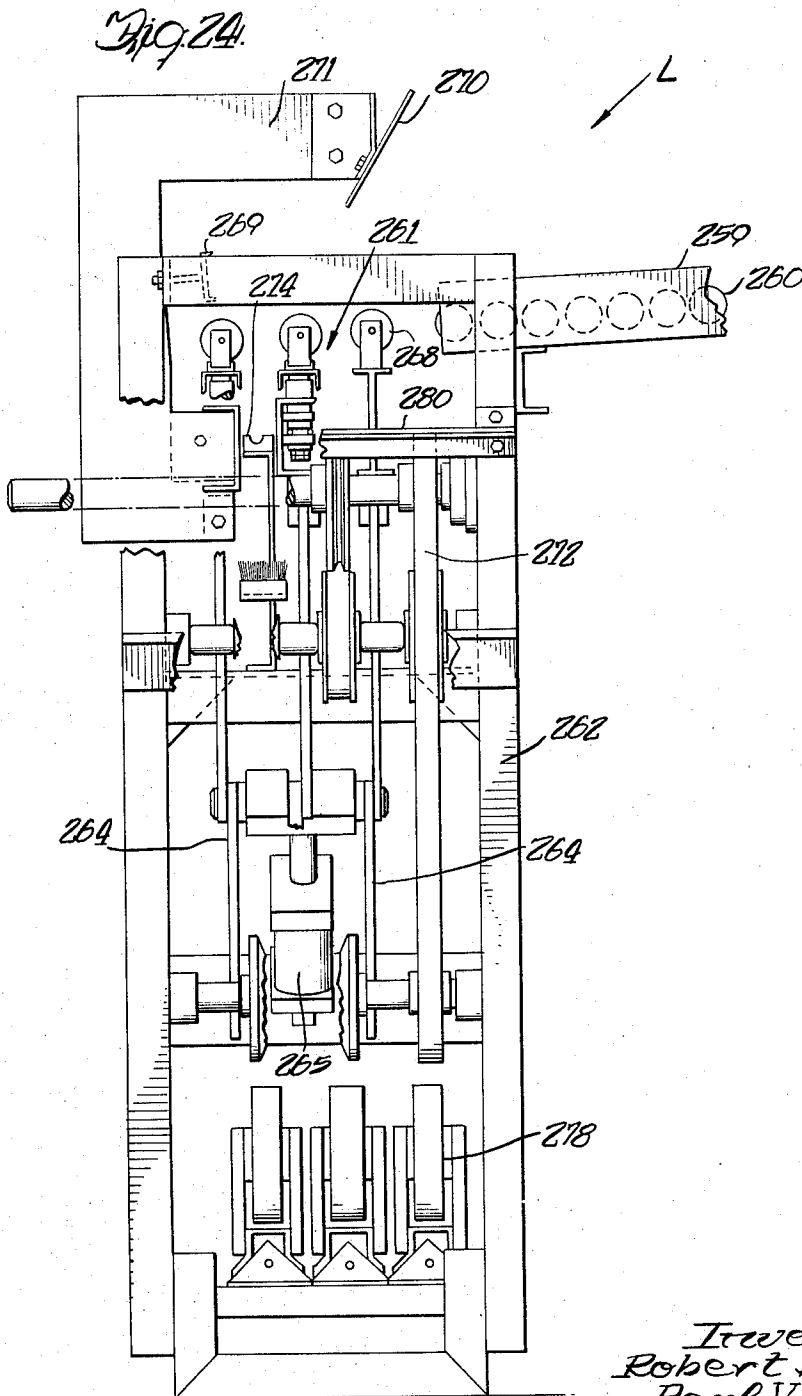
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20 Sheets-Sheet 15



