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(54) Improvements in or relating to tray assemblies.

(57) With reference to Figure 1, a method of constructing a tray assembly results in a demountable tray assembly 1 which comprises three juxtaposed stacks of vertically-spaced trays 2, opposite ends of which are supported by upright structures 3 carrying tray support members 4 which extend beneath the trays 2. The assembly 1 is provided with retaining means 5 operable to releasably retain the trays in place, on the tray support members 4.

Each of the three stacks of trays comprises six superimposed trays 2, so that the assembly 1 comprises eighteen trays. The end portions of the trays are formed with cut-away portions 6.

The tray support structures 3 each comprise a frame formed by two upstanding, laterally-spaced pillars 10 which are interconnected by the tray support members 4.

The tray retaining means 5 comprise two sets of vertically spaced tray retraining members 15 mounted on a sub-frame 16 so as to be movable towards and away from the tray support members 4. In operation, the tray retaining members 15 are received by the cut-away portions 6. When the retaining members 15 are moved down, substantially vertically, so that they are contiguous with the tray support members 4, and received by the cut-away portions 6, movement of the trays 2 relative to the members 15 and 4 is limited, so that the trays are effectively retained in place.

To allow release of the trays 2, the sub-frame 16 is moved upwardly, so that the retaining members 15 are moved away from the tray support members 4, in a substantially vertical direction.

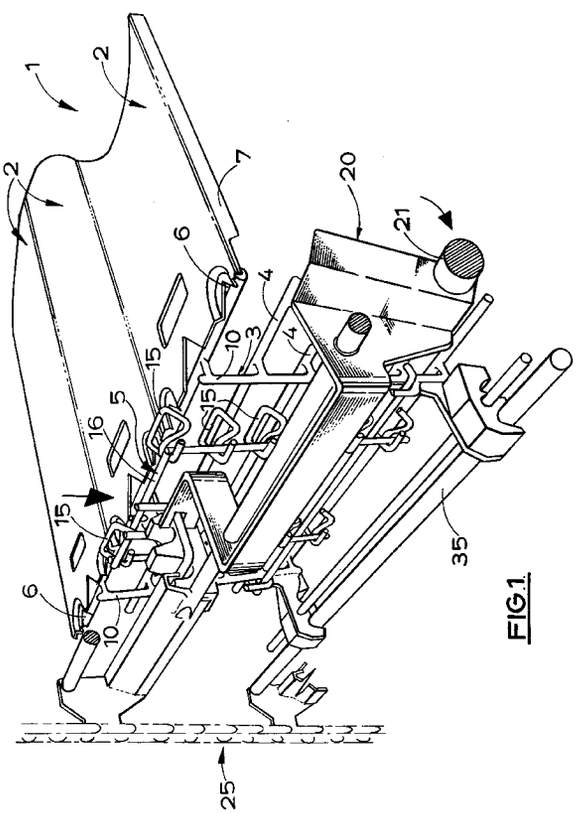

FIG.1.

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This invention relates to tray assemblies which are particularly, but not exclusively, for use in conveying food products through controlled environments.

As used herein, the term 'tray' is not limited to a structure having a flat support surface with a raised edge, and includes other forms of support structures. For example, box-shaped structures.

Freezer tunnels for use with food products have traditionally employed trays mounted on a conveyor chain which passes through a controlled temperature environment in a continuous spiral path. The shape of the spiral has taken a number of forms in order to make the best use of the volumetric space available.

However, all configurations require sufficient space to enable the trays to be turned in the spiral path. A favoured configuration combines the use of long straight sections with 180 degree turns so as to form a zig-zag. When the trays are subjected to such turns there is a speed limitation imposed by the need to retain the food products in stable positions on the trays while under centrifugal forces. For most ice-cream products it is necessary for the product to rest on plain, ie flat surfaced, trays. The use of webbed or friction surfaces would cause the products to permanently adhere to the tray surface. These factors combine to effectively limit the throughput of such freezer tunnels to a maximum of 450 product pieces per minute.

The traditional designs of spiral freezer tunnels require the conveyor belt or chain to travel through the controlled environment. Additionally, the trays are usually driven by the conveyor at one side, with the supported ends on a runner. This design usually requires the trays to be securely fixed to the conveyor chain, which causes problems of friction, planar rotation of the trays, restriction of tray size and spacing, and difficulties with lubrication and with hygiene conditions.

According to the invention, a method of constructing a tray assembly comprises the steps of forming a stack of vertically-spaced trays, supporting opposite ends of the trays by upright structures carrying tray support members and employing retaining means to releasably retain the trays in place on the support members.

