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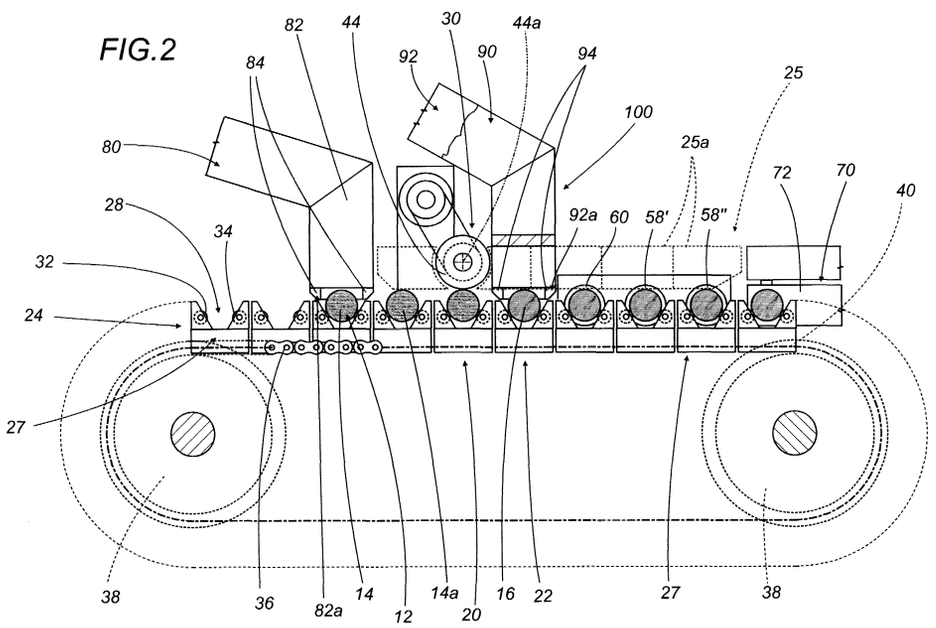
(54) Apparatus and Method for the Production of Stoppers

(57) In an apparatus for producing cork stoppers (12) or the like, in which the stoppers have a substantially cylindrical central portion (14) having a longitudinal axis (X) and in which at least a disk element (16, 18) is joined to a corresponding end (14a, 14b) of the central portion (14), to join the disk element (16, 18) to the central portion (14), the central portion (14) itself is positioned with the longitudinal axis (X) oriented substantially horizontal. An apparatus for the production of the aforesaid cork stoppers (12) comprises a station (20) for distributing glue on at least an end (14a, 14b) of the central portion (14) of the stopper (12); a station (22) for applying at least a disk element (16, 18) to the end (14a, 14b) and means (24) for conveying the central portion (14) between the glue distribution station (20) and the station (22) for applying the disk element (16, 18). In the apparatus, the conveying means (24) maintain the longitudinal axis (X) of the central portion (14) oriented substantially horizontal.

FIG.2



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Description

[0001] The present invention relates to an apparatus and a method for the production of composite stoppers made of cork or the like.

[0002] It is well known that in the field of cork stoppers, to limit the consumption of natural cork, stoppers are used which are constituted by a central body made of recycled granulated cork, at whose ends are applied discoidal plates made of natural cork.

[0003] To obtain the aforesaid type of stoppers, a first known technique consists of gluing the plates to the central body using a casein-based cold glue.

[0004] According to this method, the glue is sprayed from below towards the lower end of the central body, which is held vertical and then positioned over a first plate.

[0005] The glue is then sprayed towards the lower end of a second plate which is then applied to the upper end of the central body.

[0006] Another type of glue that can be used in said method is polyurethane glue in aqueous solution which, however, is not suitable for gluing elements that may come in contact with food products, since it can release toxic substances, if it has not completed the reticulation phase.

[0007] In the devices that employ these types of cold glue, ovens are provided to ensure the setting of the glue and thus fasten the plates to the cylindrical central body.

[0008] The solution described above therefore entails the use of a cork production plant of considerable size and consequent bulk, also due to the need to use appropriate ovens to assure the setting of the glue.

[0009] A second known technique consists of employing hot glue (known as "hot melt"): the method provides for spraying the glue from the top onto the upper surface of a first plate, then applying the central body held in the vertical position, spraying the glue from the top onto the upper end of the central body and applying the second plate.

[0010] In a first type of known apparatus that allows to implement the aforesaid methods, the stopper is actuated by means of pincers positioned on a circular structure. The stopper is kept vertical and moved from a position for dispensing the glue to a station for applying the plates, thanks to the rotation of the circular structure.

[0011] In a second known type of apparatus, described in European patent application EP 927 613, a plate is positioned on a conveyor belt, hot glue is sprayed from above onto the upper surface of the plate and then the cylindrical body is applied.

[0012] In both aforesaid devices, in particular because of the vertical disposition of the cylindrical central body, it is not possible simultaneously to apply the plates onto both sides of the central body without considerably complicating the apparatus.

[0013] Moreover, the glue is simply sprayed onto the plate or onto the ends of the central body and therefore does not uniformly cover the surface onto which it is applied.

[0014] The machine described in this prior document EP 927 613 also provides for compressing the plate and the central body against the central body in a substantially continuous manner, i.e. with a single constant compression action that has to be maintained for a predefined time, such as to allow said glue to set.

[0015] Known machines for the preparation of said composite stoppers, therefore, are rather long and bulky.

[0016] Moreover, known machines have a structure and a configuration that make it poorly suitable for obtaining composite stoppers of different types.

[0017] According to an aspect of the present invention, an apparatus is provided for the production of stoppers made of cork or the like, in which said stoppers are composed of a main cylindrical body with a longitudinal axis and at least an end face extending transversely relative to said longitudinal body and of at least a discoidal element that is joined to said cylindrical body associating a respective transverse face of said discoidal element to said transverse face of said main body, the apparatus comprises: a supporting frame; means for supporting and advancing said stoppers being formed; means for placing glue or adhesive material between said transverse face joining the discoidal element to said transverse connection face of the cylindrical body; means able to place said transverse connection face of the discoidal body and said transverse connection plate of the cylindrical body in mutual contact with each other; the apparatus is characterised in that said means for supporting and advancing stoppers being formed are able to support and advance said cylindrical body with their longitudinal axis that is positioned substantially horizontal.

[0018] The present configuration allows to obtain an apparatus structure that has an extremely reduced length and is such as to provide high quality corks.

[0019] The present invention is also directed to a method for the production of said stoppers and to the use of a polyurethane glue with a single component for the production of cork stoppers or the like.

[0020] The other claims cover other advantageous aspects of the present invention.

[0021] The invention, in its technical characteristics and in its different advantageous aspects, shall become more readily apparent from the detailed description that follows, made with reference to the accompanying drawings, which show an embodiment provided purely by way of example, in which:

- Figure 1A shows an exploded perspective view of a first preferred embodiment of a stopper obtainable by means of the apparatus according to the present invention;
- Figure 1B shows an exploded perspective view of said first preferred embodiment of a stopper in as-

sembled condition;

- Figure 1C shows an exploded perspective view of a second preferred embodiment of a stopper, in particular for sparkling wines or the like, obtainable by means of the apparatus of the present invention;
- Figure 2 shows a schematic lateral view of a first preferred embodiment of an apparatus according to the present invention;
- Figure 3A shows a schematic top view of an element for supporting the central portion of the stopper used in the conveying and advancing means of the first embodiment of the present invention;
- Figure 3B shows a schematic lateral view of the support element of Figure 3A;
- Figure 4 shows a schematic top view of the first preferred embodiment of the apparatus according to the present invention;
- Figure 5 shows a schematic lateral view of a detail of the station for distributing the glue showing the element for dispensing and spreading the glue in contact with the corresponding transverse face of the central portion of the stopper;
- Figure 6 shows a schematic front view of the front part of a preferred embodiment of the element for dispensing and spreading the glue;
- Figure 7 shows a schematic longitudinal section view of a second preferred embodiment of an apparatus for the production of composite stoppers according to the present invention;
- Figure 8A shows a schematic top view depicting the work plane of the second preferred embodiment of apparatus;
- Figure 8B shows a top schematic view, showing the means for driving the carriage of the means for longitudinally advancing the stopper of said second preferred embodiment of apparatus;
- Figure 9A shows a cross section schematic view relating to the area of application of the glue in accordance with the second preferred embodiment of the present apparatus;
- Figure 9B shows a top view of a detail relating to the spreading end of the gun for dispensing the glue;
- Figure 10 shows a schematic cross section view relating to the area of application of the cork disks to the cylindrical main body of the stopper being formed in accordance with the second preferred embodiment of the present apparatus;
- Figure 11 shows a cross section schematic view relating to the area for the compression of the cork disks against the main cylindrical body of the stopper being formed in accordance with the second preferred embodiment of the present apparatus;
- Figure 12 shows a lateral schematic view of the means for rotating the cylindrical bodies during the application of the glue;
- Figure 13 shows a lateral view showing the control lever for raising and lowering the means for rotating the stoppers of Figure 12;
- Figure 14 shows a top view depicting the components for actuating the support arm of said means for rotating the stoppers;
- Figure 15 shows a schematic view of the means for transmitting the relative motion to the means for advancing and compressing the assembled stoppers;
- Figure 16 shows a top schematic view relating to the work plane of another version of the present second preferred embodiment of an apparatus according to the present invention, this second version being particularly suitable for producing stoppers for bottles of sparkling wine or the like;
- Figure 17 shows a lateral schematic view of the means for rotating the cylindrical bodies of this second embodiment of the apparatus.

[0022] In accordance with the figures of the accompanying drawings, according to the method of the present invention a cork 12 is obtained that is constituted by a substantially cylindrical central portion 14, having a longitudinal axis X and an outer cylindrical surface 14e, in which a respective disk element is joined to a corresponding end face of the central portion 14.

[0023] Figures 1A and 1B show a preferred embodiment of a stopper in which to a first longitudinal end 14a of the central portion 14 is joined a first disk element or plate 16 and to a second longitudinal end 14b is joined a second plate 18.

[0024] According to the present method, to join each plate 16, 18 to the corresponding end 14a, 14b, the central portion 14 is positioned with the longitudinal axis X oriented substantially horizontal.

[0025] The horizontal disposition of the stopper constitutes a stable configuration which, as described farther on, does not need particularly complex retaining means.

[0026] Moreover, this horizontal configuration allows easily to apply the glue on both ends 14a, 14b of the central portion 14.

[0027] Advantageously, the glue used is a polyurethane glue with a single component, heated before its distribution onto the central portion 14 of the stopper 12.

[0028] In particular, a glue or adhesive called "XPU 18217" produced by the company Ato Findley S.A. could be used.

[0029] This glue polymerises extremely fast and, once polymerised, it is not harmful and suitable for use with foods.

[0030] In comparison to the "hot melt" type of hot glue, the single-component polyurethane glue has a higher melting temperature: the "hot melt" glue melts again at 40-50°C, whilst the single-component polyurethane glue reaches its new melting point around 200°C, and thus guarantees, in case of subsequent work processes on the stopper or on the container into which the stopper is inserted that require the attainment of high tempera-

tures, the tightness of the stopper even in such conditions.

[0031] The single-component polyurethane glue in use is a dense glue and therefore its spreading, during the distribution of the glue, onto the application face allows to apply the glue uniformly over the entire surface.

[0032] In accordance with an advantageous aspect of the method according to the present invention, the glue is distributed simultaneously on both ends 14a, 14b of the central portion 14 of the stopper 12 and subsequently each end 14a, 14b of the central portion 14 is simultaneously joined with a corresponding plate 16, 18.

[0033] In particular, each plate 16, 18 is picked up by suction in a position that is longitudinally distanced relative to the central portion 14 of the stopper 12, then is brought in contact and joined to the central portion 14, in correspondence with its transverse face 14a, 14b.

[0034] Subsequently, each plate 16, 18 is fastened to the central portion 14 performing a succession or series of compressions on the ends of the stopper 12 itself, each followed by a rest phase, in which no compression action is provided.

[0035] If it is necessary to cool the glue, for instance to increase its density after the application of the plates 16, 18, a cooling phase can be provided, for instance with air, simultaneously with the compression phase.

[0036] A first preferred embodiment of apparatus according to the present invention is shown in Figure 2.

[0037] This first embodiment of apparatus essentially comprises means 24 for supporting and advancing the stopper being formed, a station 20 for distributing the glue on the ends 14a, 14b of the central portion 14 of the stopper 12, and a station 22 for applying at least a plate 16, 18 to the corresponding end 14a, 14b.

[0038] As provided in this first preferred embodiment of apparatus, in accordance with a first advantageous aspect of the present invention, the means 24 for conveying the stopper being formed, or at least of the central portion or main body 14 of said stopper, are such as to maintain the longitudinal axis X of the central portion 14 oriented substantially horizontal.

[0039] In the embodiment of Figure 2, the conveying means 24 are constituted by a plurality of elements or cradles 27, supporting the central portion 14 of the stopper 12, positioned on a chain 36 driven on vertically set wheels 38, in such a way as to have a return segment below the line of advance 40 of the conveying means 24.

[0040] The aforesaid disposition of the supporting and advancing means 24 allows to reduce bulk relative to the circular structure provided with pincers employed in known devices.

[0041] As can be observed also with reference to the subsequent Figures 3A and 3B, each cradle support element 27 has a seat 28 which is opened in correspondence with the lateral surfaces to allow the extension outside the ends 14a, 14b of the central portion 14 of the stopper 12.

