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(54) Method and installation for manufacturing closure elements of natural cork

(57) Process and plant for the production of natural cork closure means (8; 9; 10) for containers of liquids, from raw boards of natural cork (1), that includes the following stages:

- continuously cutting semifinished natural cork products (24) from unseasoned boards (1) and classifying them according to quality, and
- carrying out continuous seasoning and boiling of the said semifinished products (24).

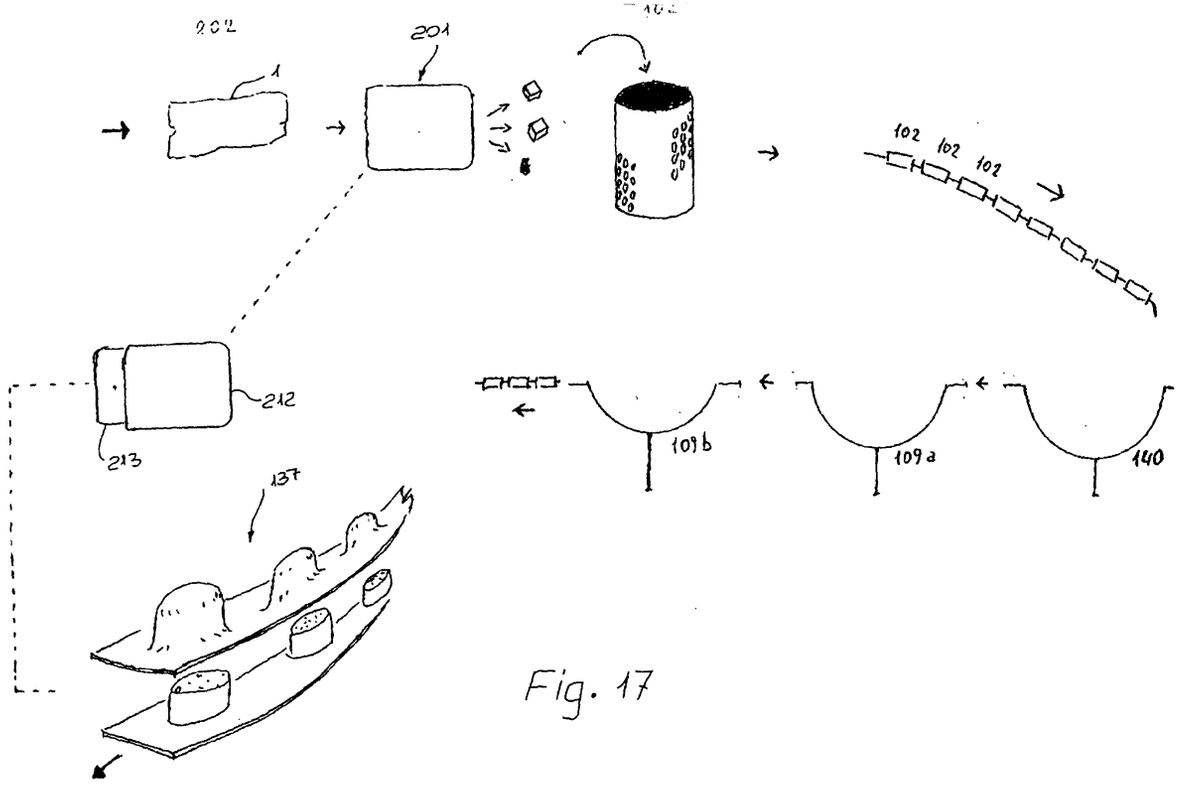


Fig. 17

EP 0 983 830 A2

Description

[0001] The present invention relates to a process and plant for the production of natural cork closure means for containers of liquids, in particular for wine bottles.

[0002] Natural cork stoppers of known type are made from the bark of the cork oak. The bark is removed in the form of curved boards from which, after a series of treatments, the stoppers are punched out. The first stage in the manufacturing process is seasoning of the boards which is done in areas exposed to atmospheric agents. The main purpose of seasoning is to arrive at dimensional stability by the loss of water from the plant tissue of the board. Seasoning usually takes about six months. The length of the board seasoning process requires large investment costs in immobilized boards and requires large storage areas for the boards. During the seasoning stage the boards may be contaminated by external pollutants from, say, plant protection products, pesticides or weed killers present in the external environment or may be contaminated by macro- or microorganisms. In this stage the entire board may also be contaminated by pollutants already present in the external layer of the board, which propagate through the rest of the board. These contaminations remain in the stoppers and can give the wine an unpleasant taste.

[0003] In addition, cork boards often have cracks which form on one side during the growth of the suberose tissue. The cracks or other cavities or the large number or pores (often known as lenticels) represent macroscopic defects of the board which are characteristic of parts made from low-quality cork or from rejects. These areas of the board create problems, particularly when the boards are used for the manufacture of stoppers for which it is necessary to use cork of high quality and uniform density. All the macroscopic defects which compromise stopper quality must therefore be removed from the boards. Furthermore, each panel has a highly irregular outline, so that many parts of the panel close to the outline have to be rejected because they do not offer sufficient material to make a complete stopper. The irregular outline of the boards and the macroscopic defects distributed at random over their surface mean that, with conventional manufacturing processes, a large number of semifinished products are produced that do not have the requisite quality characteristics and must therefore be rejected.

[0004] In accordance with a first aspect of the present invention, these problems are solved by a process and machine for the production of natural cork closure means that not only reduce rejects to a minimum but also allow the products to be traced and greatly reduce the length of time required for seasoning: this process and this machine have the characteristics forming the subject of Claims 1 to 7.

[0005] The present invention also relates to a process and plant for the continuous boiling and washing of semifinished natural cork products, and a process for the hygienic packaging of the individual finished product. The characteristics of this second part of the invention form the subject of Claims 8 - 12.

[0006] The present invention will now be described with reference to the attached drawings, in which:

- Figure 1 is a partial perspective view of a cork board intended for processing according to the invention,
- Figure 2 is a schematic perspective view of strips obtained from a stage of machining during the process according to the invention,
- Figures 3a, 3b and 3c are perspective views of closure means obtained with the process according to the invention,
- Figure 4 is a schematic front elevation of a brushing apparatus for the plant according to the invention,
- Figure 5 is a schematic perspective view of an inspection apparatus for the plant according to the invention,
- Figure 6 is a schematic axial section through a container used in the plant according to the invention,
- Figure 7 is a schematic view of a boiling and washing installation for the plant according to the invention,
- Figures 8a, 8b and 8c are perspective views of semifinished products produced by the process according to the invention,
- Figure 9 is a schematic side view of a bleaching machine for the plant according to the invention,
- Figure 10 is a partial perspective view of closure means produced and packaged according to the process forming the subject-matter of the present invention,
- Figure 11 is a schematic perspective view of a continuous seasoning installation for the plant according to the invention,
- Figure 12 is a schematic side view of a machine according to the invention for cutting cork products and separating them into quality categories,
- Figure 13 is a schematic and partial view of a cork panel,
- Figure 14 is a partial perspective view of a detail of the machine seen in Figure 12,
- Figure 15 is a schematic plan view of the machine seen in Figure 12,
- Figure 16 is a partial perspective view of a cutting apparatus for the machine seen in Figure 12, and
- Figure 17 is a schematic view of the continuous process according to the present invention.