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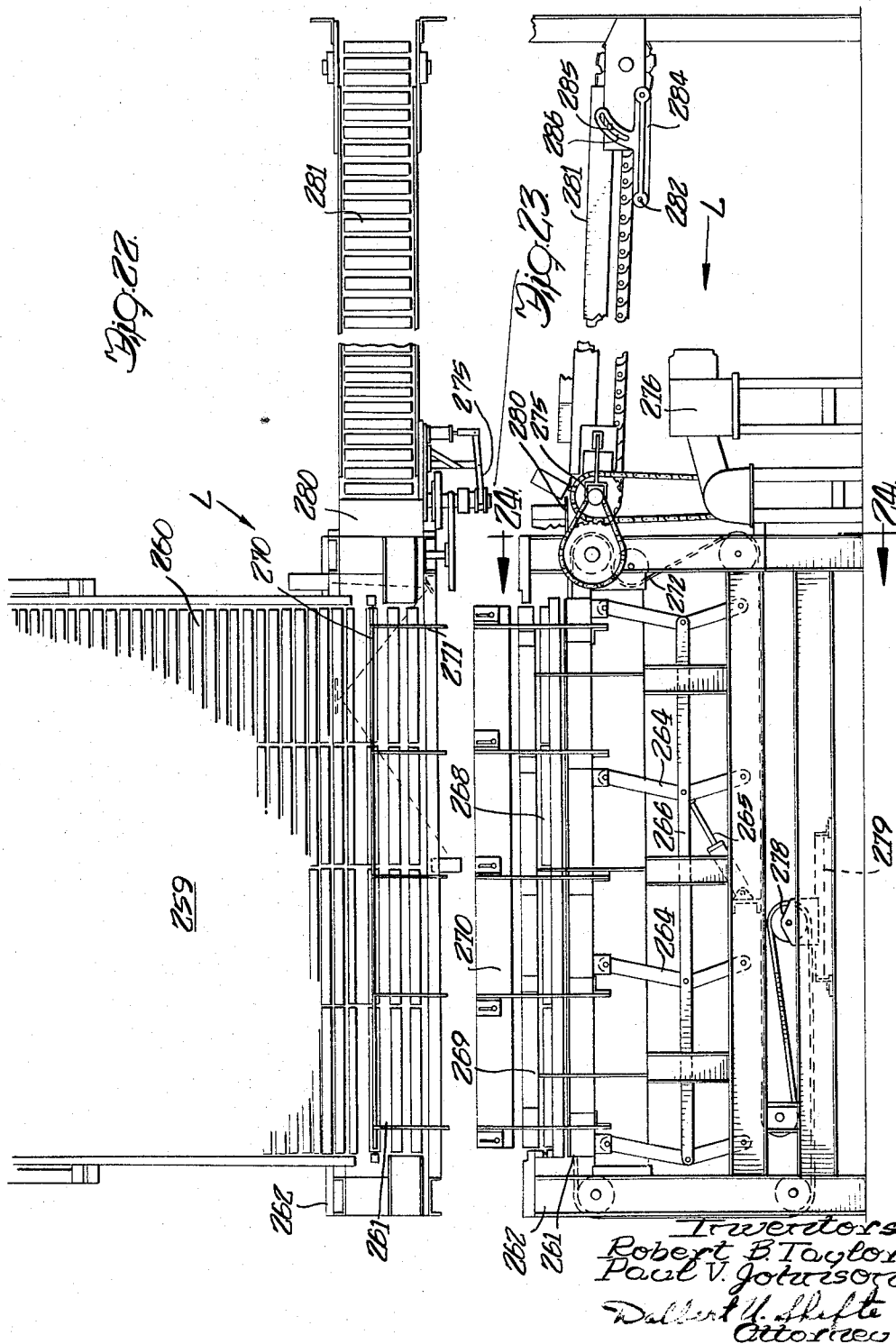
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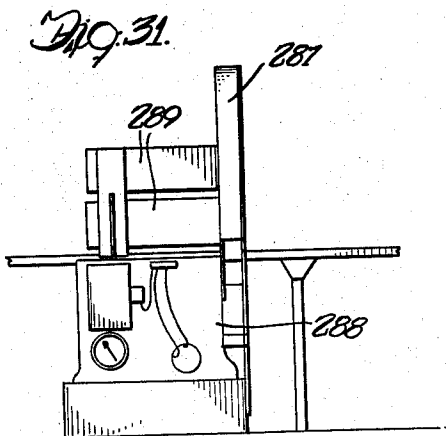
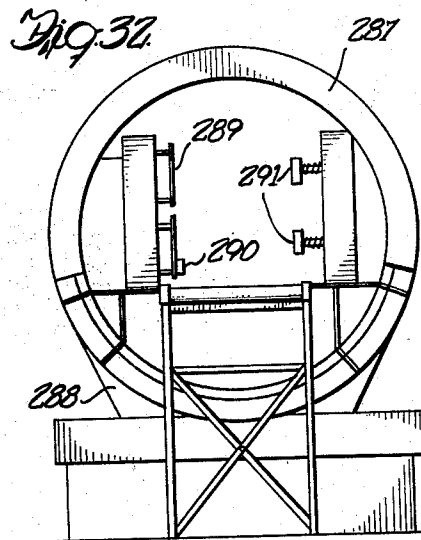
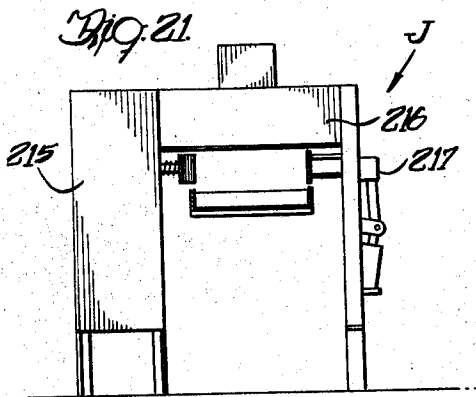
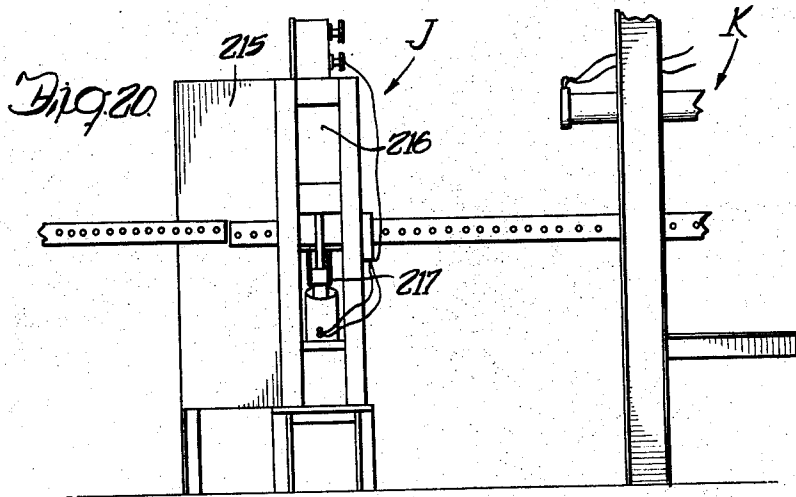
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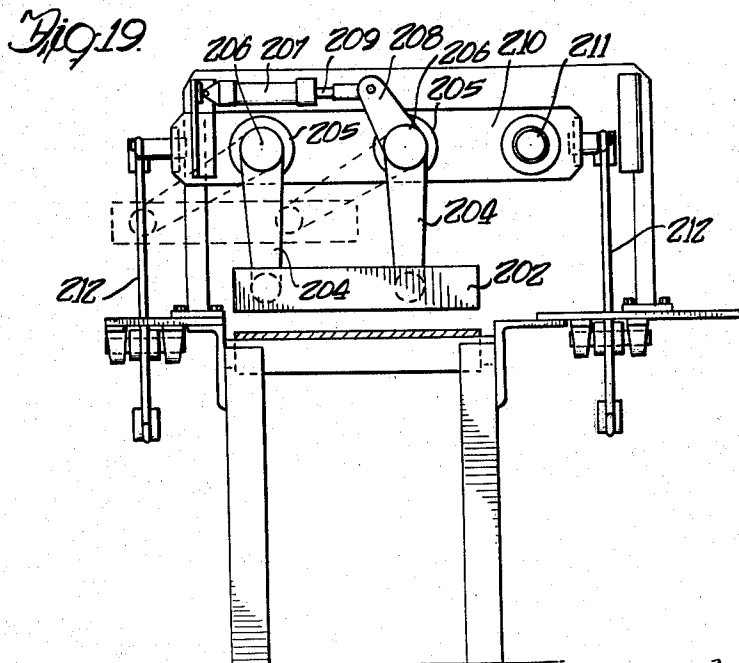
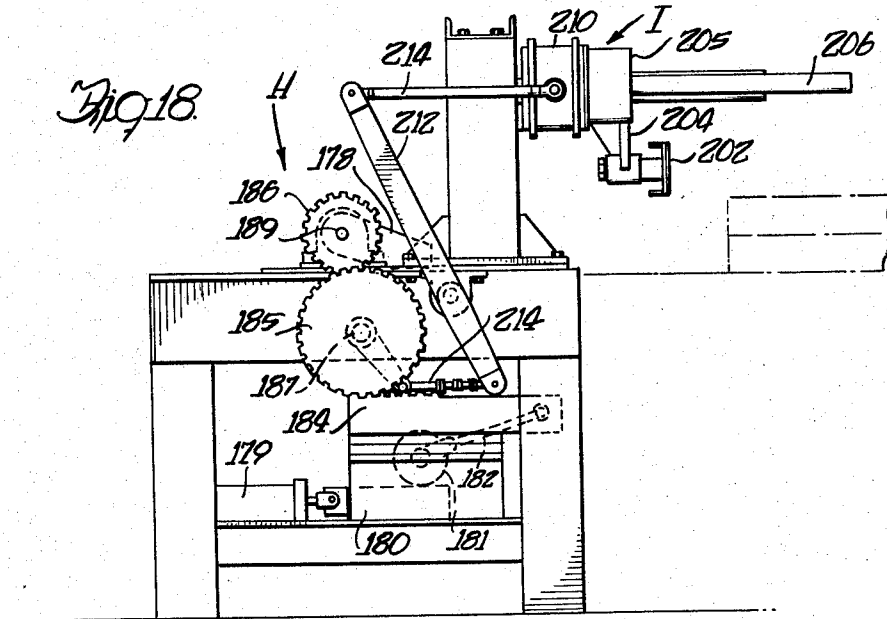
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20 Sheets-Sheet 18



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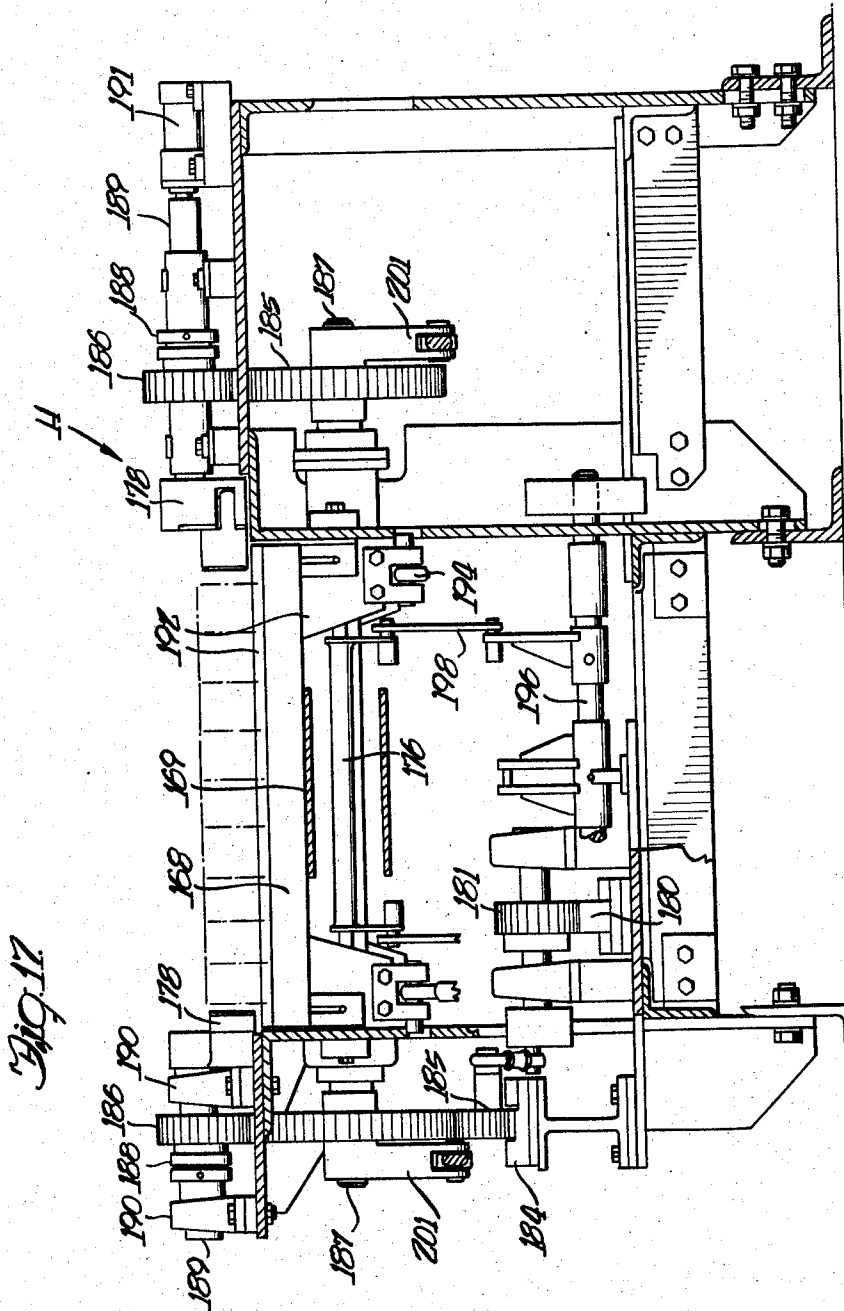
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20 Sheets-Sheet 19



