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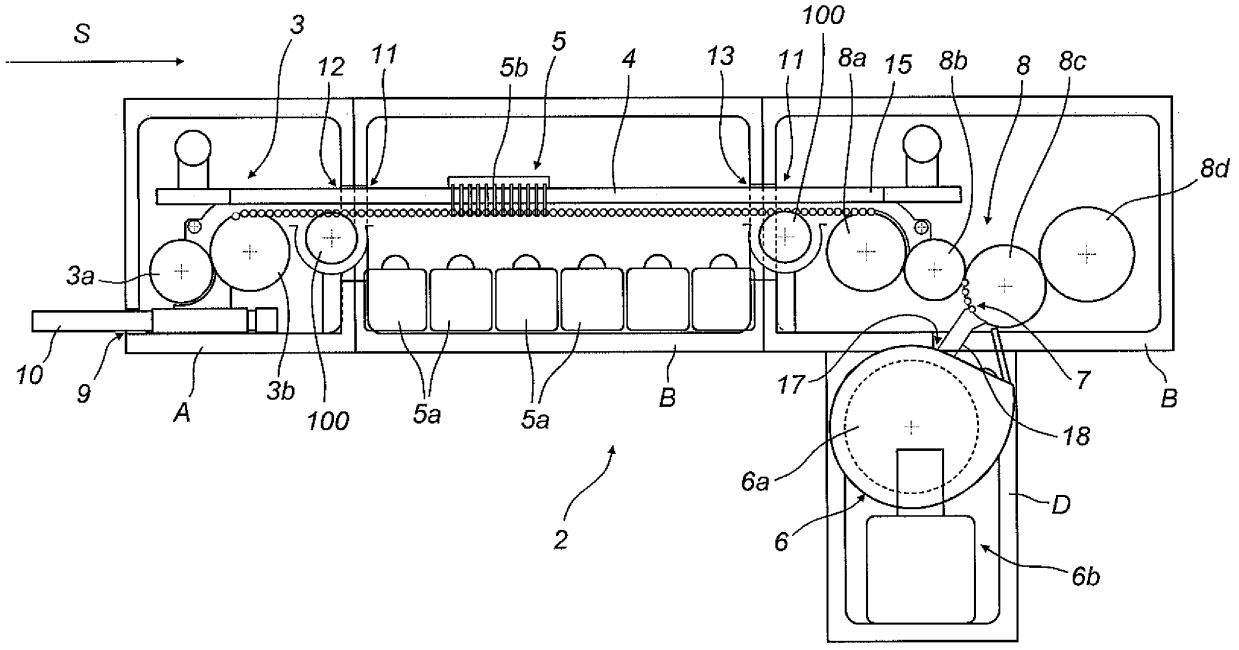
(54) **Machine for the production of vials and bottles with doses of product**

(57) Described is a machine for the production of vials/bottles, in particular for filling vials/bottles (1) with doses of product in liquid or powder form, comprising, at least, along the direction of extension (S): a first station (3) for successively feeding the empty and open vials/bottles (1) to a conveyor (4) to position the vials/bottles (1) on a second station (5) for filling the vials/bottles (1) with predetermined doses of product; a third station (6) for successively feeding means (7) for closing the vials/bottles (1); a fourth station (8) for closing the bottles (1) with the closing means (7) and feeding the vials/bottles (1) to collection areas (9); each of these stations (3, 5, 6, 8) is pre-assembled inside a module (A, B, C, D) or casing with pre-set dimensions and the module (A, B, C, D) may be associated with the respective module (A, B, C, D) or casing positioned after, before or alongside it, relative to the direction of extension (S). [Figures 8 - 12]

FIG. 16



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Description

[0001] This invention relates to a machine for the production of vials and bottles, in particular for filling vials and bottles with doses of product in liquid or powder form, in particular, but not limited to, medical and/or pharmaceutical products, and closing the vials/bottles.

[0002] Machines for dosing and filling vials and bottles, with a product in liquid or powder form, and closing the vials/bottles with a suitable closure are well known.

[0003] These machines essentially comprise, along an operating direction, at least:

- a station for feeding a succession of vials/bottles open at an upper end or mouth;
- a station for filling the vials/bottles with predetermined doses of product;
- a station for feeding a succession of closures to be used to seal the vial/bottle mouth;
- a station for applying the closures to the vials/bottles and feeding the vials/bottles out into a collection area.

[0004] All the apparatus forming part of the above-mentioned stations is located in a sterile environment in order not to alter the quality of the product handled: in short, the chambers for housing the apparatus are controlled by special systems for protecting the product processing environments. Hoods are usually installed above the stations to define the sterile environment.

[0005] The above-mentioned basic stations can also be combined with additional stations, such as a product weighing station and a station for applying a crimp seal between closure and vial/bottle.

[0006] Naturally, the arrangement of each station may differ according to the working needs of the end customer.

[0007] The vial/bottle feeding station, for example, may consist of a system for carrying the empty and open vials/bottles towards a carousel, suitably adapted to vial/bottle size, to feed the bottles to a linear conveyor belt which carries the vials/bottles in succession to the vial/bottle filling station.

[0008] The system for carrying the vials/bottles to the carousel may be of the vibrating type, for medium - low production speeds, or it may be assisted by a screw conveyor for machines with high production speeds.

[0009] The filling station usually consists of a unit fitted with one or more dosing elements fed by respective liquid or powder feeding pumps, for filling doses of the liquid or powder into the vials/bottles passing along the linear conveyor belt. Obviously, the number of dosing elements (and, therefore, pumps) depends on the machine's required productivity.

[0010] The closing station for the machine in question usually comprises: a first carousel for picking up the full vial/bottle from the above-mentioned linear conveyor belt; a second carousel for picking up the individual closures from a storage station (a hopper located close to the latter carousel with vibratory feed), and a third intermediate carousel for connecting the first two carousels to enable synchronised positioning of the vial/bottle beneath the respective closure with consequent closing of the vial/bottle itself when travelling along the second carousel. The closed vials/bottles may pass along a fourth carousel and from there released onto transport means (belt or screw conveyors) which convey them to special stores or to further processing stations.

[0011] Alternatively, the fourth carousel may directly discharge the vials/bottles directly into collection boxes.

