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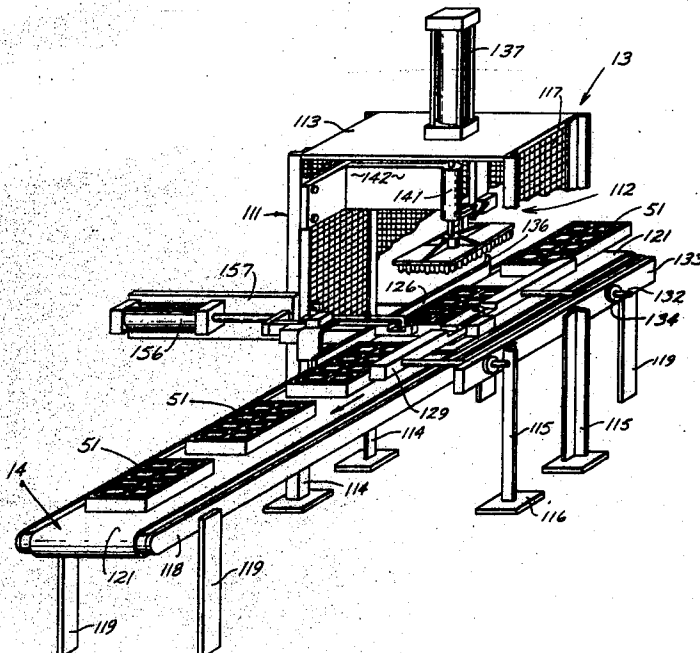
[54] AUTOMATIC FLAT FILLER AND DIBBLER

10 Claims, 16 Drawing Figs.

[52] U.S. Cl..... 47/1
 [51] Int. Cl..... A01g 9/08
 [50] Field of Search..... 47/1, 37;
 111/99

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ABSTRACT: An automatic flat filler and dibbler apparatus wherein empty nursery flats are conveyed to a hopper device and filled with packing media, such as soil. The filled flats pass under a compacting roller for compressing the material within the flats and are then moved under a scraper for removing excess soil from the flats. The filled flats are then transported to a dibbler mechanism with the flats being momentarily stopped to permit a dibbler plate to be pressed into the soil to form a plurality of dibles or openings therein. The flat is then removed from the dibbler apparatus and is in condition for receiving transplants.



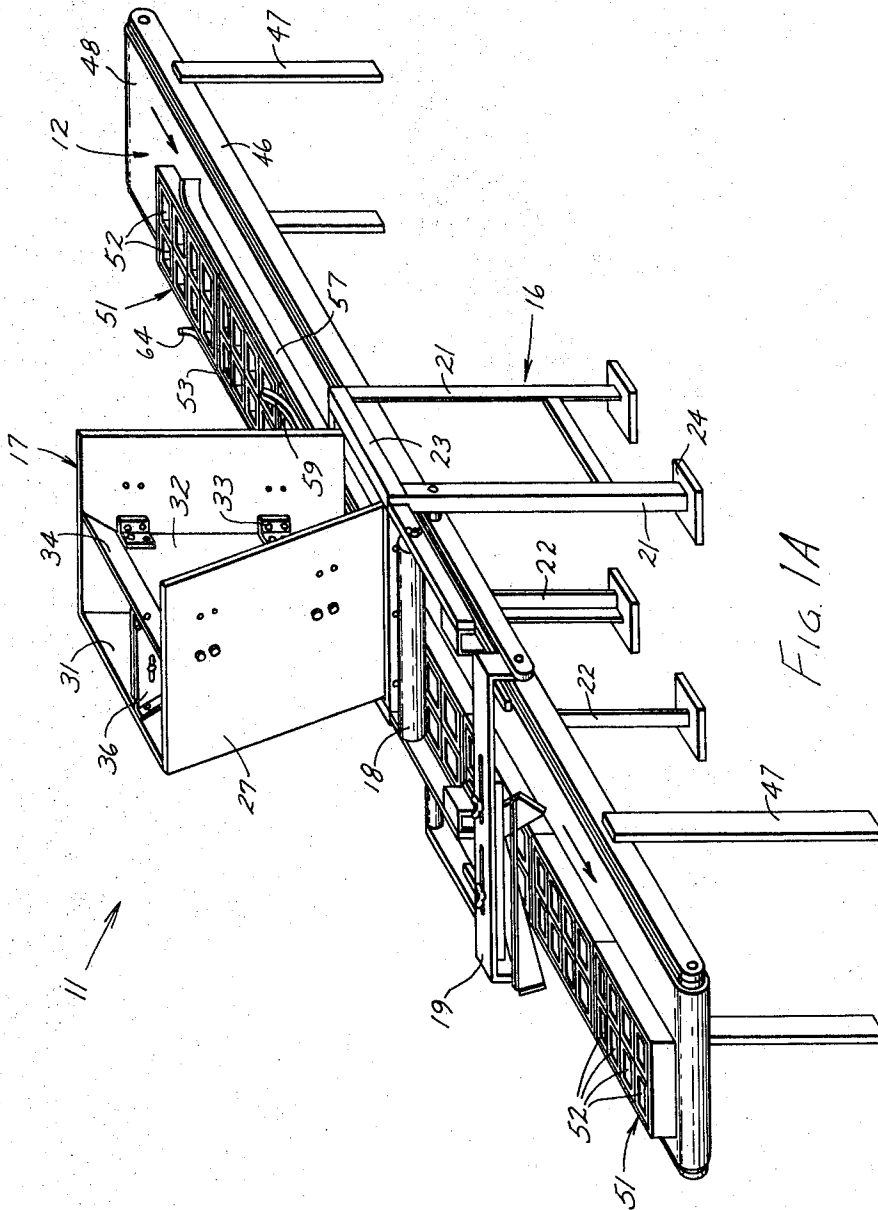


FIG. 1A

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PATENTED MAR 23 1971

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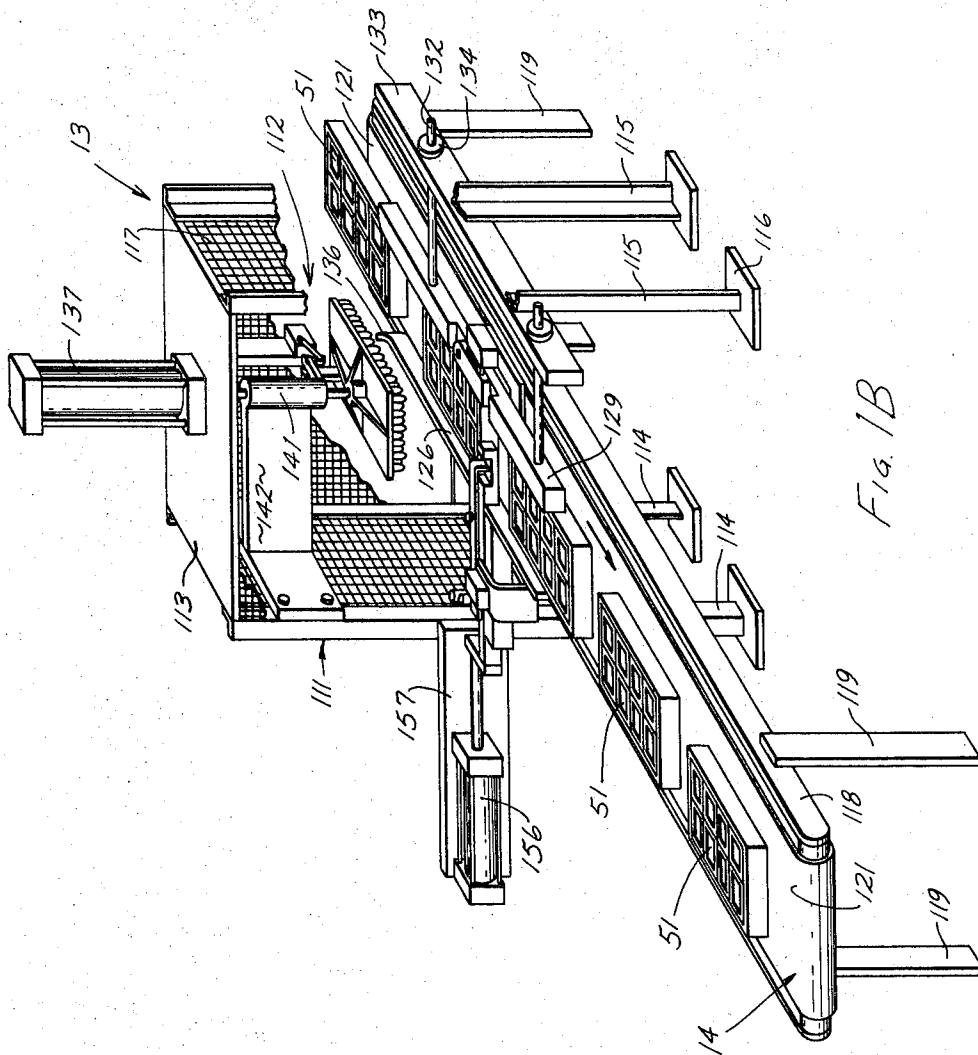