[0007] In Figure 1 the reference number 1 indicates a board of cork that has been removed from the bark tissue of a cork oak (not illustrated). The board 1 is in the shape of a portion of a cylindrical shell of length L, width W and thickness S. The board 1 has a concave face 2 termed the belly which is relatively smooth and a convex face 3 known as the back which is very rough. The board 1 also has a plurality of lenticels or pores 4 which are

small passages of regular section which extend between the belly 2 and the back 3 in roughly radial directions relative to the trunk. The board 1 has annual growth layers 5 and relatively deep natural cracks 6 which run longitudinally along the back 3.

[0008] In a precutting station (not shown) the unseasoned boards 1 are cut longitudinally to form strips, marked 19 in Figure 2, having a width W1 and a length L. Precutting is done by means of a cutting apparatus (not shown) which sections the boards into two or more strips, usually along already-existing axial cracks. Consequently the strips 19 differ from the boards 1 only in that their width W1 is substantially less than the width W of the boards 1.

[0009] The strips 19 are brushed by a brushing apparatus marked 46 in Figure 4. The apparatus 46 comprises a conveyor 47 having a frame 48 that carries supporting rollers 49 arranged in an arc of a circle. A belt conveyor 50 operates in conjunction with the rollers 49 to form a supporting surface for the strips 19 shaped as a sector of a cylinder. The apparatus 46 also includes a plurality of brushes 51, 52 and 53 positioned above the belt 50. The brushes 51, 52 and 53 are all at the same distance from the belt 50 and this distance is adjustable according to the thickness S of the strips 19. The strips 19 are advanced by the belt 50 while the brushes 51, 52 and 53 rotate about respective axes and remove surface impurities from the backs 3 of the strips 19 by abrasion of a layer of cork whose thickness can be varied by adjusting the distance between the brushes 51, 52 and 53 and the belt conveyor 50.

[0010] Figures 3a, 3b and 3c show three different kinds of cork stoppers which can be produced by the process according to the invention. Referring to Figure 3a, the stopper 8 is a cylinder of height H and diameter D with a lateral surface 8L, two bases 8B and a longitudinal axis 11. The stopper 8 is made from a single piece 12 of cork whose lenticels 14 run parallel to the axis 11. Referring to Figure 3b, a stopper 9 is a cylinder of height H and diameter D, a lateral surface 9L, two bases 9B and a longitudinal axis 13. The stopper 9 is formed from two pieces of cork 14, 15 whose respective lenticels 4 are parallel with the axis 13. The pieces 14, 15 are joined together e.g. with adhesive. Referring to Figure 3c, the process according to the invention can also be used to make conventional stoppers consisting of a single piece of cork of height H1, diameter D1, with a lateral surface 10L, two bases 10B and a longitudinal axis 16. The stopper 10 is made from a single piece of cork 17 whose respective lenticels 4 are oriented transversely to the longitudinal axis 16.

[0011] After the stages of precutting and brushing the unseasoned strips 19 are preferably sent to a flattening and softening station. After this, the strips are sent to a rapid cutting station which forms cubes of unseasoned cork with a base of approximately 5 cm and a height equal to no more than the thickness S of the boards.

[0012] After the stage of brushing and flattening the strips, panels of unseasoned cork marked 202 in Figure 13 are obtained, each having two principal parallel faces 203a, 203b and a side wall 204 with irregular profile and undulations. Each panel 202 also includes lenticels or pores 205 which extend at right angles to the principal faces. In particular, the principal faces include areas 206 in which the lenticels 205 are present with a particularly high density or have a relatively high cross section compared with other areas of the faces 203a and 203b. The areas 206 are unsuitable for high-quality finished products because of the macroscopic defects of the cork.

[0013] Referring to Figure 12, the reference number 201 indicates a cutting machine comprising an image acquisition apparatus 208, an apparatus 209 for cutting the panels 202, another cutting apparatus 210 and a selection apparatus 211. The apparatus 209, 210 and 211 of the machine 201 are controlled by an examination, processing and control unit 212 comprising a memory unit 213.

[0014] The apparatus 208 comprises a table 214 along which the panels 202 advance following a path P1. The table 214 comprises a portion 216 of crystal glass or other transparent material and metallic portions 215 and 217. As shown in greater detail in Figure 14, the apparatus 208 comprises a carriage 218 for moving the panels 202 forward, a rack guide 219 and a guide 220 that extends parallel to the rack guide 219 in the direction of advance of the panels and supports, together with the guide 219, the advancing carriage 218. The apparatus 208 includes a drive member 221 which engages with the rack guide 219 to move the carriage 218 along the guides 219 and 220. The carriage 218 comprises a bar 222 that lies transversely to the direction of advance and from which extend rods 223 that each support respective gripping members 224 each of which comprises a rod 225 extending in the direction of advance and a tooth 226 at the rear end of the rod 225, with reference to the direction of advance D1. The apparatus 208 also includes positioning members 227 that are located alongside the portion 216 and locate each panel 202 in a particular position in a direction at right angles to the direction of advance D1. The positioning members 227 comprise two hydraulic cylinders 228 fitted with push pads 231 on the ends of their rods 229. On the opposite side from the push members 227 is an elastic opposing means 232 that comprises a plurality of fixed supports 233 and a plurality of mobile supports 234 connected to the fixed supports 233 by helical springs 235 or similar elastic bodies that can deform at right angles to the direction of advance D1.

[0015] Referring to Figure 12, the apparatus 208 also includes two video cameras 236 and 237 underneath the transparent portion 216 of the table 214 and aimed at different angles towards the portion 216 which is illuminated by a lamp 238 positioned between the video cameras 236 and 237. Each video camera 236, 237 is connected to its own image analyser 239, 240 which in turn is connected to the unit 212.

[0016] Referring to Figures 12 and 14, the apparatus 209 for cutting the panels 202 comprises a shaft 241 which is supported by the portion 217 and is able to rotate about an axis 242 lying at right angles to the direction of advance D1. The shaft 241 supports a plurality of circular blades 243 at right angles to the axis 242 and uniformly distributed along this axis. The metal portion 217 has fingers 244 each lying in the space between two adjacent blades and connected to a chute 245 which guides the strips 246 to a second cutting apparatus 285 as they are cut from the panel 202.

[0017] The strips of cork 246 formed by the cutting up of the panel 202 are then cut at right angles to their longitudinal axis by a second cutting apparatus 285 that includes a motorized shaft 288 carrying a plurality of circular blades 289. This cutting action produces a plurality of blocks of cork 266. Acceptable blocks are essentially parallelepipeds with a square base and a height equal to the height of the panel. They also have no macroscopic defects. Also produced at the same time as the acceptable blocks are items of cork that have defects of shape or a high density of lenticels 206 or cracks 207. The distance between the individual rotating blades is varied on instructions from the processing unit according to the dimensions of the parts that are to be rejected and on the predetermined dimensions of the required products.

[0018] Referring to Figure 15, the selection apparatus 211 comprises a plurality of conveyors 267 for advancing the semifinished products 266a and 266b in the direction D1. Deflectors 271, 272 and 273 divide the semifinished products into two or more quality categories on the basis of information acquired by the video cameras 236 and 237.

[0019] In operation the video cameras 236 and 237 acquire data about the image in the face of a panel 202 and transmit the acquired data to the image analysers 239, 240, which then encode the various parts of the image and compare the parts of the image with intervals of acceptability so as to identify any macroscopic defects. The image analysers transmit the data about the macroscopic defects of the panel to the control unit 212. The unit 212 uses a ready-installed optimizing algorithm to determine where to make the longitudinal cutting lines 283 and transverse cutting lines 284, schematically indicated in Figure 15. The algorithm used is installed in such a way that the parts of the cork that will have to be rejected are minimized on the basis of the dimensions of the semifinished products 266 and the outline 204 of each panel 202.

