United States Patent

Powell

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[54] CONTAINER-PACKING APPARATUS

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[52] U.S. Cl. .....214/6 N, 198/30

[51] Int. Cl. B65g 57/24

[58] Field of Search .....214/6 P, 6 M, 6 N, 6 DK, 6 H, 214/6 B, 6; 198/30

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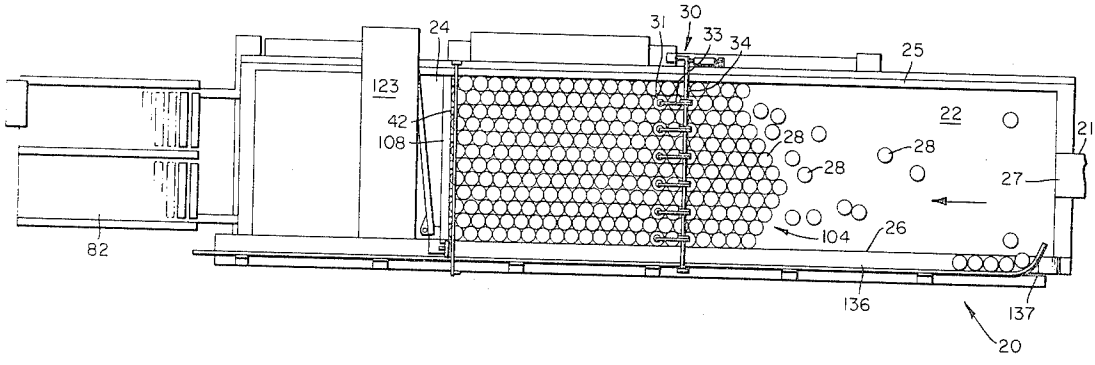
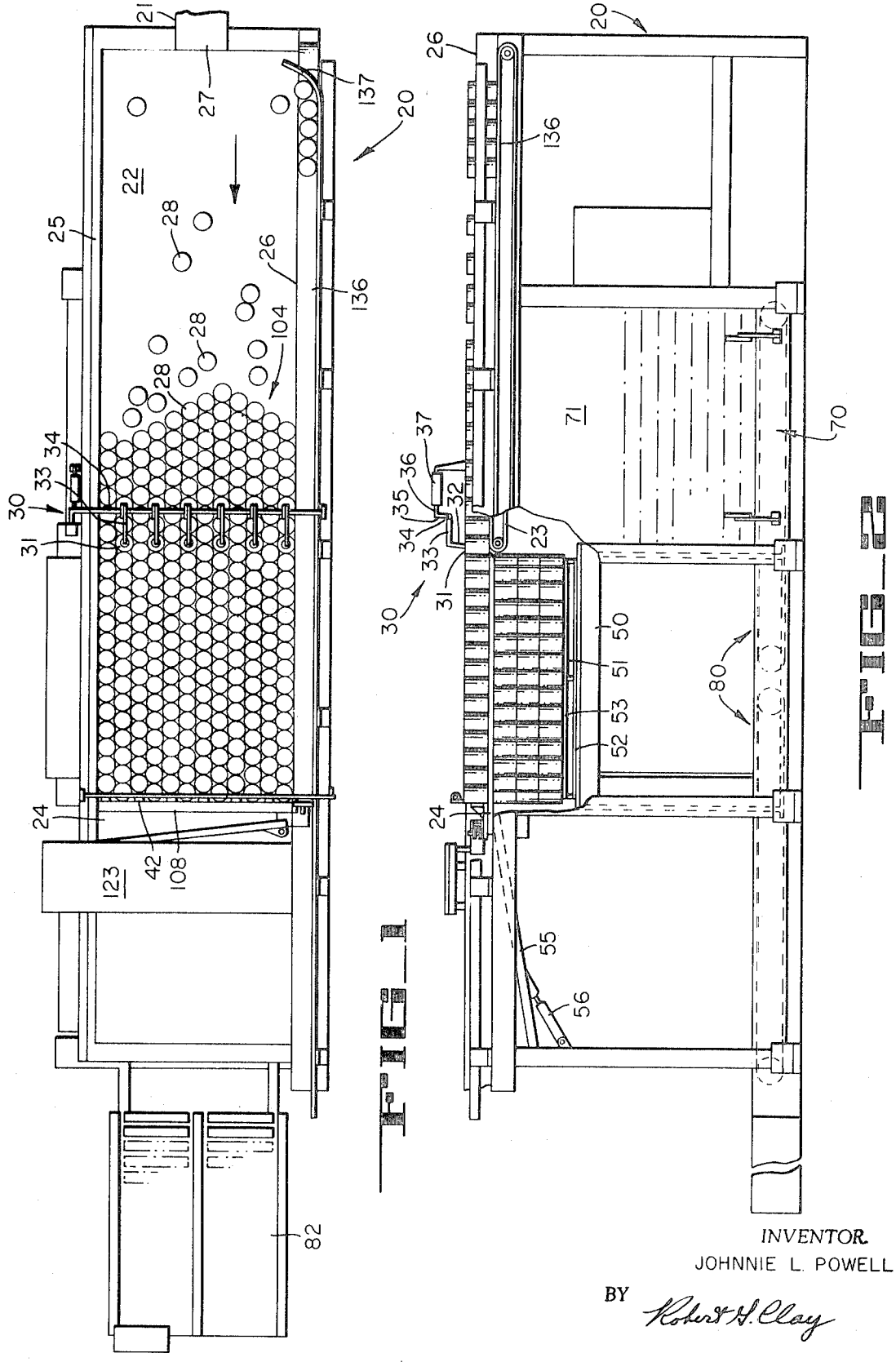
[57] ABSTRACT

