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(54) Methods and apparatus for automated cheese handling.

(57) Methods and apparatus are disclosed for separating individual rows (15) of portions (16) from the end of a cut cheese slab (1). In particular, the slab (1) is indexed up against an abutment plate (201) and a linear pusher head (213) selectively removes the individual row (15) onto a downstream conveyor (310). A tipping mechanism may be provided, having a tipping element (321) controllable to adjust the orientation of the row (15) as necessary to ensure that successive rows (15) on the downstream conveyor (310), leading to an automated packing machine, are correctly matched and/or adapted to the packing procedure desired.

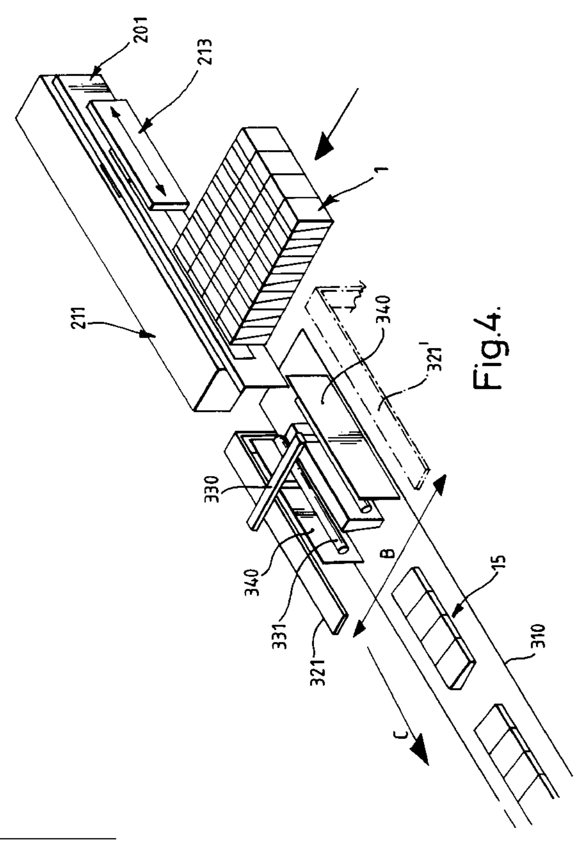

Fig.4.

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This specification discloses methods and apparatus for automated cheese handling, for use in an overall process whereby large pieces of cheese are cut into smaller portions, usually for subsequent individual packaging.

A large slab of cheese is divided into packable portions by cutting it both lengthways and widthways to form rows of portions. The cutting is done by pushing the slab through cutter frames, e.g. as in our GB-A-2225929, cutting but not dividing the slab. Conventionally, portions are separated manually from the slab and fed to an automatic packing machine. Such machines require a feed of similarly-oriented portions, so care is needed particularly if the orientation of portions within the slab varies.

Some proposals have been made for automated separation and orientation of cheese portions or rows of portions.

For example, GB-A-1589713 and EP-A-28278 describe separating a cut layer of portions from a large block as an array, and transferring the array of portions to a conveyor using individual suction cups. GB-A-2068323 describes cheese packaging machinery which separates flat portions a row at a time (in the row's width direction) from the end of a slab, pushes them into recesses on a first conveyor, and then uses an array of suction cups to transfer individual portions from the first conveyor to a second conveyor.

GB-A-2266046 considers the problem of matching the orientations of wedge-shaped portions but illustrates no specific movements or workable apparatus for doing this.

We now propose new methods and apparatus for these purposes.

One general aspect is an automated separation method for a cheese slab cut into rows of portions, comprising

(a) with the slab on a slab carrier, aligning a row of the slab with a row-selective mechanical separator element;

(b) effecting relative movement between the separator element and the slab so that the separator element engages the row selectively, separates it from the slab and moves it from the slab carrier to a conveying location, and

(c) repeating steps (a) and (b) for another row of the slab, typically until all rows of the slab have been transferred successively to the conveying location.

The alignment may be by moving the slab stepwise relative to a fixed separation station having the separator element as well as means for driving it. This movement may involve pushing the slab and/or driving the slab carrier, which may be a conveyor. Alignment with the separator element may involve bringing the slab against an indexing abutment located relative to the separation station.

Such an indexing movement is desirably in the length direction of the slab, i.e. perpendicular to the length direction of its rows. In a possible refinement, where the slab is sub-divided also along a plane in its length and width directions, i.e. into upper and lower layers, an indexing movement may also be provided to enable a movement component perpendicular to the row longitudinal direction, in the thickness direction of the slab, to bring a row of the upper or lower layer selectively and the separate element into alignment.

The relative separation movement is preferably a pushing movement, although gripping and pulling are possible. Turning may be involved, but the preferred movement is linear. Desirably the movement direction is parallel to the cut surface (typically a plane) between the row to be separated and the rest of the slab. A particularly preferred movement is in the longitudinal direction of the row, i.e. along a series of portions into which the row is subdivided. For an elongate row, this gives a significant extra facility in subsequently reorienting the row, especially when transferring onto a conveyor moving in substantially that same direction.

Thus, a preferred separator element is a reciprocating pusher which engages the ends of successive rows and pushes them in turn off the slab onto a conveyor, desirably in a pushing stroke at least as long as the row.

The conveying location is desirably on or above a conveyor, which may convey in the longitudinal direction of the row as separated. Most preferably a conveyor at the conveying location has a conveyor surface generally parallel to a major face of the slab. Alternatively stated, the row arrives at the conveying location presenting to the conveyor a surface which was at a major face of the slab.

Preferably the conveyor's conveying direction is in the rows' length direction but it may be otherwise, e.g. perpendicular to that.

Another aspect is apparatus comprising means for carrying out the above methods. Elements of the apparatus are implicit in the description above.

Further aspects, which may be and preferably are combined with the above, relate to methods of orienting rows or portions after separation from the slab, and to apparatus comprising means for doing this.

Orienting is preferably by tipping a row about one or more axes substantially parallel to its longitudinal direction. The tipping may be through substantially a right-angle, or from resting on one face to resting on an adjacent one. Advantageously it is done at a tipping station provided in line with a separation movement as mentioned above, whereby the row was separated from the slab. So, orienting may be done at the conveying location mentioned above. Tipping is preferably performed positively, by a tipping element which is driven transversely to the row's longitudinal direction to engage it and tip it over. The engagement is preferably by pushing and most preferably selectively at an upper or lower portion of the row to induce the tipping. An opposing reaction element, which may be static, may be provided to engage the opposite side of the row at a position offset from that of the tipper element, to ensure the tipping. The tipper element may move rotationally or linearly across the row's length. It is desirably elongate, to engage a row continuously or intermittently along all or most of its length.

Preferably the tipping element drive is actuable to tip rows at choice in either transverse direction. A sequence of tipping directions appropriate to a given slab may be programmed into an apparatus control processor which governs the tipping element drive.

There may be a single tipping element, which must move relatively across the row path between tips if it is to make successive tips in the same direction, or multiple tipping elements (i.e. having plural tipping portions, each capable of tipping a cheese row and disposable respectively at the two sides of the row path) to increase flexibility and speed of movement sequences available. Preferred apparatus and methods involve a control system programmable, in dependence on a predetermined cut pattern and/or other characteristics of a cut cheese slab to be processed, to produce a corresponding sequence of tipping directions for the respective rows of the slab.