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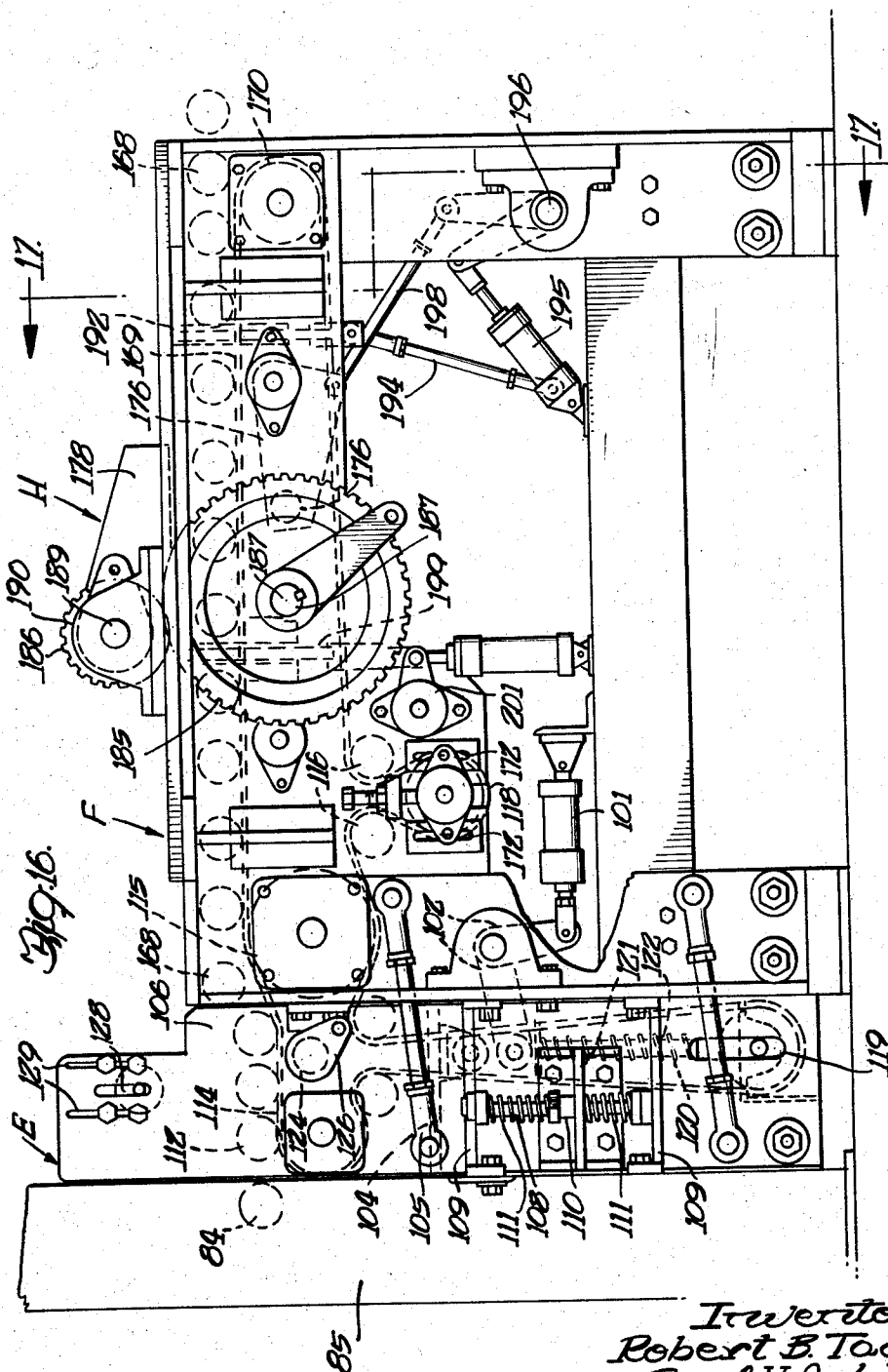
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20 Sheets-Sheet 20



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METHOD OF AND APPARATUS FOR COMBINING UNITS TO FORM A PACKAGE

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14 Claims. (Cl. 53—26)

This invention relates to a method of and apparatus for combining units to form a package, and more particularly to a method of combining units into sub-packs, stacking the sub-packs with spacer units inserted in the stack to form a complete package having a space therein between the spacer units.

The structural clay products industry has recently been attempting to reduce the materials handling difficulties encountered in the field of transporting a multitude of individual units such as structural clay brick or tile from the manufacturing plant or warehouse to the job site, and the further problems of transporting from a central location at the job site to the particular work locations. Loose brick has always been a problem, not only because of difficulties in handling, but because of the high rate of damage resulting from the contact of brick against brick when piled or handled haphazardly.

The Structural Clay Products Research Foundation, of Geneva, Illinois, has developed a package which alleviates many of the materials handling problems and further reduces the labor and expense of transporting units to a job site, and also at the job site. This package is described and illustrated in United States Letters Patent No. 2,778,491 issued on January 22, 1957. One of the embodiments of the above package is illustrated in Fig. 8 of the drawings. This complete pack 10 consists of rows 11 of individual units 12. The rows are stacked in pairs with a sheet of paper 14 between the adjacent faces, this double tier row being strapped to form a sub-pack 15. The pack 10 consists of three of these sub-packs 15, two of which are spaced apart by a pair of spacer units 16 which provide an open space 18 in the pack 10 to receive tongs of a lift truck, or to permit easy engagement by other types of material handling equipment.

In order to properly utilize the advantages of the above pack, the Structural Clay Products Research Foundation has developed the present method of packaging units, and has further developed an automatic packaging line into which individual units are fed and from which complete packs are discharged with all the operations automatically controlled and interconnected to provide a continuous flow through the line.

Basically, the method of this invention entails the accumulating of individual units 12 into rows 11 such as shown in Fig. 3; placing a sheet of paper 14 on a row and folding a row over onto the row with the paper thereon, as shown in Fig. 4, to form a double tier row, as shown in Fig. 5; strapping the double tier row to form a sub-pack 15, as shown in Fig. 6; stacking sub-packs and inserting spacer units 16 between two sub-packs, as shown in Fig. 7; and strapping the stack to form the complete pack 10 of Fig. 8.

One embodiment for performing the above method by mechanical action is diagrammatically illustrated in Figs. 1, 1A, 2 and 2A, which illustrate a feed conveyor A being loaded with units 10 either by an automatic transfer

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crane B, which transfers units from a pallet 19 to the feed conveyor A, or, in the alternative, by manually loading by operators 20 who unload units from pallet conveying apparatus C onto the feed conveyor A. With a plurality of these pallet conveying apparatus, different colors and textures of brick can be combined on the feed conveyor A to produce a pack which includes these various type brick.

The feed conveyor A feeds the units in rows onto the accumulator conveyor D, which accelerates the movement of the rows so as to separate them and feed single rows onto a releasing elevator E, which raises the row of units and releases the row onto the fold-over conveyor F. A paper feed mechanism G feeds a length of paper onto a row of units on the fold-over conveyor F and the fold-over mechanism H folds over a row of units onto the row of units with the paper thereon. The paper is then cut and the double tier row moves along the fold-over conveyor F and is moved by a pusher I onto a sub-pack strapper J which straps the double tier row to form a sub-pack. These sub-packs then move onto a stacker K which stacks three sub-packs, and while doing so, inserts spaced spacer units between the second and third sub-packs. These spacer units are fed to the stacker K by a spacer unit feed conveyor L. The full stacks are moved from the stacker by a pusher M into a full stack strapper N which straps the stack to form the complete pack.

The above operation can be varied depending upon the type of unit being stacked. Thus if large units are used the foldover operation may be omitted so that the sub-packs will be formed from single rows, or, if there is no finished face on the unit which requires protection by the sheet of paper, the paper feed mechanism may be omitted.

The general object of the present invention is to provide a new and improved method of combining units to form a package.

Another object of the present invention is to provide a new and improved method of combining units to form a package having an open space therein.

A further object of the present invention is to provide a new and improved method of combining units to form a package, the method including the forming of sub-packs and the stacking of the sub-packs with spacer units between two adjacent sub-packs to provide a final pack having an open space therein.

Still another object of the present invention is to provide a new and improved method of combining units to form a package, as described in the preceding paragraph, including the combining of the units in rows and placing one row upon another with a sheet of paper therebetween to form a sub-pack.

A still further object of the present invention is to provide a new and improved method of combining units to form a package, as described in the preceding paragraph, including the folding over of one row of units onto a subsequent row of units which has a sheet of paper thereon, so that a finished face on each unit is adjacent the sheet of paper.