[0012] The above-mentioned additional stations, such as the vial/bottle weighing station, may have various configurations and arrangements: in a first case it may be of a statistical type, that is, one vial/bottle weighed every "n" vials/bottles, or, in a second case, it may be a continuous weight control, that is, for every single vial/bottle filled.

[0013] As may be inferred from this basic description of the machine architecture, there are numerous possible configurations to obtain a machine for the production of vials/bottles, as there are numerous needs of the end customer.

[0014] In short, therefore, every new machine manufactured of this type has different features, depending on different customer specifications: high, medium or low production speed, and therefore with more or less dose filling elements; with or without weight control (when the latter is present it may either be of the statistical type or of the continuous type); different types of closure feed systems; different types of product discharge points (with screw conveyors, conveyor belts or directly into boxes); possible addition of the crimp sealing station.

[0015] In short, every machine manufactured may be defined as a special machine which is built *ex novo* on the basis of the customer's final needs. This also results in the manufacture and assembly of support structures and casings for housing the stations dedicated to the specific stations ordered.

[0016] This characteristic requires, for the machines of this type, a specific knowledge of the sector: this therefore results in high costs of manufacturing, on the one hand, and of final in-situ assembly requiring highly skilled personnel, on the other.

[0017] The aim of this invention is therefore to overcome these shortcomings by providing a machine for the production of vials/bottles, in particular for filling vials/bottles with doses of product in a liquid or powder form for medical purposes and closing the vials/bottles, with a simple and modular basic arrangement, so as to simplify the basic composition of the machine as a whole, whilst maintaining the possibility of combining the stations according to specified needs.

[0018] According to this invention, this aim is achieved by a machine for the production of vials/bottles, in particular a machine for producing vials/bottles, containing doses of product in a liquid or powder form, and compris-

ing the technical characteristics described in one or more of the attached claims.

[0019] The technical characteristics of this invention according to the above-mentioned aims may be clearly inferred from the content of the appended claims, and the advantages of the invention are apparent from the detailed description which follows, with reference to the accompanying drawings, which illustrate a non-limiting embodiment of it provided merely by way of an example and in which:

- figures 1 to 4 are schematic plan views from above illustrating respective modules or casings forming part of the structure of the machine for the production of vials/bottles according to this invention;
- figures 5 to 7 are schematic plan views from above illustrating respective closing units used to create a sterile environment in the machine for the production of vials/bottles according to this invention;
- figures 8 to 13 are schematic plan views from above, with some parts cut away to better illustrate others illustrate, of respective stations of the machine for the production of vials/bottles, assembled in the modules shown in figures 1 to 4;
- figure 14 is a schematic plan view from above, with some parts cut away to better illustrate others, of a first example of assembling a machine for the production of vials/bottles according to this invention, using the pre-assembled modules and stations shown in figures 8 to 13;
- figure 15 is a schematic plan view from above, with some parts cut away to better illustrate others, of a second example of assembling a machine for the production of vials/bottles according to this invention, using the pre-assembled modules and stations shown in figures 8 to 13;
- figure 16 is a schematic plan view from above, with some parts cut away to better illustrate others, of a third example of assembling a machine for the production of vials/bottles according to this invention, using the pre-assembled modules and stations shown in figures 8 to 13;
- figure 17 is a schematic plan view from above, with some parts cut away to better illustrate others, of a fourth example of assembling a machine for the production of vials/bottles according to this invention, using the pre-assembled modules and stations shown in figures 8 to 13;
- figure 18 is a schematic plan view from above, with some parts cut away to better illustrate others, of a fifth example of assembling a machine for the production of vials/bottles according to this invention, using the pre-assembled modules and stations shown in figures 8 to 13.

[0020] With reference to the accompanying drawings, in particular figures 1 to 13, the machine according to the invention is used for the production of vials/bottles, in particular for filling and closing vials/bottles 1 with doses of product in a liquid or powder form, such as, for example, but without limiting the scope of the invention, medical, pharmaceutical, beauty care and like products.

[0021] This machine, denoted in its entirety by the numeral 2 in figures 14 to 18, essentially comprises along a direction of extension labelled S:

- a first station 3 for successively feeding the vials/bottles 1, empty and open at the top, to a conveyor belt 4 to position the vials/bottles 1 on
- a second station 5 for filling the vials/bottles 1 with predetermined doses of product;
- a third station 6 for successively feeding means 7 for closing the vials/bottles 1;
- a fourth station 8 for sealing the upper mouth of the vials/bottles 1 with the closing means 7 and for feeding the vials/bottles 1 to collection areas (outside the machine and which, in some examples, are described below).

[0022] As shown in figures 8 to 13, each of these stations 3, 5, 6, 8 is pre-assembled inside a module or casing A, B, C, D with pre-set dimensions and the module may be associated with the respective module or casing A, B, C, D positioned after, before or alongside it, relative to the direction of extension S.

[0023] In particular, but without limiting the invention, each station 3, 5, 6, 8 is pre-assembled, in its basic composition, inside a respective basic module or casing A, B, C, D with pre-set dimensions.

[0024] Entering more in detail, the above-mentioned basic modules or casings may be of at least two types B, C with different perimeter dimensions in order to obtain a machine configuration which is ready to use and an example of which is shown in figure 14.

[0025] The full range of basic modules or casings comprises four types A, B, C, D (see figures 1 to 4):

- a first and a second module A and B have at least one equal dimension in width L relative to the direction of extension S;
- a third and a fourth module C and D also have at least one equal dimension in width L1, again relative to the direction of extension S.

[0026] Obviously, in the accompanying drawings, the modules A, B, C, D are shown in a basic plan views (in order to better understand the invention), but they are equipped with vertical walls in order to define closed or partially closed spaces.

[0027] In addition, in order to obtain a machine for production of vials/bottles, there are enclosing units U1, U2, U3 (of a prior art type and with standardised dimensions, which may be seen in figures 5, 6 and 7) in order to define a controlled processing environment along the entire extension of the stations 3, 5, 6, 8, thanks also to the presence of negative pressure means (not illustrated here).

[0028] In view of the need of these units, the above-mentioned modules or casings A, B, C, D have, singularly or side by side one another, perimeter dimensions coincident with the perimeter dimensions of the enclosing units U1, U2, U3, singularly or alongside one another, in order to define, by reciprocal coupling, single or multiple controlled environment modules.

