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B8H HKF H508

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GB 1397614 A GB 1226302 A GB 0870524 A
EP 0120291 A2

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(54) Abstract Title
Goods handling device comprising suction lifting head

(57) A goods handling device includes a lifting head 24 having a multiplicity of discrete suction devices 42 preferably arranged in a substantially flat array. Preferably, the lifting head 24 includes at least one hundred discrete suction devices 24. More preferably, the lifting head 24 includes at least five hundred discrete suction devices 24. Preferably, the suction device 24 includes a flexible bellows device 44 for engagement with an article to be lifted. Preferably, the suction device 24 comprises a check valve 46. Preferably, the suction devices are connected to a common suction chamber. The goods handling device preferably includes a plurality of goods receiving stations (26a, 26b, 26c, 26d, Fig. 2), the lifting head 24 being mounted for movement between positions directly above each of said stations. Preferably, each goods receiving station (26a, 26b, 26c, 26d, Fig. 2) is mounted on a lifting device (Fig. 2). Preferably, each goods receiving station (26a, 26b, 26c, 26d, Fig. 2) includes a conveyor (12a, 12b, 12c, 20, Fig. 2). Preferably, the lifting head 24 includes a sensing device 50 for sensing any offset in the position of a load lifted by the head relative to lifting head 24 and may also include a control device (not shown) for adjusting the position of the lifting to compensate for any offset in the position of the lifted load. Preferably, the goods handling device is used for pallet layer picking.