A pallet that is dimensioned for fully supporting a certain number of cans that are packed in layers, and the layers in an even number of staggered diamond pattern rows, is to be packed with an extra row in each layer. The bottom layer is to be centered on the pallet so that the containers of the edge rows, including the extra row, each overhang beyond the pallet by less than half so as still to be solidly supported. The apparatus accomplishes this packing by moving a set including the extra row of containers along a path above the pallet with the set preceded by a single row and followed by a remainder to permit the set to separate therefrom; and then removing the preceding row before the set is lowered onto the pallet. The containers of the preceding row are then recirculated to the upstream portion of the path to beome part of a subsequent set.

12 Claims, 11 Drawing Figures





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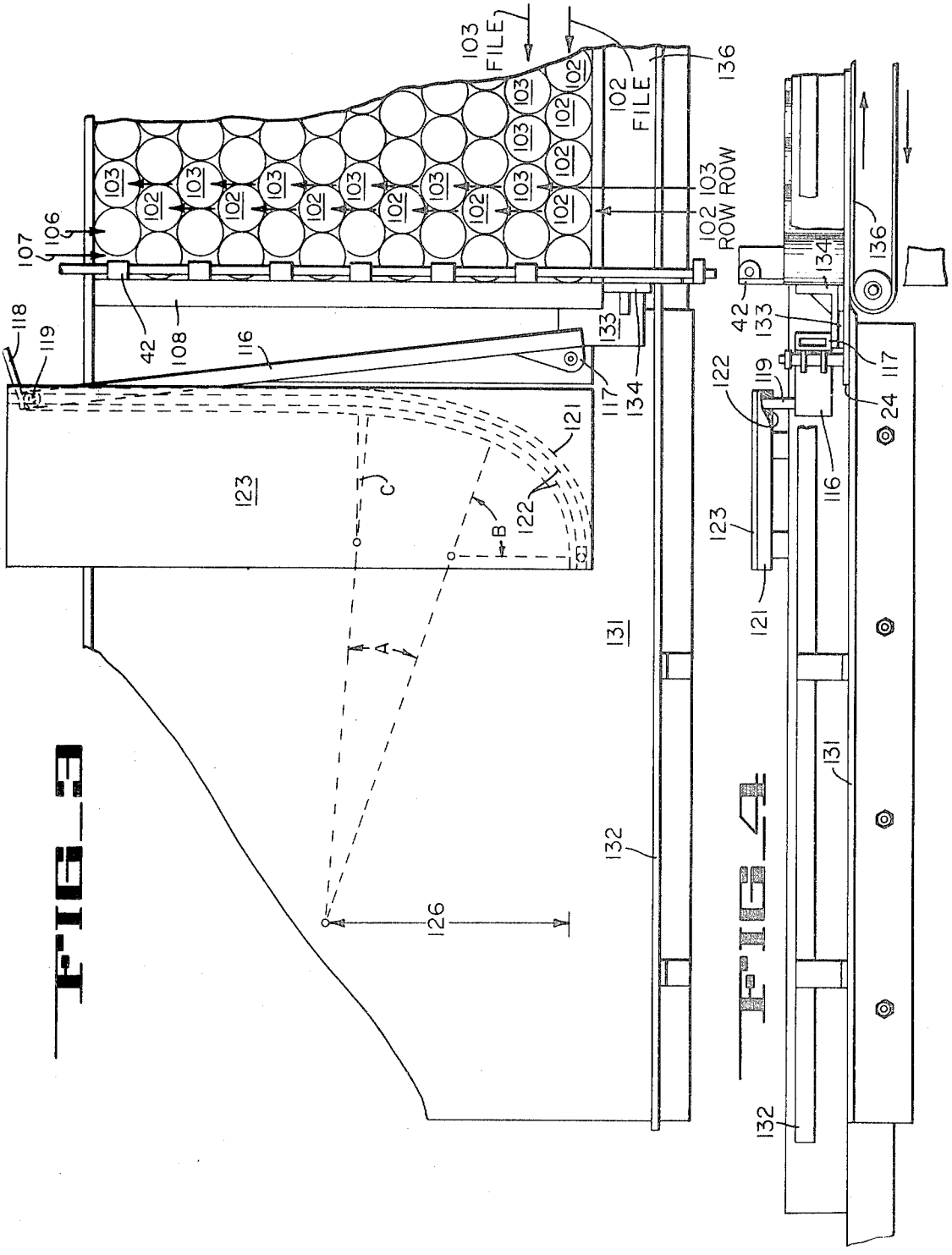

