

Oct. 22, 1963

R. F. BECHTOLD ETAL

3,107,794

UNLOADER FOR PALLETIZED BULK CAN PACKAGE

Filed July 24, 1959

12 Sheets-Sheet 1

ATTORNEYS

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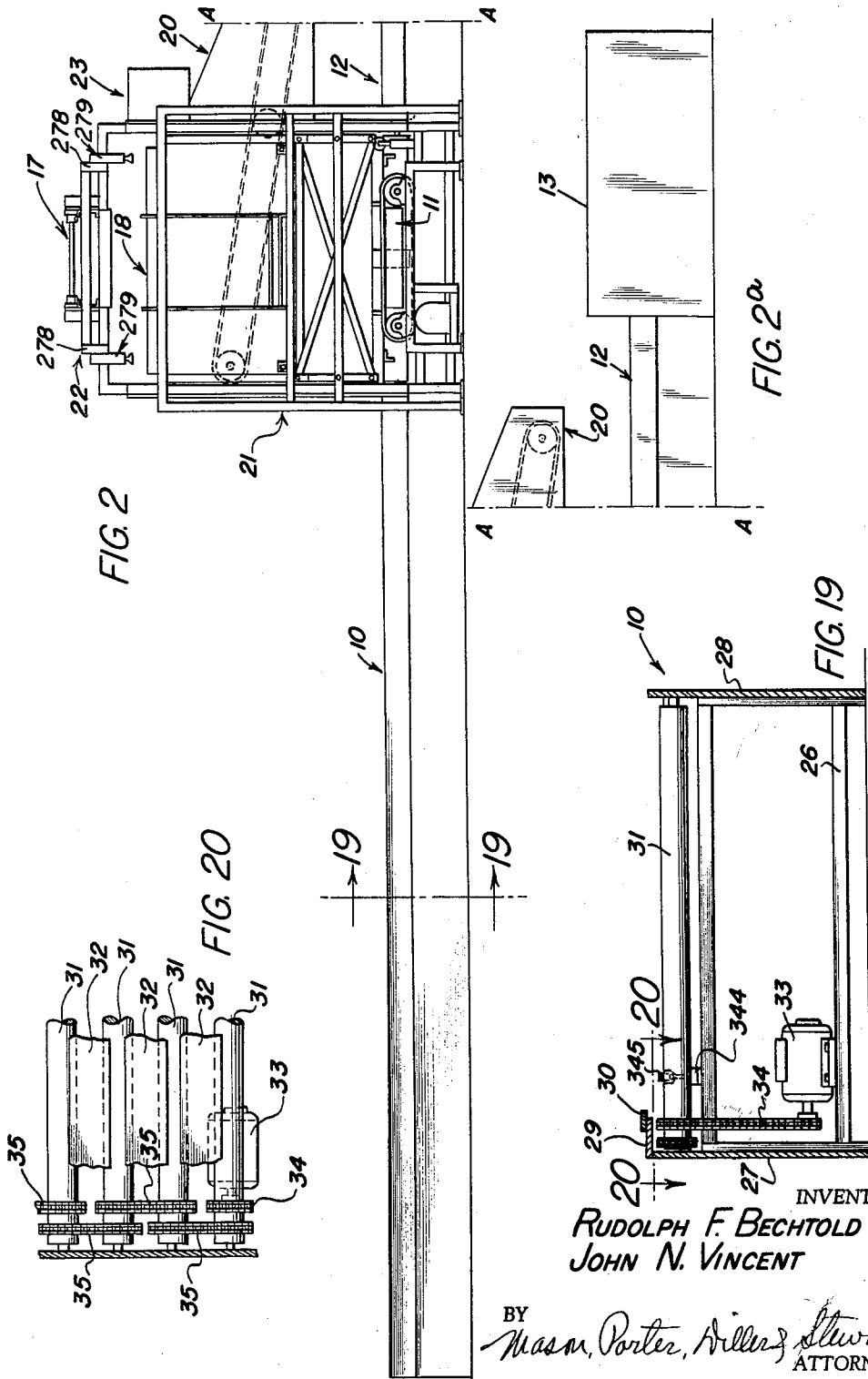
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12 Sheets-Sheet 2



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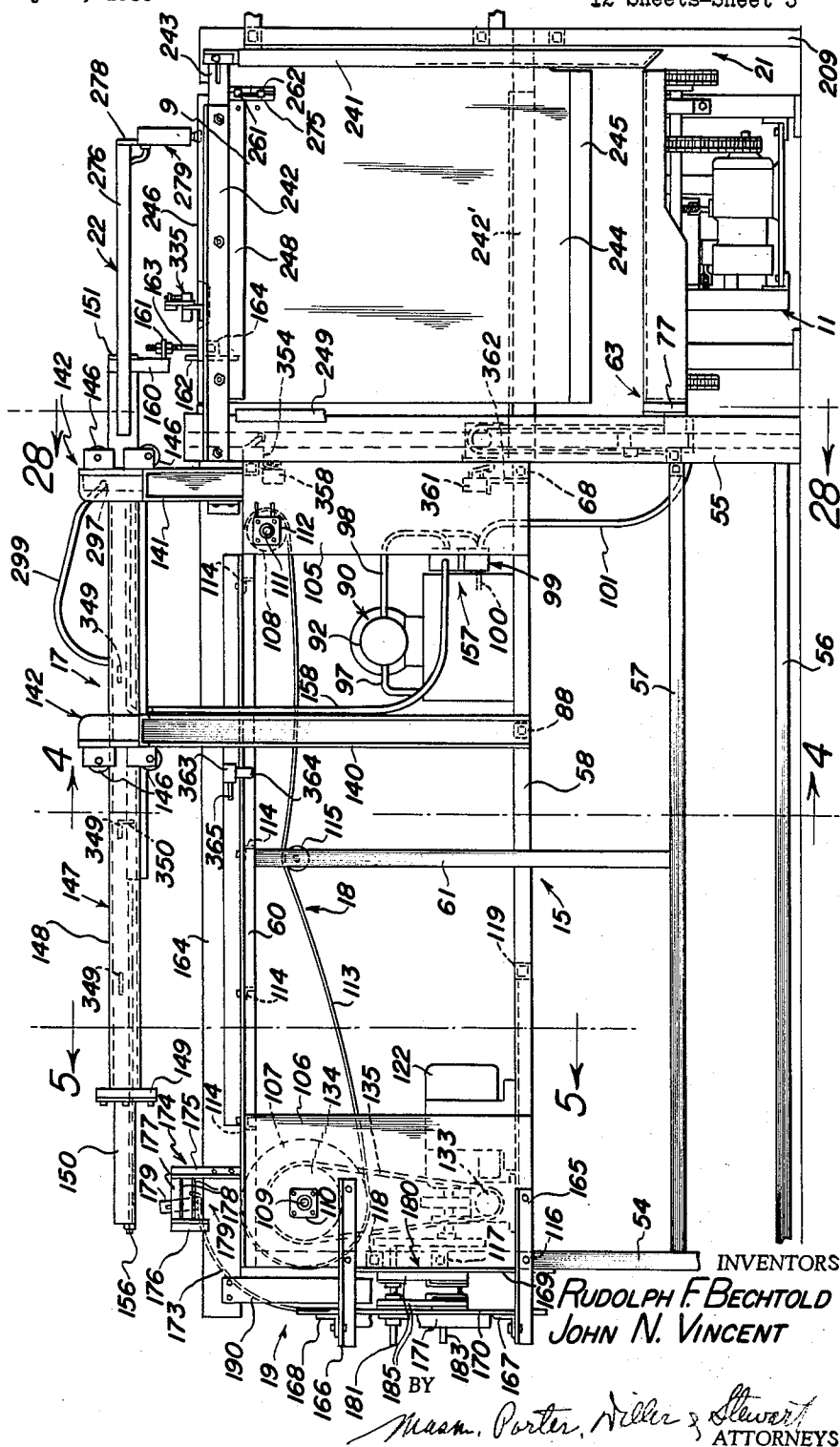
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FIG. 3



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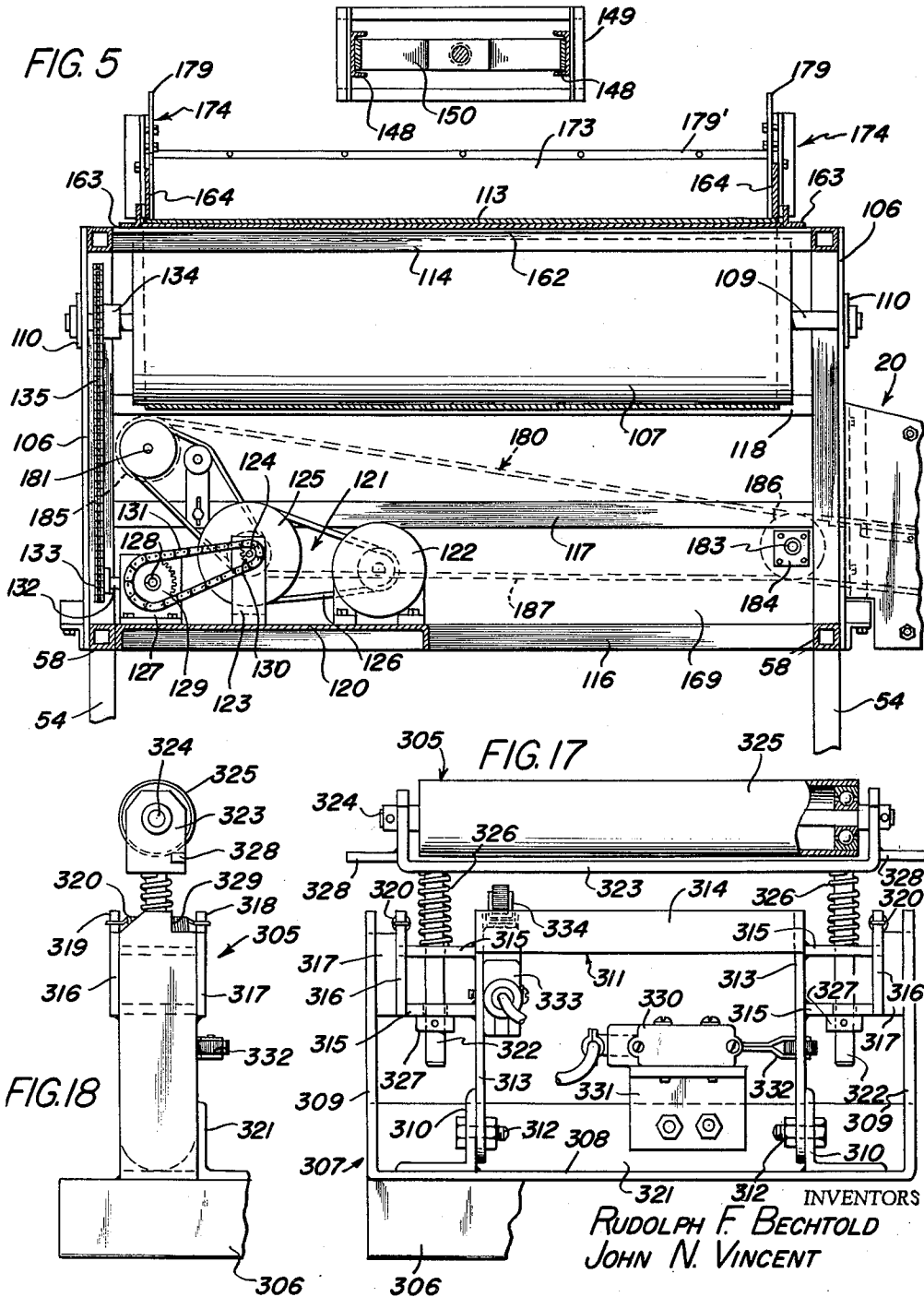
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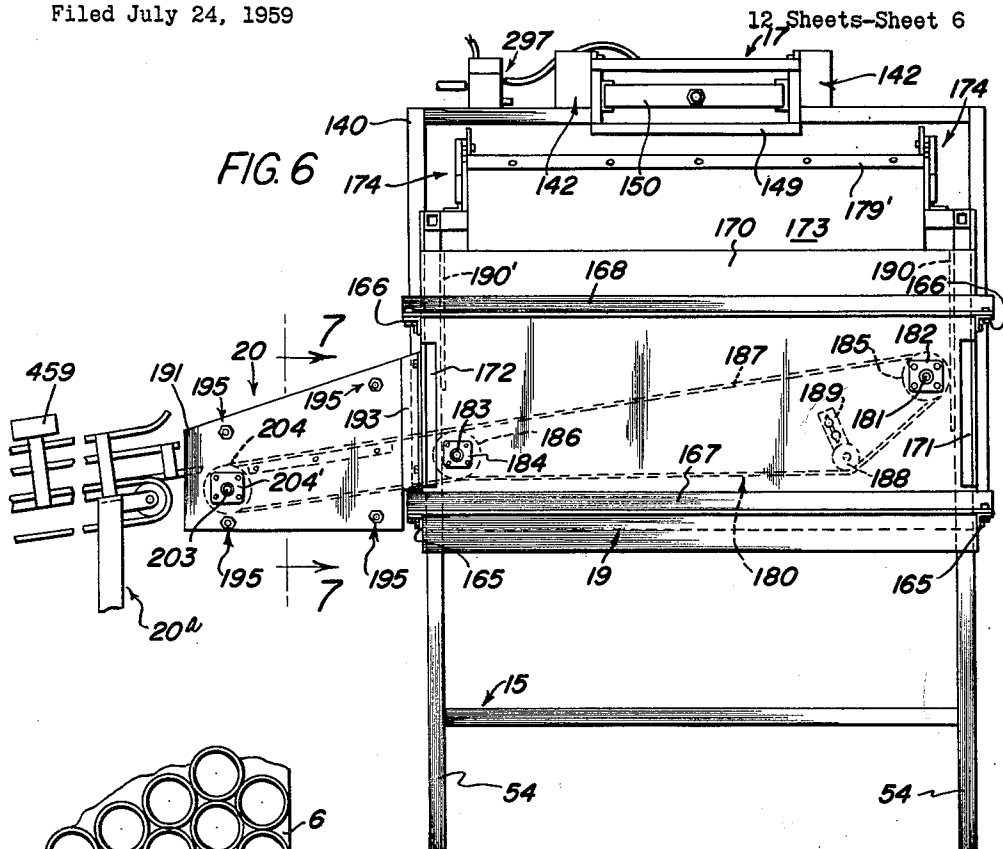
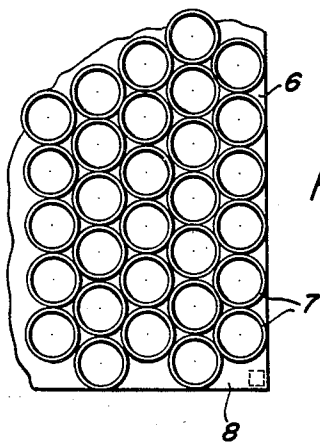
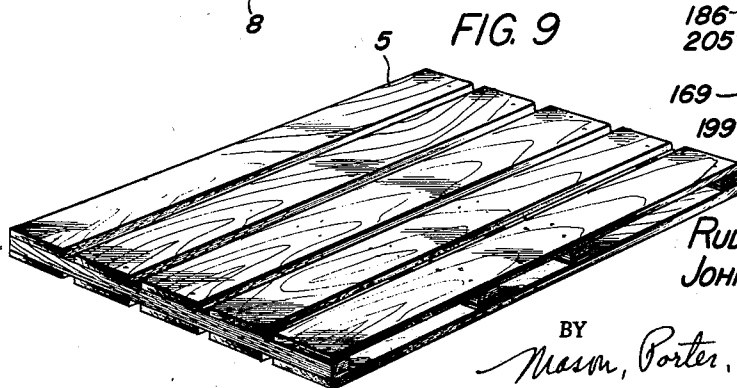
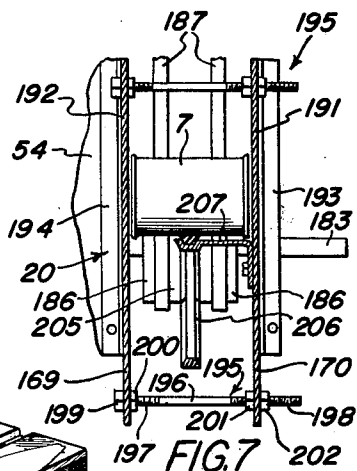
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12 Sheets-Sheet 6