Other and further objects and advantages of the present invention will be apparent from the following description and drawings, in which:

Figs. 1 and 1A are diagrammatic side elevational views of one embodiment of a packaging line capable of automatically performing the steps of the present method invention;

Figs. 2 and 2A are diagrammatical top plan views of the structure of Figs. 1 and 1A;

Fig. 3 is a perspective view of a row of units before being combined;

Fig. 4 is a perspective view illustrating the folding over

of one unit upon another with a sheet of paper therebetween;

Fig. 5 is a perspective view of a double tier row of units with a sheet of paper therebetween;

Fig. 6 is a perspective view of a strapped sub-pack;

Fig. 7 is an exploded perspective view of a full stack according to the method of the present invention;

Fig. 8 is a perspective view of the final strapped pack;

Fig. 9 is a side elevational view of the transfer crane B of the packaging line of Figs. 1 and 1A;

Fig. 10 is a vertical sectional view taken along line 10—10 of Fig. 9;

Fig. 11 is a side elevational view of one pallet conveying apparatus C of the packaging line of Figs. 1 and 1A;

Fig. 12 is an enlarged side elevational view of the discharge end of the apparatus of Fig. 11 showing the elements in an alternate position;

Fig. 13 is a side elevational view of the accumulator conveyor D and a portion of the paper feed mechanism G of the packaging line of Figs. 1 and 1A;

Fig. 14 is a side elevational view of the paper feed mechanism G not illustrated in Fig. 13;

Fig. 15 is a front elevational view of the structure shown in Fig. 14;

Fig. 16 is a side elevational view of the releasing elevator E and foldover conveyor F of the packaging line of Figs. 1 and 1A omitting the foldover drive mechanism;

Fig. 17 is a vertical sectional view taken along line 17—17 of Fig. 16;

Fig. 18 is a side elevational view of the foldover mechanism H and pusher I of the packaging line of Figs. 1 and 1A, including the foldover drive mechanism;

Fig. 19 is a front elevational view of the pusher I of Fig. 18;

Fig. 20 is a side elevational view of the sub-pack strapper J of the packaging line of Figs. 1 and 1A;

Fig. 21 is a front elevational view of the sub-pack strapper J of Fig. 20;

Fig. 22 is a top plan view of the spacer unit feed conveyor L of the packaging line of Figs. 1 and 1A;

Figs. 23 is a side elevational view of the structure of Fig. 22;

Fig. 24 is a vertical sectional view taken along line 24—24 of Fig. 23 partially broken away;

Fig. 25 is a side elevational view of the stacker K and pusher M of the packaging line of Figs. 1 and 1A;

Fig. 26 is a top plan view of the structure of Fig. 25;

Fig. 27 is a front elevational view of the structure of Fig. 26;

Figs. 28, 29 and 30 are diagrammatic side elevational views of the structure of Fig. 25 illustrating the steps of the stacking operation;

Fig. 31 is a side elevational view of the full stack strapper N of the packaging line of Figs. 1 and 1A; and

Figure 32 is a front elevational view of the full stack strapper N of Fig. 31.

While this invention is susceptible of embodiments in many different forms, there is shown in the drawings and will herein be described in detail one embodiment, with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the embodiment illustrated. The scope of the invention will be pointed out in the appended claims.

The method embodied in the present invention will best be understood by a description of the particular packaging line illustrated herein. Thus the drawings will now be referred to in detail so as to fully describe the particular construction. Every detail of the structures illustrated will not be described as there are many elements which are of conventional design and are common in the field so that this disclosure need not be complicated by their inclusion. Also, for clarity, the structure illustrated will be broken down into its various sections and each section will be described separately the intercon-

nected operation of the entire structure being described in the description of the individual sections.

Transfer crane

The transfer crane B automatically unloads courses 21 of units which are initially stacked in pairs of cubes 22 on pallets 24. These pallets are conveyed to an unloading position illustrated in Fig. 9 by any conventional conveyor system, and in the unloading position the pallet rests on a set of rollers 25 mounted on a piston 26 which automatically raises the pallets 24 one course height as the transfer crane unloads a course from both cubes. As seen in Fig. 9, alternate courses of the cubes are stacked facing 90° from the adjacent courses to hold the cube together, thus requiring the transfer crane to rotate alternate courses 90° for discharge of all courses onto the feed conveyor A in the same alignment.

The transfer crane B is mounted on tracks 28 extending between supporting legs 29 and includes a carriage 30 and a pickup assembly 31. The carriage 30 consists of a frame 32 having wheels 34 mounted thereon which engage the tracks 28 to guide the movement of the crane B from the two pickup positions superjacent the cubes 21 and the discharge position superjacent the feed conveyor A. Each wheel 34 has an annular recess therein which engages the ridge 36 of the track 28 so as to maintain the wheels on the track. The carriage 30 is moved on the tracks 28 by a pneumatic cylinder mounted on the carriage frame 32 parallel to the tracks 28. A piston 39 movable in the cylinder 38 has its outer end 40 secured to one of the rear supporting legs 29 so that when the cylinder 38 is actuated by air pressure introduced at its forward end, the carriage will be driven forward to the discharge position, and when the valves (not shown) are reversed and air introduced at the rear end of the cylinder 38 the carriage 30 will be moved to one of the pickup positions.

The pickup assembly 31 depends from the carriage frame 32 and is secured thereto by a vertical piston 41 extending upwardly from the pickup assembly 31 into a vertical cylinder 42 mounted on the carriage frame 32 so that by controlling the pressure within the vertical cylinder 42 the pickup assembly 31 can be raised to a carrying position shown in dotted lines in Fig. 9 or lowered to the pickup and discharge positions shown in solid lines in Fig. 9.

Guiding the vertical motion of the pickup assembly 31 are a pair of guide rods 44 extending upwardly from the pickup assembly 31 through bushings 45 mounted on the carriage 30. A pair of cushioning cylinders 46 mounted on the carriage frame 32 are provided to check the jarring motion of the pickup assembly 31 to which they are connected by the pistons 48.

The vertical piston 41 is secured to the top of a rotatable clamping assembly 49 which supports the horizontal plates 50 to which the guide rods 44 and cushioning piston 48 are attached. The horizontal plates 50 do not rotate with the clamping assembly 49 but are supported thereon and move vertically therewith. The lower plate 50 supports a horizontal turning cylinder 51 which has a piston 52 movable therein, the outer end of the piston being secured to the clamping assembly 49. Operation of the turning cylinder 51 rotates the clamping assembly 49 through 90° thereby rotating a row of units carried by the clamping assembly 49 for properly aligned discharge onto the feed conveyor A.

The clamping assembly 49 consists of a framework 54 having three pairs of clamping tongs 55 mounted thereon and depending therefrom. These clamping tongs 55 are each secured to positioning cylinders 56 which are provided with an equal initial pressure so that they will tend to push the clamping tongs 55 in a centered position as seen in Fig. 10. A clamping cylinder 57 is mounted on pistons 58 extending from each tong 55 and is movable thereon. The cylinder 57 is

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actuated to force the pistons 58 together so as to clamp a row of units therebetween.

This arrangement of positioning cylinders 56 and freely mounted clamping cylinders 57 results in a distinct advantage in that rows of units which are out of alignment may be engaged and firmly clamped before being moved back into alignment for proper discharge. This out-of-alignment clamping is possible because one tong 55 can engage the row of units and is not moved further until the other tong 55 is fully clamped against the other side of the units. Then, as the tongs raise the row of units, the positioning cylinders 56 operate to equalize their pressure and center the tongs 55 with respect to the feed conveyor A.

The operation of the transfer crane B is wholly automatic and is controlled by a plurality of micro-switches 59 and switch-engaging plates 60, the switching circuit including a stepping relay which signals the particular operations to be performed by the crane. The particular switch locations and the switching circuit may be varied as desired and is not described in detail.

In operation, the carriage 30 is initially positioned above the cube 22 nearest the feed conveyor A and the pickup assembly 31 is in the raised position. The operation can either be manual or automatic, the same movements being performed regardless of which type of operation. The pickup assembly 31 lowers and the clamping tongs 55 engage the course 21 on the cube 22 and then raise and move the course forward for lowering and discharging on the feed conveyor A. The pickup assembly 31 is then raised and the carriage 30 moves past the raised intermediate stop 61 to a position over the far cube 22 after which it picks up the course on the far cube and discharges it onto the feed conveyor A. Upon subsequent return the clamping assembly 49 rotates and the intermediate stop 61 is engaged to stop the carriage 30 over the nearest cube 22. The pickup and discharge is repeated with 90° rotation. The complete cycle is repeated until the pallet 24 is completely unloaded, at which time it is automatically ejected and a full pallet is positioned for unloading.

Feed conveyor

The feed conveyor A of the present structure may be of any conventional design such as a belt 62 movable on guide rollers 64 in a horizontal plane so as to feed rows of units received either from the transfer crane B above described or the pallet conveying apparatus described below. The belt 62 conveys these units to the accumulator conveyor D for further processing by the packaging line.

Pallet conveying apparatus

When it is desired to load the packaging line with units of varying color or texture, a series of pallet conveying apparatus C can be utilized, each apparatus feeding pallets 65 loaded with cubes 66 of units 12 to an unloading point adjacent the belt 62 of the feed conveyor A. The pallets 65 are manually unloaded by operators 20 on the opposite side of the belt 62.