[0020] The longitudinal cutting lines 283 are approximately the same distance apart from each other, which distance is equal to the size of the semifinished products 266. Based on the results supplied by the algorithm employed, the panel 202 is positioned by the members 227 against the elastic opposing means 232 so as to determine the position of the cutting lines 283 with respect to the panel 202 which is advanced by the carriage 218 in the direction D1 towards the blades 242 so that the strips 246 can be cut from the panel 202. The strips 246 are laid in succession on the table 247 for a further cutting operation by means of the second cutting apparatus 285.

[0021] As illustrated in Figure 16, each strip 246 laid on the table 247 is grasped at each end by respective advancing members 248 and by respective supporting members 258 and is advanced in the direction D1 in steps, determined as a function of the transverse cutting lines 284. The unit 212, having determined the cutting lines 283 and 284, stores in the memory 213 the cutting lines 283 and 284 and the images of each cube 266a and 266b defined by the lines 283 and 284 and by the outline of the panel 202. The unit 212 arranges for the strips 246 to be advanced ready for the cuts in the positions determined by the lines 284 by causing the strip 246 to stop alongside the cutting member 253, which then lowers the cutting unit 285 containing the motor 290 and the blades 289 and cuts the semifinished products 266a and 266b from the strip 246.

[0022] The transverse cutting lines 284 occur at an interval equal to the sides of the semifinished product 266a except for cases in which a semifinished product 266b with a macroscopic defect is to be isolated, thus reducing the amount of cork rejected to a minimum.

[0023] The cubes of unseasoned cork produced by the machine 201 can undergo an optional operation for the removal of portions of crust and belly.

[0024] The cubes of cork then undergo an accelerated seasoning operation. Referring to Figure 11, the seasoning station of the plant is preferably formed by a continuous seasoning plant marked 140. The plant 140 comprises a pipe 141 extending between an inlet 142 and outlet 143, the latter being closed by a hinged cap 144. A ventilation unit 146 draws in air from the external environment and passes it into the pipe 141 through an auxiliary pipe 145. Between the ventilation unit 146 and the auxiliary pipe 145 is a dehumidifier 147 and a heating unit 148.

[0025] To carry out the seasoning operation the semifinished products are placed in modular containers marked 102 in Figure 6, each of which comprises a body 103 and a cap 104 which screws onto the body 103. The body 103 contains holes 107 both on its lateral surface and on its base 105 so that the internal volume of the container 102 is in communication with the external environment.

[0026] As shown in Figure 11, the modular containers 102 containing the products to be seasoned are pulled by a chain 149 from the inlet 142 towards the outlet 143 of the pipe 141 while a stream of air flows through it in the opposite direction to the direction of movement of the containers 102.

[0027] The same containers 102 can also be used for boiling the semifinished products of seasoned cork. Referring to Figure 7, the number 109 denotes a continuous boiling plant fed with the modular containers 102

containing the seasoned cubes 24. The plant 109 includes a Y- or U-shaped tube filled with water and comprising a vertical length of tube 110 connected to two lengths of tube 111 and 112 defining a path along which the modular containers 102 advance, connected to each other by a chain 113. Tube length 111 includes an upper end closed by a cap 114 and a filling pipe 115 fitted with a valve 116 through which the plant is filled with water. Tube length 112 is fitted with a hinged cap 117, next to which is an intermittent drive apparatus AZ for pulling the chain 113 and the containers 102. Tube length 110 is closed at its lower end by a valve 118, through which the water can be drained from the plant. A heater 119 is provided to heat the water contained in the plant.

[0028] During the boiling operation the cubes of cork 24 become appreciably softer than the unboiled cubes owing to the modifications which take place in the cellular structure of the cork.

[0029] The semifinished products then undergo cutting operations to produce the stoppers illustrated in Figures 3a or 3c. The blocks of cork can also be bonded together, keeping the lenticels parallel, in such a way as to form rods of a given length which are then cut at regular intervals to produce stoppers of the type illustrated in Figure 3b, each of which is composed of two or more discs of cork bonded together.

[0030] The stoppers are then put through a washing operation which preferably takes place in a continuous-cycle plant having a form similar to that used for the boiling, using a mixture of water and food-grade ethyl alcohol.

[0031] Referring to Figure 9, the stoppers then undergo bleaching by a machine 124 comprising a conveyor 125 having a belt 126 transparent to ultraviolet radiation. The machine 125 comprises two ultraviolet-emitting apparatuses 129 and 130, one above and one below the working side of the conveyor belt. The stoppers are advanced by the conveyor along a given path and are irradiated from above and below by the ultraviolet radiation emitted by the apparatuses 129 and 130 which can be regulated to give the required intensity of treatment.

[0032] Last of all the stoppers are sent to a packing machine (not shown) where the stoppers are packed in cartridges 137, as illustrated in Figure 10, in which the stoppers are arranged separately, all oriented in the same direction and inserted into respective seats 138 in a plastic blister-pack material forming a continuous strip 139.

[0033] The process does not exclude other operations that have not been described, such as lubrication, etc., being carried out between one stage and the next.

[0034] The process and the plant according to the present invention not only reduce seasoning times but also have a great number of advantages. In particular, the separating out of parts of cork is done by cutting tools only, and tools which may produce dust which would clog the lenticels 4 are eliminated. The process thus makes it possible to produce stoppers with a higher degree of cleanliness than conventional stoppers.

Claims

1. Process for producing natural cork closure means (8; 9; 10) for containers of liquids, from raw boards of natural cork (1), characterized in that it includes the following stages:

   - continuously selectively cutting semifinished natural cork products of small dimensions (24) from unseasoned boards (1) and
   - carrying out continuous seasoning of the said semifinished products (24).

2. Process according to Claim 1, characterized in that it includes a preliminary stage of continuous brushing of at least one surface (3) of each board (1) or strip of board (19) with motorized rotary brushes, in order to remove an outer layer from the said board (1) or strip of board (19) by abrasion.

3. Process according to Claim 1, for cutting panels (202), particularly of cork, each unseasoned panel (202) having two opposite principal faces (203a, 203b), an irregular outline (204) and possible macroscopic defects (206, 207) on at least one of the principal faces (203a, 203b), the process being characterized in that it includes the continuous stages of: cutting selectively, classifying and separating semifinished products (266a) of given dimensions and free of macroscopic defects from each panel (202) and reject products (266b); acquiring for each of said panels (202) an image (I); and determining for each panel (202), by means of an optimizing algorithm, first and second cutting lines (283, 284) determined on the basis of: the macroscopic defects (206, 207); the irregular outline (204) of the said panel (202); and the dimensions of the semifinished products (266a).

4. Process for producing natural cork closure means for containers of liquids from raw boards of natural cork (1), characterized in that it includes the stage of continuously seasoning semifinished products of natural cork of small dimensions resulting from the cutting of unseasoned boards, by treating them with chemically and microbiologically controlled dry air.