A tray assembly for use with said method may comprise at least one stack of vertically spaced trays, opposite ends of which are supported by upright structures carrying tray support members which extend beneath the trays, and retaining means operable to releasably retain the trays in place on the support members.

The retaining means may comprise a plurality of vertically spaced tray retaining members movable towards and away from the tray support members and the trays may be formed so as to receive said tray retaining members.

The tray retaining members may be movable substantially vertically, or substantially horizontally.

The invention also comprises the combination of the tray assembly and a conveyor system operable to transport the assembly along a predetermined path.

The predetermined path preferably extends through a chamber, the interior of which may be made to provide a controlled environment within which the assembly is transported.

Two embodiments of the invention will now be described by way of example only, with reference to the accompanying drawings, wherein:

Figure 1 is a view in perspective of part of a tray assembly according to a first embodiment,

Figure 2 is a side view, in section, of a freezing chamber or tunnel,

Figure 3 is a plan view of the tunnel,

Figure 4 is a fragmentary view in perspective of an 'exploded' form, of an end portion of a tray as well as associated end support structures, all forming part of a second embodiment of the invention,

Figure 5 is a view in perspective of the tray assembly according to the second embodiment,

Figure 6 is a view in perspective of an 'exploded' form, which illustrates the tray support structure of the second embodiment,

Figure 7 is an end view of the tray assembly, and

Figures 8 and 9 are fragmentary side views and illustrate different operating conditions of the tray assembly.

With reference to Figure 1, a tray assembly 1 comprises three juxtaposed stacks of vertically-spaced trays 2, opposite ends of which are supported by upright structures 3 carrying tray support members 4 which extend laterally from the structure 3 and beneath the trays 2. The assembly 1 is provided with retaining means 5 operable to releasably retain the trays in place, on the tray support members 4.

The trays 2 are of elongate form. Each of the three stacks comprises six superimposed trays 2, so that the assembly 1 comprises eighteen trays. The trays 2 have downwardly-extending side edges 7. The end portions of the trays are formed with cut-away portions 6, disposed to the sides of the longitudinal axes of the trays.

The tray support structures 3 each comprise a frame formed by two upstanding, laterally-spaced pillars 10 which are interconnected by the tray support members 4, which extend substantially normal to the pillars 10.

The tray retaining means 5 comprise two sets of vertically spaced tray retraining members 15 mounted on a sub-frame 16 so as to be movable towards and away from the tray support members 4. In operation, the tray retaining members 15 are received by the cut-away portions 6 of the trays 2. When the retaining members 15 are moved down, substantially vertically, so that they are contiguous with the tray

support members 4, (as shown in Figure 1) and received by the cut-away portions 6, movement of the trays 2 relative to the members 15 and 4 is limited, so that the trays are effectively retained in place.

To allow release of the trays 2, the sub-frame 16 is moved upwardly, so that the retaining members 15 are moved away from the tray support members 4, in a substantially vertical direction.

A tray retaining member 15 comprises rod material formed so that it is of generally rectangular form, and is secured to the sub-frame 16. The retaining member 15 is inclined at an angle to the sub-frame 16. As shown in Figure 1, a single member 15 is used to retain a pair of juxtaposed trays 2.

The sub-frame 16 is movable upwardly and downwardly by displacement of a cam-operated lever 20 which carries a lug or spigot 21.

Two sets of structures 3 and associated components are disposed at opposite sides of a tray assembly elevator 25, (Figure 2), disposed within a chamber 26 comprising a freezing tunnel. A horizontal, in-feed indexing conveyor 27 extends through the tunnel 26, from one end thereof, and co-operates with a horizontal, out-feed indexing conveyor 28 at the opposite end of the tunnel. A tray assembly delevator 29 is disposed adjacent said opposite end. The tunnel 26 has ante- and post-chambers 30, 31, respectively.

Loose trays 2 are fed by the indexing conveyor 27, preferably in groups of three, onto the tray support rods 4 of the upright structures 3. The structures 3 are indexed vertically by the elevator 25, and in sequence with the tray in-feed conveyor 27, to enable the next level of the assembly to receive its trays. The lug 21 of each lever 20 follows a track (not shown) alongside the vertically-disposed elevator 25. When an assembly has been filled with trays 2, the vertical motion of the lugs 21 provides cam actions on the levers 20 so as to move the sub-frames 16 downwardly to clamp the trays 2 in place.