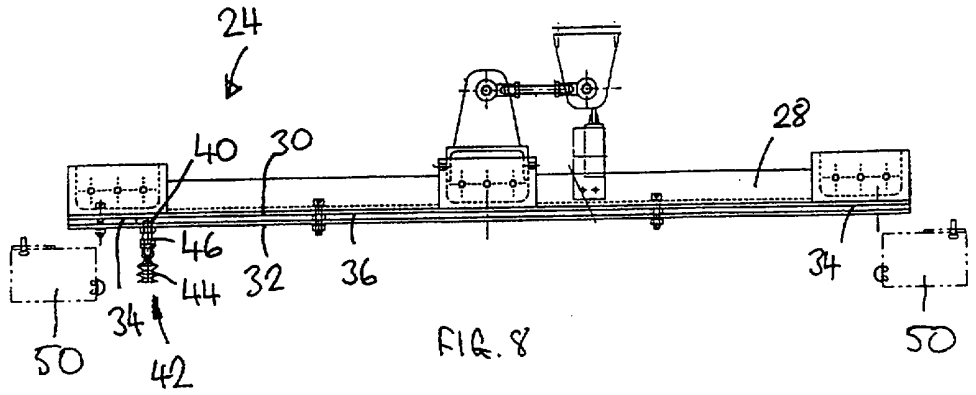

FIG. 8

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

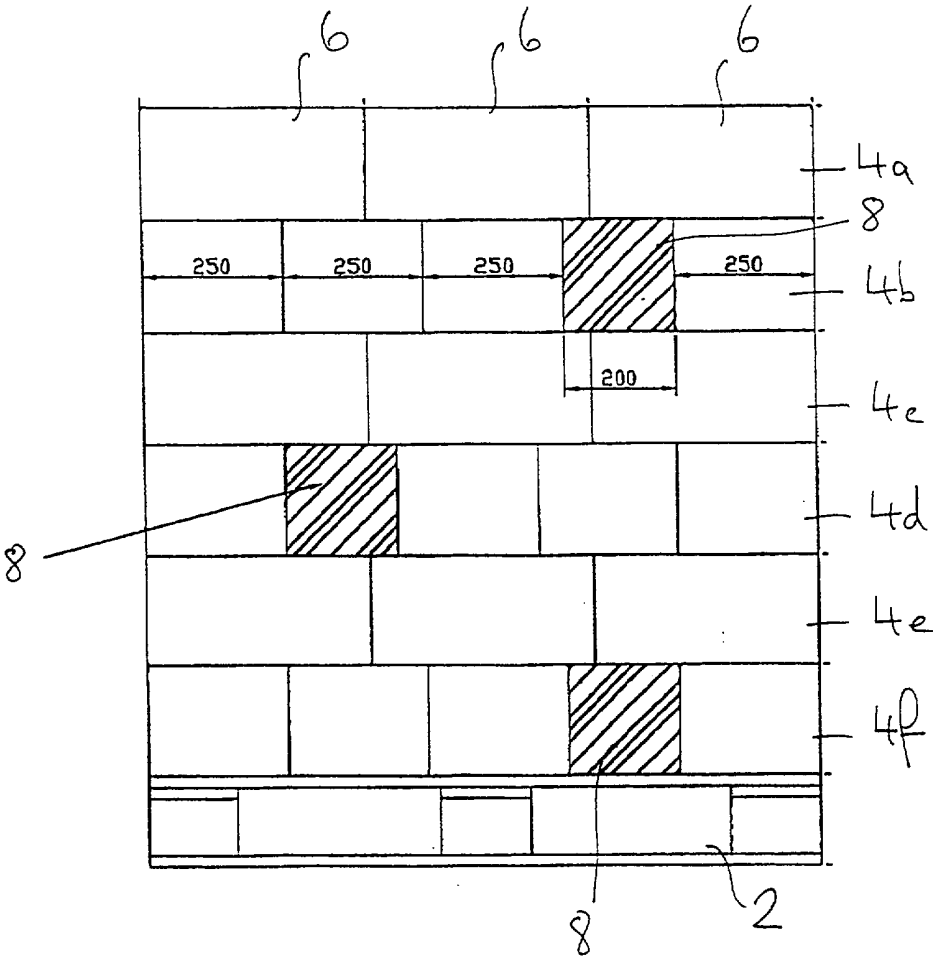

FIG. 1

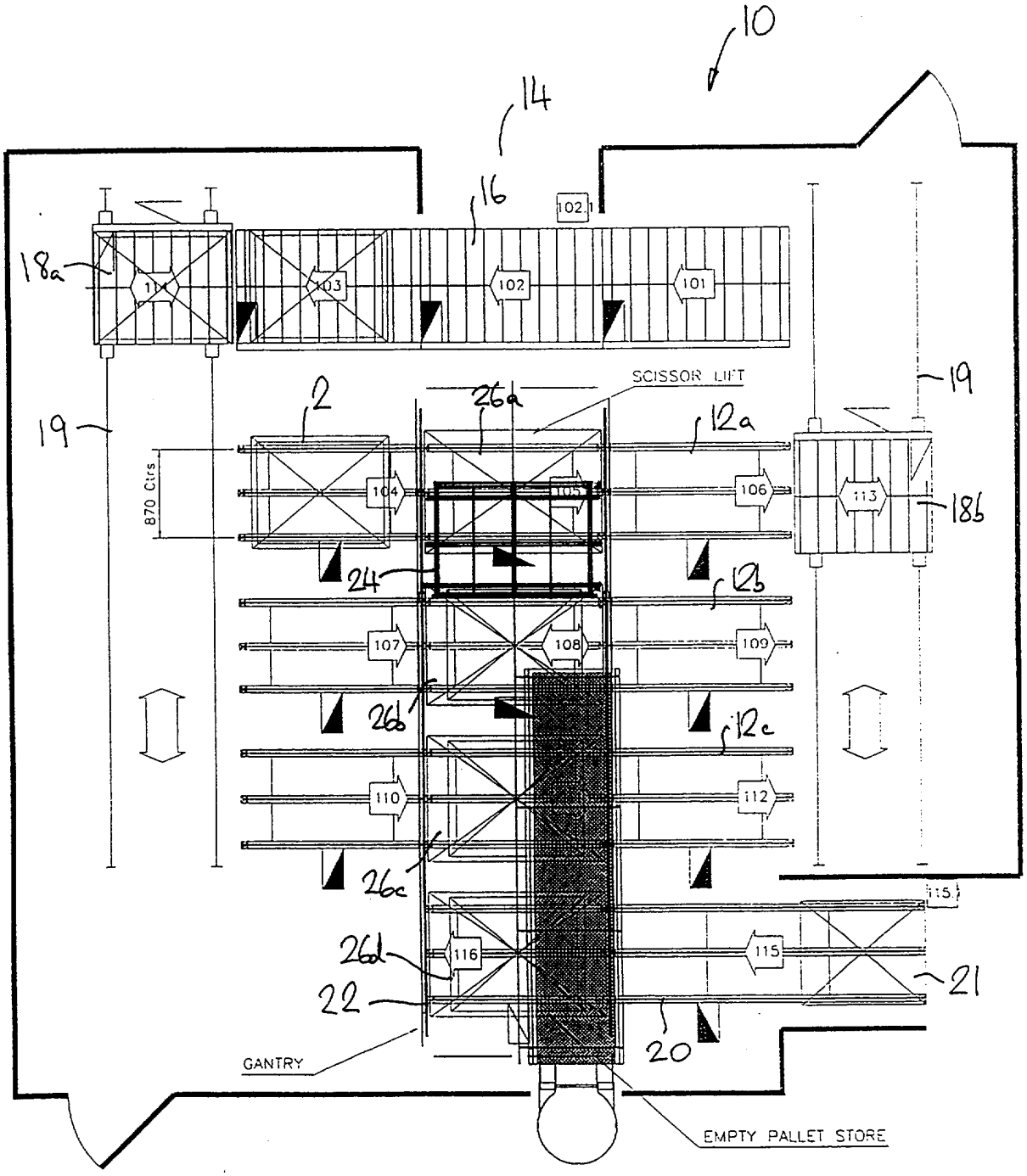
10
14
16
102.1
18a
114
103
102
101
19
2
26a
SCISSOR LIFT
12a
19
870 Ctrs
104
105
106
113
18b
24
12b
107
108
109
26b
12c
110
112
26c
115
26d
116
115
21
22
20
GANTRY
EMPTY PALLET STORE