5. Machine for cutting panels (202), particularly of cork, each panel (202) having two opposite principal faces (203a, 203b), an irregular outline (204) and possible macroscopic defects (206, 207) on at least one of the faces (203a, 203b), the machine being characterized in that it includes first and second cutting apparatuses (209, 210, 285) for cutting, from each panel (202), semifinished products

(266a) of given dimensions and free of macroscopic defects (206, 207) and reject products (266b), an acquisition apparatus (208) for acquiring for each panel (202) an image (I), and a processing and control unit (212) for determining for each panel (202), by means of an optimizing algorithm, first and second cutting lines (283, 284) and for assigning to each semifinished product (266a) a serial number and a quality level based on the acquired image, thereby enabling it to be identified unambiguously and traced throughout the entire procedure.

6. Machine according to Claim 5, characterized in that the abovementioned cutting device (209, 210, 285) includes means (219, 220, 249, 250, 251) both for advancing the complete panels (202) one after the other along a path of advance over a transparent surface, and for advancing the strips obtained from the first cut, while adjusting their position, and a number of video cameras (236, 237), at least one of which is located underneath the said transparent surface, in order to acquire the image of each semifinished product, both the semifinished products and the parts to be rejected being identified unambiguously, for the purpose both of accurately positioning the tools of the second cut, and deciding the timing of this cut and the sequences of the operation of separation into categories and of rejection, employing variable distances depending on the parts to be rejected.

7. Plant for carrying out a process according to Claim 1 or 4, characterized in that it includes a continuous seasoning installation in the shape of a y with rounded angles and consisting of a broad tubular pipe in which perforated modular containers (102) filled with semifinished products are tied together in a chain, and also consisting of a ventilation appliance for forcing controlled dry air through the said pipe.

8. Process according to Claim 1, characterized in that it includes a stage of continuously boiling small semifinished cork products from which the woody layer known as the back has been removed, such products coming from the seasoning operation and being handled and treated in perforated modular containers (102).

9. Process according to Claim 1, characterized in that it includes a stage for the continuous washing of the said closure means (8, 9, 10) in a liquid mixture containing food-grade ethyl alcohol.

10. Process according to Claim 1, characterized in that it includes the insertion of the loose semifinished products into perforated modular containers (102) for proceeding, in chain formation, to the treatments of continuous seasoning, boiling and washing, as well as to handling throughout the procedure by means (AZ, 113) for advancing the said containers.

11. Process according to Claim 1, characterized in that it includes hygienic protection of the finished products arranged in a continuous single file by packaging each product separately, thus forming a continuous blister pack strip of transparent material bearing identification numbers or codes for unambiguously identifying the individual article on the basis of the indications supplied by the processing unit.

12. Plant for carrying out a process according to Claim 1, characterized in that it includes respective continuous-treatment installations for seasoning, boiling and washing (140, 109a, 109b), each including a tubular pipe in the shape of a Y with rounded angles or in the shape of a U (111, 112) containing treatment fluids and a plurality of modular containers (102) containing the said semifinished products (24), means (AZ, 113) being provided to advance the said modular containers (102), strung together in a continuous series, along the said tubular pipe (111, 112).

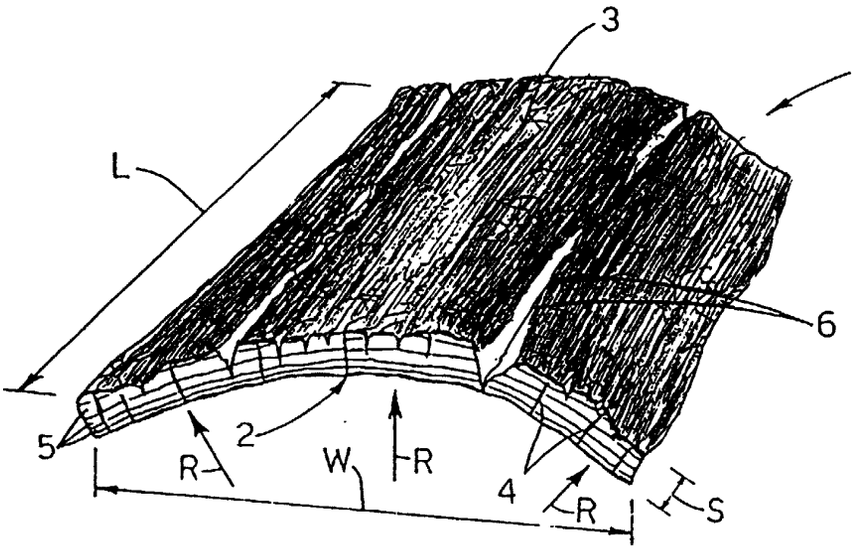


Fig.1

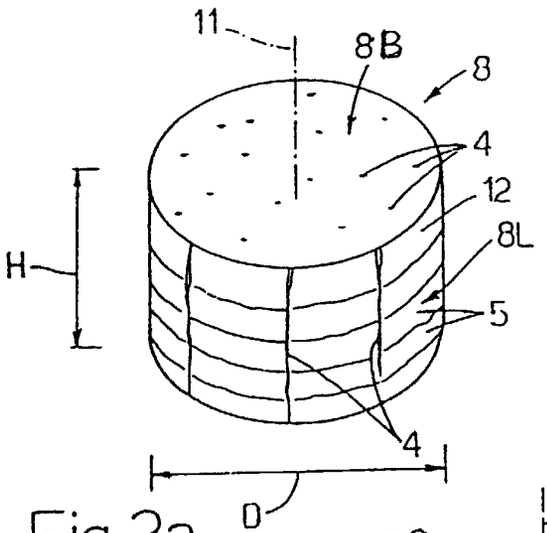


Fig.3a

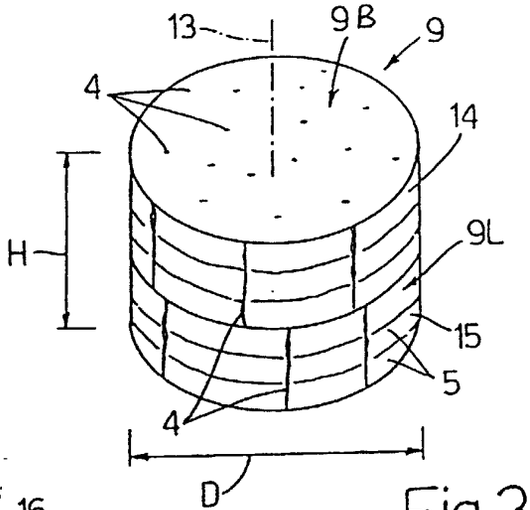


Fig.3b

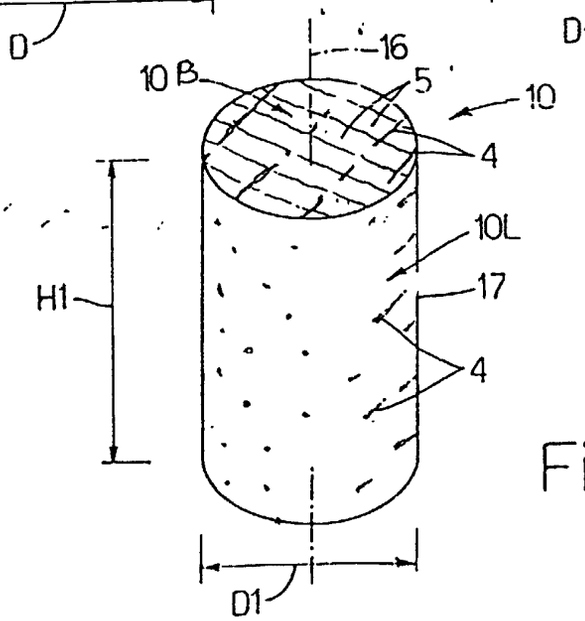
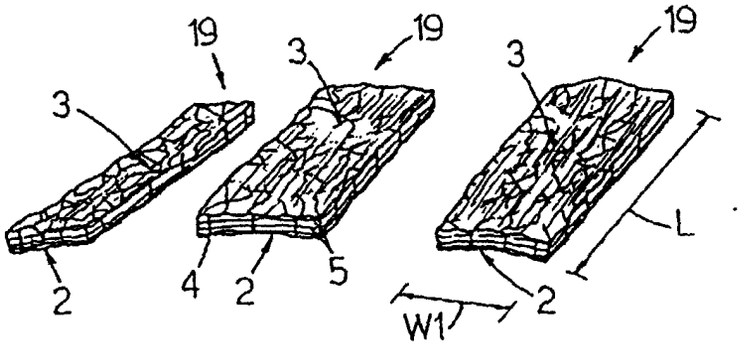