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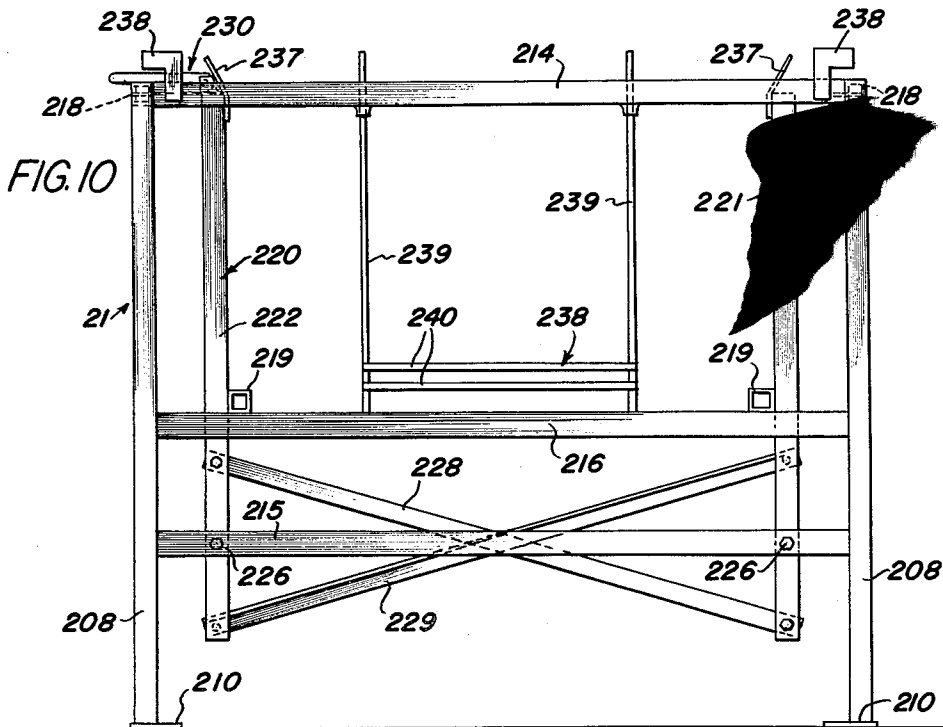
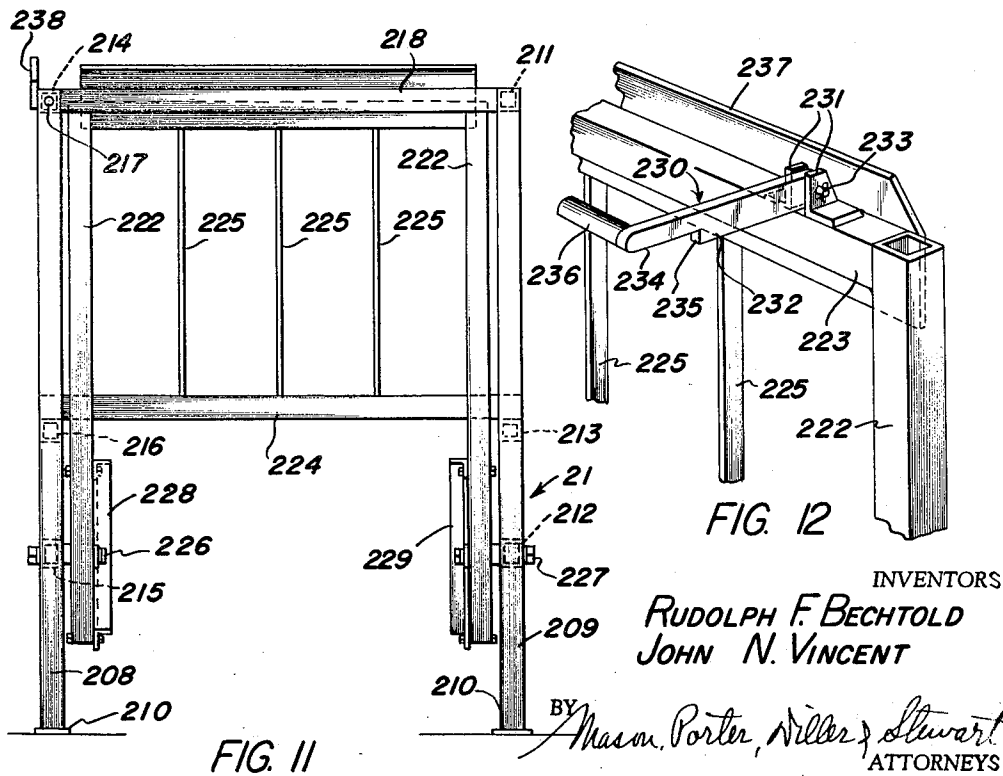
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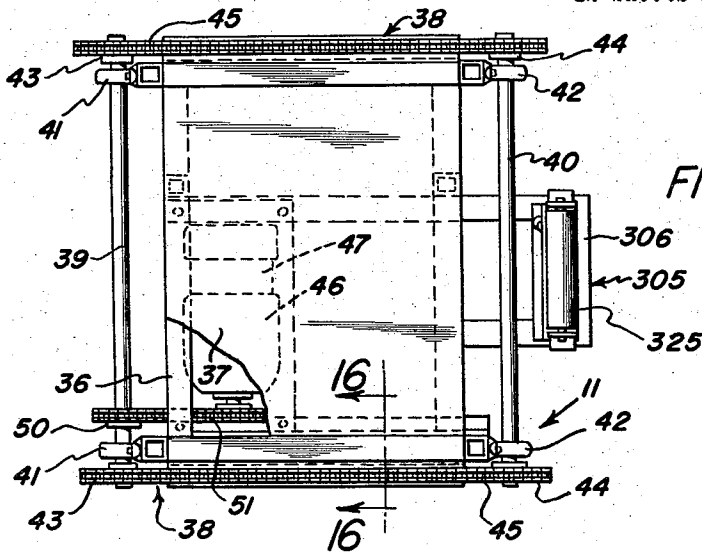


FIG. 13

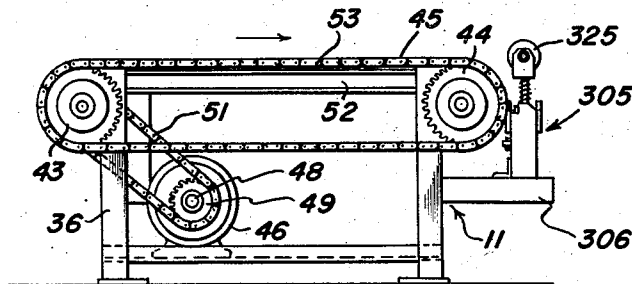


FIG. 14

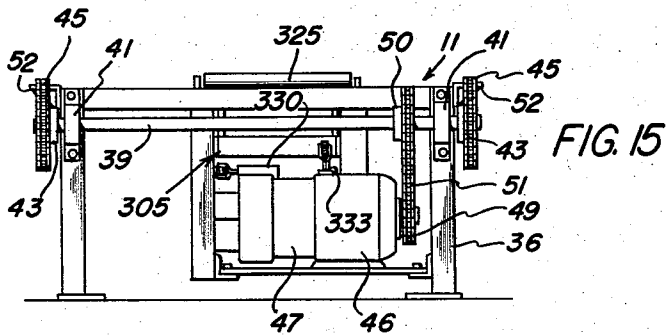


FIG. 15

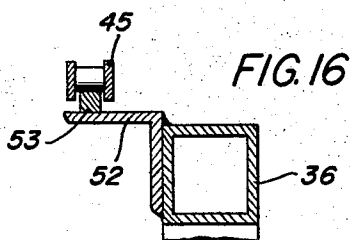


FIG. 16

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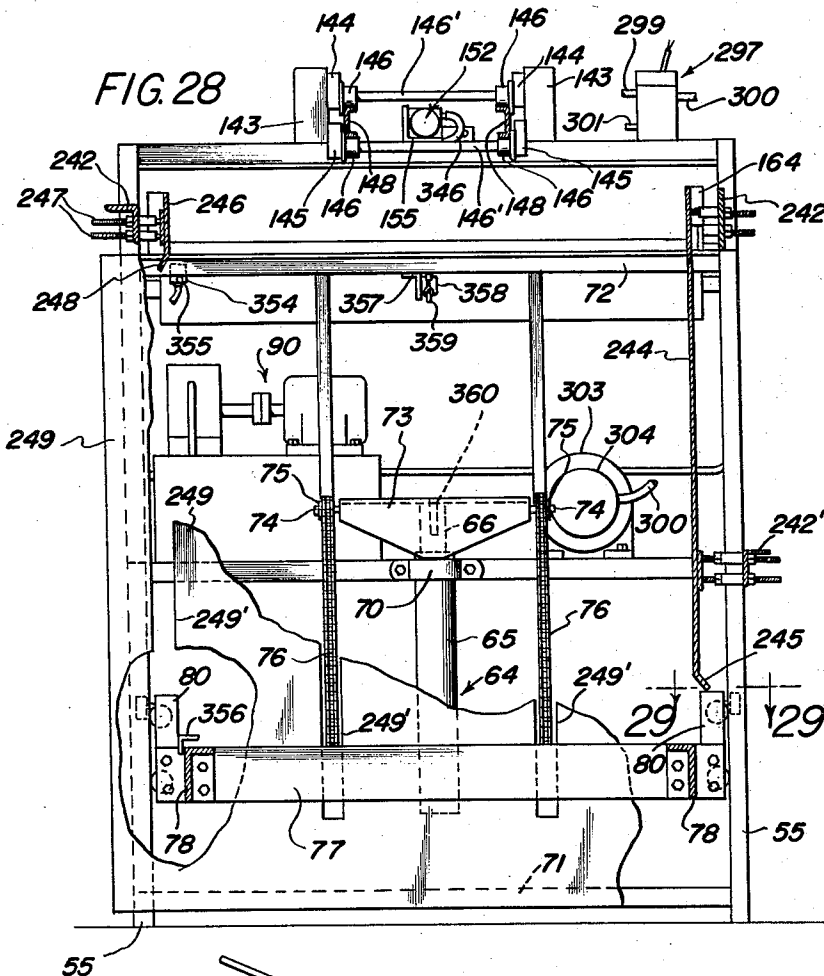
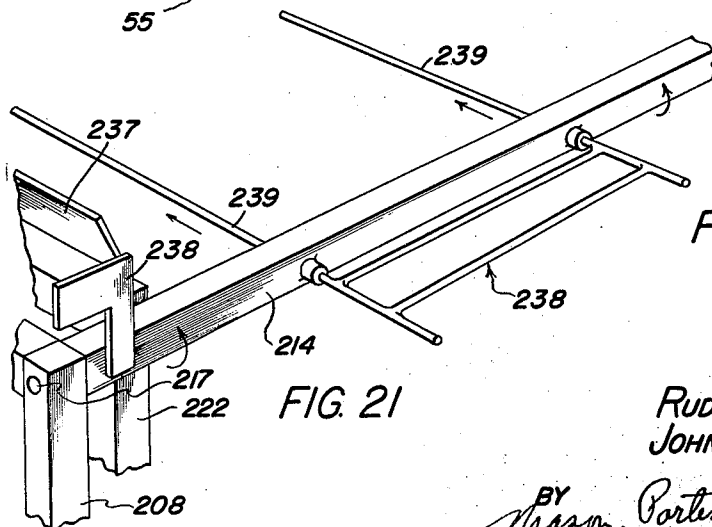
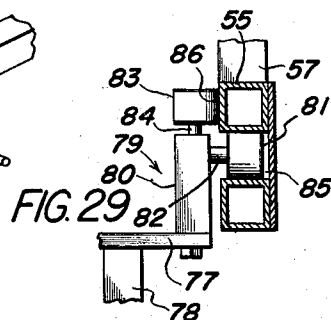
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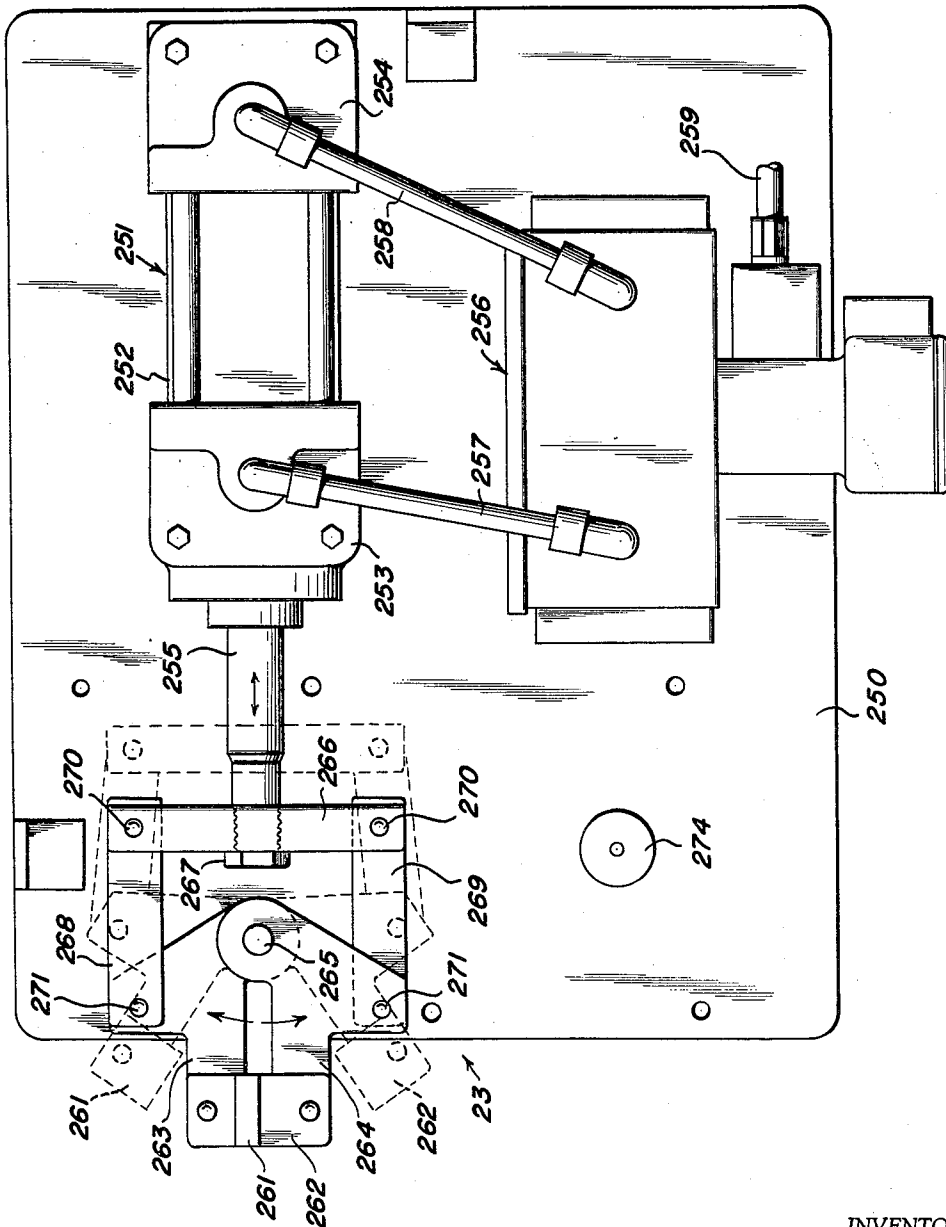


