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(54) **APPARATUS FOR MAKING CAPSULES AND  
RELATIVE METHOD FOR MAKING  
CAPSULES**

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(71) Applicant: **I.M.A. INDUSTRIA MACCHINE  
AUTOMATICHE S.P.A.**, Ozzano  
Dell'Emilia (BO) (IT)

(72) Inventor: **Enrico Davide SPREAFICO**, Garlate  
(Lecco) (IT)

(57) **ABSTRACT**

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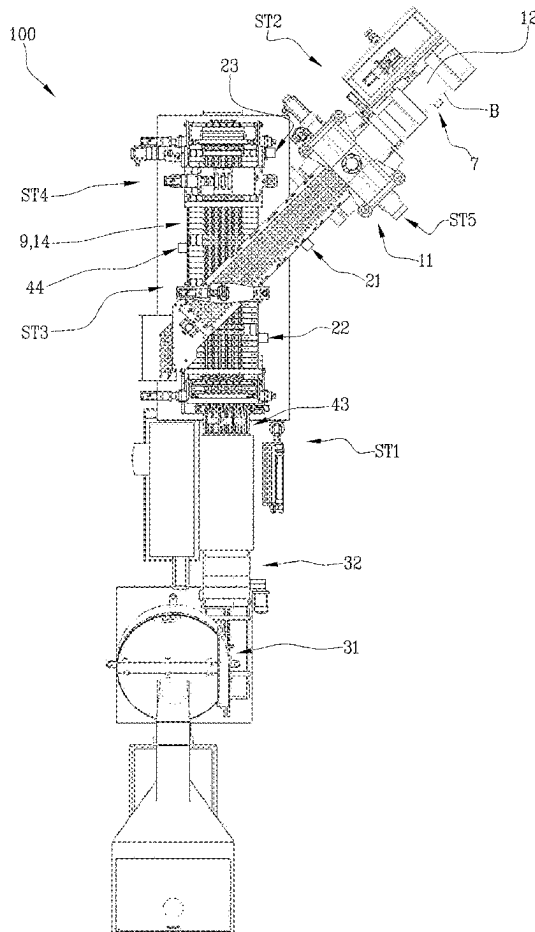
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An apparatus for making capsules, includes: a receiving station for receiving capsule bodies having bottom and side walls defining a filling cavity with an opening opposite the bottom and a flange surrounding the opening. A forming station for making sealing rings includes a device for feeding a sheet from a reel. A coupling station couples each ring to a capsule body at the respective flange. A welding station welds the rings to respective capsule bodies. Groups of receiving seats receive the capsule bodies. An etching device etches pre-cutting lines along the edges of the rings, so that a central portion of the rings is detached from the etched sheet. Detaching elements detach from the sheet the rings that had been etched onto the sheet and bring them into contact with the flange at the coupling station. The etching device operates remotely and separately from the coupling station.