For example when (as is common in the UK) alternative rows are alternately-oriented wedges, tipping can be programmed in continuously alternating directions to match the row orientations on a downstream conveyor. Or, when the slab has an outer rind and the aim is always to present a cut cheese surface to the surface of a downstream conveyor (e.g. for stability on the conveyor, and/or to present a cut surface uppermost in every pack), tipping may be programmed always in one direction except for the last row of the block which is tipped in the opposite direction. The tipper may also be programmable not to tip at all if appropriate for all or part of a given slab.

It should be noted that orientation of the cheese on the downstream conveyor is an issue distinct from its positioning relative to that conveyor, although a single operation may assure both. Generally speaking it is preferred that each row be aligned with a specific path on the conveyor to facilitate subsequent operations. There may be more than one such path - e.g. some packaging machines accept two or more "lanes" of product feed. These alignments may be wholly or partly assured in the tipping operation. For example, low-level "tripping" of wedge-shaped portions can give substantial alignment with a single path despite alternating tipping direction. Or, high-level tipping in alternating directions can be used to provide an initial separation of product onto two paths side-by-side. Additionally or alternatively, guides may be provided to align rows on the conveyor with the desired path(s).

Other aspects of the invention are overall methods comprising separating and then orienting, or cutting, separating and orienting, optionally with subsequent packaging of individual portions.

Embodiments of the invention are now described by way of example, with reference to the accompanying drawings in which

Figures 1(a), (b) and (c) illustrate cheese slab cut patterns;

Figure 2 is a plan view of apparatus for transferring, separating and orienting cheese portions, Fig 2(a) being a fragmentary view of a top guide of the apparatus;

Figure 3 is a schematic perspective view of apparatus for separating and orienting;

Figure 4 is a schematic perspective view showing variant apparatus for separating and orienting;

Figure 5 is a plan of the Fig. 4 apparatus;

Figure 6 is a side view of further apparatus for separating and orienting;

Figure 7 is a front view of the Fig. 6 apparatus showing particularly features of the orienting system, and

Figure 8 is another side view showing a stage in operation of the separating apparatus.

Figs. 1(a) to 1(c) show slab cut patterns. Fig. 1(a) is a wedge-cut slab, common with hard cheeses in the UK. The rectangular slab 1 (in reality often a half-slab, created by preliminarily halving the thickness of an as-manufactured cheese slab of perhaps 401b (18 kg)) has been cut by passing through cutter frames in perpendicular directions. The slab has a major top surface 11 and bottom surface, side surfaces 13 and end surfaces 19. The cutters are positioned to divide the slab into a plurality of portions 16, identically-shaped in this case, disposed in files 14 extending longitudinally of the slab 1 and rows 15 extending laterally. The rows 15 are made wedge-shaped in cross-section by disposing the relevant cutters alternately obliquely and upright. Thus, portions 16 within a given row 15 are similarly oriented but opposite wedge orientations alternate from one row 15 to the next. Each row and the portions in it therefore present a top surface 151 which may be broad or narrow, a bottom surface 152 likewise, and oblique and perpendicular side faces 153a,153b.

Fig. 1(b) shows a rectangular non-wedge cut pattern, all portions 16 of the slab 1' being identical cuboids but with the additional feature of a median horizontal cut so that there are upper and lower rows 15a,15b, and the internal cut surfaces 153 include horizontal cut surfaces 153c.

Fig. 1(c) shows other possibilities. Here again a simple rectangular cut has been used, creating vertical internal cut surfaces 153 in the slab 1", but without the median cut surfaces 153c of the Fig. 1(b) version. One feature here is that the edges 18 of the slab

1" are rounded, making the terminal portions 16a different in shape from the others. Another feature is the presence of a rind 17 on the outside of the slab.

A skilled reader will understand that these figures are merely exemplary; other cut patterns exist and it is possible to combine features mentioned above in various ways.

Slabs 1 typically emerge from a cutting process in the state shown, i.e. resting on a slab carrier such as a conveyor with the cuts all formed but the portions not separated. Usually, the individual portions 16 must ultimately be separated from one another and presented to a packaging machine in an appropriate condition. For example, the orientations of wedge-shaped pieces should all be the same at the feed to the packaging machine. Also, it may be preferred always to present a freshly-cut surface to the conveyor surface, for stability on the conveyor. The positioning of rind in the package may or may not also be an issue. Because of these varying and complex requirements, it has been common practice to dismantle the cut slabs 1 manually and position them by hand on a conveyor leading to the packaging machine in the generally correct position (fine alignment being done by the packaging machine itself).

Fig. 2 is a plan view of an automated cheese handling system embodying various measures now put forward. Broadly, the system comprises a cutting station CS, a transfer station 100 where a cut slab is transferred from one conveyor 110 to another 120, a separation station 200 where the cut slab is separated into rows onto a downstream conveyor 310, and a tipping station 300 positioned just downstream of the separation station 200 to adjust the orientation of separated rows as necessary. These operations are all done automatically under the control of a programmed control system 400 which may be a conventional microprocessor programmed using conventional process control techniques.

The cutting station CS is indicated only schematically, since it may be conventional. From it, a cut but undivided slab 1 issues onto a roller conveyor 110 consisting of a series of parallel idle rollers 111. The conveyor 110 may be the existing outfeed from an existing cutting installation and a roller conveyor is conventional: it is at this stage in prior art operations that manual dismantling has been necessary. The remainder of the apparatus, constructed as it is on a unified installation chassis 10 and designed to interact with the roller conveyor 110, may therefore be added on to an existing cheese producing and cutting system.

The transfer station 100 is at the downstream end of the roller conveyor 110. Here, a driven indexing conveyor 120, embodied in this example by a multicord conveyor with parallel driven carrier cords 121, is arranged perpendicular to the roller conveyor 110. A transfer carriage 130 is provided to move the cut cheese slab from one conveyor to the other. It has spaced lifting elements 131, in this embodiment a series of vertical parallel plates 131 fixed to an axle 132, which can be raised by a lift drive 133, here a pneumatic cylinder, to move up between rollers 111 of the roller conveyor 110 and lift a cheese slab thereon. The components are mounted on a transfer carriage frame 136. The transfer carriage 130 is drivable, by a transfer carriage drive 135 - again, in this embodiment a pneumatic cylinder - in the direction of arrow A along guide rails 134.

Carrying the cheese slab in their raised position, the lifting elements 131 pass to between the cords 121 of the multicord conveyor 120 and there are lowered by the drive 133 to deposit the slab on the multicord conveyor 120.

This transfer operation is carried out automatically, under the control of the control system 400, to ensure a continued presence of cut cheese slabs on the indexing conveyor 120 for the purposes described below.

It should be noted that this transfer apparatus and method is an independent aspect of our proposals herein, the essential features being the drivable transfer carriage with the drivable, spaced lifting elements cooperating with the spaced elements of the two conveyors.

The cut slab 1 on the indexing conveyor 120 is presented row by row at the separation station 200. Here, a stop for locating the end row positively in position is provided by a perpendicular abutment plate 201 facing back down the conveyor 120. Controlled drive of the indexing conveyor 120 serves to bring successive rows up against the abutment plate 201.

A pusher assembly 210 is positioned to act perpendicularly across the stop plate 201, to push rows 15 of cheese portions 16 progressively off the slab 1. A pusher drive 211, here a linear drive provided by a pneumatic cylinder, has a pusher head 213 shaped to engage selectively the end of only one row 15, on the end of a pusher shaft 212 driven by the cylinder 211.