A pallet conveying apparatus C is illustrated in detail in Figs. 11 and 12. Pallet feeding rollers 67 are mounted across the framework 68 and are driven by the driving motor 69 to convey loaded pallets in the direction of the feed conveyor A. The pallets are fed by the pallet feeding rollers 67 over dead rollers 70 and onto intermittently operated rollers 71, which are powered by a similar drive motor 72. The intermittently operated rollers 71 are spaced from the pallet feeding rollers 67 with the dead rollers 70 therebetween, the spacing being less than one pallet length so that a pallet on the dead rollers 70 will always be in engagement with either the feeding rollers 67 or the intermittently operated rollers 71. The drive motor 72 intermittently operates the rollers 71 so that as

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a vertical row of units is manually removed from the pallet, the pallet will be advanced to present the next vertical row for unloading. This drive motor 72 is controlled by photo-electric cells casting a beam across the normal position for the vertical row.

As the pallet is unloaded it is fed under the belt 62 of the feed conveyor A and onto a pallet lowering table 74 which, when the pallet is wholly thereon, is lowered by the lowering cylinder 75 and piston 76. The piston 76 is linked by a bell crank 78 to the lowering table 74 so as to lower the table from a receiving position shown in Fig. 11 to a discharging position shown in Fig. 12. The table 74 moves from a horizontal raised position to the declining lowered position of Fig. 12. This declination is accomplished by supporting one end of the table 74 on pivoted arms 79 of greater length than the arms of the bell crank 78.

When the table 74 is in the lowered position the empty pallet will move by gravity along the table rollers 80 onto the declining discharge conveyor mounted underneath the pallet feeding rollers 67 and the intermittently operated rollers 71, the pallets moving along the discharge conveyor 81 to a discharge position for removal by a lift truck or similar device. The discharge conveyor 81 has a drop 82 slightly more than two pallet lengths from its discharge end. This drop acts as a stop to prevent the pallets from backing up when the tongs of a lift truck are inserted in two pallets.

All of the controls and switches for the pallet conveying apparatus illustrated are not shown in the drawings and have not been described as any conventional switch arrangement can be used to accomplish the purposes and provide the necessary operations set out immediately below.

When loaded pallets are placed on the pallet feeding rollers 67 they are moved over the dead rollers 70 until they are engaged and moved by the intermittently operated rollers. The intermittently operated rollers 71 advance the loaded pallets so as to continuously present a vertical line of units in an unloading position. Switches are arranged so that the pallet feeding rollers 67 will be stopped when a loaded pallet thereon is adjacent to the pallet being unloaded to prevent pushing of an unloaded pallet into the feed conveyor structure, and as the unloaded pallet is fed onto the table 74 the subsequent loaded pallet will move into position. To prevent the backing up of pallets on the discharge conveyor 81 a switch may be positioned therein which stops the drive motor 72 for the intermittently operated rollers 71 so that further feeding of pallets will not occur until the empty pallets have been removed from the discharge conveyor 81.

Accumulator conveyor

The accumulator conveyor D is mounted at the discharge end of the feed conveyor A for receiving rows of units therefrom and consists of a plurality of unit supporting rollers 84 extending across a supporting framework 85. The drive for these rollers is provided by a belt 86 movable over a drive roller 87 and the belt passes around guide rollers 88 and a tensioning roller 89 adjustably mounted on a vertical traverse rod 90.

The belt 86 is held against the unit supporting rollers 84 by pressure rollers 91 mounted in a pivotal carriage 92. This carriage 92 is mounted on a shaft 94 and is pivoted thereon for movement from the belt engaging position shown in solid lines in Fig. 13 to the disengaging position shown in dotted lines in Fig. 13. The carriage 92 includes adjustable mounting plates 95 which support the pressure rollers 91. The position of these plates 95 is adjustable by adjusting screws 96 so as to properly position the plane of the pressure rollers 91 for contact of all the rollers with the belt 86.

The carriage 92 is pivoted by operation of the releasing elevator E, the movement of the releasing elevator

E being transmitted by a linkage 98 pivoted on the framework 85 so that when the elevator E rises the linkage will pivot the carriage 92 out of driving engagement with the belt 86 and when the elevator returns to the lowered position the linkage will return the carriage 92 to driving engagement with the belt 86.

The belt 86 moves at a greater speed than the belt of the feed conveyor A so that as rows of units are fed onto the accumulator conveyor D they will be separated from adjacent rows a distance greater than the spacing of the rows on the feed conveyor A for efficient feeding to the elevator E and to compensate for the period when the belt 86 is not in motion.

Releasing elevator

The releasing elevator E consists of an H frame 99 vertically movable between the supporting framework 85 of the accumulator conveyor D and the frame 100 of the foldover conveyor F. The elevator E is raised and lowered by a cylinder 101 mounted in the frame 100 of the foldover conveyor. This cylinder 101 operates a bell crank 102 which, in turn, moves a link 103 connected to the cross piece 104 of the H frame 99. Guide rods 105 pivotally secured to the frame 100 have their other ends pivotally secured to the sides 106 of the H frame so as to guide the movement of the elevator. A vertical cushioning rod 108 extends between fixed horizontal brackets 109 secured to the frame 100 of the foldover conveyor and the framework 85 of the accumulator conveyor and extending therebetween. The cushioning rods 108 move in a sleeve 110 mounted on the sides 106 of the H frame and springs 111 surrounding the rods 108 are interposed on both sides of the sleeve between the sleeve and the fixed brackets 109. This arrangement cushions the shock of the movement of the elevator.

When in the lowered position the elevator rollers 112 are in a plane with the rollers 84 of the accumulator conveyor D for receipt of a row of units therefrom. The rollers 112 are driven by a drive belt 114 passing over a drive roller 115 mounted in the frame 100 of the foldover conveyor. This belt 114 passes around guide rollers 116 attached across the H frame 99 and also passes around a tensioning roller 118 movable in vertical slots 119 in the sides 106 of the H frame. This tensioning roller 118 is urged downwardly in a tensioning direction by a spring 120 interposed between the roller 118 and bracket 121. A spring guide rod 122 is surrounded by the spring 120 and also extends between the bracket 121 and the roller 118.

When the elevator E is in the raised position the belt 114 would tend to sag away from the rollers 112. Therefore a pressure roller 124 is mounted below the belt 114 and is operable by a cam plate 125 mounted on the foldover conveyor which rocks an arm 126 attached to the pressure roller 124 for rotation of the pressure roller into engagement with the belt 114, thereby providing drive for the discharge of rows of units from the elevator. A hold-down roller 128 is provided above the rollers 112 and is mounted in slots 129 on the sides 106 of the H frame so that the spacing between the rollers 112 and the hold-down roller 128 can be adjusted to compensate for different sized units. This hold-down roller prevents units on the elevator from moving when the rollers 112 are not operating, such as when the elevator is rising.

The elevator E is actuated to rise by a switch sensitive to the positioning of a row of units wholly on the elevator. The raised row is released onto the foldover conveyor F and the elevator returns for receipt of another row.

Paper feed

The paper feed mechanism G is mounted above the accumulator conveyor D and the releasing elevator E and consists of bearing mountings 130 on both sides of the line for the mounting of a roll of paper 131, as seen in

Fig. 13. A brake band 132 controlled by a spring 133 engages the chuck 134 which mounts the roll of paper 131. This brake 132 prevents the roll of paper from unwinding except when positively operated, as will be described.

A drive roller 135 is mounted in bearings 136 secured to mounting plates 138. The drive roller has a pinion 139 mounted thereon which engages a gear segment 140 for driving the roller 135. This gear segment is mounted on a shaft 141 extending between one of the mounting plates 138 and an outbearing plate 142. A rocker arm 144 is secured to the shaft 141 and is operated by a cylinder 145 to rotate the gear segment 140 and transmit motion to the drive roller 135. A one-way clutch of any conventional design is connected to the drive roller 135 to prevent motion of the roller in a direction opposed to a paper feeding direction.

A clamping roller 146 between the mounting plates 138 is mounted in pivotal brackets 148 suspended from the mounting plates 138. This clamping roller 146 normally rests on the drive roller 135 and is driven thereby so as to positively feed the paper therebetween. Springs 149 mounted on the mounting plates 138 urge the brackets 148 in a disengaging direction and a cam 150 is operable to lock the bracket 148 in a clamping position against the urging of the spring 149. When the cam is unlocked, the spring 149 urges the clamping roller 146 away from the drive roller 135 so that the paper is freely movable therebetween.

A blade mounting assembly 151 is mounted between the mounting plates 138 and includes a reciprocating framework 152 which carries the cutting blade 154. The reciprocating framework 152 is operated by a cylinder 156 mounted on the stationary portion 157 of the blade mounting assembly 151.

