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(54) Automatic box loading and unloading apparatus.

(57) Box loading and unloading apparatus for loading assembled blocks of product items into boxes and unloading product blocks therefrom, wherein means (28,46) are provided to locate and retain the box (30), which is at least partially opened, and a pusher plate (34,54) spanning the product block (20) is used to push the block into or out of the box from or on to a transporter means (22,52).

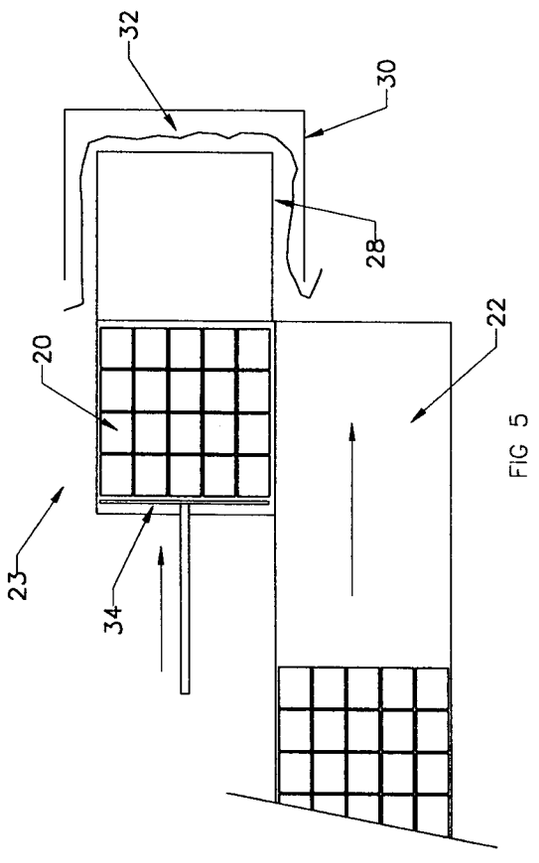

FIG 5

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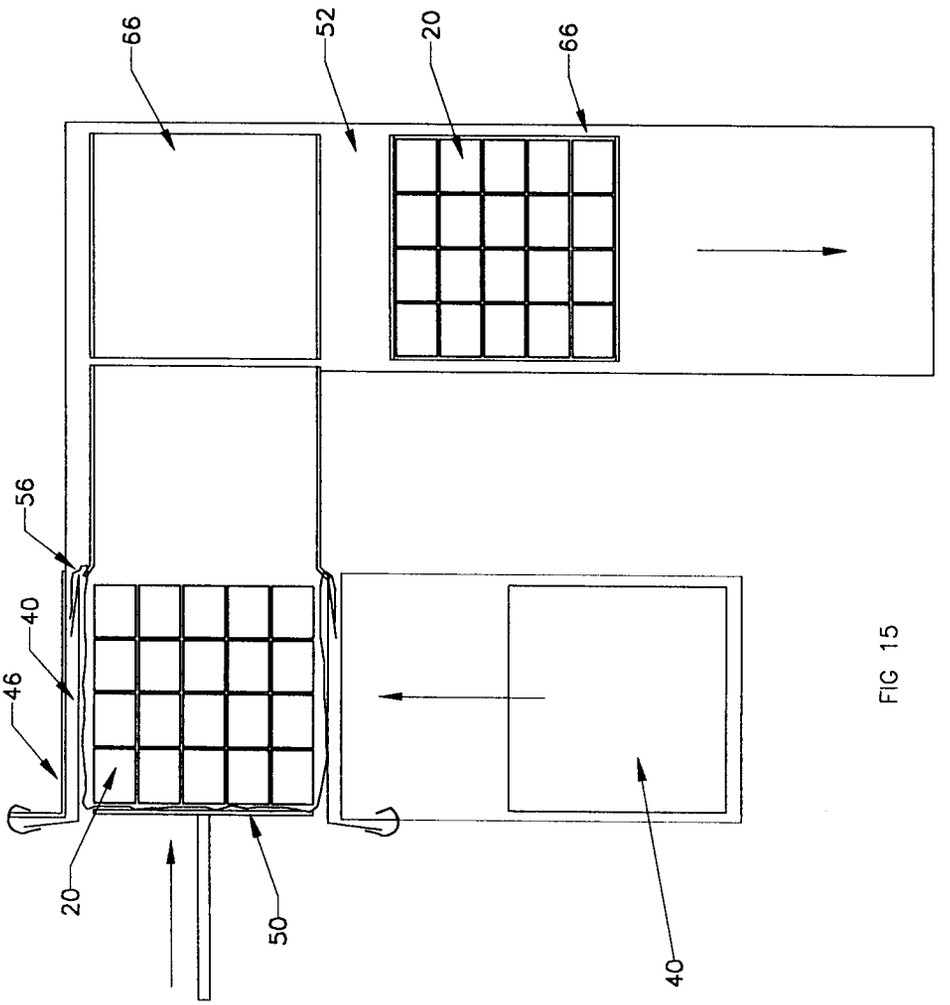

FIG 15

This invention relates to automatic box loading and/or box unloading apparatus.

Many products are packed into boxes for ease of handling and protection during storage and transit. Items which are not free-flowing are often difficult to pack automatically and loading into boxes is carried out manually. This is particularly but not exclusively the case with plastics containers and lids, which are used for packing a variety of goods, mainly foods such as margarine, cream, yoghurt, etc.

These containers and lids are formed by processes such as thermo-forming and/or injection moulding and, on exit from the forming equipment, are generally formatted for packing into sticks of a length convenient for manhandling. Typically a box may contain about 1000 pieces in 20 sticks of 50 items.