On the other side of the path of the indexing conveyor 120, an opening 204 is defined past a side retaining plate 203 which restrains from lateral movement those rows 15 not directly acted on by the pusher 210. The opening 204 allows the passage of one row 15 at a time. Fragmentary side view Fig. 2(a) shows that a top restraint plate 202 is also provided, to prevent any undesired upward movement or toppling of adjacent rows 15.

A downstream conveyor, here a driven belt conveyor 310, runs perpendicularly to the indexing conveyor 120 and is positioned directly adjacent the opening 204 to receive each row 15 of cheese portions pushed out by the pusher 210. The conveyor leads to an automated packaging system P which again may be conventional. A pair of convergent side guides 311, taking here the form of opposed motordriven guide belts, is provided on the conveyor 310 to centre rows 15 passing along it towards the packaging station P.

A tipping station 300 is provided above the conveyor 310 where it receives separated rows 15 from the pusher 210. The tipping station 300, operating like the others under automated control, comprises broadly speaking one or more tipping elements 320 and a tipper drive 323 to move the tipping element 320 in order to tip cheese rows 15 actively from the orientation in which they arrive from the pusher 210 to a different, predetermined and desired orientation on the conveyor 310, if the initial orientation is not the desired one. In particular, it may be desired to create matched orientations and/or conditions of the rows 15 on the conveyor 310, as was explained before. Particular embodiments of tipping mechanism are explained in more detail below. Typically these comprise a tipper element 320, generally elongate along the row direction and vertically localised in relation to the row 15 as received from the pusher 210, and a drive 323 to move it transversely relative to the conveyor part 310 e.g. linearly or around some pivot axis, in a predetermined direction to tip the cheese appropriately.

So, the separation and orientation operations are broadly as follows. Control movements of the indexing conveyor 120 bring the cut slab 1 up against the abutment plate 201, aligning the end row with the pusher 210. This then pushes the end row through the opening 204 and onto the conveyor 310 at the tipping station 300. The other rows remain undisturbed. Most non-soft cheeses can tolerate this sliding without difficulty or damage. Where the row orientation as received is not the desired orientation, the tipper element 320 is driven to push the row 15 over to lie on one or the other of its previously upright surfaces. Where the rows are wedges in alternating orientations, for example, the tipper is controlled to tip successive rows, in alternate directions such that every row ends up lying on its long (oblique) face 153a. The side guides 311 are provided in the event that the tipping process leads to staggered dispositions of successive rows 15 relative to the conveyor path; the guides 311 act to centre them.

This operation is repeated to consume the slab 1 row by row. Preferably slabs are consumed from one end, as in this embodiment. For safety, and/or to assure a proper rate of supply to the pushing mechanism 210, a suitable detector such as photosensor 240 may be positioned to note when the amount of cheese on the indexing conveyor 120 is less than a predetermined minimum. It may then automatically initiate, via the control system 400, the transfer of a further slab from the first conveyor 110.

Indexing with the abutment plate may be governed totally or partially by controlled stepwise movement of the indexing conveyor, the plate being provided primarily for stability of operation. This is particularly so where advancing rows e.g. of wedge section, may not present a vertical face to the plate.

Generally speaking, the described system relies on simple pushing engagements with the cheese, avoiding complex and unreliable gripping or suction operations as had previously been proposed.

Figs. 3, 4 and 5 show tipping mechanisms in greater detail. For convenience of illustration, Figs. 3 and 4 are reversed relative to the other Figures.

These embodiments show an alternative construction of the pusher system 210 having the drive cylinder 211 extending alongside the separation location, with a side-mounted pusher head 213 instead of an end-projecting shaft, operating here through a slot 205 in the abutment plate 201.

The tipper element is a tripper bar 321, movable transversely in either direction across just above the surface of the conveyor to engage a lower part of a cheese row and push it sideways. It is carried on a tipper frame 324 mounted on a linear drive such as a pneumatic cylinder (not shown) extending transversely above the conveyor 310. This is controlled to drive the tipper bar 321 in the direction of arrow B between alternative positions, as indicated by the position 321' shown in dotted lines.

Parts of the tipper sub-frame 299 extending above the conveyor 310 (not shown Figs. 3 and 4 for clarity, but indicated in Fig. 5) carry also a guide frame 330 with spaced parallel side bars 121 extending longitudinally of the conveyor 310, and a front bar 332 extending across the conveyor direction. Such a guide frame functions firstly to restrain any uncontrolled movement of a newly-arriving row 15 e.g. tipping in a wrong direction before the tipper element 321 acts. Side elements of the guide frame can also act as static tipping members, co-operating with a movable tipping element 320 vertically spaced from them to enhance tipping moment. An end member such as the front bar 332 can be provided to prevent the row 15 from escaping from the frame 330 until tipped. This latter function may however be assured merely by operational timing, and/or lengthening the side elements 331 to cover any margin of error in positioning the row 15 between them (as seen in the Fig. 4 embodiment).

Further important components in these tipping mechanisms are side restraints or stripper members 340. These have been omitted in Fig. 3 for clarity, but are in fact present as seen in Figs. 4 and 5. Where tipping is done by a low-level push or trip, the stripper plates 340 - which approach close to the conveyor surface (the tripper bar 321 goes under them) - keep the cheese on the conveyor path rather than carried away by the tripper bar 321.

Figs. 3 and 4 again show operation with wedge-shaped rows. The downstream conveyor 310 moves at a constant speed in direction C, while the tripper bar 321 traverses in direction B in alternate directions for successive rows, depositing each row with its perpendicular face 153b upwards as seen. Separation of the individual portions of the rows occurs downstream; this can be done by conventional packaging machinery.

The Fig. 4 embodiment (which corresponds to the plan view of Fig. 5) differs in providing the tripper bar 321 as a cantilevered member, connected to a drive cylinder 323 extending across beneath the conveyor 310.

Figs. 6, 7 and 8 show a further embodiment.

A first feature here is that the drive 211 for the pusher is mounted above the conveying paths, so need not act through the stop plate 201.

A second feature is a facility for separating rows from a slab 1' which has been horizontally as well as vertically divided, e.g. as in Fig. 1(b), into upper and lower rows 15a,15b. A first feature for achieving this is a pusher head 213 which can selectively engage first an upper row then a lower row. In the present embodiment, this is achieved by an exchangeable pusher endpiece 214. Fig. 6 shows a standard full-height endpiece 214 for use with cut patterns without horizontal cuts, pushing off a full-height row 15 at a time as in the previous embodiments. This can however be exchanged with a half-height end piece 214' as seen in Fig. 8 which can push off only a top row 15a selectively, in an operation sequence described below.

Of course, vertical selectivity of the pushing may be achieved by controlled relative vertical movements between the pusher assembly as a whole and the slab carrier, optionally also the downstream conveyor 310.

The present embodiment illustrates a vertically adjustable deadplate 220 which underlies the end row 15, just beyond the end of the indexing conveyor 120. This deadplate 220 is adjustable in height relative to the push mechanism 210 by means of a lift drive 221, guided on rails 222, so that only the upper one 15a of the two end rows 15a,b is presented to the pusher 213,214'. A first stroke of the pusher removes the top row 15a. The pusher head 213 then returns, the deadplate 220 is lifted to the raised position shown in Fig. 8, presenting the lower row 15b to the pusher 213 which then pushes it in turn off onto the receiving conveyor 310. In this version the deadplate lift causes the initial displacement of the row 15b relative to the slab, but does not separate it away.