[0042] These lateral openings of the seat 28 allow to distribute the glue simultaneously on both ends 14a, 14b, when the central portion 14 is in correspondence with the station 20 for distributing the glue.

[0043] The cradles 27, actuated by the chain 36, pick up the central portion 14 of the stopper 12 from a feeding line 80 and transfer it to the glue distribution station 20.

[0044] The feeding line 80 of the central portions 14 is constituted by a channel 82 with outlet section 82a having substantially vertical axis and provided, at least in correspondence with the outlet section 82a, with guides 84 for positioning the central portion 14 of the stopper 12 on the cradles 27 themselves.

[0045] The glue distribution station 20 comprises means 30 for rotating the central portion 14 about its own longitudinal axis X.

[0046] In the embodiment shown in Figure 2, these means 30 able to cause the rotation of the central portion 14 are constituted by a motorised rubber wheel 44 having its axis 44a parallel to the longitudinal axis X of the central portion 14.

[0047] As shown in Figures 3A and 3B, to facilitate the rotation of the central portion 14 about its own axis X, the central portion 14 itself is supported by a first 32 and a second 34 bearing rollers, housed free to rotate within the seat 28 relative to the central portion 14.

[0048] The rollers 32, 34 have their axis parallel to the axis X of the central portion and are housed in cavities 33 obtained in the inner part 35 of the walls 37, 39 of the cradle 27 that are parallel to the axis X itself. The inner part 35 of the walls 37, 39 is inclined towards the central part of the cradle 27, in order to form an obtuse angle α with the horizontal bottom 27a of the cradle 27.

[0049] The rollers 32, 34 project from the cavities 33 of the walls 37, 39 in such a way as to constitute the bearing of the central portion 14.

[0050] An additional embodiment can provide, instead of a first and a second roller, a first and a second pair of small rollers, coaxial and housed in respective cavities of the walls 37, 39.

[0051] Again in reference to Figure 2, the central portion 14 is conveyed by the cradle 27 in correspondence with the outlet section of a line 90 for feeding the plates 16, 18, positioned downstream of the glue distribution station 20.

[0052] The line 90 for feeding the plates 16, 18 is constituted by two channels 92 with outlet section 92a having substantially vertical axis, positioned in correspondence with each end 14a, 14b of the central portion 14 of the stopper 12.

[0053] Each channel 92 is provided, in correspondence with the outlet section 92a, with a guide 94 for positioning the plate 16, 18 on a cradle seat 54' in a position suited for being joined to the corresponding end 14a, 14b of the central portion 14.

[0054] Moreover, depending on the rate of advance of the supporting cradles, in correspondence with the outlet section 92a of each channel 92, an element 100 can be provided for thrusting the plate 16, 18 in the di-

rection of the central portion 14 of the stopper 12, in order to accelerate the fall of the plate itself.

[0055] In the embodiment of Figure 2, the apparatus has a bar 25, positioned above and parallel to the line of advance 40 to keep the stoppers 12 in the cradles 27. The bar 25 is constituted by a plurality of segments 25a, fixed or provided with elastic connection, arranged in succession, and extends from the channel 82 for feeding the central portions 14 to a line 70 for actuating and pressing the stopper 12 inserted in the fastening station 56, being interrupted in correspondence with the motorised rubber wheel 44 in the glue distribution station 20.

[0056] The advance of the stoppers according to the present first embodiment of apparatus is performed in steps. In practice, advancing phases alternate with stopped phases, during which the operations of applying the glue and applying the plates are performed. During the advancing phases, the means for applying the glue and applying the plate are distanced from the cylindrical body in order to allow said stoppers to advance without hindrances.

[0057] Figure 4 particularly highlights, in addition to the aforementioned glue distribution station 20 and plate application station 22, also means for compressing or fastening the plates to the cylindrical body 14.

[0058] These compression means comprise first compression means 56 suitable for providing a strong compression action that prolongs for a limited time, followed by a rest phase. This compression phase is applied to the plates for a duration equal to the duration of the stopped phase in the advance of said stoppers.

[0059] As the aforesaid Figure 4 shows, the glue distribution station 20 comprises a first and second element 42, 43 for dispensing the glue, each having an end 42a, 43a positioned in proximity with a corresponding transverse face 14a, 14b of the central portion 14, in order to distribute the glue simultaneously on both transverse faces 14a, 14b.

[0060] To maintain the ends 42a, 43a in contact with the central portion 14, at least one of the dispensing elements 42, 43 is positioned on a carriage connected to an elastic element. The movable dispensing element 42, 43 is therefore located in a position of interference with the cradle 27 and is displaced thereby, whilst still remaining in contact with the end 14a, 14b of the central portion 14 thanks to the elastic element.

[0061] An additional solution can be provided in which both dispensing elements 42, 43 are movable by means of elastic connection.

[0062] Figure 4 shows, downstream of the glue distribution station 20, the station 22 for applying the plates 16, 18.

[0063] The station 22 for applying the plates 16, 18 comprises, for each end 14a, 14b of the central portion 14, an apparatus 52 for aspirating and positioning the plates 16, 18.

[0064] In the first illustrated embodiment, the aspirating and positioning apparatus 52 is constituted by a first piston 54 having its axis 54a substantially parallel to the longitudinal axis X of the central portion 14, movable from a distanced position to a position in contact with the central portion 14 of the stopper 12 and having a planar end 54b provided with aspiration holes to pick up the plate 16, 18 from the cradle seat 54' and position it in correspondence with the end 14a, 14b of the central portion 14.

[0065] Downstream of the station 22 for applying the plates 16, 18, the apparatus of the present invention is provided with a station 56 for fastening the plates 16, 18 to the central portion 14 of the stopper 12.

[0066] In the embodiment of Figure 4, the fastening station 56 comprises a compression element 58 acting on the plate 16, 18, movable from a distanced position to a position in contact with the plate 16, 18 itself by means of a second piston 60 substantially parallel to the first piston 54 for aspirating and positioning the plate 16, 18.

[0067] The compression element 58 can be provided with a channel 59 for cooling the stopper 12, or the applied hot glue, for instance through the conveyance of air - through respective holes provided in the surface of the compression element 58 that contacts the stopper - against the corresponding porous plate.

[0068] As shown in Figure 4, additional compression elements 58', 58" are provided, positioned in succession on a plate 61 actuated by the same second piston 60. In practice each plate undergoes three successive compression and relaxation phases, on the occasion of the advancing phases of the stoppers. This first fastening action allows an effective adhesion of the plates 16, 18 to the cylindrical body 14.

[0069] The compression and fastening means further comprise second means 70 for the continuous compression and actuation of the stopper 12, which are positioned downstream of the compression elements 58, 58', 58".

[0070] The actuation and pressing line 70 comprises a pair of vertical belts 72 wound on pulleys 74 positioned on corresponding support planes 75 and connected to a motor 76 by means of corresponding bevel gears 76a, 76b. The belt 72 exert a lateral pressure against the plate 16, 18 in order to keep contact with the stopper 12 and thereby end the fastening phase.

[0071] The actuation and pressing line 70 further comprises an element 77 for adjusting the distance between the support planes 75 constituted, in the embodiment of Figure 4, by a hand wheel 78 acting on a pivot pin 79 connecting the planes 75 themselves. The pivot pin 70 has two adjacent portions, each connected to the respective plane 75, having opposite threads: in this way, by rotating the hand wheel, it is possible to move the support planes 75, and hence the belts 72, mutually closer or farther away, thereby adapting the belts 72 to the size of the stopper 12.

[0072] Figures 5 and 6 show a detail of the end 42a, 43a of the dispensing element 42, 43 positioned in the

glue distribution station 20.

[0073] The end 42a, positioned in proximity to the central portion 14, has a slit 46 for dispensing the glue and a profile provided with a plurality of teeth 50 with rectangular cross section to favour the distribution of the glue itself.

[0074] Relative to the prior art, therefore, this element is able to spread, and not simply to spray, the glue onto the end 14a, 14b of the central portion 14 of the stopper 12.

[0075] Moreover, as Figure 5 shows, the axis of the glue dispensing element is offset, in particular superiorly, relative to axis X of the cylindrical central portion 14, in order to allow a better distribution over the entire surface.

[0076] The method and the apparatus according to the present invention thus allow easily to join the plates to the central portion of the stopper.

[0077] The longitudinal axis of the central portion kept horizontal allows to obtain a stable configuration of the cylindrical body and thus easily to convey it and actuate it.

[0078] It is not necessary to use pincers to support the stopper, because the horizontal configuration allows for easier conveyance, at the limit by means of a simple conveyor belt.

[0079] Moreover, the horizontal configuration allows to rotate the stopper about its axis with no need to complicate the plant.

[0080] The rotation of the stopper allows a uniform application of the glue, and in particular of the single-component polyurethane glue which, being particularly dense, needs to be spread onto the surface - and not just sprayed - to guarantee an optimal grip. The present first embodiment of an apparatus according to the present invention also allows to apply the plates simultaneously from both sides of the cylindrical central portion, whilst limiting the complexity of the plant.

[0081] Figures 7 through 17 show a second preferred embodiment 100 of an apparatus for producing stoppers 12 made of cork or the like, according to the present invention.

[0082] This second preferred embodiment 100 of apparatus, in a first version illustrated in Figures 7 through 15, is particularly suitable for obtaining composite stoppers 12 that are composed, as shown in Figures 1A and 1B, by a main cylindrical body 14, having a longitudinal axis X, and at least an end face 14a extending transversely relative to said longitudinal axis X and by at least a discoidal element 16 that is joined to said cylindrical body 14, associating a respective transverse face 16a of said discoidal element 16 to said transverse face 14a of said main body 14, as well as by a second discoidal element 18 having a face 18a to be associated with a transverse face 14b of said cylindrical body 14, which is longitudinally opposite said first face 14a for the first discoidal element.

[0083] As shown in said Figures 7 and 8A, the present second embodiment of apparatus 100 comprises a support frame, globally indicated with the reference I. The frame further comprises a horizontal plane IP, which separates the upper area for treating the product from the underlying area, which houses the means for actuating the operative devices for treating the product.

[0084] The present embodiment of apparatus thus comprises means 124 for supporting and advancing said stoppers being formed, which are able to support and advance said cylindrical bodies 14 with its own longitudinal axis X that is positioned substantially horizontal. This arrangement is particularly advantageous. It allows, among other things, to operate simultaneously on both sides of the stopper. In this way, a greater rapidity is obtained in the preparation of said stoppers, as well as a particularly reduced length of the apparatus relative to similar known machines in this field.

[0085] It should also be noted that the present apparatus configuration is easily modifiable, allowing a rapid and easy setting of a machine that is suitable for producing composite stoppers for sparkling wine bottles of the kind shown in Figure 1C, as shall be better described farther on.

[0086] According to an aspect of the present apparatus, the means for supporting and advancing the stoppers being formed are such as to advance said stoppers being formed in steps, with alternating advancement motion, presenting advancing phases followed by phases in which the stoppers being formed are stopped, on the occasion of which the various operative phases for forming the stopper are carried out.

[0087] In Figure 8A, the reference IF in particular indicates a longitudinal slit of said plane IP, which allows the means for supporting and advancing the stoppers being formed from extending in correspondence with the actual work areas on said stoppers.

[0088] As shown especially in the aforesaid Figure 7, the supporting and advancing means comprise first longitudinally fixed support and advance means 127a, able to support said cylindrical bodies 14 during the stopped phases, and second support means 127b, which are movable longitudinally in alternative fashion, forward and backward, and which cause said cylindrical bodies 14 to advance by steps of predefined length.

[0089] Each of said support and advance means retains the respective stopper being formed in a respective seat 128 for supporting the cylindrical bodies 14, which has appropriate longitudinal retention means 129a, 129b for the corresponding cylindrical body 14 and which is laterally opened, to allow the execution of the operations for readying corresponding longitudinal ends of the stopper 12.

[0090] As shown in particular in Figure 12, said seat 128 comprises a semi-circular bearing surface 129 for the lower part of the peripheral surface of the cylindrical body 14 of the stopper being formed and is superiorly opened to allow the introduction of the cylindrical body 14 into the seat 128, in the initial phase of forming the

stopper by the present apparatus.

[0091] Each seat 128 has, in correspondence with the longitudinal ends thereof, respective upwardly projecting portions 129a, 129b that are able to define said longitudinal retention means for the corresponding cylindrical body 14 of the stopper being formed.

[0092] As said Figure 7 shows, said first and said second supporting means 127a, 127b comprise respective pluralities of seats 128 for receiving and supporting said cylindrical bodies 14 or stoppers 12.

[0093] These first and second support means 127a, 127b are, in particular, in the form of longitudinally elongated elements, which are shaped superiorly in such a way as to define said seats 128 for supporting the stopper, each achieving a sort of comb configuration with upwardly oriented tines.

[0094] In particular, as Figure 9A shows, said first and second support means 127a, 127b are composed by respective first and second plates 127'a, 127'a; 127'b, 127'b, which are oriented vertically and transversely distanced from each other and shaped or contoured superiorly in such a way as to define together the respective seats 128 for receiving the cylindrical bodies 14.

[0095] In particular, as preferably shown in Figure 9A, the vertical plates 127'a, 127'a defining the support seats 128 of the stoppers 12 of the first support means 127a are positioned between the vertical plates 127'b, 127'b, which define the seats 128 for housing the stoppers of said second support and advance means 127b. The support and advance means obtained are particular simple to build and require no particular maintenance operations.