Fig. 1B

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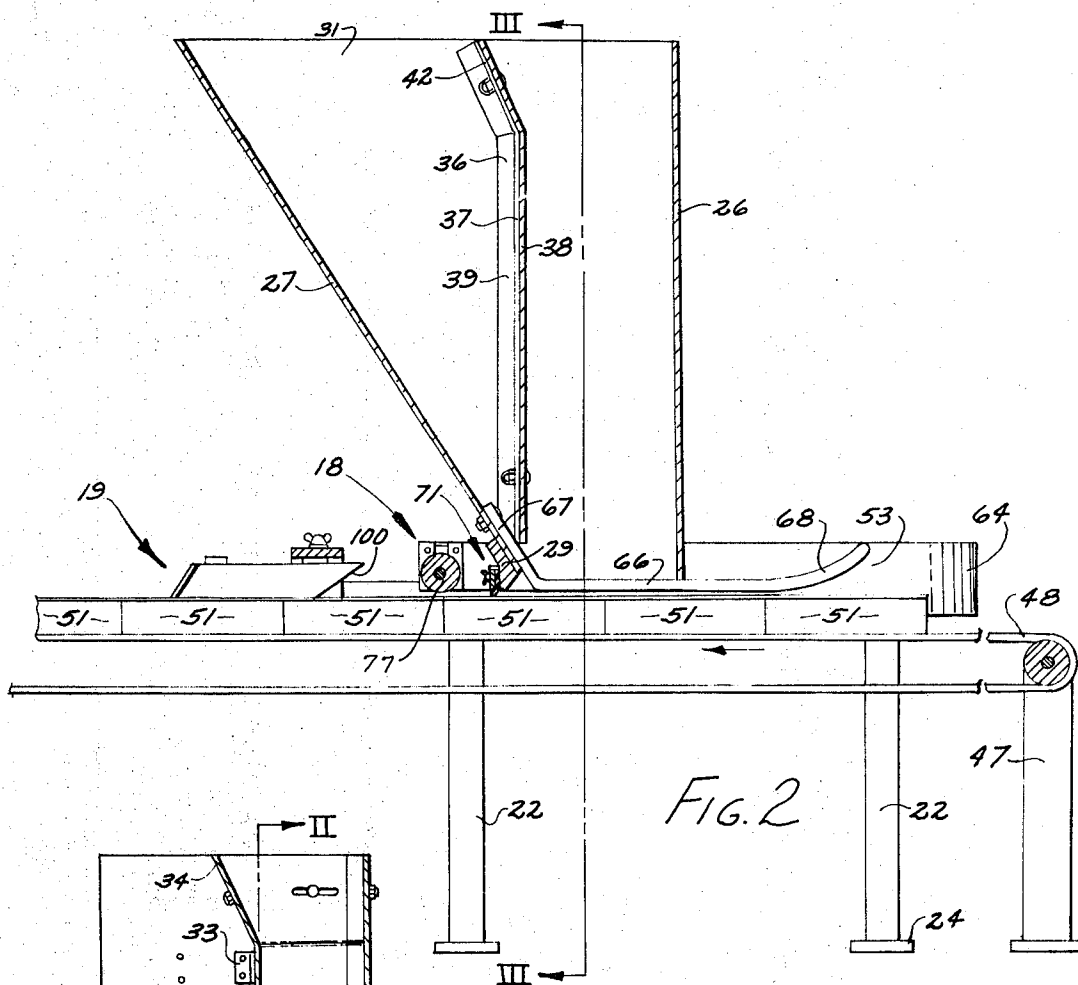


FIG. 2

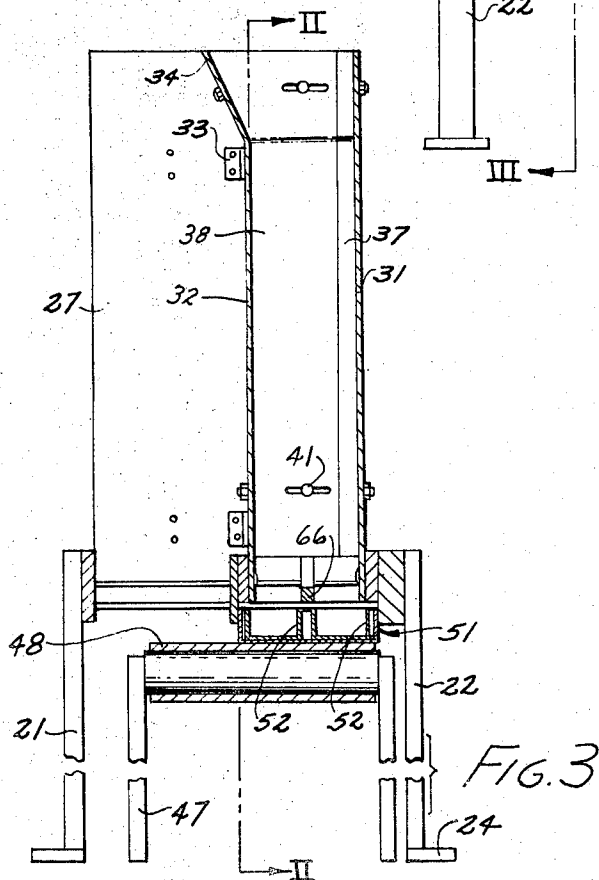


FIG. 3

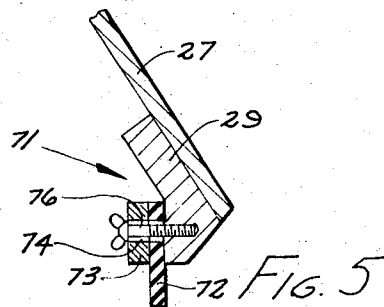
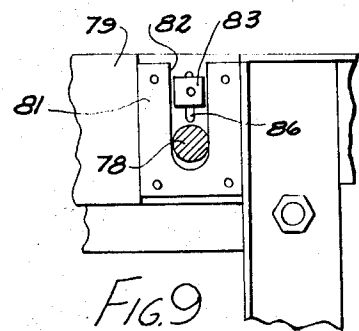
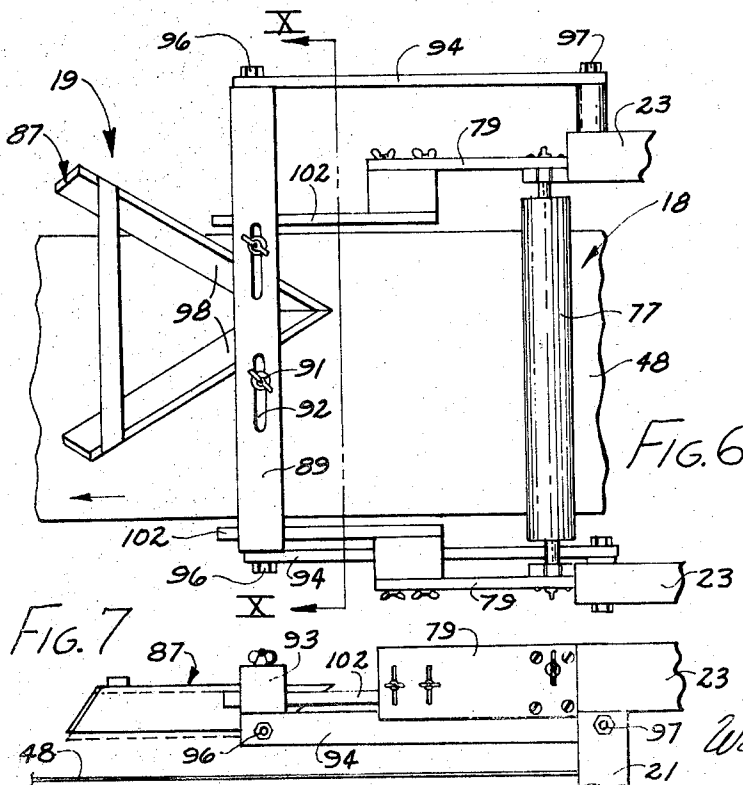
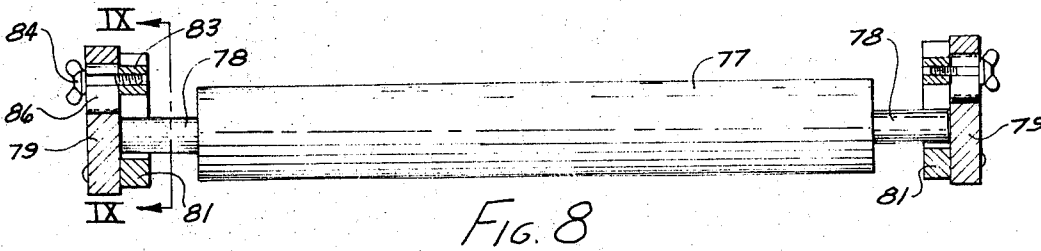
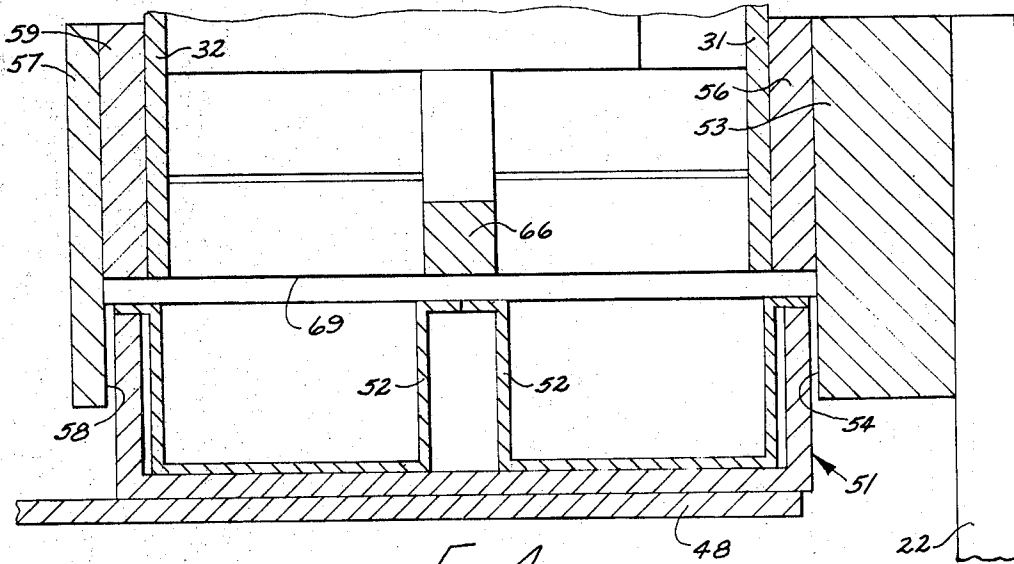