FIG 3

FIG 4

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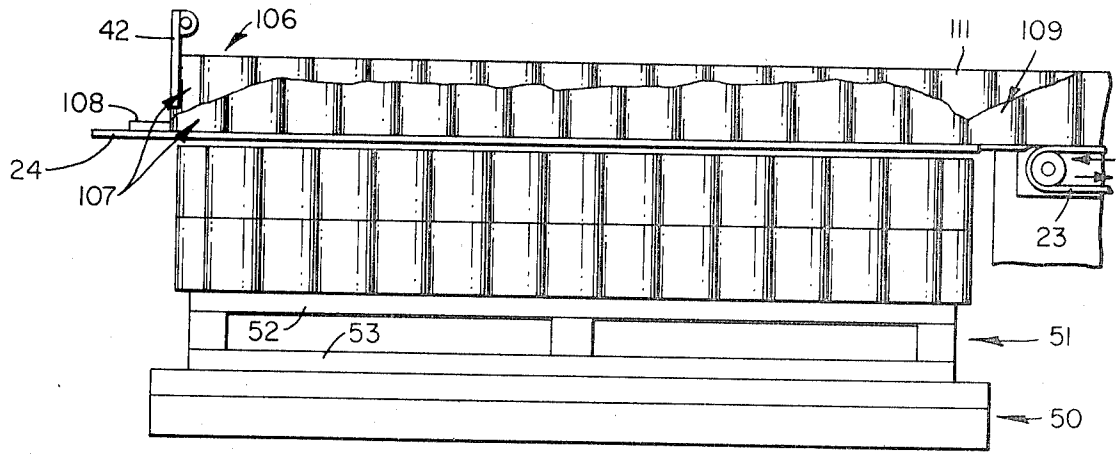