The blade mounting assembly 151 is adjustable relative to the mounting plates 138 by horizontal adjusting posts 158 movable in heads 159 which, in turn, are secured to vertical adjusting posts 160 mounted in brackets 161 on the mounting plates 138. Thus the position of the blade mounting assembly can be varied depending on the particular unit size. Paper guide plates 162 are adjustably attached to extensions 163 of depending brackets 167 attached to the heads 159 and converge from adjacent the drive rollers 135 to adjacent the cutting blade 154. A bent guide plate 164 extends from the depending bracket 167 to a position closely adjacent the blade 154. The paper guide bar 165 is mounted in the blade mounting assembly 151 and extends along the cutting blade 154 to prevent the sheet of paper from curving up in back of the blade. The blade 154 is adjustably mounted in slots 153 in the reciprocating framework 152 so that the blade position may be adjusted to compensate for wear or other changes.

In operation, the paper feed drive roller is actuated as a row of units moves off of the elevator E, thereby feeding a length of paper onto the row of units. When another row of units is folded over onto the row having the paper on its top, the paper is tensioned between the units and the drive roller thus permitting a clean cut by the blade 154, which reciprocates to cut the tensioned paper. The paper serves the purpose of protecting the face of the brick.

When the foldover operation is omitted, a hold-down element 166 is mounted on the reciprocating framework 152 for movement with the blade 154. This hold-down member 166 engages the paper on the unit and is spring-urged to firmly tension the paper to permit the blade to cut the paper.

Foldover conveyor and mechanism

The foldover conveyor frame 100 has rollers 168 mounted thereacross for transporting rows of units. These rollers are driven by a belt 169 which passes over the same drive roller 115 that drives the elevator belt 114. The belt passes over guide rollers 170 and over a tensioning roller 171 mounted in slots 172 in the frame 100

and adjusted by an adjusting screw 174 to properly tension the belt 169. The belt 169 is urged against the rollers 168 by pressure bars 175 and by a pressure roller 176 movable into engagement with the belt 169 as will be described below. This pressure roller 176 is mounted adjacent the forward position of the foldover clamps 178.

The foldover clamps 178 are rotated through 180° by the operation of a main cylinder 179. The cylinder operates a rack 180 and pinion 181. The pinion 181 in turn through a linkage 182 operates another rack 184 which rotates a bull gear 185 mounted on the same shaft 187 as a second bull gear 185 on the other side of the structure. These bull gears 185 rotate pinions 186 engageable, through connectors 188, with shafts 189 of the foldover clamps 178. The shafts 189 are mounted in bearings 190 on the top of the frame 100. One of the foldover clamps 178 is laterally movable into a clamping position by operation of a clamping cylinder 191 attached to the end of the shaft 189.

A forward stop plate 192 is mounted across the path of the rows of units and is raised by a linkage 194 driven from a cylinder 195. The forward stop plate 192 is shaped to accommodate the belt 169 when the plate is in the lowered position. The shaft 196 of the linkage 194 also operates a linkage 198 which rotates the pressure roller 176, mentioned above, out of engagement with the belt 169 when the forward stop plate 192 is raised to stop a row of units for clamping.

A rear stop plate 199 similar to the forward stop plate 192 is raised and lowered by a cylinder 200 through a shaft and arm linkage 201. This stop plate 199 is raised to stop the row of units upon which the paper is placed and upon which the other row of units will be folded.

Once again the particular arrangement of switches and circuits is omitted for clarity as it is apparent that any arrangement will be satisfactory which will provide the following operation.

The first row of units discharged from the elevator E onto the foldover conveyor F moves until it engages the forward stop plate 192, at which time the rear stop plate 199 raises to stop the next row of units upon which the paper has been fed. The foldover clamps 178 are then clamped against the row of units and the clamps are rotated to a rear position, at which point the clamps open, the forward stop plate 192 is dropped down, the pressure roller 176 engages the belt 169 and the cutting blade of the paper feed mechanism G cuts the paper. Upon the upward stroke of the blade the rear stop plate 199 is lowered and the double tier row of units continues through the foldover conveyor F.

Thus the foldover mechanism folds a row of units with top faces over upon another row so that the face of the folded over row is adjacent the top face of the other row with the paper therebetween, the faces thereby being protected against damage by the cushion provided by the sheet of paper.

When large size units are being packaged it may be desirable to omit the foldover operation, which can be accomplished by disengaging the connectors 188 and pinions 186.

Pusher

Mounted above the foldover conveyor F and at the forward end thereof is the pusher I which consists of a pusher plate 202 mounted on pivoting arms 204 depending from sleeves 205 which move horizontally on rods 206 and are freely rotatable thereon. One of the sleeves 205 has a drive arm 208 attached to a drive piston 209. This piston is operable in a cylinder 207 to rotate the sleeves 205 thereby moving the pusher plate 202 from a lower unit engaging position to a raised unengaging position.

The sleeves 205 are part of a carriage 210 which moves on the rods 206 and on a third rod 211. This carriage is interconnected to the bull gear 185 of the

foldover mechanism H by an interconnecting rocker arm 212 and links 214 so that when the foldover clamps are rotating a row of units the pusher plate will be in the lowered position and will be actuated to push the line of preceding sub-packs so that one sub-pack will be fed into the sub-pack strapper J. The drive piston 209 is operated with the same timing as the carriage 210 to move the plate 202 down at the beginning of the push stroke and to move the plate up at the beginning of the return stroke.

The sub-pack strapper J will not be described in detail as it may be any one of several conventional constructions now commercially available. As shown in Figs. 20 and 21 this strapper J consists of a housing 215 and a strap guiding structure 216 in which the sub-pack is placed for strapping. Also a clamping mechanism 217 is provided to hold the sub-pack while being strapped. Upon the subsequent movement of the pusher I the strapped sub-pack is pushed out of the strapper and continues on a gravity fed conveyor 218.

Stacker

The gravity feed conveyor 218 feeds sub-packs to the stacker K which consists of a framework 219 in which an elevator 220 is movable. The elevator has a lowered position in which it receives sub-packs from the conveyor 218. In this lowered position the rollers 221 of the elevator are in the same plane as the gravity feed conveyor 218, the frame 222 for the rollers 221 being pivoted by engagement with the screws 224 adjustably mounted in the framework 219. Stop plates 225 are secured to the framework 219 so as to stop sub-packs on the elevator and to properly align the sub-packs thereon.

The framework 219 includes vertical L-bars 226 which form an enclosure for the elevator 220. The elevator has vertical L-bars located adjacent the L-bars 226 of the framework and having guide rollers 229 mounted on each side of each L-bar. These guide rollers extend into engagement with the sides of the L-bars 226 of the framework and thereby prevent lateral movement of the elevator during operation. The elevator is raised and lowered by a vertical cylinder 230 and associated piston 231.

When the elevator rises the frame 222 for the rollers returns to a horizontal position on the channel piece 232 of the elevator. Located on the table 234 of the framework 219 adjacent the raised position of the elevator 220 is a pair of clamping rollers 235 for clamping a raised sub-pack therebetween and holding the sub-pack as the elevator returns. These clamping rollers 235 are mounted in chucks 236 which in turn are adjustably mounted in brackets 238 attached to the table 234. One of the rollers 235 is stationary and is laterally adjusted by screws and lock nuts attached to a flange 240 extending from the table 234. The other clamping roller 235 is laterally movable with the chuck 236 and is reciprocated by the cylinder 241 which drives the roller through the piston 242 into a clamping position when a sub-pack has been raised between the rollers. The rollers are mounted in the chucks 236 on shafts 244 which also have one way clutches 246 mounted thereon to prevent rotation of the clamps in a direction which would permit the clamped rows to move downwardly. The one-way clutch construction is not illustrated in detail as it may be of any conventional type.

When a sub-pack of units rolls onto the elevator 220 the elevator rises and the clamping rollers 235 hold the sub-pack therebetween while the elevator returns and receives a second sub-pack. This operation is illustrated in Figs. 28 and 29. When the second sub-pack is raised, the clamps open to drop the first sub-pack thereon and subsequently close to clamp the second sub-pack. When a third sub-pack is received by the elevator spacer units are fed onto the third sub-pack and the elevator is raised.

The clamping rollers 235 then open to drop the first and second sub-packs on the spacer units to form the completed stack.

The spacer units are fed from a plate 246 which is above and parallel to the gravity feed conveyor 218. This plate has an upstanding bracket 247 on which are mounted a pair of pusher cylinders 248 having pistons 249 extending therefrom. The pistons 249 have pusher heads 240 thereon which engage units in a line of spacer units and upon operation of the cylinder 248 force these units onto the third sub-pack on the elevator. The pusher heads 250 have horizontally extending hold plates 251 which engage the top of the units and prevent the units from tipping as they are pushed off of the plate 246. The stop plates 225, mentioned above, extend upwardly so as to engage the spacer units to provide proper alignment of the spacer units on the sub-pack.

