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(54) Machine and plant for dyeing textile materials

(57) Machine for dyeing textile materials, characterized in that it comprises a stationary structure (1) with a surface (100) for supporting or parking the materials already treated or to be treated, said materials being disposed upon said surface at corresponding predetermined positions, in that it comprises a surface (101) with a plurality of tanks (4) to be fed with a dye bath, and in that it comprises means (60) for removing and handling the materials between said supporting or parking surface (100) and said tanks (4), the said means (60) being associated with a programmable unit (UE).

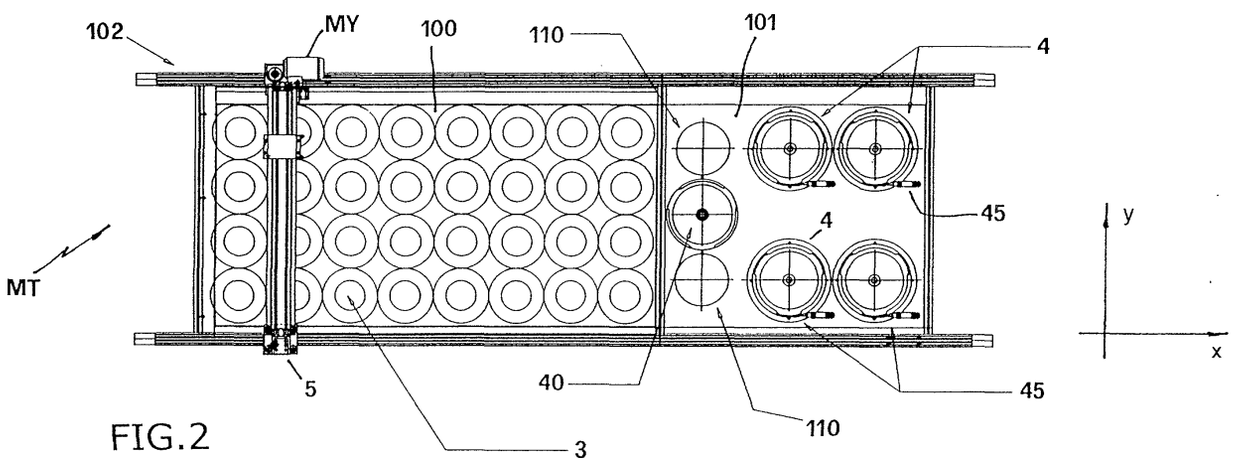

FIG.2

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Description

[0001] The present invention refers to a machine and a plant for dyeing textile materials.

[0002] More particularly, the present invention makes it possible to optimise the procedures for the preparation of the so-called "dyeing baths" and to rationalize as well the automation of the subsequent steps, that is, the use of the dyeing baths, while resulting particularly useful for dyeing reels of yarns.

This result has been achieved, according to the invention, by providing a machine and a plant having the characteristics disclosed in the independent claims. Further characteristics being set forth in the dependent claims.

[0003] The advantages of the present invention will be best understood by anyone skilled in the art from a reading of the following description in conjunction with the attached drawings given as a practical exemplification of the invention, but not to be considered in a limitative sense, wherein:

- Figs. 1 and 2 show a machine for dyeing reels of textile yarns according to the invention, in side and plan views, respectively;
- Figs. 3 and 4 show a machine for dyeing reels of textile yarns according to a further embodiment of the invention, in side and plan views, respectively;
- Fig. 5 shows a detail of the dyeing tank;
- Fig. 6 shows a plan view of the tank in Fig. 5;
- Figs. 7 and 8 show a lid for closing the tank of Fig. 5, in side and plan views, respectively;
- Fig. 9 shows a detail of a reel-holder;
- Fig. 10 shows schematically the stage of engaging a reel-holder;
- Fig. 11 shows schematically the stage of engaging a lid;
- Fig. 12 shows schematically a plant according to the invention, with a dye-cooking or metering machine (MD), a plurality of machines for dyeing reels of a type shown in Figs. 3 and 4, and a dissolution unit (D) acting as an interface;
- Fig. 13 is a plant view of the plant shown in Fig. 12;
- Figs. 14 and 15 show schematically the said machine (MD) in side and plan views, respectively;
- Figs. 16 and 17A show schematically the said dissolution unit, in front and side views, respectively;
- Fig. 17B is an enlarged detail of the drawing in Fig. 17A;
- Fig. 18 is an enlarged detail of the upper part of the dissolution unit;
- Fig. 19 illustrates the steps for metering the products needed to make a dyeing bath;
- Fig. 20 illustrates the steps for dissolving and launching the products; and
- Fig. 21 is a simplified block diagram of the operations control system.

[0004] Reduced to its basic structure, and reference being made to the figures and the attached drawings, a machine (MT) for dyeing reels of yarns according to the invention comprises a structure (1) with a horizontal surface (100) for supporting or parking the reels (2) already treated or to be treated. Each reel (2) is housed in a corresponding reel-holder (3) and each reel-holder takes a corresponding predetermined position onto said surface (100). The said structure (1) further comprises a surface (101) acting as a support for a plurality of tanks (4) to be fed with a dyeing bath (being either the same or different for all the tanks, according to the production being programmed) and into which the reels are inserted according to procedures to be described later on.

[0005] Also associated to the surface (101) of the tanks (4) are a substantially cylindrical container with vertical axis having lids (40) stacked therein intended to sealingly closing the tanks (4), and one or more service spaces (110) possibly housing therein one or more centrifuges or other suitable devices for taking out residual water or ovens for centrifuging and hot drying the material gradually removed from the tanks (4).

[0006] The said structure (1) has two upper longitudinal guides (102) with a bridge (5) driven into a sliding movement there along by a corresponding electric motor (MX). The said bridge (5) makes up a guiding element for a carriage (6) associated with an electric motor (MY) allowing it to me moved along the same bridge. The guides (102) and the bridge (5) are provided above said surfaces (100) and (101), and extend respectively longitudinally (x) and transversally (y) to the structure (1). The carriage (6) supports a clamp (60) movable from and to the surfaces (100, 101) under control of a corresponding electric motor or other equivalent actuator (MZ). The said clamp (60), as best described later, is intended to perform the following operations:

- removing the reel-holders (3) from the surface (100) to dispose them onto the tanks (4);
- removing the tanks-closing lids (40) to dispose them above the same tanks (4) before introducing the programmed dyeing bath therein;
- taking the reel-holders (3) out of the tanks (4) to place them within the spaces of the centrifuges or ovens and dispose them from here, or directly from the tanks, onto the parking surface (100).

[0007] In the example of Figs. 1 and 2, the said surfaces (100) and (101) are cascade-arranged in the direction of the longitudinal axis (x), and the tanks (4) are disposed according to the vertexes of a quadrilateral. According to the example of Figs. 3 and 4, instead, the surfaces (100) and (101) of structure (1) are cascade-arranged in the direction of the transverse axis (y), and the tanks (4) are lined up in a direction parallel to the longitudinal axis (x). In the latter case, it is possible to increase the production capacity of the machine (MT) by merely adding further modules (100', 101', 102') cascade-like disposed in the direction of longitudinal axis

(x).

[0008] As illustrated in Fig. 5, each tank (4) of the machine (MT) is made up of a substantially cylindrical vessel with vertical axis, whose height is such as to allow for a full introduction of one reel-holder (3). The bottom of the tank (4) shown in Fig. 5 is provided with an inlet duct (41) and an outlet duct (42) for the dyeing bath.

[0009] Both ducts (41, 42) lead to a pump for the recirculation of the bath (43). The inlet duct (41) is in correspondence of the reel-holder's axis (30); the said axis being hollow to allow the bath flowing from the inside of the reel to the outside and vice versa. The upper face of the tanks (4) is provided with a ring nut (44) associated to a corresponding actuator (45) and intended to block the relevant lid (40) by interfering with the radial edges (400) of the latter. Each tank (4) is also advantageously provided with an annular gasket (46) intended to result in facing relationship with the lid (40) when the latter is disposed for closing or covering the tank.

[0010] As illustrated in Figs. 7 and 8 of the attached drawings, each lid (40) has a preset number (three, angularly spaced through 120°, in the example) of radial edges or appendixes (400) intended to interact with the ring nut (44) of each tank (4). Moreover, each lid (40) is provided with an axial appendix (401) to be engaged, that is, grasped and respectively released, by the clamp (60) associated with said carriage (6). For example, the said appendix (401) is possibly made up of a central hub (410) solid to the upper side or face of lid (40) which a circular flange parallel to same lid is associated with, that is, fixed to. On the opposite side, each lid (40) exhibits a central, internally hollow appendix (402) allowing same lid to be centered on the axis of the reel-holder (3) disposed inside the tank (4).