The containers are designed to 'nest' inside each other and they generally form stable stacks which can be fairly readily handled. Lids, however, form unstable stacks which must be handled very carefully. Invariably both types of product are passed through a printing process after manufacture, but because the manufacturing and printing machines work at very different rates it is not usually possible to link them as a continuous process. Typically, products are manufactured at rates up to 50,000 items per hour per machine and printed at rates up to 25,000 parts per hour per machine. Thus, the common practice is to pack the unprinted items into boxes directly after manufacture and then pass them through the printing machine at a later time. This means that the products must be unloaded from boxes, fed into a printer, and then re-loaded into boxes.

A further complication with food containers is that hygiene regulations require a flexible plastics liner to be placed into the boxes to protect the contents from the ingress of dust or other contaminants during storage and transit. This liner has created many difficulties in previous attempts to automate the loading and unloading of boxes.

Only one automatic box loader/unloader is known to be available currently, and this machine is very expensive and can handle round tubs only. Lids of any shape and rectangular tubs cannot be handled in this known equipment.

According to one aspect of the present invention, there is provided box loading apparatus which comprises a locating means over which in use is fitted a box to be loaded, which box is open only at one vertically faced end, and a pushing plate which spans a block of assembled items to be loaded into the box and is operable horizontally to push the block into the box and then further push the loaded box off the locating means on to a supporting surface to enable its open end to be closed.

The locating means is preferably a hollow, open-ended spigot of the same shape as the box to be loaded but with slightly smaller outside dimensions.

A flexible liner may be fitted over the spigot before fitting the box. In this case the pushing plate loads the block of items into the liner within the box and further pushes the lined and loaded box off the spigot.

The invention also comprises a method of box loading in accordance with the above-described procedure.

According to another aspect of the invention, there is provided box unloading apparatus which comprises a locating means within which in use is fitted a box loaded with a block of items to be unloaded, the box being open at both vertically faced ends, and a pushing plate slightly smaller than the cross-section of the box operable horizontally to push the block of items out of the box on to a supporting surface and retractable to enable the empty box to be recovered from the spigot.

The locating means may be a hollow, open-ended spigot of the same shape as the box but with slightly larger inside dimensions, but is preferably constituted by rigid side guides for receiving the loaded box between them.

Assuming the box is loaded with a block of items within a liner, the liner is also opened within the loaded box within the guides, and a suction means may be provided on the exit side of the guides to retain the liner and free it from the block of assembled items as the block is pushed out of the box. Alternatively and preferably, with the liner open only on the exit side, the pushing plate may push the block out of and beyond the box sufficiently far first to turn the liner inside-out and then push the block out of the liner.

The invention also relates to a method of unloading a box in accordance with the above-described procedure.

It will be appreciated that the box loading apparatus may be employed at the exit from the product manufacturing machine and at the exit from the product printer, whilst the box unloading equipment may be employed at the input to the printer.

Further features of the invention will be apparent from the following description of embodiments, referring to the accompanying drawings, in which:-

Figure 1	shows stacks of product items emergent from a forming machine or printer;
Figure 2	diagrammatically shows a collator;
Figure 3	shows a block of collated product items at the exit of the collator;
Figure 4	shows the block of items during transit to the input of a box loader;
Figures 5 and 6	show the operation of the box loader in diagrammatic manner;

Figure 7	shows a modification;
Figure 8	shows a loaded box prepared for location in a box unloader according to one embodiment;
Figure 9	shows the prepared loaded box located in the unloader;
Figures 10 and 11	show the operation of the box unloader diagrammatically;
Figure 12	shows the output side of the box unloader;
Figure 13	shows a conveyor/tray system which may be used in conjunction with the box loader;
Figure 14	shows a block of product being loaded from a tray into the box loader;
Figure 15	shows a second embodiment of box unloader ready to unload a block of product on to a tray in a conveyor/tray system which may be used in conjunction with the box unloader; and
Figure 16	shows the manner of operation of the second embodiment of box unloader.

Referring to the accompanying drawings, in general Figures 1 to 7 relate to the box loader; Figures 8 to 12 to the box unloader; Figures 13 to 15 to a conveyor/tray system for use with the box loader and box unloader; and Figure 16 to a modified box unloader.

Thus, referring first to Figures 1 to 7, products are formed into stacks 10 of the desired count as they emerge from either a forming machine or printer. These stacks are presented to the box loading system in vertical mode, as shown in Figure 1.

Thus, the first equipment module, a collator 12, forms the sticks 14 emergent from the forming machine into the pattern required to suit the box size and shape into which they are to be packed. Collation may be carried out by moving the vertical sticks into position using a combination of pushers 16. The pushers are programmed automatically to produce the desired pattern, as exemplified by the block 18 being formed in the collator 12.

The completed blocks 20 of sticks are then transferred to a buffer store, usually a conveyor 22, as exemplified in Figure 3. The conveyor 22 moves the blocks 20 of product to the outfeed end of the machine, where they are queued. They are then automatically transferred to a box loading position 23, 24 or 26 whenever that position becomes vacant (see Figure 4).

A hollow, open-ended spigot 28 of the same shape as the box 30 but with outside dimensions slightly smaller than the inside of the box is fitted adjacent to the load position 23. A liner 32, if required, may be slipped over the spigot and then the box, open at one vertical face, fitted over both, as shown in Figure 5.