[0029] Examples of correspondence between modules and units may be seen in the machine examples shown in figures 14 and 15.

[0030] To obtain a non-limiting optimisation of pre-assembling a machine according to this invention with sufficient operational elements, it may be noticed that:

- the above-mentioned first station 3 for feeding the vials/bottles 1 may be pre-assembled in the first module A (figure 8);
- the second station 5 for filling the vials/bottles 1 with predetermined doses of product may be pre-assembled in a second module B (figure 9); or, alternatively,
- the first station 3 for feeding the vials/bottles 1 and the second station 5 for filling the vials/bottles 1 may be pre-assembled in a second module B (example in figure 14);
- the fourth station 8 for closing the vials/bottles 1 may be pre-assembled in a second module B (see figure 12);
- the third station 6 for feeding the closing means 7 may be pre-assembled in a third module C (see figure 10), or, alternatively,
- the third station 6 for feeding the closing means 7 is always pre-assembled in a fourth module D provided with a unit 6a for pre-feeding the closing means 7 (see figure 12).

[0031] As confirmation of the validity of the solution with pre-assembled modules, these machines may be equipped with a fifth station 19 for crimp sealing the closed vials/bottles 1 (also of known type), and usually positioned downstream of the above-mentioned fourth closing station 8, relative to the direction of extension S.

[0032] If the presence of this fifth station 19 is necessary, the station may be already pre-assembled in a second module B (see figure 13), or in a first module A as shown in figure 18.

[0033] Naturally, the above-mentioned stations 3, 5, 6, 8 and also the crimp sealing station 19, are not illustrated in detail in the attached drawings, since they are of a type well known in the sector and, therefore, the various parts of each station are schematically shown in base units.

[0034] The first closure feeding station 3 is schematically shown with two feeding carousels 3a, 3b.

[0035] The second filling station 5 is schematically shown with pump units 5a (shown with a dotted line in figure 9) and injection means 5b.

[0036] In the machine examples shown in figures 14 to 18, different numbers of pumps and injection means are illustrated, as an example, to clarify that the inside of the second module B may be fitted with the necessary quantity of this filling apparatus based on the productivity chosen for the machine.

[0037] The third station 6 for feeding the closing means 7 has a hopper 6b and, if necessary, the pre-feeding unit 6a.

[0038] The fourth vial/bottle closing station 8 is schematically shown with four carousels for feeding - closing - outfeed 8a, 8b, 8c, 8d.

[0039] The fifth crimp sealing station 19 is schematically shown with three carousels 19a, 19b, 19c and a crimping device 19d.

[0040] To confirm the validity of the solution described so far, figures 14 to 18 illustrate five types of machine 2 which may be assembled modularly with the above-mentioned structures.

[0041] For assembly, the modules A, B, C, D must obviously have connection areas or openings between the outside and a module or between one module and another to enable the housing of additional elements for connecting the various stations. One of the advantages of this modularity is that the position of certain openings on modules of the same type may be used for various additional elements.

[0042] For example, the first module A has a first through opening 9, on a side wall, occupied by means 10 for moving - feeding vials/bottles 1, such as a conveyor belt or also a screw conveyor for high operating speed (see figures 14, 16, 17 and 18).

[0043] In turn, the second module B may have a first opening 11, on a side wall, coincident with a second opening 12 of the first module A, placed alongside the second module B in figures 15 to 18, and occupied by the above-mentioned conveyor belt 4 for moving and transporting vials/bottles 1.

[0044] Once again, the first opening 11 of another second module B may connect with a second opening 13 of a similar second module B, positioned alongside, in which the above-mentioned second station 5 for filling vials/bottles 1 is pre-assembled.

[0045] These two openings 11 and 13 may be occupied by means 15 for feeding - moving the vials/bottles 1 to enable them, when filled, to be transported to the fourth closing station 8 (see figures 14 to 18).

[0046] The second opening 13 of the second module B with the fourth closing station 8 assembled may be used for housing means 16 for transporting or collecting the vials/bottles 1 already closed, as shown in the configuration in figures 15 and 17.

[0047] In the configurations illustrated in figures 14, 15, 17 and 18, the third module C equipped with the third station 6 for feeding closing means 7 is positioned alongside a second module B equipped with the fourth closing station 8 and they are provided with a respective connection opening 17 occupied by means 18 for feeding - moving the closing means 7.

[0048] Similarly, see figure 16, if the above-mentioned

fourth module D is present (with pre-feeding of closing means 7), the latter is also positioned alongside the second module B with fourth closing station 8 and both provided with the above-mentioned connection opening 17.

[0049] Figure 18 illustrates a machine 2 in which there is the fifth station 19 for crimp sealing the closed vials/bottles 1, which is placed downstream of the fourth closing station 8, relative to the direction of extension S.

[0050] In this case, a first module A with a fifth crimp sealing station 19 is added alongside a second module B and connected to it by a respective opening 9 of the first module A and an above-mentioned second opening 13 of the second module B. Openings 13 and 9 are occupied by means 21 for feeding - moving the vials/bottles 1.

[0051] Looking in more detail at the configurations illustrated, in the case shown in figure 14, the machine solution (which we shall refer to as the "short" type) comprises two second modules B placed side by side and a lateral module C for the third station 6 for feeding the closing means 7.

[0052] In this case, both the first station 3 for feeding the vials/bottles 1 and the second filling station 5 are preassembled in one of the second modules B. The two second modules B have a first and a second opening 11, 13 occupied by means 14 for feeding - moving the vials/bottles 1 in the direction of the fourth station 8 for closing the vials/bottles 1.

[0053] A unit 100 has been added to this machine 2 for statistical weight checking of the vials/bottles 1.

[0054] The three modules (two of type B and one of type C) are completed by the enclosing units, in particular by two units U1, one unit U2 and one unit U3.

[0055] Figure 15 illustrates a second embodiment of the machine 2 comprising a first module A, two second modules B and a third module C, and to which a unit 101 has been added for continuous weight checking of the vials/bottles 1 and an outfeed belt 102 for the vials/bottles 1 produced.

[0056] Figure 16 illustrates a third embodiment of the machine 2 comprising a first module A, two second modules B and a fourth module D, and to which a unit 100 has been added for statistical weight checking of the vials/bottles 1.