FIG. 2

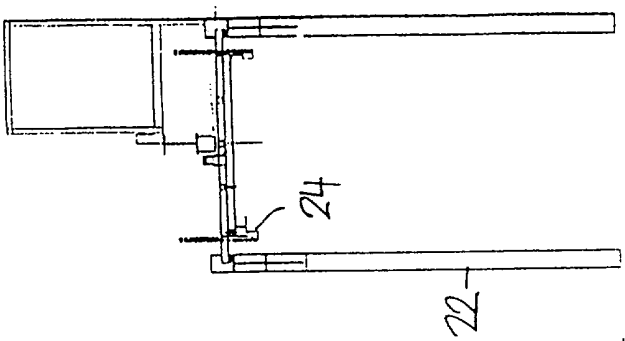

FIG. 5

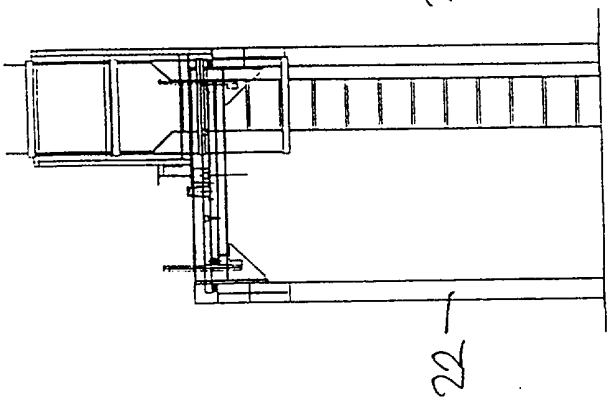

FIG. 4

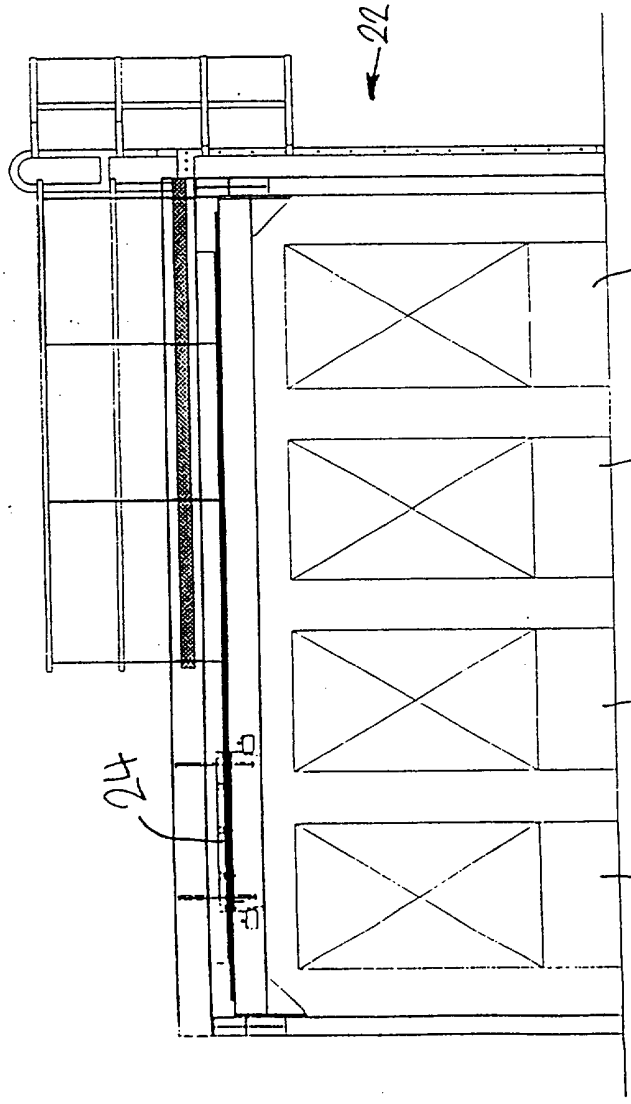

FIG. 3

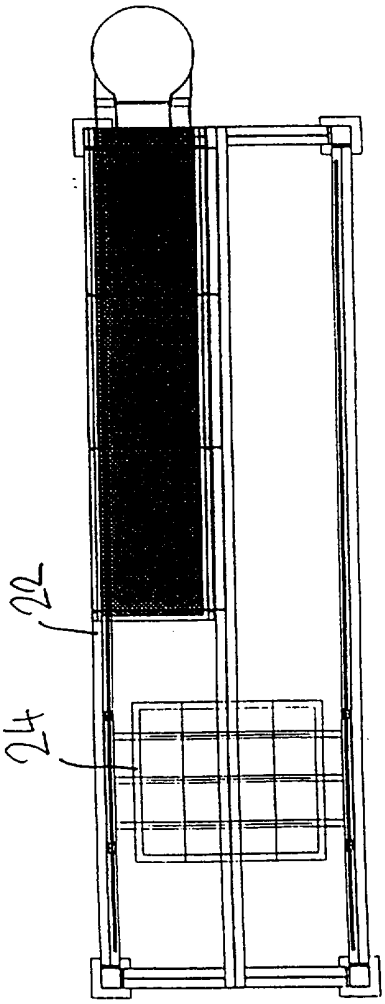

FIG. 6