When the box 30 is required to be filled, a pushing plate 34 is operated which pushes the block 20 of product from the loading position 23 and through the spigot 28, taking the liner 32 and box with it, as shown in Figure 6.

If space is limited, the pusher stroke can be shortened by using one block 20A of product to push another block 20 into the box 30 and through the spigot 28, as exemplified by the modification of Figure 7.

The above-described loading process is repeated until the buffer store 22 (Figures 4 and 5) is empty, leaving the operator free to load boxes from other machines while the buffer store is automatically re-filled by the system.

It is estimated that the time taken to unload the buffer store 22 into boxes will be only about 20% of the time taken to fill it. This will enable one operator to service 4 or 5 lines fitted with the box loading system, compared to the one line which is the normal manning level in this industry.

Unloading a box is now described with reference to Figures 8 to 12.

Again, for convenience, the system is described for use with plastics tubs and lids, as in the example of box loading.

A box 40, loaded with product 20, is prepared for unloading manually by opening the top flaps 42 at one end, pulling out the excess liner material 44 and folding it down over the flaps (see Figure 8).

The infeed of the box unloading machine is fitted with rigid side guides 46 dimensioned so that the opened box 40 will fit easily between them. Thus, the product container 40, with the top opened as described, is placed horizontally between the side guides 46, making sure that the stacks of product 20 are vertical and the desired way up as indicated in Figure 9, which shows the box fully prepared for unloading. The bottom of the product box 40 is opened and the flaps 48 retained in the open position by clipping them to flanges of the side guides, as indicated at 49. A complete, hollow, open-ended spigot, of the same shape as but slightly larger than the box, could be used in place of the side guides 46.

With the full box-holding assembly located within the guides, as shown in Figure 10, a pushing plate 50 is operated to push the contents 20 of the box 40 out onto a support plate 52. As shown in Figure 11, as the product is transferred it passes over a slot 54. A fan is fitted adjacent to the slot 54 to provide a negative air pressure, which applies suction to the box liner 56 to prevent it from snagging on the product. The pusher plate then retracts through the side guides and the empty box and liner is retrieved by the operator.

The block of product is transferred from the unloading point into a buffer store, preferably a conveyor 58. The conveyor 58 operates to carry the product block to the outfeed end and the block is moved from the buffer store 58 into a stack separator 60 where the block is split into individual sticks 62 for feed into, for example, a printer, as shown in Figure 12.

In practice, the operator will feed boxes into the unloader until the buffer store is full. The buffer store size would in practice be limited only by space requirements but a convenient capacity would be about 30 minutes of production time.

It is estimated that unloading time with this system would be about 25% of production time, thus enabling one operator to service 3 or 4 machines, also fitted with the automatic system. This compares with the current pattern of one operator per 1 or 2 machines, when the stacks are unloaded manually one stack at a time from the containers.

In the foregoing description, it is assumed that the product is loaded from a simple conveyor belt into the boxes and analogously unloaded on to a simple conveyor belt. In practice, it is preferred to employ a conveyor/tray system, wherein the blocks of product are transferred to the box loader from trays movable by a conveyor, and likewise unloaded into trays movable by a conveyor. Transporting the product in this way eliminates relative movement between the conveyor and the bottom of the product block when queueing takes place, which can result in product damage. Moreover, in the case where the product items are round, the use of trays eliminates relative movement between the product sticks which make up the blocks.

In Figures 13 to 16, similar reference numerals are employed as in Figures 1 to 12, where appropriate.

Figures 13 and 14 are analogous to Figures 2 to 6, but show that the product blocks 20 emergent from the collator 12 (Figure 2) are loaded onto trays 64 on the conveyor 22 (Figure 13), and at the box loader (Figure 14) are pushed by pusher 34 from the trays into the lined open box 30 located on the spigot 28, prior to pushing the filled box off the spigot.

Figure 15 is analogous to Figures 10 and 11, but shows that the product blocks 20 are unloaded at the box unloader on to trays 66 on the conveyor 52.

Figure 15 also shows a modified box unloader, also shown at a later stage of operation in Figure 16. In this box unloader, the loaded box, open at its ends, is again located between rigid side guides 46, but the pusher 50 has a longer stroke (twice the length of the box), so as to push the product block 20 sufficiently far out of the box, either on to the conveyor 52 or more preferably on to a tray 66 movable by the conveyor 52, that the liner 56 is turned inside out, as more particularly shown in Figure 16. The requirement for suction slot 54, shown in Figures 10 and 11, is thereby avoided, provided space requirements permit the pusher 50 to be given a long stroke.

It is found that when the pusher 50 is retracted, the liner invariably snags on the edges of the pusher and will be pulled back into the empty box 40 to facilitate removal of the empty box from between the rigid guides 46. However, this is not important; if the liner is left turned inside out, it can readily be pushed back by the operator when the empty box is removed from the guides.

Although this specification describes systems for use for plastics tubs and lids, there are many other products which could be automatically loaded into boxes and unloaded therefrom using the apparatus and method above described. Moreover, while reference has been made to use of the box loader and box unloader between the stages of product manufacture and product printing, the box loader and unloader may also be used at other stages of usage of the product, for example at a product, e.g. tub, filling machine.

Various other modifications of the above-described and illustrated arrangement are possible within the scope of the invention as claimed.

For example, the above description implies the use of cardboard boxes 30, 40, the ends of which are closed by flaps which may sometimes be required to be clipped back, e.g. as indicated at 49 in Figure 10, when an opened box is located in position for loading or unloading. However, the above-described system is also envisaged for use with plastics boxes, typically having an open-ended box portion formed by extrusion and separate vacuum formed flanged lids. In this case, it is simply necessary to remove and replace one or both lids when necessary during box loading and unloading.