[0057] Figure 17 illustrates a fourth embodiment of the machine 2 comprising a first module A, two second modules B, a third module D and an additional first module A for the addition of a unit 103 for feeding out the finished vials/bottles 1 into a box 104.

[0058] A unit 101 has also been added in this solution for continuous weight checking of the vials/bottles 1.

[0059] Figure 18 illustrates a fifth embodiment of the machine 2 comprising a first module A, two second modules B, a third module D, an additional first module A coupled with an additional third module D for addition of the fifth station 19 for crimp sealing the vials/bottles 1 and an belt unit 102 for feeding out the vials/bottles 1.

[0060] A unit 101 for the continuous weight checking of the vials/bottles 1 is also added in this embodiment.

[0061] A machine for the production of vials/bottles structured in this way therefore fully achieves the pre-set aims, thanks to the possibility of pre-assembling the stations in modules with pre-set dimensions.

[0062] The modularisation of the stations permits a standardisation of the procedures for assembly of the stations and a faster and simpler combination of solutions requested by the customer to whom a few simple separate connection accessories are supplied.

[0063] The modules are designed to combine precisely with the enclosing units for defining the sterile environment without dimensional adaptations during assembly and they have similar overall sizes in order to render the overall layout of the assembled machine compact and linear.

[0064] The invention described herein is susceptible of industrial application and may be modified and adapted in several ways without thereby departing from the scope of the inventive concept. Moreover, all the details of the invention may be substituted by technically equivalent means.

Claims

1. A machine for the production of vials/bottles, in particular for filling vials/bottles (1) with doses of product in liquid or powder form and then closing them; the machine (2) comprising at least along a direction of extension (S):

   - a first station (3) for successively feeding the vials/bottles (1), empty and open at one end or mouth, to a conveyor belt (4) to position the vials/bottles (1) on
   - a second station (5) for filling the vials/bottles (1) with predetermined doses of product;
   - a third station (6) for successively feeding means (7) for closing the vials/bottles (1);
   - a fourth station (8) for closing the vials/bottles (1), that is, the respective mouths, with the closing means (7) and feeding the vials/bottles (1) to collection areas, the machine (2) being **characterised in that** each station (3, 5, 6, 8) is preassembled inside a module or casing (A, B, C, D) with pre-set dimensions and the module (A, B, C, D) may be associated with the respective module or casing (A, B, C, D) positioned after, before or alongside it, relative to the direction of extension (S).

2. The machine according to claim 1, **characterised in that** each station (3, 5, 6, 8) is pre-assembled, in its basic composition, inside a relative basic module or casing (A, B, C, D) with pre-set dimensions.

3. The machine according to claim 1, **characterised**

in that the basic modules or casings are of at least two types (B, C) with different perimeter dimension.

4. The machine according to claims 1 and 2, **characterised in that** the basic modules or casings are of at least four types (A, B, C, D) of which a first and a second module (A, B) with at least one equal dimension in width (L), relative to the direction of extension (S); and a third and fourth module (C, D) also with at least one equal dimension in width (L1) relative to the direction of extension (S).

5. The machine according to claims 1 and 2, in which there are enclosing units (U1, U2, U3) to define a controlled processing environment along the entire extension of the stations (3, 5, 6, 8), **characterised in that** the modules (A, B, C, D) or casings have, singularly or alongside one another, perimeter dimensions coincident with the perimeter dimensions of the enclosing units (U1, U2, U3), singularly or alongside one another, in order to define, by reciprocal coupling, single or multiple controlled environment modules.

6. The machine according to claim 1, **characterised in that** the first station (3) for feeding vials/bottles (1) is pre-assembled in a first module (A).

7. The machine according to claim 7, **characterised in that** the first module (A) has a first through opening (9), on a side wall, occupied by means (10) for moving - feeding the vials/bottles (1).

8. The machine according to claim 1, **characterised in that** the second station (5) for filling the vials/bottles (1) with pre-set doses of product is pre-assembled in a second module (B).

9. The machine according to claim 8, **characterised in that** the second module (B) has a first opening (11), on a side wall, coincident with a second opening (12) of a first module (A), positioned alongside the second module (B), and occupied by a conveyor belt (4) for moving and transporting the vials/bottles (1).

10. The machine according to claim 1, **characterised in that** the first station (3) for feeding vials/bottles (1) and the second, filling station (5) are pre-assembled in the second module (B); the second module (B) having a second opening (13) occupied by means (14) for feeding - moving the vials/bottles (1) in the direction of the fourth station (8) for closing the vials/bottles (1).

11. The machine according to claim 1, **characterised in that** the fourth station (8) for closing the vials/bottles (1) is pre-assembled in the second module (B).

12. The machine according to claim 11, **characterised in that** the second module (B) has a first opening (11) for connection with a second opening (13) of a similar second module (B), positioned alongside, and in which a second station (5) for filling the vials/bottles (1) is pre-assembled; the first opening (11) and the second opening (13) being occupied by means (15) for feeding - moving the vials/bottles (1) and designed to transport the filled vials/bottles (1) towards the fourth closing station (8).

13. The machine according to claim 12, **characterised in that** the second module (B) has at least one second opening (13), opposite the first opening (11), relative to a direction of extension (S), occupied by means (16) for transporting or collecting the closed vials/bottles (1).

14. The machine according to claim 1, **characterised in that** the third station (6) for feeding closing means (7) is pre-assembled in the third module (C) alongside a second module (B) in which a fourth station (8) for closing the vials/bottles (1) is pre-assembled.

15. The machine according to claim 14, **characterised in that** between the third module (C) and the second module (B) there is a connection opening (17) occupied by means (18) for feeding - moving the closing means (7).

16. The machine according to claim 1, **characterised in that** a third station (6) for feeding the closing means (7) is pre-assembled in the fourth module (D) provided with a unit (6a) for pre-feeding the closing means (7).

17. The machine according to claim 1, in which there is a fifth station (19) for crimp sealing the closed vials/bottles (1), positioned downstream of the fourth closing station (8), relative to the direction of extension (S), **characterised in that** the fifth crimp sealing station (19) is pre-assembled in a first module (A).