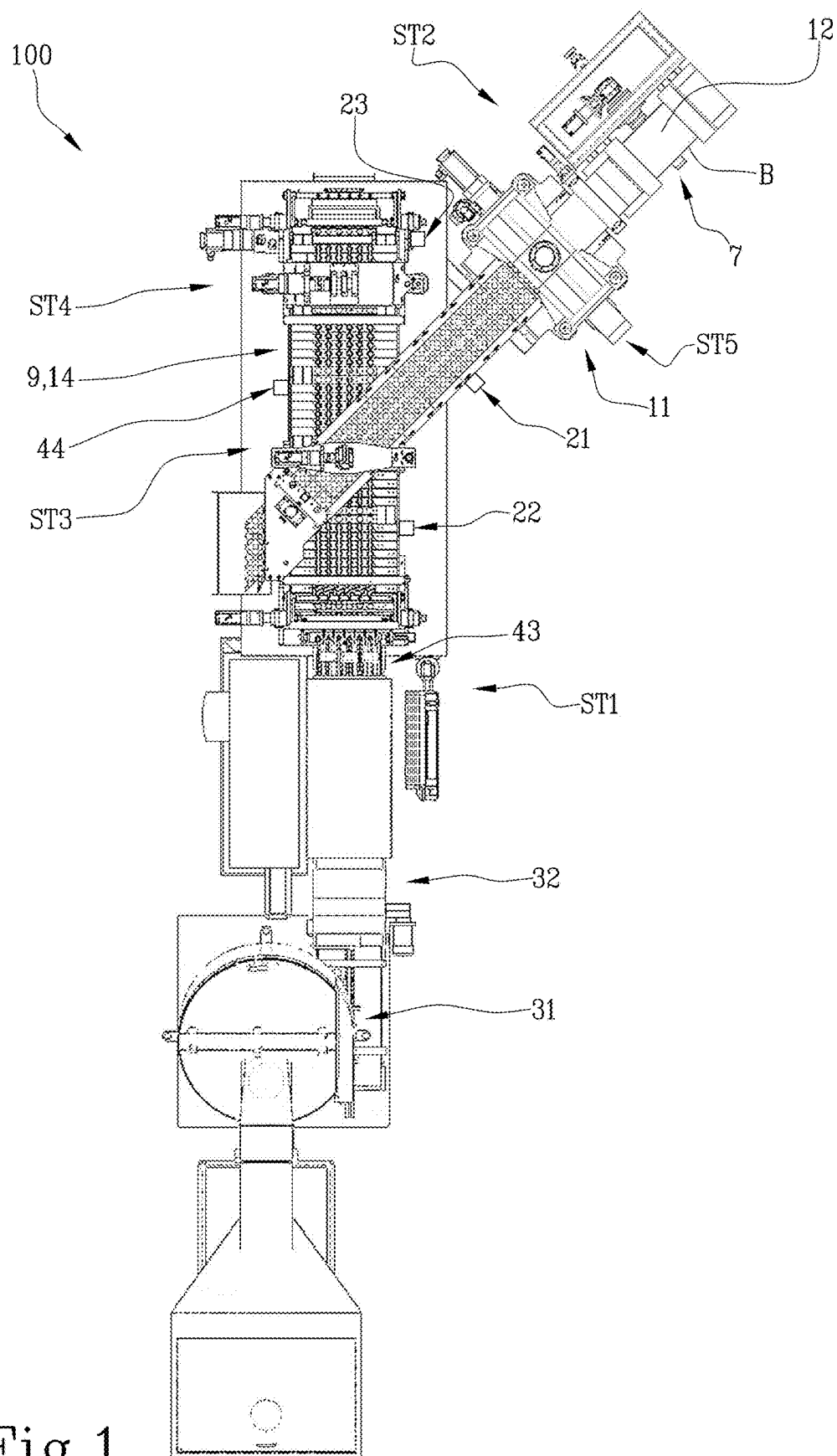


Fig.1

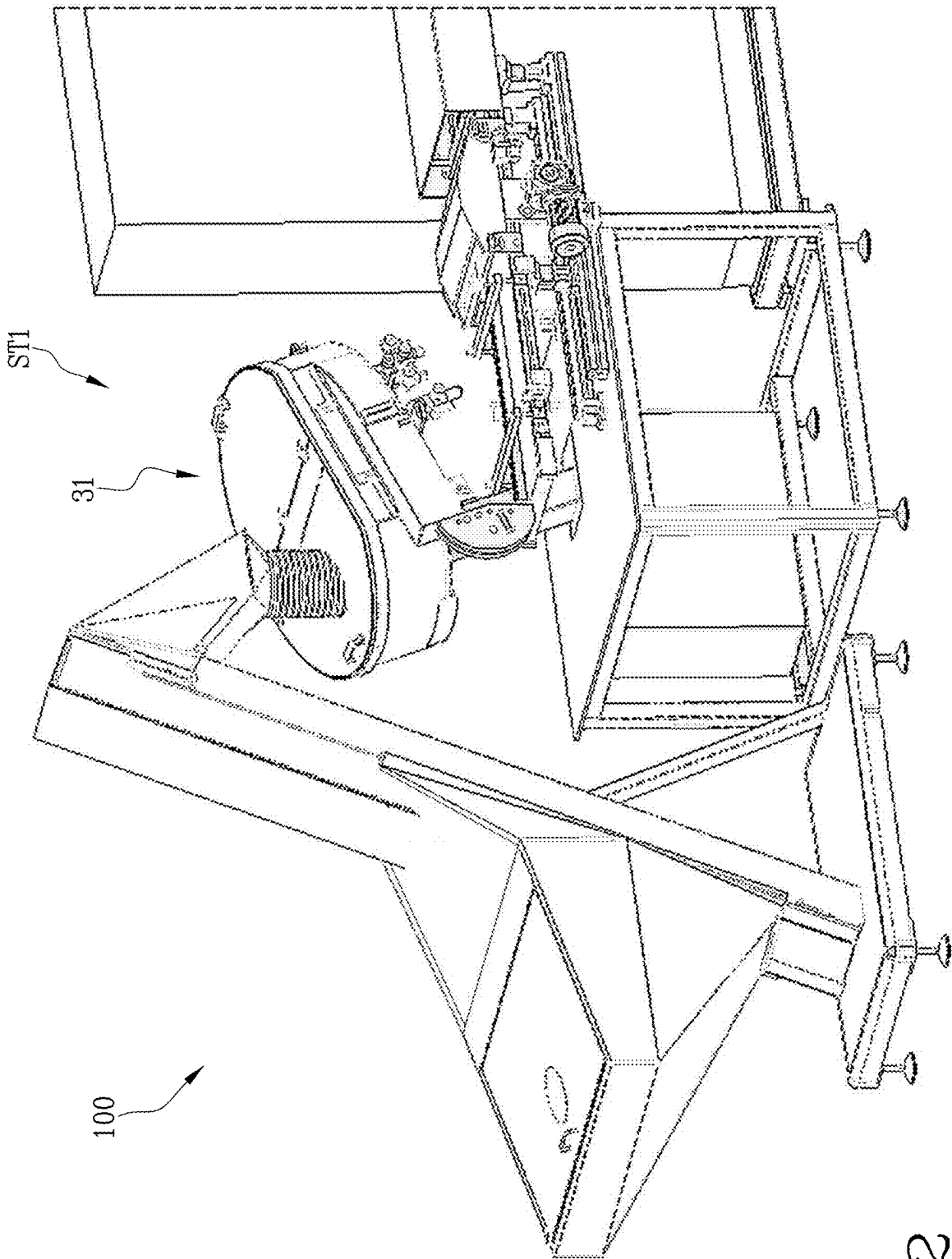


Fig. 2

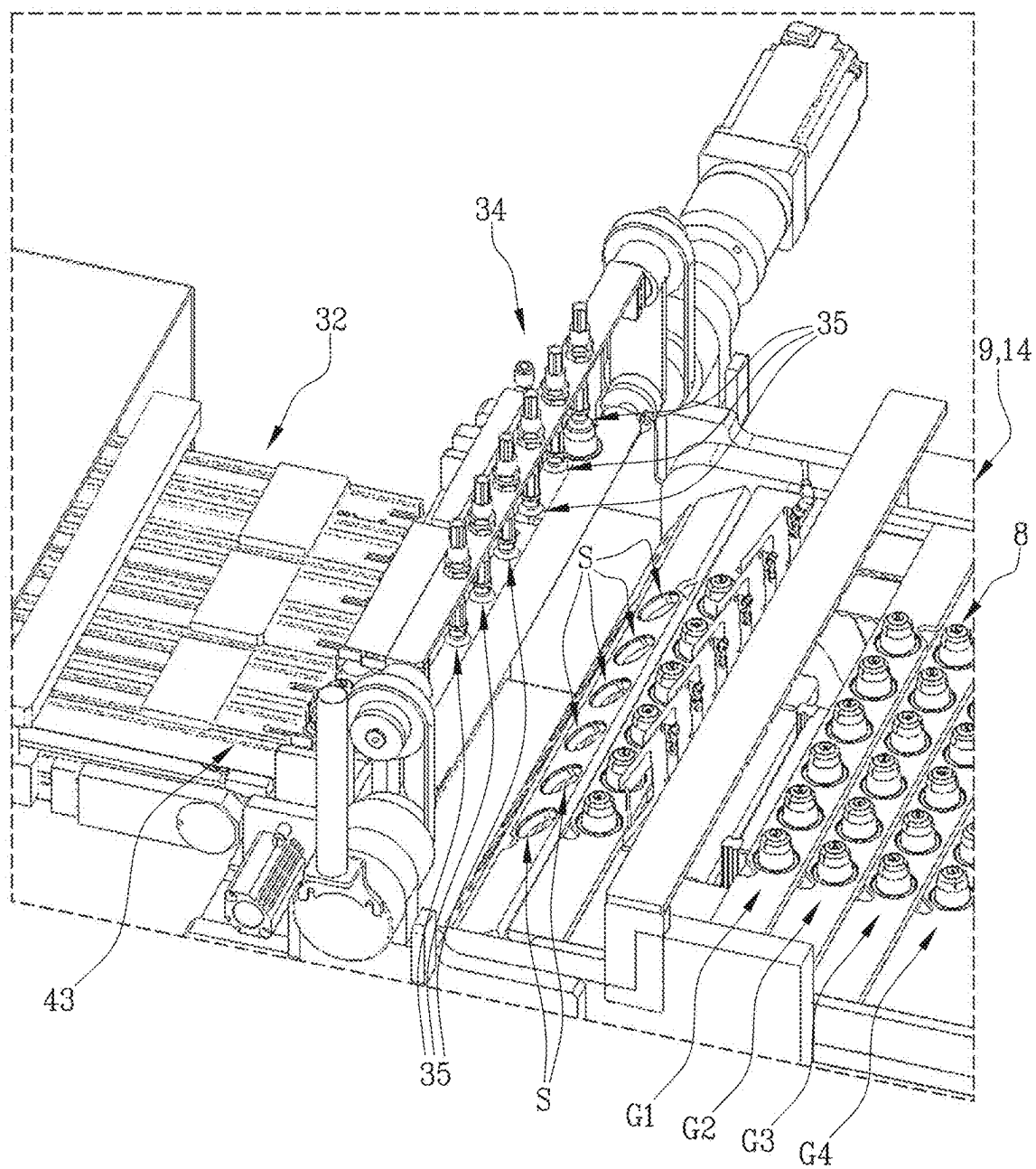


Fig.3

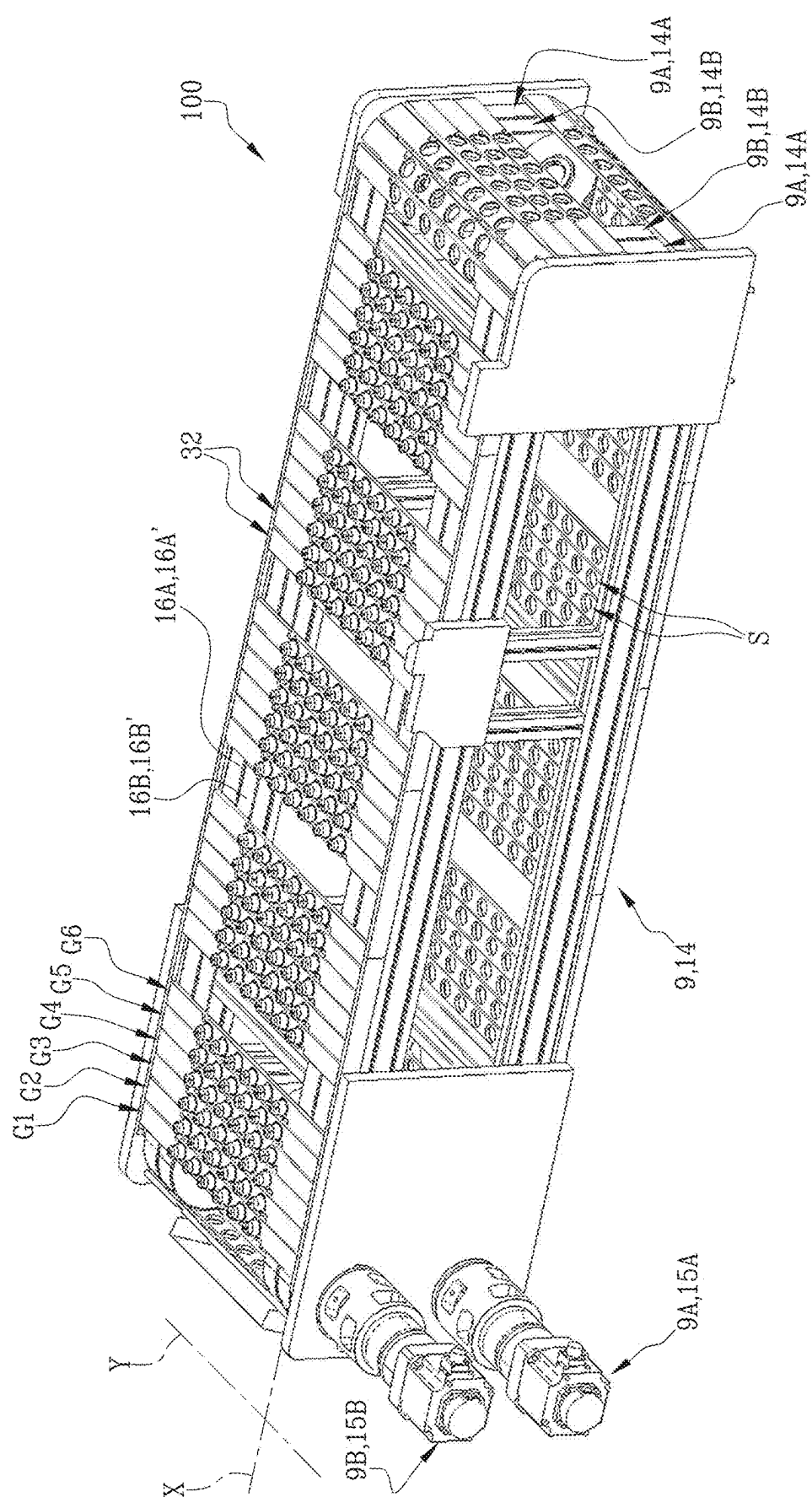