[0096] Said first and said second means for supporting and advancing the bodies being formed 127a, 127b are alternatively movable vertically between a raised position for retaining the cylindrical bodies 14 and a lowered position for releasing the cylindrical bodies 14, in such a way as to allow said cylindrical bodies 14 to be passed to the other of said first 127a and said second 127b support means. Said second means for supporting and advancing the bodies being formed 127a, 127b are, moreover, alternatively movable horizontally between a rear position, for picking up the stoppers being formed, and an advanced position, for releasing the stoppers being formed in correspondence with subsequent operative positions.

[0097] In practice, during the working phases, the stoppers being formed are held on said first support means 127a in raised position. Once the individual operations for forming the stoppers are completed, the first supporting means 127a are lowered and deliver the stoppers being formed to said second support means 127b, which, in turn, moved to the raised position. Once said second support and advance means pick up the stoppers being formed, they advance the aforesaid stoppers by a predefined step. Once this new advanced position is reached, the second support means 127b move downwards whilst said first support means 127a move upwards and again receive said stoppers 12 to allow the execution of an additional operation thereon. The movement of said second support means, in lowered condition, continuous with the backwards returning phase, until reaching a rear position, wherefrom they will start again to carry out a new cycle of picking up, advancing and transferring said stoppers to said first means 127a. In this way, the stoppers 12 are moved progressively forward by steps of predefined length between a work station and the subsequent one.

[0098] In a preferred manner, said support and advance means 127a, 127b of the stoppers being formed cover an advance step that is twice the distance between a stopper and the next one, so that, as shall be clarified better farther on, in each station two stoppers at the time are worked, increasing the production rate or, with the same feeding rate, allowing for reduced stress and wear of the components of the machine.

[0099] As previously stated, said first support means 127a therefore comprise a longitudinally elongated element 127'a, 127'a, shaped in such a way as to define a respective aligned row of seats 128 for said stoppers 12.

[0100] In the raised position said support means define the reference level or plane of the present apparatus.

[0101] As shown in particular in Figure 7, this first elongated element 127a is supported by a frame T extending below the seat bodies 127'a, 127'a, or below the working plane or area of the stopper being formed.

[0102] As shown in Figure 7, means are provided that allow vertically to move said first elongated element 127a. Said means able to move said element 127a vertically comprise appropriate guiding means, which comprise respective guiding elements 127c, integral with the frame I, whereon slide respective bushes 127d that are integral with the frame T, which supports the elongated element 127a.

[0103] As Figures 7 and 10 show, appropriate means are provided able to move, alternatively, upwards and downwards said first support element 127a. These actuation means comprise a tie rod 127'd that has an end 127e connected to said elongated crew 127'a, 127'a, and whose other end 127f is appropriately connected to the vertical actuation cam means.

[0104] As shown in Figure 10, the tie rod 127'd is vertically guided inside the hollow internal part of the corresponding element 127c, which is fastened to the frame of the apparatus and guides, with its outer part, a corresponding bush 127d of the frame T bearing the first support means 127a.

[0105] As said Figure 10 shows, the aforementioned cam means, which move the tie rod 127'd, comprise a triangular lever 127g having an end pivotally engaged, in 127h, to a longitudinal shaft A', fastened to the frame, and has a second end 127s, which is hinged with an end of a lower arm BC. The third end of the lever 127g bears a cam-following roller 127i that runs on the command profile of a cam 1271 borne and made to rotate by a

corresponding shaft A commanded in rotation by the actuating motor M of the apparatus (shown in Figure 7). As shown in Figure 7 and in Figure 10, a spar, indicated with the reference LO, connects said arm BC to the end 127f of a first and of a second tie rod 127'd and allows the simultaneous actuation thereof.

[0106] As the aforesaid Figures 7 clearly shows, the aforementioned second means 127b for supporting and advancing the stoppers being formed comprise a longitudinally elongated element 127'b, 127'b, which is shaped in such a way as to define a respective aligned row of seats 128 for said stoppers 12, and means able to move horizontally said elongated element 127'b, 127'b.

[0107] These means able to move said elongated element 127'b, 127'b horizontally advantageously comprise a carriage CA, movable longitudinally and extending integral with and underlying said seat bodies 127'b, 127'b, and means for horizontally guiding said carriage CA, which are constituted by horizontal sliding rods 129', whereof one is shown in Figure 7.

[0108] As clearly shown with reference to Figures 8B and 10, said means able to move said carriage CA horizontally comprise a connecting rod 129a having an end connected to said carriage CA and the other end connected to a lever 129b oscillating in a horizontal plane, which is mounted on a contoured shaft 129c, moved in angular oscillation by a roller 129d integral with the lower end of the contoured shaft 129c and is able to slide on an appropriate cam borne on a wheel 129e (see Figure 7) integral and set in rotation by said main actuating shaft A of the machine. Said means for actuating said carriage A forward and backward, with the exception of the cam 129e, are not shown in Figure 7.

[0109] As said Figures 7 and 9A shown, means able to move said elongated element 127'b, 127'b vertically are further provided, which comprise vertical guidance means - constituted by respective vertical rods 127'c supporting said horizontal guides 129' of the carriage CA, which vertical rods slide inside bushes B' integral with the frame I of the apparatus - and means able alternatively to move, upward and downward, said vertical support rods 127'c.

[0110] As shown in particular in Figure 9A, said means for actuating the vertical support rods 127'c comprise an articulated tie rod P, which has an end 127'e and is connected to said vertical rods 127'c supporting said horizontal guides 129' of the carriage CA and another end 127'f is connected to the cam means for commanding the vertical motion.

[0111] Said cam means comprise a lever 127'g having its articulation pivot pin pivotally engaged, in 127'h, to the shaft A' fastened to the frame and having an end pivotally connected with said end 127'f of the strut P.

[0112] A second lever 127"g bears a cam-following roller 127'i that travels on the profile of a cam 127'l, borne on a corresponding shaft A, set in rotation by the actuation motor M. Said second lever 127"g is appropriately connected to the first lever 127'g that actuates a corresponding strut P. A preferred way to connect said second lever 127"g to the first lever 127'g could consist of making them integral with the shaft A', which in this case would be made to rotate by an appropriate angle to command the vertical movement of the second means 127b for supporting and advancing the stoppers. In this case the connection between the shaft A' and the other actuating levers of the other organs of the machine would be of the freely rotating type so that its rotation does not influence the motion of said other organs.

[0113] According to an additional aspect, the present apparatus is provided with advantageous means for the application of glue or adhesive material between said transverse connecting face 16a of the discoidal element 16 and said transverse connecting face 14a of the cylindrical body 14.

[0114] Said means for applying said glue are, in particular, in the form of means able to distribute a layer of glue on the entire face to be joined 14a, 14b.

[0115] Advantageously, these means for applying the glue are able to apply it in such a way that the applied glue has a thickness of the glue layer that is differentiated from an area to the other. According to the present embodiment, said glue is distributed according to strips of differentiated thickness, in particular according to circular strips.

[0116] As shown in particular in Figure 9A, said means for distributing said glue layer comprise means 142 for emitting the glue layer on the face to be joined, in particular on the transverse face 14a of said cylindrical body 14.

[0117] The present emission means 142 emit said glue according to a horizontal direction, substantially perpendicular to the face 14a, whereon said glue is to be spread.

[0118] Advantageously, said means 142 for emitting the glue emit the glue in substantial contact with the face 14a whereon it is to be applied, the openings for the emission thereof being separated from the face to be treated by a distance equal to the length of the spreading teeth.

[0119] According to a further advantageous aspect, said means for distributing said glue layer are constructed in the form of means able to spread said layer of glue on the face to be joined.

[0120] In a preferred way, said spreading means comprise means 142a that extend parallel to the face 14a whereon said glue is to be spread and which are able to engage said face to be joined.

[0121] Advantageously, according to the present preferred embodiment, said engagement means are defined by the front part or end 142a of said means for emitting the glue, which said front part or emission head has a contact surface 150 of the face whereon the glue is to be spread which is toothed - as shown in particular in Figure 9B - in such a way as to obtain a differentiated thickness of the layer of glue and a better adherence

capacity, at least in the initial processing phases. Moreover, during the subsequent phases of compression of the faces to be joined, the risk of glue being expelled laterally is minimised. In a preferred manner, said teeth 150 extend anteriorly from said front surface of the head and are shaped substantially with a triangular profile.

[0122] As shown, each engagement element 142a extends horizontally and also has a predefined length (see Figure 8A), greater than half the diameter of the face 14a whereon the glue is to be applied and is positioned in such a way as to involve an extension that is equal to or greater than half said diameter, of the face to be spread 14a, thereby guaranteeing that, when the face whereon the glue is to be distributed is made to rotate, the glue is spread on the entire surface of said face 14a.

[0123] As Figure 8A clearly shows, advantageously, the emission head of the dispensing gun has a first and a second elements 142a, 142a for emitting and spreading the glue, which are set mutually side by side, in a single body, to enable the simultaneous distribution of glue on two faces belonging to two different bodies 14, 14 positioned one after the other according to their direction of advance.

[0124] As shown in particular in Figure 9A, said emission means comprise a dispensing gun 142b, which is able to heat the glue emitted thereby.

[0125] The glue is conveyed through a conduit 142c under pressure inside a section 142d of said dispensing gun which provides for heating the glue and is emitted, subsequently, through at least a corresponding hole provided in the front part or head 142a of the dispensing gun. This gun for the emission of hot glue, with the exception of the spreading block 142a is essentially known and does not need any additional detailed description. To the traditional emitting gun, according to an aspect of the present apparatus, is applied the front part or head 142a provided by the present inventor.

[0126] As Figures 8A and 9A show, these emission means 142 are positioned laterally to the line of longitudinal advance of the cylindrical bodies 14 maintained with their axis horizontal. Means are provided for moving said means 142a for emitting the glue, starting from a rear position shown in Figure 9A, towards and against the respective face 14a of the cylindrical body 14 whereon the joining glue is to be applied.

[0127] These actuating means, which are not expressly shown in Figure 9A, are able to move the block 142' which carries the emitter of the glue 142 between a forward position (not shown in the accompanying figures) for emitting the glue and a rear position, shown in Figure 9A, which allows the forward translation of the stoppers being formed. These actuating means are commanded by the individual actuating shaft A of the present apparatus and are wholly similar to those for the means to compress the stoppers being formed, which shall be described better farther on. In this translating and transverse movement of the block 142'.

[0128] As said Figures 8A and 9A shows, said block 142' that bears the gun for emitting the glue is borne able to slide on horizontal guidance bars 142'g of a small frame 142't integral with the frame IP of the apparatus.

[0129] Elastic means 142m are provided, able to maintain said engagement and glue spreading means in advanced thrusting position against said face 14a whereon the glue is to be applied. In this way, contact against said face and an efficient spreading of the glue are assured.

[0130] These elastic means are in the form of springs 142m which are provided between the block 142', integral with the emitting gun 142, and a rear wall 142'p of said small frame 142't. In practice, the elasticity of the spring 142m is such that, after said block 142' and the gun 142 have been brought to the forward position, said spring 142m is still able to provide a further elastic thrust action of the front part for engaging the gun 142 against said cylindrical body 14.

[0131] According to an advantageous aspect, means are provided, indicated in Figure 7 with the reference 144, able to move relatively to each other said face to be joined 14a and said means for emitting the glue or contact and spreading means. These means 144 for rotating the cylindrical bodies 14 are supported, in correspondence with the glue distribution area, in a position overlying said means for supporting the cylindrical bodies 14, in such a way as to engage and move said cylindrical body 14, making it execute a rotary motion.

[0132] Said rotating means comprise an organ 144 for the tangential engagement of the peripheral cylindrical surface of said cylindrical body 14, which is movable in the tangential direction to the axis of the cylindrical body 14, in such a way as to drive the cylindrical body in rotation.

[0133] With reference also to the subsequent Figures 12, 13 and 14, one can observe that said organ for driving the cylindrical body 14 in rotation is in the form of a continuous belt or the like 144, which has a tangential contact and driving surface for said cylindrical body 14, and is driven on suitable guiding means. Said guiding means comprise a first and a second roller 144a, 144c, which are longitudinally distanced from each other, in such a way as to define a lower segment 144' for engaging and driving in rotation said cylindrical bodies 14. Advantageously, the lower driving segment 144' has such a length as to allow to drive in rotation at least a pair of said cylindrical bodies 14.

[0134] Means are provided for setting said belt 144 in rotation. As shown in particular in Figures 12 and 14, to cause said belt 144 to rotate, the first of said driving rollers 144a is made to rotate by means of a toothed belt 144c, which extends longitudinally, between a toothed pulley 144'a, integral with the same axis of said first roller 144a, and an additional toothed pulley 144d. This pulley 144d is connected by means of a shaft 144'd to an additional toothed pulley 144e, which received motion from yet another toothed pulley 144f that extends verti-

cally and receives motion from an electric motor 144m.

[0135] Means are provided, able to actuate said means 144 for rotating the cylindrical bodies 14 between a lowered position for engaging and driving in rotation said cylindrical bodies 14 and a raised position that allows said cylindrical bodies to advance.