[0011] With reference to the example illustrated in Fig. 9, wherein the rectangles of dotted lines represent reels of various possible shapes, each reel-holder (3) comprises a central hollow axis or shaft (30) onto which a reel (2) is manually fitted, a lower tray (31) and an upper tray (32) which are intended for cooperatively clamping the reel (2) from opposite sides, and a ring nut (33) for tightening the upper tray (32) onto the upper face of the reel (2). The upper tray (32) is suitably drilled in the centre to allow the positioning thereof onto the axis (30) at a level corresponding to the height of reel (2). The lower tray is centrally provided with a seat (34) to receive the lower face of the axis (30) and, on the opposite side, with a cup (35) allowing the centering thereof within the intended tank (4): each tank (4) being suitably provided with a vertical, central appendix (not shown in the drawings) in correspondence of the respective lower face. Screwed onto the upper part of the shaft (30) is an appendix (301) whose shape and function correspond exactly to those of appendix (401) which the lids (401) are provided with.

The jaws (600) of clamp (60) exhibit an inner cavity (601) matching the profile of appendixes (301, 401) of the reel-holder (3) and lids (40).

In order to load a reel-holder (3), an operator fits a reel (2) onto the axis (30) until it rests fully on the lower tray (31), inserts the upper tray (32) on the same axis until it rests on the upper face of the reel (2) and tightens the ring nut (33), and then screws the gripping appendix (301) onto the upper end of the axis (30).

[0012] The operation of the machine (MT) is as follows.

Once the reel-holders (3) - being loaded by one or more operators as above indicated - have been disposed onto the surface (100) at the respective preset positions, the selected production program is started: the carriage (6) moves on in correspondence of the reel-holder, according to program, the clamp (60) comes down to result at the level of the respective gripping appendix (301) and is activated, as illustrated in Fig. 10, to engage the latter and the reel-holder therewith; afterwards, the clamp (60) goes up and the carriage (6) performs the transfer of the reel-holder, thus held by the clamp (60), up to the tank (4) in which, according to program, the reel carried by the reel-holder will be dyed; at this moment, the clamp (60) comes down, thereby fully introducing the reel-holder into the said tank; subsequently, the clamp is deactivated, thereby releasing the reel-holder, and moved on until it results in correspondence of the space in which the lids (40) are stacked; here the clamp is lowered and activated, as shown schematically in Fig. 11, to engage the first lid of the stack; afterwards the clamp (60) lifts up, with the lid (40) thus picked up, and the carriage (6) moves on the same clamp in correspondence of the tank (4) wherein the reel-holder with the reel to be dyed has been previously disposed; here the clamp comes down by positioning the lid (40) onto the tank, then the same clamp is deactivated and finally moved away with the carriage (6); following the deactivation of the clamp (60), the actuator (45) of the same tank drives into rotation the corresponding ring nut (44), thereby blocking the lid (40); at this point, the dyeing bath (prepared, for example, as described below) is introduced into the tank (4) and recirculated by the pump (43) for a programmed period of time; after this time is elapsed, the pump (43) is deactivated and the ring nut (44) is rotated in opposite direction by the same actuator (45) so as to release the lid (40); the latter is picked up by the clamp (60), likewise as previously described, moved into the lids-housing space and released; the reel-holder (3) is taken out from the tank (4) by the clamp (60) suitably moved on again to result in correspondence of the tank (4), and disposed on the surface (100) of the structure (1), in the same starting position or other programmed one, either directly or after a prolonged dwell within an oven or centrifuge (110), or other suitable system known per se to those skilled in the art, for the removal of residual water. What has been above described being repeated cyclically throughout the programmed production process.

[0013] Moving the carriage (6) in the directions (x) and (y) of structure (1) is obtained by motors (MX) and re-

spectively (MY), which drive into motion the bridge (5) along the guides (102) and the carriage (6) along the bridge (5), respectively. The lifting and lowering of the clamp (60) are operated by the motor (MZ). These three motors are associated with a programmable central unit (UE) according to an operational scheme such as the one illustrated in Fig. 21 known per se to those skilled in the art. The activation and, respectively deactivation of the clamp (60) are operated by an electromagnetic actuator, not shown in the drawings, also associated with the programmable unit (UE). The latter is provided with a memory wherein the coordinates of each reel-holder being on the parking surface (100) or on the reel-treatment surface (101) are stored. Also stored in the said memory are the recirculation times for the baths within the tanks (4), as well as the coordinates of the same tanks, of the space for housing the lids (40) and of the spaces for centrifugation/drying of the dyed reels.

[0014] The dyeing bath intended to feed the tanks (4) of the machine (MT) can be prepared in any suitable way, that is, by means of any suitable machine or equipment.

For example, a machine (MD) can be used such as the one manufactured by the same applicant and available on the market with the trademark "DOSORAMA WS". This machine is described in the document (IT) FI/2000/A153 to which reference may be made for further details. The said machine comprises, substantially, a stationary structure (7) with a platform (70) upon which a plurality of containers/dispensers (76) of solid products for preparing dyeing baths, and a plurality of bottle-like containers for solutions or liquid products, are placed at corresponding and preset positions. The said platform (7) has a transverse bridge (71) standing there above, movable along two longitudinal guides (72) and having a mobile carriage (73) mounted thereon. Mounted on said carriage are means (74) able to pick up, move and operate the containers-dispensers of the solid products, and means (75) able to remove the liquid products out of the respective bottles in order to inject them into the vessels which receive the solid products from the containers-dispensers. A description relating to one way of using the machine (MD) is given later on.

[0015] Disposed between the machine (MD) and the machine (MT) is a dissolution unit (D) which receives the liquid and solid products from the machine (MD), provides for the dissolution thereof and launch them, that is, delivers them to the tanks (4) of the machine (MT).

[0016] With reference to the example of Figs. 16-18, the said dissolution unit comprises a stationary structure (8) upon which a horizontal table or platform (80) is placed. The latter is associated with a rotary actuator allowing it to rotate about its central axis (82) and thereby allowing the positioning of a vessel (83) resting thereon, between a station (A) for receiving the products to be dissolved to form the dyeing bath, and a station (B) wherein the very dissolution takes place. The dissolution means comprise a mixer (84) solid to a vertical hollow shaft (85) which is associated with a corresponding electric motor (850) via a belt drive (851). The shaft (85) and mixer (84) are protected by a cylindrical fixed screen (88) anchored to said structure (8) and, in correspondence of its upper face has a sealing gasket (880) and a port for the hollow shaft (85) to go through. When the vessel (83) at station (B) is lifted up (in a manner to be described later on) until its edge is against the upper face of the screen (88), a sealed chamber is formed, for the dissolution of the products, which is limited below and laterally by the vessel (83) and above by the upper face of the screen (88). The shaft (85) is connected to a fixed conduit (852) by a rotary joint (853). Beside, above the screen (88), a chamber (89) is provided associated with a compressor (890). The latter makes it possible to pressurize the said chamber (89) and to launch the products dissolved therein via the shaft (85) and conduit (852). The latter, as can be seen in Figs. 12 and 13, is connected to the pump (43) of each tank (4) via corresponding ducts (800) by-passed via three-way solenoid valves (801) associated with the central unit (UE).

Disposed in correspondence of station (A) below table (80) is an electronic scale (86) to weigh the quantity of solid products gradually introduced into the vessel (83). The said scale (86) is mounted on a support associated with an actuator cylinder having vertical axis (860).

Disposed in correspondence of station (B) below platform (80) is an actuator cylinder with vertical axis (87) allowing the vessel to be disposed in lifted position for the dissolution of the products being put therein and, vice versa, be re-positioned on platform (80) upon completion of the dissolution and launch steps.

The motor (850), scale (86, compressor (890) and actuators (87) and (860) are all associated to the central unit (UE) for their programmed operation.

The bottom (830) of vessel (83) is loosely positioned in a corresponding seat (880) of platform (80) so that the lower face of the vessel (83) will result simply supported on the platform and able to be lifted from the pan of the scale (86) to the station (A) and from the cylinder (87) to the station (B) of the dissolution unit. The drawing of Fig. 17B shows actually this constructional detail.

[0017] One possible operating cycle of preparation and launch of a dyeing bath according to the invention is as follows. The carriage (73) places the means (74) in correspondence of the container-dispenser (76) holding the necessary solid product, the same means (74) pick up the container-dispenser and place it in the station (A) of the dissolution (D), in correspondence of the vessel (83) which rests onto the table (80) above the scale (86), as illustrated in Fig. 19-I. At this point, the scale (86) is lifted by the actuator (860), so that the weight of the vessel (83) will weigh fully onto the scale pan (Fig. 19-11), after which the means (74) operate the dispenser (76) to introduce the programmed quantity of solid product into the vessel (83), as illustrated in Fig.