When a complete stack has been formed by the co-operation of the elevator 220, the clamping rollers 235 and the pusher heads 250 the elevator is in the raised position and the clamping rollers 235 are open. At this time the pusher M engages the completed stack and pushes it from the elevator onto the discharge conveyor 252. This pusher M is mounted on an upward extension 253 of the framework 219 of the stacker K. The pusher M consists of a plate 254 which is moved horizontally by a cylinder 255 secured to the upward extension 253. The plate 254 is further guided by guide rods 256 movable in sleeves 258 mounted on the upward extension 253.

The pusher M pushes the full stack into a line of full stacks which are forced into the full stack strapper broadly illustrated in Figs. 31 and 32 but details are omitted as this strapper can be of any conventional type. In Figs. 31 and 32 it is seen that this strapper has a framework 287 which surrounds the full stack and feeds the strap around the stack. The strapper also has a housing 288 in which the operating mechanism is mounted. Guide plates 289 center the stacks as they are fed to the strapper and a switch 290 sensitive to the sub-pack straps stops the forward stroke of the pusher M to properly position the stack in the strapper N. A clamping mechanism 291 holds the stack in position during strapping.

Spacer unit feed conveyor

The spacer units which are fed from the plate 246 are conveyed to the plate by a spacer unit feed conveyor L which consists of a loading conveyor section 259 upon which upright units are loaded in rows and which declines to permit gravity feed of the units over the freely rotatable rollers 260. A direction-changing elevator 261 is movably mounted in a framework 262 adjacent the loading conveyor section 259 for receipt of rows of units therefrom. The elevator is movable from a raised receiving position to a lowered discharging position by means of toggle joints 264 operated by a piston cylinder 265 and interconnected by a horizontal link 266. The elevator is provided with rollers 268 parallel to the rollers 260 of the loading conveyor and adjusted so as to be in the same plane as the rollers 260. An adjustable stop bar 269 is mounted on the elevator to stop a row of units when wholly on the rollers 268 and an inclined stop plate 270 is mounted on an upward overhang 271 of the elevator for engagement with the first row of units on the loading conveyor section when the elevator is lowered so as to prevent further movement of rows of units from the loading conveyor section until the elevator has once again raised.

The rollers 268 of the elevator are spaced so as to move between belts 272 when lowered and move to a position below the belts so that the row of units will be deposited on the belts. These belts move on a system of rollers so as to feed the row of units out of the elevator. Drive rollers 274 are on a common shaft connected by a clutch 275 to a drive motor 276 which causes

the belts to move and tensioning rollers 278 mounted on traverse rods 279 on the framework 262 are adjustable to tension the belts 272. The row of units is conveyed by the belts in a direction parallel to the length of the row and the units are fed across a turning plate 280 extending from the framework 262. The units move off the turning plate 280 onto the discharge conveyor 281 and the discharge conveyor 281 is spaced sufficiently below the turning plate 280 so that the upright units will tip and fall upon their sides for movement on a discharge conveyor 281, thus they will be in proper position for movement onto the plate 246 of the stacker K.

The discharge conveyor 281 is a slat conveyor and is run continuously by the drive motor 276. The slat conveyor 281 is tensioned by a rod 282 mounted in a pivotal bracket 284 for movement to raise or lower the slat conveyor. The pivotal bracket 284 is locked in an adjusted position by a locking nut 285 engageable in an arcuate slot 286 of the bracket 284. A switch (not shown) is mounted along the discharge conveyor 281 to sense when brick are backing up on the conveyor. The switch then actuates the clutch 275 which disengages the operation of the belts 272 to stop feeding of units onto the discharge conveyor 281.

When a row of units has been discharged from the elevator 261 the piston cylinder 266 is actuated to raise the rollers 268 for receipt of another row of units from the roller conveyor section 259.

Thus the spacer unit conveyor L provides a continuous supply of spacer units to the stacker K for insertion into the stack of units.

All of the above-described structures, except the feed conveyor A, sub-pack strapper J and full pack strapper N, are disclosed in more detail in the co-pending applications.

The above description clearly sets out a packaging line which is continuously operable and each section of which is linked both mechanically and through switches to adjacent sections to provide a continuous flow of product therethrough. Also switches are provided in each section sensitive to a piling up of units, the switches stopping the operation of preceding sections so as to prevent jamming.

Thus the present invention clearly provides a method of combining units into a package simply and efficiently. The method being conveniently adaptable for commercial exploitation as by the automatic packing line described.

We claim as our invention:

1. A method of combining units to form a package, comprising: placing a plurality of units contiguously in a row; placing a second plurality of units contiguously to form a second row, each said row containing an equal number of units and being of substantially similar size; advancing said rows successively along a generally horizontal path; placing a sheet of paper on the trailing one of said rows; moving the leading one of said rows upwardly and rearwardly away from said path and onto the paper on the trailing row so that the paper is between rows; binding the rows together to form a sub-pack; similarly forming a second sub-pack and a third sub-pack; vertically stacking the first and second sub-packs; placing a spacer unit on top of and at one end of the third sub-pack; placing a second spacer unit on top of and at the other end of said third pack; placing the stacked first and second sub-packs on top of the spacer units to form a final stack having an open space between the spacer units; and binding the final stack together to form a complete package.

2. A method of combining units to form a package, comprising: placing a plurality of units contiguously in a row; binding said row of units together to form a sub-pack; similarly forming a second sub-pack and a third sub-pack; vertically stacking the first and second sub-packs one on top of the other; raising said first and second sub-packs; inserting said third sub-pack ver-

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tically below and spaced from said first and second sub-packs; placing a spacer unit on top of and at one end of the third sub-pack; placing a second spacer unit on top of and at the other end of said third sub-pack; stacking the first and second sub-packs on top of the spacer units to form a final stack; and binding the final stack to form a complete package having an open space between the spacer units.

3. An apparatus for combining units to form a package, comprising: a loading conveyor upon which units are placed in parallel rows for movement on said loading conveyor in a direction perpendicular to the rows; an accumulator conveyor moving at a greater rate than said loading conveyor and receiving said rows therefrom and spacing the rows; a releasing elevator receiving single rows from the accumulator conveyor and movable from a position adjacent said accumulator conveyor to a raised releasing position; means for stopping the accumulator conveyor when the releasing elevator is in the releasing position and for starting the accumulator conveyor when the accumulator elevator returns; a foldover conveyor receiving rows from the elevator when the elevator is in the releasing position; a paper feed mechanism which feeds a sheet of paper onto alternate rows on the foldover conveyor; means included in said foldover conveyor for folding the other rows over onto said alternate rows to form a double tier stack with paper between tiers; said paper feed mechanism including cutting means for cutting the paper on the stack from the paper in the paper feed mechanism; a strapper receiving said double tier stacks from the foldover conveyor and strapping the double tier stacks to form sub-packs; a stacker elevator receiving sub-packs singly from said strapper when in a receiving position, said stacker elevator being movable to raise said single sub-pack to a stacking position, said stacker elevator including clamping means for holding said sub-pack in the stacking position to permit the stacker elevator to return to the receiving position for the receipt of a second sub-pack, said clamping means operable to receive a second sub-pack and holding both said sub-packs in the stacking position when the stacking elevator returns for a third sub-pack, said stacker elevator including means for placing a pair of spaced spacer units onto the third sub-pack, and said clamping means being operable to receive said third sub-pack to form final stack including the third sub-pack, the spacer units, the second sub-pack and the first sub-pack; and a second strapper which receives said final stack and straps said stack to form a package having a space therein between said spacer units.

4. The apparatus for combining units to form a package of claim 3 having a spacer unit conveyor on which upright units are loaded in rows for movement perpendicular to the rows, said spacer unit conveyor having a direction changing section which receives rows singly and moves them in a direction parallel to the row, said spacer unit conveyor having a unit turning section which turns each unit upon its side, and said spacer unit conveyor having a discharge portion which feeds a single line of turned units into the stacker elevator for stacking on the third sub-pack.

5. An apparatus for combining units to form a package, comprising: a loading conveyor receiving units in rows and moving said rows in a direction perpendicular to the rows; a releasing elevator which receives single rows from the loading conveyor when in a receiving position and movable with a single row thereon to a releasing position; a foldover conveyor receiving rows from said elevator when the elevator is in the releasing position; a paper feed mechanism which feeds a sheet of paper onto alternate rows on the foldover conveyor; said foldover conveyor including means for folding the other rows over onto said alternate rows to form a double tier stack with paper between tiers; said paper feed mechanism including cutting means for cutting the

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paper on the stack from the paper in the paper feed mechanism; a strapper receiving said double tier stacks from the foldover conveyor and strapping the double tier stacks to form sub-packs; a stacker elevator receiving sub-packs singly from said strapper when in a receiving position, said stacker elevator being movable to raise said single sub-pack to a stacking position, said stacker elevator including clamping means for holding said sub-pack in the stacking position to permit the stacker elevator to return to the receiving position for the receipt of a second sub-pack, said clamping means operable to receive a second sub-pack and holding both said sub-packs in the stacking position when the stacking elevator returns for a third sub-pack, said stacker elevator including means for placing a pair of spaced spacer units onto the third sub-pack, and said clamping means being operable to receive said third sub-pack to form a final stack, including the third sub-pack, the spacer units, the second sub-pack and the first sub-pack; and a second strapper which receives said final stack and straps said stack to form a package having a space therein between said spacer units.