FIG. 5

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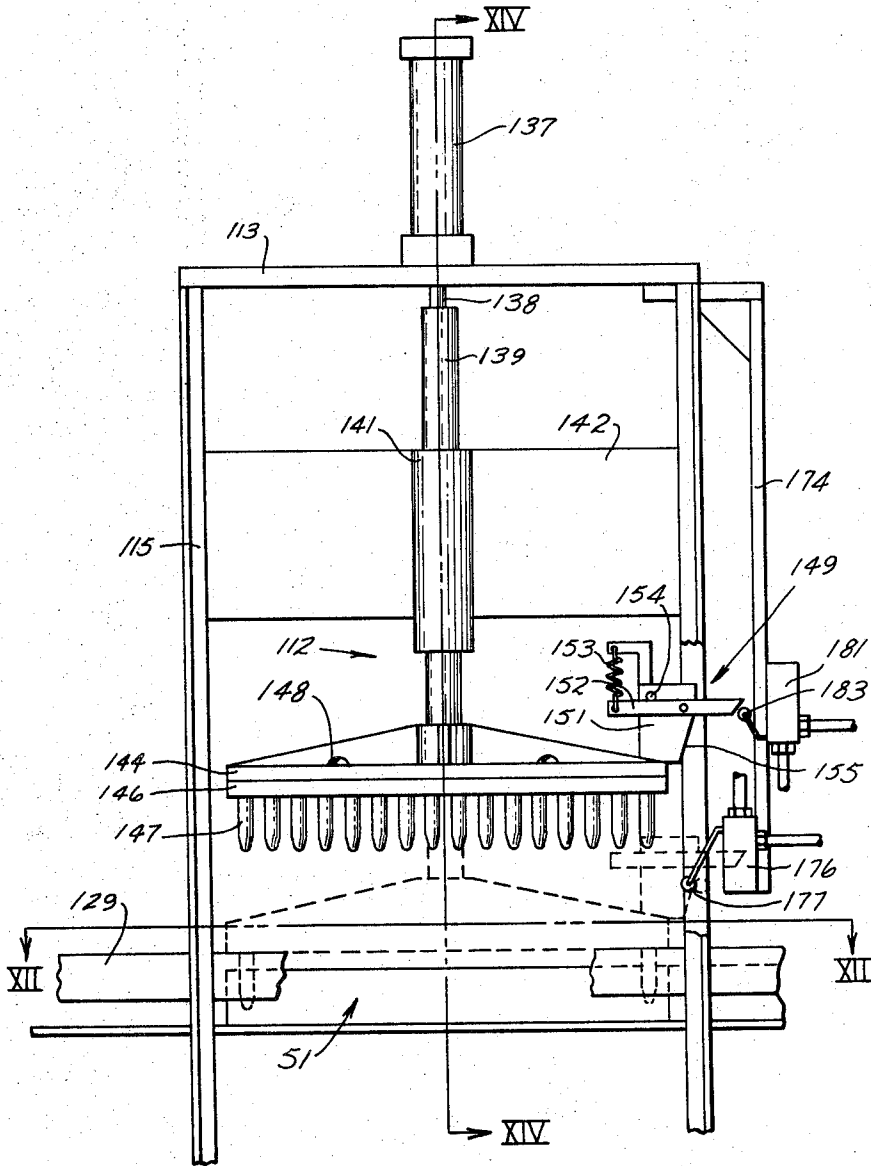


FIG. 11

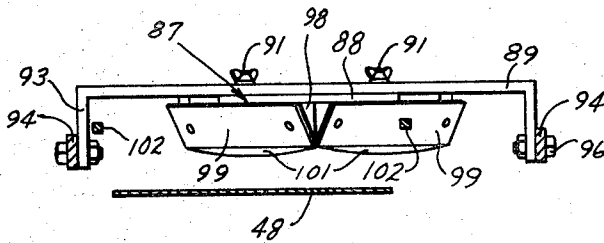


FIG. 10

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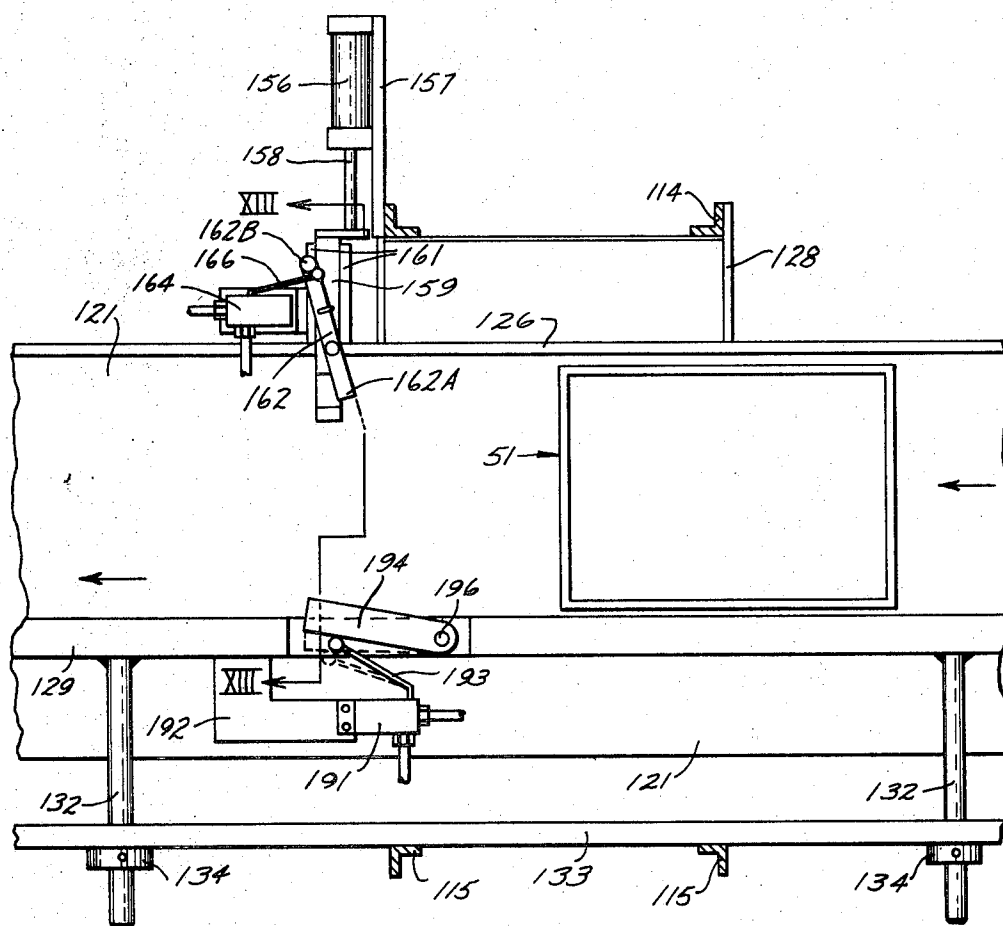
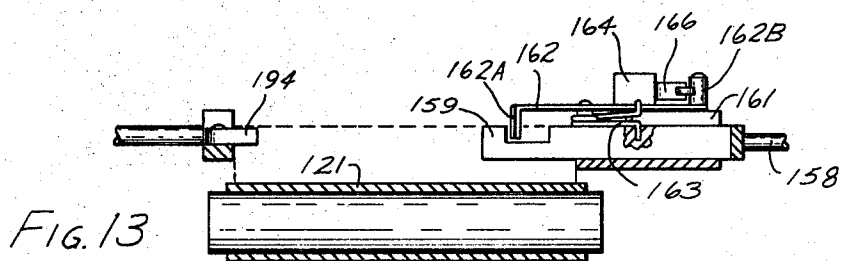


Fig. 12

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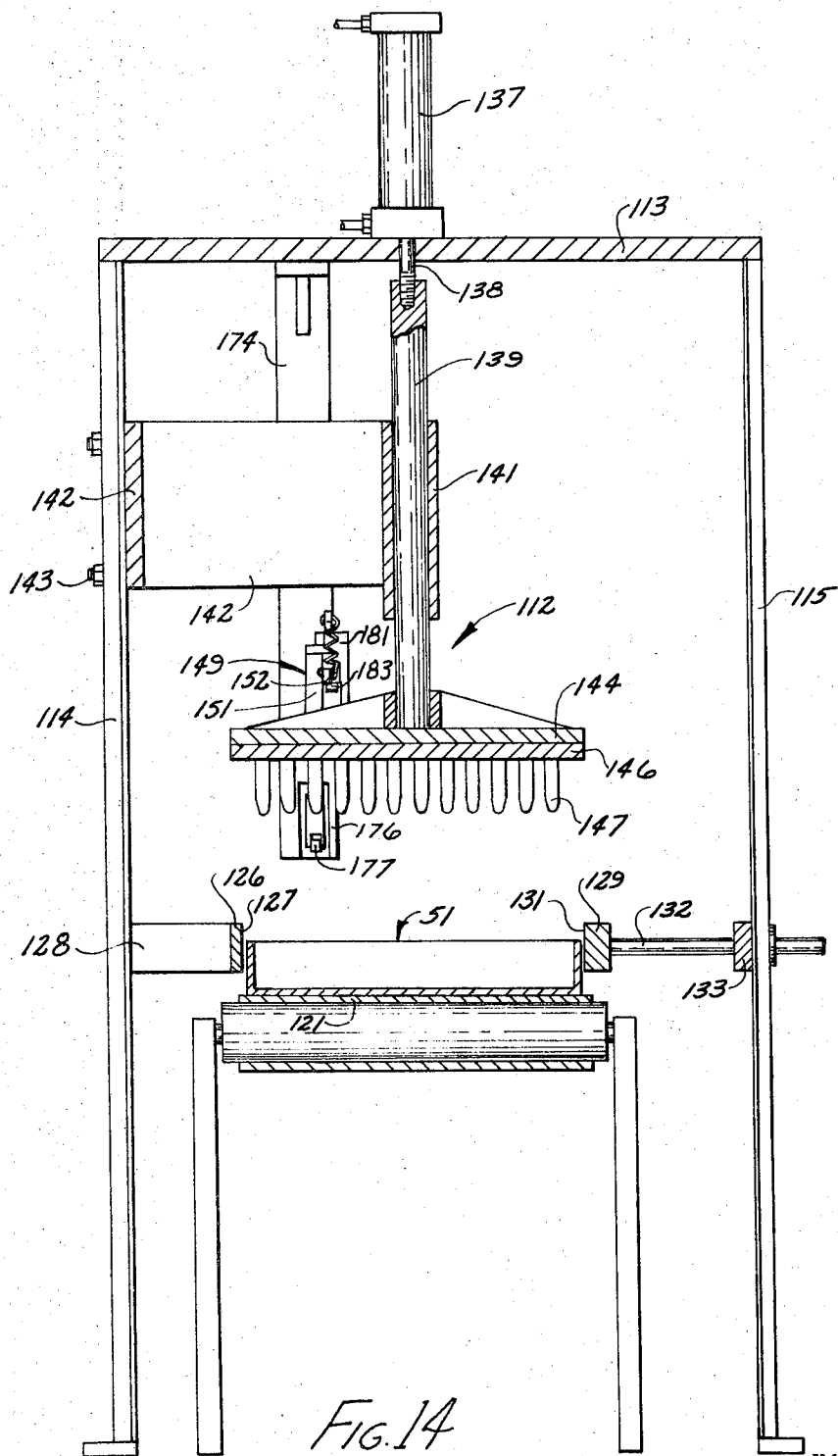