19-III. Afterwards, the means (74) move away from station (A), as illustrated in Fig. 19-IV, and their place is taken by the means (75) provided for the delivery of liquid products, as necessary for the completion of the selected formula (Fig. 10-IV). Thereafter, the means (75) are activated for delivering the programmed quantity of liquid into the vessel below (83), as illustrated in Fig. 19-IV, then the means (75) drive the carriage (73) away and the scale (86) is lowered (Fig. 19-VII, 19-VIII e 20-I), so that at end of this step the vessel (83) holding the ingredients of the required bath will result again resting onto the platform (80), as shown in detail in Fig. 17B. Following this, the platform (80) is rotated through 180° about the axis (82) by the actuator (81), so that the vessel (83) moves on to result in correspondence of station (B) of dissolution unit (Fig. 20-II). At this point, the actuator (87) lifts up the vessel (83) until the edge of the latter is in contact with the upper face of the screen (88), as illustrated in Fig. 20-III. Then the motor (850) is started, as shown in Fig. 20-IV, and the dissolution of solid products into liquid products, that is, the formation of the programmed dyeing bath takes place with the addition of programmed amounts of hot and cold water being fed through a corresponding feed pipe (855), which is shown schematically only in Fig. 20-IV for the sake of simplicity. After a preset time, the motor (850) is deactivated (Fig. 20-V) and the bath flows through the duct (852) (Fig. 20-VI) owing to the pressurization of the dissolution chamber (Fig. 20-VII), while possibly keeping the shaft (85) in rotation (Fig. 20 VIII). Upon completion of this step, during which the dyeing bath is introduced into the tank (4) programmed by the machine (MT) as previously described, the motor (850) is switched off, the vessel (83) is moved back onto the underlying platform (80) (Fig. 20-IX) and the latter is again rotated through 180° about the axis (82) to dispose the vessel (83) at the initial position (Fig. 20-X) ready to receive other products for the preparation of a further dyeing bath.

Claims

1. Machine for dyeing textile materials, **characterized in that** it comprises a stationary structure (1) with a surface (100) for supporting or parking the materials already treated or to be treated, said materials being disposed upon said surface at corresponding predetermined positions, **in that** it comprises a surface (101) with a plurality of tanks (4) to be fed with a dyeing bath, and **in that** it comprises means (60) for removing and handling the materials between said supporting or parking surface (100) and said tanks (4), the said means (60) being associated with a programmable unit (UE).

2. Machine according to claim 1, **characterized in that** said materials are reels of yarns (2) fitted onto corresponding reel-holders (3).

3. Machine according to claim 1, **characterized in that** a substantially cylindrical container is associated with the surface (100) of the tanks (4) and has more lids (40) fitted into its vertical axis for closing sealingly the tanks (4).

4. Machine according to claim 1, **characterized in that** at least a space (110) is associated with the surface (110) of the tanks (4) for housing a residual water extraction device or a drying oven.

5. Machine according to claim 1, **characterized in that** the said structure (1) has two upper longitudinal guides (102) with a bridge (5) driven into a sliding movement there along by a corresponding electric motor (MX), said bridge (5) making up a guiding element for a carriage (6) associated with an electric motor (MY) allowing the movement thereof along the same bridge, the carriage (6) supporting said means (60) for a movement from and to the surfaces (100, 101) under control of a corresponding electric motor or other equivalent actuator (MZ).

6. Machine according to claims 1 and 5, **characterized in that** the said means (60) consist of a clamp.

7. Machine according to one or more preceding claims, **characterized in that** the said means (60) provide for carrying out the following operations:

   - removing the reel-holders (3) from the surface (100) to dispose them onto the tanks (4);
   - removing the tanks-closing lids (40) to dispose them above the same tanks (4) before introducing the programmed dyeing bath therein;
   - removing the reel-holders (3) out of the tanks (4) to dispose them within the spaces of the centrifuges or ovens and dispose them from here, or directly from the tanks, onto the parking surface (100).

8. Machine according to claim 1, **characterized in that** the said surfaces (100) and (101) are cascade-arranged in the direction of the longitudinal axis (x), and the tanks (4) are disposed according to the vertexes of a quadrilateral.

9. Machine according to claim 1, **characterized in that** the said surfaces (100) and (101) are cascade-arranged in the direction of the transverse axis (y), and the tanks (4) are lined up in a direction parallel to the longitudinal axis (x).

10. Machine according to one or more preceding claims, **characterized in that** each of said tanks (4) is associated with a corresponding pump (43) for the recirculation of the dyeing bath.

11. Machine according to claim 1, **characterized in that** the upper face of the tanks (4) is provided with a ring nut (44) associated with a corresponding actuator (45) and intended to block the relevant lid (40) after introduction therein of the material to be treated.

12. Machine according to claims 1 and 3, **characterized in that** each lid (40) has a preset number of radial edges or appendixes (400).

13. Machine according to claim 12, **characterized in that** the said radial edges (400) of lids (40) are in number of three, angularly spaced through 120°.

14. Machine according to claims 1 and 3, **characterized in that** each lid (40) is provided, in correspondence of its upper side or face, with a gripping appendix (401) intended to be engaged with, and respectively disengaged from said means (60).

15. Machine according to claims 1 and 3, **characterized in that** each lid (40) is provided, in correspondence of its lower side or face, with a central hollow appendix (402).

16. Machine according to claims 1 and 2, **characterized** each reel-holder (3) comprises a central hollow axis or shaft (30) onto which a reel (2) is manually fitted, a lower tray (31) and an upper tray (32) which are intended for cooperatively clamping the reel (2) from opposite sides, and a ring nut (33) for tightening the upper tray (32) onto the upper face of the reel (2): the upper tray (32) being suitably drilled in the centre to allow the positioning thereof onto the axis (30) at a level corresponding to the height of reel (2), the lower tray is centrally provided with a seat (34) to receive the lower face of the axis (30) and, on the opposite side, with a cup (35) allowing the centering thereof within the selected tank (4), each tank (4) being provided with a vertical, central appendix in correspondence of the respective lower face.

17. Machine according to claim 16, **characterized in that** on the upper part of the shaft (30) an appendix (301) is provided intended for engagement with, and respectively release from said means (60).

18. Plant for dyeing textile materials, **characterized in that** it comprises a machine (MT) according to one or more preceding claims, a machine (MD) for feeding the materials necessary for the preparation of a dyeing bath, and a dissolution unit (D) located between said machines, the said dissolution unit (D) being provided with means for receiving and dissolving solid and/or liquid products with which the said bath is obtained.

19. Plant according to claim 18, **characterized in that** the said dissolution unit comprises a stationary structure (8) upon which a horizontal table or platform (80) is placed, the latter being associated with a rotary actuator allowing it to rotate about its central axis (82) and thereby allowing the positioning of a vessel (83) resting thereon, between a station (A) for receiving the products to be dissolved to form the dyeing bath, and a station (B) wherein the very dissolution takes place.

20. Plant according to claim 18, **characterized in that** the said dissolution means comprise a mixer (84) solid to a vertical hollow shaft (85) which is associated with a corresponding electric motor (850) via a belt drive (851), the shaft (85) and mixer (84) being protected by a cylindrical stationary screen (88) which is fixed to said structure (8) and, in correspondence of its upper face has a sealing gasket (880) and a port for the hollow shaft (85) to go through.

21. Plant according to claims 18-20, **characterized in that** the said vessel (83) and said screen (88) cooperate to delimit a sealed dissolution chamber, delimited below and laterally by the vessel (83) and above by the upper face of the screen (88).

22. Plant according to claims 18-20, **characterized in that** the said shaft (85) is connected to a fixed conduit (852) via a rotary joint (853).

23. Plant according to claim 18, **characterized in that** said dissolution unit can be pressurized.

24. Plant according to claim 18, **characterized in that** said dissolution unit (D) is connected to the pump (43) of each tank (4) via corresponding ducts (800) by-passed via three-way solenoid valves (801) associated with the central unit (UE).

25. Plant according to claims 18 and 19, **characterized in that** in correspondence of station (A), below table (80), an electronic scale (86) is disposed to weigh the quantity of solid products gradually introduced into the vessel (83), the said scale (86) being mounted on a support associated with an actuator cylinder having vertical axis (860).

26. Plant according to claims 18 and 19, **characterized in that** in correspondence of station (B) below platform (80) an actuator cylinder with vertical axis (87) is disposed allowing the vessel to be disposed in lifted position for the dissolution of the products being put therein and, vice versa, be re-positioned onto platform (80) upon completion of the dissolution and launch steps.