Fig. 4

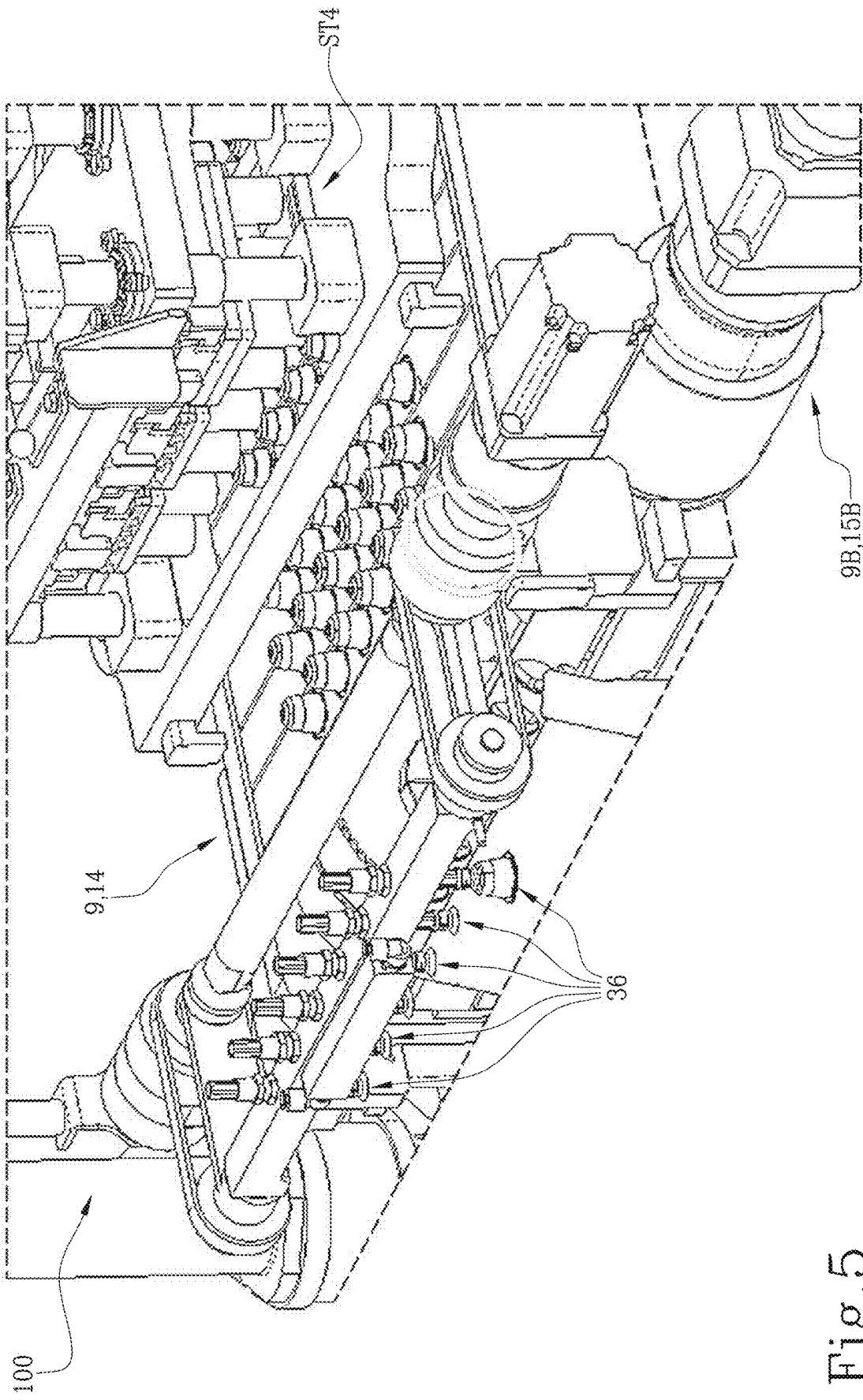


Fig. 5

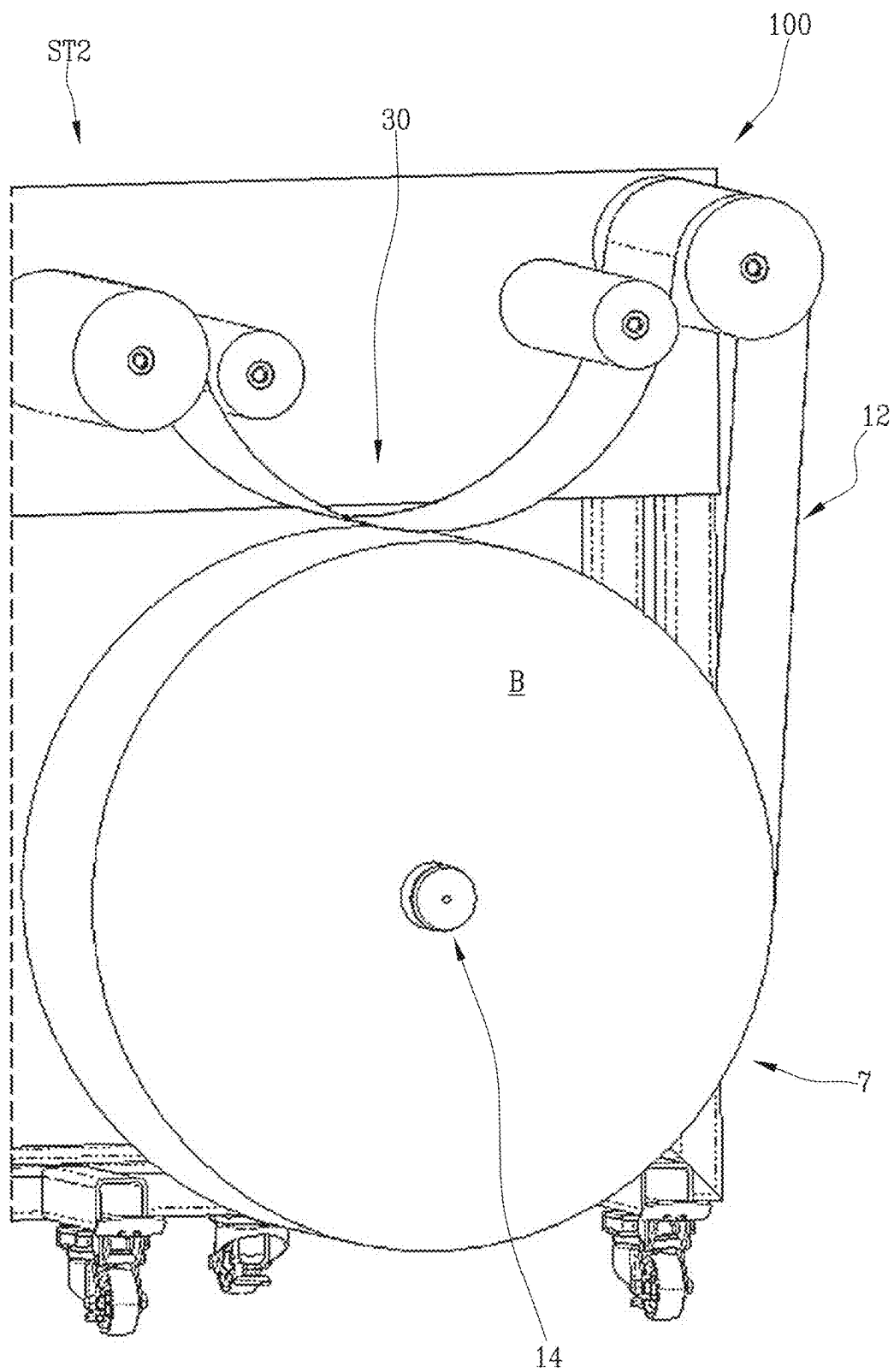


Fig.6

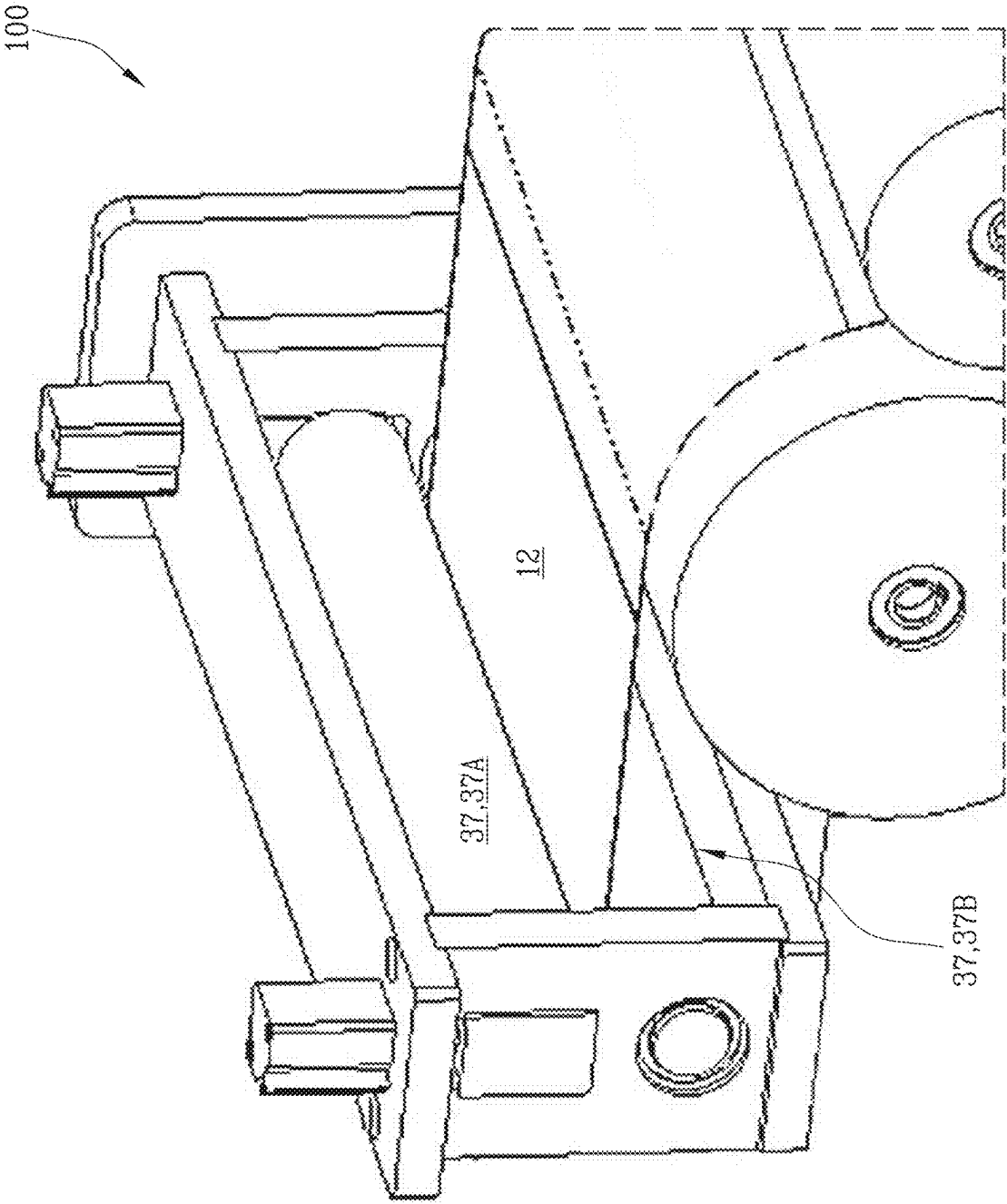


Fig. 7