FIG_5

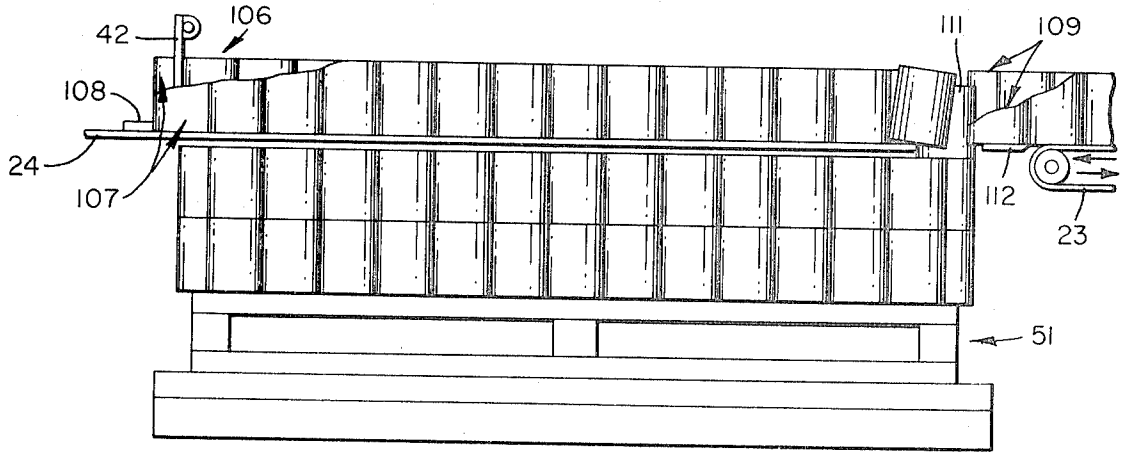

FIG_6

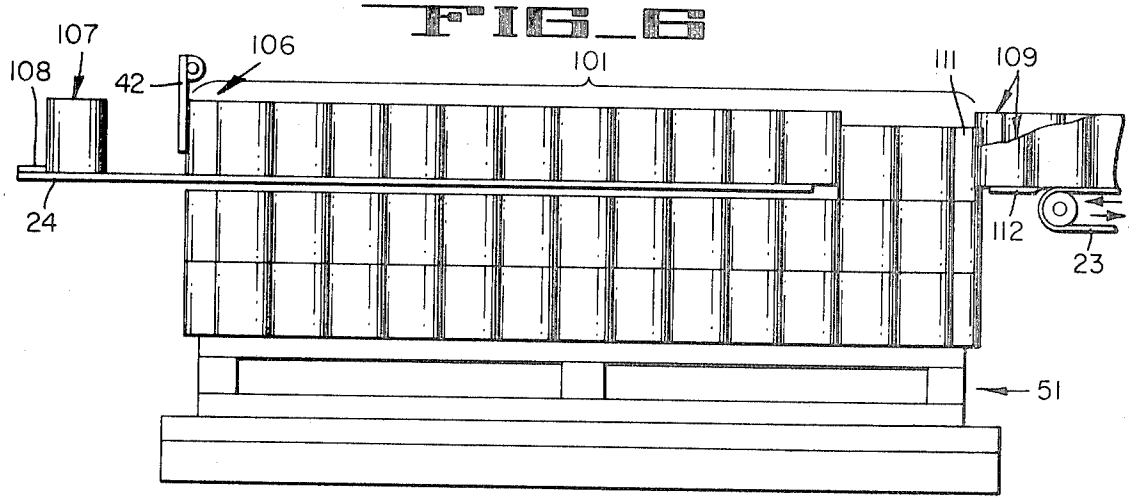

FIG_7

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FIG_8

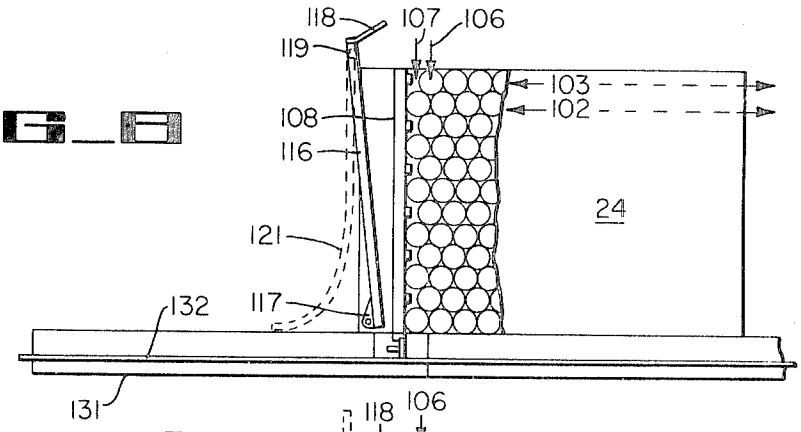


FIG_9

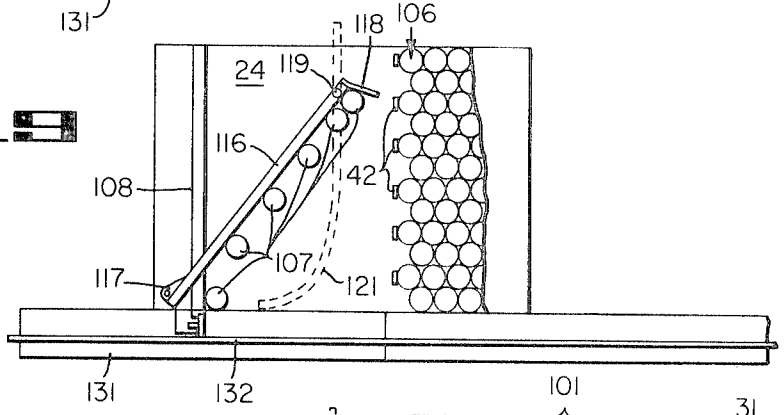


FIG_10

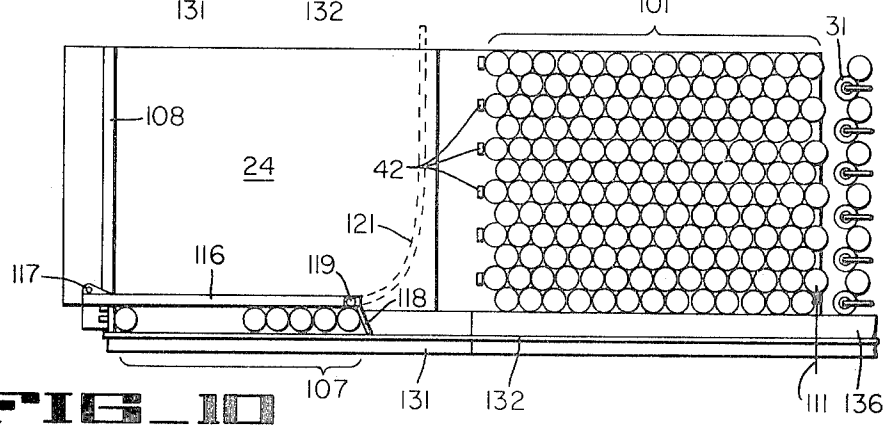
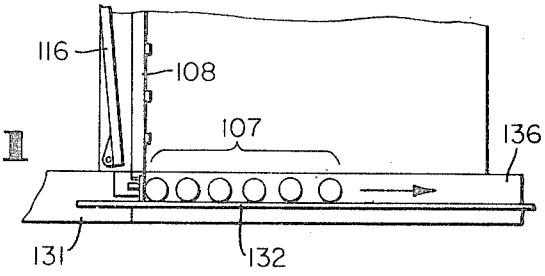


FIG_11



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CONTAINER-PACKING APPARATUS

BACKGROUND OF THE INVENTION

This invention relates to container-packing apparatus and particularly to palletizing machines.