Fig.3c

Fig.2



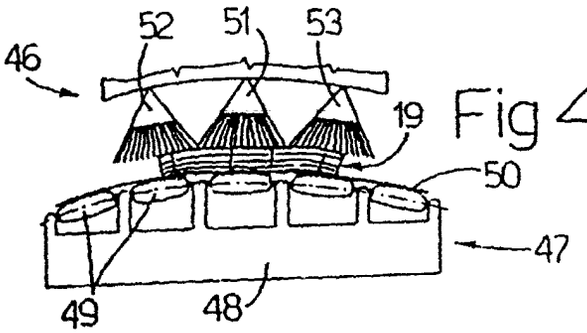


Fig 4

Fig. 5

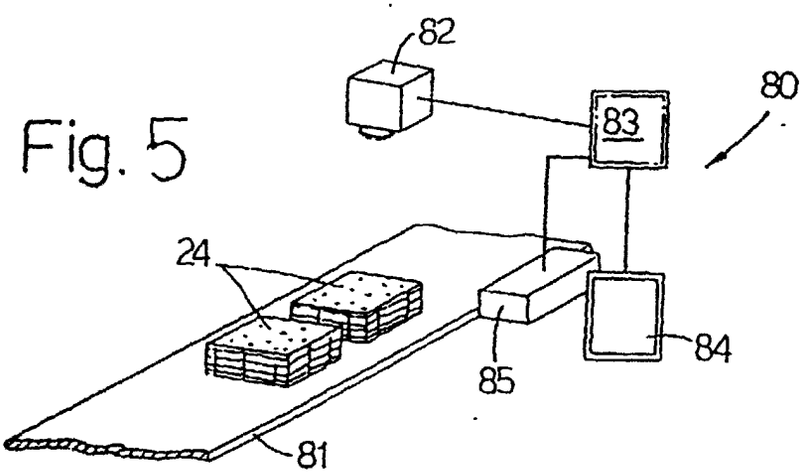
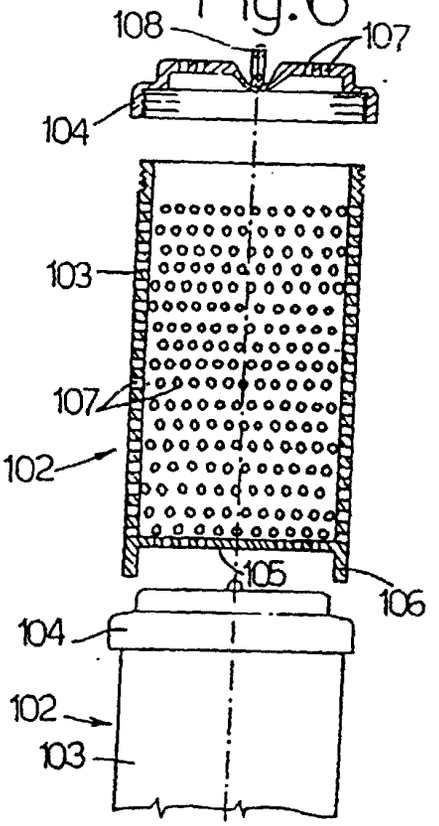


Fig.6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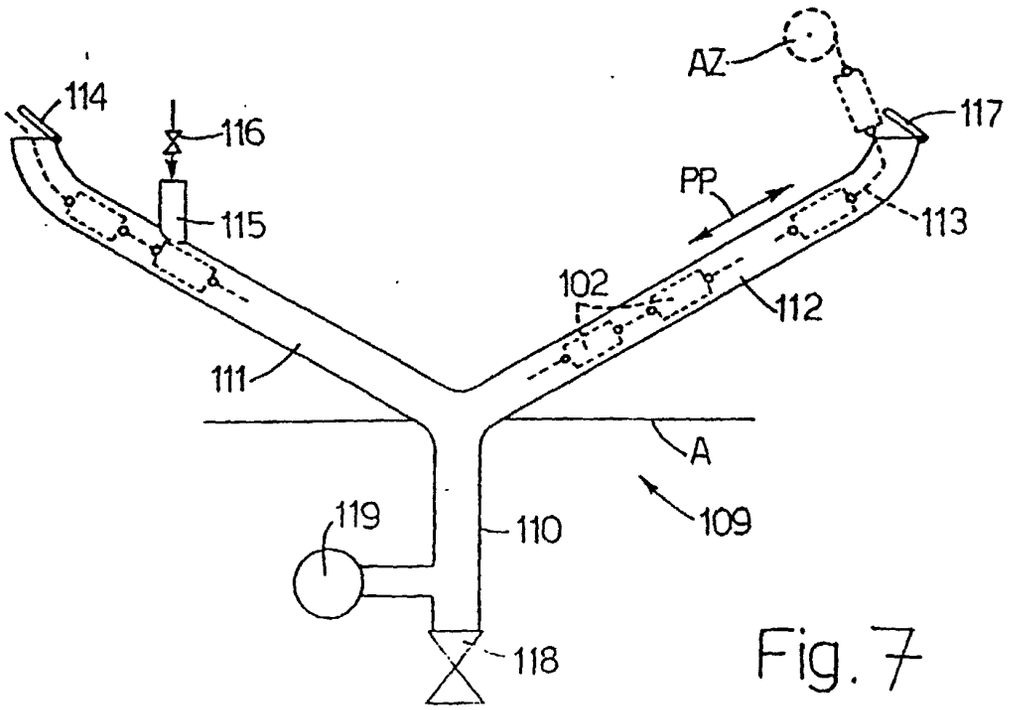
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Fig. 7

Fig.8a

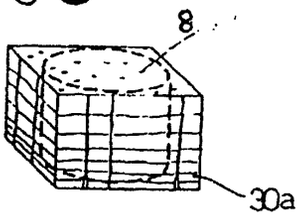


Fig.8b

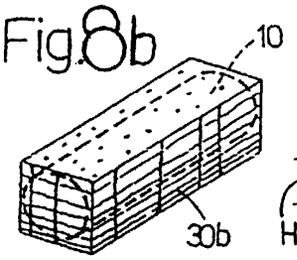


Fig.8c

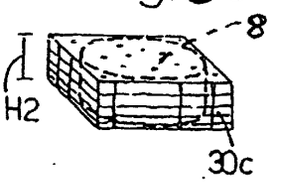
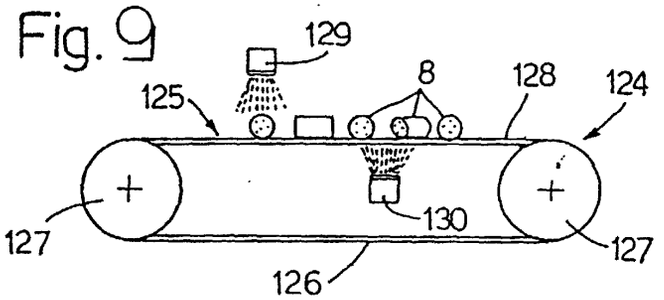