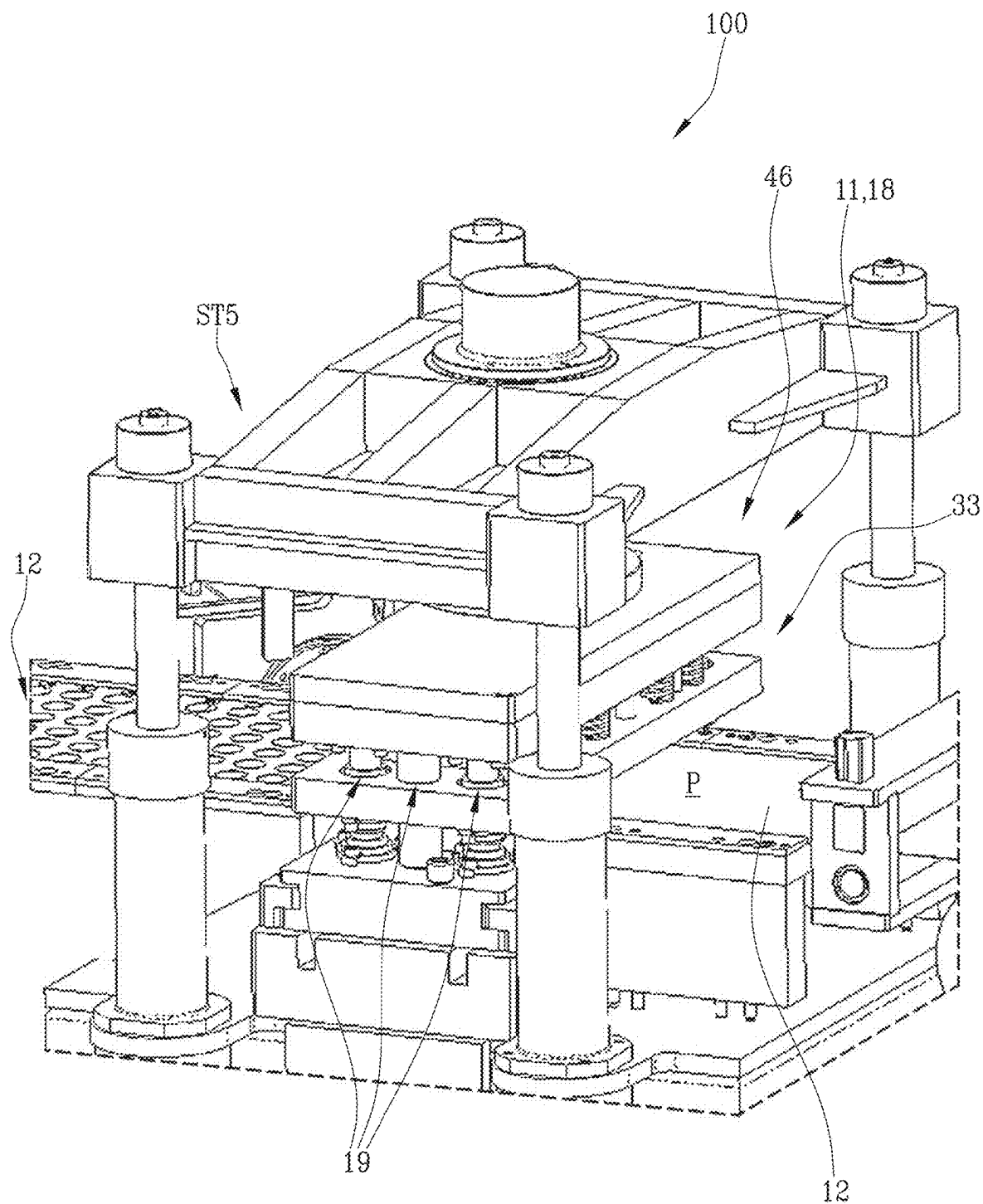


Fig.8

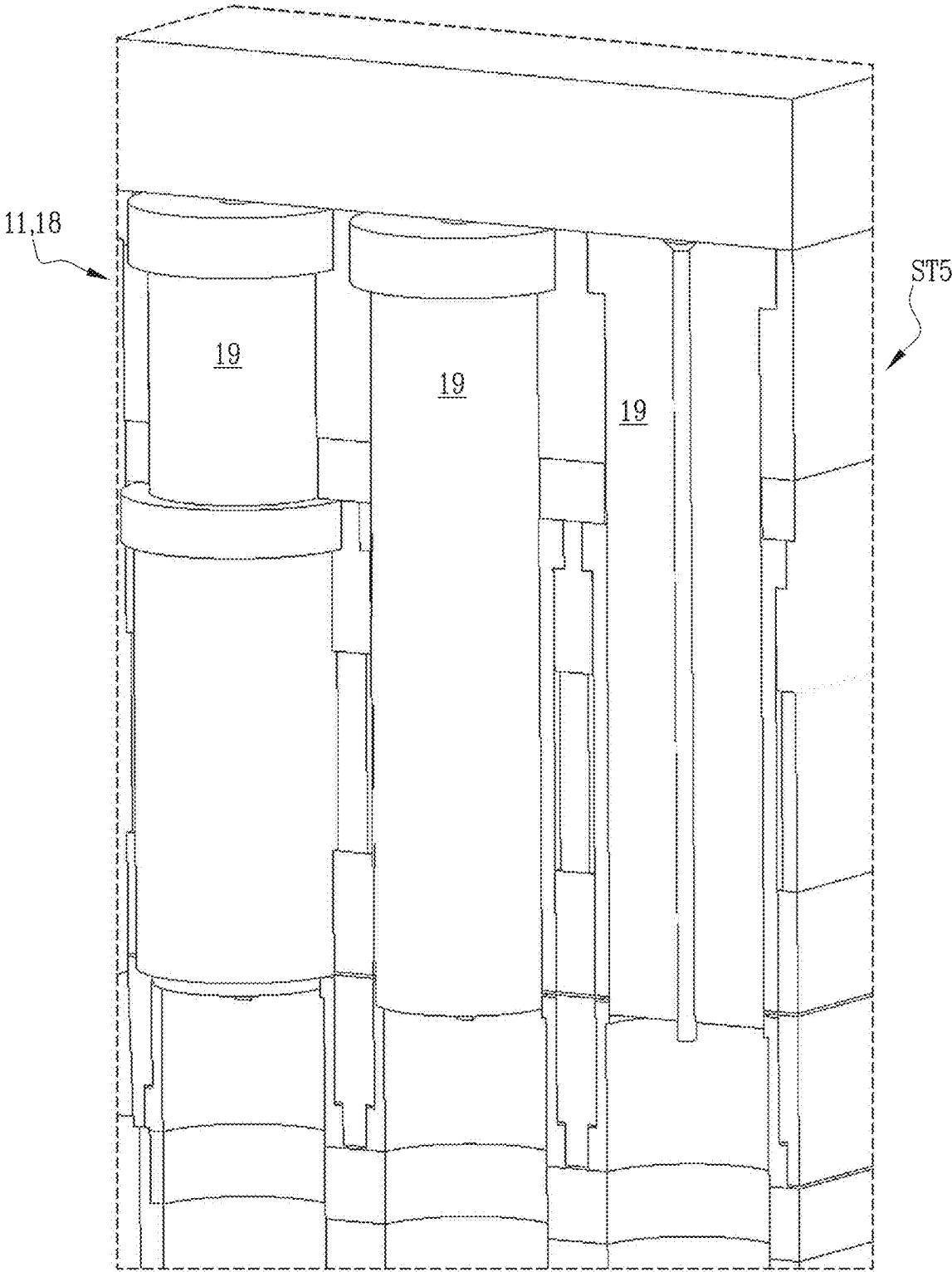


Fig.9

Fig.10A

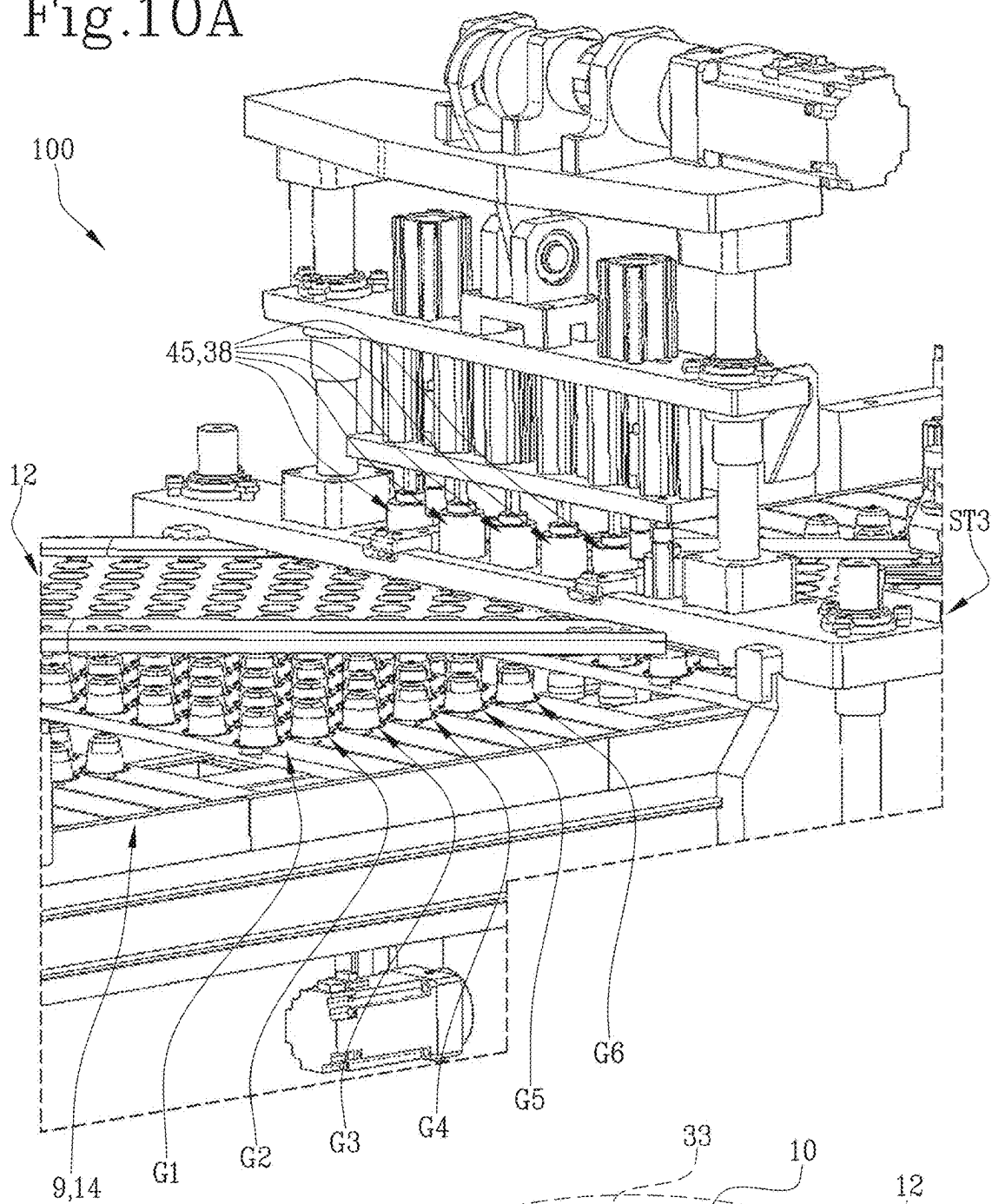
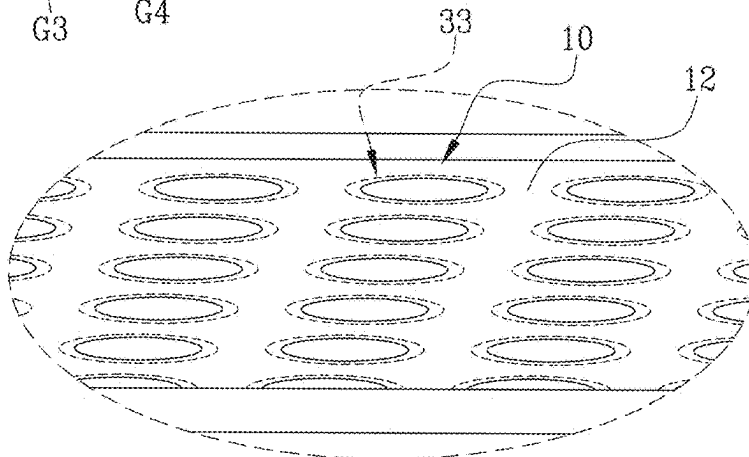