FIG. 22

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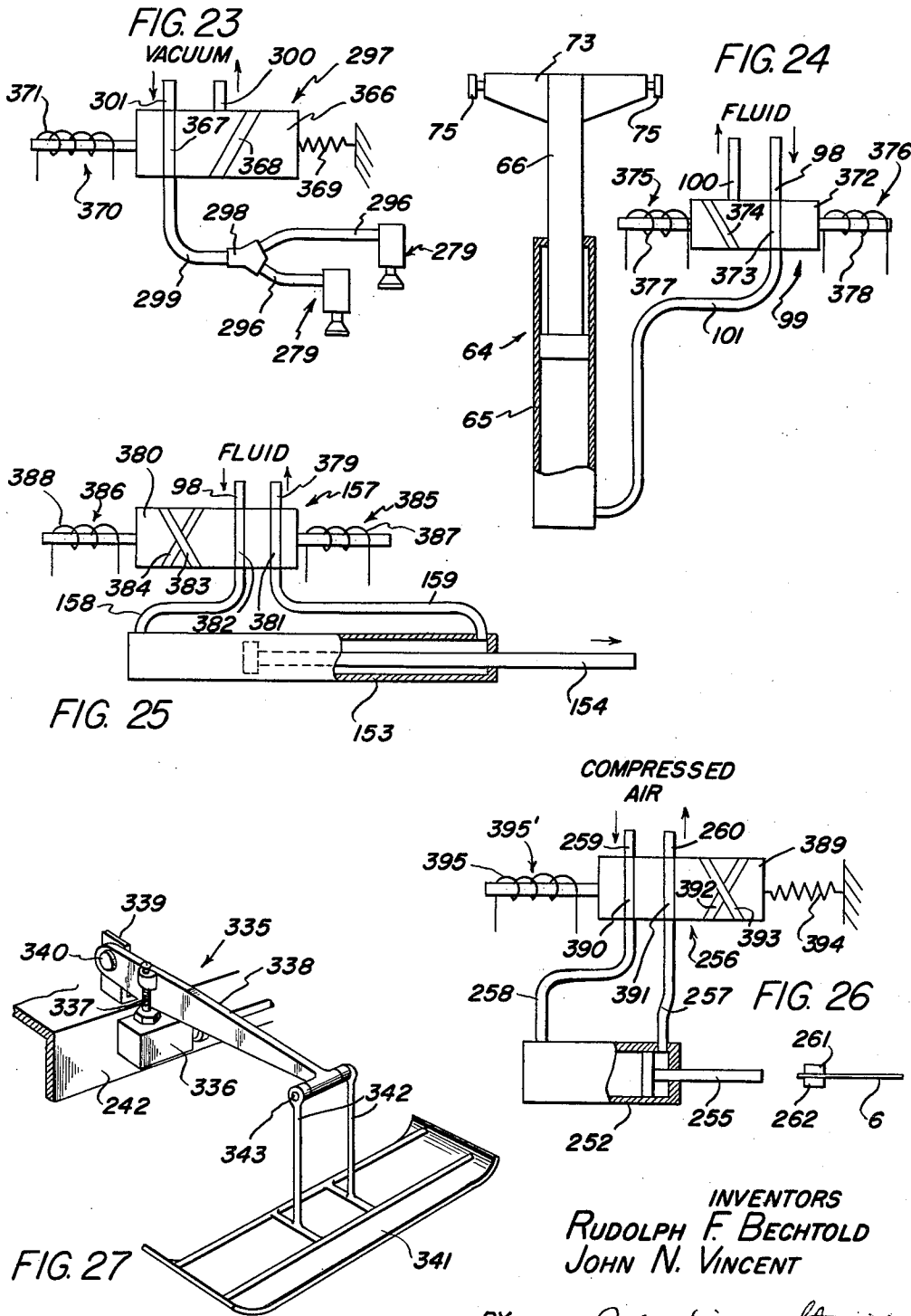
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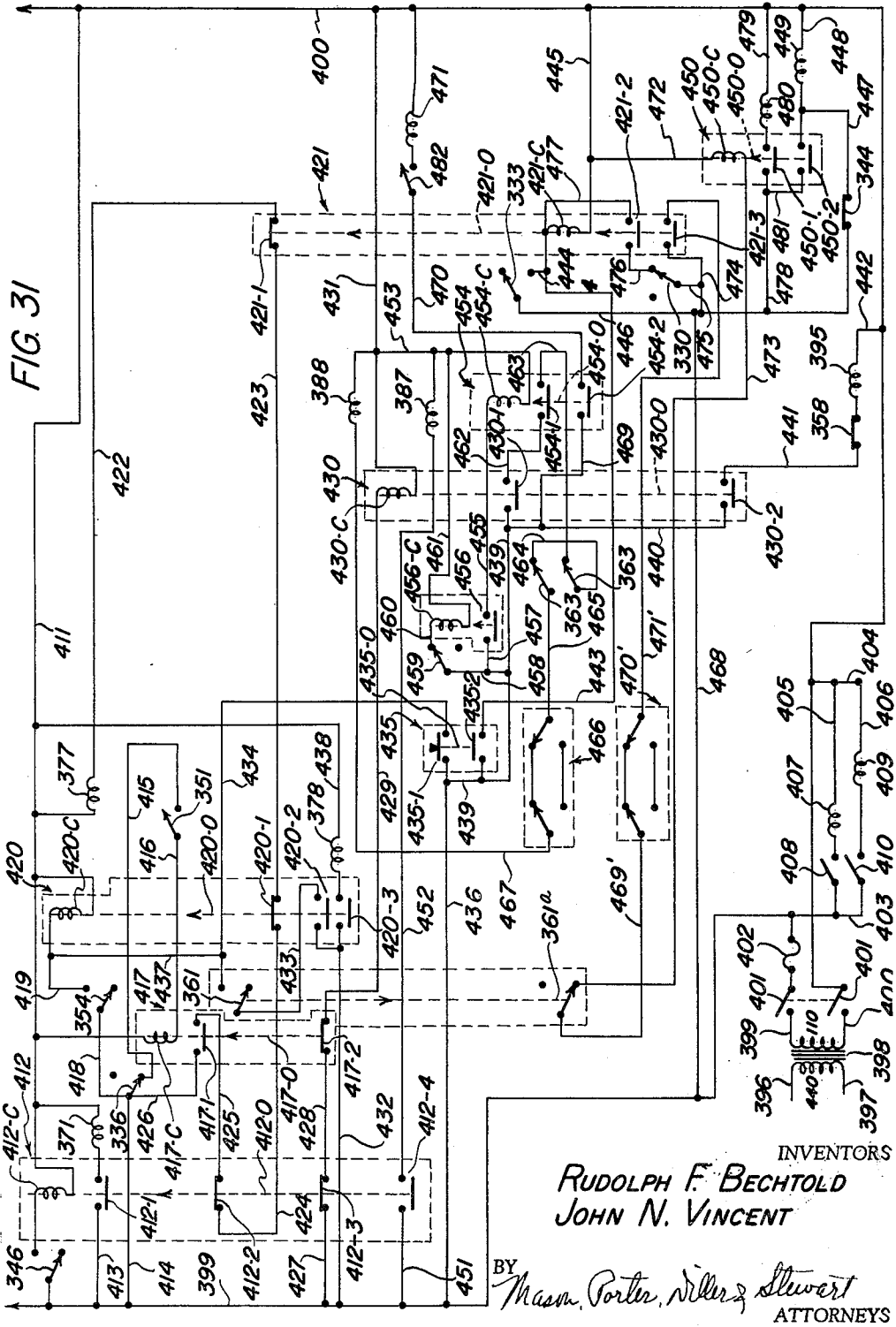
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3,107,794

UNLOADER FOR PALLETIZED BULK CAN PACKAGE

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16 Claims. (Cl. 214—8.5)

The invention relates in general to new and useful improvements in the art of handling cans, and more particularly seeks to provide a novel apparatus for unloading palletized bulk can packages.

The handling of cans has continuously presented a problem to the can making industry. The problem is of such a nature that in the instance of large canneries, under certain conditions, it has been feasible to build a can forming plant next door to the cannery. In other large installations, the cans are shipped in freight cars, the cans being delivered to the freight car by endless conveyors from the can making plant and being delivered from the freight car to the cannery by other conveyors. Even this mode of transportation of cans is relatively expensive due to the fact that the cans must be manually transferred from the conveyor to the railroad car at the can making plant, and from the railroad car to the conveyor at the cannery.

Other attempts to ship cans including the packaging of cans in boxes and bags have been made. Once again, this requires the manual handling of the cans at both ends.

In recent years, it has been found that palletized articles may be readily handled and shipped at a reduction in cost. This will apply equally as well to cans, if the cans can be automatically mechanically stacked and unloaded.

The present invention relates to an improved unloader for palletized cans and primarily seeks to provide a machine which is readily adaptable to all types of installations, and which will efficiently unload the cans arranged in tiers and stacked on a pallet, with the cans being unloaded a tier at a time.

Another object of the invention is to provide an improved unloader for palletized cans wherein the cans are stacked in tiers, the unloader including a hoist which will receive a palletized load of cans and will automatically elevate the cans, tier by tier, so that each tier is sequentially aligned with can take-away means, after which a pusher member automatically pushes all of the cans of a tier off of the package and onto the can take-away means.

Still another object of the invention is to provide an improved unloader for palletized cans, the unloader being of such a construction that a pallet loaded with cans stacked in tiers may be placed upon a conveyor, after which the pallet and the cans are moved by the conveyor to a hoist, the pallet and the cans are then automatically elevated until the uppermost tier of cans is aligned with a can take-away means, which includes a waterfall over which the cans fall and a can blender to unscramble the cans so they leave the unloader in a single line, the machine being of such a nature that it will automatically continue the unloading of the palletized cans, tier by tier, until the pallet is empty, after which the pallet will be automatically discharged from the hoist and another palletized load of cans will be delivered to the hoist.

Another object of the invention is to provide a novel apparatus for unloading cans stacked in tiers on a pallet with the individual tiers of cans being separated by tier separator sheets, the machine being of such a construction that the pallet and the cans stacked thereon are automatically sequentially elevated so that the uppermost tier

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of cans is disposed generally in alignment with can take-away means, after which the tier of cans is automatically pushed from the stack, the tier separator sheet underlying the tiered cans being held during the unloading operation to prevent movement of the tier separator sheet with the cans and the tilting of the stack of cans on the pallet.

A further object of the invention is to provide an apparatus for unloading cans which are palletized in tiers, and wherein the individual tiers of cans are separated by tier separator sheets, the apparatus including means for holding the tier separator sheets during a tier unloading operation, and other means for removing the tier separator sheets and storing the tier separator sheets so that they may be salvaged.

Still another object of this invention is to provide an apparatus for removing tier separator sheets from a palletized bulk can package wherein the cans are stacked in tiers with the tiers separated by a tier separator sheet, and wherein the individual tiers of cans are removed therefrom by a pusher assembly, the pusher assembly also including suction means for engaging and lifting a tier separator sheet, and a bin remote from the palletized package into which the tier separator sheet may be dropped.

Yet another object of the invention is to provide an improved bin for stacking tier separator sheets and the like, the bin being in the form of a generally rectangular cage having an open top, one wall or side of the cage being pivotally connected to the remainder of the cage and being swingable from a generally vertical position to a generally horizontal position within the confines of the cage at the top part thereof, whereby tier separator sheets may be continued to be stacked in the bin while other tier separator sheets are being removed therefrom.

A still further object of the invention is to provide a novel bin for receiving sheets, such as tier separator sheets, the bin including a pair of guides for aligning tier separator sheets dropped into the bin, the guides being pivotally mounted and being swingable apart to facilitate the removal of a stack of tier separator sheets from therebetween.

Yet another object of this invention is to provide a novel conveyor system for automatically conveying palletized products to a hoist upon demand, and for receiving the empty pallets from the hoist after the articles have been unloaded therefrom, and automatically removing the empty pallet from the area of the hoist, the conveyor system including an in-feed conveyor, an out-feed conveyor, and an intermediate conveyor, at least the in-feed conveyor and the intermediate conveyors being separately driven.

With the above, and other objects in view that will hereinafter appear, the nature of the invention will be more clearly understood by reference to the following detailed description, the appended claims, and the several views illustrated in the accompanying drawings.

In the drawings:

FIGURE 1 is a plan view of the unloader, and shows the general arrangement of the various components thereof, an intermediate portion of the in-feed conveyor being broken away.

FIGURES 2 and 2-A when connected along section line A—A present an end view of the unloader of FIGURE 1, looking into the unloader from an end thereof remote from the discharge end and generally normal to the conveyor system axis.

FIGURE 3 is an enlarged fragmentary side elevational view of the unloader, looking into the unloader from the in-feed conveyor side thereof, the in-feed conveyor being omitted for purposes of clarity.

FIGURE 4 is an enlarged transverse vertical sectional

view taken substantially upon the plane indicated by the section line 4—4 of FIGURE 3, and shows the specific details of the interior construction of the unloader.

FIGURE 5 is an enlarged fragmentary transverse sectional view taken along the section line 5—5 of FIGURE 3, and shows the specific details of the drive for the take-away means.

FIGURE 6 is an enlarged fragmentary end view of the unloader taken from the can discharge end thereof, and shows the general arrangement of the take-away means including the waterfall, can blender, and the customer's take-away conveyor.

FIGURE 7 is an enlarged fragmentary transverse sectional view taken along the section line 7—7 of FIGURE 6, and shows the specific details of the blender.

FIGURE 8 is a fragmentary plan view of a palletized stack of cans, the upper tier of cans and the upper tier separator sheet being shown, the part of the tier separator sheet engaged by gripping means to prevent the movement of the tier separator sheet during the transfer of cans being shown by dotted lines.

FIGURE 9 is a perspective view of a typical pallet to be used in conjunction with the invention.

FIGURE 10 is an enlarged elevational view of the bin for receiving tier separator sheets.

FIGURE 11 is an enlarged end view of the bin of FIGURE 10 and shows further the details thereof.

FIGURE 12 is an enlarged fragmentary perspective view of an upper part of one of the guides of the bin, and shows the specific details of the upper part of the guide and a fitting for holding the guide in position for guiding tier separator sheets into the bin.

FIGURE 13 is an enlarged plan view of the intermediate conveyor with a portion thereof broken away and shown in section in order to illustrate the details of the drive thereof.

FIGURE 14 is a side elevational view of the intermediate conveyor and shows the relationship of the swing switch with respect thereto.

FIGURE 15 is an enlarged end view of the intermediate conveyor and shows further the details of the drive therefor.

FIGURE 16 is an enlarged fragmentary sectional view taken along the section line 16—16 of FIGURE 13, and shows the specific details of the mounting of one of the conveyor chains of the intermediate conveyor.

FIGURE 17 is an enlarged elevational view of the swing switch, and shows the specific details of the individual switches and operating mechanism thereof.

FIGURE 18 is an enlarged side elevational view of the swing switch, and shows further the details thereof.