6. An apparatus for combining units to form a package, comprising: a loading conveyor upon which units are placed in parallel rows for movement on said loading conveyor in a direction perpendicular to the rows; an accumulator conveyor moving at a greater rate than said loading conveyor and receiving said rows therefrom and spacing the rows; a releasing elevator receiving single rows from the accumulator conveyor and movable from a position adjacent said accumulator conveyor to a raised releasing position; means for stopping the accumulator conveyor when the releasing elevator is in the releasing position and for starting the accumulator conveyor when the elevator returns; a foldover conveyor receiving rows from the elevator when the elevator is in the releasing position, said foldover conveyor including means for folding alternate rows over upon adjacent rows to form a double tier stack; a strapper receiving said double tier stacks from the foldover conveyor and strapping the double tier stacks to form sub-packs; a stacker elevator receiving sub-packs singly from said strapper when in a receiving position, said stacker elevator being movable to raise said single sub-pack to a stacking position, said stacker elevator including clamping means for holding said sub-pack in the stacking position to permit the stacker elevator to return to the receiving position for the receipt of a second sub-pack, said clamping means operable to receive a second sub-pack and holding both said sub-packs in the stacking position when the stacking elevator returns for a third sub-pack, said stacker elevator including means for placing a pair of spaced spacer units onto the third sub-pack, and said clamping means being operable to receive said third sub-pack to form a final stack including the third sub-pack, the spacer units, the second sub-pack and the first sub-pack; and a second strapper which receives said final stack and straps said stack to form a package having a space therein between said spacer units.

7. An apparatus for combining units to form a package, comprising: a loading conveyor upon which units are placed in parallel rows for movement on said loading conveyor in a direction, perpendicular to the rows; an accumulator conveyor moving at a greater rate than said loading conveyor and receiving said rows therefrom and spacing the rows; a releasing elevator receiving single rows from the accumulator conveyor and movable from a position adjacent said accumulator conveyor to a raised releasing position; means for stopping the accumulator conveyor when the releasing elevator is in the releasing position and for starting the accumulator conveyor when the accumulator elevator returns; a paper feed conveyor which receives rows from said elevator when in the releasing position, said paper feed conveyor including means for feeding a sheet of paper

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onto each row, means for holding the paper on the row, and means for cutting the paper on the row from the paper in the paper feed conveyor; a strapper which receives rows from said paper feed conveyor and straps said rows to form a sub-pack; a stacker elevator receiving sub-packs singly from said strapper when in a receiving position, said stacker elevator being movable to raise said single sub-pack to a stacking position, said stacker elevator including clamping means for holding said sub-pack in the stacking position to permit the stacker elevator to return to the receiving position for the receipt of a second sub-pack, said clamping means operable to receive a second sub-pack and holding both said sub-packs in the stacking position when the stacking elevator returns for a third sub-pack, said stacker elevator including means for placing a pair of spaced spacer units onto the third sub-pack, and said clamping means being operable to receive said third sub-pack to form a final stack including the third sub-pack, the spacer units, the second sub-pack and the first sub-packs; and a second strapper which receives said final stack and straps said stack to form a package having a space therein between said spacer units.

8. An apparatus for conveying units, comprising: a feed conveyor which receives rows of upright generally rectangular units and moves the rows perpendicular thereto; a direction changing section which receives single rows from said feed conveyor and moves each said row in a direction parallel thereto; a unit turning section which receives said rows of units and in which each unit is turned upon its side from the upright position on said feed conveyor; a discharge conveyor which moves the turned units from the unit turning section in a single line while maintaining the units on their sides; and means for pushing said units laterally from said single line.

9. An apparatus for conveying units, comprising: a feed conveyor which receives rows of upright units and moves the rows perpendicular thereto; a direction changing section which receives single rows from said feed conveyor and moves each row in a direction parallel thereto; a unit turning section which receives said rows of units and in which each unit is turned upon its side; a discharge conveyor which moves the turned units from the unit turning section in a single line; and means for pushing said units laterally from said single line; said unit turning section comprising a flat plate spaced above said discharge conveyor and the upright units being forced by the row of units on the direction changing section so as to move from the end of said plate and pivot onto their sides as they are received on the discharge conveyor.

10. In a method of combining units to form a package, the steps of arranging a plurality of units contiguously in a row, arranging a second plurality of units contiguously to form a second row, each row containing an equal number of units and being of substantially similar size, advancing said rows successively along a generally horizontal path, moving the leading row rearwardly and upwardly away from said path and onto the top of the trailing row, binding the rows together to form a sub-pack, similarly forming second and third sub-packs, vertically stacking the first and second sub-packs, placing spacer units on top of and at opposite ends of said third pack, placing the stacked first and second packs on top of the spacer units to form a final stack having an open space between the spacer units, and binding the final stack together to form a completed package.

11. In packaging apparatus, the combination of a loading conveyor receiving units in a row and moving said rows in a direction perpendicular to the rows, a releasing elevator which receives single rows from the loading conveyor when in a receiving position and moves with a single row thereon to a releasing position, a fold-over conveyor receiving rows from said elevator when

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the elevator is in said releasing position, a paper feed mechanism which feeds a sheet of paper onto alternate rows on the foldover conveyor, said foldover conveyor including means for folding the other rows over onto said alternate rows to form a double tier stack with paper between tiers, said paper feed mechanism including cutting means for cutting the paper on the stack from the paper in the feed mechanism, a strapper receiving said double tier stacks from the foldover conveyor and strapping the double tier stacks to form sub-packs, a stacker elevator receiving sub-packs singly from said strapper when in a receiving position and movable to raise said single sub-pack to a stacking position, said stacker elevator including clamping means for holding said sub-packs in the stacking position to permit the stacker elevator to return to the receiving position for the receipt of another sub-pack, means included in said stacker elevator for placing a pair of spaced spacer units onto said other sub-pack, said clamping means being operable to receive said other sub-pack to form a final stack including the two sub-packs and the spacer units between them, and a second strapper receiving said final stack and strapping the same to form a package with a space between said spacer units.

12. In packaging apparatus, the combination of, a loading conveyor receiving units in rows and advancing the same in a direction perpendicular to the rows, a foldover conveyor for receiving these successive rows advanced by said feeding conveyor, a paper feed mechanism operable to feed a sheet of paper onto alternate rows on said foldover conveyor, said foldover conveyor including means for folding the other rows over onto said alternate rows to form a double tier stack with paper between tiers, a strapper receiving said double tier stacks from the foldover conveyor and strapping the double tier stacks to form sub-packs, a stacker elevator receiving sub-packs singly from said strapper when in a receiving position and movable to raise said single sub-pack to a stacking position, said stacker elevator including clamping means for holding said sub-pack in the stacking position to permit the elevator to return to the receiving position for the receipt of another sub-pack, means included in said stacker elevator for placing a pair of spaced spacer units onto said other sub-pack, said clamping means being operable to receive said other sub-pack to form a final stack including the two sub-packs and the spacer units between them, and a second strapper which receives said final stack and straps the same to form a package with a space between said spacer units.

13. Packaging apparatus having, in combination, a loading conveyor receiving units in rows and moving said rows in a direction perpendicular to the rows, a foldover conveyor receiving the successive rows advanced by said feeding conveyor and including means for folding alternate rows over onto the intervening rows to form a double tier stack, a strapper receiving said double tier stacks from the foldover conveyor and strapping each stack to form a sub-pack, a stacker elevator receiving sub-packs singly from said strapper when in a receiving position and movable to raise said single sub-pack to a stacking position, said elevator including clamping means for holding said sub-pack in the stacking position to permit the stacker elevator to return to the receiving position for the receipt of another sub-pack, means included in said stacker elevator for placing a pair of spaced spacer units onto said other sub-pack, said clamping means being operable to receive said other sub-pack to form a final stack including the two sub-packs and the spacer units between them, and a second strapper receiving said final stack and strapping the same to form a package with a space between said spacer units.

14. Packaging apparatus having, in combination, a loading conveyor upon which units are placed in parallel rows for movement on said loading conveyor in a direc-

tion perpendicular to the rows, releasing means receiving single rows advanced by said loading conveyor and releasing the rows one at a time, a strapper receiving rows from said releasing means and strapping the same to form a sub-pack, a stacker elevator receiving sub-packs 5 singly from said strapper when in a receiving position and movable to raise each sub-pack to a stacking position, clamping means included in said elevator for holding said sub-pack in the stacking position to permit the elevator to return to the receiving position to receive another sub-pack, means included in said elevator for placing a pair of spaced spacer units onto said other sub-pack, said clamping means being operable to receive said other sub-pack to form a final stack including the two sub-

packs and the spacer units between them, and a second strapper receiving said final stack and strapping the same to form a package with a space between said spacer units.

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