[0136] As shown in the details of Figures 12 to 14, said means able to move vertically said arm 144g, which brings the means for rotating the cylindrical bodies 14, comprise a vertical rod 144h commanded to move vertically, in alternating motion, through suitable cam means actuated by the rotation of said single actuating shaft A (these means not being expressly shown in the accompanying figures and being shaped in substantially similar fashion to that illustrated for the other operative parts of the present machine). Said vertical rod 144h moves a horizontal arm 144i, whereon is keyed a contoured transverse rod 144l, which is borne free to rotate by said frame I and which has its other end connected to said arm 144g, which bears the rotating means. The motion of the lever 144i, in this way, causes said arm 144g, bearing the means for rotating the stopper, to swivel in a vertical plane.

[0137] These means for driving in rotation allows to adjust the vertical position of said means for driving in rotation said cylindrical bodies to allow to operate on cylindrical bodies of different diameter. The driving belt can swivel relative to the support arm adapting to the diameter of the stopper body being formed.

[0138] Advantageously, as Figure 12 shows, means 132, 133, 134 are provided for supporting said cylindrical body 14 are able to support, in rolling fashion, said cylindrical body 14.

[0139] Said rolling support means comprise for each cylindrical body 14 at least a first 132, 133 and a second 133, 134 annular bearings or elements, whereon said cylindrical body 14 bears with its lower peripheral surface. Said rolling means are supported free to rotate in correspondence with respective seats 128, of the first support means 172a, which are situated in correspondence with the means for readying the glue. In particular, a first and a second longitudinally distanced rotating elements 132, 134 are provided, which define respective rolling elements for corresponding first and second successive cylindrical bodies 14, 14 and also provided is an intermediate rotating element 133 longitudinally equidistant from said first and second extreme rotating elements 132, 134, which is able to define a common rolling element for said first and second successive cylindrical bodies 14, 14.

[0140] With particular reference to Figures 8A and 10, one can observe that advantageous means are also provided, able to put said transverse connecting face 16a of the discoidal element 16 and said transverse connecting face 14a of the cylindrical body 14 in mutual contact with each other.

[0141] As shown in particular in Figure 10, said means able to put said transverse connecting face 16a of the discoidal element 16 and said transverse connecting face 14a of the cylindrical body in mutual contact with each other advantageously comprise means 154 for applying said discoidal element 16 which bring it towards and against the face to be joined 14a of said cylindrical body 14.

[0142] Said application means 154 comprise an organ 154a for supporting said discoidal element 16. Said supporting organ 154a comprises, as shown in Figure 10, a vertical plate 154b, exhibiting a circular profile 154c, which substantially conforms to the profile of said discoidal element 16 and from whose front surface extends inferiorly a horizontal lip 154d providing lower support for said discoidal element 16.

[0143] Said organ 154a for supporting said discoidal element 16 comprises a transverse block 154'd, which is supported by a frame 154e sustained by the frame IP of the apparatus.

[0144] Retaining means are provided, able to retain on said discoidal element 16, and to release therefrom, said support organ 154a. Said retaining means are in the form of means able to create a vacuum in correspondence with the vertical face 154b of said support organ 154a. Means are provided for maintaining said vacuum suitable for maintaining said discoidal element 16 on said support element 154a and for releasing said vacuum after said discoidal element 16 has been brought into contact with said cylindrical body 14. These means able to create a vacuum comprise suction means (not shown in the accompanying figures) which are connected, through a respective conduit 154f in the block 154d of said application organ 154a, to holes 154g provided in said transverse face 154b.

[0145] With particular reference to Figure 8A, one can observe, in particular, that on said frame 154e is supported a pair of said application organs 154a to provide simultaneously a pair of said discoidal elements 16, 16 to two successive elements 14, 14.

[0146] Elastic means, in the form of a spring 154m, are provided between the frame 154e and a support or block 154n, which bears the application means of the discoidal element and which is guided on horizontal rods 154s integral with the frame 154e. These elastic means allow to maintain under thrust said means for applying the discoidal element, when they are in advanced position, against said cylindrical body 14.

[0147] Further provided are means for actuating said engagement organ 154a towards said cylindrical body 14.

[0148] These actuation means comprise means able to move a support block 154n transversely to the longitudinal axis of the apparatus. These actuation means are not expressly shown in the accompanying figures, but are wholly similar to those of the means for compressing the discoidal element against the cylindrical body, better described below.

[0149] With particular reference to Figures 8A and 11, one can observe that, advantageously, first means 158

are provided for compressing said transverse connecting face 16a of the discoidal element 16 and said transverse connecting face 14a of the cylindrical body 14 against each other. This compression allows to obtain a first substantial adhesion between the discoidal element and the cylindrical body.

[0150] As Figure 11 shows, said first means 158 for compressing said transverse connecting face 16a of the discoidal element 16 and of said transverse connecting face 14a of the cylindrical body 14 against each other comprise means 158 thrusting against said discoidal element 16.

[0151] Said means 158 for thrusting against said discoidal element 16 comprise a pad 158a for engaging said discoidal element 16. The engagement pad 158a comprises an organ 158b for contacting or engaging said discoidal element 16. The engagement pad 158a comprises a contact or engagement organ 158b extending perpendicularly to the axis of the stopper being formed, which has a circular profile 158c substantially conforming to the profile of said discoidal element 16. Said pad 158a for engaging said discoidal element 16 is borne by a horizontal stem 158d supported by a block 158e supported in movable fashion, as shall become more readily apparent hereafter, by the frame of the apparatus.

[0152] The compression pads 158a have a flattened perpendicular engagement surface, with the exception of the compression pad 158'a, which act immediately downstream of said means for applying the discoidal elements and which present a projecting circular lip 158'l for engaging and centring the discoidal elements, as shown in Figure 11.

[0153] Means are provided for actuating said engagement pad 158a towards and from said discoidal element 16. As particularly shown in Figure 11, said actuating means are in the form of a transmission leverage commanded by suitable cam means. Said actuating means comprise means able to move said support block 158e in a direction transverse to the longitudinal axis of the apparatus. The block 158 is in particular supported able to slide on horizontal guiding rods 158g of a frame 158t fastened to the frame IP of the apparatus and it is moved between an advanced compression position and a rear position for the advancement of the stoppers. This alternating motion of the block 158e is obtained by means of a knee-joint lever 1581 pivotally engaged, in its intermediate articulation point, to a longitudinal axis G, which has an end connected to the block 158e, whilst the other end is connected to an organ 158o movable vertically between a raised position and a lowered position. This organ 158o comprises tie rod means 158p movable within respective bush means 158q fastened to the frame I of the apparatus. Said tie rod means 158q, as shown in said Figure 11, are actuated by appropriate cam means, which comprise a triangular lever 158r having an end pivotally engaged, in 158s, to a shaft A', fastened to the frame, and has a second end that is pivotally engaged to said lower end 158u of an articulated tie rod TI, which is connected to the lower part of said vertically movable organ 158o. The third end of the lever 158r bears a cam-following roller 158v which runs on the command profile of a cam 158z that is borne and made to rotate by a corresponding shaft A set in rotation by the actuating motor M of the apparatus (shown in Figure 7).

[0154] The present configuration of the movable organ 158o allows, as shown, the simultaneous actuation of two opposite compression means 158, 158.

[0155] Further provided are elastic means 158h able to maintain said pad 158a in advanced position thrusting against said discoidal element 16. In this way, the thrusting contact against said discoidal element is assured even in the case of cylindrical bodies of different length. As Figure 11 shows, these elastic means act between said pad 158a and a transverse extension of the supporting block 158e.

[0156] In accordance with this preferred embodiment, a series of successive compressions are provided for fastening the discoidal elements 16, 16 to the respective cylindrical body 14, 14. In each compression action two stoppers are compressed at the time. In practice, as Figure 8A shows, eight consecutive compression phases are provided for each stopper. Each of these compressions is applied with a high specific pressure and they are imparted for a reduced time corresponding to the duration of the stopped phase in the advancement of the stoppers.

[0157] As Figure 7 shows, further provided are means for providing said cylindrical bodies 14, which comprise a loading hopper (not shown in the accompanying figures), of the type actuated in vibration to cause the advancement of said cylindrical bodies 14, and a slide or channel TS1 for conveying the cylindrical bodies 14. Appropriate means are able to release said cylindrical bodies 14 in sequence at the end of said conveying slide or channel.

[0158] Said release means comprise a first "L" shaped lever L1 for the corresponding channel, which is articulated in correspondence with a its own end to said slide and has at its end a folded portion which extends normally inside the path defined by said channel TS1 to interfere with the trajectory and retain the cylindrical body which is the first to be released of the aligned row of cylindrical bodies being fed on said channel. When the lever L1 is actuated in rotation in such a way as to free the corresponding cylindrical body and simultaneously to allow its release, a second lever L2, substantially similar to the previous one and which normally does not interfere within the conveying space of said channel TS1, is commanded to insert itself with its own end folded and pointed within the aforesaid path of the second cylindrical body of the row of said bodies 14, in such a way as to retain it and prevent it from following the first body to be offloaded. Once the respective cylindrical body 14 is offloaded, the two levers L1 and L2

return to the starting position ready for a new release cycle. The actuation of said levers is executed through cam means commanded by the shaft A. This actuation, which is similar to the previously described actuation, is not shown in detail in order not to burden excessively the present description.

[0159] As Figure 7 shows, the present supply means are able, in particular, to supply a pair of said cylindrical bodies 14, 14 in corresponding channels TS1', TS1" set side by side or, as in the present case, mutually superposed. A pair of levers L1 and a pair of levers L2 are thus used, each lever being destined to be used in correspondence with a respective channel.

[0160] As Figure 7 shows, the slide TS1 extends with at least a portion or an end E1 for transferring the cylindrical bodies positioned above the area for the loading of the cylindrical bodies by said feeding means.

[0161] As Figure 7 shows, further provided are means for supplying said first discoidal elements 16, which comprise a loading hopper T2, of the type actuated in vibration to cause the advancement of said discoidal elements 16, and a slide or channel TS2 for conveying the discoidal elements 16. Means able to release said discoidal elements 16 in sequence at the end of said conveying slide or channel are provided.

[0162] Said supply means are able to supply a respective discoidal element 16 in a position downstream of the area for the release of said cylindrical bodies 14 and downstream of the glue application area.

[0163] Said supply means are able to supply a pair of discoidal elements 16, 16 in corresponding channels TS2', TS2" set side by side or mutually superposed.

[0164] Said slide extends with at least a portion or an end E2 for transferring the cylindrical bodies positioned above the area for loading the discoidal elements 16 by said supply means.

[0165] The means for releasing said first discoidal elements 16 at the end of the respective corresponding channel are wholly similar to those for said cylindrical bodies 14 and it is therefore not necessary to describe them again.

[0166] Also provided are means for supplying a second discoidal element 18, which comprise a loading hopper, of the type actuated in vibration to cause the advancement of said discoidal elements 18, a slide or channel for conveying the discoidal elements 18. These means are not expressly shown in the accompanying figures; they are positioned parallel to the means for supplying the first discoidal elements.

[0167] Also provided are appropriate means able to release said discoidal elements 18, in sequence, at the end of said conveying slide or channel.

[0168] Said supply means are able to supply a respective discoidal element 18 in a position downstream of the area for releasing said cylindrical bodies 18 and downstream of the glue application area, on the opposite side from that of the supply of said first discoidal elements 16, 16.

[0169] These second means for supplying the discoidal elements are able to supply a pair of said discoidal elements 18, 18, in corresponding channels set side by side or mutually superposed.

[0170] Said second slide for the discoidal elements extends with at least a portion or and end for transferring the cylindrical bodies positioned above the area for loading the discoidal elements 18 by said feeding means.

[0171] The means for releasing the second discoidal elements 18 at the end of the respective corresponding channel are wholly similar to those for said cylindrical bodies 14 and it is therefore not necessary to describe them again.

[0172] As Figure 7 shows, further provided are guiding and sliding means acting superiorly to said cylindrical bodies 14 which comprise a longitudinal bar BL positioned above said cylindrical bodies 14, which is able to be contacted by the upper edge of their peripheral profile and extends at least starting from the area for supplying the first discoidal elements to the end for transfer by said advancement means to said further compression and transfer means, better described hereafter.

[0173] This longitudinal vertical guiding and retaining bar BL is connected to said frame relative whereto it is sprung thanks to springs BL' that dampen contact with said cylindrical bodies 14 and defines means for compensating the differences in diameter that the cylindrical bodies 14 could have.

[0174] With particular reference to Figures 7 and 8A, one can observe that the present apparatus is further advantageously provided with means 172' for the subsequent compression and transfer of the stoppers 12, which are able to compress axially, in continuous fashion, said stoppers 12 and are actuated in longitudinal advancement to provide for the transfer of the stoppers 12, towards the exit of the present apparatus.

[0175] These compression and transfer means comprise a first and a second belt 172, 172, which have respective segments 172a, 172a for conveying the stoppers, which segments extend parallel and mutually distanced transversely and between which are held said stoppers 12 with continuous axial compression.

[0176] Means for actuating said belts 172, 172 in rotation are provided. These means for actuating in rotation comprise a respective driving roller 172b. In Figure 8A, the reference numbers 172c indicate respective driving and transmission rollers for the corresponding belt 172.

[0177] These actuating means comprise, as shown in Figure 7, a toothed transmission belt CD, which is connected in rotation to said main actuating shaft A by means of suitable operative connection means comprising, as shown in the detail of Figure 15, a pulley, indicated in Figure 7 with the reference P1, which actuate through a belt C1 a successive pulley P2, which through an angular transmission R1, wholly known, sets in rotation, in a longitudinal plane, a pulley P0 for actuating

said toothed belt CD.