FIGURE 19 is an enlarged fragmentary transverse vertical sectional view taken along the section line 19—19 of FIGURE 2, and shows the specific details of the in-feed conveyor.

FIGURE 20 is an enlarged fragmentary horizontal sectional view taken along the section line 20—20 of FIGURE 19, and shows further the details of the drive of the in-feed conveyor.

FIGURE 21 is an enlarged fragmentary perspective view showing one side of the bin for the tier separator sheets swung upwardly from its normal vertical position to a horizontal position for receiving tier separator sheets while other tier separator sheets are being removed from the bin.

FIGURE 22 is an enlarged elevational view of a gripper mechanism for gripping the tier separator sheets to prevent movement thereof at the time a tier of cans is being pushed therefrom.

FIGURE 23 is a diagrammatic view showing the details of a control valve for the suction cup assemblies which are used in the removal of the tier separator sheets.

FIGURE 24 is a diagrammatic view showing the control valve for the extensible fluid motor of the hoist.

FIGURE 25 is a diagrammatic view showing the de-

tails of the control valve for the extensible fluid motor which operates the pusher member.

FIGURE 26 is a diagrammatic view showing the details of the control valve for the extensible fluid motor of the gripper assembly.

FIGURE 27 is an enlarged perspective view of the switch which is engaged by the cams of the uppermost tier of cans to discontinue the upward movement of the hoist and thus position the uppermost tier of cans at the required elevation for unloading.

FIGURE 28 is an enlarged fragmentary vertical sectional view taken along the section line 28—28 of FIGURE 3, and shows the details of the unloader in the area of the hoist.

FIGURE 29 is an enlarged fragmentary horizontal sectional view taken along the section line 29—29 of FIGURE 28, and shows the manner in which the hoist is guided for vertical movement.

FIGURE 30 is an enlarged fragmentary longitudinal vertical sectional view showing the cans in the process of having been pushed onto the dead plate with one of the cans moving onto the take-away conveyor.

FIGURE 31 is a wiring diagram showing the various controls of the unloader and their electrical circuits.

FIGURE 32 is an enlarged fragmentary sectional view taken through one of the suction cup assemblies, and shows the specific details thereof.

The embodiment of the invention illustrated in the drawings is primarily intended for unloading cans which are stacked in tiers on a pallet and transferring such cans to a single line conveyor. The cans are stacked on a conventional pallet, such as the pallet 5 illustrated in FIGURE 9. The pallet 5 is of the type which may be readily engaged by a fork lift truck to facilitate movement of the palletized bundle of cans. The cans will be stacked in tiers on the pallet 5 with each tier of cans being separated by a tier separator sheet 6. The tier separator sheet 6 is preferably in the form of a relatively stiff paper product which may be salvaged and reused. It is to be noted that the cans, which are referred to by the numeral 7, are disposed in staggered rows on the tier separator sheet 5 so as to occupy a minimum of space. It is also to be noted that a corner of the tier separator sheet 6, as at 8, is vacant, thus facilitating the gripping thereof in a manner to be described hereinafter.

The general lay-out of the de-palletizing machine is illustrated in FIGURE 1. The de-palletizing machine includes a hopper 9 into which a can package is moved as an initial step in the de-palletizing of the cans 7. This is accomplished through an in-feed conveyor, generally referred to by the numeral 10, which is aligned with an open side of the hopper 9. An intermediate conveyor, which is generally referred to by the numeral 11, is disposed in the bottom part of the hopper 9 for receiving a palletized packet of cans from the in-feed conveyor 10 and positioning such palletized stack of cans within the hopper 9. An out-feed conveyor 12 is aligned with the in-feed conveyor 10 and the intermediate conveyor 11 for receiving empty pallets 5 which are delivered to a suitable platform area 13.

A hoist assembly, generally referred to by the numeral 14, is positioned within the hopper 9 for receiving a palletized can package. The hoist assembly 14 is provided for the purpose of elevating a palletized can package so that the individual tiers of cans may be progressively disposed at an unloading level.

The hopper 9 is generally defined by a frame structure, generally referred to by the numeral 15. The frame structure 15 also supports many of the other components of the de-palletizing machine, including the hoist 14. The de-palletizing machine also includes a dead plate 16 which is supported by the frame 15 at the unloading elevation. The hoist 14 will elevate an uppermost tier of cans 7 until the bottoms of the cans 7 are disposed slightly above the elevation of the dead plate 16. A pusher assembly,

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generally referred to by the numeral 17, is mounted on the frame 15 above the main part of the de-palletizing machine and in overlying relation to the hopper 9. The pusher assembly will engage the cans 7 of an uppermost tier of cans and move them off of the uppermost tier separator sheet onto the dead plate 16.

A can take-away conveyor 18 is supported by the frame 15 with one end thereof underlying the dead plate 16 for receiving cans 7 from the dead plate 16. The other end of the take-away conveyor 18 terminates in a waterfall, generally referred to by the numeral 19, where the cans 7 are turned from an upstanding position to a generally horizontal position. A blender, generally referred to by the numeral 20, is associated with the waterfall 19 for delivering cans 7 in a single line side by side into the customer's single line take-away conveyor, generally referred to by the numeral 20a.

A bin, generally referred to by the numeral 21, for receiving tier separator sheets 6 is disposed along one side of the hopper 9 remote from the dead plate 16. After each tier of cans 7 has been removed from the palletized package of cans, the tier separator sheet 6 which is then uppermost, is removed. This is accomplished by a tier separator sheet removing mechanism, generally referred to by the numeral 22. The tier separator sheet removing mechanism 22 is supported by the pusher assembly 17 and operated in conjunction therewith. The tier separator sheet removing mechanism 22 picks up the exposed uppermost tier separator sheet 6 and transfers it to the bin 21. Incidentally, a gripping mechanism, generally referred to by the numeral 23, is provided for gripping a tier separator sheet during the period when an uppermost tier of cans 7 is being pushed off of the uppermost tier separator sheet 6.

Suitable platforms 24 and 25 are disposed alongside the take-away conveyor 18, the hopper 9 and the bin 21. The platforms 24 and 25 are for the purpose of supporting the operator of the de-palletizing machine in positions where he can readily inspect the operation thereof.

The in-feed conveyor 10 is that part of the depalletizing machine which is first engaged by a palletized can package. Accordingly, the details of the in-feed conveyor 10 will be set forth first.

The in-feed conveyor 10 includes a suitable frame 26 to which a pair of side panels 27 and 28 are secured. The side panel 27 terminates at its upper end in a guide 29 which is horizontally disposed and which has connected thereto a resilient rub rail 30. In this manner, a pallet, such as the pallet 5, is properly aligned on the in-feed conveyor 10.

The in-feed conveyor 10 also includes a plurality of feed rollers 31 which extend between the side panels 27 and 28. The feed rollers 31 are spaced apart and suitable supporting plate portions 32 extend therebetween. The feed rollers 31 do, however, project slightly above the plates 32 to facilitate the movement of a pallet or the like along the feed rollers 31.

An electric motor 33 drives the in-feed conveyor 10. The electric motor 33 is mounted in a lower part of frame 26 within the general confines thereof. A chain drive 34 between the electric motor and one of the feed rollers 31 is provided. Other chain drives 35 are provided between adjacent feed rollers 31. The chain drives 35 are disposed in offset staggered relation, as is best shown in FIGURE 20.

A palletized package of cans 7 is delivered to the intermediate conveyor 11 from the in-feed conveyor 10. Accordingly, the details of the intermediate conveyor 11 will be set forth next.

The intermediate conveyor 11 includes a suitable rectangular frame 36. The frame 36 has a cover plate 37 secured to the upper surface thereof. A pair of endless conveyor chain assemblies 38 are supported by the frame 36 along opposite sides thereof.

The two conveyor chain assemblies 38 operate in

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unison and include a common drive shaft 39 and a common idler shaft 40. The drive shaft 39 is secured to the frame 36 for rotation through a pair of pillow blocks 41 which are secured to upright members of the frame 36. Other pillow blocks 42 are secured to upright frame members of the frame 36 remote from the pillow blocks 41 and the idler shaft 40 is rotatably journaled in the pillow blocks 42. A pair of drive sprockets 43 is secured to the outer ends of the drive shaft 39. A pair of idler sprockets 44, which are similar to the drive sprockets 43, are secured to the outer ends of the idler shaft 40. Conveyor chains 45 are entrained over the pairs of sprockets 43 and 44.

A speed reducer 46 is mounted on the frame 36 within the confines thereof in the manner best illustrated in FIGURE 15. The speed reducer 46 is driven by an electric motor 47. The speed reducer 46 includes an output shaft 48 on which a drive sprocket 49 is mounted. The drive sprocket 49 is aligned with a sprocket 50 secured to the drive shaft 39 for rotation therewith. A drive chain 51 is entrained over the sprockets 49 and 50.

The conveyor chains 45 support the weight of a palletized can package. Accordingly, it is necessary that the upper runs of the conveyor chains 45 be provided with suitable supports. A typical support assembly is illustrated in FIGURE 16. The support assembly includes an elongated support member 52 which is secured to an upper frame member of the frame 36 and projects outwardly therefrom. A guide track 53 is secured to the support member 52 and projects upwardly therefrom in alignment with an associated one of the conveyor chains 45. The upper run of the conveyor chain 45 rides on the guide track 53 and is supported thereby.

The general details of the frame 15 are best illustrated in FIGURES 3 and 4. The frame 15 includes a first pair of standards 54, disposed at the left end thereof, as viewed in FIGURE 3, and a second pair of standards 55 disposed at the right end thereof, the standards 55 to be described in more detail hereinafter. A pair of lower frame members 56 extend between the pairs of standards 54 and 55. Intermediate frame members 57 and 58 are disposed above the frame members 56. Top frame members 60 connect together upper ends of the standards 54 and 55 at each side of the frame 15. Vertical frame members 61 connect together intermediate portions of the frame members 57, 58 and 60. The frame 15 includes a plurality of transverse frame members which will be described in detail as the description of the components of the de-palletizing machine continues.

The specific details of the hoist 14 are best illustrated in FIGURES 4, 28 and 29. The hoist 14 includes a lifting mechanism, generally referred to by the numeral 62, and a platform, generally referred to by the numeral 63.

The lifting mechanism 62 includes an extensible fluid motor, generally referred to by the numeral 64. The fluid motor 64 is of the conventional type, and includes an upstanding cylinder 65 and a piston rod 66, which projects from the upper end of the cylinder 65. The frame 15 includes a transverse frame member 67 which extends between the longitudinal frame members 57 immediately adjacent the standards 55. A similar transverse frame member 68 extends between the longitudinal frame members 58 immediately adjacent the standards 55. Suitable clamps 69 and 70 are connected to the transverse frame members 67 and 68, respectively, and secure the cylinder 65 in place with respect to the frame 15. At this time, it is pointed out that the frame 15 also includes a lower transverse frame member 71, which extends between the longitudinal frame members 56, and an upper transverse frame member 72, which extends between the longitudinal frame members 60, the frame members 71 and 72 lying in a common plane with the frame members 67 and 68.

The lift mechanism 62 also includes a cross-head 73 which is secured to the upper end of the piston rod 66 and which extends transversely of the frame 15. A pair of stub shafts 74 project outwardly from opposite ends of the cross-head 73. Sprockets 75 are freely rotatably journaled on the stub shafts 74. A lifting chain 76 is entrained over each of the sprockets 75 and has one end thereof terminally connected to the transverse frame member 67. The opposite end of each of the lifting chains 76 is connected to the platform 63.

The platform 63 includes a transverse frame member 77 and a pair of forwardly extending arms 78 which are secured to one side of the transverse frame member 77. The arms 78 are spaced apart a relatively great distance and when the arms 78 are in their lowered positions, they will be disposed at opposite ends of the intermediate conveyor 11. The intermediate conveyor 11 is of a length less than the length of a pallet 5, and the arms 78 are spaced apart a distance also less than the length of a pallet. Thus, when the arms 78 are in lowered positions, a pallet may be positioned on the intermediate conveyor 11, after which the arms 78 may be elevated to move a pallet off of the intermediate conveyor 11.

The elements of the platform 63 are guided in their vertical movement by a guide assembly, which is generally referred to by the numeral 79, there being one guide assembly 79 disposed at each end of the transverse frame member 77. One of the guide assemblies 79 is best illustrated in FIGURE 29.

Each guide assembly 79 includes an upstanding support member 80 which is secured to a respective end of the transverse member 77 on the side thereof remote from the arms 78. The support member 80 projects upwardly above the transverse support member 77 and has upper and lower sets of guide wheels and rollers fixed thereon. Each set includes a guide wheel 81 which is mounted on a horizontal, transversely disposed axle 82, and a guide roller 83 which is mounted on the horizontal longitudinally extending axle 84. Each of the standards 55 is in the form of a guide and includes a vertical guideway 85 in which the guide wheels 81 are received, and an inner guide surface 86 against which the guide rollers 83 bear. In this manner, the platform 63 is mounted for vertical movement.

A pair of fittings 87 is secured to the face of the transverse support member 77 remote from the arms 78. The fittings 87 are utilized to secure the chains 76 to the platform 63. Since the opposite ends of the chains 76 are terminally fixed to the transverse frame member 67, when the cross-head 73 is moved upwardly, the platform 63 will move upwardly at twice the rate of movement of the cross-head 73. In this manner, a relatively short stroke of the fluid motor 64 may be converted into a relatively great movement of the platform 63 and the platform 63 may be disposed generally coplanar with the cross-head 73 at the upper end of the stroke of the fluid motor 64.

Another transverse frame member 88 extends transversely between the longitudinal frame members 58 to the left of the transverse frame member 68. This is best shown in FIGURE 3. A suitable platform 89, which is shown in FIGURE 4, extends between the transverse frame members 68 and 88 and is supported thereby. A hydraulic pump assembly 90 is mounted on the platform 89.

The hydraulic pump assembly 90 includes a hydraulic fluid reservoir 91 which is seated directly on the platform 89. A hydraulic pump 92 is seated on the reservoir 91 in alignment with an electric motor 93. The electric motor 93 has an armature shaft 94 which is aligned with a drive shaft 95 of the pump 92 and is connected thereto through a coupling 96. The hydraulic pump 92 is connected to the reservoir 91 by a hydraulic line 97. A hydraulic line 98 extends from the pump 92 to a con-

trol valve 99 which is mounted on a side of the reservoir 91 and is communicated with the fluid reservoir 91 through a hydraulic line 100. A hydraulic line 101 extends from the control valve 99 to the bottom of the cylinder 65 to facilitate the operation of the extensible fluid motor 64. The details of the control valve 99 will be described hereinafter.

Reference is now made to FIGURE 30 in particular, wherein the details of the dead plate 16 are illustrated. A transverse frame member 102 extends between the standards 55 and to the right of the transverse frame member 72, as viewed in FIGURE 30. Straps 103 and 104 overlie the transverse frame members 72 and 102, respectively. The dead plate 16 is seated on the straps 103 and 104, and extends to the left of the transverse frame member 72 and terminates in overlying relation to the take-away conveyor 18.

Referring now to FIGURE 3 in particular, it will be seen that a plate 105 is disposed to the left of each of the standards 55 and extends between the longitudinal frame members 58 and 60. A similar plate 106 is disposed to the right of each of the standards 54 and extends vertically between the frame members 58 and 60.