Fig.10B



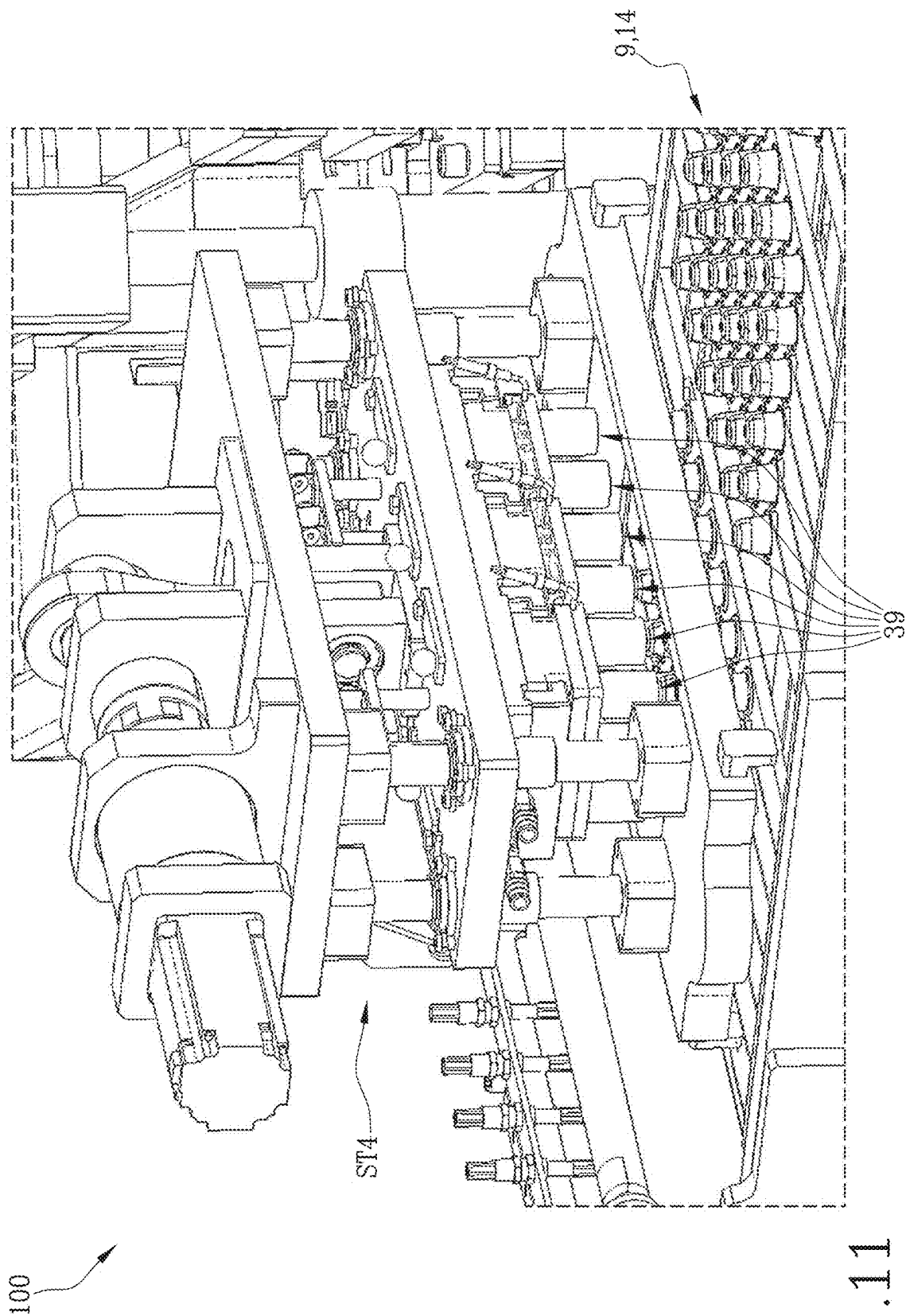


Fig.11

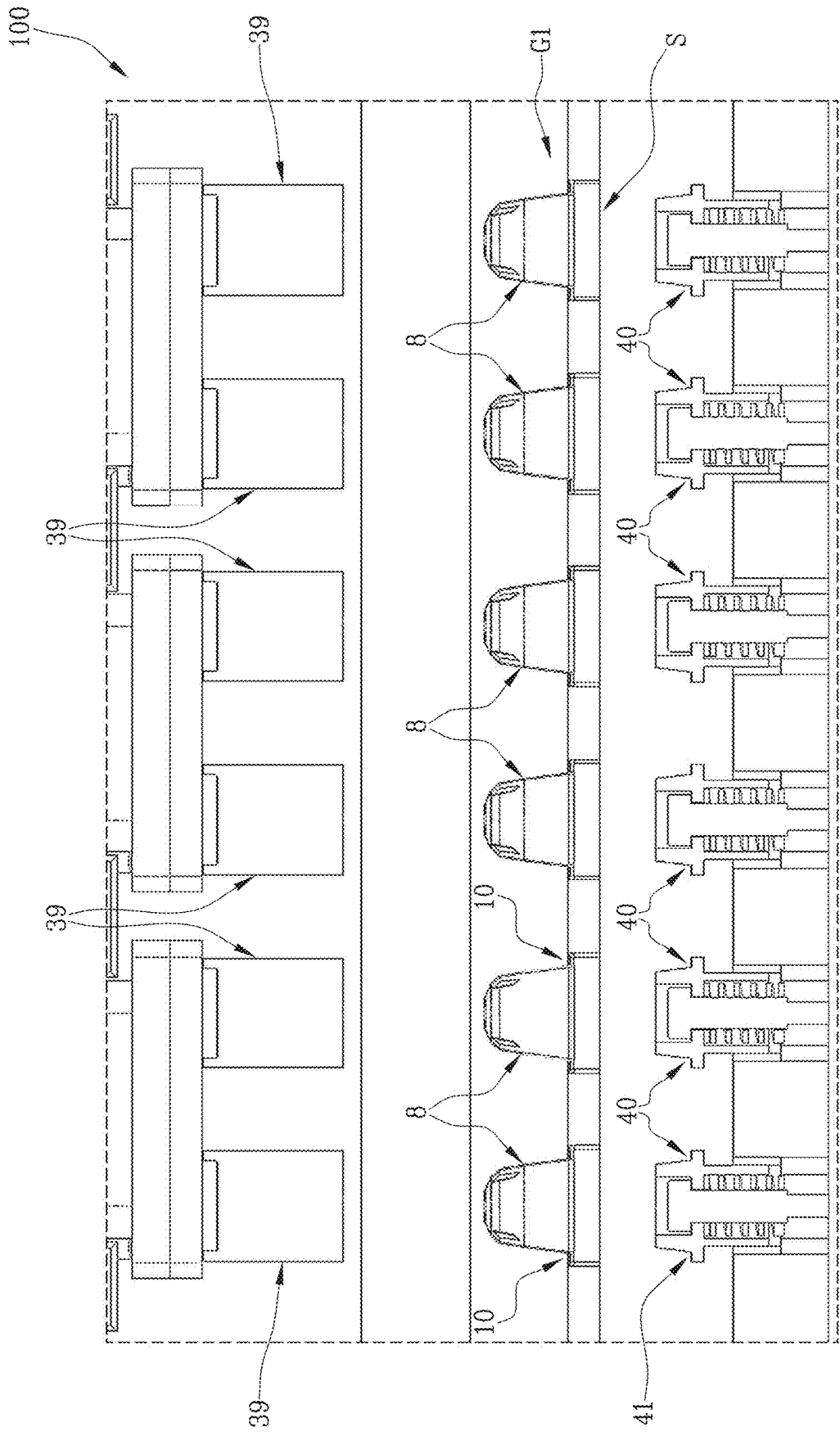


Fig.12A

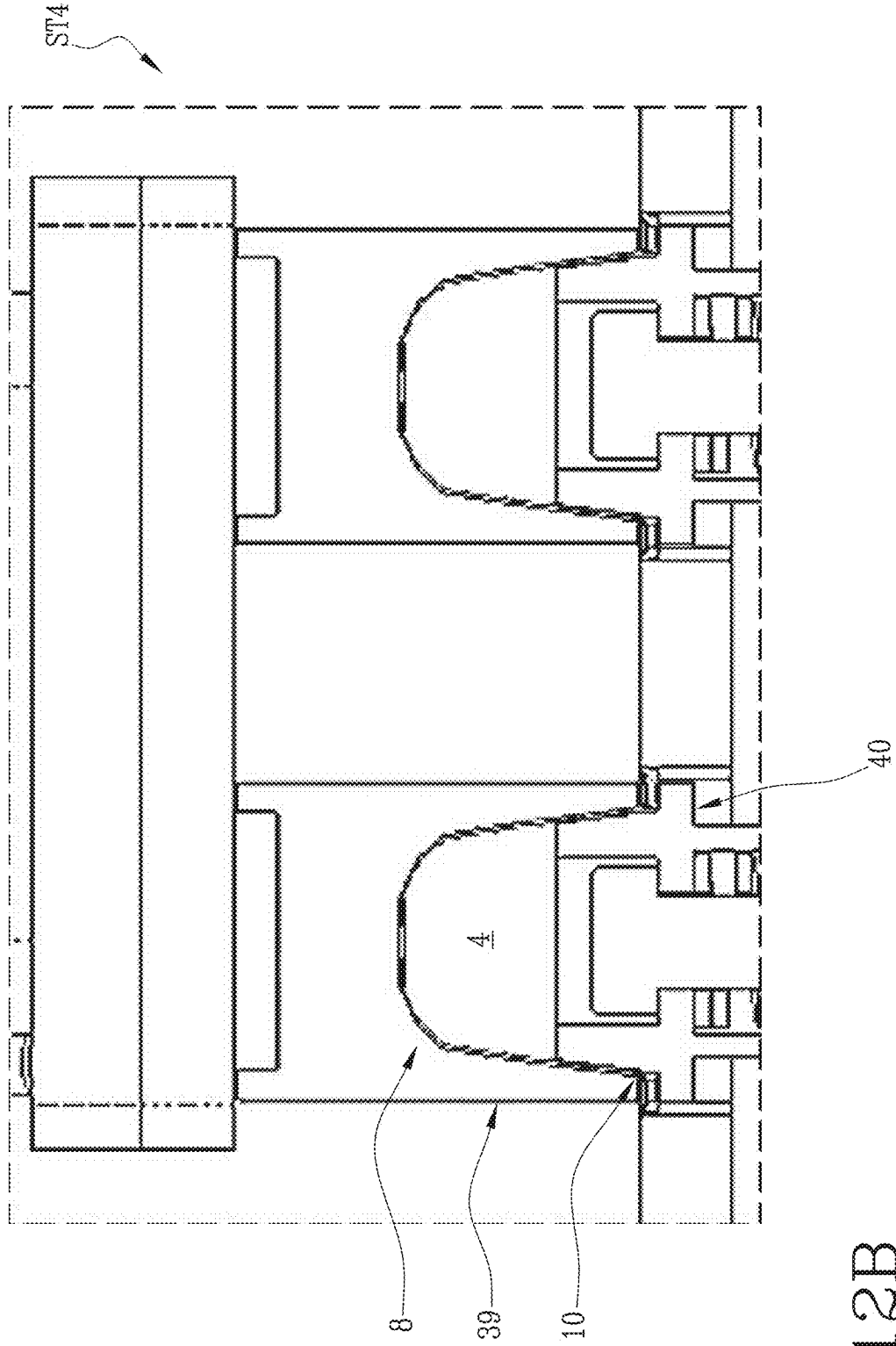


Fig.12B

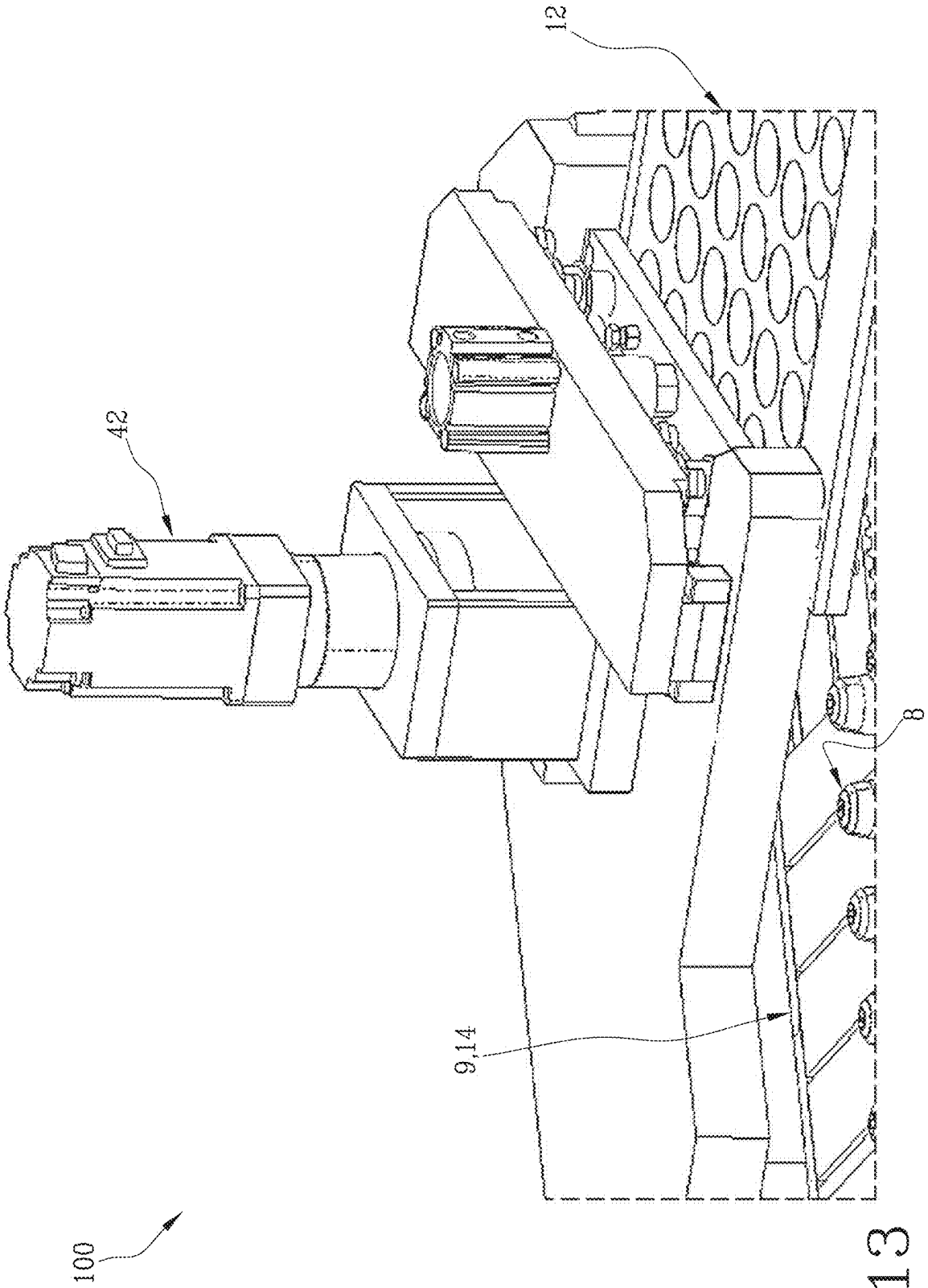


Fig. 13

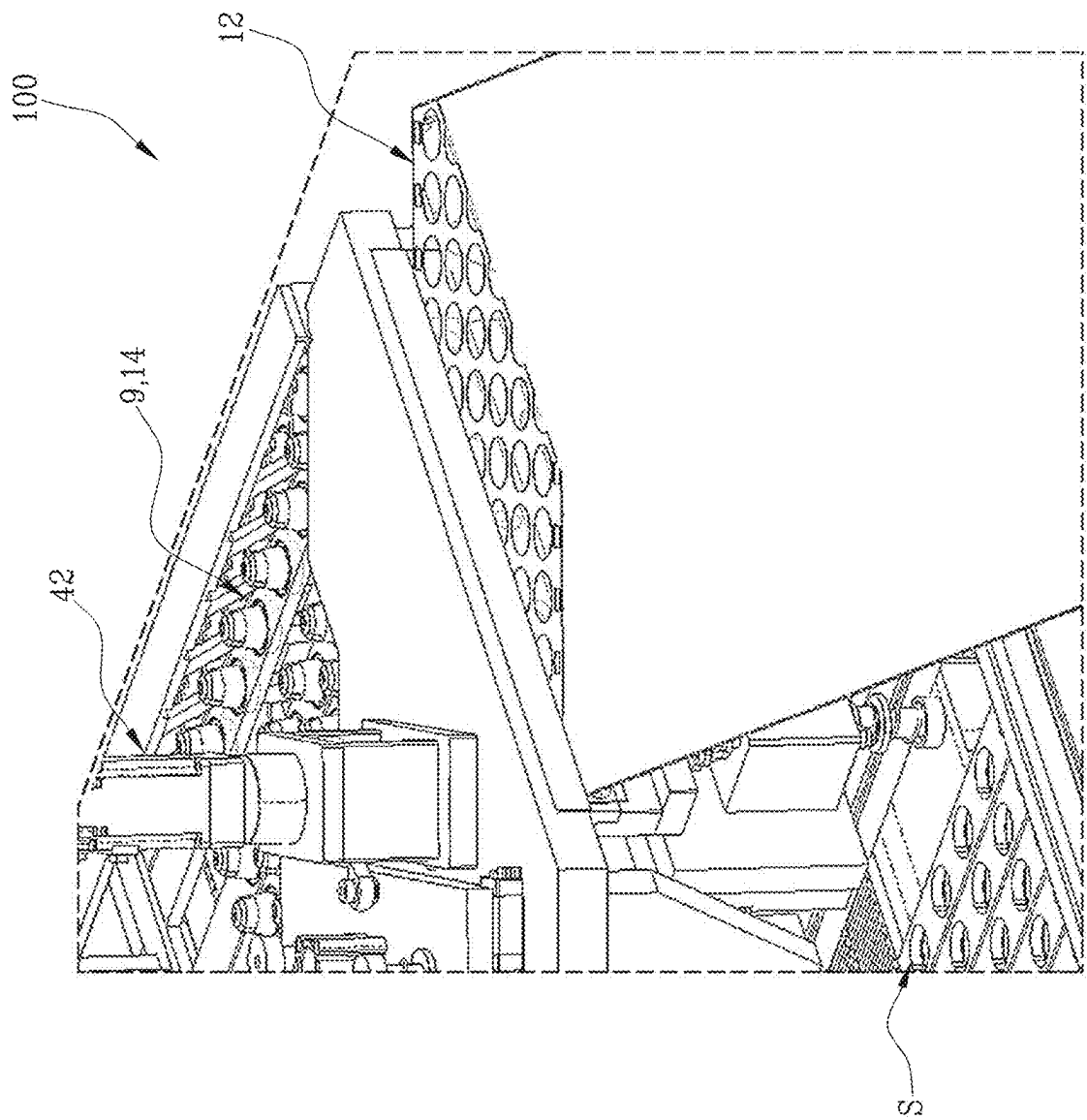


Fig.14



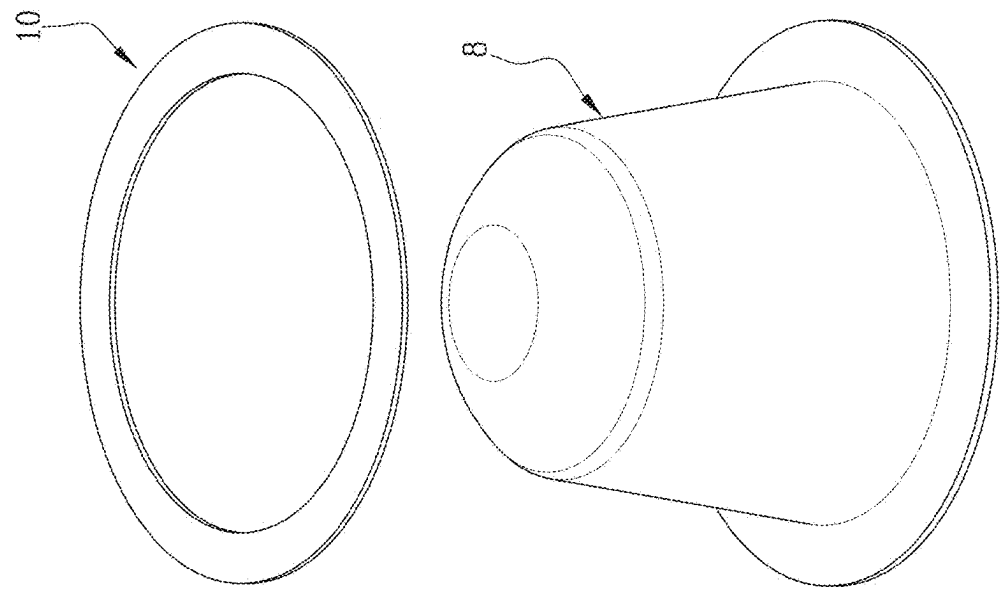


Fig.15

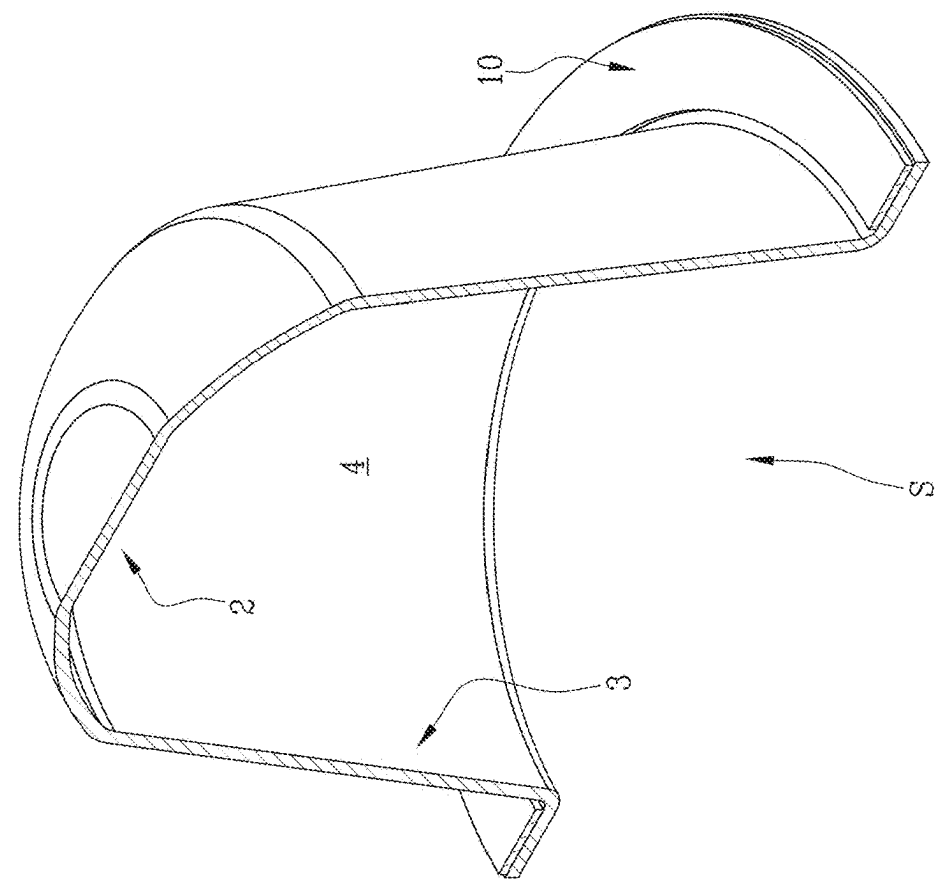


Fig.16

## APPARATUS FOR MAKING CAPSULES AND RELATIVE METHOD FOR MAKING CAPSULES

### TECHNICAL FIELD

[0001] This invention relates to an apparatus for making capsules and a relative method for making capsules.

### BACKGROUND ART

[0002] In the food sector, the prior art teaches the making of capsules or containers, containing a food preparation, which can be used in machines for dispensing a beverage.

[0003] Generally speaking, these capsules are made from a sheet of aluminium foil or other deformable material, which is cut and suitably deformed to define a space for containing the product, and to constitute an outer case.

[0004] According to an alternative technique, the capsules may be made by means of a process for injecting material.

[0005] The case has a bottom wall, a lateral wall which define a cavity and a peripheral flange.

[0006] It should be noted that the product is housed inside the cavity and that the capsule has an opening on the opposite side relative to the bottom wall.

[0007] After inserting the product, through the opening, the prior art comprises closing the opening, in a hermetically sealed fashion, using a sheet of aluminium or multilayer plastic film, thereby sealing the product inside the cavity.

[0008] A problem encountered in the capsules made starting from a sheet of aluminium or other material is a certain difficulty in guaranteeing the seal between the peripheral flange of the capsule and the housing of the capsule of the dispensing machine.

[0009] In effect, the flange is in the order of a few tenths of a millimetre and, therefore, having a reduced thickness, is easily deformable.

[0010] The seal is important in order to prevent percolations of the product in the dispensing machine during the preparation of the beverage, so as to also allow the production of a beverage under perfect quality conditions and keep the dispensing machine in perfect conditions of efficiency and cleaning.

[0011] In order to improve the seal of the capsule relative to the housing of the dispensing machine, a sealing element (ring) (made, for example, of elastomeric material) is generally applied to the capsule.

[0012] The sealing element generally has the shape of a ring, and is inserted on the lateral wall of the capsule in contact with the flange. When the capsule is inserted in the dispensing machine, the sealing element is flattened against a contact element of the housing of the capsule of the dispensing machine, so that deforming guarantees a certain seal.

[0013] According to the prior art machines for making capsules the sealing element is made of elastic material, and may consist of a ring inserted elastically on the lateral wall of the capsule, or fixed to the lateral wall, in contact with the surface of the flange facing the opposite side relative to the opening of the cavity of the capsule.

[0014] The ring may also be made by applying (according to different techniques) a composition of elastomers, silicones, plastic materials in a liquid or viscous form on the outer surface of the capsule, and subsequently hardening said composition.

[0015] However, the making of said annular sealing element is complex and costly, thus increasing the production costs of the capsule.

[0016] There is therefore a strongly felt need for providing an apparatus for making capsules which can, advantageously, operate with reduced costs, using environmentally-friendly materials, without adversely affecting a perfect cleaning, safety, and reliability, and at the same time allowing capsules to be made which, once used, guarantee an optimum seal with the dispensing machine.

### DISCLOSURE OF THE INVENTION

[0017] An aim of the invention is therefore to satisfy the need expressed in the introduction, that is to say, to provide an apparatus and a method for making capsules for beverages which can operate with perfect cleanliness, safety and reliability.

[0018] Said aims are fully achieved by an apparatus and a method for making capsules for beverages according to the appended claims.

### BRIEF DESCRIPTION OF DRAWINGS

[0019] The invention will be described with reference to the accompanying drawings, provided by way of example only and without limiting the scope of the invention, in which:

[0020] FIG. 1 is a perspective view of an apparatus for making capsules equipped with sealing rings according to the invention;

[0021] FIG. 2 is a perspective view of certain details of the apparatus of FIG. 1 relating to a first zone of the station for feeding capsules;

[0022] FIG. 3 is a perspective view of certain details of the apparatus of FIG. 1 relating to a second zone of the station for feeding capsules;

[0023] FIG. 4 is a perspective view of certain details of the apparatus of FIG. 1, more specifically a conveyor for transporting capsules forming part of the apparatus of FIG. 1;

[0024] FIG. 5 is a perspective view of certain details of the apparatus of FIG. 1, more specifically a zone for releasing the capsules made by the apparatus of FIG. 1;

[0025] FIG. 6 is a perspective view of certain details of the apparatus of FIG. 1, more specifically a first zone relative to the station for making sealing rings for capsules of the apparatus of FIG. 1;

[0026] FIG. 7 is a perspective view of certain details of the apparatus of FIG. 1, more specifically a second zone relative to the station for making sealing rings for capsules of the apparatus of FIG. 1;

[0027] FIG. 8 is a perspective view of certain details of the apparatus of FIG. 1, more specifically a third zone relative to the station for making sealing rings for capsules of the apparatus of FIG. 1;