[0178] As shown in Figure 7, said belt CD then sets in rotation an additional pulley P0', which is operatively connected to the wheels 172b for driving said belts 172, 172, for instance by means of a respective gear (not shown the accompanying figures). In this way, a continuous rotation actuation is obtained for said advancement belts 172a, 172a.

[0179] Adjustment means can be provided for mutually approaching, and respectively, distancing said first and second longitudinal belts 172, 172, in such a way as to adapt the distance between said belts to the length or height of the stoppers being processed. Said means are not expressly shown in the accompanying figures.

[0180] As Figure 7 shows, further provided is a slide S that extends starting from the end in which the stoppers 12 are received by said means 172 for compressing and transferring the stoppers 12, remaining below them. Said slide S receives the stoppers which, being defective, are not withheld between said compressing and transferring means 172 and thus fall onto the slide S.

[0181] With the present machine structure it is possible easily to adjust the various components to operate on elements having different geometric dimensions. For instance, cylindrical bodies with different diameters and height.

[0182] As shown in accordance with the present first version of this second embodiment of apparatus further provided are operative means for the readying of a second discoidal element 18 on the side of said cylindrical body which is opposite that of application of the first discoidal element 16, which are identical and specularly (or symmetrically) positioned with reference to the longitudinal direction of the machine relative to the first operative means for the readying of the first discoidal elements. Said second operative means for readying the second disk comprise, as clearly shown in Figure 8A, means 142 for applying the glue, means 154 for applying the disk, and compressing means 158. Said devices or means for readying the second disk 18, 18 are wholly identical and have already been described in relation to the devices for the application of the first disk and therefore it is not necessary to describe them again. In practice, said operative means acting to ready the first disk and those acting to ready the second disk act simultaneously on both sides of the respective stopper being formed, with mutually compensating axial thrust actions.

[0183] Further provided, as shown in Figure 7, is an Encoder E for the determination of the angular position of the shaft for actuating the cams, which has a shaft E', set in rotation, by means of a respective belt CE, by a corresponding shaft AE projecting from the reduction gear R from the side opposite the one wherefrom the shaft A of rotation of the cams projects.

[0184] With the present embodiment, therefore, an automatic machine has been provided for the production of composite stoppers 12, in which the actuation of the various parts of the machine is guaranteed in synchronised fashion by a single actuating shaft A whereon are mounted the actuating cams and which projects from a reduction gear actuated by a single motor M. In the figures, the reference A' indicates a pivoting shaft for the actuating levers which extends parallel to said shaft A.

[0185] As Figure 7 shows, the motor M has a pulley PM connected to its own shaft which is connected by means of a belt CR to a pulley PE actuating a shaft entering the reduction gear R.

[0186] In the following Figures 16 and 17, a second version of this second preferred embodiment of apparatus according to the present invention is shown. This second version is particularly suited for the production of composite stoppers of the kind shown in Figure 1C, in which the second discoidal element, indicated here with the numerical reference 19, has a respective face 19a to be associated with a transverse face 16b of the first discoidal element 16 already positioned on the cylindrical body 14 made of granular cork.

[0187] In practice, in this second version the cork disks 16, 19 are applied on the same side of the cylindrical body 14 defining stoppers that are particularly suited for bottles of sparkling wines.

[0188] Therefore, in accordance with this second version, downstream of the first means for readying the first discoidal element 16, on the same side of the apparatus, second means are provided for readying a second discoidal element 19 on said first discoidal element 16.

[0189] In accordance with this second version, the means for supplying the second discoidal elements 19, 19 are wholly similar to those of the first version and therefore need not be described in detail.

[0190] In this second version, said supply means,differ only in that they are able to supply respective discoidal elements 19, 19 in a position downstream of the area for releasing said cylindrical bodies 14 and of the area for providing said first discoidal elements 16, 16, as well as downstream of the area of application of the glue on the outer side of said first discoidal elements 16, 16. The means TS3 for supplying the disks 19 are schematically shown, drawn in dashed lines, in said Figure 7.

[0191] In this second version, operations are conducted only on one side of the machine and, therefore, lateral guidance and contrast means are provided that comprise a longitudinal bar B whereon slide the cylindrical bodies 14 engaging said bar with the side that is opposite that of application of the discoidal elements 16 and 19.

[0192] In this second embodiment of apparatus, the second means for applying the glue for the second disks 19, 19 are located in a position downstream of the area of application of the first disks 16, 16 and apply said glue on the face of said first discoidal elements 16, 16 which is opposite that of attachment to the respective cylindrical body 14, 14.

[0193] Downstream of said second means for apply-

ing the glue are provided second means for applying the second discoidal elements 19, 19 on the face 16b of said first discoidal elements 16, 16, whereon the glue has been distributed.

[0194] Said second means for applying the glue and second means for applying the second discoidal elements are wholly similar to the analogous means of the first embodiment and therefore it is not necessary to describe them in detail.

[0195] In this second embodiment of apparatus, means 158 are provided, exerting one or more compression actions on said first discoidal elements 16, 16 against said cylindrical bodies 14, 14, which are positioned between said means for applying the first discoidal element 16, 16 and said means for applying the glue on said first discoidal elements 16, 16.

[0196] Also provided are second means 158, exerting one or more compression actions on said first discoidal elements 16, on said second discoidal elements 19, 19 against said first discoidal elements 16, 16 downstream of said means for applying the second discoidal elements 19, 19. These second compression means therefore also further compress said discoidal elements 16, 16 against said cylindrical bodies 14, 14.

[0197] These first and second impulsive compression means 158 are wholly similar to those of the first version and therefore they need not be described again.

[0198] As shown in the subsequent Figure 17, the means for rotating the cylindrical bodies have been modified, relative to the first version, in such a way as to have a second extension arm 144p, which supports and allows the readying, in addition to the first engagement organ 144' for the glue-spreading rotation for the first disks 16, 16, of a second organ 147 for the tangential engagement of the cylindrical peripheral surface of said cylindrical body 14 which is located - in a position above said means for supporting the cylindrical bodies 14 - in correspondence with the second area for distributing the glue on said discoidal elements 16, 16, in order to allow the application of second discoidal elements 19, 19.

[0199] As shown, this second engagement organ 147 is movable in a direction tangential to the axis of the respective cylindrical body 14, in such a way as to drive in rotation the cylindrical body itself.

[0200] Advantageously, the apparatus uses a single belt 144, which defines a first and a second surface 144', 144' for contacting and tangentially driving said cylindrical body 14, which is driven on suitable guiding means.

[0201] Said guiding means comprise, in addition to the rollers 144a, 144b, wholly similar to those of the previous embodiment, a first and a second rollers 147a, 147b longitudinally aligned and mutually distanced in such a way as to define an upper segment 147' for the engagement and rotary driving of said cylindrical bodies 14.

[0202] This second lower driving segment 147' also has such a length as to allow to drive in rotation at least a pair of said cylindrical bodies 14.

[0203] Advantageously, as said Figure 17 shows, the individual belt 144 that is driven on said rollers 144a, 144b, 147a, 147b and on additional transmission rollers 147c, 147d defining a raised segment for said belt which allows the placement of a longitudinal bar 147e, between said first rotation means 144 and said second rotation means 147, able to guide or hold vertically said cylindrical bodies during the phases of application of the first discoidal elements 16, 16 and of first compression.

[0204] Said longitudinal vertical retaining rod 147e is mounted elastically on said second arm 144p, by means of springs 147f, 147f that allow to dampen the contact with said cylindrical bodies 14.

[0205] Obviously, means are provided that are able to move the arm 144g and, together with it, said means 144p for supporting the rotation means 144 of the cylindrical bodies 14, between a lowered position for engaging and driving in rotation said cylindrical bodies 14 and a raised position that allows the advancement of said cylindrical bodies.

[0206] Thus a machine structure is provided that is suitable, apart from modest adaptation modifications, both to produce composite stoppers in which the discoidal elements 16, 18 are positioned at both ends of the cylindrical body 14 made of granular cork or cork scraps, and to produce stoppers in which the discoidal elements are positioned in correspondence with a single end of the cylindrical body 14. For this purpose, as Figure 8A shows, in the first version of this second apparatus, there are four intermediate compression pads, supported on a respective intermediate block 158e and which are designed to be removed, together with said block, to allow the arrangement of said means for applying the glue and the second disk 19, in the second version.

[0207] The invention thus conceived can be subject to numerous modifications and variations, without thereby departing from the scope of the inventive concept. Moreover, all components can be replaced by technically equivalent elements.

Claims

1. An apparatus for producing cork stoppers (12) or the like, in which said stoppers (12) are composed by a main cylindrical body (14) that has a longitudinal axis (X) and at least an end face (14a) extending transversely relative to said longitudinal axis (X) and by at least a discoidal element (16) which is joined to said cylindrical body (14) associating a respective transverse face (16a) of said discoidal element (16) to said transverse face (14a) of said main body (14), the apparatus comprises: a support frame (I); means (124) for supporting and advancing said stoppers being formed; means for applying glue or adhesive material between said transverse connecting face (16a) of the discoidal element (16)

and said transverse connecting face (14a) of the cylindrical body (14); means suitable for placing said transverse connecting face (16a) of the discoidal element (16) and said transverse connecting face (14a) of the cylindrical body (14) in mutual contact; the apparatus is **characterised in that** said means (124) for supporting and advancing the stoppers being formed are able to support and advance said cylindrical bodies (14) with their own longitudinal axis (X) which is positioned substantially horizontal.

2. An apparatus as claimed in claim 1, **characterised in that** said support and advancement means retain each stopper being formed in a respective seat (128) for bearing the cylindrical bodies (14), which has appropriate longitudinal retaining means (129a, 129b) for the corresponding cylindrical body (14) and is laterally opened, on at least one side.

3. An apparatus as claimed in claim 2, **characterised in that** said bearing seat (128) comprises a semicircular bearing surface (129) for the lower part of the peripheral surface of the cylindrical body (14) of the stopper being formed and is superiorly open to allow the introduction of the cylindrical body (14) into the seat (128), in the initial phase of forming the stopper.

4. An apparatus as claimed in either of the previous claims 2 or 3, **characterised in that** each seat (128) has, in correspondence with its longitudinal ends, respective portions (129a, 129b) projecting upwards defining said longitudinal retaining means for the corresponding cylindrical body (14) of the stopper being formed.

5. An apparatus as claimed in any of the previous claims, **characterised in that** said support and advancement means make said stoppers advance in steps, with alternated advancing motion, having advancement phases, followed by phases in which the stopper being formed is stopped, during which the various phases of work and readying the stopper are performed by the present apparatus.

6. An apparatus as claimed in claim 5, **characterised in that** the support and advancement means comprise first longitudinally fixed support means (127a), which are able to support said cylindrical bodies (14) during the stopped phases, and second support means (127b), which are movable longitudinally and alternatively forward and backward and make said cylindrical bodies (14) advance in steps of predefined length.

7. An apparatus as claimed in any of the previous claims from 2 to 6, **characterised in that** said first support means and said second support means (127a, 127b) comprise respective pluralities of bearing seats (128) of said cylindrical bodies (14) or stoppers (12).

8. An apparatus as claimed in any of the previous claims from 2 to 7, **characterised in that** said first and second support means (127a, 127b) comprise respective first and second plate (127'a, 127'a; 127'b, 127'b) which are oriented vertical and transversely distanced from each other and superiorly shaped or contoured, in such a way as together to define the respective seats (128) for receiving the cylindrical bodies (14).

9. An apparatus as claimed in any of the previous claims from 5 to 8, **characterised in that** said first and said second means for supporting and advancing the bodies being formed (127a, 127b) are alternatively movable vertically between a raised position for retaining the cylindrical bodies (14) and a lowered position for transferring the cylindrical bodies (14), in such a way as to allow to pass said cylindrical bodies (14) to the other said first (127a) and said second (127b) support means; said second means for supporting and advancing the bodies being formed (127a, 127b) being alternatively movable horizontally between a rear position for picking up the stoppers being formed and a forward position for releasing the stoppers being formed in correspondence with successive operative positions.

10. An apparatus as claimed in any of the previous claims, **characterised in that** said means (127a, 127b) for supporting and advancing the stoppers being formed perform and advancement step equal to twice the distance between a stopper and the next.

11. An apparatus as claimed in any of the previous claims or in the pre-**characterising** part of claim 1, **characterised in that** said means for applying said glue are in the form of means able to distribute a layer of glue on the entire face (14a, 14b) to be joined.

12. An apparatus as claimed in claim 11, **characterised in that** said means for applying the glue are able to apply said glue with the thickness of the glue layer that is differentiated from one zone to another.

13. An apparatus as claimed in claim 12, **characterised in that** said glue is distributed according to strips of differentiated thickness.

14. An apparatus as claimed in any of the previous claims or in the pre-**characterising** part of claim 1, **characterised in that** said means for applying said layer of glue comprise means (142) for emitting the

layer of glue onto the face to be joined, and means able to move said emitting means (142) and said face to be joined (14a) relative to each other.

15. An apparatus as claimed in any of the previous claims or in the pre-**characterising** part of claim 1, **characterised in that** said means for distributing said layer of glue are in the form of means able to spread said layer of glue on the face (14a) to be joined.

16. An apparatus as claimed in claim 15, **characterised in that** said spreading means comprise means (142a) that extend parallel to the face (14a) whereon said glue is to be spread and which are able to engage said face to be joined.