Containers, particularly cylindrical metal cans, are usually packed on pallets for bulk handling, the various layers of cans being arranged either with the cans in rectangularly ordered rows with all of the cans in a row touching, or else in a so-called diamond pattern in which the cans in a "file" in one direction are touching, but in "rows" normal thereto are spaced apart, each of such latter rows being staggered with respect to the adjacent rows. For large pallets the greatest packing density is achieved with the diamond pattern. For this pattern, the pallets are usually dimensioned so as to hold an even number of rows in each layer, and to fully support the cans of the bottom layer, with no cans overhanging beyond the pallet edges. However, some canneries, desiring to make optimum use of the pallet space, prefer to add an extra row of cans and to permit all of the cans at opposite edges of the pallet to overhang the edges. Such an arrangement with rectangularly ordered cans would leave the overhanging cans of the bottom layer only half supported at best and would not be a stable arrangement. However, with cans in diamond pattern, the cans in two opposite staggered edge rows of the bottom layer can be arranged to overhang, so that each can is substantially more than half supported by the pallet, and the arrangement is both stable and practical. The chief problem then arises in devising apparatus to pack and load the pallets automatically.

Copending U.S. Pat. application Ser. No. 745,274 filed July 16, 1968 and now U.S. Pat. No. 3,522,890 for Can Pelletizer, by Thomas D. Birchall, discloses a typical prior art diamond pattern automatic pallet-loading machine, in which a set having an even number of staggered rows of cans in closely packed diamond pattern is moved along a path to a position above the pallet to be loaded, and encounters a stop element and is stopped. The staggered row of cans immediately following the set is then clamped in such a way that, when the set is dropped onto the pallet, the clamped row of cans is held back and forms a bulwark against which the following cans of the next set are formed up and packed for subsequent palletizing. In short, the row immediately following one set becomes the leading row of the following set.

Since, in the diamond pattern, alternate staggered rows are unlike in that the cans thereof belong to different files normal to the staggered rows, it is arranged in the Birchall apparatus that the can clamps always clamp the same type of row, and the trailing row of the set is unlike the clamped row. Since the leading row of each set is always a row that was previously clamped, it follows that the leading and trailing rows of each prior art set are of unlike types, and each prior art set has an even number of rows. This circumstance poses a problem when it is desired to add an extra row, for then the set would have an odd number of rows, the leading row of the set being like the trailing row of the set, but unlike the leading row of the next set, and the clamps would have to be arranged to clamp an odd row to define one set and an even row to define the next, and so on alternatingly. However, this is not a satisfactory solution, for at least two corner cans of each set would end up unsupported from beneath when palletized, except of course in the case of the bottom set next the pallet. Therefore, some other modification must be made.

Accordingly, it is an object of the present invention to provide apparatus for packing containers in staggered rows for pallet loading so as to make optimum use of the space provided by the pallet.

It is another object to provide apparatus as above described and adapted to pack the pallet with the edge row containers each overhanging the pallet edges by less than half.

An apparatus in accordance with the invention accomplishes these and other objects by moving a set including the extra row of containers along a path above the pallet with the set preceded by a single row and followed by a remainder portion of containers; stopping the remainder to permit the set to separate therefrom; and then removing the preceding row before the set is lowered onto the pallet. The containers of the preceding row are then recirculated to the upstream portion of the path to become part of a subsequent set.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of an apparatus in accordance with the invention;

FIG. 2 is an elevation view of the apparatus of FIG. 1;

FIG. 3 is an enlarged broken away plan view of a portion of FIG. 1;

FIG. 4 is an enlarged broken away elevation of FIG. 3;

FIG. 5 is an enlarged fragmentary elevation of FIG. 2 illustrating one stage in the operation thereof;

FIG. 6 is an elevation similar to FIG. 5 illustrating a further stage of operation;

FIG. 7 is an elevation similar to FIG. 6, illustrating a still further stage of operation;

FIG. 8 is a fragmentary plan, to a different scale, of a portion of FIG. 1, illustrating a stage in the operation thereof;

FIG. 9 is a plan similar to FIG. 8 illustrating a further stage;

FIG. 10 is a plan similar to FIG. 9 illustrating a still further stage; and

FIG. 11 is a plan similar to FIG. 10, illustrating a yet further stage.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown in FIGS. 1 and 2, the palletizer of this invention is similar to that of Ser. No. 745,274 previously noted, in that it comprises a main frame 20 which supports on its upper end two belt conveyors 22 and 23. The first conveyor 22, reading from the input end 21, is termed a long draper and the second conveyor 23 is termed a short draper each of them having its top surface moving in the direction from the input end 21 toward a stripper plate 24. The drapers are bounded by sidewalls 25 and 26. The long draper 22 moves continuously during normal operation. A single-file conveyor 27 brings cans 28 to the draper level and deposits them thereon in single file at the center of the long draper 22. When cans are so deposited and when a diamond type pattern as shown in FIG. 1 is initially set up, the cans automatically keep forming this diamond pattern.