A lower row stop abutment is provided in the form of a plate or peg 230 which can project up at the front of the deadplate 220 (in this case, through a hole 223 in the deadplate 220) to prevent undesired movement of the bottom row as the top row is pushed off. In the process described, the necessary relative movement is achieved by moving the deadplate 220 and the cheese on it, but a drive cylinder 231 is also provided for independent control of the stop peg or plate 230 as desired.

For these "half-height" pushing operations the lower surface of a separated row is at a higher level than for normal full-height operation, so the downstream conveyor 310 is mounted for vertical adjustability (arrow D, Fig. 8) so as to be raised as seen in Fig. 8.

Another feature in this embodiment is a high-level tipping mechanism, having a tipping element 322 which tips the rows 15 by pushing their upper portions to topple them about their (resting) lower edges. This could be done by a linear movement, but the present version uses a longitudinal tipping bar 322 mounted on swing arms 325 pivoted to the sub-frame 299 at a pivot point 326, and driven by a drive cylinder 323 also mounted on the sub-frame 299. As shown by arrow E, the tipping element can be swung between opposed positions 322,322' on opposite sides of the row path. It is also possible to provide plural opposed tipping elements, disposed simultaneously on either side of the path, movable selectively in one direction or the other according to the desired tip direction and then returning immediately to the centred position. This is preferable for complex tip schedules, where a single side-to-side tipping element would have to make rapid return strokes when programmed tipping directions did not alternate.

Fig. 7 shows the system set up for operation with rectangular-section rows 15 of round-shouldered slabs 1", e.g. as in Fig. 1(c). These might require a tipping direction sequence as indicated by the small arrows in Fig. 1(c).

The rows 15 may be pushed directly onto the conveyor surface 310. With some softer or more rubbery cheeses this may give rise to excessive friction, so we use a low-friction support rail 350 having a low surface contact area per unit length, achieved here by round rods 351 positioned side-by-side on an underlying frame element 352. See also Fig. 6.

Side guiding is desirable to ensure that undesirable toppling does not take place. With high-level tipping, however, the intended tipping movements are in effect topplings. So, we provide side guide plates 345 movable by guide plate drives 346 to retracted positions 345'. For each tipping operation, the guide plate 345 on the appropriate side is retracted to allow the row 15 to fall past it onto the conveyor 310.

High-level tipping is generally preferably to low-level tripping in cases where the cheese rows 15 have broad, stable lower surfaces 152.

Speaking generally, it has been mentioned above that not every row need necessarily be tipped. There may also be cases in which, because of the shape of the row, it will reliably fall spontaneously from the pushed-off orientation to the desired conveyor orientation without positive tipping. The important thing in the tipping system is that there is provision for positive tipping when needed, and means for controlling it according to need.

The apparatus and methods have been described above in relation to cheese, and that is the material with which use of the system is primarily envisaged. They may nevertheless be applied to other food materials susceptible to cutting in large masses without division, and sufficiently hard to withstand the pushing and tipping operations. Such uses are comprehended herein.

Claims

1. An automated separation method for separating a cheese slab (1) cut into elongate rows (15) of portions (16), comprising:
   (a) with the slab on a slab carrier (120), aligning a row of the slab (1) with a row-selective pusher (210);
   (b) effecting relative movement between the pusher (210) and the slab carrier (120) so that the pusher (210) engages the end of the row (15) and pushes it linearly from the slab (1) in its length direction to a conveying location, and
   (c) repeating steps (a) and (b) for further successive rows (15) of the slab (1).

2. A method according to claim 1, in which step (a) comprises driving the slab carrier (120) to bring an end row (15) of the slab (1) against an indexing abutment.

3. A method according to claim 1 or claim 2, further comprising adjusting the orientation of separated rows (15).

4. A method according to claim 3 in which the orientation adjustment comprises pushing a row (15) to tip it about its length direction, to lie on a conveyor (310).

5. A method according to claim 3 or claim 4 in which the rows (15) have varying orientation along the slab (1) and the adjustment brings them into matched orientation on a conveyor (310).

6. A method according to claim 5 in which the slab (1) is cut into wedge-section rows (15) with alternating orientation.

7. A method according to claim 3 or claim 4 in which the orientation adjustment is sequenced to bring an internal cut surface of each row into a given desired orientation relative to the conveyor (310).

8. Apparatus for automated handling of cheese, comprising
   a slab carrier (120) for receiving a cheese slab (1) cut into rows (15);
   a linear row-selective pusher (210), and means (120) for aligning a row (15) of a slab (1) on the carrier (120) with the pusher (210), characterised in that the pusher (210) is adapted to push a row (15) selectively from the slab (1) in its length direction to a conveying location, by pushing on its end.

9. Apparatus for automated handling of cheese according to claim 8 comprising
   a downstream conveyor (310) leading from the conveying location and a tipping mechanism acting across the path of the downstream conveyor to tip a separated row (15) around its length direction.

10. Apparatus for automated handling of cheese according to claim 9 in which the tipping mechanism comprises one or more tipping elements (320,321,325), elongate in the row length direction and drivable selectively to tip in either direction across said path.

Fig.1(a)

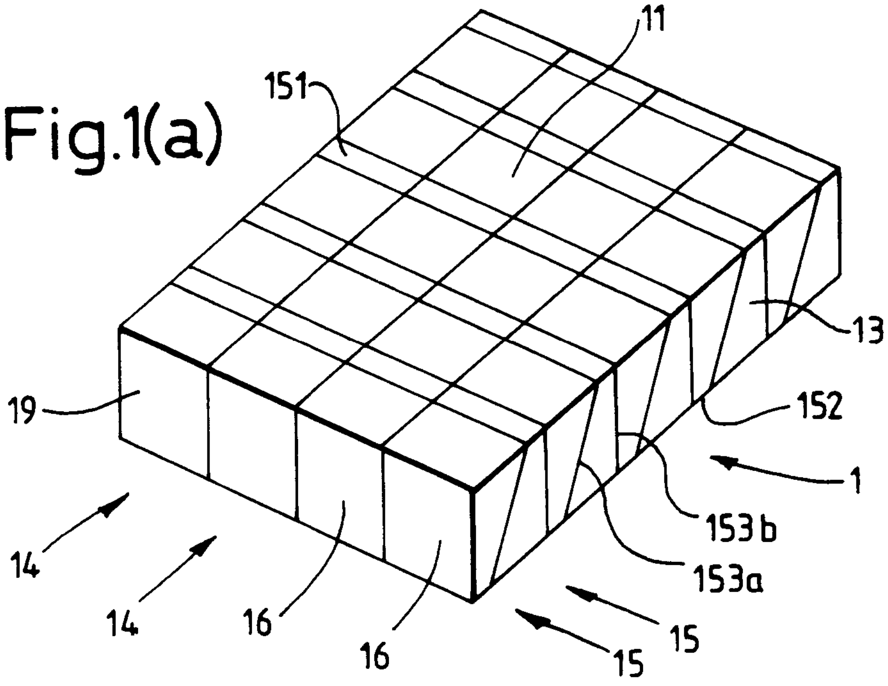


Fig.1(b)