The freezing tunnel 26 is preferably of a height able to accommodate four assemblies 1, preferably between two and six. Commencing with an empty elevator 25, clamped assemblies 1 are indexed vertically until the leading assembly reaches the top. The four assemblies 1 are then transferred together from lifting runners 35 (Figure 1) onto similar, long, runners (not shown) that extend through the freezing tunnel 26. Reciprocating paddle actuators (not shown) engage with the structures 3 of all the assemblies 1 on the elevator 25 and in the freezing tunnel 26 to index the assemblies through the tunnel. In so doing, a set of four assemblies are transferred from the freezing tunnel 26 to the assembly delevator 29. The assemblies 1 are removed from the delevator 29 in a reverse process to, and in sequence with, that described for the loading of the elevator 25. In this way a compact loading of the freezer tunnel 26 is possible.

Products to be frozen, (such as products 130 of Figures 7 and 8), are deposited on the conveyor 27 at a deposit zone 40, and subsequently transferred to the tray assemblies 1.

The products take a predetermined path through the tunnel 2, whereby four vertically stacked assemblies are sequenced together horizontally, from the infeed end of the tunnel 26, to the outfeed end thereof.

The interior of the tunnel 26 houses refrigeration coils 41 whereby a controlled environment is produced and the products treated in a controlled manner. The products leave the tunnel 26 by way of the conveyor 28 and are subsequently transferred to take-off conveyors 42, 43.

Trays 2 leave the delevator 29 to be returned for re-use by the conveyor 27.

With reference now to Figures 4 to 9, a tray assembly 101 according to a second embodiment comprises three juxtaposed stacks of vertically-spaced trays 102, opposite ends of which are supported by upright structures 103 carrying a plurality of vertically spaced tray support members 104 which extend laterally from the structure 103 and beneath the trays 102. The members 104 have parts 105 which are engageable with the trays 102 so as to releasably retain the trays in place. The members 104 thus comprise tray retaining means as well as tray support members.

The trays 102 are of elongate form. Each of the three stacks comprises six superimposed trays 102, so that the assembly 101 comprises eighteen trays. The trays 102 have tapered ends as well as downwardly-extending edges 106, 107. The end portions of the trays are formed with apertures 108 of elongate form, disposed centrally on the longitudinal axes of the trays.

The tray support structures 103 each comprise a frame formed by three upstanding, laterally-spaced pillars 110, the lower ends of which are interconnected by an integral crossbar 111. The upper ends of the two outer pillars 110 carry brackets 112 each formed with notches 113, 114. The brackets 112 are interconnected by a crossbar 118. The lower end of the central pillar 110 carries a bracket 115 formed with notches 116, 117. Figures 8 and 9 show the true shapes of brackets 112, 115.

As best shown in Figure 4, each tray support member 104 is of generally triangular form and comprises rod material bent into that form.

The part 105 of a member 104 is disposed at the 'apex' of the member, and comprises an integral loop which extends inwardly and upwardly of the member.

The tray support members 104 co-operate with the trays 102 so as to centralise and stabilise the same, when the parts 105 of the members 104 are disengaged from the trays. This co-operation results from the tapered profiles of the undersides of the

trays and the presence of the edges 106, which together form recesses for receiving the generally triangular members 104.

The edges 107 are provided to assist stacking of the trays 102, when free of their supports 103.

Each member 104 is also formed with an upwardly-projecting part 125 on its 'base'. Each part 125 is received by an aperture 108 formed in a tray 102.

Opposite ends of a tray 101 are formed with cutaway portions 126 (Figure 6) which receive the adjacent pillars 110 of the tray support structures 103. The cutaway portions 126 each have a generally truncated triangular form, with its 'apex' extending inwardly of the tray.

The trays 102 of the assemblies 1 are retained in place, by displacing the tray support structures 103 towards each other (as in Figure 8) in a substantially horizontal direction. With reference to Figure 6, this movement causes the parts 125 of the support members 104 to be displaced to the inner ends of the apertures 108, and the parts 105 displaced within the cutaway portions 126 and over the upper surfaces of the trays 102.

Thus the parts 105 retain, by latching movements, the trays 102 and the support structures 103 together.

In a similar but opposite sequence, the trays 102 and support structures 103 are disconnected.

The substantially horizontal tray retaining and tray release displacement movements may be performed by mechanical or other non-manual means.

The embodiments of the invention each provide for assembly of loose trays, placing products thereon and then transporting the assemblies, in a dense-packed manner, (see Figure 2), through a controlled environment chamber, (the freezer tunnel 26), with little or no dead space, followed by removal of the products and return of the trays for re-assembly.

Claims

1. A method of constructing a tray assembly, characterised in that it comprises the steps of forming a stack of vertically-spaced trays (22), supporting opposite ends of the trays by upright structures (3) carrying tray support members (4) and employing retaining means (5) to releasably retain the trays (2) in place on the support members (4).