FIG. 14

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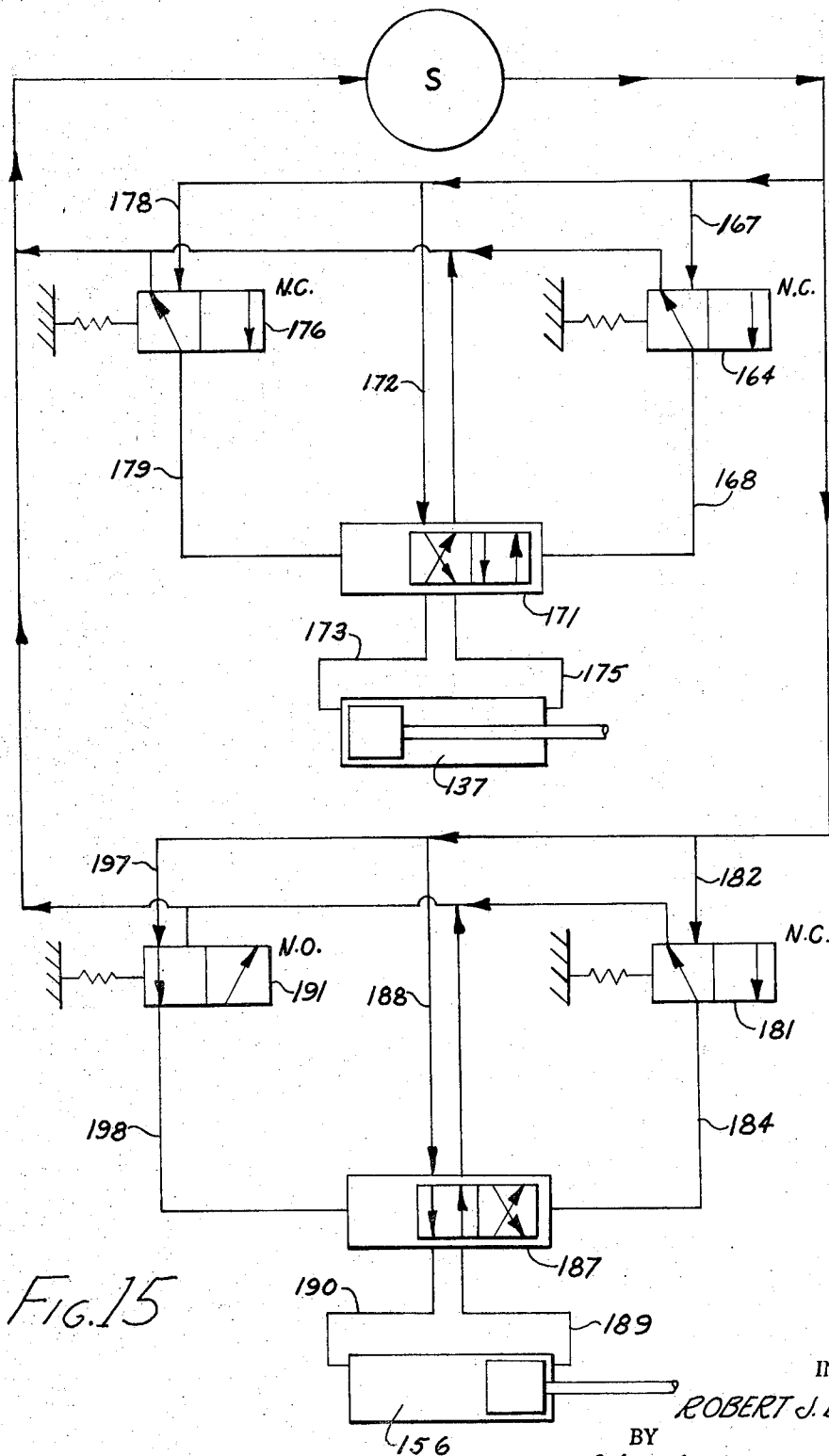


FIG. 15

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AUTOMATIC FLAT FILLER AND DIBBLER

FIELD OF THE INVENTION

This invention relates to a flat filler and dibbler apparatus and, more particularly, relates to an apparatus for automatically filling empty nursery flats with packing media and for automatically forming a plurality of dibbles within the packing media in the flat for permitting plants to be transplanted thereinto.

BACKGROUND OF THE INVENTION

It has long been the general practice in the nursery industry, particularly among bedding-plant growers, to transplant small plants and seedlings into traylike containers generally referred to as nursery flats. These bedding plants, when transplanted, are generally quite small and fragile and are thus easily damaged. Since only a relatively small number of plants can generally be grown within a single flat, there is a need for large numbers of flats to accommodate the large numbers and different varieties of plants and seedlings placed therein.

The nursery industry has long been confronted with the problem of how to quickly and efficiently fill large numbers of flats so as to facilitate the transplanting of the bedding plants. The filling process generally used heretofore was very inefficient, uneconomical and highly inadequate. The individual flats were generally filled by shoveling soil into the empty flat whereupon a worker then used a board to level the soil within the flat by scraping off the excess. The filled flats were then generally stacked in a pile and steamed to kill any disease which might exist within the soil, thereby insuring a healthy growing plant. Some nurseries modified the above process by first steaming the soil in bulk whereupon the flats were then manually filled and leveled in the same manner as described above.

After the individual flats were filled, the flats were then generally placed on a support, such as on a potting bench, whereupon a worker would then take a rectangularly shaped board having a series of wooden plugs on the face thereof, generally referred to as a dibble plate, and would press the board against the top of the flat, the plugs thus forming a plurality of holes in the soil within the flat. The dibble plate would then be manually removed whereupon the small plants would be inserted into the individual holes and the soil lightly compressed around the roots of the plants.

It will be apparent that manually filling each of the flats and then manually forming the holes therein in the manner as explained above is not only time consuming but is also expensive since it requires a substantial amount of manual labor.

Further, such a manual filling and dibbling operation is uneconomical and inefficient for bedding plant growers filling large numbers of flats since such growers must employ a substantially large number of workers in order to be able to fill and dibble the many flats required. However, since the nursery business is seasonal, it is often difficult to obtain large numbers of workers for the seasonal periods in which these operations must be performed. Further, even if the required number of workers can be obtained, the nursery operator must provide sufficient working facilities and space to accommodate the large number of workers and accordingly the cost of operating such a large volume business is seriously increased.

There thus exists a need for a compact and efficient apparatus capable of rapidly and automatically filling large numbers of flats with the apparatus further being able to automatically dibble the filled flats.

Accordingly, it is an object of this invention to provide:

1. An apparatus capable of filling and dibbling nursery flats.
2. An apparatus, as aforesaid, capable of automatically filling flats with packing media, compacting the packing media within the flat, and scraping the excess packing media from the flat.
3. An apparatus, as aforesaid, capable of automatically filling a plurality of successively presented flats at a relatively rapid rate.

4. A flat filler apparatus, as aforesaid, capable of being adjusted to accommodate various sized flats.
5. A flat-filler apparatus, as aforesaid, which is usable with conventional conveyor systems as normally possessed by nurseries.
6. A flat filler apparatus, as aforesaid, which is simple and economical in operation and requires a minimum of maintenance.
7. An apparatus, as aforesaid, capable of automatically dibbling a plurality of sequentially presented flats at a relatively rapid rate.
8. A dibbler apparatus, as aforesaid, having control means for automatically controlling the movement of the flats and the movement of the dibble plate whereby the complete dibbling operation is substantially automatically accomplished.
9. A dibbler apparatus, as aforesaid, capable of being adjusted to accommodate flats of different sizes.
10. A dibbler apparatus, as aforesaid, which is adaptable for use with conventional conveyor systems as possessed by nurseries.
11. A dibbler apparatus, as aforesaid, which is simple and economical in operation and requires a minimum amount of maintenance.

Certain terminology will be used in the following description for convenience in reference only and will not be limiting. The words "upwardly," "downwardly," "rightwardly" and "leftwardly" will designate directions in the drawings to which reference is made. The word "forwardly" will refer to the normal direction of movement of the flats through the apparatus. The words "front" and "rear" will refer to the inlet and outlet ends of the apparatus, respectively, relative to the normal flow direction of the flats. The words "inwardly" and "outwardly" will refer to directions toward and away from, respectively, the geometric center of the device and designated parts thereof. Said terminology will include the words above specifically mentioned, derivatives thereof and words of similar import.

SUMMARY OF THE INVENTION

In general, the objects and purposes of the invention are met by providing an apparatus for filling successively presented flats with packing media, the excess packing media then being scraped from the flats and the remaining packing media being compacted within the flats. The flats are then presented to a dibbler mechanism whereupon a plurality of holes are automatically formed within the packing media contained in the flats, the flats then being transported to a transplant working area.

The flat-filler apparatus includes a frame adapted to have a power conveyor positioned adjacent thereto, the frame having a hopper positioned directly above the power conveyor whereupon the conveyor successively presents a series of empty flats to the hopper, the flats being filled with packing media as they pass thereunder. The filled flats pass beneath a scraper mechanism when leaving the hopper. The frame also has a compacting roller positioned adjacent the hopper exit whereupon the flats move under the roller and partially compact the material therein. The flats then pass under a plow device whereupon additional, excess packing media is removed from the flat. The pressure roller is floatably mounted on the frame to permit adjustment in the degree of compaction imposed on the packing media. Similarly, the plow is floatably mounted to permit same to slide along the upper edges of the flats. The hopper is additionally provided with a pair of relatively movable guide members and sidewalls to adapt the machine to flats of different widths. A removable divider wall permits the hopper to be converted from a tapered configuration particularly usable with dry packing media to a substantially straight chimney-type configuration particularly suitable for use with wet packing media.