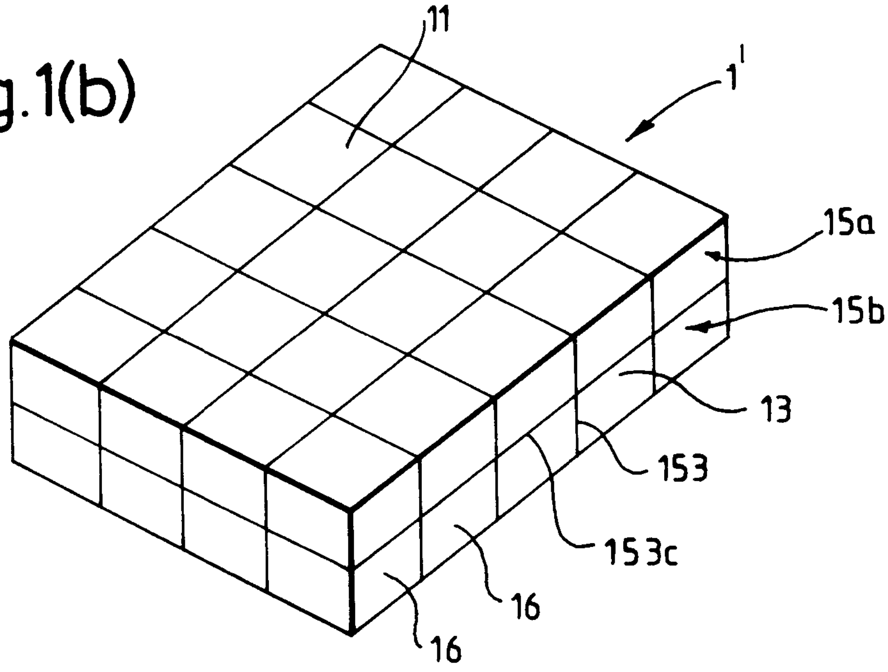
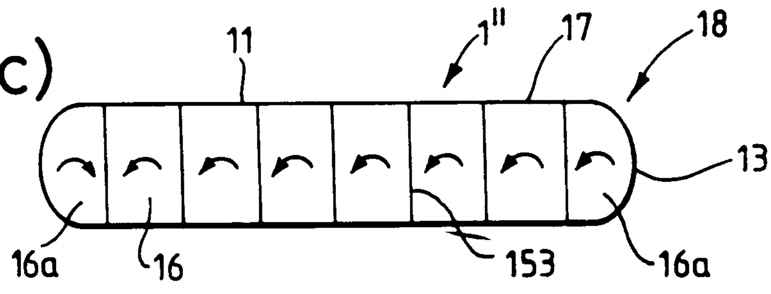
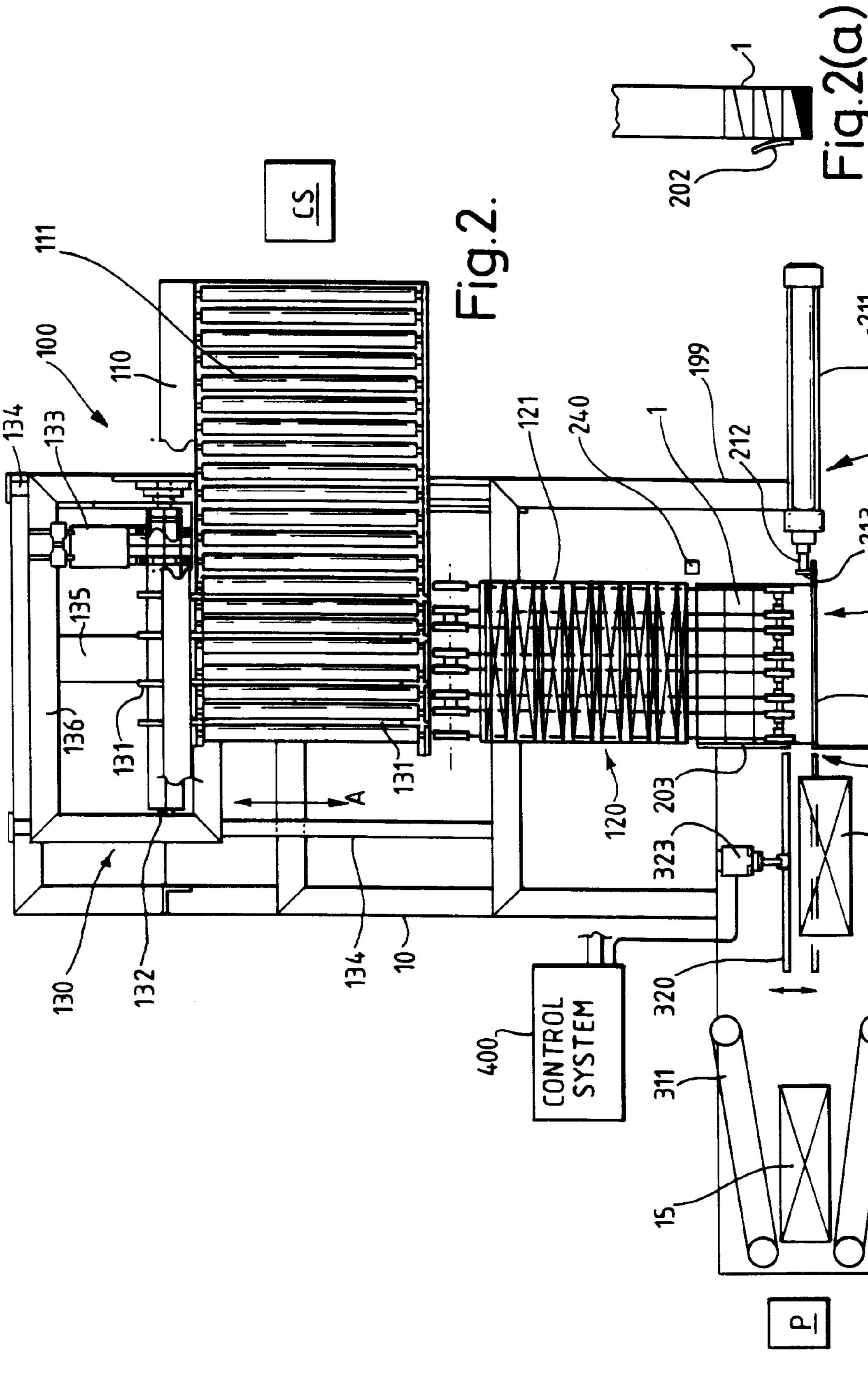


Fig.1(c)




CONTROL SYSTEM
CS
P
A
X
1
10
15
100
110
111
120
121
130
131
132
133
134
135
136
199
200
201
202
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210
211
212
213
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300
310
311
320
323
400

Fig.2.

Fig.2(a)