The short draper 23, unlike the long draper 22, does not move continuously but is operated intermittently each time a set of cans is to be loaded on a pallet. At the front of the short draper 23 is a hydraulically operated can clamp assembly 30 comprising a plurality of clamp feed 31 each adjustably and yieldingly mounted on a stud 32, which is carried on an arm 33. The arms 33 are all secured to a shaft 34 having a crank 35 at one end, to which is secured a rod 36 extending from a piston of a hydraulic cylinder 37.

Beyond the can clamps 30 and the short draper 23 is the stripper plate 24, to which the cans are transferred by the short draper 23 when the clamps 30 have been released. The stripper plate 24 is preferably mounted on guides and may be secured to hydraulic cylinders (not shown), so that the plate 24 is moved slightly further than its own length in the downstream direction, passing under an array of stop fingers 42 to strip the cans 28 from the plate 24 so that they drop gently onto a pallet 51 or onto a layer of cans previously stacked thereon. The pallet 51 is, at the time when the cans drop, supported by a hoist mechanism 50, and the pallet 51 has upper and lower decks 52 and 53, shown best in FIG. 5. The drop is exaggerated in the figure for clarity, but is usually only slightly greater than the thickness of the stripper plate 24 itself, so that the cans are gently transferred.

When the stripper plate 24 is moved out, it lies above a paper feed tray 55, which may be supported by a hydraulic mechanism which includes two cylinders 56 for raising and lowering one end of the paper feed tray 55, the other end

being pivotally supported. These mechanisms (or suitable pneumatic or mechanical devices) raise one end of the tray **55** in an arc, until that end approaches the bottom of the stripper plate **24**. Then a piece of heavy paper is picked up and held by suction cups (not shown) mounted on the plate **24**, and the tray **55** is lowered back to its original position. Later, the sheet of paper is released to drop onto a layer of cans on the pallet **51**. The purpose of these pieces of paper, which are of the same area as the pallet **51** and which are deposited first on the empty pallet **51** and then over each layer of cans on the pallet **51**, is to tie all the can layers together, so that when the loaded pallet **51** is transported on a fork lift truck, the load will be held together.

Beneath the short draper **23** is provided a pallet feed device **70** which enables a stack of pallets **51** to be placed in a pallet feed bin **71** for transfer of one empty pallet **51** at a time to the hoist mechanism **50**, i.e., each time a loaded pallet there has been moved out to a dock station **82** by means of a pallet conveyor device **80**.

Except for the stop fingers **42**, the structure and operations thus far described are similar to those disclosed in the previously mentioned copending application Ser. No. 745,274, and reference to that application may be had to obtain a more detailed description of the palletizing operation. The present invention is more directly concerned with the problem of supplying a set including an extra staggered row of cans to the stripper plate **24** and in correct position thereon for dropping onto the pallet **51** when the stripper plate is retracted to the left as shown in the figures.

As shown in FIG. **5**, the pallet **51** is dimensioned to be approximately 13.5 can diameters in length, so that it will fully support 26 staggered rows in diamond pattern packing. In practice, the dimension is usually slightly in excess of 13.5 diameters, to be on the safe side, but is here shown to be precisely 13.5 diameters so as to illustrate a virtual "worst case" for operation of the present invention.

Now it will be seen that, when an extra staggered row of cans is to be added to a set that is 13.5 can diameters in length, the new length will be 14.0 can diameters. This is because, in the diamond pattern, one-half the diameter of each of the cans of the extra row is nestled into an opening between cans of an adjacent row, with the result that the length of the set is augmented by an increment equal to one-half a can diameter for each staggered row that is added to the set. It is clear that a set that is 14.0 diameters long can be supported on a pallet that is 13.5 diameters long, with a total overhang of one-half a can diameter, or one-fourth a can diameter at each end, if the set is centered on the pallet, as shown in FIG. **5**. In fact, such a set could be supported on a pallet that is only slightly more than 13.0 diameters long if need be, for this would still leave an overhang of less than half a can diameter at each end, and each end can would still be more than half supported by the pallet, or by another layer of cans beneath.

Referring now to FIGS. **7** and **10**, the complete can set **101** including the extra staggered row, is shown in elevation and in plan. The set contains 27 staggered rows of spaced-apart cans, the rows being aligned transverse to the path of movement and being classed according to position as being of two types **102** and **103** alternatingly as better shown in FIG. **3**. The cans **102**, **103** are also grouped according to position into two types of alternating files parallel to the path of movement. Each can touches the adjacent cans in its file, but is spaced from the adjacent cans in its staggered row.