18. The machine according to claim 17, **characterised in that** the first module (A) is positioned alongside, that is to say, downstream, of a second module (B) in which the fourth station (8) for closing the vials/bottles (1) is pre-assembled; the first module (A) and the second module (B) being connected together by a respective opening (9, 13) occupied by means (21) for feeding - moving the vials/bottles (1).

19. The machine according to claim 1, in which there is a fifth station (19) for crimp sealing the closed vials/bottles (1), positioned downstream of the fourth closing station (8), relative to the direction of extension (S), **characterised in that** the fifth crimp sealing station (19) is pre-assembled in a second module (B).

FIG. 1

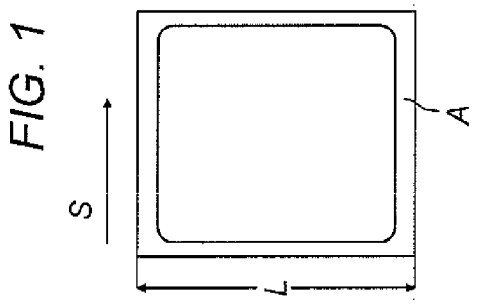


FIG. 2

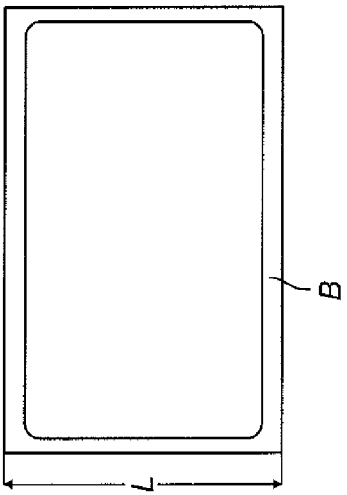


FIG. 3

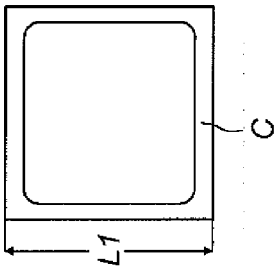


FIG. 4

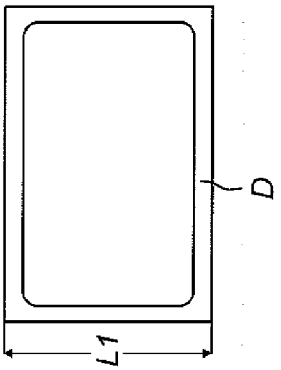


FIG. 5

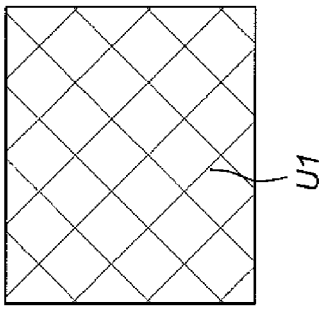


FIG. 6

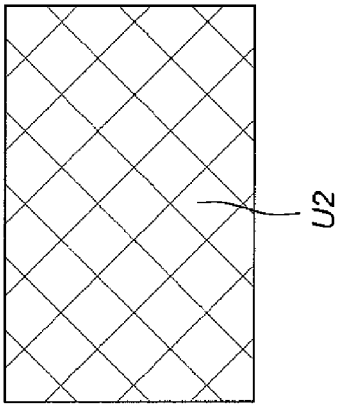


FIG. 7

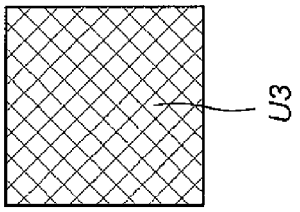


FIG. 8

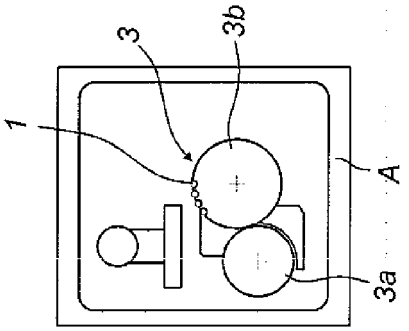


FIG. 9

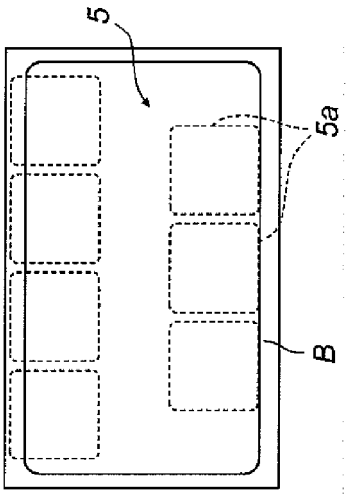


FIG. 10

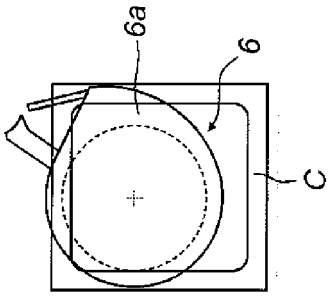


FIG. 11

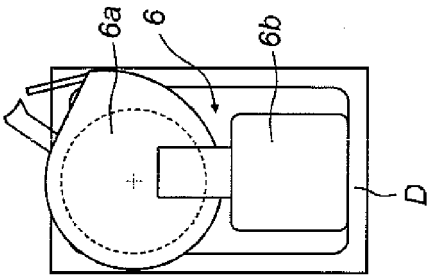


FIG. 12

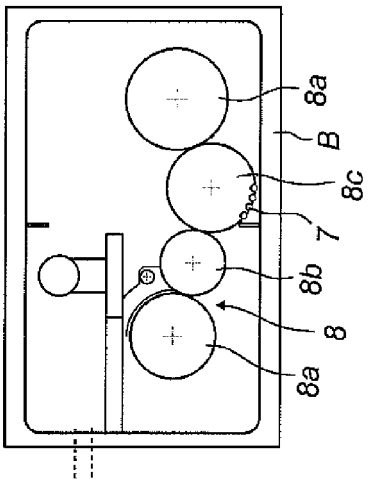
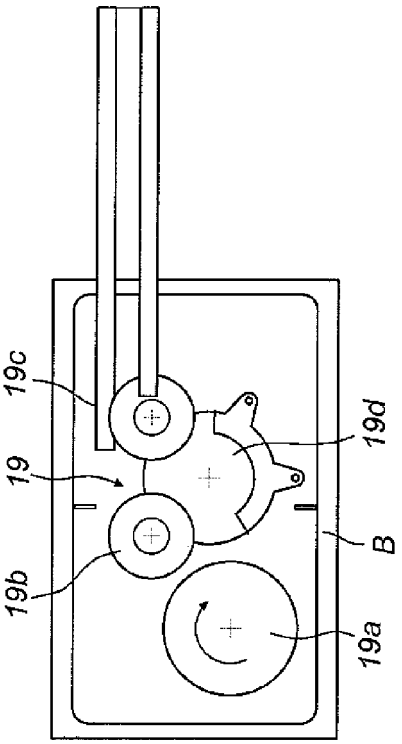
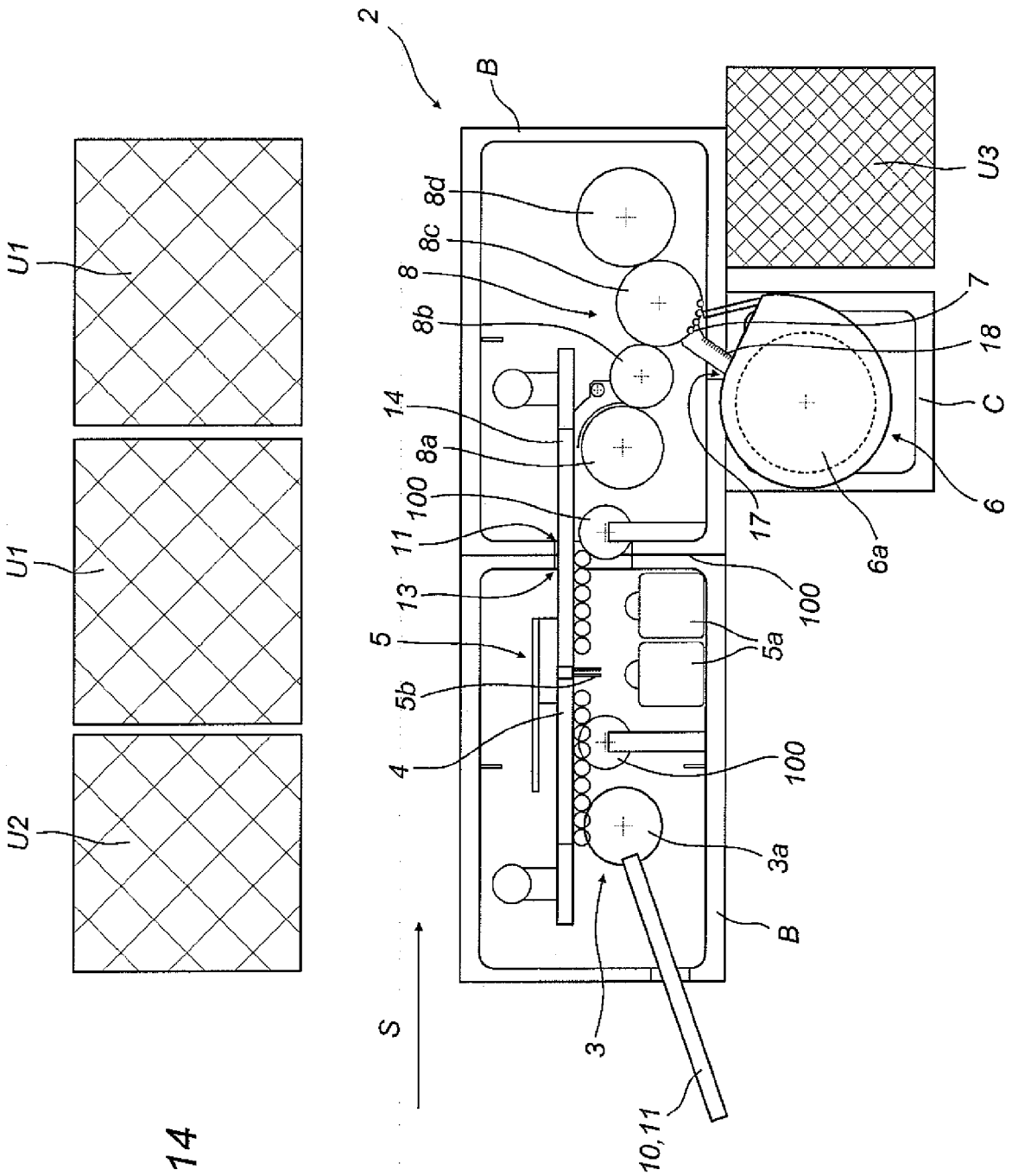


FIG. 13

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6a
U3
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18
C
6