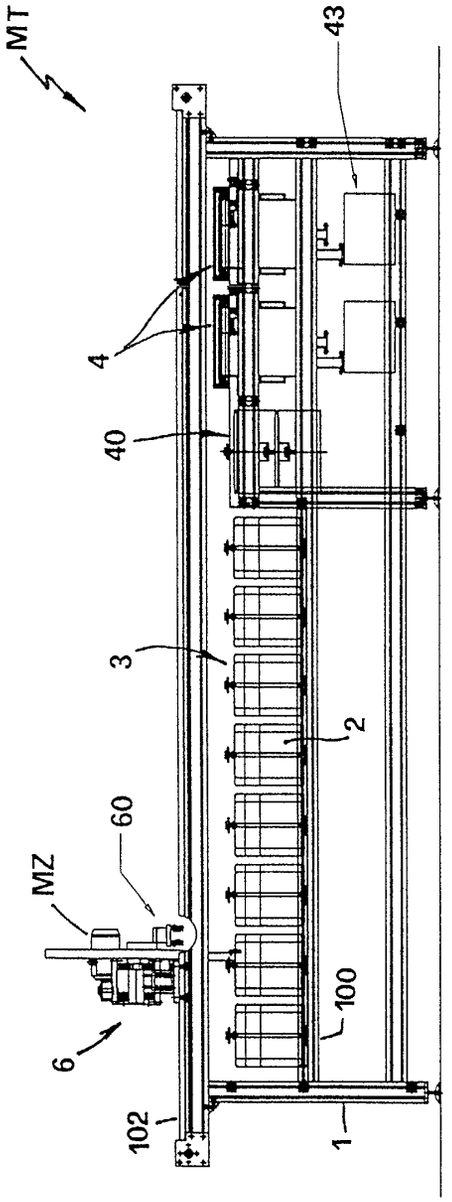
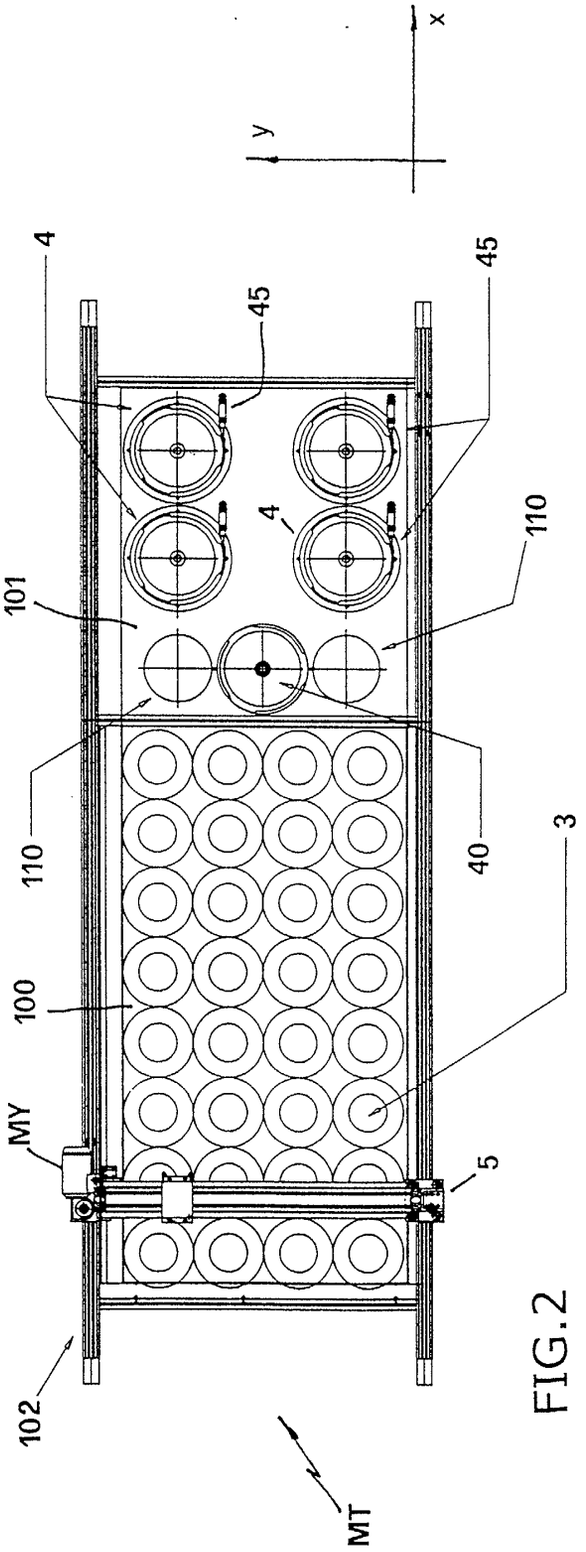

MT
43
4
40
3
2
60
MZ
6
100
102
1

FIG.1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x
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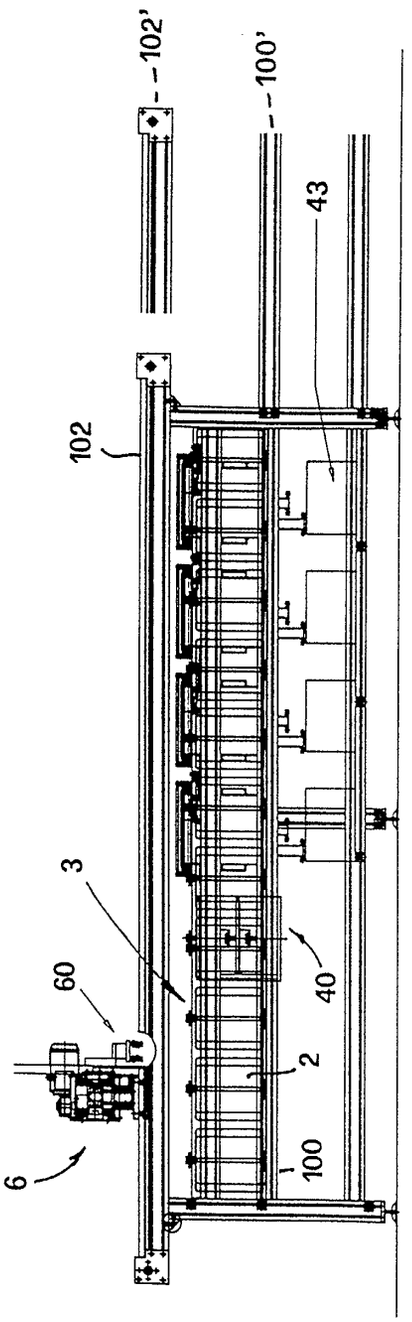
45
45
4
110
101
110
40
3
100
MY
5
102
MT

FIG.2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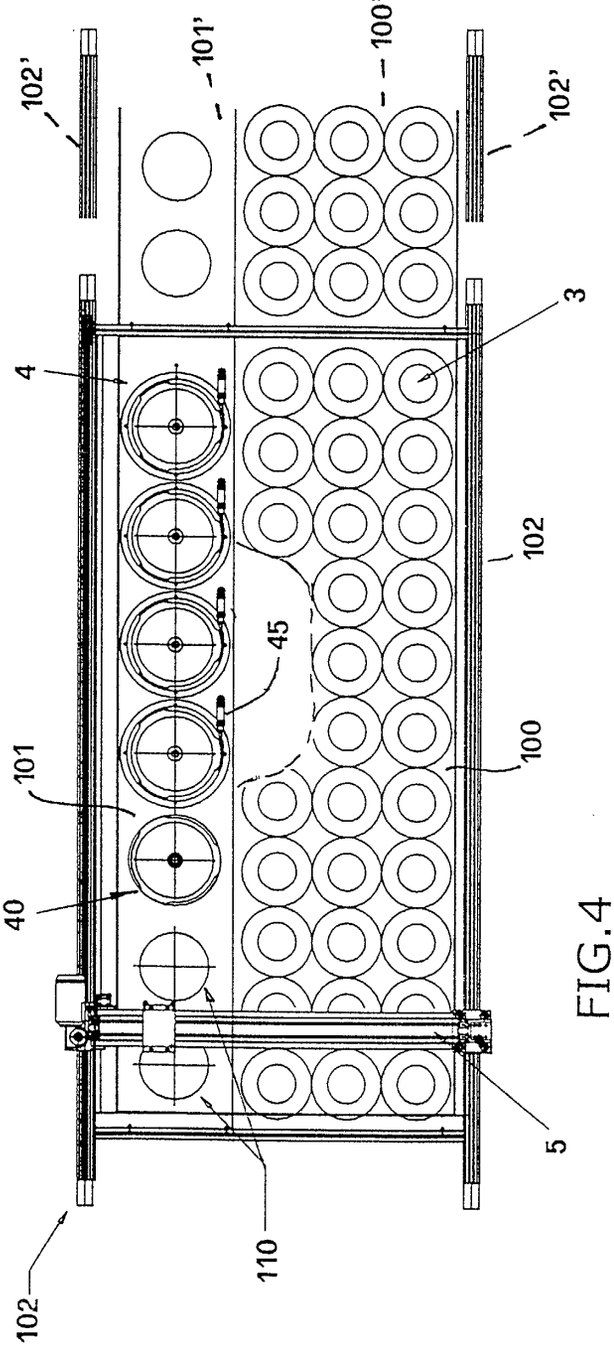
100'
43
102
3
60
40
2
100
6