The filled flats, after leaving the filler apparatus, are transferred to a second power conveyor which runs at a faster

speed whereupon the adjacent flats become spaced from one another. This latter conveyor is positioned underneath a frame supporting a dibbler mechanism thereon. The flats are individually moved into position under the dibbler mechanism whereupon the flat contacts a stop which holds the flat stationary and causes the dibbler mechanism to be moved downwardly to form a plurality of holes in the packing media contained in the flat. The dibbler mechanism is then automatically retracted and, when returned to its original position, causes, energization of an auxiliary power mechanism for removing the stop out of the path of the flat whereupon the conveyor again causes the flat to move forwardly out from underneath the dibbler mechanism. A sensing mechanism indicates when the flat is moved from underneath the dibbler mechanism so that the stop is again automatically returned to its original position so as to project into the path of travel of the flats, thereby stopping the next flat whereupon the above-described dibbling operation is again repeated. Other objects and purposes of this invention will be apparent to persons acquainted with apparatus of this general type upon reading the following specification and inspecting the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1A is a perspective view of a flat-filler apparatus according to the present invention.

FIG. 1B is a perspective view of a dibbler apparatus according to the present invention.

FIG. 2 is a side elevational view of the flat-filler apparatus, partially in cross section, taken along the line II-II of FIG. 3.

FIG. 3 is a cross-sectional elevational view taken along the line III-III of FIG. 2.

FIG. 4 is an enlarged cross-sectional view of a fragment of FIG. 3.

FIG. 5 is an enlarged cross-sectional view of the scraper mechanism.

FIG. 6 is an enlarged, fragmentary top view of the pressure roller and plow mechanism.

FIG. 7 is a side elevational view of the structure illustrated in FIG. 6.

FIG. 8 is an enlarged elevational view of the pressure roller and of the mounting arrangement therefor.

FIG. 9 is an elevational view of the mounting for the pressure roller taken along the line IX-IX of FIG. 8.

FIG. 10 is a front elevational view of the plow mechanism taken along the line X-X of FIG. 6.

FIG. 11 is a broken, side elevational view of the dibbler apparatus illustrated in FIG. 1B.

FIG. 12 is a fragmentary horizontal sectional view taken along the line XII-XII of FIG. 11.

FIG. 13 is a sectional view taken along line XIII-XIII of FIG. 12.

FIG. 14 is an elevational sectional view taken along the line XIV-XIV of FIG. 11.

FIG. 15 is a schematic diagram of the control system for the dibbler apparatus.

DETAILED DESCRIPTION

FIG. 1A illustrates therein a flat filler apparatus 11 according to the present invention, which apparatus is preferably positioned in substantial alignment with the dibbler apparatus 13 illustrated in FIG. 1B. The exit end (leftward end in FIG. 1A) of the flat-filler apparatus is preferably positioned closely adjacent the entrance end (rightward end in FIG. 1B) of the dibbler apparatus whereupon the empty flats are conveyed by a first conveyor means 12 to the flat filler apparatus and, after being filled, are automatically conveyed to the dibbler apparatus by a second conveyor means 14 whereupon the dibbling operation is performed on the filled flats, the flats then being automatically conveyed away from the dibbler apparatus.

Considering first the flat filler 11 of FIG. 1A, this apparatus includes a frame 16 having a packing media hopper 17 thereon, a compacting device 18 and a plow mechanism 19 being positioned adjacent the exit end of the hopper for a purpose to be explained hereinafter.

The frame 16 includes opposite pairs of legs 21 and 22, which pairs of legs are fixedly interconnected by means of side pieces 23 extending therebetween. The lower ends of the legs are preferably provided with flanges 24 thereon to permit the frame to be fixedly secured to a mounting surface, such as a floor, by means of conventional anchor bolts or screws.

The hopper 17 (FIGS. 1A, 2 and 3) has a substantially vertical front wall 26 with the lower edge of the wall extending between and being fixedly secured to the side pieces 23. The hopper is further provided with a rear wall 27 which tapers upwardly and outwardly relative to the front wall 26 in the manner illustrated in FIG. 2. The rear wall 27 has a frame member 29 extending across the lower edge thereof, which frame member is fixedly connected to the opposite side pieces 23. A fixed sidewall 31 extends between the front and rear sidewalls 26 and 27 adjacent one edge of the hopper, the sidewall 31 being substantially parallel to a movable sidewall 32 having mounting brackets 33 thereon so as to permit the movable sidewall 32 to be adjustably secured to the front and rear sidewalls, thereby permitting adjustment in the distance separating the sidewalls 31 and 32. The upper portion 34 of the movable sidewall 32 is tapered outwardly (FIG. 3) to form an enlarged opening at the top of the hopper to facilitate filling same with packing media.

The hopper also has associated therewith a removable divider wall 36 which can be secured therein to convert the hopper from a substantially tapered configuration to a substantially rectangular chimney-shaped configuration. The removable divider wall 36 (FIGS. 2 and 3) includes a pair of substantially flat overlapping strips 37 and 38 having flanges 39 on the opposite edges thereof, which flanges abut against the sidewalls 31 and 32 of the hopper and are adapted to be secured thereto by means of bolts or screws. The strips 37 and 38 are laterally interconnected by means of a bolt-and-slot connection 41 (FIG. 3) so as to permit the width of the divider wall 36 to be adjusted in accordance with the distance separating the sidewalls 31 and 32. Further, the upper portion 42 of the removable divider wall 36 is tapered outwardly (FIG. 2) to form an enlarged opening to facilitate filling of the hopper with packing media. While FIGS. 1-3 illustrate the hopper as having the removable divider wall 36 mounted therein, this wall can be removed in its entirety from within the hopper if so desired.

The hopper 17 is supported directly above the first conveyor means 12 with the conveyor means 12 being positioned between the opposite pairs of legs 21 and 22 (FIG. 1A). The first conveyor means 12 is of conventional construction and has a conveyor frame 46 supported by a plurality of legs 47 which rest on a conventional bearing surface, such as a floor, whereupon the conveyor thus functions completely independently of the flat filler 11. The conveyor means 12 has a conventional movable conveying belt 48 thereon with the upper surface of the belt being utilized to convey nursery flats or trays 51 to and from the flat filler 11. If desired, the flats 51 may have a plurality of bedding baskets or liners 52 therein, such bedding baskets being of conventional configuration.

To assist in feeding the empty flats 51 into the flat filler 11, the hopper is provided with a fixed side guide 53 (FIG. 4) having an inner substantially vertical guide 53 (FIG. 4) having an inner substantially vertical guide surface 54 thereon, which side guide 53 is fixedly secured to the lower edge of the fixed sidewall 31 and extends longitudinally thereof. There is also provided an adjustable side guide 57 having an inner guide surface 58 thereon, the inner guide surfaces 54 and 58 being substantially parallel to one another and extending substantially lengthwise of the conveyor belt 48. The side guides 53 and 57 each have upper guide shoes 56 and 59, respectively, positioned directly over and slightly above the upper edge of

the flat 51 substantially as illustrated in FIG. 4. The adjustable side guide 57 is fixedly secured to the movable sidewall 32 for simultaneous adjustment therewith. The side guides 53 and 57 each extend longitudinally outwardly beyond the front of the hopper for a substantial distance and, as illustrated in FIG. 1A, are provided with outwardly flared ends 65 thereon to assist in aligning and positioning the empty flats 51 therebetween. Similarly, the upper guide shoes 56 and 59 extend outwardly beyond the front wall 26 of the hopper for a distance at least equal to the length of the flat 51, the extreme forward end of the upper guide shoes being curved upwardly so as to define a converging passageway between the guide shoes and the conveyor belt as the flats are moved into position underneath the hopper 17.

The hopper 17 is also provided with a detachable center guide shoe 66 (FIG. 2) which extends substantially parallel to the upper surface of the conveyor belt 48, the guide shoe having a rear mounting portion 67 which is positioned adjacent the lower edge of the rear wall 27 of the hopper, being fixedly connected thereto by means of a screw or bolt. The center guide shoe 66 is also provided with a curved lead-in portion 68 which extends outwardly beyond the front wall 26 for a distance at least equal to the longitudinal length of the flat 51 and is curved upwardly so as to define a converging passageway between the guide shoe 66 and the conveyor belt 48 as the flats 51 are moved into position underneath the hopper 17. The center guide shoe 66 is preferably utilized only when the apparatus is used to fill flats containing a plurality of bedding baskets 52 therein, the guide shoe 66 being adjustably secured to the hopper 17 so as to extend substantially along the longitudinal centerline of the flat so as to overlie the abutting edges of the bedding baskets in the manner as illustrated in FIG. 4, thereby preventing tipping of the baskets as the packing media is deposited therein. Similarly, the upper guide shoes 56 and 59 extend along the opposite longitudinal edges of the flat and overlie the edges of the bedding baskets so as to prevent tipping of the baskets as packing media is deposited therein. When the apparatus is utilized to fill flat containing no bedding baskets therein, then the guide shoe 66 can be easily detached and removed from the hopper.

As illustrated in FIGS. 2 and 3, the lower edges of the hopper walls are spaced from the upper surface of the conveyor belt 48 by a distance slightly greater than the height of the flats 51 so as to permit same to freely pass thereunder. The sidewalls 31 and 32 and the front and rear walls 26 and 27 define a substantially rectangular discharge opening 69 in the bottom of the hopper 17, the packing media being deposited into the empty flats 51 as they move past and underneath the opening 69.

To prevent the flats from being filled with a quantity of packing media substantially in excess of that required, the hopper is provided with a scraper mechanism 71 (FIGS. 2 and 5) positioned adjacent the lower edge of the rear wall 27. The scraper mechanism includes a scraper blade 72 which extends transversely across the width of the hopper, the blade being secured to a backing plate 73 which in turn is secured to the frame member 29 by means of a plurality of screws 76. The backing plate 73 is preferably provided with elongated vertical slots 74 therein so as to permit the elevation of the scraper blade 72 to be adjusted, thereby permitting adjustment in the quantity of packing media scraped or removed from the flats 51 as same move out from beneath the hopper 17. The scraper blades 72 are preferably of a flexible resilient material, such as rubber or plastic.