FIG. 14

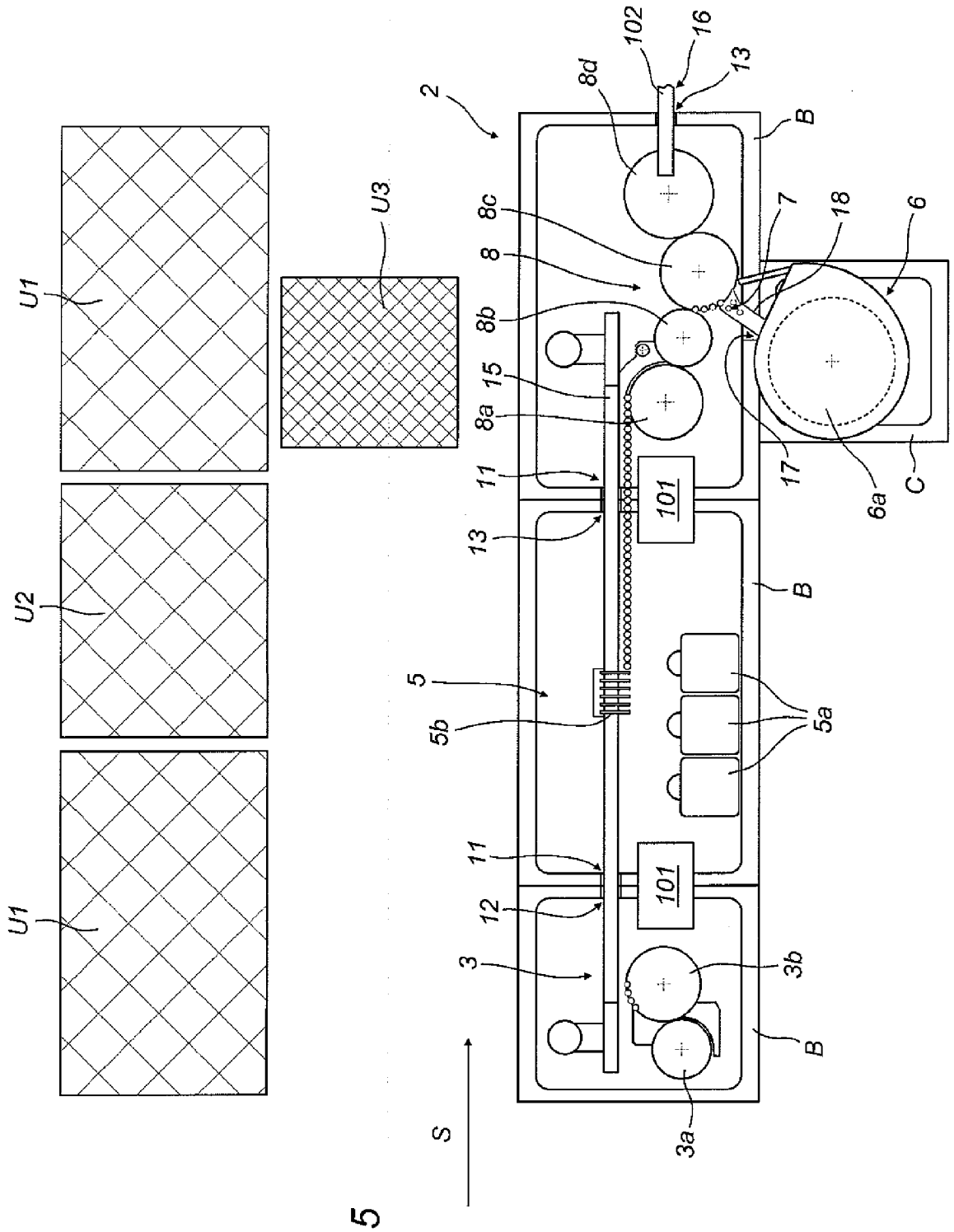
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FIG. 15

FIG. 16

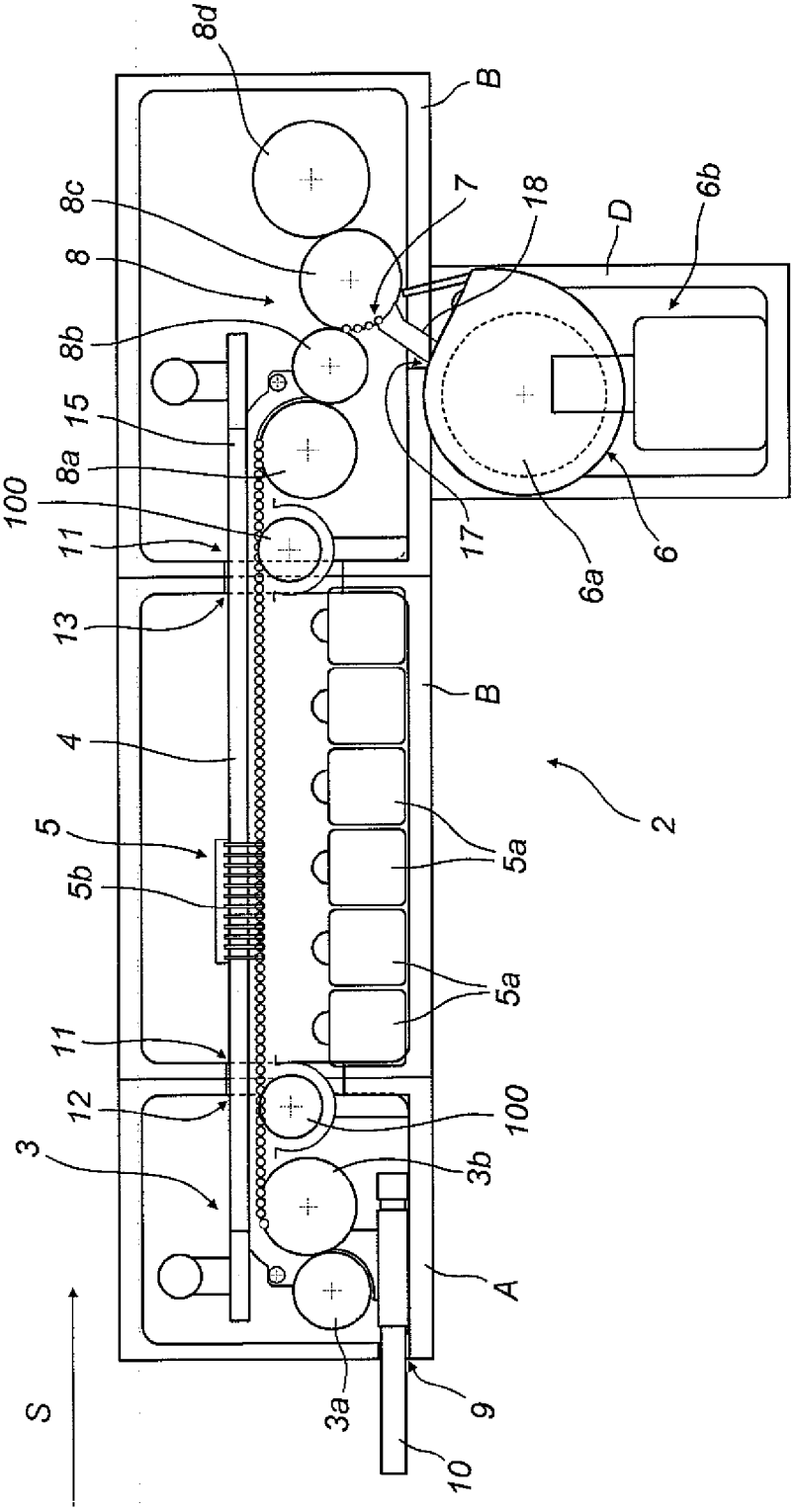
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FIG. 17