FIG.3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101'
100'
102'
4
3
102
45
101
100
40
5
110
102

FIG.4

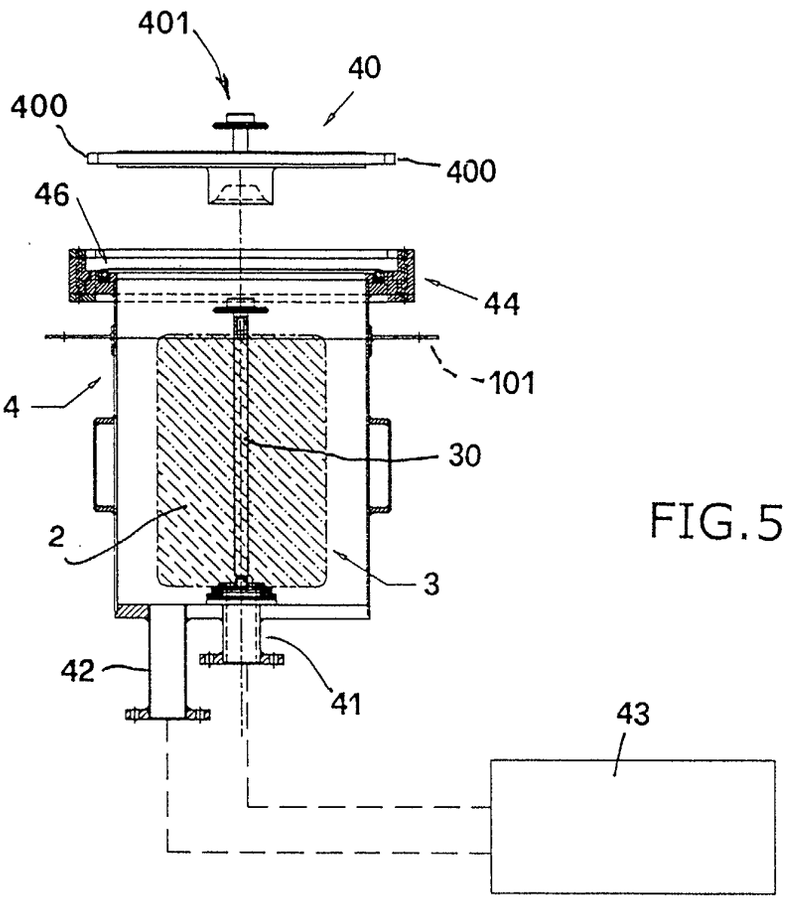

FIG.5

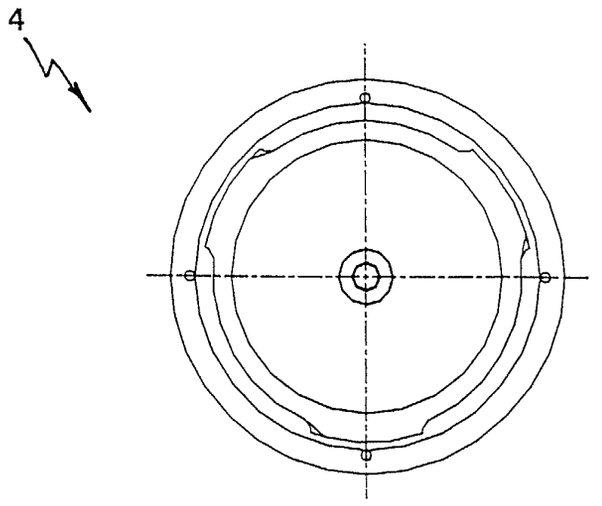

FIG.6

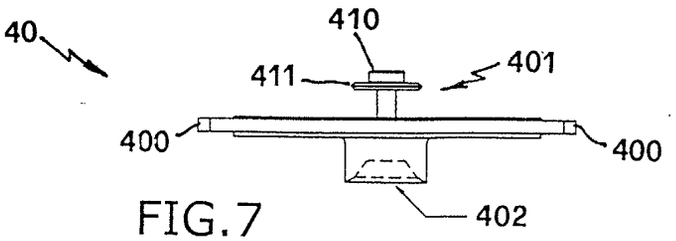

FIG.7

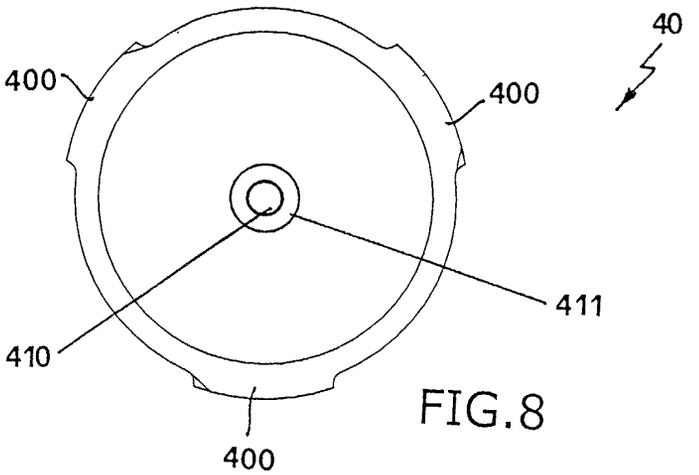

FIG.8

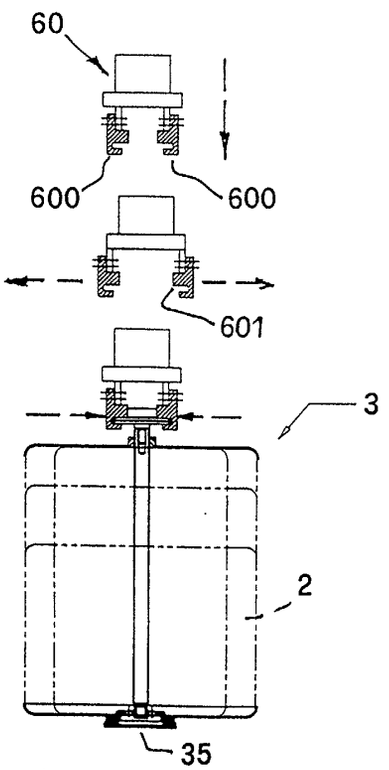

FIG.10