Positioned directly rearwardly (FIG. 2) of the scraper mechanism 71 is the compacting device 18, which device includes a cylindrical pressure roller 77 positioned above and extending transversely across the conveyor belt 48. The pressure roller 77 (FIGS. 6-9) is provided with support pins 78 extending outwardly from the opposite axial ends thereof, which support pins are rotatably supported within a pair of extensions 79 extending rearwardly from and fixedly connected to the side pieces 23. Each of the extensions 79 is provided

with a substantially rectangular bearing block 81 fixedly secured to the inner side thereof, which bearing block is provided with an elongated vertical slot 82 therein. The vertical slot 82 has a width slightly greater than the diameter of the support pin 78 whereupon the support pin extends into the slot and is freely movable vertically therein. Also mounted within the vertical slot 82 is an adjustable stop block 83, which stop block is provided with a locking screw 84 extending through a small vertical slot 86 formed in the extension 79. The adjustable stop block 83 is positioned within the slot 82 above the support pin 78 and is adjustable vertically relative thereto with the stop block being locked in a desired vertical position by means of the locking screw 84, which locking screw causes the stop block 83 to be tightly held in frictional engagement with the extension 79. With the stop block 83 locked in a vertically spaced position as illustrated in FIG. 9, the pressure roller 77 is mounted for a limited amount of vertical floating movement. When the support pins 79 of the pressure roller 77 are positioned at the extreme lower ends of the slots 82, as illustrated in FIGS. 8 and 9, the lower periphery of the pressure roller 77 is positioned closely adjacent to the upper edge of the flats 51.

The plow mechanism 19 (FIGS. 6 and 7) is positioned directly behind the compacting device 18 and includes a substantially V-shaped plow member 87 having a mounting bar 88 (FIG. 10) extending across and fixedly secured to the upper edges thereof. The mounting bar 88 is in turn connected to a U-shaped crossarm 89 by means of bolts 91, the crossarm being provided with elongated slots 92 therein so as to permit the plow 87 to be adjustably secured to the crossarm in a desired transverse position relative to the conveyor belt 48. The U-shaped crossarm has downwardly extending leg portions 93 (FIG. 10) positioned on opposite sides of the conveyor, which leg portions 93 are connected to a pair of support levers 94 by means of pivot bolts 96. Similar pivot bolts 97 interconnect the other ends of the support levers 94 to the frame 16 and, in particular, to the legs 21 and 22. The pivot axes of the bolts 96 and 97 preferably lie in a plane defined by the lowermost edge of the plow 87. The plow mechanism 18 is thus pivotably mounted on the frame 16 whereupon the V-shaped plow 87 can freely float in a vertical direction relative to the conveyor belt 48.

The V-shaped plow 87 is formed from a pair of platelike members 98 which are fixedly connected at one end thereof, such as by welding, with the platelike members then extending angularly outwardly and rearwardly, the members also tapering inwardly in a vertical direction in the same manner as a conventional plow device. Such a construction thus provides a downwardly sloped leading edge 100 (FIG. 2) whereupon the plow can be cammed upwardly over the leading edge of the flats 51. The platelike members 98 are preferably provided with detachable blades 99 (FIG. 10) thereon, the lower edge 101 of which can be provided with a curved configuration if desired so as to permit the packing media within the flat to be dished out. If the lower edge 101 is formed with a portion thereon extending below the upper edge of the flat 51, such extending portion is preferably constructed of rubber or other suitable resilient material if the flats contain bedding baskets therein. Further, fixed stops 102 (FIGS. 6 and 7) are provided adjacent opposite sides of the conveyor belt 48 and extend upwardly above the surface thereof so as to contact the crossarm 89. The stops 102 prevent the V-shaped plow from falling downwardly onto the surface of the conveyor belt 48 when no flat is present thereunder. The stops 102 are preferably adjustably mounted on the frame 16, such as by being fixedly secured to the extensions 79.

Considering now the dibbler apparatus 13 illustrated in FIG. 1B, same generally comprises a frame 111 having a dibbler mechanism 112 movably mounted thereon. The frame of the dibbler apparatus is provided with a substantially horizontal top plate 113 supported of downwardly extending legs 114 and 115, which legs are supported on a suitable bearing surface, such as a floor. The lower ends of the legs are preferably

provided with flanges 116 to permit the frame 111 to be fixedly secured to the floor, such as by conventional anchor bolts. The portion of the frame 111 positioned above the second conveyor means 14 is preferably provided with a metal mesh 117 surrounding same to prevent workers from accidentally becoming injured by the movable dibbler mechanism.

The second conveyor means 14 is positioned between the opposite pairs of legs 114 and 115 and comprises a conventional conveyor having a conveyor frame 118 supported on a plurality of legs 119, which legs support the conveyor on the bearing surface on floor. The second conveyor means 14 is thus supported and operates completely independently of the dibbler apparatus 13. The conveyor means 14 has a conventional conveyor belt 121 thereon, the upper surface of the belt being utilized for transporting filled flats 51 to and from the dibbler apparatus.

As illustrated in FIGS. 12 and 14, the dibbler apparatus is provided with a fixed side guide 126 positioned adjacent to and extending longitudinally along the conveyor belt adjacent the upper surface thereof, which side guide 126 is provided with a vertically extending guide surface 127 thereon. A pair of intermediate members 128 fixedly interconnect the side guide 126 to the pair of adjacent leg members 114. An adjustable side guide 129 is positioned adjacent the other side of the conveyor belt and has a vertical guide surface 131 thereon which confronts and is substantially parallel to the guide surface 127. The adjustable side guide 129 is fixedly connected to a pair of support rods 132 (FIG. 12) which slideably extend through openings formed in a horizontal frame element 133, which frame element extends between and is fixedly connected to the pair of legs 115. The frame element 133 has a pair of collars 134 fixedly secured thereto through which slideably extend the support rods 132. The collars are provided with conventional locking means therein, such as set-screws, for permitting the support rods 132 to be fixedly secured in the desired adjusted position. The side guide 129 is thus adjustable in a direction transversely across the width of the conveyor belt 121 so as to vary the separation distance between the guide surfaces 127 and 131. Further, as illustrated in FIG. 1B, the side guides 126 and 129 each extend toward the entrance end of the conveyor belt with the extreme ends 136 thereof being flared or tapered outwardly so as to form a diverging opening to assist in aligning and positioning the flats 51 between the side guides 126 and 129. The flats, when confined between the side guides 126 and 129, are moved by the conveyor belt 121 to a position directly underneath the dibbler mechanism 112.

The dibbler mechanism 112 (FIGS. 11 and 14) includes therein a reciprocating power means 137, such as a fluid power cylinder, fixedly secured to the top plate 113 adjacent the upper surface thereof. The power cylinder 137 has a reciprocating piston rod 138 which extends downwardly through the top plate and is fixedly connected to a shaft or plunger member 139 for reciprocating same. The plunger 139 is slideably received within a bushing 141 which is integrally secured to a T-shaped bracket 142 fixedly secured to the legs 114 by means of the bolts 143. The extreme lower end of the plunger 139 is provided with a substantially rectangular, horizontal mounting plate 144 fixedly secured thereto, which mounting plate is adapted to have secured thereto a dibble plate 146 having a plurality of downwardly extending dibles or projections 147 thereon. The dibble plate 146 is fixedly but detachably secured to the mounting plate 144 by means of conventional fastening means, such as screws 148. The dibble plate 146 is thus easily removed from the mounting plate whereupon dibble plates of different sizes and/or having different numbers of projections thereon can be readily and interchangeably utilized on the machine.

A trip mechanism 149 (FIG. 11) is provided for controlling the vertical movement of the dibbler mechanism and includes a mounting block 151 mounted on the upper surface of the mounting plate 144 adjacent one edge thereof. A one-way trip

lever 152 is pivotally mounted on the block 151 and is biased by a compression spring 153 into engagement with a stop pin 154. The trip lever 152 is adapted to cooperate with the actuating lever 183 of a control valve 181, which valve is fixedly mounted on a frame member 174 which extends downwardly from the top plate 113. The control valve 181 is a conventional three-way, normally closed valve adapted to be opened by the trip lever 152 when the dibble plate is moved upwardly. Downward movement of the dibble plate does not cause actuation of the control valve 181 since trip lever 152 is permitted to freely pivot (counterclockwise in FIG. 11) away from stop pin 154 in opposition to spring 153.

The mounting block 151 also has a tapered camming surface 155 thereon which is adapted to cooperate with the actuating lever 177 of a control valve 176, which valve is also a conventional three-way, normally closed valve. The tapered surface 155 contacts and deflects the actuating lever 177 so as to open the control valve 176 whenever the dibble plate 146 reaches its extreme lowermost position, whereupon the control valve 176 initiates reverse movement of the dibbler mechanism as explained hereinafter.

The dibbler apparatus 13 further includes a fluid-pressure-power cylinder 156 (FIG. 12) mounted on a flange 157 which extends outwardly from and is fixedly secured to one of the legs 114. The power cylinder 156 has a reciprocating piston rod 158 extending therefrom and fixedly connected to an elongated slide or stop member 159. The stop member 159 is slideably received between a pair of substantially parallel rails 161 which are fixedly interconnected to and extend laterally outwardly from the fixed side guide 126. The guide 126 is provided with a slot therein in alignment with the slot formed by the parallel rails 161 whereupon the stop member 159 can extend through the side guide 126 so as to be positionable above the upper surface of the conveyor belt 121 as illustrated in FIG. 13.

A trip lever 162 is pivotally mounted on the stop member 159 and is interconnected thereto by means of a torsion spring 163 (FIG. 13), which spring biases the trip lever in a direction (counterclockwise in FIG. 12) whereby the end 162A thereof projects forwardly beyond the stop member when same is in the extended position illustrated in FIG. 12.

A control valve 164 is fixedly positioned adjacent the stop member 159 and has an outwardly extending actuating lever 166 for controlling the position thereof. The control valve 164 is preferably a conventional three-way valve maintained in the normally closed position when the stop member 159 is in the extended position of FIG. 12. The trip lever 162 has an upwardly extending projection 162B on the rearward end thereof adapted to coact with the actuating lever 166 for opening the control valve 164 as explained hereinafter.

A further control valve 191 (FIG. 12) is positioned substantially across from the control valve 164 adjacent the opposite side of the conveyor belt 121. The control valve 191 is a conventional three-way, normally open valve and is fixedly secured to a bracket 192, which bracket is secured to the adjustable side guide 129. The control valve 191 has an actuating lever 193 which bears against a trigger 194 pivoted by means of a pin 196 on the adjustable side guide 129. When the control valve 191 is in the open position, as illustrated in FIG. 12, the actuating lever 193 bears against the trigger 194 and causes same to be positioned angularly outwardly so as to project into the path of movement of the flats 51 traveling on the conveyor belt 121. Angular movement of the trigger 194 into the dotted position illustrated in FIG. 12 causes the control valve 19 to be closed.

To permit the reciprocating movement of the dibbler mechanism 112 to be synchronized with the movement of the flats 51 on the conveyor belt 121, the apparatus is provided with an automatic control system which is, in the preferred embodiment, pneumatically operated. However, it will be apparent that the control system could be operated by other fluid means or, alternatively, could be replaced by a conventional electrical control circuit.