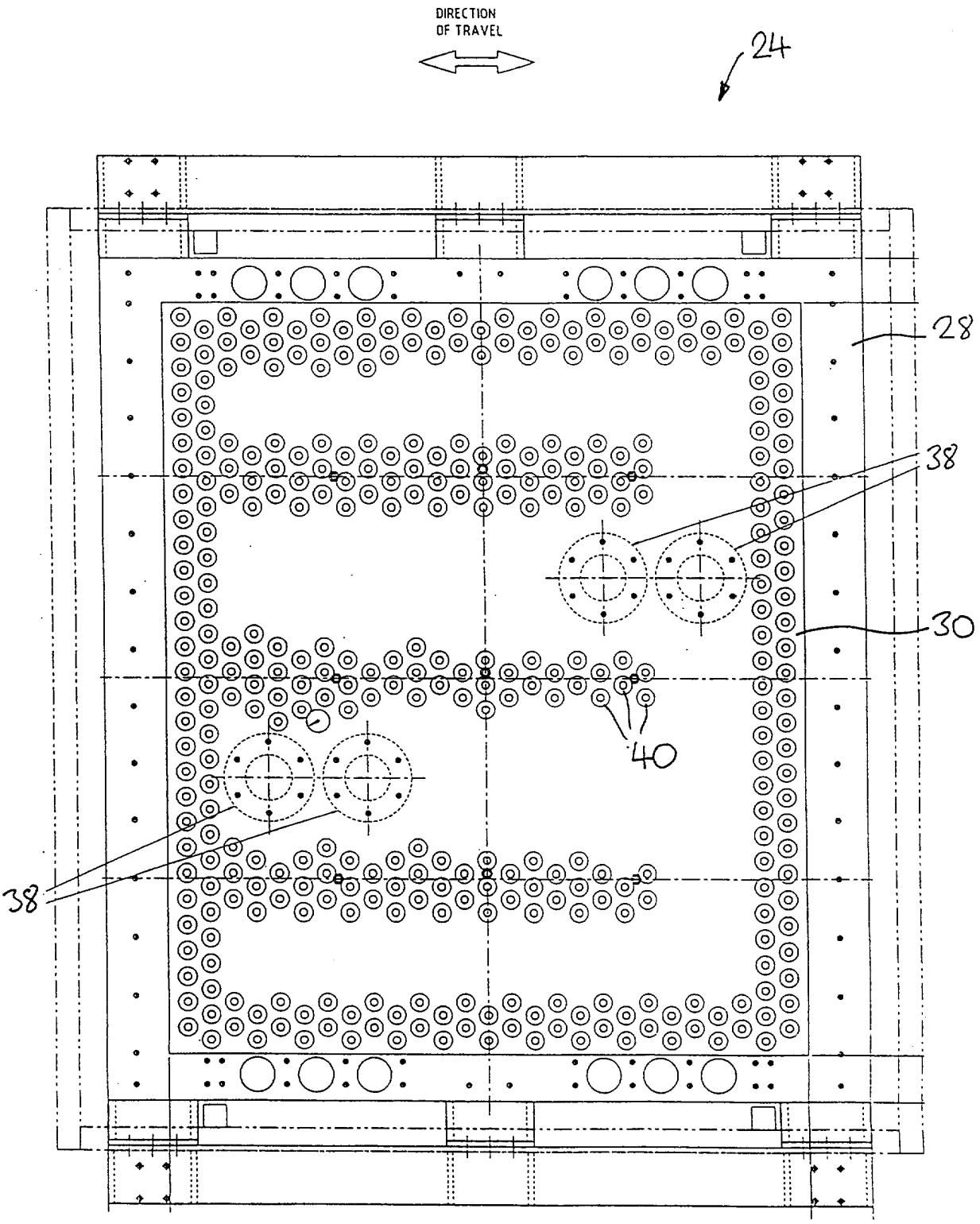

FIG.7

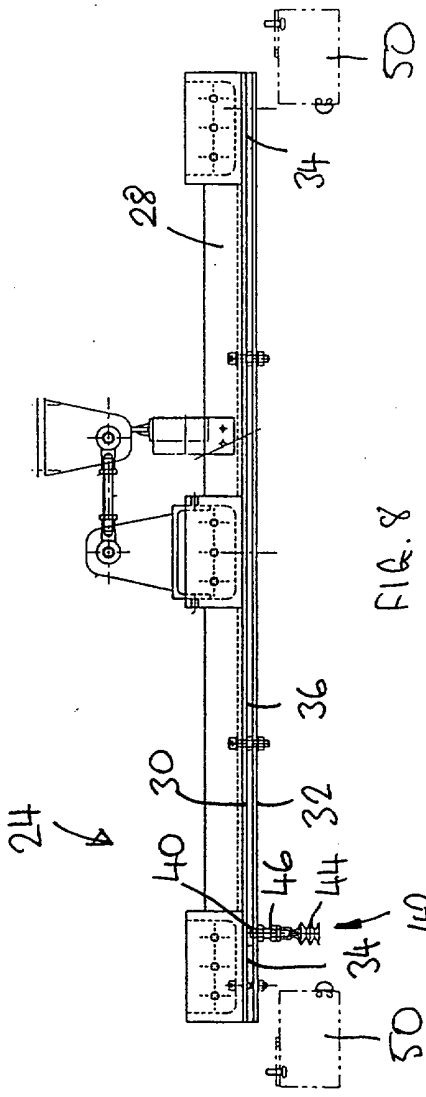
24
28
30
32
34
36
40
42
44
46
50

FIG. 8

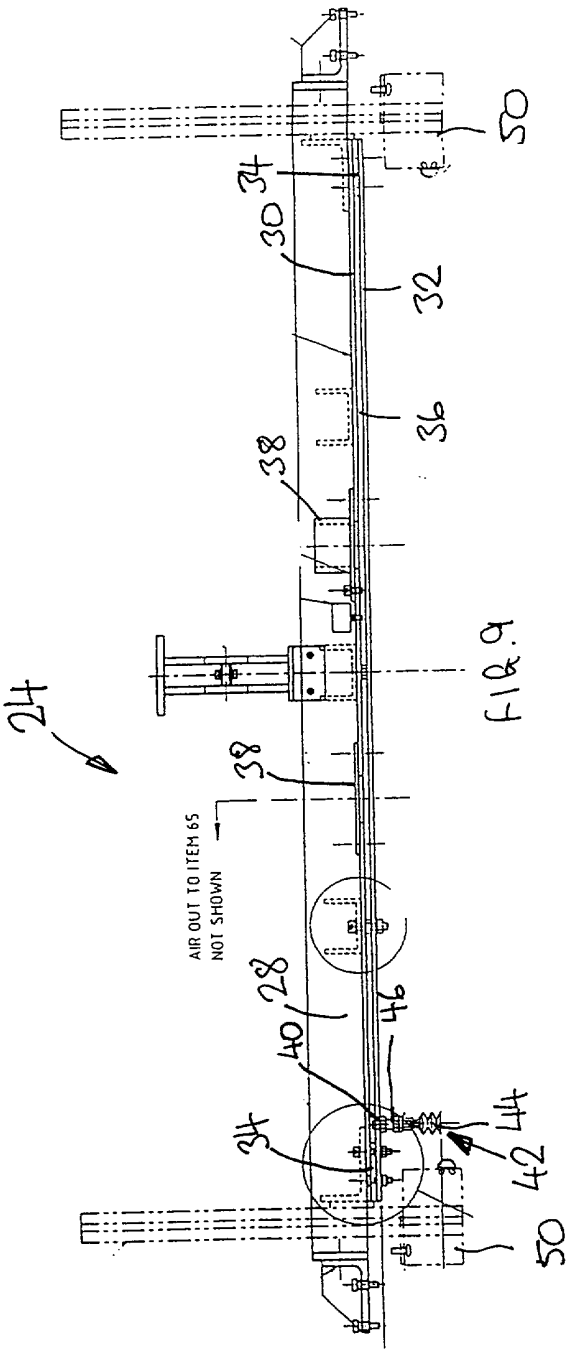
24
28
30
32
34
36
38
40
42
44
46
50
AIR OUT TO ITEM 65
NOT SHOWN