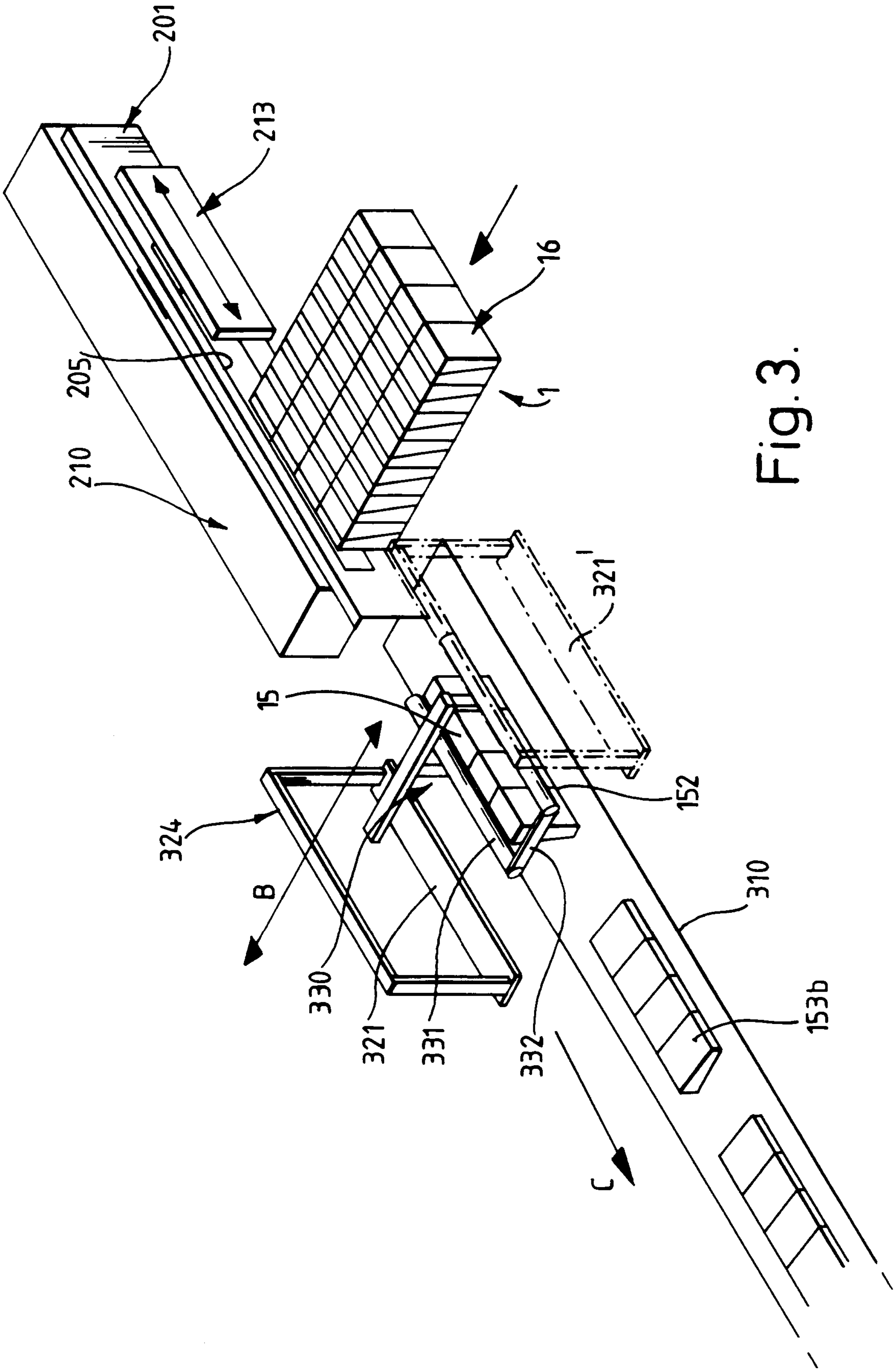

Fig. 3.

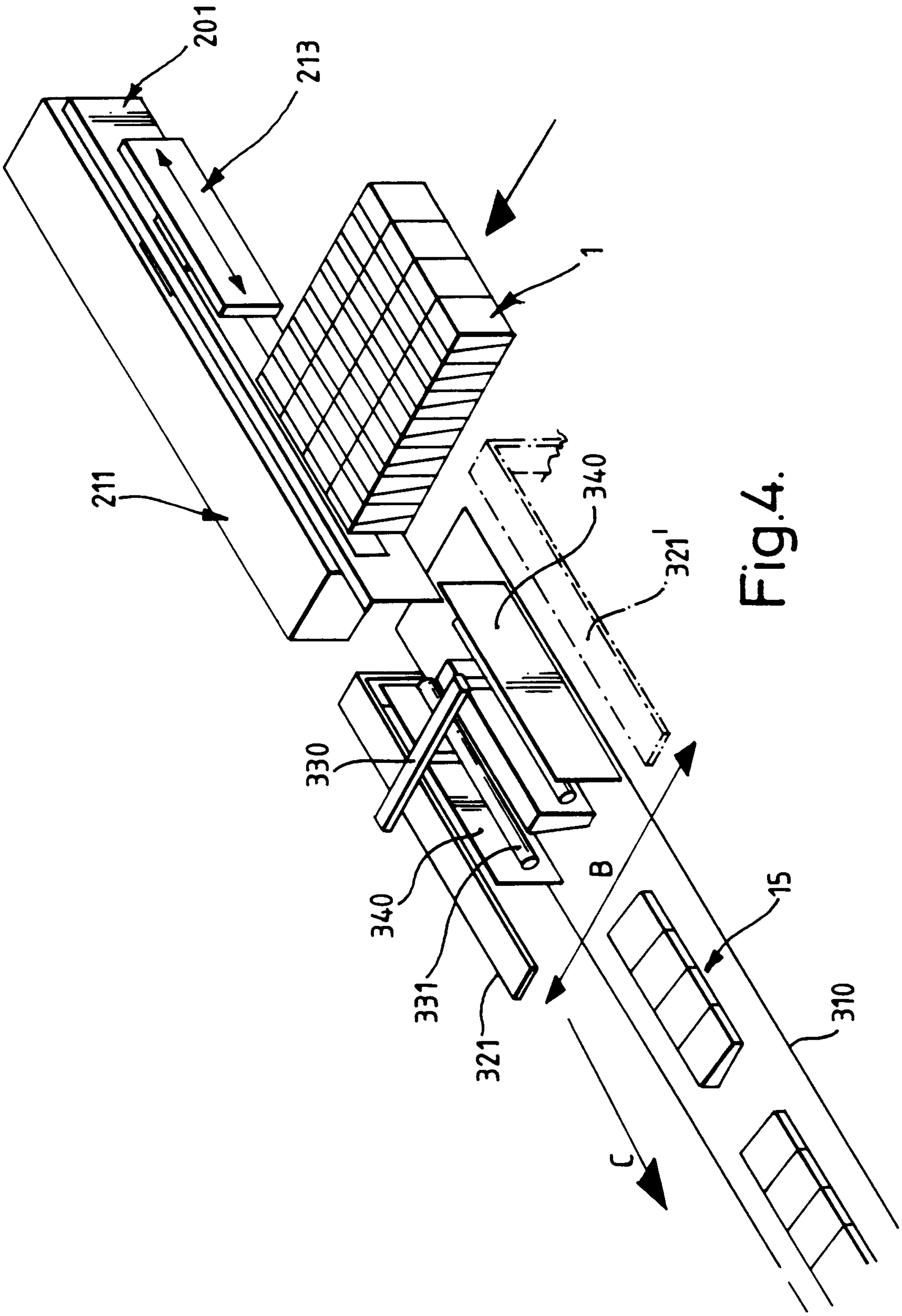

Fig.4.