[0028] FIG. 9 is a perspective view, according to different cross section planes, of a detail of FIG. 8 relative to a shearing device for making the sealing rings;

[0029] FIGS. 10A, 10B and 11 are perspective views of certain details of the apparatus of FIG. 1, more specifically a zone relative to the station for the sealing of sealing rings for capsules of the apparatus of FIG. 1;

[0030] FIGS. 12A and 12B schematically illustrate the station for the sealing of sealing rings for capsules illustrated in FIGS. 10A, 10B and 11 with the elements in different positions;

[0031] FIGS. 13 and 14 are perspective views of certain details of the apparatus of FIG. 1;

[0032] FIGS. 15 and 16 schematically illustrate a capsule according to the processing in the apparatus of FIG. 1, with the sealing ring not coupled and coupled, respectively, to the capsule body.

#### DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

[0033] With reference to the accompanying drawings, and with particular reference to FIGS. 1 to 14, the apparatus according to the invention, labelled 100 in its entirety, is used for making capsules.

[0034] The apparatus 100 comprises a receiving station ST1 for receiving capsule bodies 8 having a bottom 2 and side walls 3 defining, in combination, a filling cavity 4 provided with an opening 5 opposite the bottom 2 and a flange 6 positioned to surround said opening.

[0035] The capsule bodies 8 are well illustrated in FIG. 15.

[0036] The receiving station ST1 comprises a container 31 designed to contain capsule bodies 8 (the container 31 is filled with loose capsule bodies 8).

[0037] The container 31 releases the capsules to a conveyor 32 which suitably conveys them to a predetermined release zone 43 (shown in FIG. 3).

[0038] The apparatus 100 comprises, in the release zone 43, a pickup device 34 comprising a plurality of pickup units 35.

[0039] Each pickup unit 35 is equipped with a suction cup, to allow a single capsule body 8 to be picked up from the conveyor 32.

[0040] It should be noted that the pickup device 34 releases the capsule bodies 8 to a successive conveyor 14 (clearly visible in FIG. 4), which is described in more detail below, forming part of the apparatus 100.

[0041] According to another aspect, the apparatus 100 comprises a station ST2 for making sealing rings 10 comprising a device 7 for feeding a sheet 12 unwound from a reel B (clearly visible in FIG. 6).

[0042] Preferably, the sheet 12 is made of paper material.

[0043] According to another aspect, the apparatus 100 comprises a station ST3 for coupling said sealing rings 10 with the respective capsule bodies 8 (clearly visible in FIG. 10), configured for coupling each sealing ring 10 to a capsule body 8 at the respective flange 6.

[0044] The coupling station ST3 comprises a plurality of detaching elements 38, preferably defined by punches 45, configured to detach the sealing rings 10 from the sheet 12 and position them on the flanges 6 of the capsule bodies 8 positioned at the coupling station ST3.

[0045] FIG. 16 illustrates, by way of example, a capsule body 8 with the sealing ring 10 applied.

[0046] The apparatus also comprises a sealing station ST4 (clearly visible in FIGS. 11 and 12A) designed for sealing said rings 10 to the respective capsule bodies 8.

[0047] Moreover, the apparatus 100 comprises a plurality of groups G1, G2, G3, G4, G5, G6 (for simplicity, only six groups are indicated in the accompanying drawings) of seats S for receiving said capsule bodies 8 and means 9 for handling said groups G1, G2, G3, G4, G5, G6 of receiving

seats S, configured to allow a handling of the capsule bodies 8 between the station ST1 for receiving capsule bodies 8, the station ST3 for coupling said sealing rings 10 with the respective capsule bodies 8, and the sealing station ST4.

[0048] The apparatus 100 further comprises etching means 11 designed to etch the sheet 12 creating pre-cutting lines 33 along the (outer) edges of said sealing rings 10, in such a way that a central portion of the sealing rings 10 is detached from the etched sheet 12, whilst the sealing rings 12 remain anchored to the sheet 12 by means of anchor points on the sheet 12 defined by the pre-cutting lines 33.

[0049] The etching means 11 are clearly visible in FIGS. 9 and 10.

[0050] Further, the apparatus 100 comprises a plurality of detaching elements 38 configured to detach from the sheet 12 the sealing rings 10 which have been etched on the sheet 12 and move them into contact with the flange 6 in the coupling station ST3.

[0051] The detachment means 38 are positioned at the coupling station ST3.

[0052] FIG. 10B illustrates a sheet 12 in which, by means of the shearing device 18, the etches have been made relative to the different sealing rings 10: it should be noted that the central portion (disc) of each sheet delimited by the innermost edge of the sealing ring 10 is removed, whilst the line 33 (pre-cutting) of the outermost edge of the sealing ring 10 is illustrated, with a dashed line.

[0053] The dashed line 33 of the outermost edge of the respective sealing ring 10 comprises a preferential pre-cutting line 33, defined by actual notches and portions of sheet 12 which allow the ring 10 to be kept coupled to the remaining part of the sheet 12.

[0054] It should be noted that the etching means 11 operate at an etching station ST5 (far) and separate from the coupling station ST3 (illustrated in FIGS. 8 and 9), more precisely in an etching station ST5 not superposed on the path of the seats S.

[0055] More specifically, in effect, the etching station ST5 does not affect the path of the capsule bodies 8, that is to say, it is not positioned above them. In this way, the waste material generated does not affect the capsule bodies 8, and thus prevents the capsule bodies 8 from being accidentally contaminated with dust.

[0056] With reference to the sealing station ST4, illustrated in FIGS. 10 and 11, that station comprises a plurality of sealing elements 39.

[0057] Each sealing element 39 operates on a capsule body 8.