The take-away conveyor 18 includes a drive roller 107 and an idler roller 108. The drive roller 107 includes a shaft 109 which extends through the plates 106 and has the ends thereof rotatably journaled in bearing members 110 secured to the plates 106. The idler roller 108 includes a shaft 111 which extends through the plates 105 and which has its ends rotatably journaled in bearing members 112 secured to the plates 105. The bearing members 112 are adjustably secured to the plates 105 to vary the tension of a conveyor belt 113 which is entrained over the rollers 107 and 108. Incidentally, while the conveyor belt 113 may be of any type, it is preferably of the mesh type.

The upper run of the conveyor belt 113 is supported by a plurality of transverse frame members 114 which extend between the longitudinal frame members 60 and directly underlie the upper run of the conveyor belt 113. An intermediate part of the lower run of the conveyor belt 113 is supported by a transverse roller 115. The roller 115 extends between and is supported by upper portions of the upright 61.

Reference is now had to FIGURES 3 and 5, wherein further details of the frame 15 are shown. At the left end of the frame 15, a plurality of transverse frame members are provided. These transverse frame members include a transverse frame member 116 which is aligned with the longitudinal frame members 58. Other transverse frame members 117 and 118 are disposed above the transverse frame member 116. Also, a transverse frame member 119 extends between the longitudinal frame members 58 to the right of the transverse frame member 116. A platform 120 extends between the transverse frame members 116 and 119 within the frame 15 and adjacent one of the longitudinal frame members 58. A drive assembly, generally referred to by the numeral 121, is mounted on the platform 120.

The drive assembly 121 includes an electric motor 122 which is mounted on the platform 120. If desired, the electric motor 122 may be in the form of a combined electric motor and reduction gear drive unit. A pair of uprights 123 are disposed to the left of the electric motor 122 and are longitudinally aligned. A longitudinal shaft 124 extends through the uprights 123 and is rotatably journaled relative thereto. A large diameter drive wheel 125 is secured to the shaft 124 for rotation therewith and is coupled to the electric motor 122 by means of a drive belt 126.

A right angle reduction gear drive unit 127 is mounted on the platform 120 adjacent the left edge thereof, as viewed in FIGURE 5. The drive unit 127 includes an input shaft 128 which is disposed parallel to the shaft 124. The input shaft 128 carries a sprocket 129 which

is aligned with a sprocket 130 on the shaft 124. A drive chain 131 is entrained over the sprockets 129 and 130 to drivingly connect the drive unit 127 to the shaft 124.

The drive unit 127 also includes an output shaft 132 which is disposed parallel to the drive shaft 109 of the drive roller 107. The output shaft 132 has a sprocket 133 secured thereto, which is aligned with a sprocket 134 on the shaft 109. A drive chain 135 is entrained over the sprockets 133 and 134 to drivingly connect together the shafts 109 and 132. Incidentally, when the conveyor belt 113 is of the mesh type, the drive roller 107 may have a rubber coating of a waffle pattern to match the mesh of the conveyor belt 113 and thus facilitate the positive driving thereof.

The pusher assembly 17 includes a pair of U-shaped supports 140 and 141 which extend upwardly from the frame 15. The U-shaped support 141 is secured to the longitudinal frame members 60 adjacent the standards 55. On the other hand, the inverted U-shaped support 140 is disposed to the left of the support 141 and is relatively long. The U-shaped support 140 is secured to the longitudinal frame members 58 and 60.

A set of guides, generally referred to by the numeral 142, extends upwardly from the horizontal portion of each of the supports 140 and 141 on opposite sides of the center line of the frame 15. Each pair of sets of guides 142 is disposed in opposed relation, as is best shown in FIGURE 4.

Each set of guides 142 includes an upstanding mounting member 143, which is secured to the horizontal portion of the respective one of the supports 140 and 141. The mounting member is generally T-shaped in cross-section and upper and lower mounting plates 144, 145 are secured thereto. Each of the mounting plates 144, 145 carries a guide roller 146. The guide rollers 146 of each pair are in vertically aligned relation and are of the stepped type so as to limit the movement of a frame disposed therebetween both vertically and horizontally. The horizontally opposed guide rollers 146 have common shafts 146'.

The pusher assembly 17 also includes an elongated frame generally referred to by the numeral 147. The frame 147 is formed of a pair of elongated frame rails 148 which are of a channel section and are disposed between the guide rollers 146. The left end of the frame 147 includes an open, generally vertically disposed frame 149 into which the ends of the frame rails 148 terminate. A generally V-shaped in plan extension 150 is secured to the frame 149 and the frame rails 148. A transverse frame member 151 extends across the right ends of the frame rails 148, as viewed in FIGURE 3.

Since the frame rails 148 of the frame 147 are disposed between the guide rollers 146, it will be apparent that the frame 147 is mounted for longitudinal sliding movement only. The frame 147 is reciprocated by means of an extensible fluid motor, generally referred to by the numeral 152. The fluid motor 152, as is best shown in FIGURE 1, includes a cylinder 153 and a piston rod 154. The cylinder 153 is secured to an angle member 155 which rests on top of the horizontal portions of the supports 140 and 141, and extends longitudinally therebetween. The piston rod 154 is secured to the extension 150, as at 156.

The operation of the extensible fluid motor 152 is controlled by a control valve, generally referred to by the numeral 157. The extensible fluid motor 152 is of the double-acting type and has fluid lines 158 and 159 connected to opposite ends thereof. The fluid lines 158 and 159 are connected to the control valve 157. The control valve 157 is connected to the pump 92 by the fluid line 98 and is communicated with the reservoir 91 by line 379. The operation of the control valve 157 will be described in detail hereinafter.

A pair of hangers 160 extend down from the right hand ends of the frame rails 148 (FIGURE 3). A trans-

verse strap 161 extends between the hangers 160. A pusher plate 162 is supported from the strap 161. This is accomplished through a pair of vertically adjustable hangers 163 which are secured to the strap 161. The lower ends of the hangers 163 are connected to a reinforcing member 164 secured to the right hand surface of the pusher plate 162, as viewed in FIGURE 3. The left hand face of the pusher plate 162 is preferably covered with a rubber composition or the like, which is referred to by the numeral 165.

After the cans 7 which form the uppermost tier of the palletized can package are pushed onto the dead plate 16 by the pusher assembly 17, the movement of additional cans 7 onto the dead plate 16 results in the movement of the first cans onto the top run of the conveyor belt 113. As was stated above, the top run of the conveyor belt 113 is supported by a plurality of transverse frame members 114. A support plate 162 rests upon the transverse frame members 114 and underlies the top run of the conveyor belt 113. It is to be noted that the support plate 162 is of a greater width than the endless belt 113. A pair of longitudinally extending angle members 163 are supported on the transverse frame members 114 alongside the edges of the support plate 162. The angle members 163, in turn, support upstanding guides 164 for cans which may be disposed upon the endless conveyor belt 113, the guides 164 being disposed slightly above the endless conveyor belt 113 upper run and slightly inwardly of the edges thereof.

The cans 7 deposited on the endless conveyor belt 113 are moved to the left end of the take-away conveyor 18 and are deposited in the waterfall 19. As is best shown in FIGURES 3, 5 and 6, the waterfall 19 includes a pair of angle members 165 and 166 which are secured to the plates 106. A transverse angle member 167 is secured to and extends between the angle members 165. A second transverse angle member 168 is secured to and extends between the angle members 166. A first vertical guide plate 169 is secured to the left end of the frame 15 and is attached to the standards 54 and the transverse frame members 116, 117 and 118. A second vertical guide plate 170 extends transversely of the frame 15 in spaced parallel relation to the guide plate 169. The guide plate 170 is secured to the angle members 167 and 168 and is reinforced adjacent its ends by vertical angle members 171 and 172.

It is to be noted that the surface of the guide plate 169 which is the inner surface thereof is disposed substantially coplanar with the extremity of the endless conveyor belt 113. Thus, the endless conveyor belt 113, as it moves about the drive roller 107, forms a lower half of the upper guide part of the waterfall 19. The waterfall 19 also includes a flexible curved guide 173. The guide 173 is formed of sheet material and has its lower end secured to the upper part of the guide plate 170. The guide member 173 is of a lesser width than the guide plates 169 and 170, as is clearly shown in FIGURE 6.

A support structure is provided for opposite upper corners of the guide member 173, each support structure being generally referred to by the numeral 174. Each support structure 174 includes a pair of angle members 175 and 176 which are secured to respective ones of the guides 164 for the top run of the conveyor belt 113. A plate 177 extends between the angle members 175 and 176. The plate 177 is provided with longitudinally extending slots 178 which adjustably receive fasteners which, in turn, secure brackets 179 to the plates 177. The brackets 179 are slotted so as to be vertically adjustable, and are connected to a transverse support bar 179' to which the upper edge of the guide member 173 is attached.

It is to be understood that the waterfall 19 is to accommodate cans of various heights. Accordingly, it is necessary that the spacing between the guides thereof be variable. The spacing between the guide plates 169 and

170 is accomplished by adjusting the position of the guide plate 170. The brackets 179, being adjustable with respect to the plate 177, permit the necessary adjustment of the guide members 173. Cans 7, as they move to the end of the endless conveyor belt 113, ride over the curved portion of the endless conveyor belt 113 about the roller 107 and within the confines of the guide member 173. The cans 7 are then deposited in horizontal positions between the guide plates 169 and 170.

A conveyor belt assembly, generally referred to by the numeral 180, is positioned in the lower part of the waterfall 19 between the guide plates 169 and 170. The conveyor belt assembly 180 includes a drive shaft 181 which extends through the guide plates 169 and 170 and is rotatably journaled in suitable bearing members 182 carried by the guide plates 169 and 170. An idler shaft 183 also extends through the guide plates 169 and 170 and is rotatably journaled in bearing assemblies 184 carried by the guide plates 169 and 170.

A pair of transversely spaced guide pulleys 185 are adjustably carried by the drive shaft 181 within the confines of the guide plates 169 and 170. A pair of idler pulleys 186 are adjustably secured to the idler shaft 183 in alignment with the drive pulleys 185. A pair of spaced apart conveyor belts 187 are entrained over the pulleys 185 and 186. It is to be noted that the top runs of the endless conveyor belts 187 slope downwardly and to the right, as viewed in FIGURE 5.

Reference is now had to FIGURE 6 in particular, wherein it is shown that each of the conveyor belts 187 also passes over a slack take-up pulley 188. Each slack take-up pulley 188 is individually supported by a bracket 189 which is secured to a respective one of the guide plates 169 and 170.

Normally, the cans 7 will fall onto the top runs of the conveyor belts 187 in horizontal positions. In order to assure that the cans do not twist as they pass downwardly between the conveyor belt 113 and the guide 173, the spacing between the two is maintained at substantially the height of the can distance. Movement of the cans 7 out of the near end of the waterfall 19, as viewed in FIGURE 3, is prevented by means of a stop member 190 which is relatively narrow and is secured to an end portion of an associated one of the guides 164. The stop member 190 is disposed in alignment with the space between the guide plates 169 and 170. A similar stop member 190' depends from the other of the guides 164 into the other end of the waterfall 19, as is best shown in FIGURE 6. When the blender 20 is not being used, the stop member 190' will terminate above the conveyor belts 187 a distance slightly greater than the diameter of one of the cans so that only one can at a time may pass therefrom. On the other hand, when the blender 20 is used, the stop member 190' will terminate sufficiently above the conveyor belt 187 to permit several rows of cans to pass out of the waterfall 19 into the blender 20.

The blender 20 includes a pair of side plates 191 and 192 which are coplanar with the guide plates 169 and 170, respectively. An angle bracket 193 is connected to the right edge of the side plate 191, as viewed in FIGURE 6, and secures the side plate 191 to the guide plate 170, the angle bracket 193 being secured to the angle member 172. An angle member 194 is secured to the right end of the side plate 192, as viewed in FIGURE 6, and is secured to a corresponding one of the standards 54, the angle bracket 194 being shown in FIGURE 7. The side plates 191 and 192 are retained in spaced parallel relation by a plurality of spacer bolt assemblies 195. Each of the spacer bolt assemblies 195 includes an elongated bolt 196 having threaded portions 197 and 198 at opposite ends thereof. A pair of nuts 199 and 200 are threaded on the threaded portions 197 on opposite sides of the side plate 169. A pair of nuts 201 and 202 are threaded onto the threaded portion 198 on opposite sides of the plate 170. The threaded portion 198 is of an

extent to provide for the necessary adjustment in the spacing between the plates 191 and 192.

A shaft 203 extends transversely through the side plates 191 and 192 and is rotatably journaled in bearing assemblies 204' carried by the plates 191 and 192. The shaft 203 carries a pulley 204 which is located generally centrally between the side plates 191 and 192. The pulley 204 is aligned with a pulley 205 carried by the idler shaft 183. A single conveyor belt is entrained over the pulleys 204 and 205, the conveyor belt being referred to by the numeral 206. A combination conveyor belt support and can support 207 is secured to the innerface of the side plate 191 and underlies the upper run of the conveyor belt 206. In this manner, a single conveyor belt can support and move a plurality of cans 7 through the blender 20.

It is intended that the blender 20 be adaptable to a customer's existing single line conveyor 20a for delivering the cans 7 in a single line thereto. The blender will deliver the cans 7 to a single line conveyor in a single row. Of course, the blender 20 may be varied in construction to be coupled to the customer's single line conveyor, as is required. The customer's conveyor will be provided with a can operated switch 459 which will be explained later.

The details of the bin 21 for receiving tier separator sheets 6 are best illustrated in FIGURES 10, 11 and 12. The bin 21 includes two pairs of standards 208 and 209. Each of the standards 208, 209 is provided with a suitable base 210. The standards 209 are disposed adjacent the frame 15, whereas the standards 208 are disposed remote from the frame 15.

The upper ends of the standards 209 are connected together by a transverse frame member 211. A lower transverse frame member 212 extends between the standards 209 a considerable distance above the bases 210 thereof. A third transverse frame member 213 extends between the standards 209 above the transverse frame member 212.

The standards 208 are connected together by an upper transverse frame member 214, a lower transverse frame member 215, and an intermediate transverse frame member 216 which correspond to the transverse frame members 211, 212 and 213, respectively. However, the transverse frame member 214 is pivotally connected to the standards 208 through a pair of aligned pivot pins 217 carried by the upper ends of the standards 208 in order that the top transverse frame member 214 may be pivoted for a reason to be described hereinafter.

A longitudinal frame member 218 extends between the upper ends of adjacent ones of the standards 208 and 209 at each side of the bin 21. Also, a pair of longitudinal frame members 219 extend between the transverse frame members 213 and 216 inwardly of the standards 208 and 209.

A pair of guides 220, 221 are mounted within the bin 21. The guides 220 and 221 are identical, except for being complementary, and each of the guides 220 and 221 includes a pair of uprights 222. The upper ends of the uprights 222 are connected together by a frame member 223. A second frame member 224 extends between intermediate portions of the uprights 222. Vertical bars 225 extend up between the frame members 223 and 224. One of the uprights of each of the guides 220, 221 is pivotally connected to the frame member 215 by a pivot pin 226. A similar pivot pin 227 pivotally connects the other of the uprights 222 of each of the guides 220, 221 to the transverse frame member 212. It is to be noted that the location of the pivot pins 226 and 227 is such that the frame members 224 are disposed in the same plane as the frame members 219.

A link 228 extends diagonally between and is pivotally connected to the uprights 222 adjacent the transverse frame member 215. A similar link 229, which extends diagonally in cross relation to the link 228, extends between and is pivotally connected to the uprights 222 ad-

jacent the transverse frame member 212. Through the function of the links 228 and 229, any pivotal movement of one of the guides 220 results in a like and opposite pivotal movement of the other of the guides.