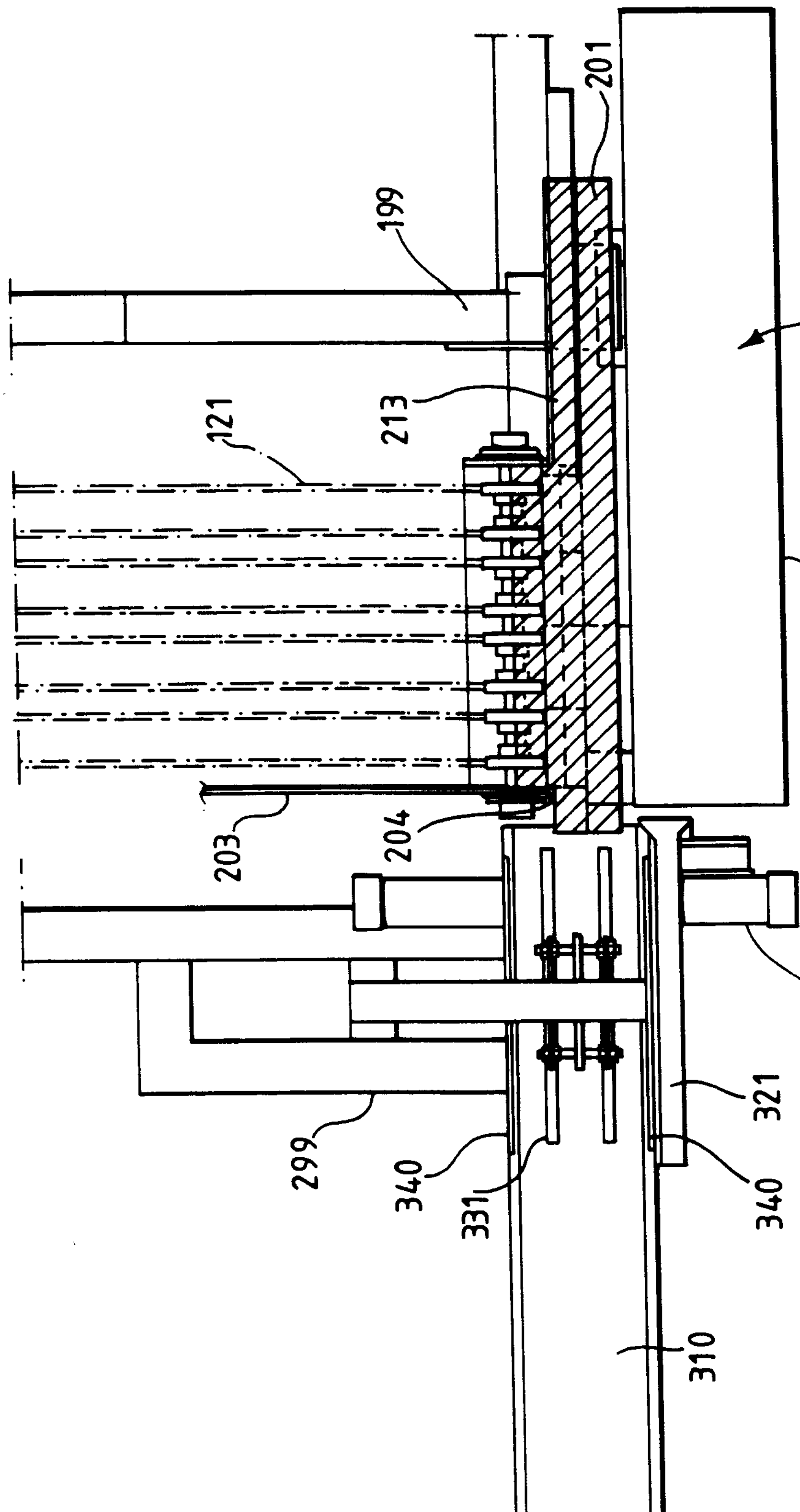

Fig.5.

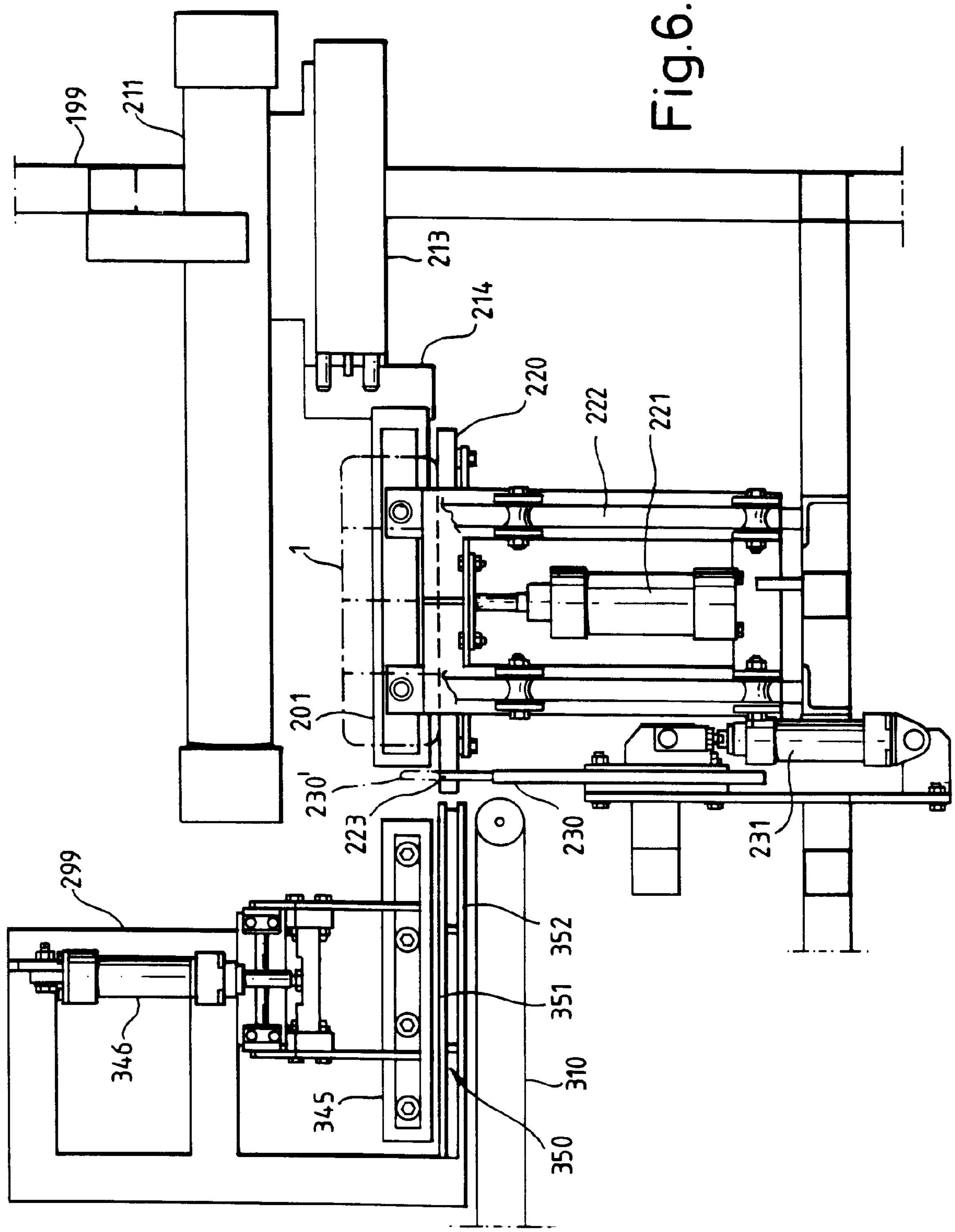
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Fig.6.