17. An apparatus as claimed in claim 16, **characterised in that** said engagement means are defined by the front part (142a) of said means for emitting the glue.

18. An apparatus as claimed in either of the previous claims 16 or 17, **characterised in that** said front part has a contact surface (150) of the part whereon the glue is to be spread which is toothed.

19. An apparatus as claimed in any of the previous claims from 16 to 18, **characterised in that** said engagement element (142a) has a predefined length greater than half the diameter of the face (14a) whereon the glue is to be applied and is positioned in such a way as to involve an extension that is greater than or at least equal to half of said diameter, of the face to be spread (14a).

20. An apparatus as claimed in any of the previous claims from 15 to 19, **characterised in that**, on each organ for emitting the glue (142) are provided a first and a second element (142a, 142a) for emitting and/or spreading the glue, which are set mutually side by side in such a way as to provide for distributing the glue, simultaneously, on two faces to be joined (14a, 14a) belonging to two different bodies (14, 14).

21. An apparatus as claimed in any of the previous claims from 15 to 20, **characterised in that** said emitting means (142) are positioned laterally to the line of longitudinal advancement of the cylindrical bodies (14) maintained with their own axis horizontal.

22. An apparatus as claimed in any of the previous claims from 15 to 21, **characterised in that** means are provided for moving said means (142a) for emitting the glue towards and against the respective face (14a) of the cylindrical bodies (14) whereon the joining glue is to be applied.

23. An apparatus as claimed in any of the previous claims from 15 to 22, **characterised in that** elastic means (142m) are provided, able to maintain said engagement and glue emitting means (142m) in advanced position thrusting against said face (14a) whereon the glue is to be applied.

24. An apparatus as claimed in any of the previous claims from 15 to 23, **characterised in that** means (144) are provided, able to move said face to be joined (14a) and said glue emitting or contacting and spreading means relative to each other.

25. An apparatus as claimed in claim 24, **characterised in that** said means able to move (144) move said cylindrical body (14).

26. An apparatus as claimed in either of the previous claims 24 and 25, **characterised in that** said means (144) able to move are such as to impart a rotary motion to the part to be moved.

27. An apparatus as claimed in claim 26, **characterised in that** said rotary means comprise an organ (144) for the tangential engagement of the cylindrical peripheral surface of said cylindrical body (14); said engagement organ (144) being moved in tangential direction to the axis of the cylindrical body, in such a way as to drive in rotation the cylindrical body (14).

28. An apparatus as claimed in claim 27, **characterised in that** said organ for driving in rotation (144) is such as to allow simultaneously to drive in rotation at least a pair of said cylindrical bodies (14).

29. An apparatus according to claim 28, **characterised in that** means (132, 133, 134) are provided for supporting said cylindrical body (14) that are able to support in rolling fashion said cylindrical body (14), in correspondence with the glue distribution area.

30. An apparatus as claimed in any of the previous claims or as claimed in the pre-**characterising** part of claim 1, **characterised in that** said means able to place said transverse connecting face (16a) of the discoidal element (16) and said transverse connecting face (14a) of the cylindrical body (14) in mutual contact with each other comprise means (154) for applying said discoidal element (16) which bring said discoidal element (16) towards and against the face to be joined (14a) of said cylindrical body (14).

31. An apparatus as claimed in claim 30, **characterised in that** said application means (154) comprise an organ (154a) for supporting said discoidal ele-

ment (16) which presents inferiorly a horizontal lip (154d) for the lower support of said discoidal element (16).

32. An apparatus as claimed in either of the previous claims 30 or 31, **characterised in that** retaining means are provided, able to retain and release said discoidal element (16) on and from said support organ (154a), said retaining means being in the form of means able to create a vacuum on the vertical face (154b) of said support organ (154a), when retaining the discoidal element (16), and able to nullify said vacuum, when releasing the discoidal element (16).

33. An apparatus as claimed in any of the previous claims or in the pre-**characterising** part of claim 1, **characterised in that** it comprises means for compressing said transverse connecting face (16a) of the discoidal element (16) and said connecting face (14a) of the cylindrical body (14) against each other.

34. An apparatus as claimed in claim 33, **characterised in that** said means for compressing said transverse connecting face (16a) of the discoidal element (16) and said transverse connecting face (14a) of the cylindrical body (14) against each other comprise means (158) thrusting against said discoidal element (16) for a predefined time.

35. An apparatus as claimed in either of the previous claims 33 and 34, **characterised in that** compression pads (158'a) are provided which act immediately downstream of said means for applying the discoidal elements, which have a projecting circular lip (158'l) for engaging and centring the discoidal elements.

36. An apparatus as claimed in any of the previous claims from 33 to 35, **characterised in that** means are provided for actuating said engagement pad (158a) towards and against said discoidal element (16).

37. An apparatus as claimed in any of the previous claims from 33 to 36, **characterised in that** elastic means (158h) are provided able to maintain the compressing pad (158a) in advanced thrusting position against said discoidal element (16).

38. An apparatus as claimed in any of the previous claims or in the pre-**characterising** part of claim 1, **characterised in that** guiding and sliding means are provided, acting superiorly to said cylindrical bodies (14).

39. An apparatus as claimed in any of the previous claims or in the pre-**characterising** part of claim 1, **characterised in that** means (172') are provided for the subsequent compression and transfer of the stoppers (12), which are able to compress axially said stoppers (12) and are actuated in longitudinal advancement to provide for the transfer of the stoppers (12).

40. An apparatus as claimed in claim 39, **characterised in that** said compressing and transferring means comprise a first and a second belt (172, 172), which have respective segments of a conveyance of the stoppers (172a, 172a) which extend mutually parallel and transversely distanced and between which said stoppers (12) are held with axial compression.

41. An apparatus as claimed in either of the previous claims 39 and 40, **characterised in that** a slide (S) is provided that extends starting from the end in which the stoppers (12) are received by said means (172) for compressing and transferring the stoppers (12) remaining below them.

42. An apparatus as claimed in any of the previous claims or in the pre-**characterising** part of claim 1, **characterised in that** the actuation of parts of the machine is assured in synchronised fashion by a single actuation shaft (A) that extends longitudinal to the apparatus.

43. An apparatus as claimed in any of the previous claims or in the pre-**characterising** part of claim 1, **characterised in that** operative means are provided for the readying of a second discoidal element (18) on the side of said cylindrical body which is opposite the side of application of the first discoidal element (16), said operative means acting for the readying of the first disk (16) and those acting for the readying of the second disk (18) act simultaneously on both sides of the respective stopper being formed with axial thrust actions that compensate each other, said operative means acting on both longitudinal sides of the stopper being formed comprise at least one of the means selected among: said means for readying the glue on the face to be joined, said means for applying the respective discoidal elements to the corresponding end of the cylindrical bodies, and said means for pressing the discoidal elements against the cylindrical bodies.

44. An apparatus as claimed in any of the previous claims from 1 to 42 or in the pre-**characterising** part of claim 1, **characterised in that**, downstream of the first operative means for readying the first discoidal element (16), on the same side of the apparatus, second operative means are provided for the readying of a second discoidal element (19) on said first discoidal element (16), said operative means

downstream comprise at least one of the means selected among: said means for readying the glue on the face to be joined, said means for applying the respective discoidal elements to the corresponding end of the cylindrical bodies, and said means for pressing the discoidal elements against the cylindrical bodies.

45. An apparatus as claimed in claim 44, **characterised in that** lateral guidance and contrast means (B) are provided whereon the cylindrical bodies (14) slide engaging said guidance means with the side that is opposite that of application of the discoidal elements (16, 19).

46. An apparatus as claimed in any of the previous claims or in the pre-**characterising** part of claim 1, **characterised in that** said means (24) for supporting and advancing the cylindrical bodies (14) are supported and advanced by a continuous chain (36).

47. An apparatus as claimed in any of the previous claims or in the pre-**characterising** part of claim 1, **characterised in that** means (59) are provided for cooling the joining glue.

48. An apparatus as claimed in claim 47, **characterised in that** said compression means (58) are provided with means (59) for cooling the glue joining said stopper (12).

49. A method for producing cork stoppers (12) or the like, in which said stoppers have a substantially cylindrical central portion (14) having a longitudinal axis (X) and in which at least a disk element (16, 18) is joined to a corresponding end (14a, 14b) of the central portion (14), **characterised in that** to join said disk element (16, 18) to said central portion (14), the central portion (14) is positioned with the longitudinal axis (X) oriented substantially horizontal.

50. A method as claimed in claim 49 or in the pre-**characterised** part of claim 49, **characterised in that** single-component polyurethane glue is employed to join the disk element (16, 18) to the central portion (14) of the stopper (12).

51. A method as claimed in either of the previous claims 49 or 50, **characterised in that** the glue is distributed simultaneously on both ends (14a, 14b) of the central portion (14) of the stopper (12).

52. A method as claimed in any of the previous claims from 49 to 51, **characterised in that** to each end (14a, 14b) of the central portion (14) is simultaneously joined a corresponding disk element (16, 18).

53. A method as claimed in any of the previous claims from 49 to 52, **characterised in that** it comprises a phase whereby the disk element (16, 18) is fastened onto the central portion (14) of the stopper (12) subsequent to the phase of joining the disk element (16, 18) to the central portion (14).

54. A method as claimed in claim 53, **characterised in that** the fastening phase comprises at least a compression of the disk element (16, 18) on the central portion (14) of the stopper.

55. Use of a single-component polyurethane glue for the production of cork stoppers (12) or the like, wherein which said stoppers have a substantially cylindrical central portion (14) having a longitudinal axis (X) and wherein at least a disk element (16, 18) is joined to a corresponding end (14a, 14b) of the central portion (14).

FIG.1A

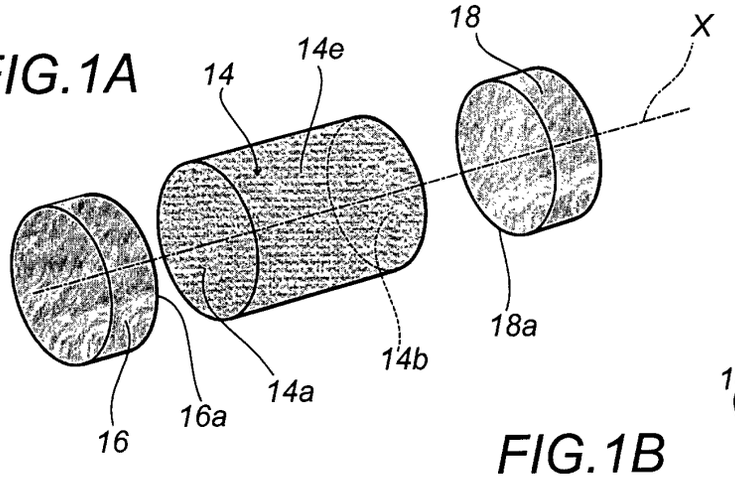


FIG.1B

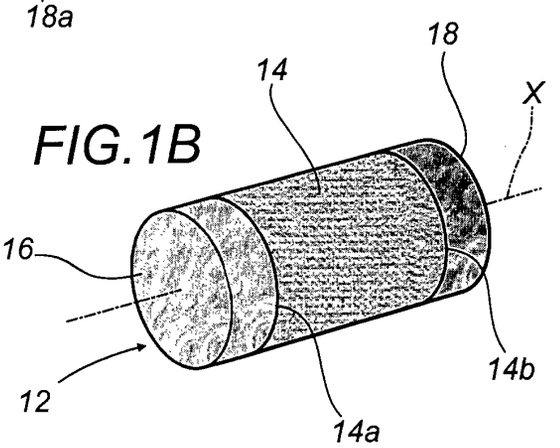


FIG.1C

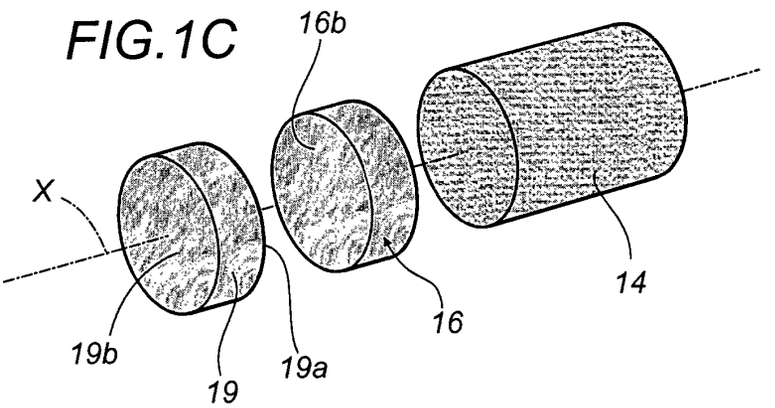


FIG.5

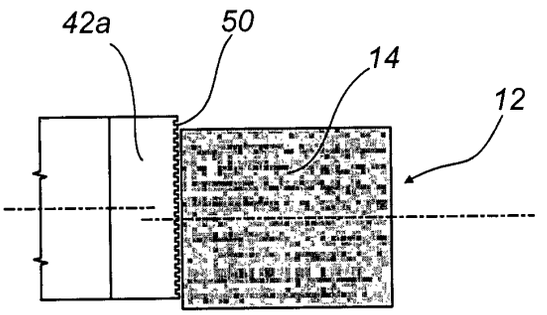
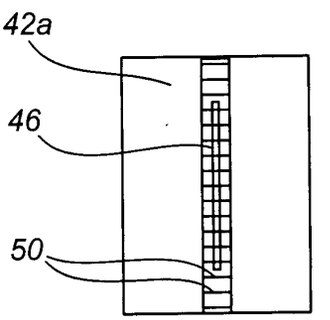