The description also implies manual fitting of the box on the spigot 28 of the box loader and between the side guides 46 of the box unloader. Sometimes, however, it may be possible to place the prepared boxes, i.e. boxes with either one or both vertical end faces open, in a buffer store, from which the boxes are conveyed and automatically located on to the spigot 28 or between the side guides 46.

Claims

1. A method of box loading according to which an empty box (30) to be loaded is located with one vertical

end face open, and a block (20) of assembled product items to be loaded is pushed into the box and then further push the block so that the loaded box is pushed out of the located position to enable its open end to be closed.

2. Box loading apparatus for use in carrying out the method of claim 1, comprising a locating means over which in use is fitted a box to be loaded, which box is open only at one vertically faced end, and a pushing plate which spans a block of assembled items to be loaded into the box and is operable horizontally to push the block into the box and then further push the loaded box off the locating means on to a supporting surface to enable its open end to be closed.

3. Box loading apparatus according to claim 2, wherein the locating means is a hollow, open-ended spigot of the same shape as the box to be loaded but with slightly smaller outside dimensions.

4. A method of box unloading according to which a loaded box (30) to be unloaded is located with its vertical end faces open, and a block (20) of product items filling the box is pushed out of the box on to a transporting means (52), leaving the box retained by the locating means (46) for removal and re-use.

5. A method according to claim 4, according to which the product block is contained within a flexible box liner (56) which is retained when the product block is pushed out of the box.

6. A method according to claim 5, according to which the liner is retained by means of suction (54).

7. A method according to claim 5, in which the product block is pushed sufficiently far out of the box to turn the retained liner inside-out.

8. Box unloading apparatus for carrying out the method of any of claims 4 to 7, comprising a locating means within which in use is fitted a box loaded with a block of items to be unloaded, the box being open at both vertically faced ends, and a pushing plate slightly smaller than the cross-section of the box operable horizontally to push the block of items out of the box on to a supporting surface and retractable to enable the empty box to be recovered from the spigot.

9. Apparatus according to claim 8, wherein the locating means comprises a pair of rigid side guides for the box, to which the opened box is attached.

10. Apparatus according to any of claims 3, 8 or 9, wherein the product block is loaded from a tray movable by a conveyor and/or is unloaded on to a tray movable by a conveyor.

11. Apparatus according to any of claims 1 and 2 or claims 8 to 10, wherein prepared boxes with one or both vertical end faces open are stored in a buffer from which said prepared boxes are automatically conveyed and located at the locating means.

12. Production apparatus according to claims 3, 8 and 10, comprising at least one box loader, at least one box unloader, and at least one tray/conveyor system for handling blocks of product items assembled by a collator.