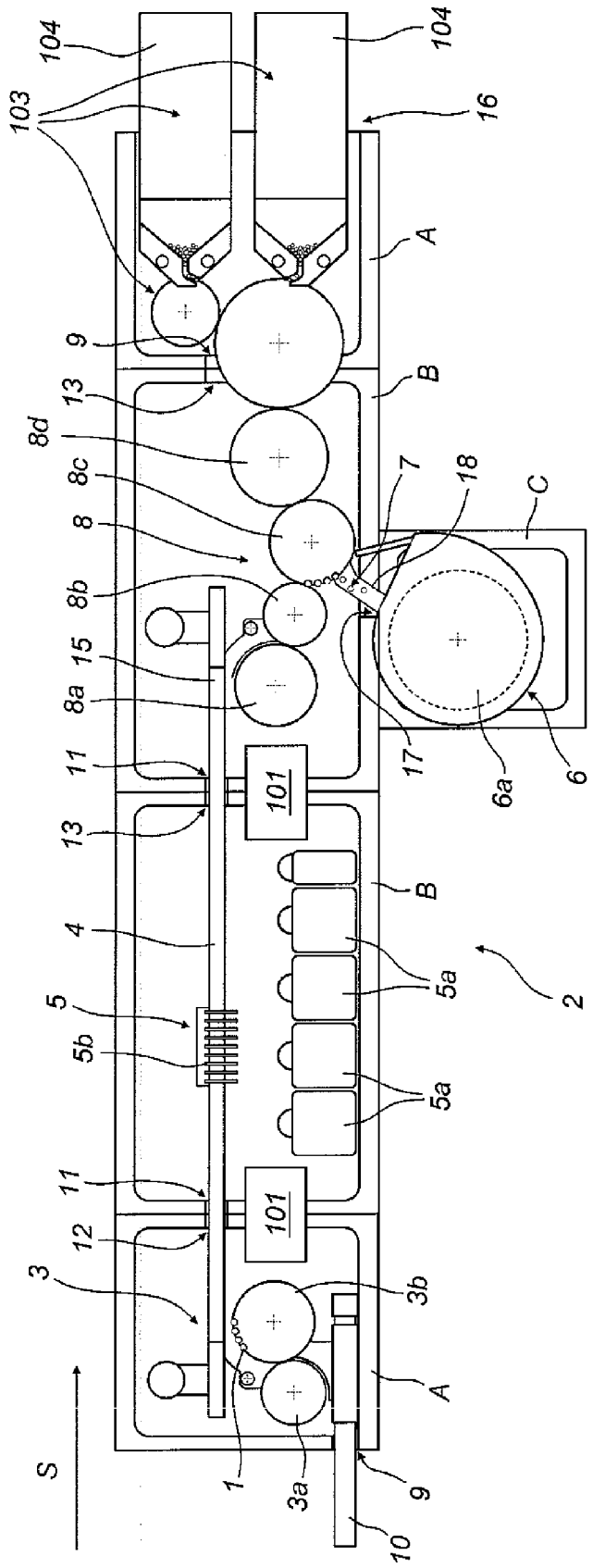
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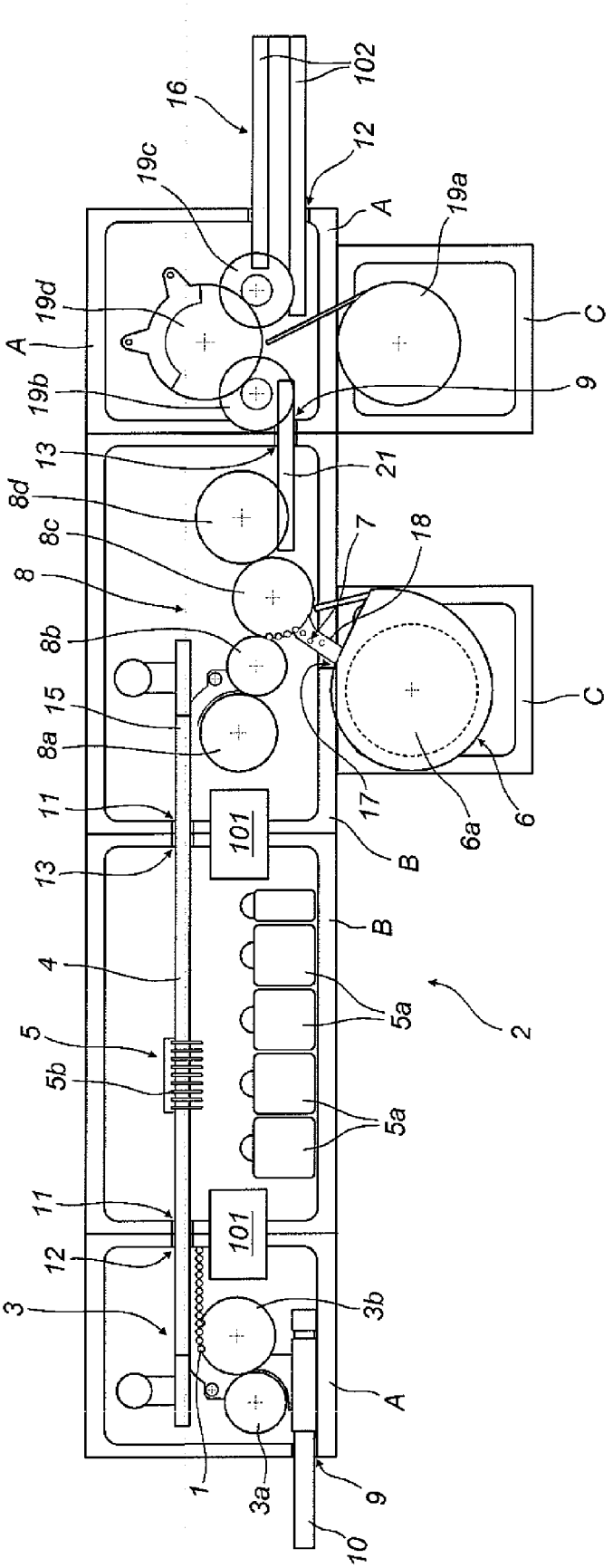
FIG. 18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Place of search	Date of completion of the search	Examiner
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