Fig. 9



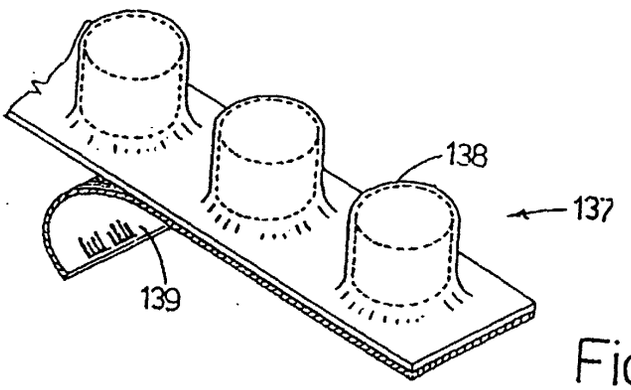


Fig 10

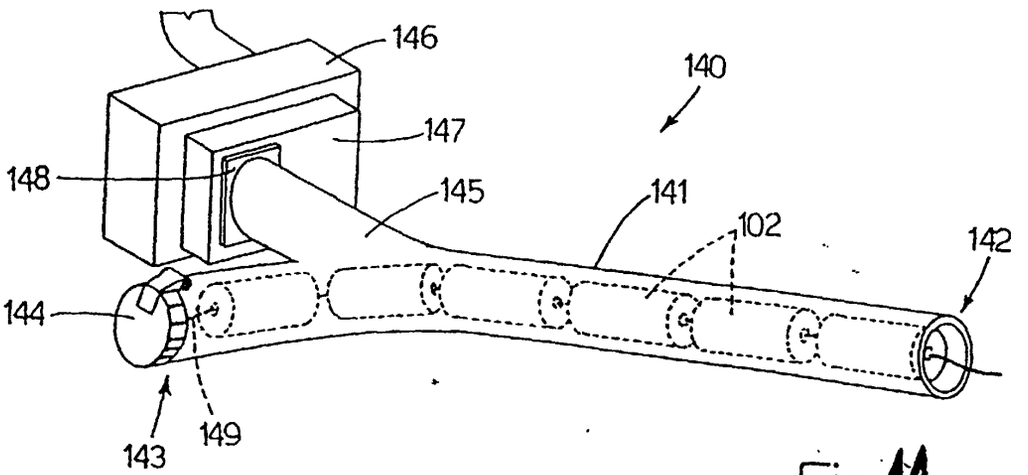
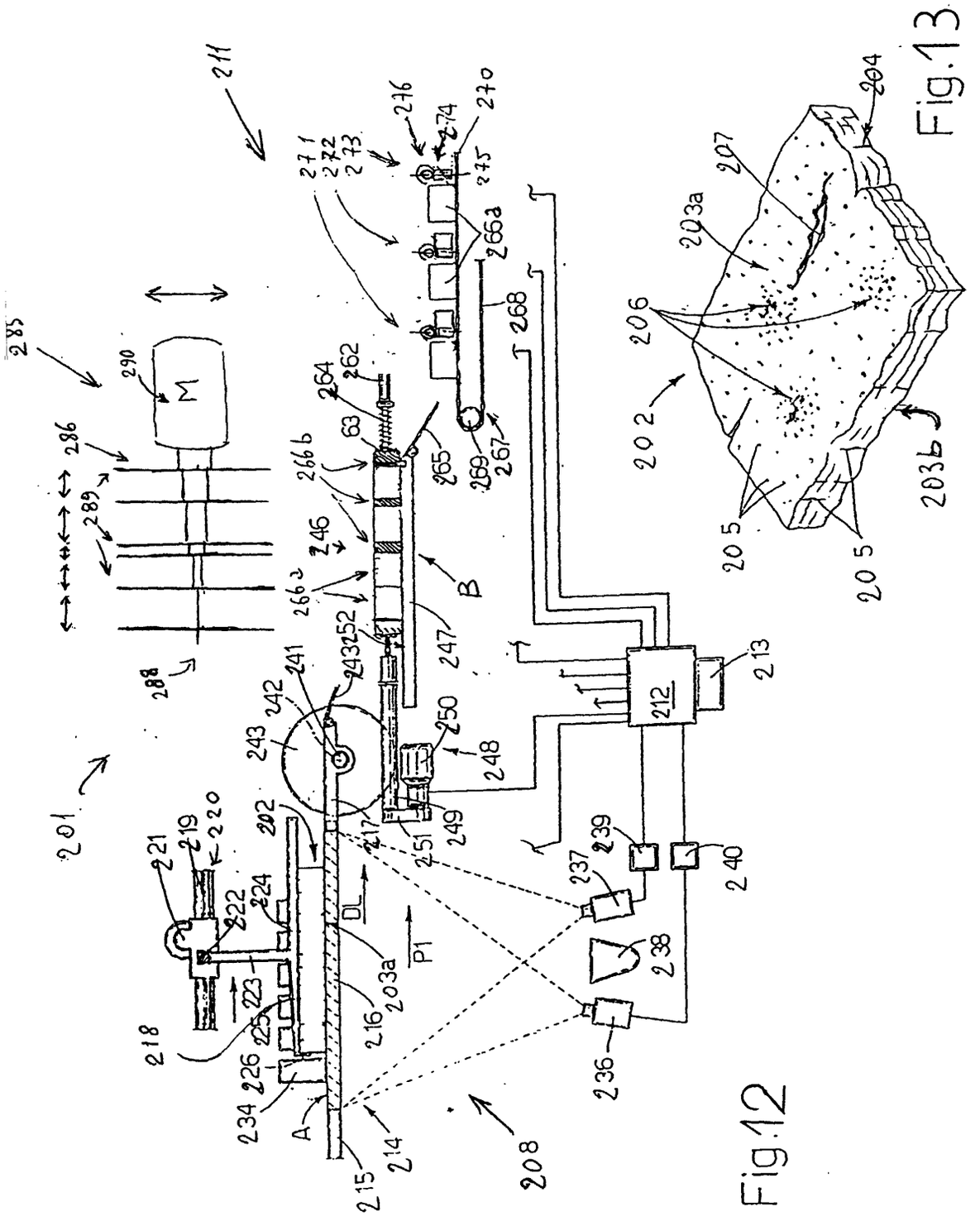


Fig.11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266a
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Fig.12