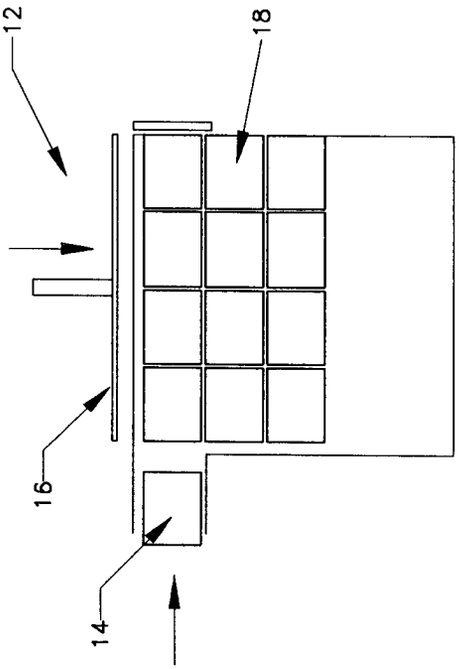

FIG 2

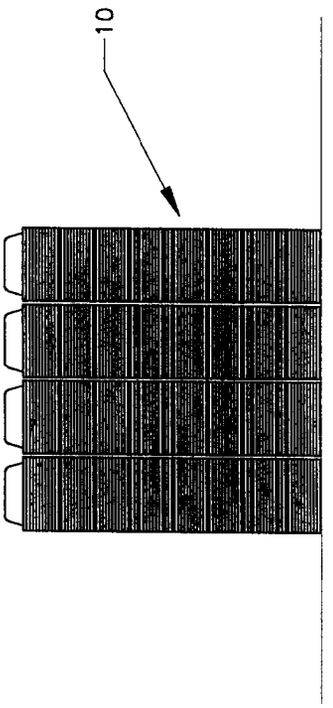

FIG 1

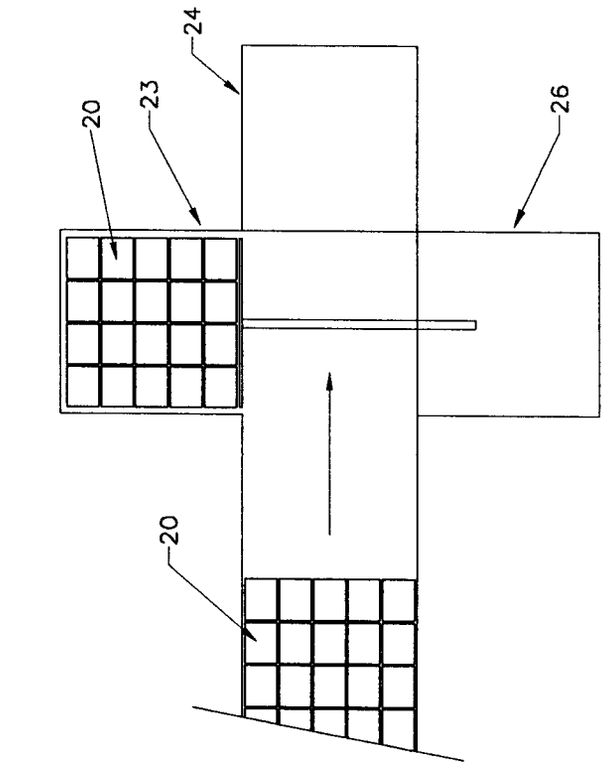

FIG 4

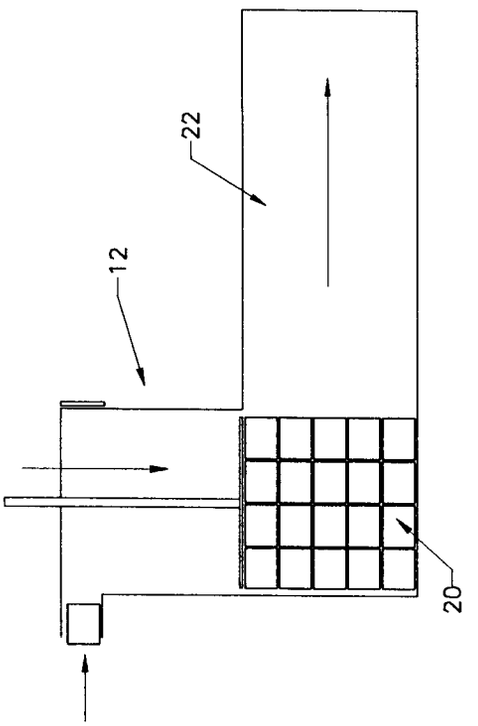

FIG 3

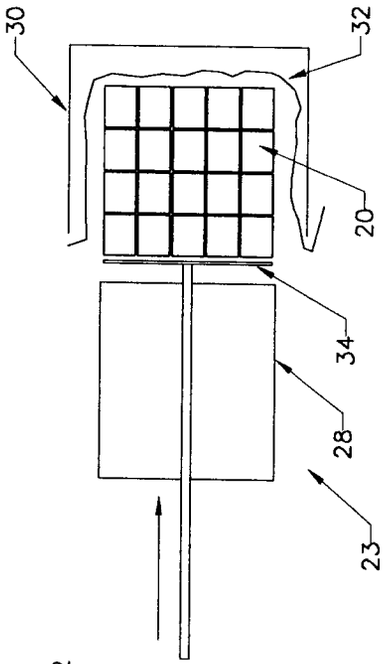

FIG 6

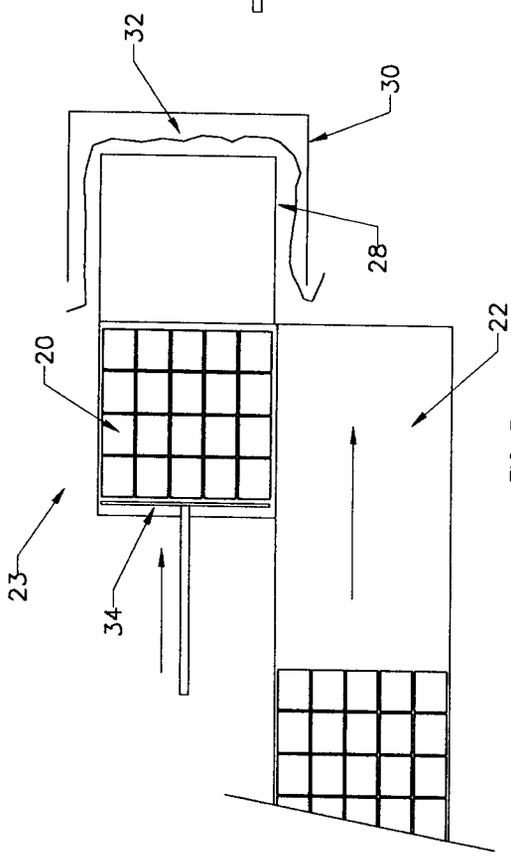

FIG 5

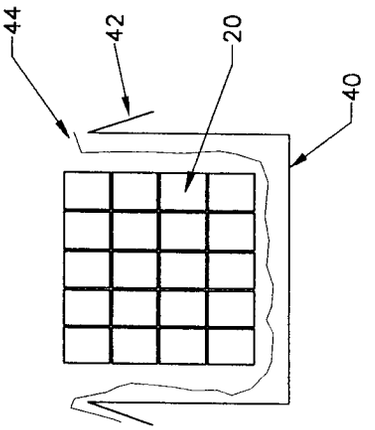

FIG 8