The frame members 219 are intended to support a pallet for receiving tier separator sheets 6. The pallet may be similar to the pallet 5. When the guides 220, 221 are in place, they will abut the frame members 219. The guides 220, 221 are held in the positions illustrated in FIGURE 10 by a latch which is generally referred to by the numeral 230, and which is best illustrated in FIGURE 12. The latch 230 includes a pair of mounting brackets 231 which are in opposed spaced relation and are secured to the frame member 223 of the guide 220. A latch element 232 is pivotally connected to the mounting brackets 231 by a pivot pin 233. The latch element 232 is notched, as at 234, to present a shoulder 235 which will engage an adjacent one of the frame members 218. A handle 236 is secured to the latch element 232 to facilitate the manipulation thereof.

It is also pointed out that each of the guides 220, 221 is provided at the upper end thereof with a guide plate 237. The guide plates 237 diverge upwardly to facilitate the alignment of a tier separator sheet 6 with the space between the guides 220, 221.

It is to be understood that when a pallet loaded with tier separator sheets 6 is to be removed from the bin 21, the guides 220, 221 will be moved apart so as to release the pallet and the stack of tier separator sheets 6 carried thereby. Further, in order to permit removal of the pallet and the stack of tier separator sheets, the transverse frame member 214 is pivotally mounted, as was described above. A pair of stop members 238 is secured to the transverse frame member 214 for engaging the frame members 218 and limit the swinging thereof to a 90° angle of rotation. A filler bar assembly 238 is carried by the transverse frame member 214. The filler bar assembly 238 includes a pair of rods 239 which pass through the transverse frame member 214 and are slidable relative thereto. The rods 239 are connected together by transverse rods 240.

Reference is now made to FIGURE 21 wherein the transverse frame member 214 is illustrated in its rotated position. The transverse frame member 240, upon being rotated, swings the filler bar assembly 238 from a vertical position to a horizontal position with the rods or bars 239 disposed generally within the confines of the bin 21. The rods 239 will receive tier separator sheets 6 which are deposited in the bin 21 while the pallet loaded with tier separator sheets 6 is being removed therefrom. In this manner, there is no interruption of the can unloading operation.

The hopper 9 is defined by a sheet metal panel 241 which is secured to the standards 209 of the bin 21. Also, angle members 242 extend between the upper parts of the standards 55 and the upper part of the sheet metal panel 241 and terminate just short of the panel 241. The end of the hopper 9 facing the in-feed conveyor 10 is open. On the other hand, the sheet metal panel 244 partially closes the end of the hopper 9 facing the out-feed conveyor 12. The panel 244, as is best shown in FIGURE 28, is secured to the angle member 242 and depends therefrom. The panel 244 also extends generally between one of the standards 55 and one of the standards 209 and is additionally secured to a lower angle member 242' similar to angle member 242. The lower edge of the panel 244 terminates in an outwardly directed flange 245 which is disposed above the level of a pallet passing out of the hopper 9 onto the out-feed conveyor 12. The flange 245 functions as a guide to prevent damage to a palletized package of cans within the hopper 9 as the package is raised.

A guide plate 246 is adjustably secured to the angle member 242 overlying the entrance into the hopper 9 by means of suitable fittings 247. The guide plate 246 terminates at its lower edge in an outwardly directed

flange 248 to facilitate the guiding of cans up into the upper part of the hopper 9. A portion of a sheet metal guide panel 249 has been illustrated in FIGURES 3 and 28 separating the hopper 9 from the general area defined by the frame 15. However, this sheet metal panel 249 has been omitted from the remainder of the views of the drawings. Panel 249 is provided with vertical slots 249' for receiving the fittings 87 and the support members 80, since the chains 76 will be disposed to the left of the panel 249 and the platform 63 will be disposed to the right thereof. An adjustable connection 243 is provided between the sheet metal panel 241 and the panel 244 and also between the guide plate 246 and panel 241.

When the cans 7 are being pushed off of the uppermost tier separator sheet 6 by the pusher member 162, there is a tendency for the tier separator sheet to slide with the cans. In order to overcome this, there is provided a tier separator sheet gripper, which has been previously referred to by the reference numeral 23, and is best shown in FIGURES 1, 22 and 26. The gripper mechanism 23 includes a mounting plate 250 on which a double-acting extensible fluid motor 251 is mounted. The double-acting fluid motor 251 includes a cylinder 252 having cylinder heads 253 and 254 at opposite ends thereof. A piston rod 255 extends through the cylinder head 253.

A control valve, generally referred to by the numeral 256, is mounted on the mounting plate 250 below the extensible fluid motor 251. A fluid line 257 extends between the control valve 256 and the cylinder head 253. A similar fluid line 258 extends between the control valve 256 and the cylinder head 254. A suitable compressed air line 259 and an exhaust line 260 are also connected to the valve 256. The compressed air line 259 may be connected to any convenient supply of compressed air.

A pair of gripper fingers 261, 262 are mounted on generally V-shaped levers 263, 264. The levers 263, 264 are pivotally mounted on a pivot pin 265 carried by the mounting plate 250 in alignment with the piston rod 255.

A bar 266 is secured to the end portion of the piston rod 255 by a nut 267. Links 268, 269 are pivotally connected to the bar 267, as at 270. The forward ends of the links 268, 269 are pivotally connected to the levers 263, 264, as at 271.

In FIGURE 22, the gripper fingers 261, 262 are shown in solid lines in their gripping positions. Normally, the piston rod 255 is retracted and the gripper fingers 261, 262 are separated, as is shown in their dotted line positions.

Normally, a housing encloses the mechanism of the gripper mechanism 23. The housing, which is referred to by the numeral 273, is shown in FIGURE 1, but is omitted from FIGURE 22. The housing 273 is suitably secured to the mounting plate 250 by fastening means, including a spacer 274 projecting from the mounting plate 250.

The gripper mechanism 23 is mounted on the panel 244 exteriorly of the hopper 9. An opening 275 is formed in the upper right hand corner of the panel 244, as viewed in FIGURE 3, and the gripper fingers 261, 262 project therethrough and into the hopper 9 for engaging a corner of a tier separator sheet 6. When in separated position, the gripper fingers 261, 262 do not project into the hopper and thus will not interfere with a can package being elevated in the hopper.

After the top tier of cans 7 has been pushed off of the uppermost tier separator sheet 6, it is necessary that the tier separator sheet 6 be removed before the next tier of cans may be removed from the palletized can package. The tier separator sheet removing mechanism 22 has been provided for this purpose. The mechanism 22 includes a pair of diverging support arms 276 which are secured to the right ends of the frame rails 148 and extend to the right therefrom. The support arms 276 are braced by diagonal braces 277 which extend from the central part of the frame member 151 to central portions of the support arms 276. A hanger 278 is disposed in depending

relation at the forward end of each of the support arms 276. Each of the hangers 276 supports a suction cup assembly, generally referred to by the numeral 279.

Reference is now had to FIGURE 32, wherein the details of the suction cup assembly 279 are illustrated. The suction cup assembly 279 includes a cylinder 280 having a pair of end walls 281 and 282. The cylinder 280 also has a reduced internal portion 283 adjacent the end wall 281 forming a shoulder 284.

A piston 285 is slidably positioned within the cylinder 280 and is sealed relative thereto by means of a sealing ring 286. A piston rod 287 is secured to the piston 285 for movement therewith, the piston rod 287 passing out through a bore 288 in the end wall 282. The end wall 282 carries a sealing ring 289 extending about the bore 288 and forming a seal with the piston rod 287. A coil spring 290 is positioned in the lower part of the cylinder 280 and bears against both the piston 285 and the end wall 282 to normally retain the piston 285 in its in-stroke position.

A conventional type of suction cup 291 is secured to the lower end of the piston rod 287. A vacuum passage 292 extends through the suction cup 291, the piston rod 287 and the piston 285 so as to open into the upper part of the cylinder 280 above the piston 285.

The piston 285 divides the cylinder 280 into two chambers 293 and 294 at all times. A passage 295 is formed in the cylinder 280 and opens into the compartments 293 and 294. A vacuum line 296 is secured to the cylinder 280 and is communicated with the passage 295.

Normally, the piston 285 is in the retracted position illustrated in FIGURE 32. When a vacuum is applied to the passage 295 through the vacuum line 296, a vacuum is formed in the chamber 294. There is a tendency for a vacuum to be formed in the chamber 293. However, this chamber is vented through the passage 292. When the vacuum is first applied to the suction cup assembly 279, the vacuum in the lower chamber 294, as opposed to the absence of a vacuum in the upper chamber 293, will result in the downward movement of the piston 285 against the compression of the spring 290. As the piston 285 moves downwardly, the piston rod 287 and the suction cup 291 move downwardly therewith until the suction cup 291 engages the surface of a tier separator sheet 6. At this time, a seal is formed between the suction cup 291 and the tier separator sheet 6, and a vacuum is pulled within the suction cup 291 through the passage 292. When this seal and vacuum is formed, the chamber 293 will also be placed under a vacuum, with the result that the spring 290 will now have sufficient force to return the piston 285 to its original position. In this manner, the tier separator sheets 6 are elevated.

The tier separator sheet removing mechanism 22 is supported by the pusher assembly 17. The tier separator sheet 6 is engaged immediately after the pusher assembly 17 has pushed a tier of cans 7 off of the tier separator sheet. Then as the pusher assembly 17 moves back into its initial position, the tier separator sheet removing mechanism 22 moves therewith so that the tier separator sheet 6 carried thereby will be in overlying relation to the bin 21. At this time, the tier separator sheet 6 is released and drops into the bin 21.

Reference is now had to FIGURE 23 in particular, wherein there is illustrated a control valve, generally referred to by the numeral 297, which controls the operation of the two suction cup assemblies 279. The two suction cup assemblies 279 have their vacuum lines 296 connected to a Y-fitting 298 which, in turn, is connected to a vacuum line 299, the opposite end of which is connected to the control valve 297. The control valve 297 also has a vacuum line 300 and an inlet line 301 connected thereto.

A second platform 302 extends between the transverse frame members 68 and 88. An electric motor 303 and a vacuum pump 304 are mounted on the platform 302. The electric motor 303 is connected to the vacuum pump

304 for driving the same. The vacuum line 300 is connected to the vacuum pump 304. This is best illustrated in FIGURE 4. Also, it is shown that the control valve 297 is mounted on the upper horizontal portion of the inverted U-shaped support 140.

The operation of the pallet unloader is automatic, and accordingly, a plurality of control switches is provided. Most of these control switches are of conventional type and need not be described in detail. However, several of the control switches are of a special construction, and the specific details of these will be set forth here.

The first of these special switch assemblies is a swing switch assembly, generally referred to by the reference numeral 305. The swing switch assembly 305 is mounted on a support 306 which projects outwardly from the frame 36 of the intermediate conveyor 11, as is best shown in FIGURES 13 and 14.

Reference is now had to FIGURES 17 and 18, wherein the specific details of the swing switch assembly 305 are illustrated. The swing switch assembly 305 includes a generally U-shaped support, which is referred to by the numeral 307, seated upon the support 306. The support 307 includes a base 308 and a pair of parallel upstanding legs 309. A pair of angle brackets 310 are secured to the base 308 in opposed relation. A frame, generally referred to by the numeral 311, extends upwardly from the angle bracket 310 and is pivotally connected thereto by pivot assemblies 312.

The frame 311 includes a pair of upstanding legs 313 which are connected together at their upper ends by straps 314, there being a strap 314 on each side of the legs 313. A pair of horizontal ears 315 is secured to the outer surface of each of the legs 313. The horizontal ears 315 are vertically spaced and are connected together by a vertical member 316. A plate 317 is secured to an adjacent leg 309, the plate 317 terminating at its upper end in a projection 318 which is aligned with a similar projection 319 on the upper end of the vertical member 316. A coil spring 320 extends between the projections 318 and 319 to return the frame 311 to its upright position.

An angle member 321 is secured to the support 306 immediately adjacent the support 307. The angle member 321 is engaged by the legs 313 so as to cooperate with the springs 320 to retain the frame 311 in its upright position.

A shaft 322 extends vertically through each pair of horizontal ears 315 for vertical sliding movement. A U-shaped support 323 is secured to the upper ends of the shafts 322 and extends therebetween. The U-shaped support 323, in turn, carries a horizontally disposed shaft 324 on which a roller 325 is mounted. As is best shown in FIGURE 14, the roller 325 projects above the plane of the upper surface of the upper run of the conveyor chains 45. Thus, the roller 325 will be struck by a pallet moving onto the intermediate conveyor 11 either horizontally or vertically.

The support 323 and the roller 325 are retained in elevated positions by coil springs 326 which are positioned on the shafts 322 above the uppermost horizontal ear 312. The coil springs 326 permit the resilient downward movement of the support 323. A collar 327 is secured on the lower part of each of the shafts 322 and engages the lowermost one of each pair of ears 315 to limit the upward movement of the support 323 due to the urging of the spring 326.

A pair of fingers 328 extends outwardly from the support 323. The fingers 328 are engageable in notches 329 formed in the upper ends of the legs 309, as is best shown in FIGURE 18. This engagement prevents the swinging of the frame 311 as a pallet 5 passes over the roller 325 on its way to the out-feed conveyor 12.

The swing switch assembly 305 also includes a pair of electrical switches. The first of these switches is the switch 330 which is supported by a mounting bracket 331 secured to the angle member 321. The switch 330 in-

cludes an actuator 332 which is disposed in the path of one of the legs 313 of the frame 311 and is actuated when the frame 311 is tilted. Normally, the one leg 313 is constantly engaged with the actuator 332, and the actuator 332 is spring loaded so as to be moved when the frame 311 moves away from it.

A second switch 333 is secured to the opposite one of the legs 313. The switch 333 has an actuator 334 which is mounted for vertical movement and which is aligned with the support 323 for actuation thereby. Thus, when the support 323 and the roller 325 moves downwardly, the actuator 334 will be engaged to operate the switch 333.

A switch assembly 335 is mounted on the angle member 242 in overlying relation to the hopper 9. The switch assembly 335 includes a switch 336 having an operator 337. The operator 337 is connected to an arm 338 which is pivotally mounted relative to the angle member 242 by means of an angle bracket 339 and a pivot pin 340. The arm 338 extends into overlying relation with respect to the hopper 9 and has a relatively large shoe 341 depending therefrom. The shoe 341 is connected to the arm 338 by a pair of hangers 342 and a pivot fitting 343. Details of the switch assembly 335 are best illustrated in FIGURE 27.

Reference is now had to FIGURES 1 and 19 in particular. The in-feed conveyor 10 has a control switch 344 mounted on the frame 26 thereof. The control switch 344 has an upwardly projecting actuator 345 which projects above the rollers 31 of the in-feed conveyor 10 and is engaged by a pallet 5 to operate the switch 344.

A switch 346 is secured on the horizontal portion of the inverted U-shaped support 141 within the general confines of the frame or boom 147. The switch 346 is of the double-acting type and has a plunger type actuator 347 which projects from opposite sides thereof. When the frame or boom 147 reaches the end of its sweeping stroke, a cam 348 carried by the frame member 151 of the frame 147 engages the actuator 347 to move the switch 346 in one direction.

As is best shown in FIGURE 3, a plurality of straps 349 extend between the frame rails 148. An intermediate one of the straps 349 carries a cam 350 (FIGURE 3) which is aligned with the actuator 347 of the switch 346 and is engageable with the actuator 347 for shifting the switch in an opposite direction from its movement by the cam 348 when the frame or boom 147 reaches its farthestmost position to the right, as viewed in FIGURE 3.

In FIGURE 4, the position of another control switch 351 is illustrated. The control switch 351 is carried by the support 143 at the left of the center line of the machine, and has an actuator 353 which is engaged by the frame 149 when the boom 147 is disposed to its right hand limit, as viewed in FIGURE 3.