FIG. 9

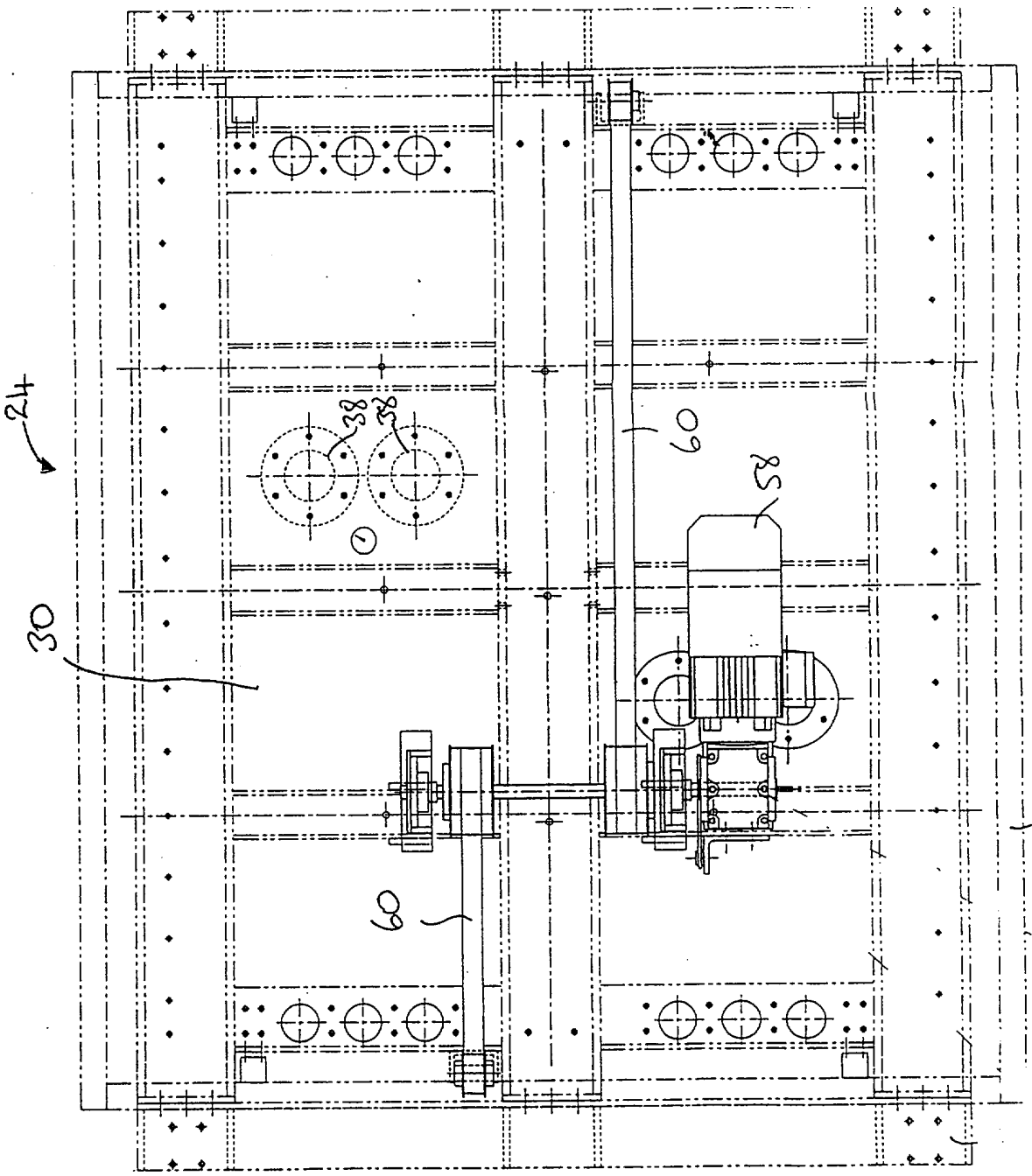

FIG. 10

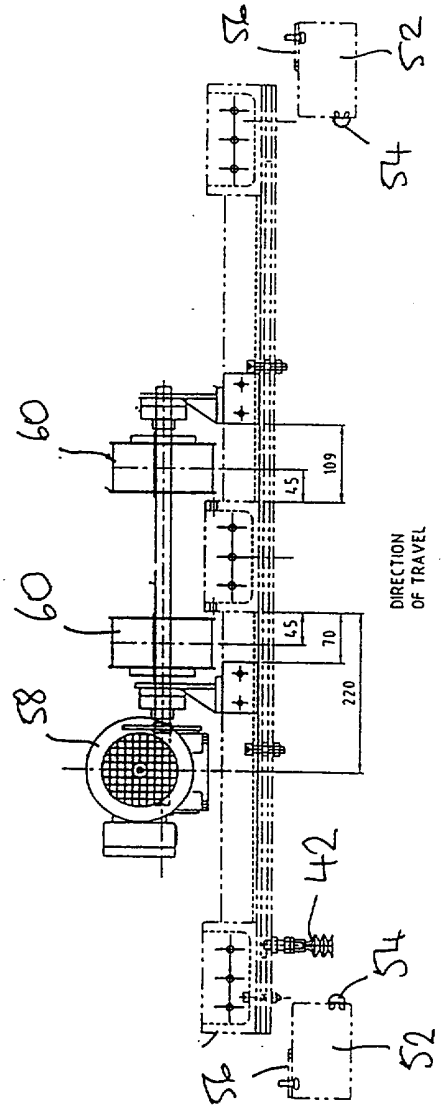
52
54
60
109
45
60
45
70
220
58
42
54
52
52
DIRECTION OF TRAVEL