[0058] Preferably, the sealing elements 39 heat seal the sealing ring 10 on the capsule body 8.

[0059] According to this aspect, the sealing elements 39 comprise a heating element.

[0060] It should be noted that the sealing elements 39 are located above the conveyor 14, and are movable vertically between a non-operating position (illustrated in FIG. 12A), wherein the sealing element 39 is not in contact with the sealing ring 10, and an operating position (illustrated in FIG. 12B), that is to say, a sealing position, wherein the sealing element 39 is in contact with the sealing ring 10 to seal the sealing ring 10 to the capsule body 8.

[0061] The sealing station ST4 is configured to allow several groups of seats S (illustrated in FIG. 11) to be activated simultaneously on the capsule bodies 8, preferably three groups of seats S).

[0062] The apparatus 100 also comprises a plurality of contact elements 40.

[0063] The contact elements 40 are positioned at the sealing station ST4.

[0064] The contact elements 40 are shaped to match the cavity 4 of the capsule body 8, and each also has a movable flange 41 configured to abut on the flange 6 of the capsule bodies 8 positioned in the seats S at the sealing station ST4.

[0065] The contact elements 40 are movable vertically between a non-operating position (illustrated in FIG. 12A) and an operating position (illustrated in FIG. 12B).

[0066] The contact means 40 are located below the capsule bodies 8.

[0067] It should be noted that the capsule bodies 8 are transported by the conveyor 14 in the respective seats S with the opening 5 facing downwards.

[0068] In the operating position, illustrated in FIG. 12B, the sealing is performed: in this position the movable flange 41 of each contact element 40 comes into contact with the flange 6 of a capsule body 8 positioned in the seats S and the sealing element 39 comes into contact with the sealing ring 10 to perform the sealing.

[0069] According to another aspect, the groups of seats S for receiving said capsule bodies 8 comprise first groups of seats for receiving (G1,G2,G3) and second groups (G4,G5,G6) of seats S for receiving.

[0070] These first groups (G1,G2,G3) and second groups (G4,G5,G6) of receiving seats are different and independent from each other with regard to the handling, as described in more detail below.

[0071] In essence, and more precisely, each group of receiving seats, belonging to the first or second groups, comprises seats S aligned in a direction Y transversal to the direction X of conveying the seats (as illustrated in FIG. 4).

[0072] More specifically, along the conveying direction X, the first groups (G1,G2,G3) are alternated with the second groups (G4,G5,G6), that is to say, along the conveying direction X there is an alternation of first and second groups of seats S.

[0073] It should be noted that the means 9 for handling the groups of receiving seats S comprise first handling means 9A, operating on said first groups (G1,G2,G3) of receiving seats S, and second handling means 9B, operating on said second groups (G4,G5,G6) of receiving seats S.

[0074] The first and second handling means 9A, 9B are independent of each other, to allow an independent handling, respectively, of said first groups (G1,G2,G3) and second groups (G4,G5,G6) of receiving seats S.

[0075] In short, the operation of the first groups (G1,G2,G3) and the second groups (G4,G5,G6) of receiving seats S is independent of each other, as described in more detail below.

[0076] It should be noted that the apparatus 100 comprises a control unit 13 configured to control the first and second handling means 9A, 9B in such a way as to allow a step-by-step handling, respectively, of the first groups (G1,G2,G3) and second groups (G4,G5,G6) of receiving seats S.

[0077] The expression step-by-step handling is used to mean a handling wherein the first and second handling means 9A, 9B are periodically started/stopped according to a predetermined time frequency (corresponding to a step).

[0078] More precisely, the control unit 13 is configured for controlling said first and second handling means 9A, 9B in

such a way as to allow a handling of the receiving seats S in accordance with the following time sequence which is cyclically repeated:

[0079] a first motion phase, wherein said first handling means (9A) are active while said second handling means (9B) are inactive, so as to move said first groups (G1,G2,G3) of seats (S) closer to the second groups (G4,G5,G6) of seats (S); followed by

[0080] a second motion phase, wherein said first handling means (9A) are active and said second handling means (9B) are simultaneously active, so as to move said first groups (G1,G2,G3) and second groups (G4,G5,G6) of seats (S) simultaneously; followed by

[0081] a third motion phase, wherein said second handling means (9B) are active while said first handling means (9A) are inactive, so as to move said second groups (G4,G5,G6) of seats (S) away from said first groups (G1,G2,G3) of seats (S).

[0082] The time sequence described above is repeated cyclically, so as to move each group of seats S between the various stations.

[0083] In effect, the groups (G1,G2,G3,G4,G5,G6) of seats S are moved along a closed path, preferably a loop-shaped path (defined by the conveyor 14), so that they cyclically come into contact with the various stations receiving a capsule body 8 and performing on it the operations which will be described in more detail below.

[0084] The handling means 9 are described below in more detail.

[0085] As illustrated in FIG. 4, the handling means 9 comprise a loop conveyor 14 configured to define a closed-loop path P for handling the groups of receiving seats S.

[0086] More specifically, the first handling means 9A comprise a first loop conveyor 14A, configured to define a first closed-loop path for handling the first groups (G1,G2,G3) of receiving seats.

[0087] The second handling means 9B comprise a second loop conveyor 14B, configured to define a second closed-loop path for handling the second groups (G4,G5,G6) of receiving seats S.

[0088] It should be noted that, in effect, the first and second loop paths are coincident.

[0089] The first conveyor 14A comprises a first drive unit 15A and first belts 16A extending in a loop.

[0090] The first belts 16A comprise a pair of belts, 16A' and 16A'', positioned, relative to the conveying direction X of the seats S, on opposite sides.

[0091] The first belts 16A are connected to the first drive unit 15A for being driven and to the first groups (G1,G2,G3) of receiving seats for handling them.

[0092] Similarly, the second conveyor 14A comprises a second drive unit 15B and second belts 16B.

[0093] The second belts 16B comprise a pair of belts, 16B' and 16B'', positioned, relative to the conveying direction X of the seats S, on opposite sides.

[0094] The second belts 16B extend in a loop and are connected to the second drive unit 15B for being actuated.

[0095] It should be noted that the second belts 16B are positioned alongside said first belts 16A and connected to the second groups of receiving seats S for handling the receiving seats S.

[0096] More specifically, the belt 16A' is alongside the belt 16B' and the belt 16A'' is alongside the belt 16B''.

[0097] With reference to the longitudinal conveying direction X of the receiving seats S, the first belts 16A are positioned substantially parallel, at a predetermined distance along the transversal direction Y.

[0098] Similarly, with reference to the longitudinal conveying direction X of the receiving seats S, the first belts 16A are positioned substantially parallel, at a predetermined distance along the transversal direction Y.

[0099] Each group (G1,G2,G3,G4,G5,G6) of seats S comprises a respective connecting body 32, in which the seats S are made and is connected on both sides to the first belts 16A or, alternatively, to the second belts 16B.

[0100] The seat S is shaped in such a way as to house the capsule body 8 with the opening 5 positioned downwards.

[0101] The various stations, respectively the station ST1 for receiving capsule bodies 8, the station ST3 for coupling said sealing rings 10 with the respective capsule bodies 8, the sealing station ST4, are positioned at the first and the second conveyor 14A and 14B, that is to say, they affect areas connected to the conveyors 14A and 14B.

[0102] On the other hand, the etching station ST5 is positioned in a spatial region which does not affect the first and second conveyors 14A and 14B.

[0103] In this way, advantageously, the waste generated during the etching by the etching means 9 does not affect the region of the conveyors 14A and 14B, where the capsule bodies 8 are positioned in the respective seats S, thus increasing overall the cleaning, efficiency and food safety of the apparatus 100.

[0104] In effect, it should be noted that the first loop conveyor 14A and the second loop conveyor 14B are configured in such a way that the path of the first group of seats S and of the second group of seats S is substantially coincident.

[0105] According to another aspect, the feeding device 7 comprises a roller 17 for supporting and unwinding the reel B (as illustrated in FIG. 6).

[0106] The sheet 12 is a sheet generally made of paper material.

[0107] It should be noted that the feeding device 7 is configured to unwind the reel B at a constant speed without stopping, whilst the etching means 11 operate with the sheet stationary.

[0108] In essence, according to the apparatus 100, in a predetermined region 33 corresponding to the etching station ST5, the sheet 12 can be stopped, whilst it is generally unwound continuously from the reel B.

[0109] In this regard, in order to allow operation in this way, the apparatus 100 comprises a compensation zone 30 of variable length along the sheet 12 feeding path.

[0110] In the compensation zone 30, therefore, the sheet 12 has a length along the unwinding path which is variable from a minimum to a maximum: the maximum length is reached when the sheet 12 is stationary at the etching station ST5, to be etched by the etching means 9, and the reel B is simultaneously unwound (its unwinding having caused the elongation in the compensation zone 30).

[0111] FIG. 7 illustrates, on the other hand, auxiliary means 37 for pulling the sheet 12, upstream of the etching station ST5, forming part of the apparatus 100.

[0112] The auxiliary means 37 comprise at least one pair of rollers 37A and 37B.

[0113] Preferably, the auxiliary drive means 37 may be coupled to or uncoupled from the sheet 12.

[0114] The apparatus 100 further comprises main means 42 for driving the sheet 12, illustrated in FIGS. 13 and 14, positioned preferably downstream of the etching station ST5.

[0115] The means 42 for driving the sheet 12 preferably comprise a motor, preferably of the brushless type.

[0116] Moreover, preferably, the apparatus 100 comprises a winding reel, not illustrated, configured to wind the remaining portion of the sheet 12, etched in the etching station ST5, in which the rings 10 have been made.

[0117] According to another aspect, the control unit 13 is configured to rotate the supporting and unwinding roller 17 at a constant and coordinated speed with the handling means 9 of the receiving seats G.

[0118] In effect, the apparatus 100 comprises a drive unit (not illustrated) operatively connected to the supporting roller 17 to allow its rotation, and the control unit 13 is connected to the drive unit.

[0119] According to another aspect, the etching means 11 comprise a shearing device 18, comprising a plurality of cutting elements 19 which can be activated on said sheet 12 for etching it and defining a plurality of shapes defining said sealing rings 10.

[0120] The shearing device 18 is illustrated in FIGS. 8 and 9.

[0121] According to an aspect, said shearing device 18 is configured in such a way that the cutting elements 19 operate in a cutting plane P in a substantially planar portion of said sheet 12.

[0122] It should be noted that the shearing device 18 does not in any way affect the region above the conveyor 14: in this way, the waste and/or dust generated during shearing does not affect the capsules.

[0123] According to an aspect, the shearing device 18 operates on a portion of the sheet 12 stopped (that is to say, under stationary conditions) below the shearing device 18.

[0124] According to another aspect, at the etching station ST5, the apparatus 100 comprises a suction device 46, configured to act on the sheet 12 in such a way as to detach the central portions from the sealing rings 10 etched on the sheet 12.

[0125] According to an embodiment not illustrated, the etching means 11 comprise a pair of rotary etching elements, acting in conjunction with each other to etch the sheet 12 and make the shapes of the sealing rings 10 on it. According to this embodiment, not illustrated, it should be noted that one of said rotary elements is equipped with etching elements defining punches (i.e. "knives") and the other of said rotary elements is provided with cavities, configured to receive said etching elements, defining a die.

[0126] The sheet 12 is interposed between said rotary elements. These rotary units substantially operate the etching of the sheet 12 during their rotation, in a coordinated fashion, that is to say, preferably the sheet 12 is not stopped and the rotary units perform the etching during the pulling of the sheet 12.

[0127] According to another aspect, the apparatus 100 comprises a device 21 for controlling the sealing rings 10 configured for detecting, after the etching, a parameter inherent to a shape and/or a colour and/or a presence/absence of said sealing rings 10 on said sheet 12.

[0128] According to yet another aspect, the apparatus 100 comprises a device 22 for controlling the capsule bodies 8 configured for detecting a parameter inherent to a shape

and/or a colour and/or a presence/absence of the capsule bodies **8** in said receiving seats **S**.

[0129] According to yet another aspect, the apparatus **100** comprises a device **23** for controlling the sealing configured for detecting a parameter inherent to a shape and/or a colour and/or a presence/absence of an assembly defined by the capsule body **8** and the sealing ring **10** sealed to each other, said sealing control device **23** being positioned downstream of the sealing station **ST4**.

[0130] According to yet another aspect, the apparatus **100** comprises a device **44** for controlling the correct coupling of the sealing ring **10** on the capsule body **8**, positioned downstream of, or at, the coupling station **ST3** to check if each sealing ring **10** has been correctly coupled on the relative capsule body.

[0131] Advantageously, the apparatus **100** is particularly efficient in allowing the production of capsules, guaranteeing an optimum cleaning and conditions with a high level of food safety and hygiene.