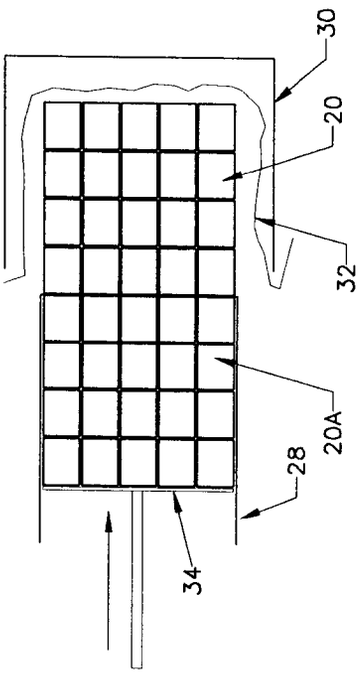

FIG 7

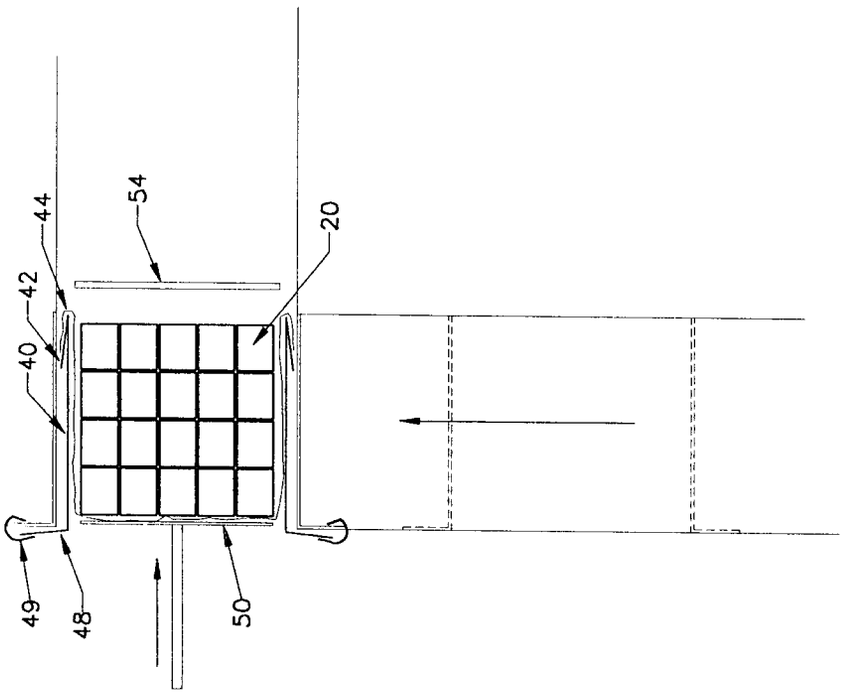

FIG 10

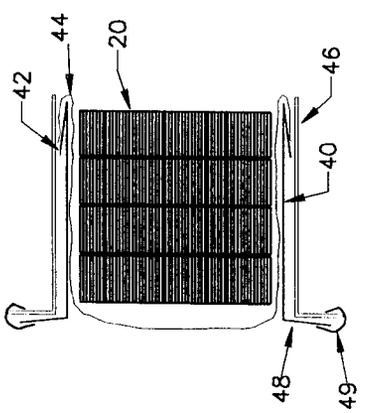

FIG 9

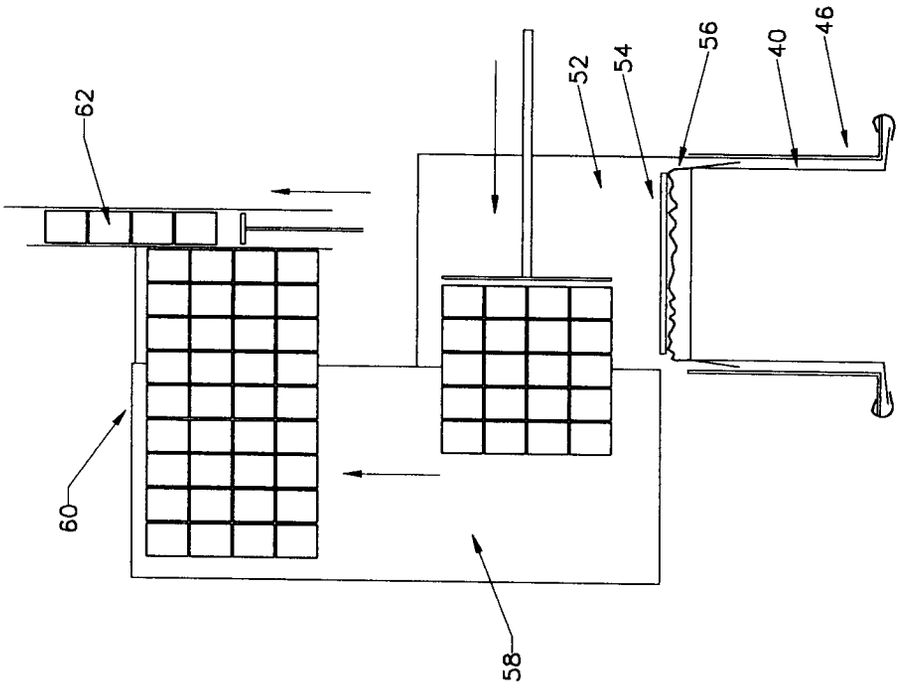

FIG 12

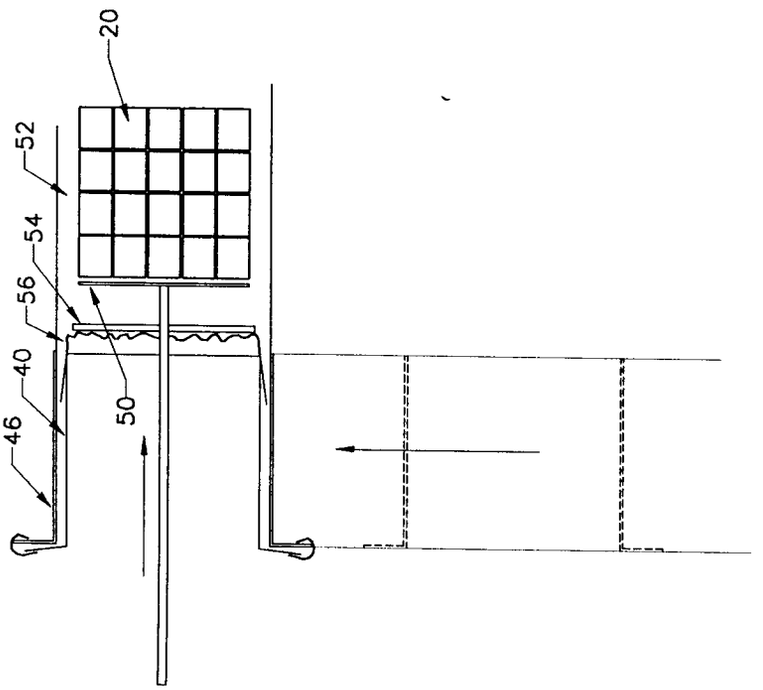

FIG 11

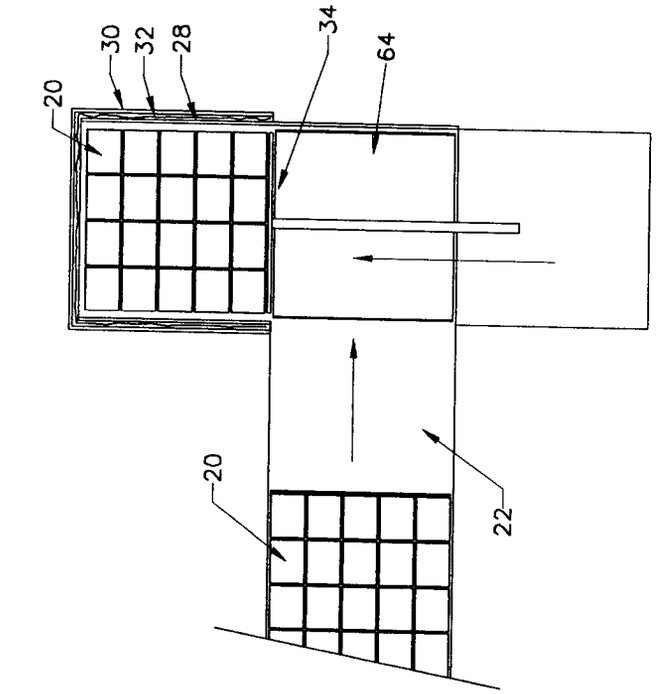

FIG 14

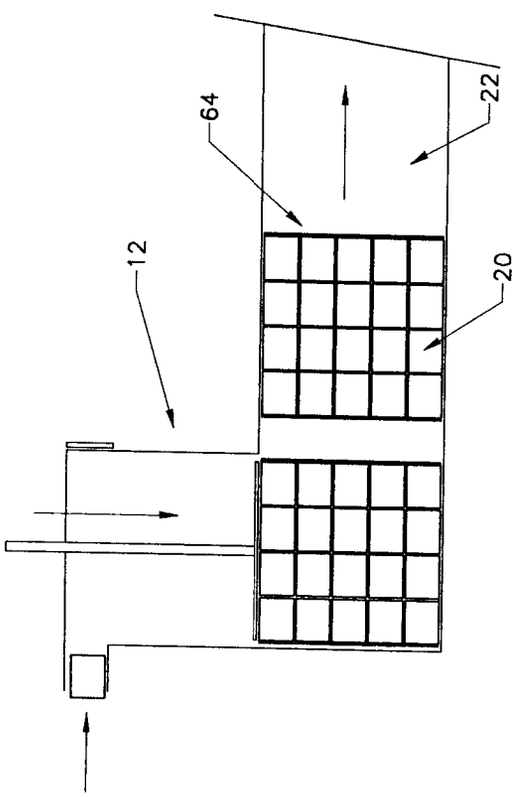

FIG 13