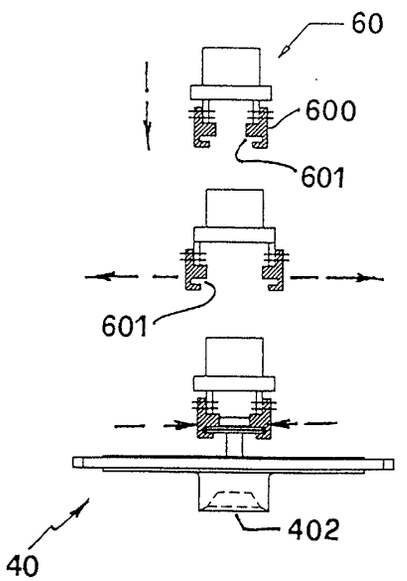

FIG.11

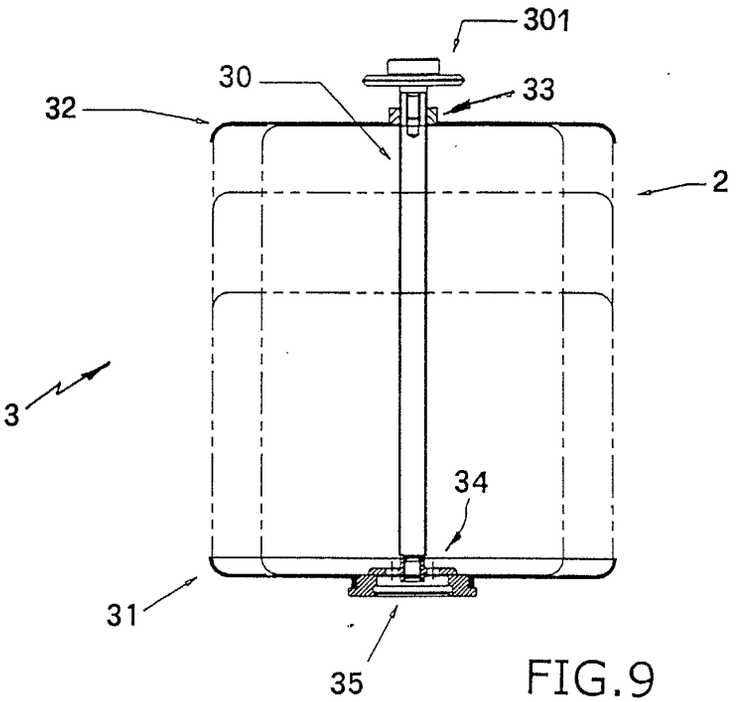

FIG.9

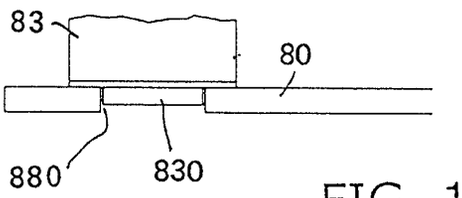

FIG. 17B

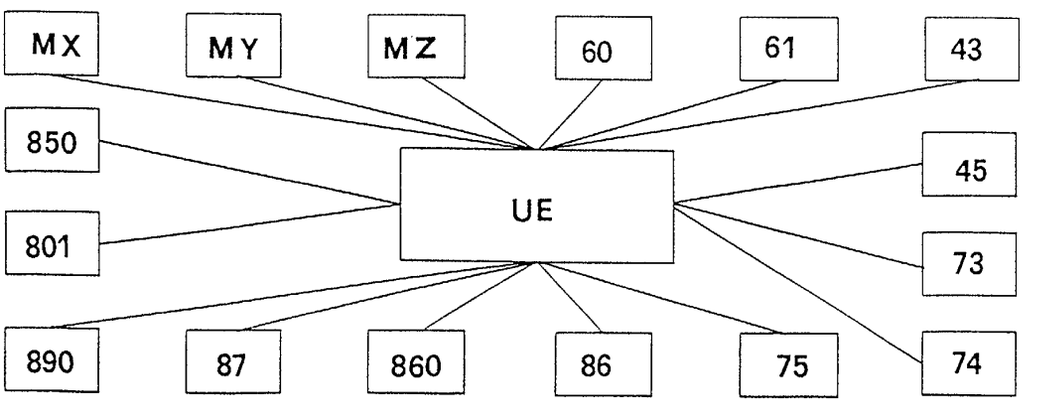

FIG.21

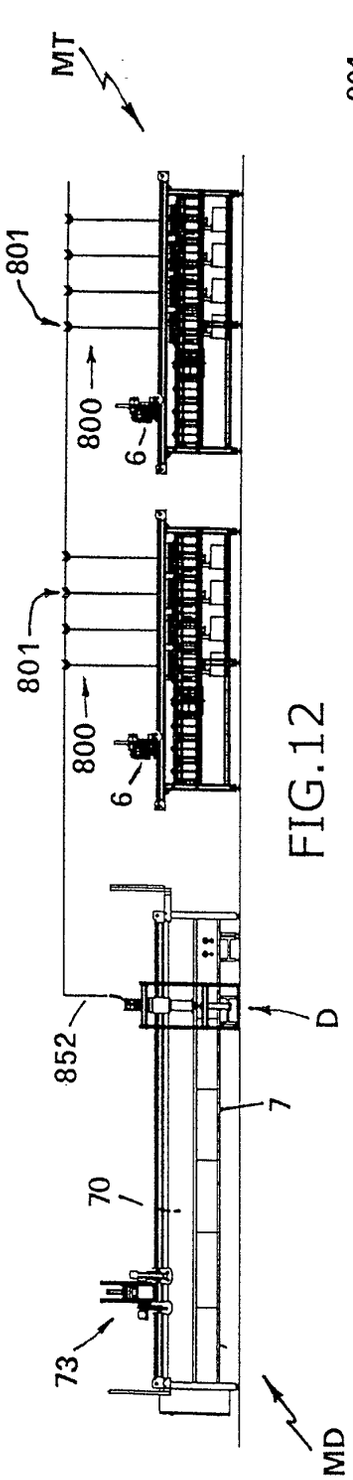
MT
801
800
6
801
800
6
852
D
7
70
73
MD

FIG.12

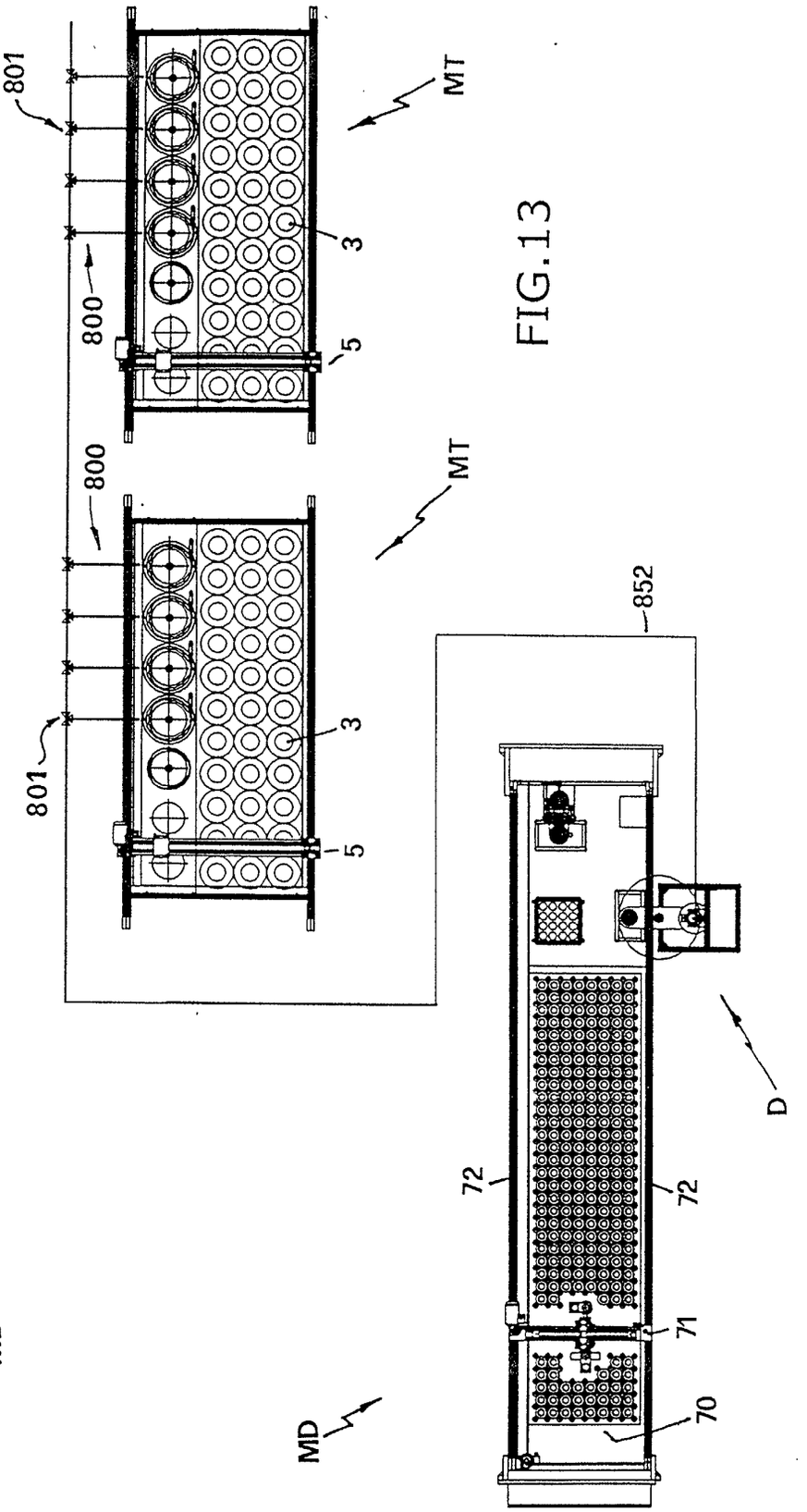
801
MT
800
3
5
800
MT
801
3
5
852
D
72
72
71
70
MD