2. The method of claim 1, characterised in that it is followed by the steps of transporting the tray assembly (1) through a controlled environment (26), demounting the assembly (1), and then returning the trays (2) for re-assembly.

3. The method of claim 2, characterised in that a plurality of such tray assemblies (1) are provided, said assemblies (1) being close-packed together during transport through the controlled environment (26).

4. The method of claim 2 or 3, characterised in that the controlled environment (26) comprises a freezer tunnel.

5. A tray assembly for use with the method claimed in claim 1, 2, 3 or 4, characterised in that it comprises at least one stack of vertically spaced trays (2, 102), opposite ends of which are supported by upright structures (3, 103) carrying tray support members (4, 104) which extend beneath the trays (2, 102), and retaining means (5, 105) operable to releasably retain the trays (2, 102) in place on the support members (4, 104).

6. A tray assembly as claimed in claim 5, characterised in that the retaining means (5, 105) comprise a plurality of vertically spaced tray retaining members (15, 104) movable towards and away from the tray support members (4).

7. A tray assembly as claimed in claim 6, characterised in that the tray retaining members (15) are movable substantially vertically, towards and away from the tray support members (4).

8. A tray assembly as claimed in claim 6, characterised in that the tray retaining members (104) are movable substantially horizontally towards and away from the tray support members (also 104).

9. A tray assembly as claimed in claim 7, characterised in that each tray retaining member (104) is of generally rectangular form, and is receivable by a portion (126) formed in the associated tray (102).

10. A tray assembly as claimed in claim 9, characterised in that said portion (126) is a cut-away portion formed in said associated tray (102).

11. A tray assembly as claimed in claim 8, characterised in that each tray retaining member (104) is of generally triangular form, with an upwardly projecting part (105) receivable by an aperture (108) formed in the associated tray.

12. The combination of a tray assembly as claimed in any one of claims 5 to 11, characterised in that it also comprises a conveyor system (28 etc) operable to transport the assembly along a predetermined path.