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203b

Fig.13

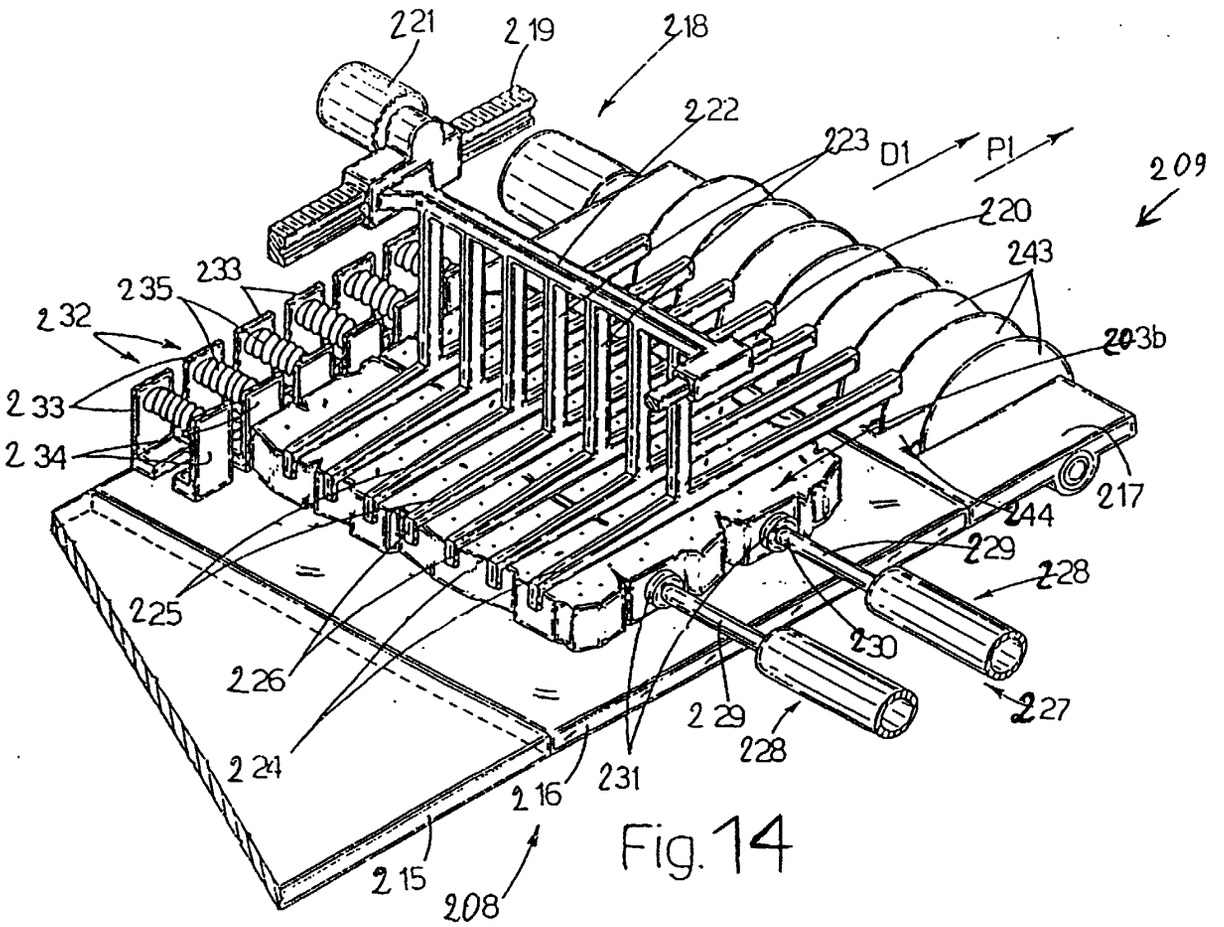
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Fig.14

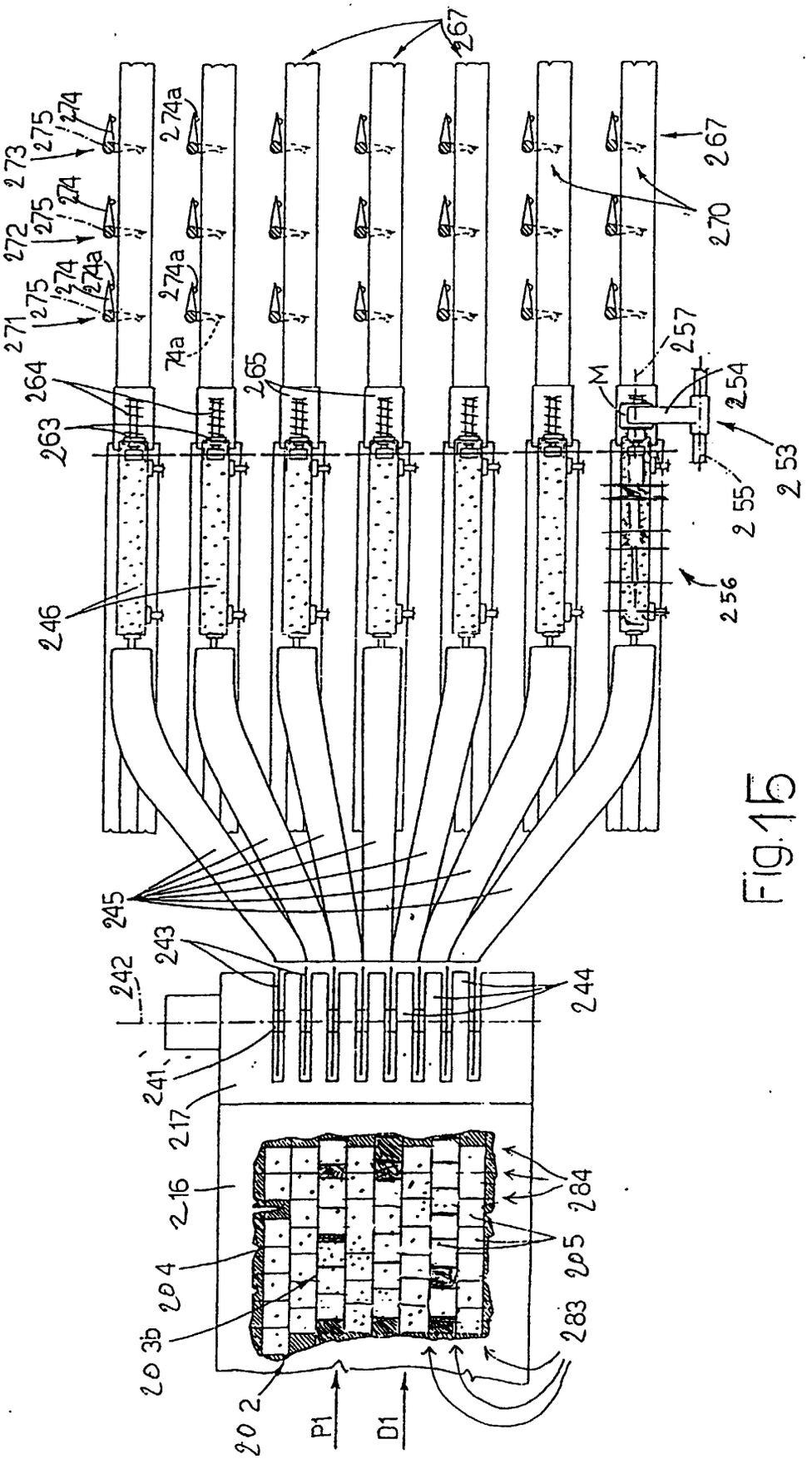
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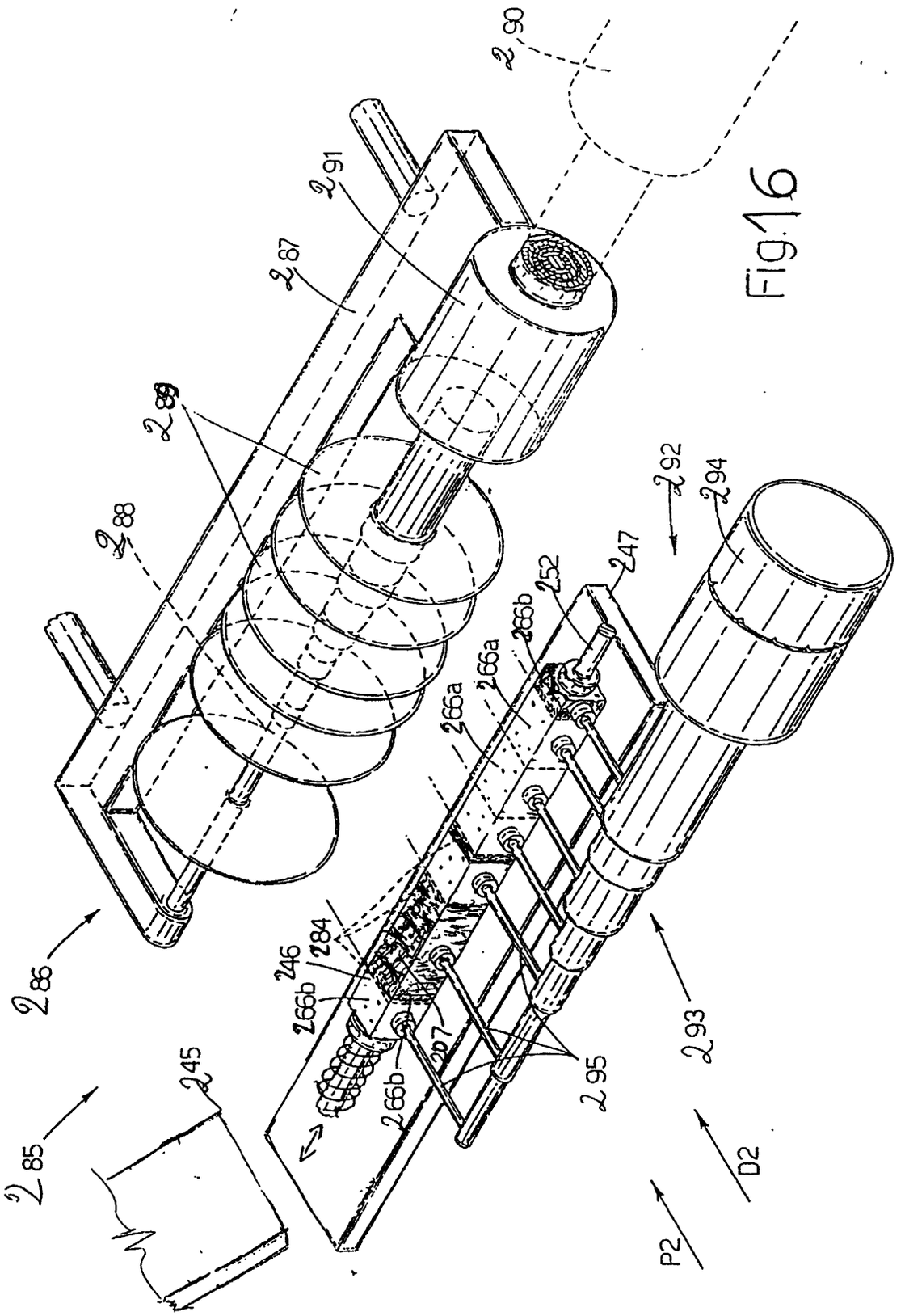
Fig.15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D2
P2