FIG.13

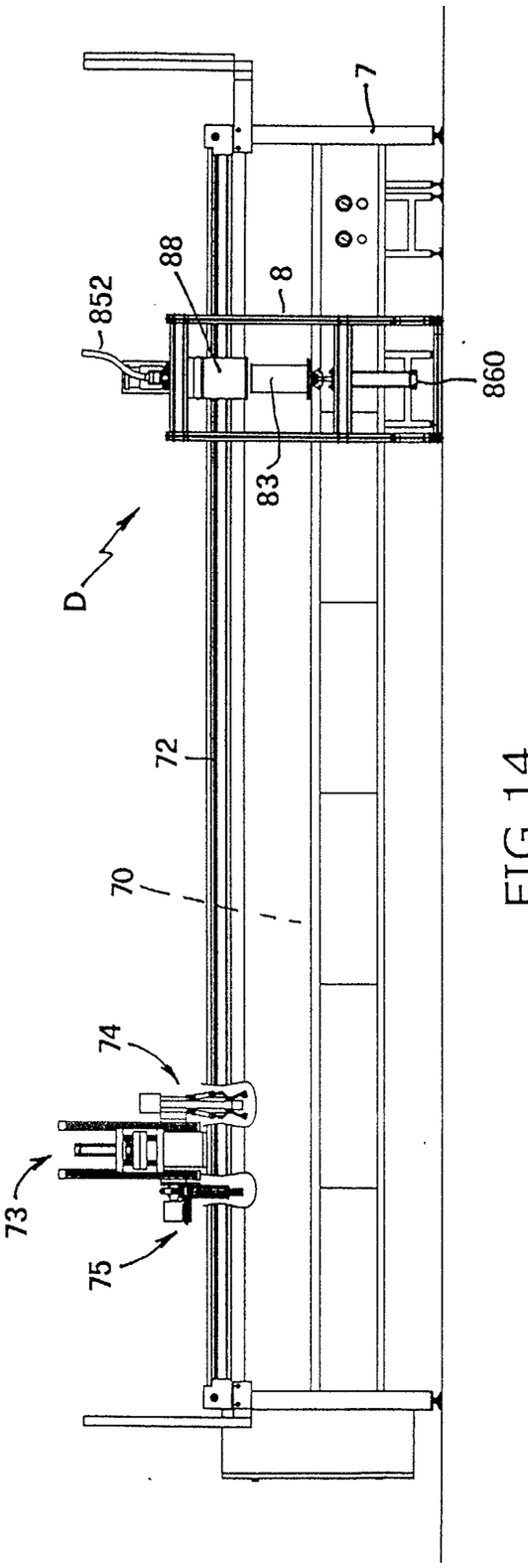

FIG.14

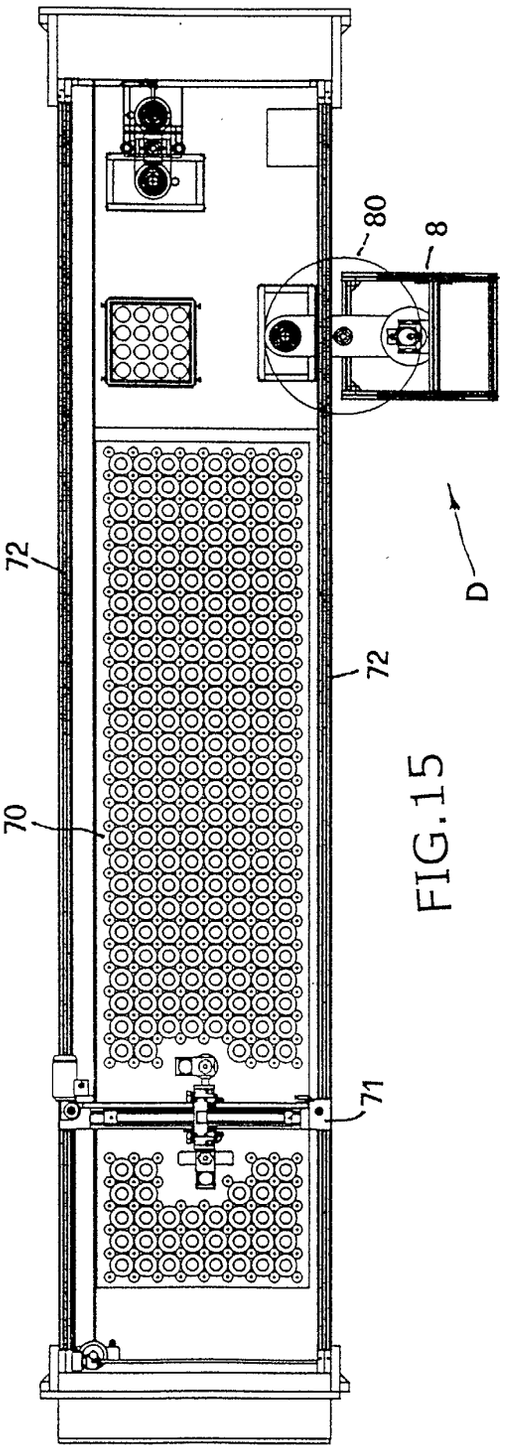

FIG.15

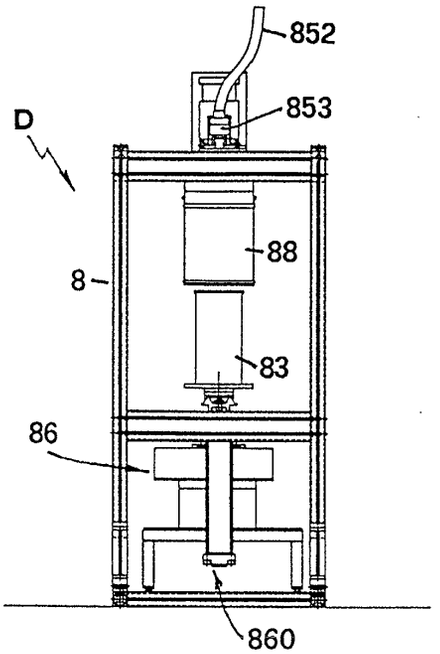

FIG.16