A control switch 354 is mounted on the transverse frame member 72 at the left end thereof, as viewed in FIGURE 28. The control switch 354 includes a generally horizontally projecting actuator 355 which is disposed in the path of a cam 356. The cam 356 is mounted adjacent the left hand end of the support 77 on the support 80 thereof.

A bracket 357 is secured to the underside of the transverse frame member 72 at substantially the center thereof. A control switch 358 is secured to the bracket 357 and has an actuator 359. The actuator 359 is disposed in the path of a cam 360 carried by the cross-head 73.

The cam 360 also actuates a control switch 361. The control switch 361, as is best shown in FIGURE 4, is carried by a mounting bracket 362 which is secured to the central portion of the transverse frame member 68 and projects upwardly therefrom. The switch 361 is actuated when the fluid motor 64 reaches the lower end of its stroke.

A pair of switches 363 are mounted on opposite sides of the top run of the take-away conveyor 18. The switches 363 are supported by angle brackets 364 which are secured to the frame members 60. Each of the switches 363 includes a feeler type actuator 365 which projects through the associated side plate or guide 164 into overlying relation to the endless conveyor belt 113, as is best shown in FIGURE 4.

Reference is now had to FIGURE 23 wherein it is shown that the control valve 297 includes a valve member 366 which has a straight passage 367 and a diagonal passage 368 therethrough. A spring member 369 normally retains the valve member 366 with the passage 367 aligned with the vacuum line 299 and atmospheric air inlet 301. The control valve 297 includes a solenoid type actuator 370 which is connected to the valve member 366 for shifting the valve member 366 to the left from its position in FIGURE 23. The actuator 370 includes a coil 371. When the coil 371 is energized, the valve member 366 is moved to the left to align the passage 368 with the vacuum inlet line 300 and the vacuum line 299.

In FIGURE 24, it is shown that the control valve 99 includes a valve member 372. The valve member 372 has a straight passage 373 and a diagonal passage 374 therethrough. The valve member 372 is shiftable to either align the straight passage 373 with the fluid lines 98 and 101, or the passage 374 with the fluid lines 100 and 101.

The valve member 372 is positioned by a pair of solenoid type actuators 375 and 376. The solenoid type actuator 375 includes a coil 377, whereas the solenoid type actuator 376 includes a coil 378.

Referring now to FIGURE 25 in particular, it will be seen that the connection between the control valve 157 and the reservoir 91 is illustrated in the form of a fluid line, which will be designated by the reference numeral 379. The control valve 157 also includes a valve member 380. The valve member 380 includes a pair of parallel transverse passages 381 and 382 and a pair of crossed diagonal passages 383 and 384. In one position of the valve member 380, the passage 381 is aligned with the fluid lines 379 and 159 and the passage 382 is aligned with the fluid lines 98 and 158. When the valve member 380 is shifted to the right from its position in FIGURE 25, the fluid passage 383 will be aligned with the fluid lines 159 and 98 and the passage 384 will be aligned with the fluid lines 158 and 379.

The position of the valve member 380 is controlled by a pair of solenoid type actuators 385 and 386. The solenoid type actuator 385 includes a coil 387 and a solenoid type actuator 386 includes a coil 388.

Reference is now had to FIGURE 26, wherein the details of the control valve 256 are illustrated. The control valve 256 includes a valve member 289 which includes a pair of parallel transverse passages 390 and 391 and a pair of crossed diagonal fluid passages 392 and 393. The valve member 389 is spring loaded by a spring 394 so that it is normally positioned with the passage 392 aligned with the compressed air line 258 and exhaust 260, and the passage 393 aligned with the line 257 and the compressed air inlet 259. However, the valve 256 is provided with a solenoid type actuator 395 which includes a coil 395. When the coil 395 is energized, the valve member 389 is shifted to the right as shown, whereupon the passage 391 becomes aligned with the exhaust 260 and the line 257 and the passage 390 becomes aligned with the compressed air line 259 and the line 258.

Referring to the wiring diagram of FIGURE 31, it will be seen that there is provided a 440 v. power input, which includes a pair of lead wires 396, 397. The lead wires 396, 397 go into one coil of a transformer 398 which reduces the voltage down to 110 v. in a pair of wires 399, 400. A master switch 401 is incorporated in the wires

399, 400. Also, a fuse 402 is incorporated in the wire 399.

Wires 403 and 404 are connected to the wires 399 and 400, respectively. A pair of wires 405 and 406 extend between the wires 403 and 404. A starter coil 407 for the vacuum pump electric motor 303 is incorporated in the wire 405, together with a control switch 408. A starter coil 409 for the electrical motor 93 is incorporated in the wire 406, together with a control switch 410.

Referring to the top of the wiring diagram of FIGURE 31, a wire 411 extends between the wires 399 and 400. The switch 346, which is selectively placed in one of two positions, and a coil 412-C of a multiple switch 412 are incorporated in the wire 411. The multiple switch 412 includes a plurality of individual switches 412-1, 412-2, 412-3 and 412-4, which are connected together for movement in unison by an operator 412-O, with contacts 412-4 being operated after a slight time delay.

A wire 413 extends between the wire 399 and the wire 411. The switch 412-1 and the coil 371 are incorporated in the wire 413.

A wire 414 extends from the wire 399 to one terminal of the switch 336. A wire 415 extends from a second terminal of the switch 336 to a terminal of the switch 351, which is normally open. A wire 416 extends from the second terminal of the switch 351 to the wire 411. A coil 417-C of a multiple switch 417 is incorporated in the wire 416. The multiple switch 417 includes a switch 417-1 and a switch 417-2 which are connected together for operation in unison by a switch operator 417-O.

A wire 418 extends from the same terminal of the switch 336 to which the wire 414 is connected, and has its opposite end connected to one terminal of the switch 354. A wire 419 extends from a second terminal of the switch 344 through a coil 420-C of a multiple switch 420 and terminates at wire 411. The multiple switch 420 includes individual switches 420-1, 420-2 and 420-3. The individual switches of the multiple switch 420 are connected together for operation in unison by an operator 420-O.

The automatic controls for the unloader also include a multiple switch 421, which has a coil 421-C. The multiple switch 421 includes individual switches 421-1, 421-2 and 421-3. The individual switches of the multiple switch 421 are connected together and operated in unison by an operator 421-O.

A wire 422 extends from the line 411 to one terminal of the switch 421-1, and has incorporated therein the coil 377. A wire 423 extends between the switches 421-1 and 420-1. Another wire 424 extends between the switches 420-1 and 412-2. A wire 425 extends between the switches 412-2 and 417-1. The switch 417-1 is connected to the switch 336 at the same terminal to which the wires 414 and 418 are connected.

A wire 427 extends between the wire 399 and the switch 412-3. A wire 428 connects the switch 412-3 to the switch 417-2. A wire 429 extends between the switch 417-2 and a coil 430-C of a multiple switch 430. The multiple switch 430 also includes switches 430-1 and 430-2, which are connected together for operation in unison by an operator 430-O. A wire 431 extends from the coil 430-C to the wire 400.

A wire 432 extends from the wire 399 to the switches 420-2 and 420-3. A wire 433 extends from the switch 420-2 to the switch 361. A wire 434 extends from the switch 361 to a switch 435-1 of a multiple switch 435. The multiple switch 435 also includes a switch 435-2. The switches 435-1 and 435-2 are connected together by a common operator 435-O for movement in unison. The switch 435 is hand actuated. A wire 436 connects the switch 435-1 to the wire 399. A wire 437 extends between the wires 434 and 419.

A wire 438 extends from the switch 420-3 remote from the wire 432 and is connected at its opposite end to the wire 411. The coil 378 is incorporated in the wire 438.

A wire 439 is connected to the wire 436 and is connected to both the switch 435-2 and the switch 430-1. A wire 440 is connected to the wire 439 and to the switch 430-2. A wire 441 extends between the opposite terminal of the switch 430-2 and a switch 358 which is connected in series with the switch 430-2. The switch 358 is connected to the wire 400 by a wire 442 in which there is incorporated the coil 395.

A wire 443 is connected to the switch 435-2 opposite from the wire 439 and has its opposite ends connected to the coil 421-C. A wire 444 extends between the wire 443 and a terminal of the double-throw switch 333. A wire 445 extends from the coil 421-C to the wire 400.

A wire 446 is connected to the central terminal of the switch 333 and has its opposite end connected to the switch 344. A wire 447 is connected to the opposite terminal of the switch 344 and its opposite end is connected to a wire 448 which is connected at one end to the wire 400. A starting coil 449 for the electric motor 33 is incorporated in the wire 448. The opposite end of the wire 448 is connected to a switch 450-2 of a multiple unit switch 450. The multiple unit switch 450 includes an operating coil 450-C and a switch 450-1. The switches 450-1 and 450-2 are connected together for operation in unison by a control member 450-O.

A wire 451 extends between the wire 399 and the switch 412-4. A wire 452 extends from the opposite terminal of the switch 412-4 to a wire 453. The wire 452 has incorporated therein the coil 387. One end of the wire 453 is connected to the wire 431. The other end of the wire 453 is connected to a coil 454-C of a multiple unit switch 454. The multiple unit switch 454 also includes switches 454-1 and 454-2 which are connected together by an operator 454-O for operation in unison.

A wire 455 extends between the coil 454-C and a time delay relay switch 456 which includes a coil 456-C. A wire 457 is connected to the opposite terminal of the switch 456 and is, in turn, connected to a wire 458 which has one end thereof connected to the wire 439.

The opposite end of the wire 458 is connected to a terminal of an overload switch 459 which is conveniently located on the customer's take-away conveyor to be actuated when the conveyor becomes full of cans and cannot accept any more. A wire 460 connects the opposite terminal of the switch 459 to the coil 456-C. A wire 461 extends from the coil 456-C to the wire 453.

A wire 462 extends between the switches 430-1 and 454-1 to connect the switches together in series. A wire 463 extends from the opposite terminal of the switch 454-1 to one of the switches 363. The switches 363 are connected together in series by a wire 464 and a wire 465 connects the opposite terminal of the second switch 363 to a three-way switch assembly 466. A wire 467 is connected to the opposite end of the three-way switch assembly 466. The wire 467 terminates at its opposite end in the wire 431 and has incorporated therein the coil 388.

A wire 468 extends between the wire 399 and the wire 446. A wire 469 extends between the wire 440 and one terminal of the switch 454-2. A second wire 470 extends from the second terminal of the switch 454-2 to the wire 400. A starting coil 471 for the electric motor 122 is incorporated in the wire 470.

A wire 472 extends from the wire 445 to the coil 450-C. A wire 473 extends between the coil 450-C and one terminal of the second half of the switch 361, which will be referred to by the numeral 361a. A wire 469' extends from the other terminal of the switch half 361a and is connected to a three-way switch assembly, generally referred to by the numeral 470'. A wire 471' is connected to the opposite end of the three-way switch assembly 470' and the opposite end of the wire 471' is connected to a terminal of the switch 412-3. A wire 474 extends from the opposite terminal of the switch 412-3 to the wire 446.

A wire 475 extends from the wire 474 to one terminal.

of the switch 330. A second wire 476 connects the switch 330 in series with the switch 421-2. A wire 477 connects the opposite terminal of the switch 421-2 to the connection between the wire 445 and the coil 421-C.

A wire 478 extends between the wire 446 and one terminal of the switch 450-1. Another wire 479 extends between the other terminal of the switch 450-1 and the wire 400. A starting coil 480 for the electric motor 47 is incorporated in the wire 479. A wire 481 extends between the wire 478 and the terminal of the switch 450-2 remote from the terminal to which the wire 448 is connected.

In order to control the energization of the coil 471, a switch 482 is incorporated in the wire 470 in advance of the coil 471. The switch 482, together with the switches 401, 408, 410, 466, 470 and 435 will be mounted in convenient operating positions alongside the unloader for the manual operation of the operator thereof.

Operation

In the operation of the pallet unloader, a palletized can package is positioned on the in-feed conveyor 10 through the use of a fork lift truck or other type of pallet package handling apparatus. After the palletized package is placed on the in-feed conveyor 10, the switch 401 is closed so as to energize the wires 399 and 400. Since the switch 344 is normally closed, the starting coil 449 for the electric motor 33 of the in-feed conveyor 10 will automatically be operated, with the result that the palletized can package will be fed towards the hopper 9. When the leading edge of the pallet 5 of the palletized can package approaches the hopper 9, it will strike the operator 345 of the switch 344 and move the switch 344 to an open position, thus stopping the operation of the in-feed conveyor. The palletized can package is now in position for the automatic operation of the unloader.

The switches 408, 410 and 482 are now closed. This results in the energization of the starting coils 407, 409 and 471 for the electric motor 303 of the vacuum pump 304, the electric motor 93 for the hydraulic pump 92, and the electric motor 122 for the take-away conveyor 18, respectively. At this time, it is pointed out that the switch 459 is normally in its circuit-making position, with the result that when the switch 401 is closed, the coil 456-C is energized to close the time delay switch 456. This, in turn, results in the energization of the coil 454-C which operates the switch 454 to move the switches 454-1 and 454-2 to closed positions. Thus, the circuit to the switch 482 and the coil 471 is completed when the switch 482 is closed.

The unloader is now ready for operation, and the automatic unloading cycle is started by closing the momentary switch 435 to close the switches 435-1 and 435-2. The closing of the switch 435-2 results in the energization of the coil 421-C of switch 421. The switch 330 is normally closed and the operation of the switch unit 421 results in the closing of switch 421-2 so as to continue the energization of the coil 421-C as long as the switch 330 is closed. The switches 361a and 470 being closed, the closing of the switch 421-3 will result in the energization of the coil 450-C of the switch unit 450 to close the switches 450-1 and 450-2. The closing of the switch 450-1 results in the energization of the starting coil 480 for the electric motor 47 of the intermediate conveyor 11. The closing of the switch 450-2 energizes the starting coil 449 of the electric motor 33 of the in-feed conveyor 10. The operation of the in-feed conveyor 10, together with the operation of the intermediate conveyor 11, results in the feeding of a palletized can package from the in-feed conveyor 10 onto the intermediate conveyor 11, until the leading edge of the pallet 5 strikes the roller 325 of the swing switch assembly 305. At this time, the normally closed switch 330 is opened to break the circuit to the coil 421-C, with the result that the switch assembly 421 moves to its de-energized position.

When the switch assembly 421 moves to its deenergized

position, the circuit to the coil 450-C of the switch assembly 450 is broken through the opening of the switch 421-3. As a result, the operation of the intermediate conveyor 11 is automatically stopped. The in-feed conveyor 10 continues to run until switch 344 is opened by the next incoming pallet. The palletized can package is now positioned in the hopper 9 ready to be lifted up for unloading the top layer or tier of cans onto the take-away conveyor 18.

It is to be noted that when the switch assembly 421 is in its de-energized position, the switch 421-1 thereof is closed.

At this time, it is pointed out that the at-rest position of the frame or boom 147 is to the right, with the result that the switch 351 is held closed. Since switch 351 is in series with the coil 417-C which positions switch 417-1 which is in series with hoist lifting solenoid 377, it is apparent that the hoist can be raised only when the switch 351 is held closed, which is only when the boom is in its at-rest position all the way to the right. Also, the switch 336 is a normally closed switch, so that the coil 417-C of the switch unit 417 is energized. Thus, the switch 417-1 is closed and the switch 417-2 is open at this time.