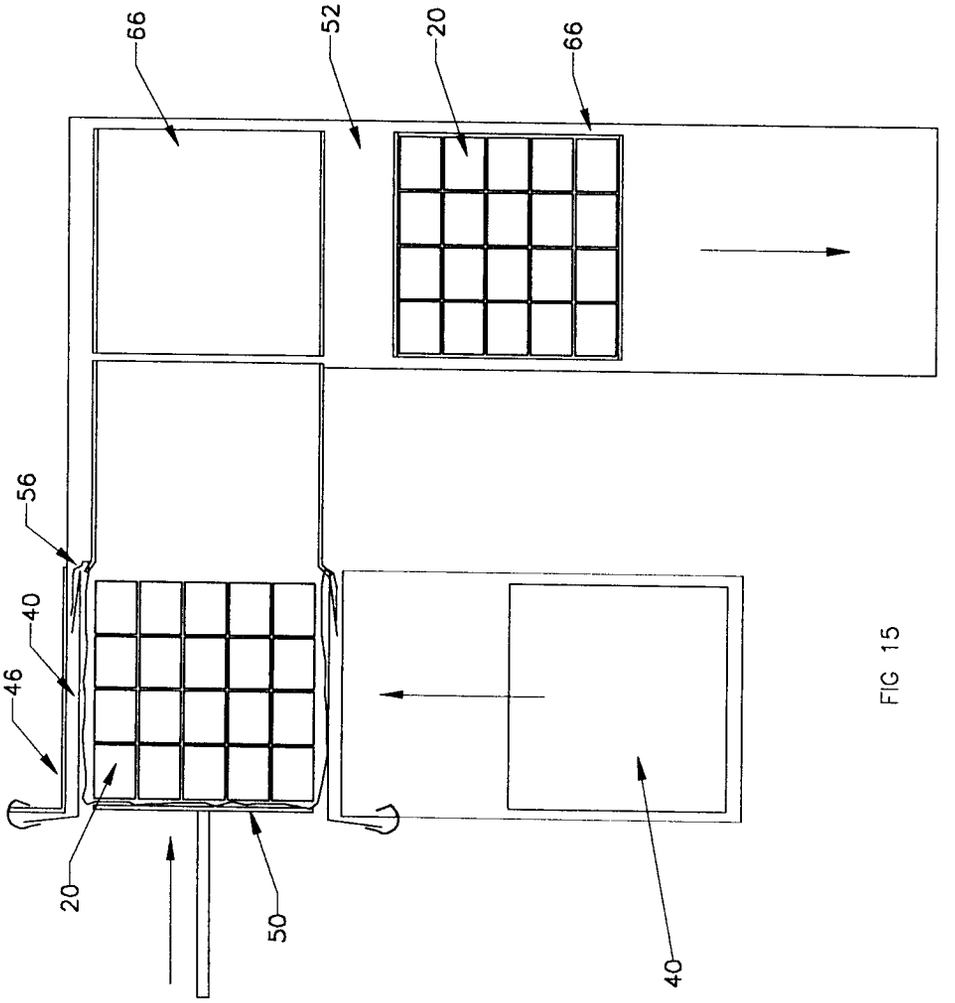

FIG 15

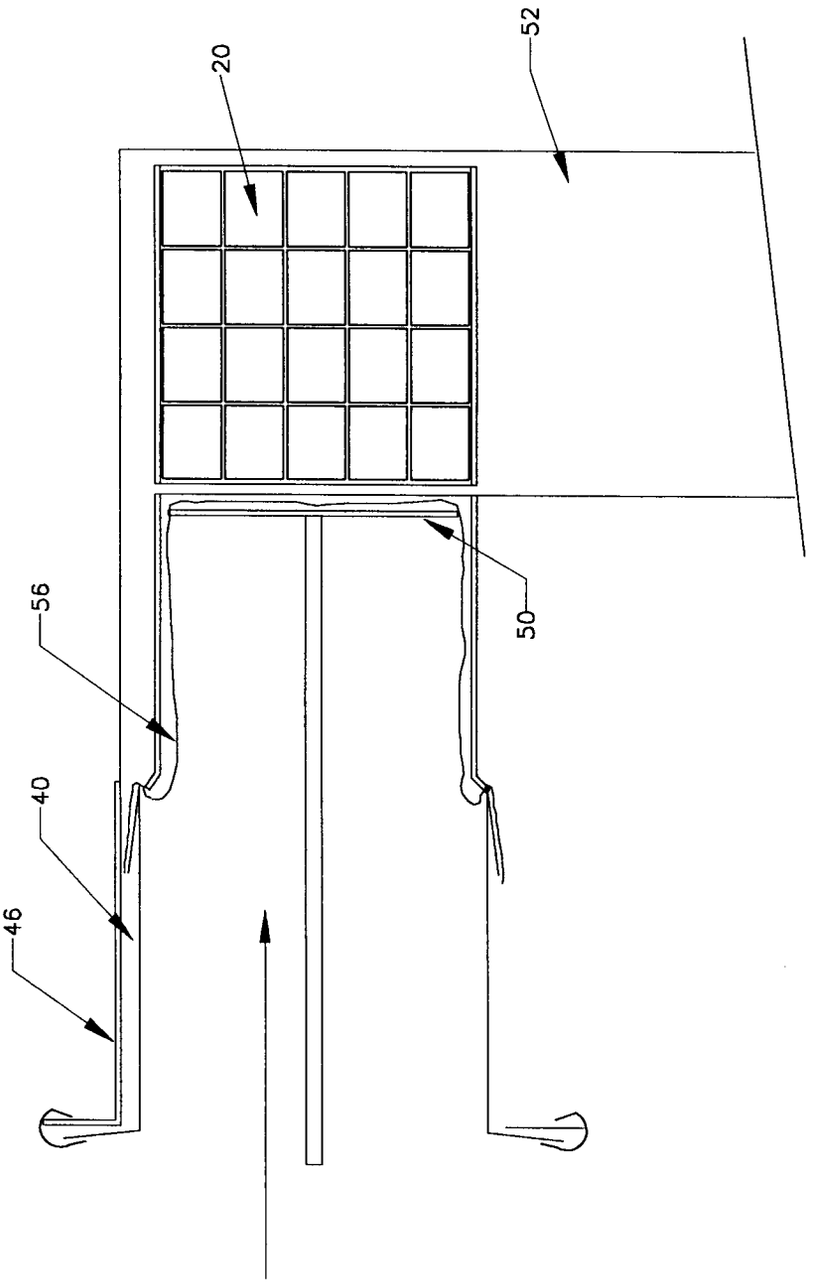

FIG 16

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 30 5994

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	US-A-3 041 803 (G. GAMBERINI) * column 2, line 40 - column 4, line 16; figures *	1-3,10	B65B5/06 B65B69/00
A		12	
A	CH-A-389 503 (UNILEVER) * page 3, line 4 - line 59; figures *	1-3	
A	US-A-3 022 615 (A. SCHROEDER)		
A	GB-A-2 096 092 (FOCKE & CO)		

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

B65B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	19 December 1994	Jagusiak, A

CATEGORY OF CITED DOCUMENTS

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