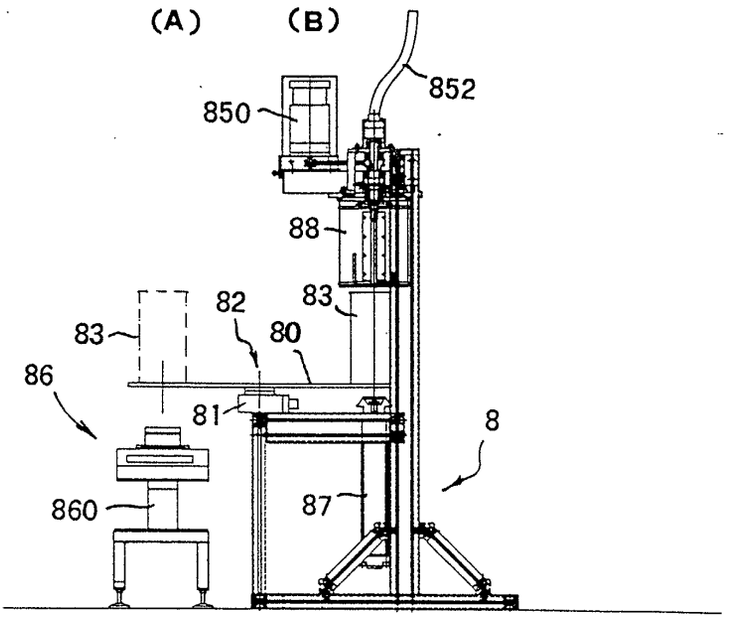

FIG.17A

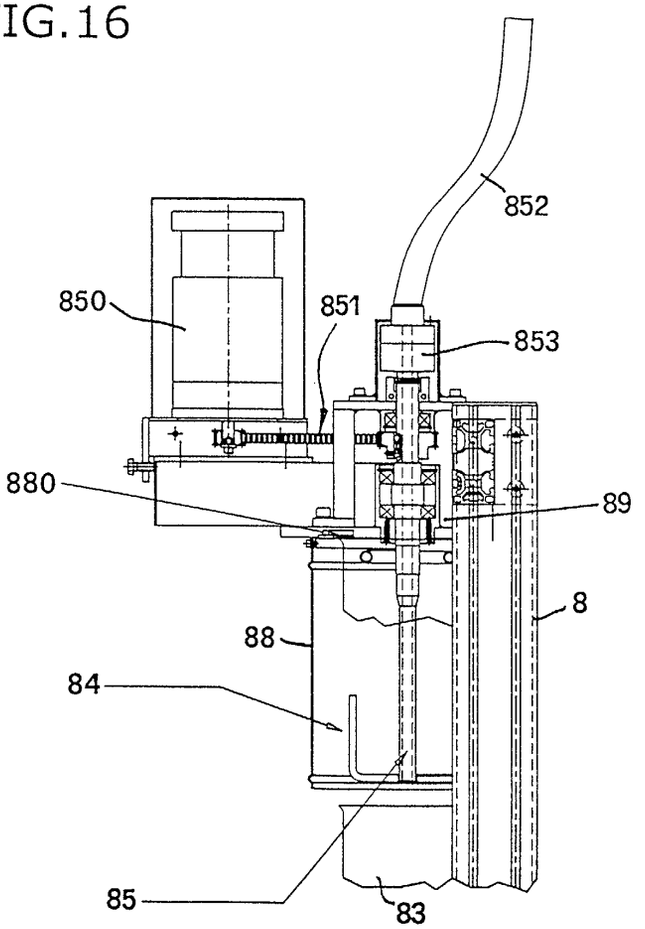

FIG.18

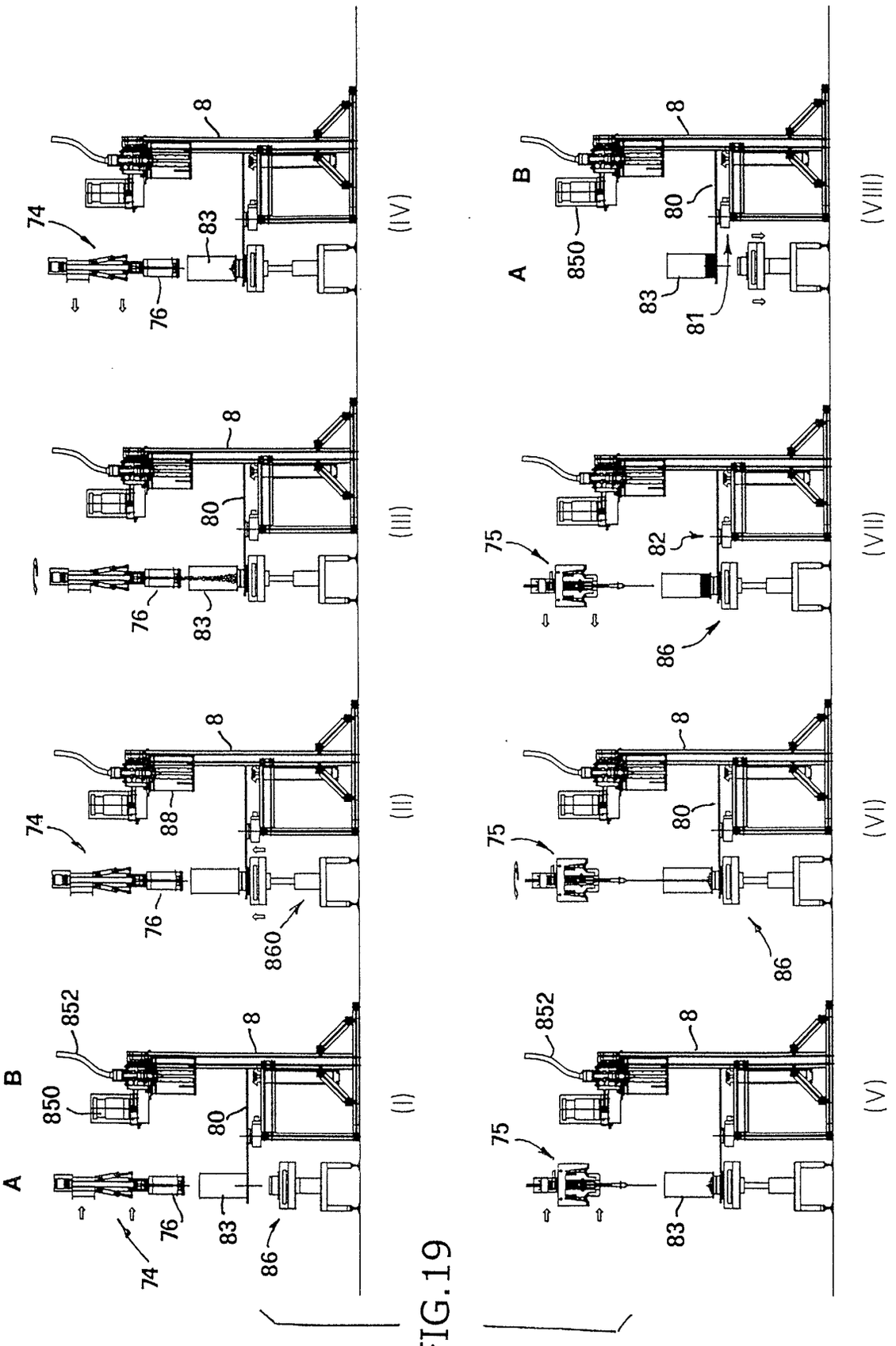

FIG.19

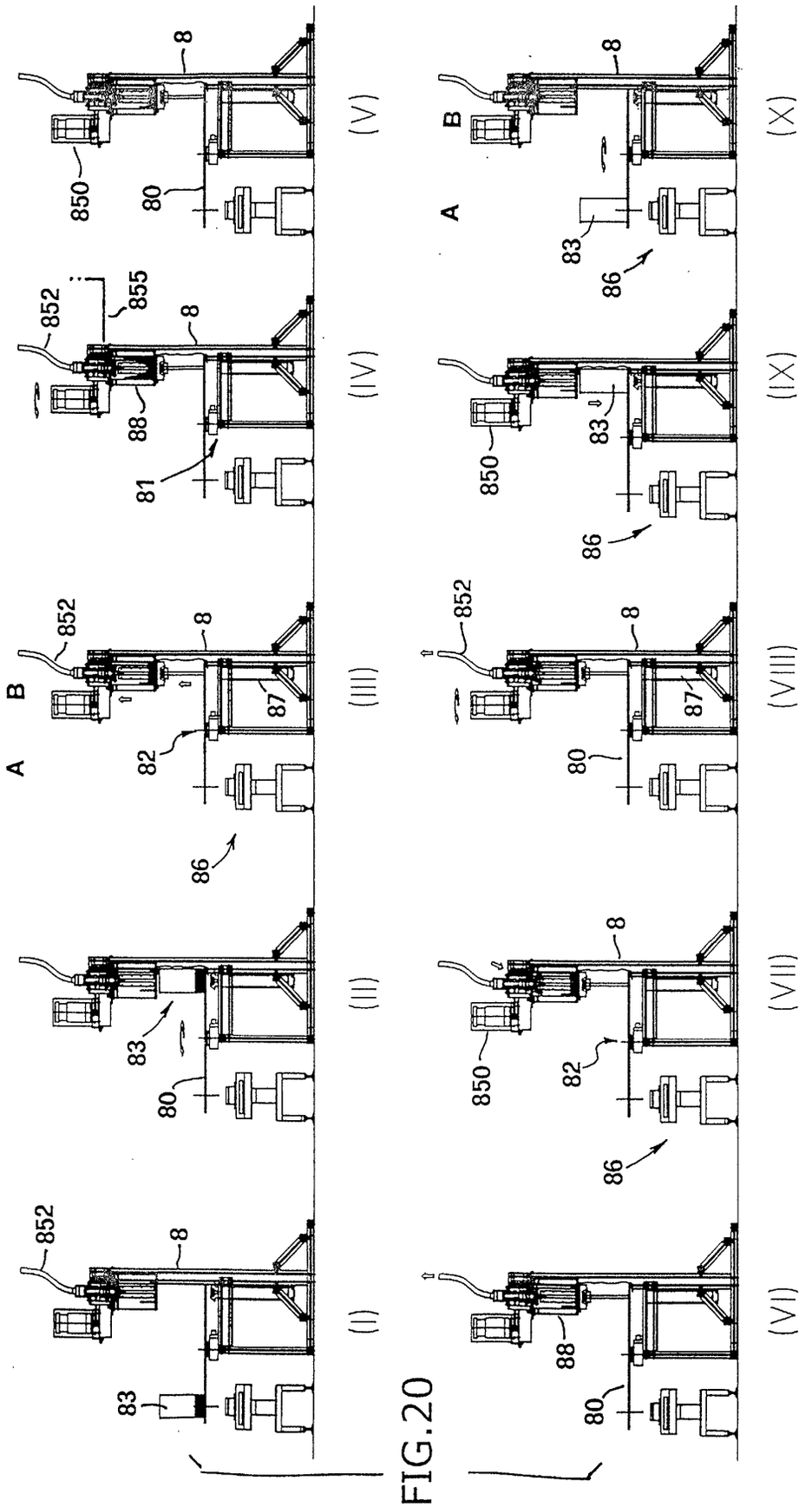

FIG.20