When the coil 421-C is de-energized and the switch assembly 421 is reset, the switch 421-1 is closed. Also, the switch 412-2 is normally closed. In this manner, the coil 377 for the control valve 99 is energized to shift the valve member 372 to the position illustrated in FIGURE 24 and thus effect the operation of the extensible fluid motor 64. The hoist 62 is operated to move the elevator 63 and the palletized can package disposed thereon upwardly, with the palletized can package moving up off of the intermediate conveyor 11. The upward movement of the hoist continues until the cans of the uppermost tier of cans strike the shoe 341 of the switch unit 335, at which time the switch 336 is moved from its normally closed position to an open position. When the switch 336 is opened, the circuit to the coil 417-C is opened, with the result that the switch unit 417 returns to its normal position, breaking the circuit to the coil 388 and the valve member 372 returns to a neutral position. In this manner, the flow of fluid to the cylinder 65 is shut off and the elevator or platform 63, together with the palletized can package carried thereby, remaining stationary with the cans of the uppermost tier of cans in position for being swept off of the uppermost tier separator sheet 6 onto the dead plate 16.

When the switch unit 417 returns to its normal position, the switch 417-2 closes, with the circuit to the coil 430-C being completed and the switch unit 430 being actuated to close the switches 430-1 and 430-2. The closing of the switch 430-2 energizes the coil 395 to operate the control valve 256 to thus actuate the gripper mechanism 23 and cause the uppermost tier separator sheet to be held against movement through the action of the gripper mechanism 23.

The switch 459 remaining closed, the time delay switch 456 remains closed, with the result that the switches 454 also remain closed. As a result, when the switch 430-1 is closed, a circuit is completed through the switch 430-1 and the switch 454-1, together with the switches 363 and 466 to energize a coil 388 and shift the valve member 380 of the control valve 157 to the position illustrated in FIGURE 25. This will result in the movement of the frame or boom 147 from right to left, as viewed in FIGURE 3, to sweep the upper tier of cans from the upper tier separator sheet 6 onto the dead plate 16 and the take-away conveyor 18. The movement of the boom 147 continues until the switch 346 is closed to energize the coil 412-C of the switch assembly 412. The switch 412 is of a construction whereby the switches 412-1, 412-2 and 412-3 are immediately actuated and the switch 412-4 is actuated after a slight time delay. The energization of the coil 412-C results in the immediate closing of the switch 412-1 and the immediate opening of the switches

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412-2 and 412-3. The closing of the switch 412-1 results in the energization of the coil 371 to shift the valve member 366 of the control valve 297 to the position opposite from that illustrated in FIGURE 23, at which time the suction cup assemblies 279 are actuated to move downwardly, form a suction with the uppermost tier separator sheet 6, and then lift the tier separator sheet up out of the hopper 9.

The tier separator sheet 6 is now held in position for being transported by the boom 147 into the paper storage bin 21. The switch 412-2, being open, prevents the operation of the hoist 62. This prevents the hoist 62 from moving the elevator 63 upwardly immediately upon the removal of the cans 7 which hold the switch 336 open. Switch 351 being in its normally open position is an additional safeguard to further insure that the hoist will not raise at this time. The opening of the switch 412-3 breaks the circuit to the coil 430-C and permits the switch unit 430 to return to its normally open position. Thus, the switch 430-2 is opened to de-energize the coil 395 and to discontinue the operation of the gripper mechanism 23 to release the tier separator sheet 6.

After a short time interval, the switch 412-4 closes, the time interval being that necessary for the operation of the suction cup assembly 279 to lift the tier separator sheet 6 up out of the hopper 9. When the switch 412-4 closes, the coil 387 of the control valve 157 is energized to shift the valve member 380 to the opposite position from that illustrated in FIGURE 25 so that the movement of the boom 147 is reversed, the boom now moving from left to right back to its original position.

When the boom 147 reaches the end of its stroke, the switch 346 is again opened to de-energize the coil 412-C with the result that the switches of the switch unit 412 return to their normal positions. This de-energizes the coil 371 with the result that the valve member 366 is returned to its position of FIGURE 23 and the vacuum to the suction cup assemblies 279 is broken to release the tier separator sheets 6 so that they may drop into the bin 21. The return of the switch unit 412 to its normal position begins a second cycle of operation wherein the hoist 62 moves upwardly until the cans of the next upper tier of cans, which cans are now disposed uppermost, engage the shoe 341 and open the switch 336, at which time the operation of the hoist 62 discontinues, and the gripper mechanism 23 is energized to grip the now uppermost tier separator sheet 6, together with the operation of the boom 147.

The above cycle continues tier after tier until the pallet 5 is empty. When the last tier of cans 7 has been swept from the pallet 5, the pallet 5 in raising will actuate the switch 354 to swing it to a closed position momentarily. This will result in the energization of the coil 420-C to shift the switches of the switch unit 420. When the switch 420 is actuated, the switch 420-2 will be closed with the result that a circuit will be completed through the switches 420-2 and 361 to continue to energize the coil 420-C even though the switch 354 may be returned to its normally open position. A circuit is formed through switch 420-3 to energize coil 378 of the control valve 99 with the result that the valve member 372 is shifted to permit the fluid to be released from the cylinder 65 and the hoist 62 lowered. As the hoist moves downwardly, the switch 354 returns to its normal open position.

When the hoist 62 nears its lowermost position, the pallet 5 carried thereby strikes the roller 325 to close the normally open switch 333, causing the switch to close. The closing of the switch 333 energizes the coil 421-C to again set the switch assembly 421. The closing of the switch 421-2 sets up a holding circuit through the coil 421-C to hold the switch assembly 421 in its set position. The closing of the switch 421-3 results in the energization of the coil 450-C after the switch 361a is moved to its closed position by the movement of the elevator 63. In this manner, the in-feed conveyor 10 and

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the intermediate conveyor 11 are actuated to remove the empty pallet 5 from the in-feed conveyor and to position a next palletized can package on the intermediate conveyor in alignment with the hopper 9.

When the last layer of cans 7 is swept off of the pallet 5, it is not desired to grip the tier separator sheet 6 on which they are sitting because of interference by the pallet 5 with the gripper fingers 261 and 262. Accordingly, the switch 358, which is disposed in series with the coil 395 of the gripper mechanism 23, is opened slightly before the last tier of cans 7 is positioned for removal from the pallet 5. A high degree of friction between the pallet and the last remaining tier separator due to the rough surface of the pallet will prevent this tier separator from being shifted when the cans are swept off even though the gripper mechanism 23 is opened.

The machine has several safety features that either halt operations momentarily to prevent a jam from taking place, or else stop operations in the event a jam-up of cans has occurred. The switches 363 mounted on the sides of the take-away conveyor 18 are normally closed and are opened by the presence of cans on the conveyor. The switches 363 are positioned so that they will be closed only when there is enough room on the conveyor belt 113 to accept a full tier of cans 7. The switches 363 are held open by the cans 7 on the conveyor belt 113. When either of the switches 363 is open, the circuit to the coil 388 will be opened and operation of the boom 147 is prevented. When the path is clear, both switches 363 will be closed and the coil 388 may be energized to bring about the operation of the boom 147.

Should the can customer's single line take-away conveyor become fully loaded with cans 7, the operation of the take-away conveyor 18 will be stopped through the opening of the switch 459, the switch 459 being suitably placed to be actuated by cans backed up in the customer's take-away conveyor. Switch 459 is in series with solenoid actuated time delay switch 456 which remains closed during normal passage of cans but will be caused to open shutting off the conveyor 18 when the switch 459 is held open by backed-up cans for the necessary time delay period required to cause switch 456 to open.

The three-way switches 466 and 470' are conveniently located and the operator can turn off the current to the coil 388 and the coils 449 and 480 to discontinue the operation of the boom 147 and/or the electric motors for the in-feed conveyor and the intermediate conveyor.

From the foregoing, it will be seen that novel and advantageous provision has been made for carrying out the desired end. However, attention is again directed to the fact that variations may be made in the example method and apparatus disclosed herein without departing from the spirit and scope of the invention as defined in the appended claims.

We claim:

1. An apparatus for unloading cans and the like stacked in tiers and tier separator sheets disposed between said tiers, said apparatus comprising a frame, a hoist carried by said frame for supporting and elevating a stack of cans, said hoist having a lower stack receiving position, can take-away means mounted on said frame offset from said hoist and above the elevation of said hoist, a pusher member carried by said frame in alignment with said take-away means and offset from said hoist in a direction opposite from that of said can take-away means, means mounting said pusher member for movement across said hoist and at least to an edge of said can take-away means, controls for operating said hoist to align tiers of cans with said can take-away means and said pusher member, said controls including a control member overlying said hoist and engaged by cans of an uppermost tier of cans to stop the upward movement of said hoist with the uppermost tier of cans slightly above said can take-away means and in alignment with said pusher member, and tier separator sheet gripping means carried by said frame

for gripping and holding an uppermost tier separator sheet during a can unloading operation.

2. The apparatus of claim 1 together with tier separator sheet removing means connected to said pusher member and movable therewith to remove an upper tier separator sheet immediately following a can unloading operation of said pusher member.

3. The apparatus of claim 1 wherein said gripping means includes a control mechanism the operation of which is initiated by said control member.

4. In an apparatus for unloading cans and the like stacked in tiers with the individual tiers separated by separator sheets, a pusher assembly including a reciprocal boom and a pusher, and means carried by said boom for elevating an exposed tier separator sheet subsequent to a pushing stroke of said pusher assembly and carrying the elevated tier separator sheet therewith during the return stroke of said pusher assembly.

5. The device of claim 4 wherein said tier separator sheet elevating means includes a plurality of suction cups.

6. The device of claim 4 wherein said tier separator sheet elevating means includes a plurality of suction cups, and each of said suction cups is secured to a vertically extensible support.

7. The device of claim 4 wherein said tier separator sheet elevating means includes a plurality of suction cups, vertically extensible supports for said suction cups, and a vacuum source connected to said extensible supports and said suction cups for extending said supports and creating a suction force in said suction cups.

8. In an apparatus for unloading cans and the like stacked in tiers with the individual tiers separated by separator sheets, a pusher assembly including a reciprocal boom and a pusher, means carried by said boom for elevating an exposed tier separator sheet subsequent to a pushing stroke of said pusher assembly and carrying the elevated tier separator sheet therewith during the return stroke of said pusher assembly, and gripper means engageable with an uppermost tier separator sheet during the pushing stroke of said pusher assembly to prevent sliding of the uppermost tier separator sheet during the unloading or articles seated thereon.

9. The device of claim 8 wherein said gripper means has a control actuated in response to said pusher assembly reaching the end of its pushing stroke to move said gripper means to a tier separator sheet releasing position.

10. In an apparatus for unloading cans and the like stacked in tiers with the individual tiers separated by separator sheets, a pusher assembly including a reciprocal boom and a pusher, and gripper means engageable with an uppermost tier separator sheet during the pushing stroke of said pusher assembly to prevent sliding of the uppermost tier separator sheet during the unloading of articles seated thereon, said gripper means including a pair of pivotally mounted levers, opposed gripper fingers carried by said levers for movement together to engage upper and lower surfaces of the sheet in gripping relation along an edge thereof, a reciprocable actuator, and linkage connecting said levers to said actuators.

11. An apparatus for unloading cans and the like stacked in tiers and tier separator sheets disposed between said tiers, said apparatus comprising a frame, a hoist carried by said frame for supporting and elevating a stack of cans, said hoist having a lower stack receiving position, can take-away means mounted on said frame offset from said hoist and above the elevation of said hoist, a pusher member carried by said frame in alignment with said take-away means and offset from said hoist in a direction opposite from that of said can take-away means, means mounting said pusher member for movement across said hoist and at least to an edge of said can take-away means, controls for operating said hoist to align tiers of cans with said can take-away means and said pusher member, said controls including a con-

trol member overlying said hoist and engaged by cans of an uppermost tier of cans to stop the upward movement of said hoist with the uppermost tier of cans slightly above said can take-away means and in alignment with said pusher member, and mechanical means for automatically removing an uppermost one of said tier separator sheets immediately following a can unloading operation of said pusher member, said tier separator sheet removing means being connected to said pusher member remote from said can take-away means and movable with said pusher member to a position overlying a tier separator sheet bin at the end of the unloading stroke of said pusher member.

12. The apparatus of claim 11 wherein said tier separator sheet removing means include vacuum lift members energized upon the reaching of the end of the unloading stroke by said pusher member to lift an uppermost tier separator sheet, and de-energized upon the reaching of the end of the return stroke by said pusher member to release the tier separator sheet carried thereby.

13. An apparatus for unloading cans and the like stacked in tiers with tier separator sheets separating said tiers, said apparatus comprising elevated can take-away means, a hoist for elevating tiers of cans generally into alignment with said can take-away means, pusher means for pushing an uppermost tier of cans onto said can take-away means, tier separator sheet removing means mounted on said pusher means for removing an uppermost tier separator sheet after the cans having been removed therefrom, and a bin for receiving salvaged tier separator sheets.

14. An apparatus for unloading cans and the like stacked in tiers and tier separator sheets disposed between said tiers, said apparatus comprising a hopper, an intermediate conveyor disposed in the lower part of said hopper, and in-feed conveyor aligned with said intermediate conveyor for delivering palletized stacks of cans to said intermediate conveyor, an out-feed conveyor aligned with said intermediate conveyor for removing empty pallets, a hoist, said hoist including a platform projecting into said hopper at opposite ends of said intermediate conveyor, a take-away conveyor at the upper end of said hopper, pusher means mounted at the top of said hopper and including a pusher member movable transversely of said hopper for pushing cans onto said take-away conveyor, a single line conveyor extending transversely of said take-away conveyor remote from said hopper, means for transferring cans from said take-away conveyor to said single line conveyor, and mechanical means for automatically removing an uppermost one of said tier separator sheets immediately following a can unloading operation of said pusher means, said tier separator sheet removing means being connected to said pusher means remote from said can take-away means and movable with said pusher means to a position overlying a tier separator sheet bin at the end of the unloading stroke of said pusher means.

15. The apparatus of claim 14 wherein said tier separator sheet removing means include vacuum lift members energized upon the reaching of the end of the unloading stroke by said pusher means to lift an uppermost tier separator sheet, and de-energized upon the reaching of the end of the return stroke by said pusher means to release the tier separator sheet carried thereby.

16. An apparatus for unloading cans and the like stacked in tiers and tier separator sheets disposed between said tiers, said apparatus comprising a hopper, an intermediate conveyor disposed in the lower part of said hopper, an in-feed conveyor aligned with said intermediate conveyor for delivering palletized stacks of cans to said intermediate conveyor, an out-feed conveyor aligned with said intermediate conveyor for removing empty pallets, a hoist, said hoist including a platform projecting into said hopper at opposite ends of said intermediate conveyor, a take-away conveyor at the upper end of said hopper, pusher means mounted at the top of

said hopper and including a pusher member movable transversely of said hopper for pushing cans onto said take-away conveyor, a single line conveyor extending transversely of said take-away conveyor remote from said hopper, means for transferring cans from said take-away conveyor to said single line conveyor, mechanical means for automatically removing an uppermost one of said tier separator sheets immediately following a can unloading operation of said pusher means, and means for gripping and holding the tier separator sheet below the uppermost tier of cans during the can pushing stroke of said pusher means.

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References Cited in the file of this patent

UNITED STATES PATENTS

1,720,449	Seligman	July 9, 1929
1,935,478	Mason	Nov. 14, 1933
2,338,048	Minaker	Dec. 28, 1943
2,521,126	Price	Sept. 5, 1950
2,656,060	Fischer	Oct. 20, 1953
2,679,678	Stephan	June 1, 1954
2,686,233	Obszarny	Aug. 10, 1954
2,729,344	Birchall	Jan. 3, 1956
2,774,489	Guigas	Dec. 18, 1956