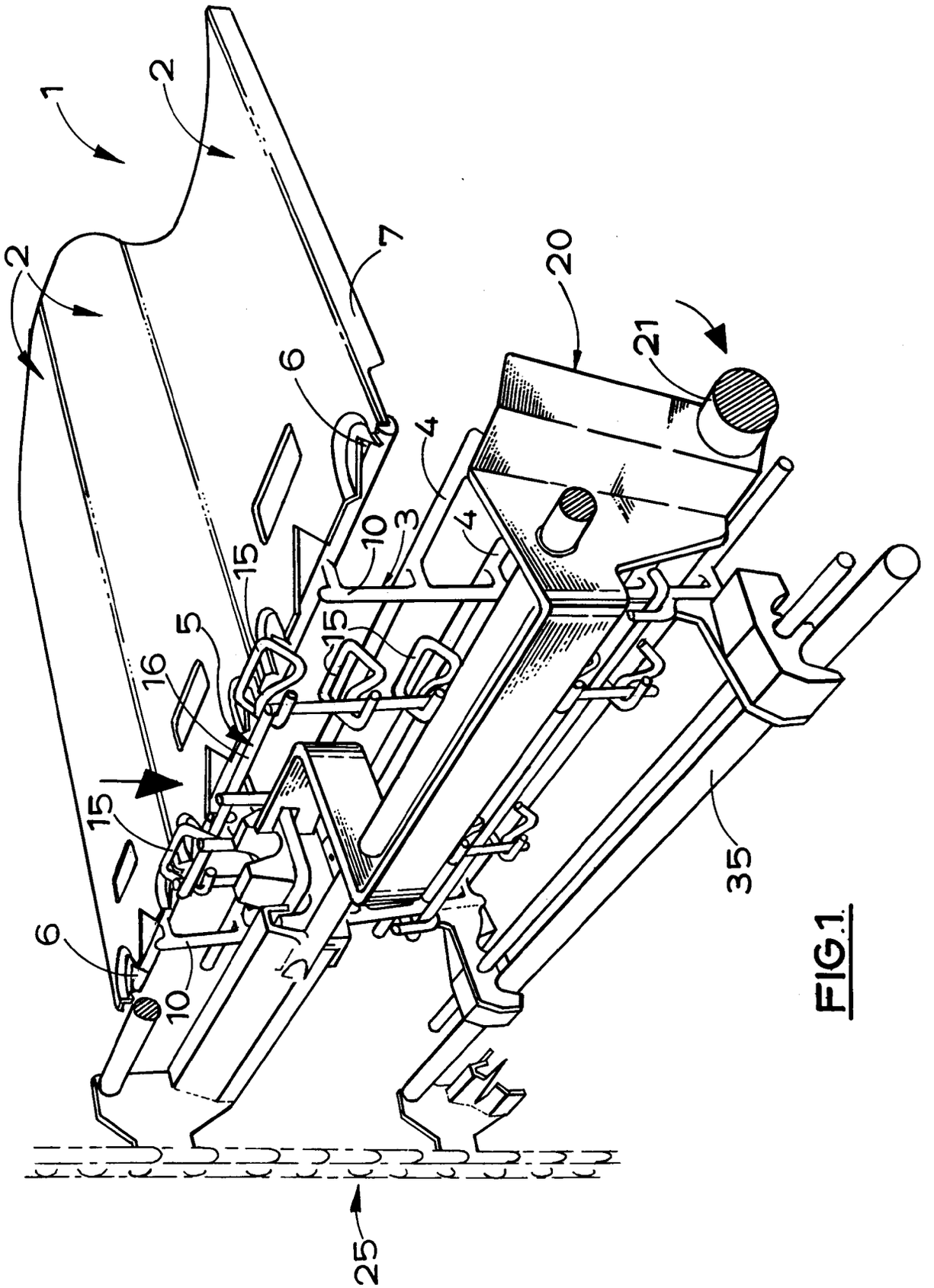


FIG.1.

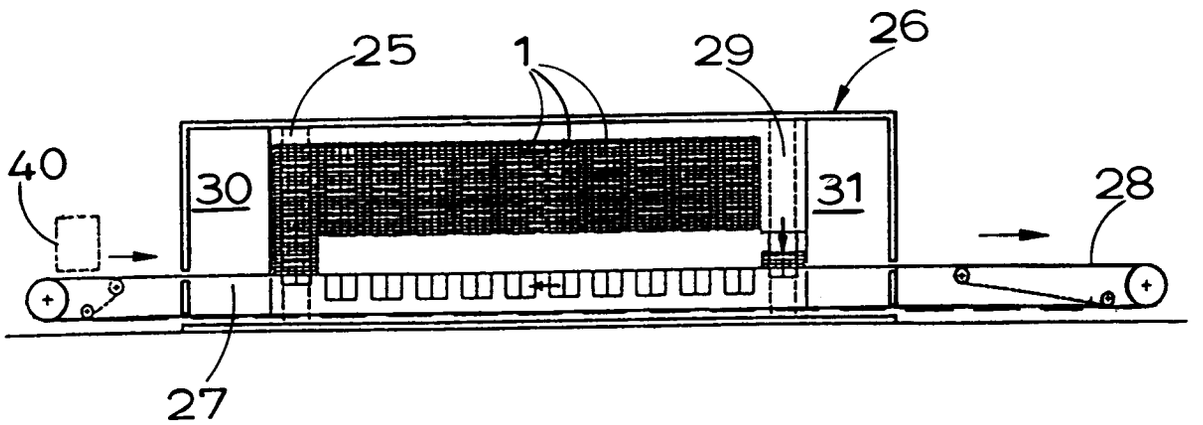


FIG.2.