Referring again to FIG. **10**, it will be seen that the can clamps **31** always clamp cans of position type **102**, that is to say, cans lying in files of type **102**, and cans lying in rows of type **102**, just as in the prior art. Thus must be so, for if it were otherwise, that is, if the machine were arranged so that the can clamps **31** alternatingly or randomly clamped first one type and then the other, then some corner cans of type **103** (e.g., the upper left can **103** of the set of FIG. **10**) would inevitably end up on the pallet directly above an empty space and would thus be unsupported. So the clamps must always be arranged to define the set that is to be palletized as by clamping a row of unchanging type, in this example, of type **102**, at the leading or downstream end of the "remainder" cans **104** (FIG. **1**). This condition being established, the problem arises, that the leading row **106** of the set must be of type **103**, and yet it cannot be, if the prior art procedure is followed, of forming each set with a leading row that was previously the leading remainder row that was clamped to define the previous set, which row is always of type **102**.

The present invention solves this problem by passing a redundant row **107** (FIG. **8**) preceding the set **101** along the path of movement, and then separating this preceding row **107** from the set **101** and returning it to the remainder **104** as illustrated in FIGS. **8–11** and **1**. It will be seen from FIGS. **8** and **10** that the preceding row **107** is of type **102**, that is, of the same type as the clamped row **102**, and therefore of the type that is naturally produced by the clamping action for leading the set **101** onto the stripper plate **24** when the clamps are released and the short draper **23** is activated. At such time, the set **101**, preceded by row **107** and followed by the remainder **104**, moves downstream until the preceding row **107** is stopped against a bar stop **108** attached to the stripper plate **24** (FIGS. **5** and **8**). The clamps **30** are then activated and the remainder **104** is prevented from moving further downstream. The stripper plate **24** is then set in motion downstream, and the preceding row **107** and the set **101** move bodily downstream for a short distance (FIG. **6**) until the leading row **106** of the set encounters and is stopped by a group of downwardly extending stop fingers **42**, which are positioned in the intervals between the cans of preceding row **107** so as to permit the latter to pass, as they are carried on downstream by the stripper plate **24**. As shown in FIG. **6**, the initial separation of the set from the clamped cans **109** permits the trailing row **111** of the set to clear the underlying supports **112** of the remainder **104** before being stripped from the plate **24** by action of fingers **42** to drop onto the pallet load.

As shown in FIGS. **9** and **10**, as the preceding row of cans **107** moves separately downstream on the stripper plate **24**, they are swept to one side of the plate by a sweep arm **116**, which is pivoted at one end **117** to a downstream corner of the plate **24**, and has a gathering and sweeping crook extension **118** at the other end. Also at the other end is a cam follower pin **119**, which engages a curved overhead track **121** to cause the arm to sweep at a correctly changing angle and at substantially constant velocity as the plate **24** moves downstream. Further details are shown in FIGS. **3** and **4**. The track **121** includes a pair of parallel flanges **122** extending downwardly from an overhead mounting plate **123**. In an actual apparatus, the dimension **125** is 22¼ inches, the radius of angle A is 43¼ inches, and the radii of angles B and C are 12 inches. To give the cans of preceding row **107** time to clear the fingers **42** before the sweeping action begins, the arm **116** is cocked somewhat downstream in the forward position of plate **24**, as shown in FIG. **3**.

As the cans of row **107** reach the side of the plate **24**, they are swept completely off the plate and onto a shelf **131**, which is slightly lower than the surface of plate **24**, to prevent return of the cans to the plate. A can guide rail **132** is mounted at the side of shelf **131**. For returning the cans **107** toward the upstream end of the machine, a bracket **133** and pusher flange **134** extend from the plate **24** near the pivot end **117** of the sweep arm, and the flange pushes the cans **107** upstream along shelf **131** as plate **24** returns upstream after dropping the set **101** of cans onto the pallet load (FIGS. **10** and **11**). At the furthest upstream excursion of plate **24**, the cans **107** are pushed onto a downstream-to-upstream moving conveyor belt **136** (see also FIG. **4**). As shown in FIG. **1**, the belt **136** carries the cans **107** to the upstream end of long draper **22**, where a curved extension **137** of guide rail **136** forces the cans **107** onto the draper **22** for return to remainder **104** to become part of a subsequently formed set.

Thus there has been described an arrangement in which a pallet that is dimensioned for fully supporting a certain

number of cans that are packed in layers, and the layers in an even number of staggered diamond pattern rows, is to be packed with an extra row in each layer. The bottom layer is to be centered on the pallet so that the containers of the edge rows, including the extra row, each overhand beyond the pallet by less than half so as still to be solidly supported. The apparatus accomplishes this packing by moving a set including the extra row of containers along a path above the pallet with the set preceded by a single row and followed by a remainder portion of containers; stopping the remainder to permit the set to separate therefrom; and then removing the preceding row before the set is lowered onto the pallet. The containers of the preceding row are then recirculated to the upstream portion of the path to become part of a subsequent set.