FIG. 11

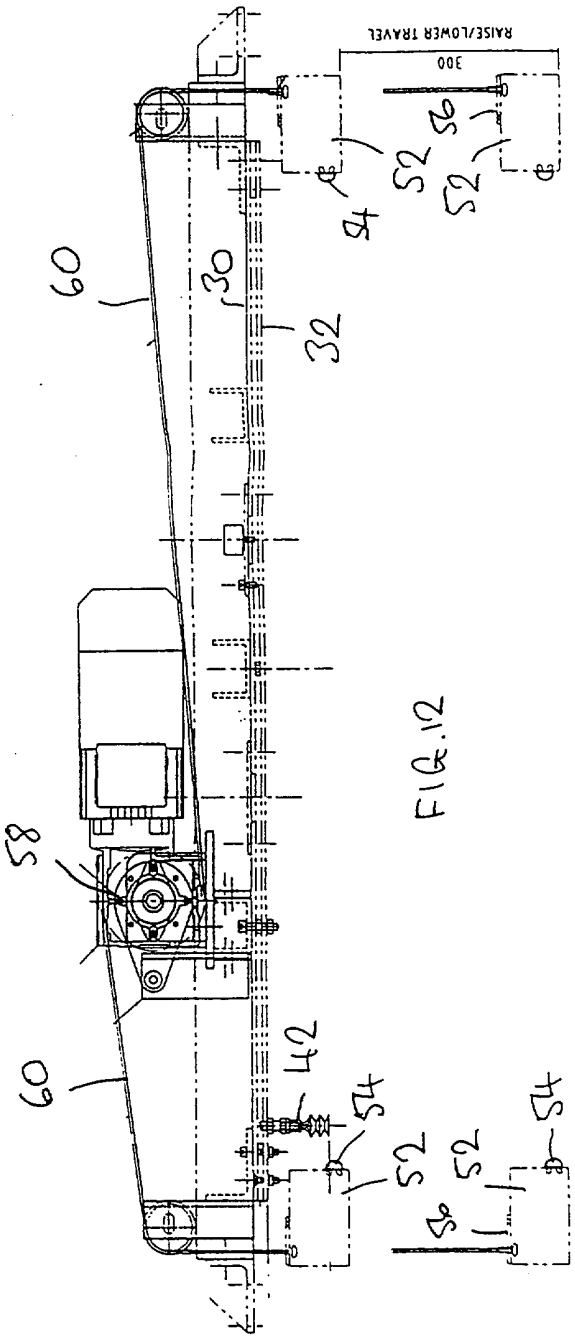
RAISE/LOWER TRAVEL
300
52
54
52
60
30
32
58
42
54
52
52
54
60

FIG. 12

GOODS HANDLING DEVICE

The present invention relates to a goods handling device and in particular, but not exclusively, to a layer picking device for use, for example, in goods distribution warehouses.

In distribution warehouses, the goods can be stored stacked on pallets and delivered to users on pallets. Frequently, however, a user will not require a whole pallet load of identical goods. Pallets therefore have to be stacked in the warehouse before delivery with layers of different goods, according to the user's requirements. Other types of load carriers are also sometimes used but, for the purposes of the present application, all such carriers will be referred to as "pallets".

Traditionally, pallets have been stacked by hand. This is, however, laborious and slow.

To automate the layer picking process, layer picking devices have been designed that are capable of transferring goods layer-by-layer from one pallet to another using a suction head with a large suction hood that engages an entire layer of goods. However, these devices have met with only limited success, since the suction head is capable of lifting only certain types of goods, for example complete layers of closely packed boxes or cartons. They are generally unable to lift oddly shaped goods, since these do not form a good seal with the suction heads, or layers that have voids in them, which are either not lifted or, alternatively, "capture" goods from the layer below that being lifted. Such goods therefore have to be picked and stacked manually.

It is an object of the present invention to provide a layer picking device that mitigates at least some of the above-mentioned disadvantages.

According to the present invention there is provided a goods handling device including a lifting head having a multiplicity of discrete suction devices for lifting engagement with an article or articles to be lifted.

The provision of a multiplicity of discrete suction devices allows the device to lift a complete layer of a wide range of goods, or different sizes and shapes, since each item in that layer will be engaged separately by a plurality of suction devices. Oddly-shaped goods can therefore be lifted as easily as rectangular boxes, allowing automation of the stacking operation.

Advantageously, said suction devices are arranged in a substantially flat array, such that the article-engaging surfaces of the suction devices lie substantially in a plane. This allows the suction devices to engage a flat layer of goods simultaneous.

Advantageously, the lifting head includes at least one hundred discrete suction devices.

Advantageously, the lifting head includes at least one hundred, and preferably at least five hundred discrete suction devices.

Advantageously, each suction device includes a flexible device, for example a flexible bellows device, for engagement with an article to be lifted, thereby allowing small differences in the height of the goods to be accommodated.

Advantageously, each suction device includes a check valve to prevent air flowing through any suction device that is not in sealed contact with the goods, so preventing any reduction in the vacuum.

Advantageously, said suction devices are connected to a common suction chamber.

Advantageously, said goods handling device including a plurality of goods receiving stations, said lifting head being mounted for movement between positions directly above each of said stations, this arrangement allowing the lifting head to transfer goods readily from one station to another.