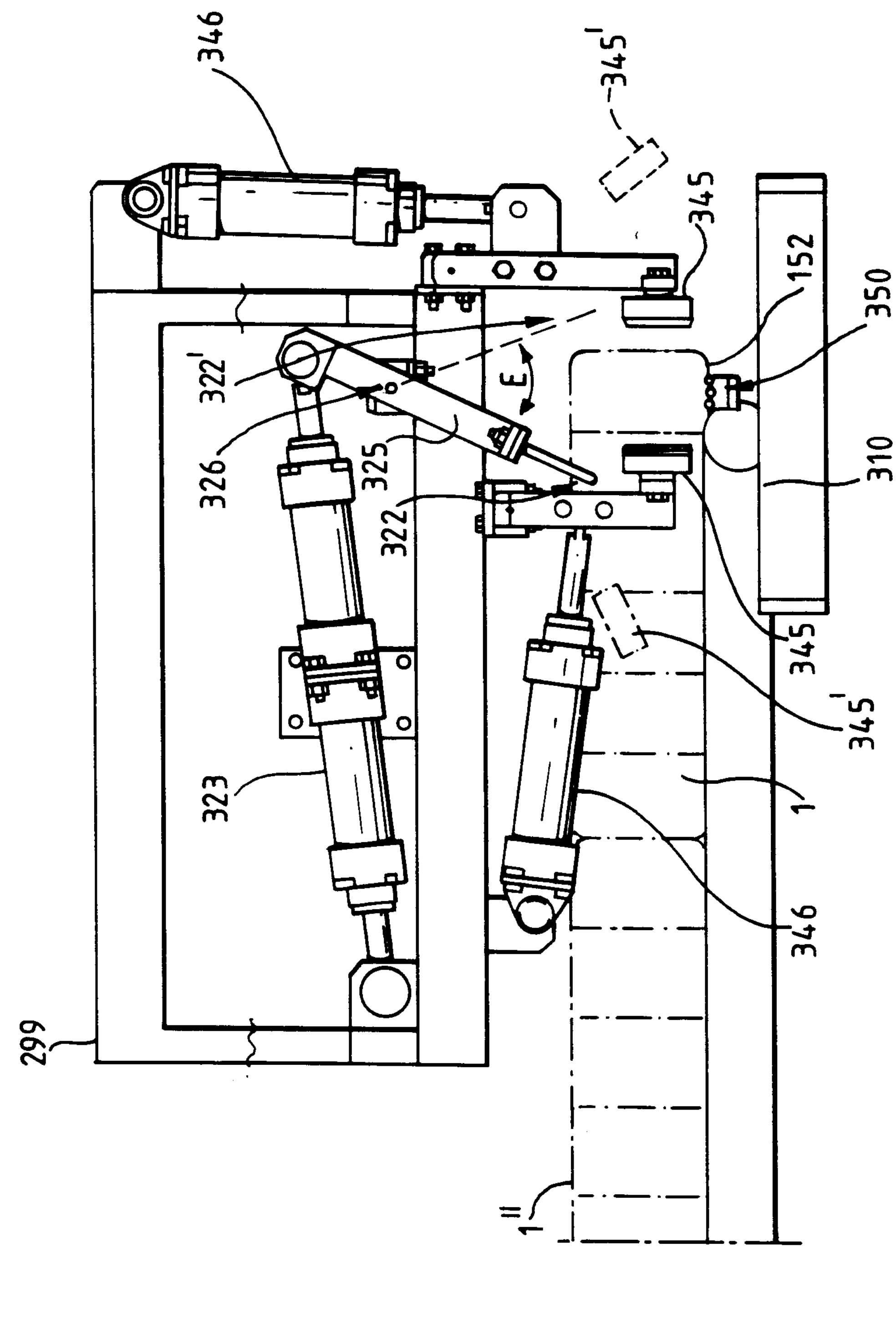
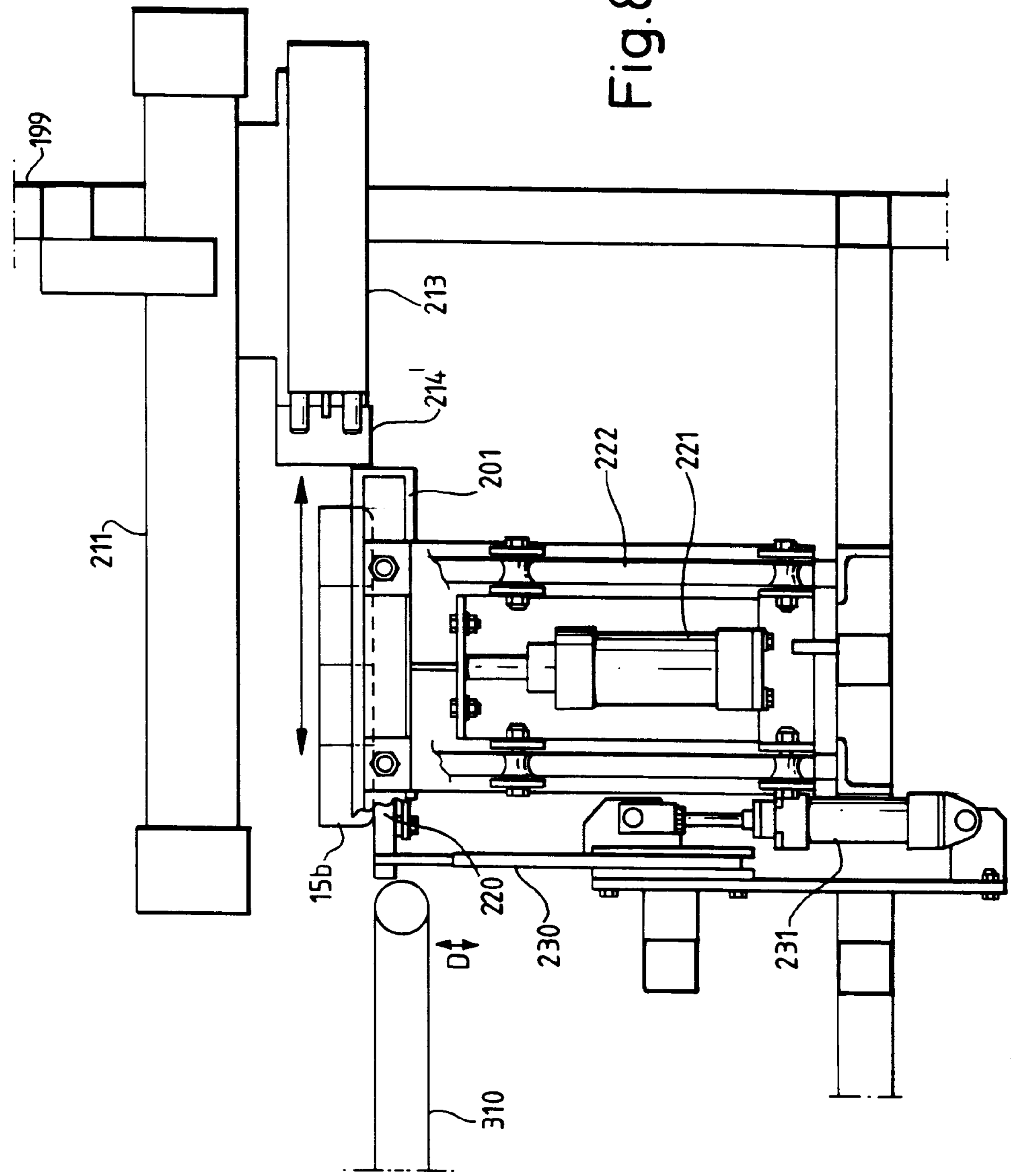


Fig.7.

Fig.8.



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EUROPEAN SEARCH REPORT

Application Number
EP 95 30 0105

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	DE-A-24 27 317 (KOSER) * the whole document * ---	1,2,8	B65B35/20
A	GB-A-19 685 (MERRELL) * page 2, paragraph 2 - paragraph 3 * * figures 1-3 * -----	1,8	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)
B65B
B65G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	27 April 1995	Claeys, H

CATEGORY OF CITED DOCUMENTS

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