What is claimed is:

1. Apparatus for packing a set of containers in staggered rows for pallet loading, comprising:

means for moving said containers in said staggered rows serially along a path with said set preceded by a single row and followed by the remainder of said containers;

means for moving said preceding row and said set concurrently away from said remainder and to a position in which said set is above said pallet and said preceding row is beyond said pallet; and

means for moving said preceding row away from said set.

2. Apparatus as described in claim 1, adapted for a pallet of the type that has a dimension along said path less than the corresponding dimension of said set but greater than the corresponding dimension of said set less two rows; and further characterized in that:

said means for moving said preceding row and said set away from said remainder includes first stop means for stopping said set in said position above said pallet so that the leading and trailing containers of said set each overhang beyond said pallet by less than half.

3. Apparatus as described in claim 1, wherein:

there is also provided a means for returning said preceding row containers to said remainder to become part of a subsequently formed set.

4. Apparatus as described in claim 2, wherein said means for moving said preceding row away from said set includes:

means for sweeping the containers of said preceding row to one side of said path at a point substantially downstream from said stopped position of said set above said pallet.

5. Apparatus as described in claim 4, wherein said means for moving said preceding row and said set away from said remainder includes:

second stop means for stopping the leading row of said remainder at a position spaced from said stopped position of said set by a dimension sufficient to permit vertical descent of said set without interference from the portions of said container moving means underlying said remainder.

6. Apparatus as described in claim 5, wherein:

said means for moving said preceding row and said set away from said remainder also includes a stripper plate reciprocating along said path between a first set supporting position engaging said underlying supports of said remainder, and a second set dropping position entirely downstream from said above-pallet position of said set;

said stripper plate having a transverse stop element for said preceding row positioned in the first position of said plate to stop said containers with said leading row of said remainder aligned with said second stop means, prior to the actuation of said second stop means.

7. Apparatus as described in claim 6, wherein:

said containers are cylindrical cans, and said staggered rows are the discontinuous rows of a diamond pattern oriented with said staggered rows transverse to said path, so that the continuous files of cans lying along said path in said set contain alternately odd and even numbers of cans and said preceding staggered row contains cans from the same files as the leading staggered row of said remainder;

whereby said leading staggered row of said remainder is fitted to become the preceding staggered row of a subsequently formed set, and whereby the leading and trailing staggered rows of said set also contain cans from the same files, different from the files of said set-preceding and remainder-leading staggered rows.

8. Apparatus as described in claim 7, wherein said sweeping means includes:

a sweep arm having a crook at one end and pivoted at the other end to said stripper plate at the downstream end, thereof and adjacent said one side of said path to which said preceding row cans are to be swept; and

a cam track mounted above said stripper plate and engaged by a cam follower projection on said crook end of said sweep arm for guiding said arm between a first position aligned substantially transversely across said stripper plate in the first position of said stripper plate, and a second position aligned along said one side of said path in the second position of said stripper plate.

9. Apparatus as described in claim 8, wherein:

a shelf is provided for receiving said swept cans at said one side of said path and slightly lower than the top of said plate, said shelf being provided with an outboard guide rail for said cans; and

a pusher flange is provided at the downstream end of said stripper plate for pushing said swept cans in a downstream to upstream direction along said shelf when said stripper plate returns from second to first position.

10. Apparatus as described in claim 9, wherein:

a conveyor belt is provided alongside said path, together with an extension of said guide rail, for receiving said swept cans and conveying same in a downstream to upstream direction past said set and to a point substantially upstream from the accumulated cans of said remainder for return of said swept cans to the upstream end of said remainder.

11. Apparatus as described in claim 1, wherein:

said container moving means includes a long draper continuously moving along said path in an upstream to downstream direction, means for presenting containers to said long draper at the upstream end thereof, and a normally stopped short draper downstream from said long draper for receiving said containers therefrom;

said means for moving said preceding row and said set away from said remainder of said containers, includes a stripper plate on said path downstream from said short draper and movable between a first position above said pallet and engaging said short draper and a second position spaced downstream therefrom for a dimension greater than the length of said set along said path, and second stop means for said remainder at the downstream end of said short draper;

said means for moving said preceding row away from said set includes a first stop means for said set whereby said set is stopped above said pallet in spaced relation to said remainder and is stripped from said stripper plate while said preceding row remains on said stripper plate and moves downstream therewith.

12. Apparatus as described in claim 10, wherein said container moving means includes:

a long draper upstream from said stripper plate and continuously moving on said path;

means for presenting cans to said long draper at the upstream end thereof, said last-named means including said conveyor belt and guide rail extension; and

a normally stopped short draper between said long draper and said stripper plate and constituting at least part of said underlying support of said remainder.

* * * * *