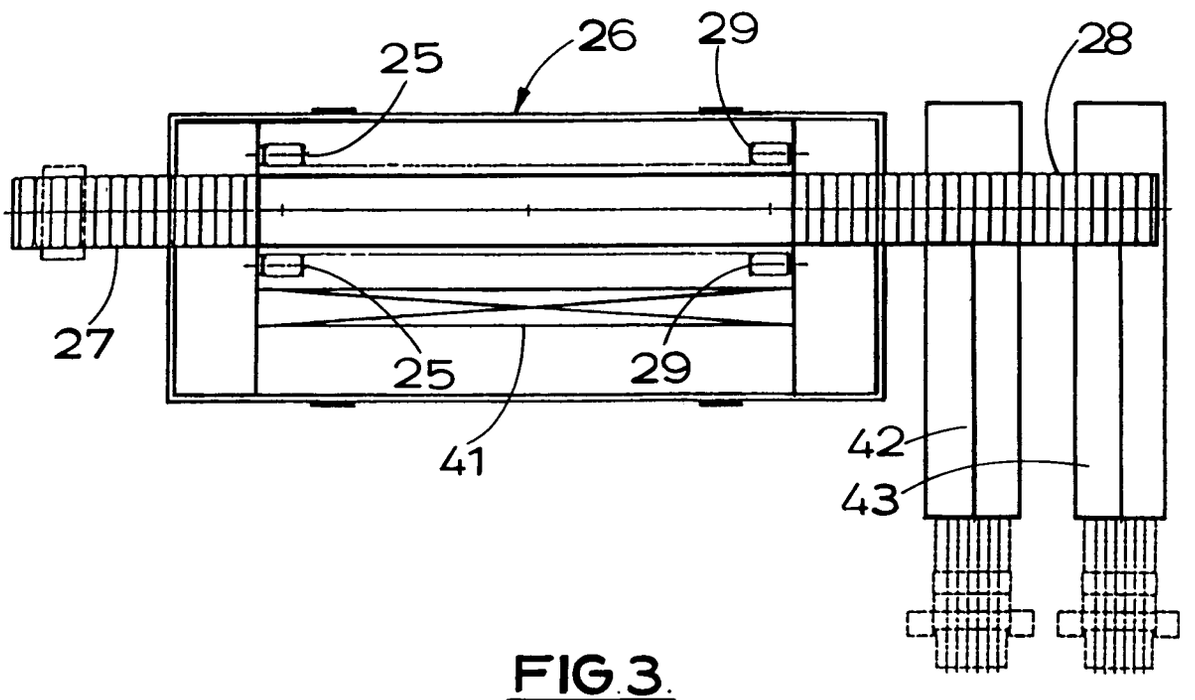


FIG.3.

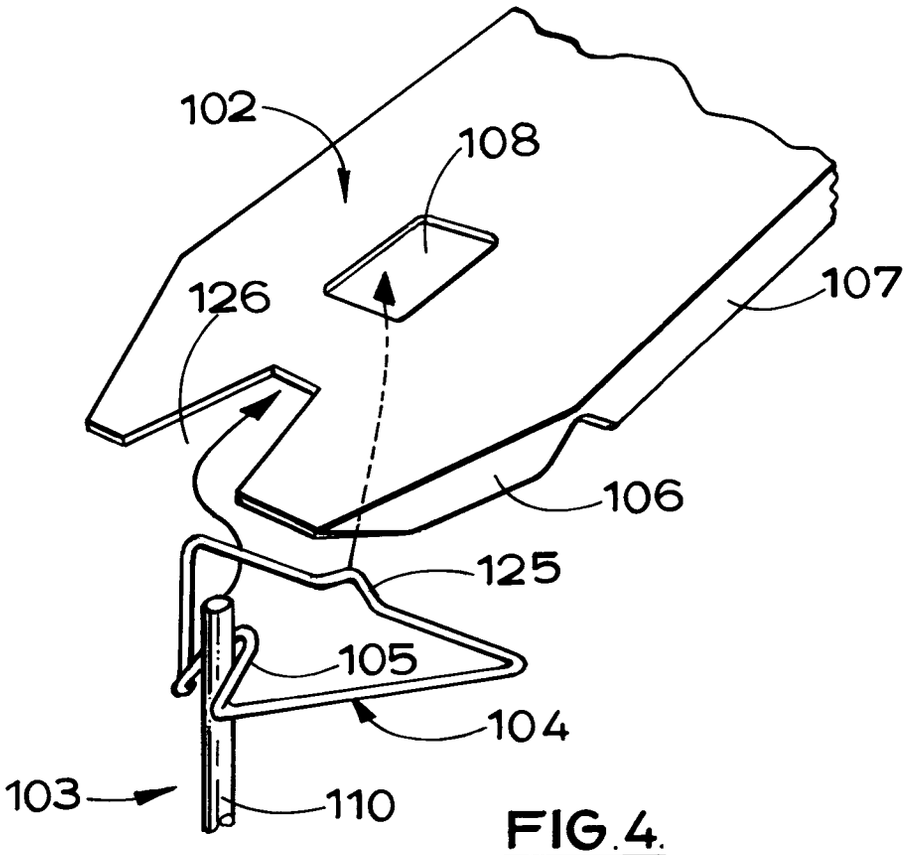
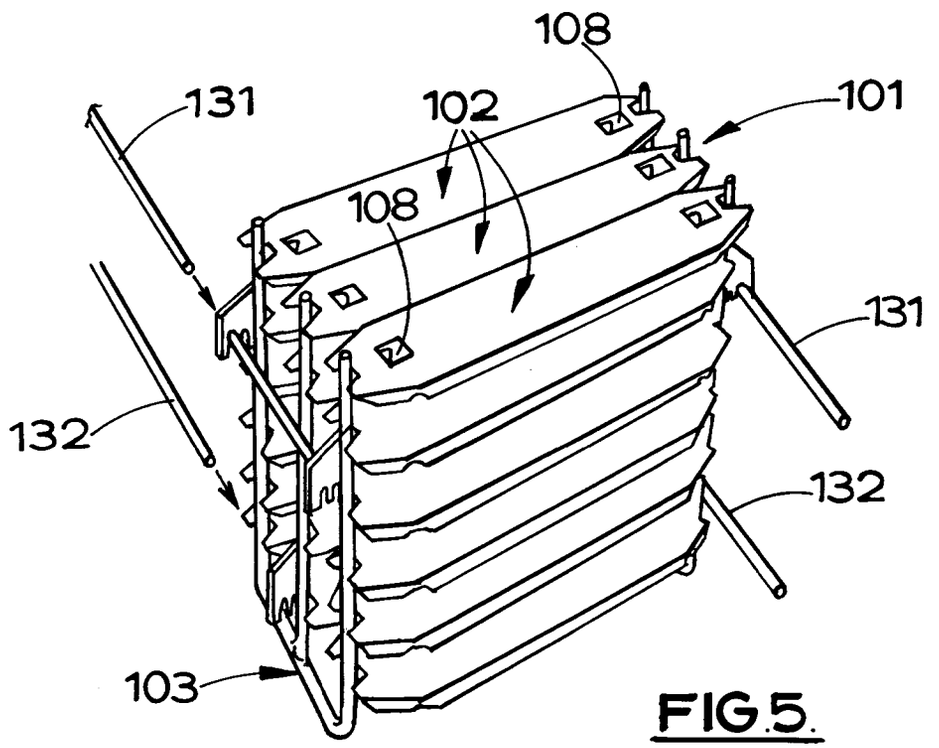