The control circuit is diagrammatically illustrated in FIG. 15 and includes therein the control valves 164, 176, 181 and 191, which valves are normally supplied with a pressurized fluid from a conventional pressure source S. The control valves 164 and 176 control the position of a flow control valve 171, which in turn controls the flow of pressurized fluid to the power cylinder 137 for controlling the movement of the dibbler mechanism 112. The control valves 181 and 191 control the position of a flow control valve 187, which in turn controls the flow of pressurized fluid to the power cylinder 156 for controlling the position of the stop member 159. The flow valves 171 and 187 are preferably conventional four-way valves. A detailed explanation of the control system will be given below.

OPERATION

Although the operation of the device embodying the invention has been indicated somewhat above, the operation will be described in detail hereinbelow for a better understanding of the invention.

The use and operation of the flat filler apparatus 11 will first be considered. Before initiating operation, the flat filler apparatus is positioned over a conventional conveyor apparatus in the manner illustrated in FIG. 1A and the conveyor apparatus is adjusted vertically so that the upper surface of the conveyor belt 48 is spaced below the upper guide shoes 56 and 59 by a distance slightly greater than the height of the flat 51. A worker then places some empty flats on the inlet end of the conveyor belt 48 in end to end abutting relationship, the front-most flat 51 being positioned directly under the discharge opening 69 formed in the bottom of the hopper 17. The adjustable sidewall 32 having the adjustable side guide 57 thereon is then moved laterally across the belt and fixed in the desired adjusted position such that the inner guide surface 58 is positioned substantially adjacent one side of the flat 51, the other side of the flat 51 being positioned adjacent the fixed side guide 53, sufficient clearance being maintained so as to permit the flats to freely move between the side guides substantially as illustrated in FIG. 4. The width of the hopper opening 69 is thus slightly less than the width of the opening formed in the flat 51. Further, if the flats are to be filled with a fairly wet packing media, then the divider wall 36 is maintained within the hopper. On the other hand, if the packing media is dry, then the divider wall 36 is removed from the hopper. For purposes of this explanation, it will be assumed that the packing media utilized is dry and that the dividing wall 36 has been removed from the hopper. The hopper is then filled with packing media, such as soil or other suitable growing media. The apparatus is now in condition for continuous operation.

The conveyor motor is then energized so as to move the empty flats under the hopper 17. As the empty flats move under the hopper, a worker standing adjacent the inlet end of the conveyor continuously places empty flats on the conveyor in abutting end to end relationship so as to assure a continuous supply of flats to the hopper. As an empty flat 51 moves under the hopper opening 69, the soil within the hopper completely fills the flat with soil. Since the sidewalls 31 and 32 are substantially positioned directly above the opposite longitudinal sidewalls of the empty flat 51 as illustrated in FIG. 4, the soil falls directly into the flat and thus is not deposited on the upper edges of the longitudinal sidewalls of the flat. If the flat contains bedding baskets 52 therein, the bedding baskets are prevented from tipping or moving by the upper guide shoes 56 and 59 and the center guide shoe 66, which guide shoes are positioned directly over the longitudinal edges of the bedding baskets so as to maintain same in position.

When a flat moves underneath the hopper and is filled with soil, the soil within the hopper directly above the flat tends to move with the flat in a direction toward the rear tapered wall 27. The scraper mechanism 71, in cooperation with the rear wall 27, causes the excess soil to be removed from the flat as same moves thereunder, the excess soil tending to move up

the tapered interior surface of the rear wall 27 with the excess soil then rolling over backwards toward the front wall 26 whereupon the material then falls downwardly into the next incoming flat. In this manner, the soil tends to maintain a circular flow pattern within the hopper, thereby insuring a continuous supply of soil for the incoming flats.

In passing under the flexible scraper mechanism 71, the blade 72 not only removes excess soil from the top of the flat, but also partially compresses the soil within the flat. The flat then passes underneath the pressure roller 77 whereupon the soil is further compacted within the flat, the amount of compaction or compression of the soil being dependent upon the position of the adjustable stop block 83. If the adjustable stop block is positioned at the lower end of the slot 82 in contact with the support pins 78, then the pressure roller 77 is not permitted to float and accordingly a maximum compression of the soil will be obtained. On the other hand, if the stop block 83 is positioned substantially adjacent the top of the slot 82, then the pressure roller 77 will be permitted to flow vertically upwardly as it contacts the packing media within the flat and accordingly the packing media will then be compressed or compacted to a lesser degree.

The filled flat is then moved out from underneath the pressure roller 77 and comes into contact with the plow mechanism 19 whereupon the tapered leading edge 100 causes the V-shaped plow 87 to slide up onto the upper edge of the flat. The V-shaped plow, which is positioned so that its leading edge 100 is substantially aligned with the longitudinal centerline of the flat, thus substantially removes any excess soil which now remains or extends above the upper edge of the flat and also further compacts the soil remaining in the flat. Since the plow mechanism is pivotally mounted so as to float vertically, the plow will remain in sliding engagement with the upper edges of the flat irrespective of whether the edges are warped or deformed. Further, if the plow blades 99 are provided with extending edges 101 thereon, the soil within the flat will be dished out in accordance with the configuration of the edges 101.

In the above-described manner, a continuous succession of empty flats are filled with soil with the excess soil being scraped from the flat as it leaves the hopper, the soil then being compacted within the flat and the flat again scraped to remove the excess soil therefrom. The filled flats, upon leaving the plow mechanism 19, are thus in condition to be conveyed to the dibbler apparatus 13 in the manner as explained below.

Considering now the adjustment and operation of the dibbler apparatus 13, operation of this apparatus is initiated with the dibbler plate 146 in the upward or retracted position substantially as illustrated in FIG. 13. The adjustable side guide 129 is initially moved transversely across the conveyor belt 121 so that the spacing between the side guides 126 and 129 is slightly greater than the width of the flats 51. Further, a dibble plate 146 is secured to the mounting plate 144 having a size corresponding to the size of flats being utilized and further having the desired dibble pattern thereon, that is, having the desired number of projections and having projections of the desired length. Further, the external power source S is energized so as to supply compressed fluid, such as air, to the control valves 164, 176, 181 and 191 and the flow valves 171 and 187. Since the control valve 191 is in the open position, the pressurized fluid supplied to conduit 197 flows through the valve 191 into conduit 198 and causes shifting of the flow valve 187 (into the position illustrated in FIG. 15), whereupon pressurized fluid flows through the conduits 188 and 190 to the rearward end of the power cylinder 156. This causes stop member 159 to be moved into the position illustrated in FIG. 12 whereby same extends beyond the side guide 126 into the path of movement of the flats. The conveyor means 14 is then energized and the dibbler apparatus 13 is then in condition for automatic operation.

The inlet end of the conveyor means 14 is preferably positioned closely adjacent to the outlet end of the conveyor means 12 utilized in conjunction with the flat filler 11. The

filled flats are thus transferred directly from the outlet end of the flat filling conveyor 12 onto the inlet end of the dibbler conveyor 14. However, the conveyor 14 for the dibbler apparatus runs at a slightly faster speed than the conveyor 12 whereupon the flats, upon being transferred onto the conveyor belt 121, will become longitudinally separated from one another and will thus not be in tight, end-to-end abutting relationship as was true when the flats were positioned on the conveyor belt 48.

As a filled flat moves along the conveyor belt 121, the leading edge of the flat comes into contact with the trigger 194 (FIG. 12) and causes same to move outwardly against the actuating lever 193 whereupon the control valve 191 is closed. The leading edge of the flat then comes into contact with the stop member 159 whereby the flat is held stationary, the moving conveyor belt 121 slipping relative to the flat. Upon contacting the stop 159, the flat initially contacts the end 162A and causes the trip lever 162 to angularly move against the bias of the spring 163 (FIG. 13), which movement causes the upwardly extending projection 162B to momentarily cam the actuating lever 166 inwardly, whereupon the control valve 164 is thus temporarily opened. The trip lever 162 is moved into a position substantially aligned with the stop 159, the projection 162B thus moving beyond and out of engagement with the actuating lever 166 so as to permit same to reclose the valve 164.

However, the momentary opening of the control valve 164 permits pressurized fluid from the conduit 167 to pass through the valve into the conduit 168, which pressurized fluid thus causes the flow valve 171 to shift (leftwardly in FIG. 15), whereupon pressurized fluid then flows from the conduit 172 through the flow valve 171 into the conduit 173. The conduit 173, being connected to the upper end of the power cylinder 137, causes the dibble plate 146 to be moved downwardly whereupon the projections or dibbles 147 are pressed into the packing media contained within the flat. The downward movement of the dibbler mechanism continues until the dibble plate 146 substantially comes into contact with the upper edge of the flat 51.

When the dibble plate 146 reaches the extreme lower position, the cam surface 155 (FIG. 11) contacts and depresses the actuating lever 177, whereupon the control valve 176 is opened. This valve thus permits pressurized fluid to flow from the conduit 178 into the conduit 179, which in turn causes a shifting of the flow valve 171 back to its original position (rightwardly in FIG. 15). Fluid supplied to the conduit 172 then flows through the conduit 175 into the lower end of the power cylinder 137 whereby the dibble plate 146 is then retracted upwardly toward its original position. As the dibble plate moves upwardly from its lowermost position, the cam surface 155 moves out of contact with the actuating lever 177 and permits the control valve 176 to return to its normally closed position.

As the dibble plate again reaches its uppermost retracted position, the one-way trip lever 152 mounted thereon contacts and depresses the actuating lever 183 whereupon the control valve 181 is temporarily moved to the open position. Pressurized fluid supplied to the conduit 182 is then permitted to flow into the conduit 184, which pressurized fluid is then supplied to one end of the flow valve 187 causing a shifting thereof (leftwardly in FIG. 15). The upward movement of the dibble plate 146 continues until the plate 146 passes beyond the actuating lever 183 so as to permit the control valve 181 to return to its normally closed position, the upward movement of the dibble plate being controlled by the power cylinder 137.

The shifting of the flow valve 187, as described above, causes the pressurized fluid in the conduit 188 to flow into the conduit 189, which conduit is connected to the inner end of the power cylinder 156, whereupon the power cylinder is thus energized so as to cause the piston rod 158 and the slideable stop 159 connected thereto to be slideably retracted out of the path of movement of the flat, whereby the movable conveyor belt 121 thus causes the flat to be moved out from underneath

the dibbler mechanism. The filled and dibbled flat is then conveyed to a transplant working area whereupon workers can perform the transplant of seedlings or small plants into the holes formed in the filled flat.