Advantageously, each said goods receiving station is mounted on a lifting device for raising the goods receiving station to meet the lifting head. This allows the goods to be pre-positioned at an appropriate height for engagement by the lifting head, so providing for efficient operation.

Advantageously, each said goods receiving station includes a conveyor for transferring goods to or from the goods receiving station.

Advantageously, said lifting head includes a sensing device for sensing any offset in the position of a load lifted by the head relative to the lifting head., thereby allowing any offset in the stacking of the goods to be corrected.

Advantageously, the goods handling device includes a control device for adjusting the position of the lifting relative to at least one of said goods receiving stations to compensate for any offset in the position of the lifted load relative to the lifting head as sensed by the sensing device.

According to the present invention there is provided a pallet layer picking device including a goods handling device according to any one of the preceding claims, for transferring goods layer by layer from one pallet to another.

An embodiment of the present invention will now be described, by of way of example, with reference to the accompanying drawings, in which:

Figure 1 is side view of a pallet stacked with layers of goods;

Figure 2 is a plan view of a goods handling device according to the present invention;

Figure 3 is a front view of a lifting gantry forming part of the goods handling device;

Figures 4 and 5 are end views of the lifting gantry;

Figure 6 is a plan view of the lifting gantry;

Figure 7 is a plan view showing the underneath of a lifting head;

Figure 8 is an end view of the lifting head;

Figure 9 is a side view of the lifting head;

Figure 10 is a top view of the lifting head, depicting a raise/lower mechanism for a sensing device;

Figure 11 is an end view of the mechanism shown in Figure 10; and

Figure 12 is a side view of the mechanism shown in Figure 10.

Layer picking devices are used for transferring goods from one pallet to another, for example in a goods distribution warehouse.

A typical stacked pallet is shown in Figure 1. The pallet 2 is stacked with six layers 4a-4f of goods, which in this example are in the form of rectangular boxes 6. The boxes 6 are stacked in a bond pattern with the periphery of each layer matched to the size and shape of the pallet 2. Because the width of the pallet 2 is not equal to an exact multiple of the width of the boxes 6, each layer contains one or more voids 8. If an attempt is made to pick up the uppermost layer 4a with a traditional layer picking device having a large suction hood, air will flow through the voids in the layer and will either reduce the vacuum, preventing the layer being lifted, or will cause some goods from the next layer 4b to be captured and lifted with the top layer 4a.

An example of a goods handling device according to the present invention is shown in Figures 2, 3, 4 and 5.

A pallet stacking installation 10 is shown in plan view in Figure 2. The installation includes three parallel chain conveyors 12a,12b,12c. The two outer conveyors 12a,12c are intended to receive pallets from the warehouse, which are stacked with goods of a single type, whereas the central conveyor 12b is intended to receive an empty pallet, onto which goods are transferred from the pallets on the outer conveyors 12a,12c. This arrangement is of course changeable, as also is the number and type of the conveyors.

Pallets stacked with goods are transferred to the stacking installation 10 from an adjacent warehouse (not shown) through a doorway 14. A roller conveyor 16 extends across the doorway 14, parallel to the chain conveyors 12a,12b,12c. A pair of pallet transfer trucks 18a,18b, which are also provided with roller conveyors, are provided, one at each end of the three chain conveyors. The transfer trucks 18a,18b are mounted on rails 19 for movement across the ends of the conveyors.

A fourth chain conveyor 20 for delivering empty pallets 21 to the installation extends parallel to the three chain conveyors 12a,12b,12c on one side of the installation 10.

A gantry 22 extends over the four chain conveyors 12a,12b,12c and 20. The gantry 22 supports a lifting head 24 that is mounted for movement along the gantry, perpendicular to the chain conveyors. The central section 26a,26b,26c,26d of each conveyor

12a,12b,12c,20 is provided with a scissor lift that can lift that section of the conveyor and any pallet on that section upwards to meet the lifting head 24.

The installation also includes a computer (not shown) for controlling the entire stacking operation, including retrieving and returning pallets of goods from the warehouse, stacking layers of goods on the empty pallet and delivering the loaded pallets to a loading bay. The installation is therefore capable of fully automatic operation.

In use, pallets stacked with goods are transferred through the doorway 14 onto the central section of the roller conveyor 16. Each pallet is then transferred in turn to the left (in the direction of arrows 102,103) onto the first transfer truck 18a which transfers the pallet onto one of the outer chain conveyors 12a,12c. The pallet is then transferred in the direction of the arrows 104,110 onto the central section 26a,26c of the respective conveyor, which lifts the pallet to meet the lifting head 24. The lifting head 24 engages and removes the top layer of goods (as described below) and then moves sideways until it is over the central conveyor 12b. The empty or partially stacked pallet on the central conveyor 12b is lifted to meet the head, which releases the lifted layer to place it on top of the pallet or the goods already stacked on that pallet.

This process is repeated as often as necessary, transferring layers of goods from the pallets on the outer conveyors 12a,12c onto the pallet on the central conveyor 12b, until that pallet is fully stacked with the desired selection of goods. It is then transferred to the right (in the direction of arrow 109) onto the second transfer truck 18b, which transfers the stacked pallet onto the roller conveyor 16 from where it is removed through the doorway 14 and conveyed to a loading bay for loading onto a delivery lorry.

A new pallet is transferred from the fourth chain conveyor 20 onto the central conveyor 12b by the lifting head 24, and the whole process is then repeated.

The central section 26b of the central conveyor 12b and the position of the lifting head 24 may both be adjusted horizontally as layers of goods are being placed on the pallet, to ensure that the goods placed on the pallet are stacked accurately.