102
108
126
107
106
125
105
104
103
110

FIG.4.


108
131
102
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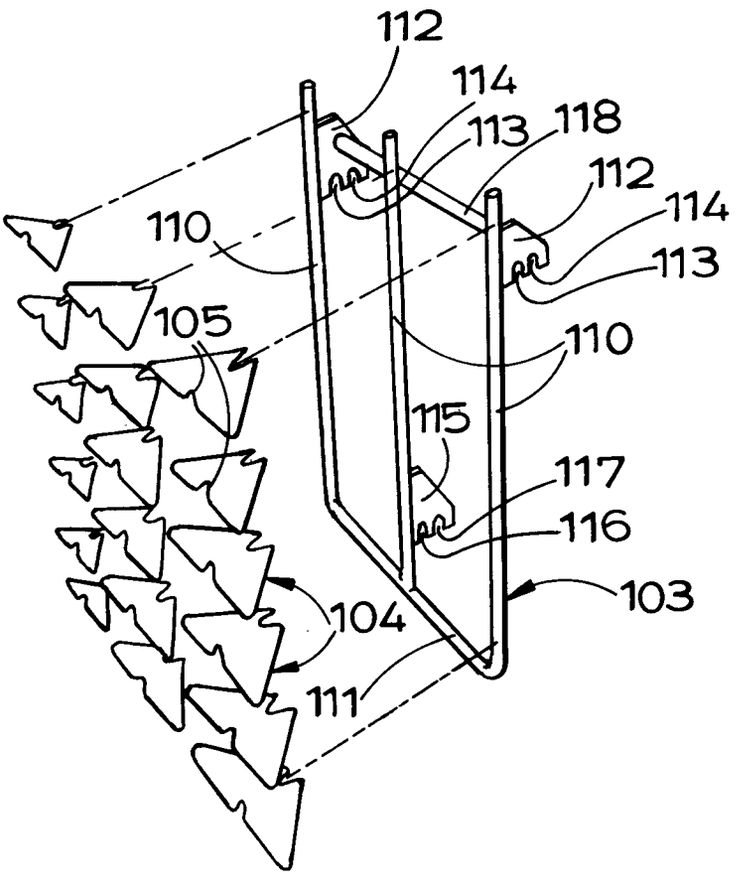
132
132
103

FIG.5.


112
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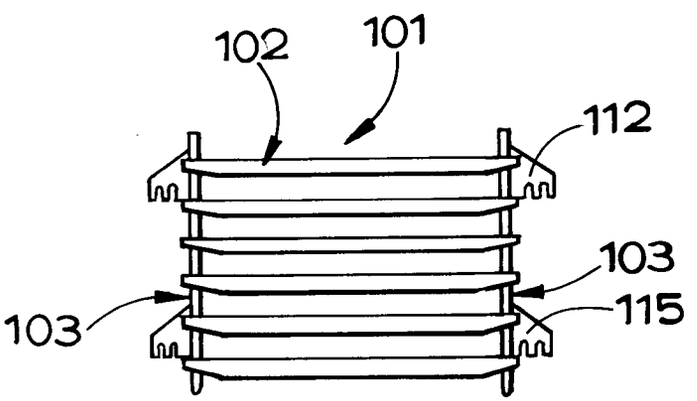
103
104
111

FIG.6.