[0132] With reference to FIG. 5, the apparatus **100** comprises a pickup device **36**, configured for picking up the capsule bodies **8** to which the sealing ring **10** has been applied by the conveyor **14**, more specifically by the seats **S**.

[0133] The pickup device **36** releases the capsules to a subsequent transport line (not illustrated), for the storage and/or packaging.

[0134] According to another aspect, a method is defined for making capsules, comprising the following steps:

[0135] preparing a plurality of capsule bodies **8**, provided with a bottom **2** and side walls **3** defining, in combination, a filling cavity **4** provided with an opening **5** opposite the bottom **2** and a flange **6** positioned to surround said opening **5**;

[0136] arranging said capsule bodies **8** inside groups of receiving seats **S**;

[0137] moving said groups of receiving seats **S** along a feed path, preferably in a closed loop;

[0138] preparing a reel **B** of sheet material (preferably paper) and unwinding said reel **B** to make available a sheet **12**;

[0139] obtaining sealing rings **10** from said sheet **12**;

[0140] coupling in a coupling station **ST3** each sealing ring **10** to the respective capsule body **8** at the respective flange **6**;

[0141] sealing each sealing ring **10** to the body **8** on which it is inserted, and wherein the step of obtaining capsule sealing rings **10** from said sheet **12** includes the sub-step of etching the sheet **12** by creating pre-cutting lines **33** along edges of said sealing rings **10**, so that a central portion of the sealing rings **10** having a discoidal shape is detached from the etched sheet **12**, while the sealing rings **10** remain anchored to the sheet **12** by means of anchor points present in the pre-cutting lines **33**.

[0142] The step of coupling in a coupling station **ST3** each sealing ring **10** to the respective capsule body **8** is preceded by a step of detaching from the sheet **12** the sealing rings **10** which had been etched on the sheet **12**.

[0143] The sub-step of etching the sheet **12** is performed in an etching **ST5** far from and separate from the coupling station **ST3**, where the step of detaching the sealing rings **10** from the sheet **12** is performed.

[0144] According to another aspect, the step of positioning the capsule bodies **8** inside groups of receiving seats **S**

comprises a step of positioning a first portion of said capsule bodies **8** inside first groups (**G1,G2,G3**) of receiving seats and a second portion of said capsule bodies **8** inside second groups (**G4,G5,G6**) of receiving seats.

[0145] Moreover, the step of moving the groups of receiving seats **S** along the feeding path comprises a step of handling independently said first groups (**G1,G2,G3**) of receiving seats relative to the second groups (**G4,G5,G6**) of receiving seats **S**.

[0146] According to another aspect, the step of moving said groups of receiving seats **S** along the feeding path is performed with a step-by-step movement.

[0147] In other words, the step-by-step handling presupposes, over time, stoppages of the groups (**G1,G2,G3,G4,G5,G6**) of seats **S** at the different stations or processing devices, to allow simultaneous processing on different groups of capsule bodies **8**. Generally speaking, during the stoppages, processing or activities are performed on capsule bodies **8** which are stationary at different stations/regions.

[0148] According to another aspect, the step of moving said groups of receiving seats **S** along the feeding path comprises the following steps, in the following time sequence, which is repeated cyclically:

[0149] moving said first groups (**G1,G2,G3**) of receiving seats **S** closer to the second groups (**G4,G5,G6**) of receiving seats **S**; then

[0150] moving at the same time said first groups (**G1,G2,G3**) of receiving seats **S** and said second groups (**G4,G5,G6**) of receiving seats **S**; then

[0151] moving said second groups (**G4,G5,G6**) of receiving seats **S** away from the first groups (**G1,G2,G3**) of receiving seats **S**.

[0152] It should be noted that, preferably, the step of simultaneously moving said first groups (**G1,G2,G3**) of receiving seats **S** and said second groups (**G4,G5,G6**) of receiving seats **S** comprises an  $n$  number of steps, whilst the step of moving the first groups (**G1,G2,G3**) of receiving seats **S** towards the second groups (**G4,G5,G6**) of receiving seats **S** comprises an  $m$  number of steps. According to an aspect,  $n > 1$   $m > 1$  and  $m > n$ .

[0153] According to this aspect, during the movement of the first groups (**G1,G2,G3**) of receiving seats **S** towards the second groups (**G4,G5,G6**) of receiving seats **S**, a portion of the second groups (**G4,G5,G6**) of receiving seats **S** is kept at the sealing station **ST4**. According to another aspect, the step of moving said first groups (**G1,G2,G3**) of receiving seats closer to the second groups of receiving seats **S** is performed by keeping said second groups (**G4,G5,G6**) of receiving seats in a fixed position, and the step of moving said second groups (**G4,G5,G6**) of receiving seats **S** away from the first groups (**G1,G2,G3**) of receiving seats **S** is performed by keeping said first groups (**G1,G2,G3**) of receiving seats **S** in a fixed position.

[0154] According to a yet further aspect, the step of etching said sheet **12** to determine sealing rings **10** occurs with the sheet **12** in a stoppage position, whilst the reel **B** continues to unwind (without stopping).

[0155] According to another aspect, the step of unwinding said reel **B** occurs at a constant speed.

[0156] According to a further aspect, the step of etching said sheet **12** to determine sealing rings **10** defined on said sheet **12** with pre-cutting lines **33** comprises a step of

shearing said sheet 12 using a plurality of shearing elements 19 for defining, on said reel B, a corresponding plurality of shapes of sealing rings 10.

[0157] Further, according to another aspect, during the step of cutting the shapes of the sealing rings 10 from the sheet 12, the shearing elements 19 operate in a cutting plane P on a portion of the sheet 12 of said substantially planar reel B.

[0158] According to another aspect, the step of detaching said sealing rings 10 from the sheet 12 comprises a step of sucking the sealing rings 10, in such a way as to detach the sealing rings 10 etched in the reel B.

[0159] According to another aspect, the method further comprises a step of controlling the sealing rings 10, wherein a parameter inherent to a shape and/or a colour of said sealing rings 10 is detected.

[0160] Further, the method comprises a step of controlling said capsule bodies 8, wherein a parameter inherent to a shape and/or a colour of the capsule bodies 8 is detected.

[0161] According to another aspect, the method further comprises a step of controlling the sealing, wherein a shape and/or colour parameter of an assembly defined by the capsule bodies 8 and sealing rings 10 sealed to each other is detected.

[0162] According to another aspect, the step of coupling the sealing ring 10 to the capsule body 8 is performed by mutually moving the sealing ring 10 and the capsule body 8 along a vertical direction (more specifically, the capsule body 8 is kept in a predetermined vertical position whilst the sealing ring 10 is moved vertically).

[0163] It should be noted that the step of positioning said capsule bodies 8 inside groups of receiving seats S is performed by placing inside the seats S the capsule bodies 8 resting, respectively, with the flanges 6 below and the bottoms 2 at the top.

[0164] Advantageously, the proposed method for making capsules is particularly simple, and effective in terms of cleanliness and food safety.

1. An apparatus for making capsules, comprising:

- a receiving station for receiving capsule bodies having a bottom and side walls defining, in combination, a filling cavity provided with an opening opposite the bottom and a flange surrounding said opening,
- a forming station for making sealing rings comprising a device for feeding a sheet unwound from a reel;
- a coupling station for coupling said sealing rings with respective capsule bodies, configured to couple each sealing ring to a capsule body at the respective flange;
- a welding station configured to weld said rings to respective capsule bodies;
- a plurality of groups of receiving seats for receiving said capsule bodies and handling means of said groups of seats for receiving, configured to allow a handling of the capsule bodies between the station for receiving capsule bodies, the station for coupling said rings with the respective capsule bodies, the welding station,

the apparatus being characterized in that it further comprises etching means configured to etch the sheet forming pre-cutting lines along the edges of said sealing rings, so that a central portion of the sealing rings is detached from the etched sheet, while the sealing rings remain anchored to the sheet by means of anchor points spaced by the pre-cutting lines, and by further comprising a plurality of detaching elements configured to detach from the sheet the sealing

rings that had been etched onto the sheet and bring them into contact with the flange at the coupling station, the etching means operating at an etching station remote and separate from the coupling station.

2. Apparatus according to claim 1, wherein said groups of receiving seats comprise first groups of receiving seats and second groups of receiving seats, and wherein the handling means of said groups of receiving seats comprise first handling means operating said first groups of receiving seats, and second handling means operating said second groups of receiving seats, said first and second handling means (9A,9B) being independent from each other, in order to allow an independent movement of respectively said first groups and second groups of receiving seats.

3. Apparatus according to claim 2, further comprising a control unit configured to control said first and second handling means so as to allow a movement of the receiving seats in accordance with the following cyclically repeating sequence:

- a first phase of motion, wherein said first handling means are active while said second handling means are inactive, so as to move said first groups of seats closer to the second groups of seats; followed by
- a second phase of motion, wherein said first handling means are active and said second handling means are simultaneously active, so as to move said first groups and second groups of seats simultaneously; followed by
- a third motion phase, wherein said second handling means are active while said first handling means are inactive, so as to move said second groups of seats away from said first groups of seats.

4. Apparatus according to claim 2, wherein said first handling means comprise a first loop conveyor, configured to define a first handling closed-loop path for the first groups of receiving seats and wherein said second handling means comprise a second loop conveyor, configured to define a second handling closed loop path for the second groups of receiving seats said first and second loops being preferably parallel.

5. Apparatus according to claim 4, wherein said first conveyor comprises first belts developing along a loop and driven by the first drive, said first groups of receiving seats being connected to the first belts to move with them, and wherein said second conveyor comprises second belts developing along a loop and driven by a second drive, said second groups of receiving seats being connected to the second belts to move with them, the first and the second belts being arranged side by side.

6. Apparatus according to claim 1, wherein the feeding device comprises a supporting roller for supporting and unwinding the reel, said feeding device being configured to unwind the reel at a constant speed, while the etching means operate with the sheet at a standstill.

7. Apparatus according to claim 1, wherein the etching means comprise a shear which comprises a plurality of cutting elements operable on said sheet for etching it and defining a plurality of said sealing rings.

8. Apparatus according to claim 1, wherein the apparatus comprises a suction device configured to act on the sheet to detach the central portions from the sealing rings etched on the sheet.

9. A method for making capsules, comprising the following steps:

providing a plurality of capsule bodies having a bottom and side walls defining, in combination, a filling cavity provided with an opening opposite the bottom and a flange arranged to surround said opening;  
 arranging said capsule bodies inside groups of receiving seats;  
 moving said groups of receiving seats along an advancement path, preferably in a closed loop;  
 providing a reel and unwinding said reel to make available a sheet;  
 obtaining sealing rings from said sheet;  
 coupling in a coupling station each sealing ring to the respective capsule body at the respective flange;  
 welding each sealing ring to the body to which it is coupled, wherein the step of obtaining capsule sealing rings from said sheet includes the sub-step of etching the sheet by creating pre-cutting lines along edges of said sealing rings, so that a central portion of the sealing rings having a discoidal shape is detached from the etched sheet, while the sealing rings remain anchored to the sheet by means of anchor points spaced by the pre-cutting lines,  
 and wherein the step of coupling in a coupling station each sealing ring to the respective capsule body is preceded by a step of detaching from the sheet the sealing rings which had been etched on the sheet, the sub-step of etching the sheet being carried out in an etching station remote and separate from the coupling station.

**10.** Method according to claim 9, wherein the step of arranging said capsule bodies within groups of receiving seats comprises a step of arranging a first portion of said capsule bodies within first groups of receiving seats and a second portion of said capsule bodies within second groups

of receiving seats and wherein the step of moving said groups of receiving seats along the advancement path comprises a step of independently moving said first groups of receiving seats with respect to said second groups of receiving seats.

**11.** Method according to claim 10, wherein the step of moving said groups of receiving seats along the advancement path is carried out stepwise and comprises the following steps, in the following cyclically sequence:

moving said first groups of receiving seats closer to the second groups of receiving seats; then

moving at the same time said first groups of receiving seats and said second groups of receiving seats; then moving said second groups of receiving seats away from the first groups of receiving seats.

**12.** Method according to claim 11, wherein the step of moving said first groups of receiving seats closer to said second groups of receiving seats is performed by keeping said second groups of receiving seats in a fixed position, and the step of moving said second groups of receiving seats away from the first groups of receiving seats is performed by keeping said first groups of receiving seats in a fixed position.

**13.** A method according to claim 9, wherein the step of etching said sheet to form sealing rings on said sheet comprises a step of blanking said sheet by means of a plurality of cutting elements to define, on said sheet, a plurality of said sealing rings.

**14.** A method according to claim 9, wherein the step of detaching said sealing rings from said sheet comprises a step of suctioning said sealing rings, so as to detach said sealing rings from the sheet.

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