FIG.6



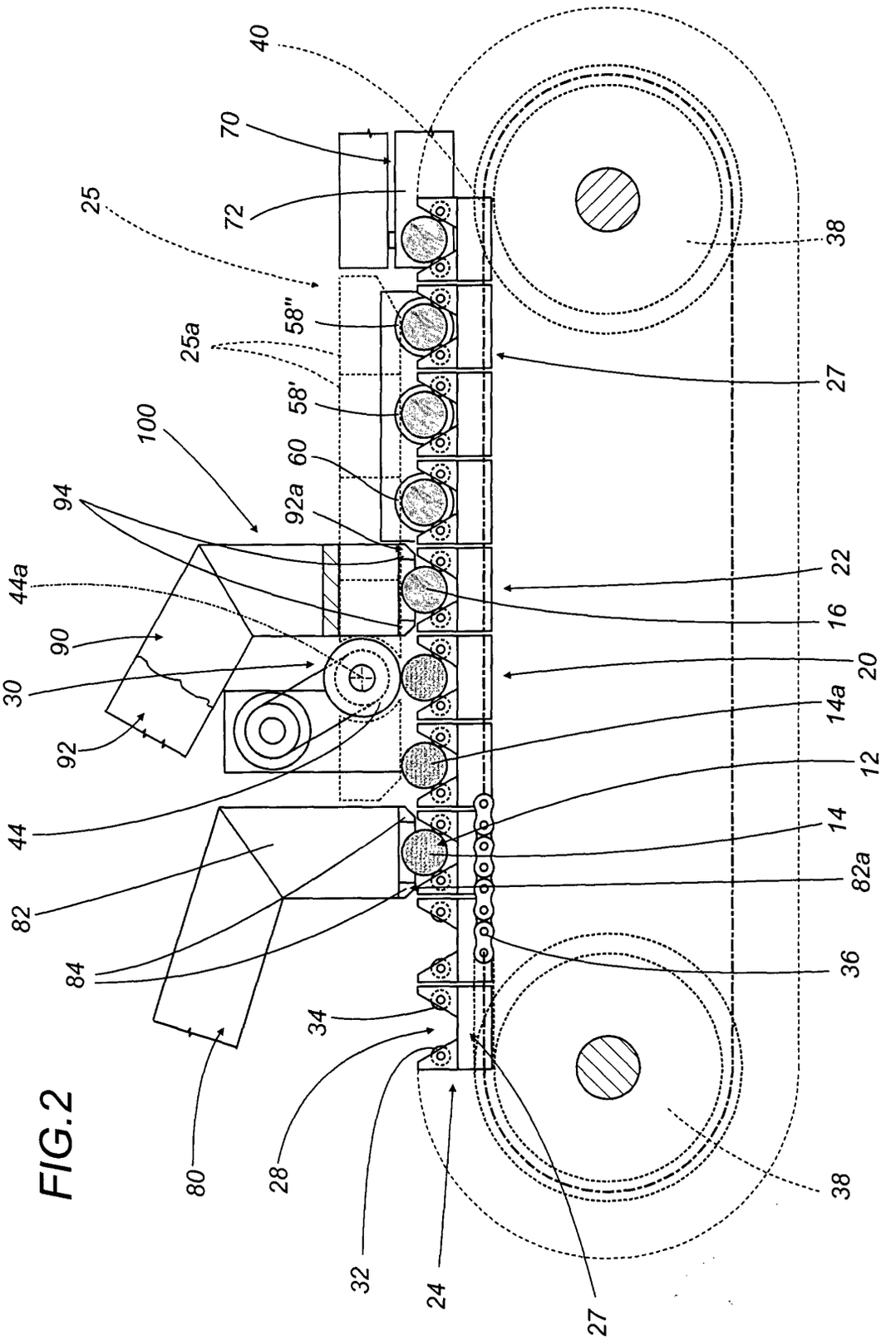

40
70
72
25
25a
58"
58'
60
92a
100
94
44a
90
30
92
44
82
84
80
28
34
32
24
27
38
27
22
16
20
14a
12
14
82a
36
38

FIG.2

FIG.3A

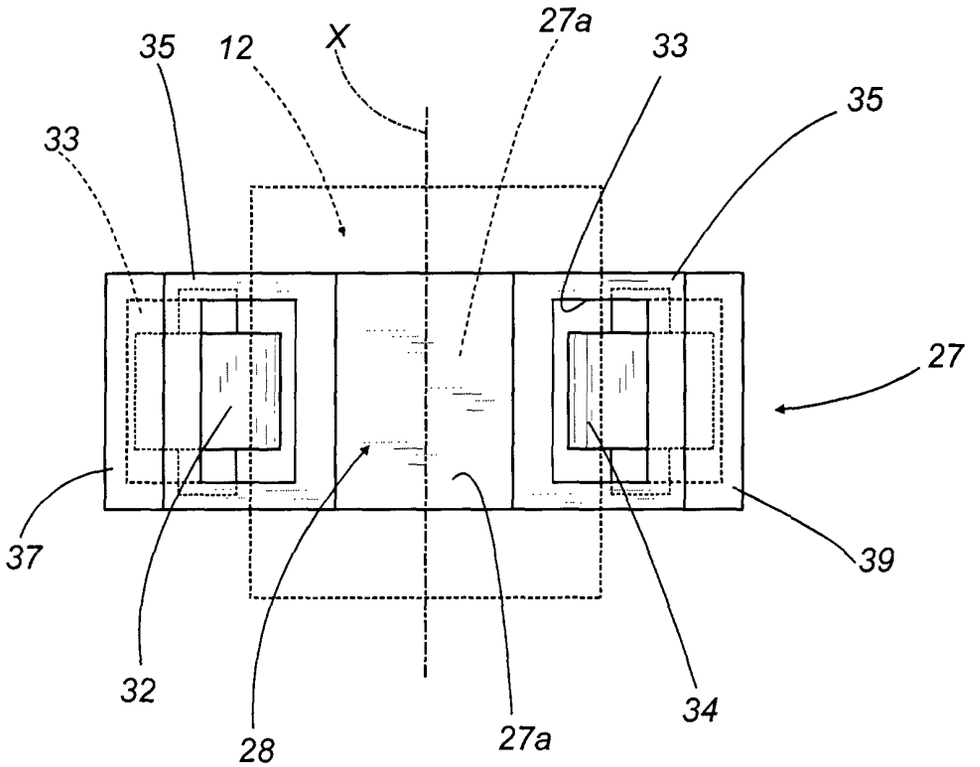
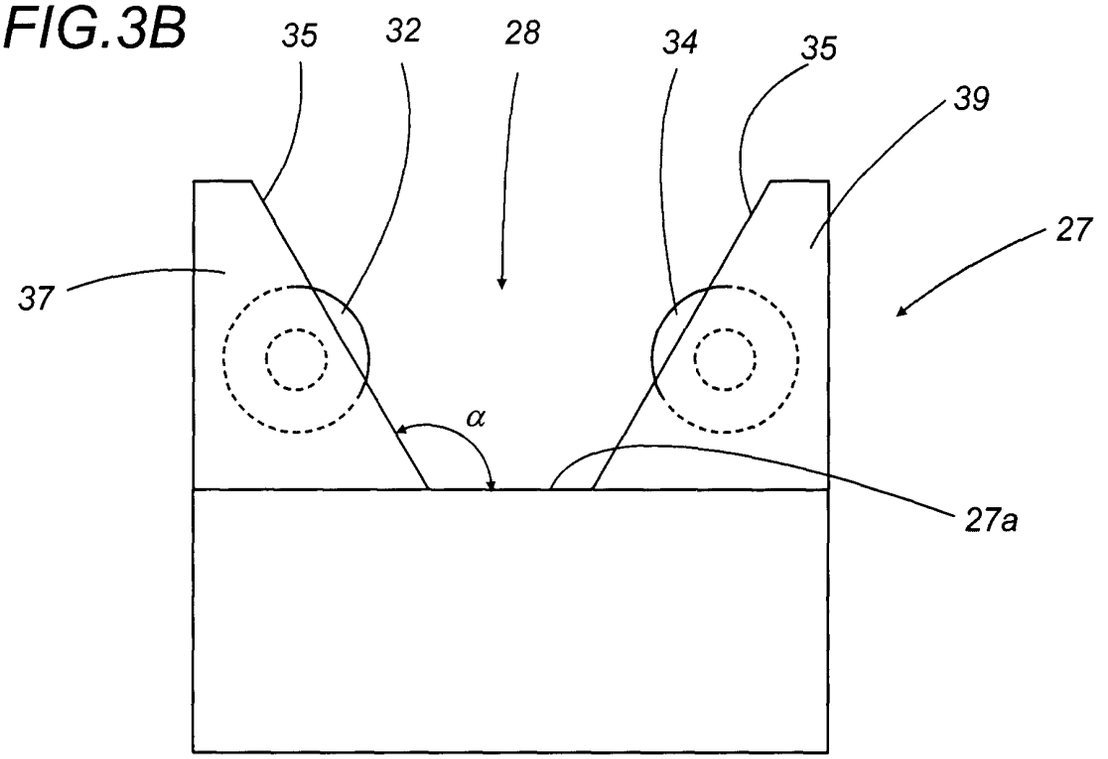


FIG.3B



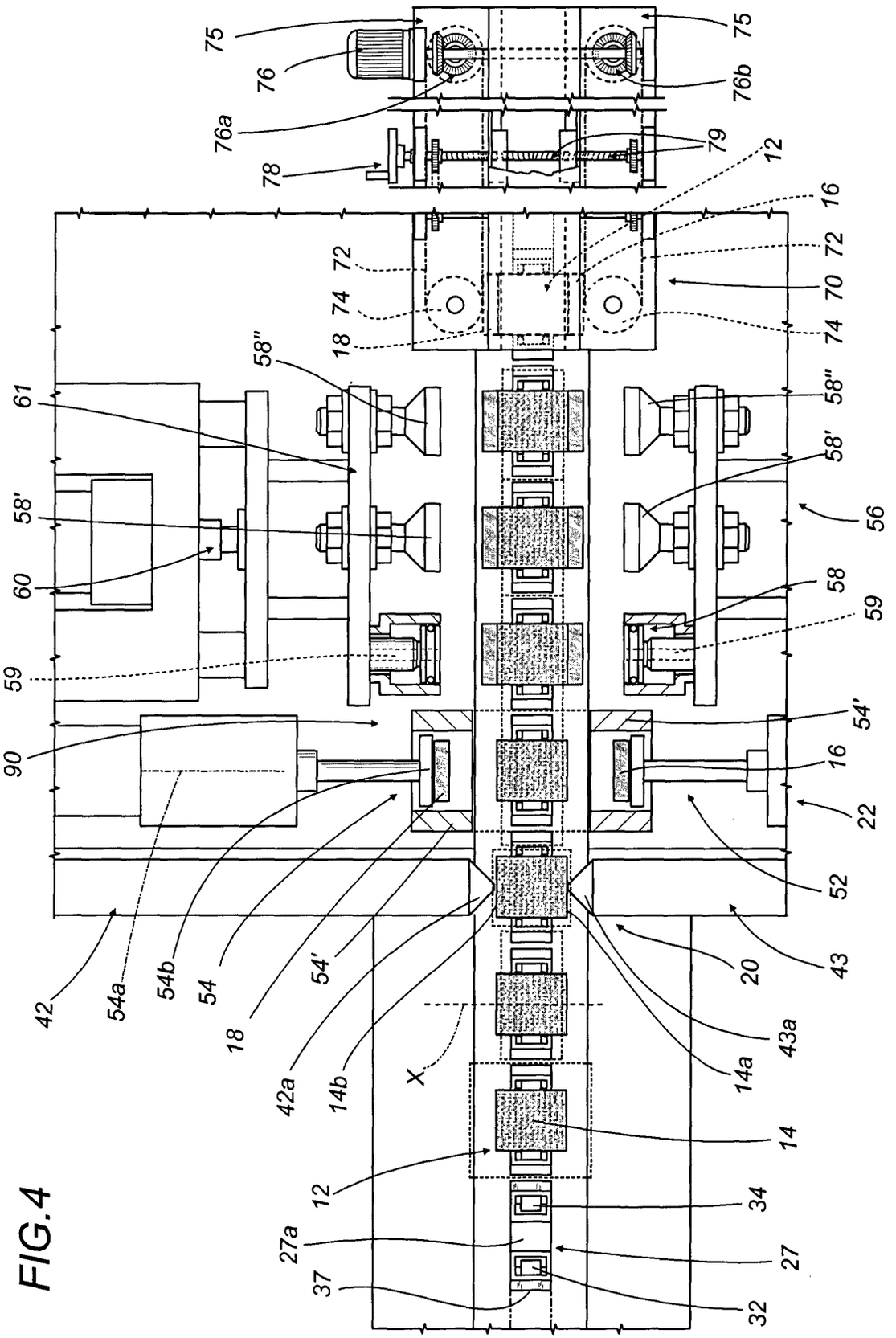

75
76
76a
78
75
76b
79
12
16
72
70
74
18
58"
61
58'
60
59
90
56
58
59
54'
16
22
52
43
20
42
54a
54b
54
18
54'
42a
14b
X
14a
43a
14
12
34
27a
27
37
32