102
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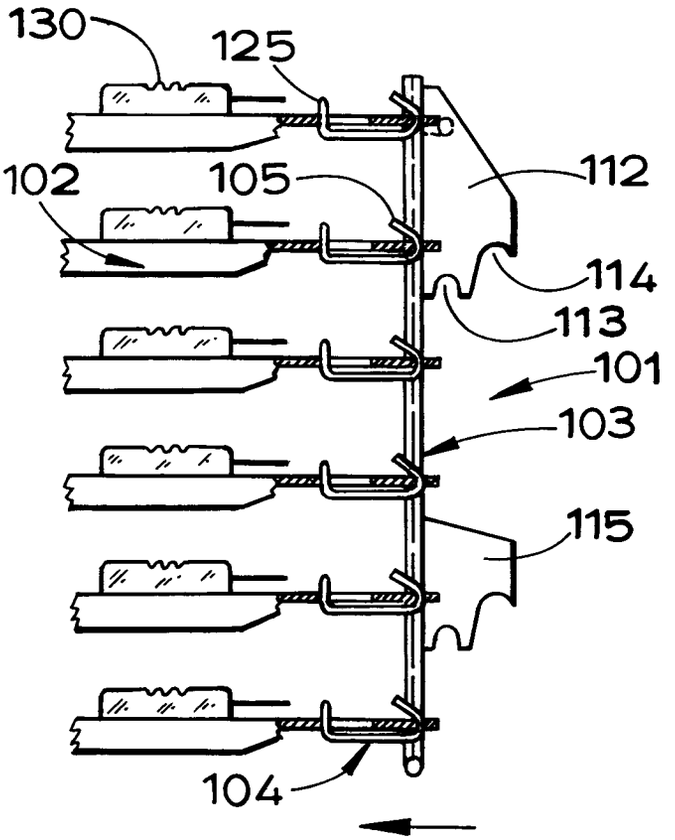
103
115
103

FIG.7.


130
125
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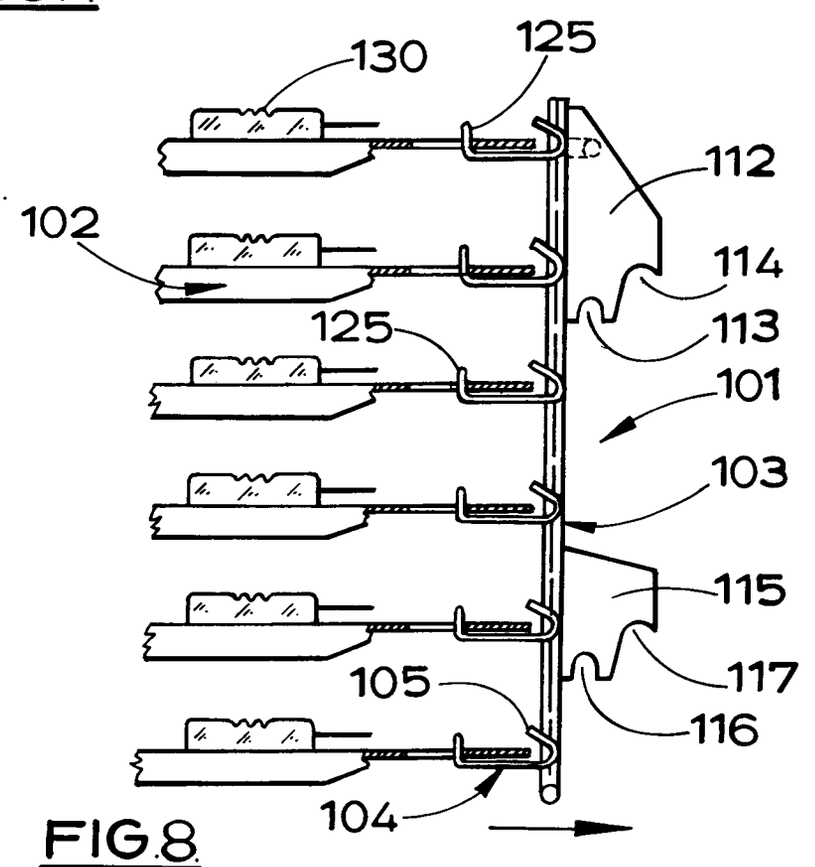
101
103
115
104

FIG.7


130
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117
116
104

FIG.8