Fig.16

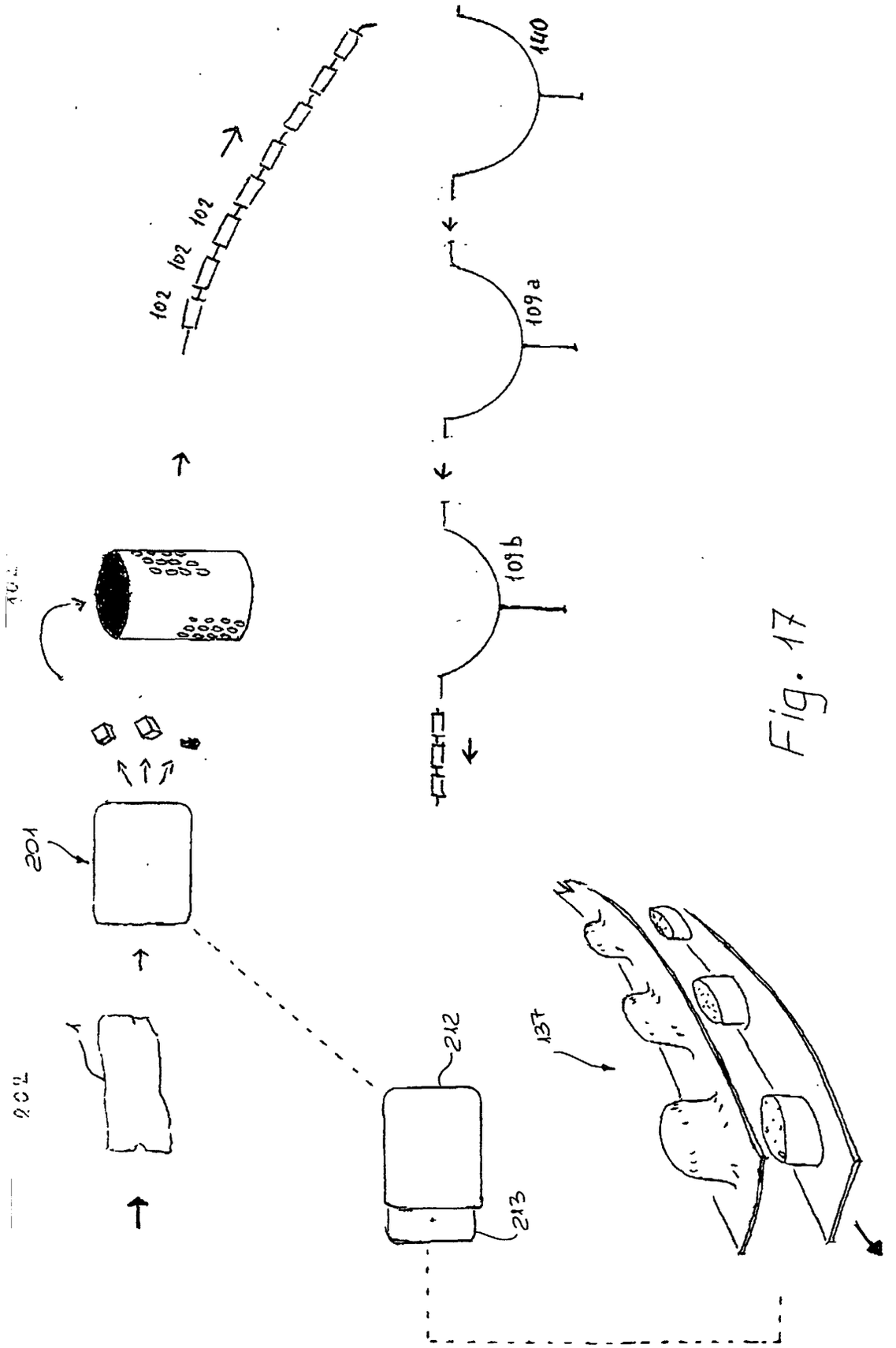

Fig. 17