The lifting head 24, which is shown in more detail in Figures 7-9, includes a square box 28 having a top plate 30, a bottom plate 32, and a square frame 34 that extends between the edges of the plates to separate them from each other, forming a void 36 that may be evacuated in use through vents 38 in the top plate 30. The bottom plate 32 is provided with a plurality of threaded apertures 40, in each of which there is provided a suction device 42 (only one of which is shown in the drawings). The suction device 42 includes a rubber bellows 44 and a body 46 that includes a check valve to close the valve in use if the airflow through the device exceeds a predetermined rate. This is to ensure that the vacuum in the void 36 is not reduced by air leaking into void through suction devices that are not in contact with the object being lifted.

In the embodiment shown in the drawings, the lifting head 24 has 783 suction devices 42, arranged in a 29 x 27 array. The lifting head may of course have more or fewer lifting devices than this.

Attached to the lifting head 24 is a load position sensing device 50, which is shown in more detail in Figures 10 to 12. The device includes eight sensors 52, each of which has a touch sensitive probe 54 mounted on a telescopic boom having a linear encoder to sense the position of the probe. In use, the probes are extended towards the load carried by the lifting head until they touch the load and the position of the load is then determined from the readings of the linear encoders. In this way, any offset of the load can be measured, and the position of the lifting head relative to the central section 26b of the central conveyor 12b can be adjusted to compensate for that offset.

The probes 52 are mounted on a frame 56, which may be raised or lowered by means of a lifting mechanism comprising a motor 58 that drives a set of belts 60. The raise/lower mechanism allows the height of the sensing device 50 to be adjusted relative to the load, to accommodate loads of different heights.

In use, an empty pallet to be loaded with goods is placed on the centre section 26b of the central conveyor 12b by the lifting head 24. Pallets with goods to be transferred onto the empty pallet are delivered automatically under computer control to the outer conveyors

12a,12c. The lifting head 24 transfers goods layer-by-layer, again under computer control, to the empty pallet.

The sequence is as follows:

1. The lifting head 24 is located over a pallet of goods on one of the outer conveyors, for example 12a.

2. The central section 26a of the conveyor 12a lifts the pallet to meet the lifting head 24.

3. A vacuum is then applied to the lifting head to support the top layer of goods.

4. The centre section 26a of the conveyor 12a descends.

5. The lifting head 24 moves over the central conveyor 12b.

6. The centre section 26b of the central conveyor 12b lifts to meet the lifting head 24.

7. The vacuum is released, so that the lifting head places the layer of goods on the pallet.

8. The centre section 26b of the conveyor 12b is then lowered.

9. The process is repeated until the pallet has been fully stacked.

While the layer of goods is being carried by the lifting head 24, the sensing device 50 measures the position of the lifted layer of goods relative to the head and, if any offset is detected, this is corrected by adjusting the position of the lifting head 24 and/or the pallet on the centre section 26b of the central conveyor 12b.

The stacked pallet is transferred through the warehouse doorway 14 to a wrapping station (not shown), and from there it is transferred to a loading bay for delivery to the client.

CLAIMS

1. A goods handling device including a lifting head having a multiplicity of discrete suction devices for lifting engagement with an article or articles to be lifted.

2. A goods handling device according to claim 1, wherein said suction devices are arranged in a substantially flat array, such that the article-engaging surfaces of the suction devices lie substantially in a plane.

3. A goods handling device according to claim 1 or claim 2, wherein the lifting head includes at least one hundred discrete suction devices.

4. A goods handling device according to claim 1 or claim 2, wherein the lifting head includes at least five hundred discrete suction devices.

5. A goods handling device according to any one of the preceding claims, wherein each suction device includes a flexible bellows device for engagement with an article to be lifted.

6. A goods handling device according to any one of the preceding claims, wherein each suction device includes a check valve.

7. A goods handling device according to any one of the preceding claims, wherein said suction devices are connected to a common suction chamber.

8. A goods handling device according to any one of the preceding claims, said goods handling device including a plurality of goods receiving stations, said lifting head being mounted for movement between positions directly above each of said stations.

9. A goods handling device according to any one of the preceding claims, wherein each said goods receiving station is mounted on a lifting device for raising the goods receiving station to meet the lifting head.

10. A goods handling device according to any one of the preceding claims, wherein each said goods receiving station includes a conveyor for transferring goods to or from the goods receiving station.

11. A goods handling device according to any one of the preceding claims, wherein said lifting head includes a sensing device for sensing any offset in the position of a load lifted by the head relative to the lifting head.

12. A goods handling device according to claim 11, including a control device for adjusting the position of the lifting relative to at least one of said goods receiving stations to compensate for any offset in the position of the lifted load relative to the lifting head as sensed by the sensing device.

13. A pallet layer picking device including a goods handling device according to any one of the preceding claims, for transferring goods layer by layer from one pallet to another.

14. A pallet layer picking device substantially as described herein with reference to and as illustrated by the accompanying drawings.

The Patent Office

INVESTOR IN PEOPLE

10

Application No: GB 9925057.3 **Examiner:** Matthew Tosh
Claims searched: 1-14 **Date of search:** 14 January 2000

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.R): B8H (HKF, HPB, HSA)

Int Cl (Ed.7): B65G 1/04, B66C 1/02, B66F 9/07

Other: ONLINE: EPODOC, WPI, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X,Y	GB 1397614	(EATON CORPORATION). See especially line 68, page 2 to line 15, page 3 and figures.	X:1,2,6,7, 8,13 Y:5
X	GB 1226302	(RAPISTAN). See whole specification.	X:1-3, 6,7,10,13
X,Y	GB 870524	(UNILEVER). See whole specification.	X:1-3, 6,7,8,13 Y:5,6
X,Y	EP 0120291 A2 (equiv. to US 4787812)	(GÖPFERT). See abstract and figures.	X:1,2,5,7 Y:5,6

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.