As the filled and dibbled flat is moved out from underneath the dibbler mechanism, the trigger 194 is again moved outwardly into the path of movement of the flats, whereupon the actuating lever 193 is similarly moved so as to return the control valve 191 to its normally open position. Pressurized fluid thus again enters the line 198 whereby the flow valve 187 is shifted back to its opposite extreme position (rightwardly in FIG. 15). Pressurized fluid in the conduit 188 again flows into and through the conduit 190 to the outer end of the power cylinder 156, whereby the slide stop 159 is again extended outwardly into the path of movement of the flats. The next incoming flat thus comes into contact with the stop 159, causing movement of the trip lever 162 and the trigger 194 so as to automatically initiate a new dibbling cycle.

The dibbling cycle as explained above can be accomplished very rapidly, in approximately 2 seconds or less, and accordingly the apparatus permits a large number of flats to be automatically dibbled within a short period of time. Further, the dibbling operation is performed with a high degree of accuracy and consistency so as to result in a uniformity which greatly facilitates and speeds up the transplanting operation.

The apparatus of the present invention is thus able to rapidly and substantially automatically fill empty flats with packing media and compress the packing media within the flats to the desired degree of compaction, the filled flats then being automatically dibbled so as to be in condition for transplanting. Further, the apparatus is readily adaptable to fit the various sizes of flats commonly utilized in the nursery industry. The flats utilized in the nursery industry generally vary from a minimum height of approximately 1 inch to a maximum height of approximately 3 inches. Further, the flats generally have a width of between 10 and 16 inches and a length of between 15 and 23 inches. The apparatus of the present invention is thus designed to accommodate flats having dimensions which fall within the above ranges.

To insure that the flat will be sufficiently guided yet freely moved through both the flat filler and dibbler apparatus, the side guides on the flat filler and dibbler apparatus are preferably adjusted so as to provide a clearance of approximately $\frac{1}{4}$ inch to $\frac{3}{8}$ inch. Similarly, the height of the conveyor is adjusted so as to accommodate the height of the particular flat being utilized, there being additionally provided a height clearance of approximately $\frac{1}{4}$ inch between the top of the flat and the bottom surfaces of the upper guide portions 56 and 59.

The conveyor means 12 and 14 used to supply flats to the flat filler apparatus 11 and the dibbler apparatus 13, respectively, are of conventional construction and are completely independent of the flat filler and dibbler apparatus.

Although a particular preferred embodiment of the invention has been disclosed above for illustrative purposes, it will be understood that variations or modifications thereof which lie within the scope of the appended claims are fully contemplated.

I claim:

1. An apparatus for forming dibbles in trays containing packing media and movable along a path, said apparatus comprising:

a frame adapted to be supported on a support surface; dibbler means mounted on said frame for reciprocating movement between first and second positions along a line of movement which intersects the path of movement of said trays, said dibbler means when in said second position being adapted to form openings within packing media contained within a tray;

drive means mounted on said frame for causing reciprocation of said dibbler means between said first and second positions;

conveyor means positioned under said dibbler means and having a continuously movable endless conveyor member thereon extending outwardly from opposite sides of said frame, said endless conveyor member having an upper reach movable in a first direction substantially transverse to the line of movement of said dibbler means and adapted to have filled trays positioned on the inlet end thereof whereby said trays are sequentially conveyed to a predetermined position under said dibbler means;

stop means for positioning one of said trays within said predetermined position in alignment with said dibbler means, said stop means exerting no control over the movement of said endless conveyor member and including a mechanical stop member movably mounted on said frame for movement between first and second positions, the movement of said stop member between said first and second positions being independent of and having no control over the movement of said endless conveyor member; and

said stop member when in said first position being disposed directly over the upper reach of said endless conveyor member and within the path of movement of said trays for positively contacting the front end wall of one of said trays and maintaining said tray stationary in said predetermined position while said endless conveyor member continues to move whereby said one tray slips relative to the upper reach of said conveyor member, whereupon movement of said dibbler means to said second position causes said tray to be dabbled, said stop member when in said second position being laterally displaced from the path of movement of said trays for permitting said continuously movable conveyor member to move said dabbled tray out of said predetermined position for permitting the next tray to move into said predetermined position for contact with said stop member.

2. An apparatus according to claim 1, further including first sensing means mounted on said stop means for sensing the presence of said one tray and for initiating the movement of said dibbler means from said first position toward said second position, second sensing means movably mounted on said frame adjacent said conveyor member for indicating when no tray is positioned in alignment with said dibbler means for causing said stop means to be disposed within the path of movement of said trays, and third sensing means mounted on said frame within the path of movement of said dibbler means and adapted for contacting said dibbler means for indicating when the dibbler means has completed the dabbled operation and for withdrawing the stop means out of the path of movement of said one tray for permitting the continuously running conveyor member to move the tray out of said predetermined position.

3. An apparatus for forming dabbles in trays containing packing media and movable along a path, said apparatus comprising:

a frame adapted to be supported on a support surface;

dibbler means mounted on said frame for reciprocating movement between first and second positions along a line of movement which intersects the path of movement of said trays, said dibbler means when in said second position being adapted to form openings within packing media contained within a tray;

drive means mounted on said frame for causing reciprocation of said dibbler means between said first and second positions;

stop means for positioning one of said trays within a predetermined position in alignment with said dibbler means, said stop means including a stop member movably mounted on said frame for movement between first and second positions, said stop member when in said first position being disposed within the path of movement of said trays for positively contacting one of said trays and maintaining said tray in said predetermined position whereby movement of said dibbler means to said second

position causes said tray to be dabbled, said stop member when in said second position being laterally displaced from the path of movement of said trays for permitting said dabbled tray to be moved out of said predetermined position;

said stop means further including a drive unit interconnected to said stop member for moving same between said first and second positions; and

sensing means for indicating when no tray is positioned in said predetermined position and interconnected to said drive unit for activating same to move said stop member to said first position.

4. An apparatus for forming dabbles in trays containing packing media and movable along a path, said apparatus comprising:

a frame adapted to be supported on a support surface;

dibbler means mounted on said frame for reciprocating movement between first and second positions along a line of movement which intersects the path of movement of said trays, said dibbler means when in said second position being adapted to form openings within packing media contained within a tray;

drive means mounted on said frame for causing reciprocation of said dibbler means between said first and second positions;

stop means for positioning one of said trays within a predetermined position in alignment with said dibbler means, said stop means including a stop member movably mounted on said frame for movement between first and second positions, said stop member when in said first position being disposed within the path of movement of said trays for positively contacting one of said trays and maintaining said tray in said predetermined position whereby movement of said dibbler means to said second position causes said tray to be dabbled, said stop member when in said second position being laterally displaced from the path of movement of said trays for permitting said dabbled tray to be moved out of said predetermined position; and

actuating means for sensing the presence of a tray in said predetermined position and for energizing said drive means for causing movement of said dibbler means from said first toward said second position, said actuating means including an actuating member movably mounted on said stop member and disposed for contacting a tray as said tray is moved into said predetermined position.

5. An apparatus according to claim 4, further including reversing means coaxing between said dibbler means and said frame for automatically reversing said drive means for returning said dibbler means to said first position after same reaches said second position.

6. An apparatus according to claim 5, wherein said stop means includes:

a drive unit interconnected to said stop member for moving same between said first and second positions; and

sensing means for indicating when no tray is positioned in said predetermined position and interconnected to said drive unit for activating same to move said stop member to said first position.

7. An apparatus for forming dabbles in trays containing packing media and movable along a path, said apparatus comprising:

a frame adapted to be supported on a support surface;

dibbler means mounted on said frame for reciprocating movement between first and second positions along a line of movement which intersects the path of movement of said trays, said dibbler means when in said second position being adapted to form openings within packing media contained within a tray;

drive means mounted on said frame for causing reciprocation of said dibbler means between said first and second positions;

stop means for positioning one of said trays within a predetermined position in alignment with said dibbler means, said stop means including a stop member movably mounted on said frame for movement between first and second positions, said stop member when in said first position being disposed within the path of movement of said trays for positively contacting one of said trays and maintaining said tray in said predetermined position whereby movement of said dibbler means to said second position causes said tray to be dabbled, said stop member when in said second position being laterally displaced from the path of movement of said trays for permitting said dabbled tray to be moved out of said predetermined position;

said stop means further including a drive unit interconnected to said stop member for causing movement thereof between said first and second positions; and

control means, including circuitry means, operably interconnected between said drive means and said drive unit for automatically controlling the movements of said stop member and said dibbler means relative to each other and relative to said frame.

8. An apparatus according to claim 7, wherein said drive means includes a first fluid-pressure power cylinder interconnected to said dibbler means for causing movement thereof between said first and second positions;

said drive unit comprising a second fluid-pressure power cylinder interconnected to said stop member for causing movement thereof between said first and second positions; and

said circuitry means including a pneumatic fluid pressure circuit interconnected between said first and second power cylinders, said circuit including valve means for controlling the flow of pressure fluid to said first and second power cylinders.

9. An apparatus according to claim 7, wherein said control means includes:

first means for sensing the presence of a tray in said predetermined position and for causing energization of said drive unit for moving said stop member to said first position when no tray is present in said predetermined position;

second means for sensing the presence of a tray in said predetermined position and interconnected to said drive means for causing energization of same for moving said dibbler means from said first toward second position when a tray is present in said predetermined position;

third means for sensing the presence of said dibbler means in said second position and interconnected to said drive means for reversing the energization thereof to automatically move said drive means from said second position back toward said first position; and

fourth means for sensing the movement of said dibbler means from said second position toward said first position and interconnected to said drive unit for automatically causing energization thereof for moving said stop member from said first position to said second position for permitting the dabbled tray to be removed from said predetermined position.

10. An apparatus according to claim 9, wherein said drive means comprises:

a first fluid-pressure power cylinder;

said drive unit comprising a second fluid pressure power cylinder; and

said control means including a fluid-pressure circuit having first valve means associated with and comprising a portion of said first sensing means, second valve means associated with and comprising a portion of said second sensing means, third valve means associated with and comprising a portion of said third sensing means, and fourth valve means associated with and comprising a portion of said fourth sensing means.

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