FIG.4

FIG. 7

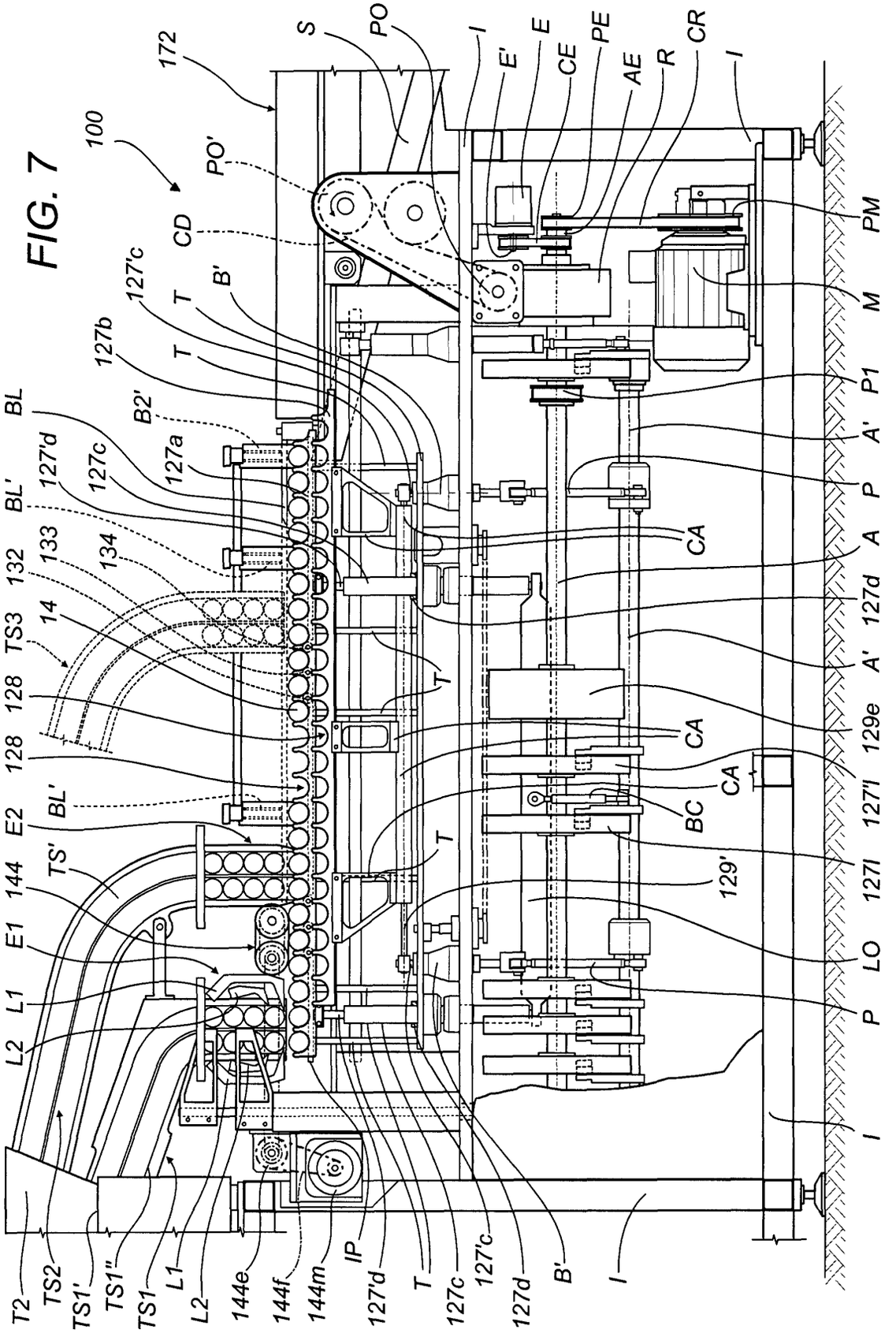

100
172
S
PO
I
E'
E
CE
PE
AE
R
CR
I
PO'
CD
B'
127'c
T
T
127b
B2'
127a
BL
BL'
127'd
127c
132
133
134
TS3
14
128
128
E2
BL'
TS'
144
E1
L1
L2
T2
TS2
TS1'
TS1"
TS1
L1
L2
144e
144f
144m
IP
127'd
T
127c
127'c
127d
B'
I
T
T
T
T
CA
CA
CA
BC
129'
PM
M
P1
A'
P
A
127d
A'
129e
127'l
127l
LO
P
I

FIG. 8A

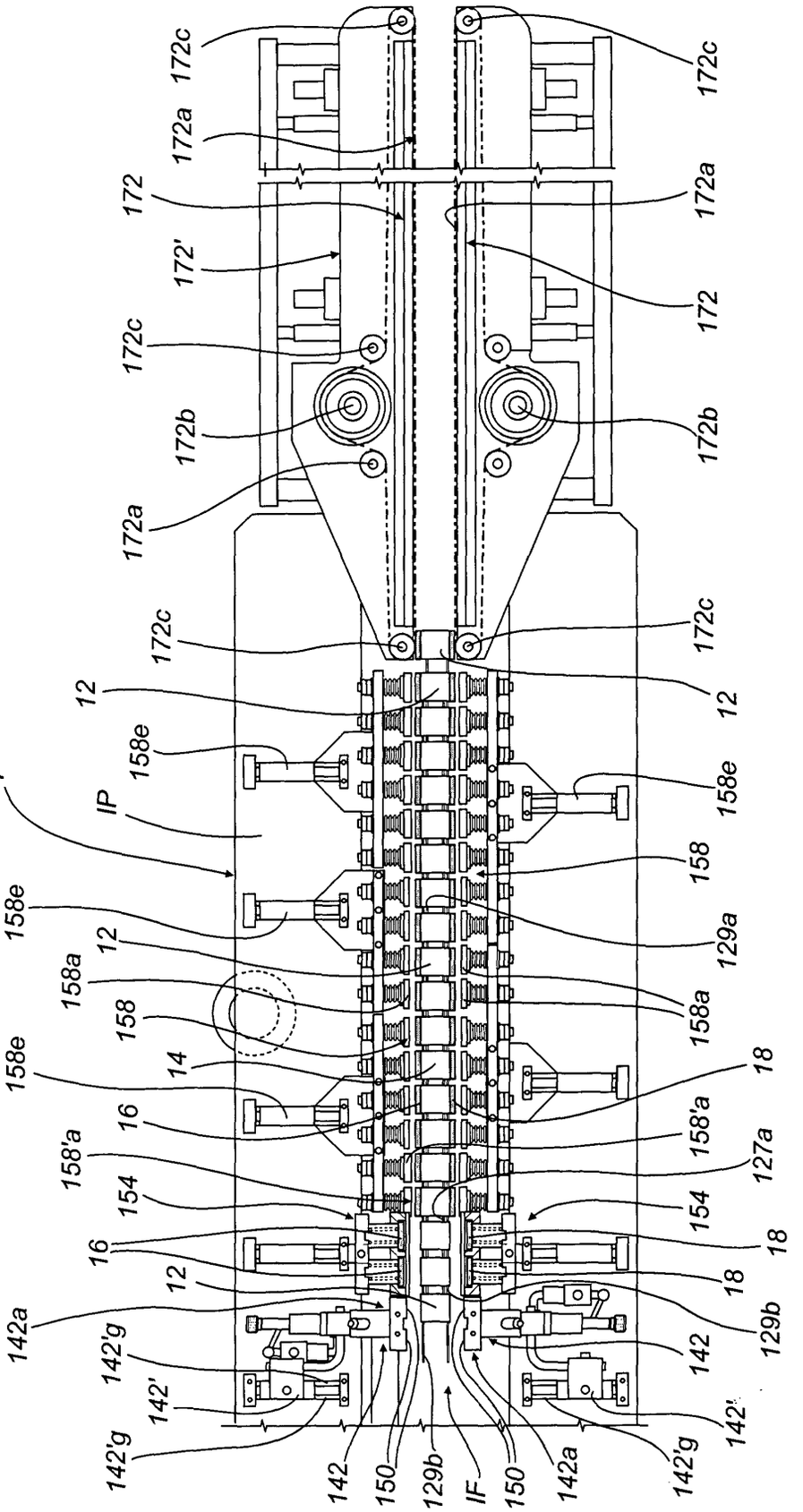
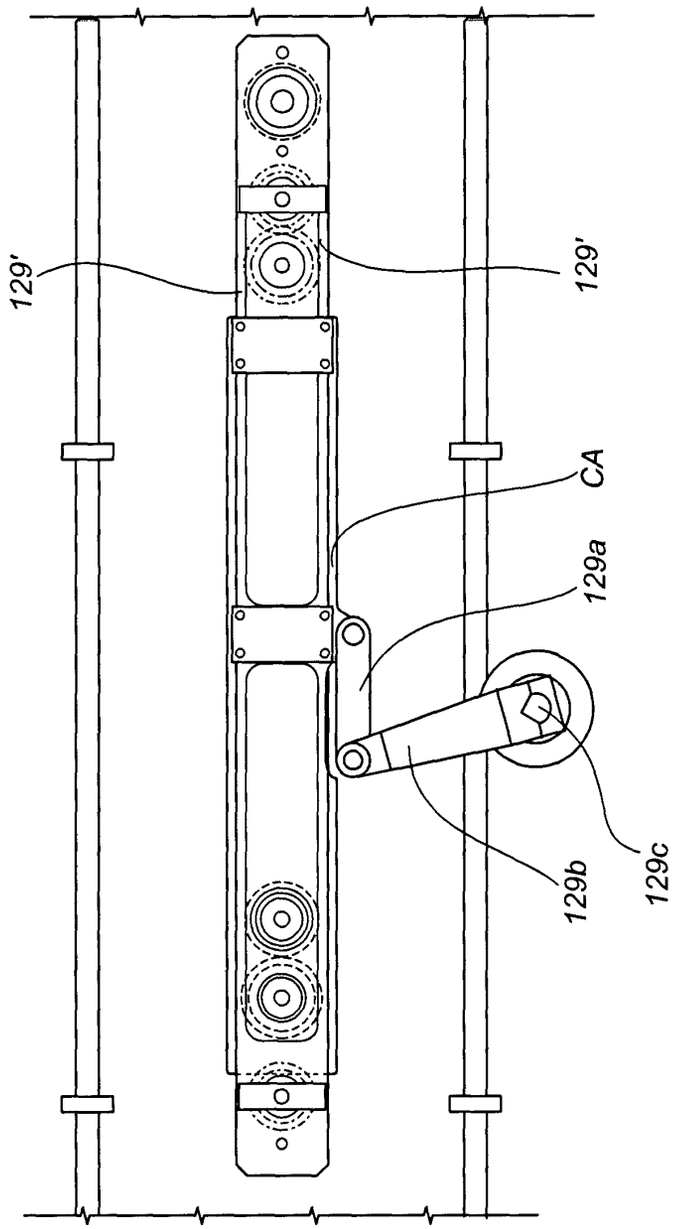

I
IP
12
14
16
18
127a
129a
129b
150
154
158
158a
158e
158'a
172
172a
172b
172c
172'
142
142a
142'
142'g
IF

FIG. 8B


129'
129'
CA
129a
129b
129c

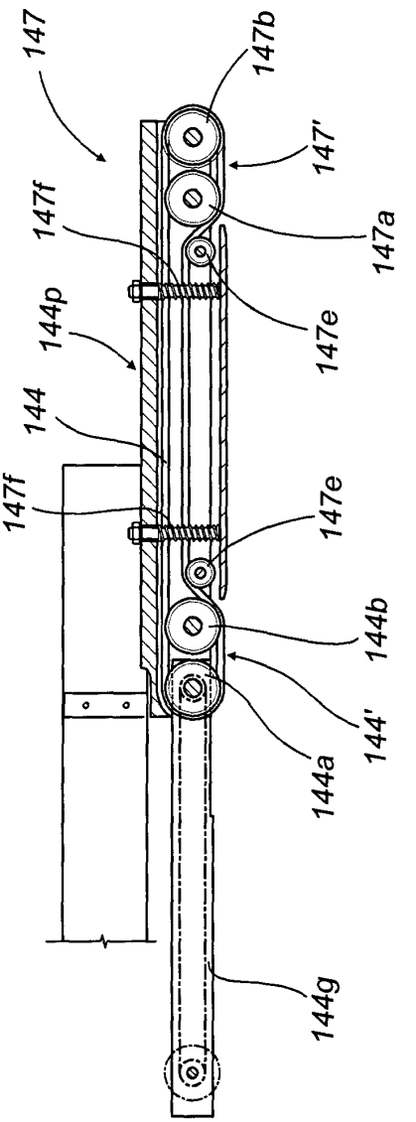

147
147b
147'
147f
147a
144p
147e
144
147f
147e
144b
144'
144a
144g

FIG. 17

FIG. 9B

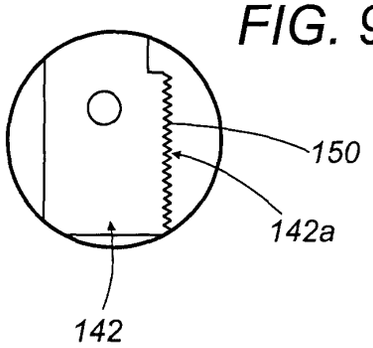

150
142a
142

FIG. 9A

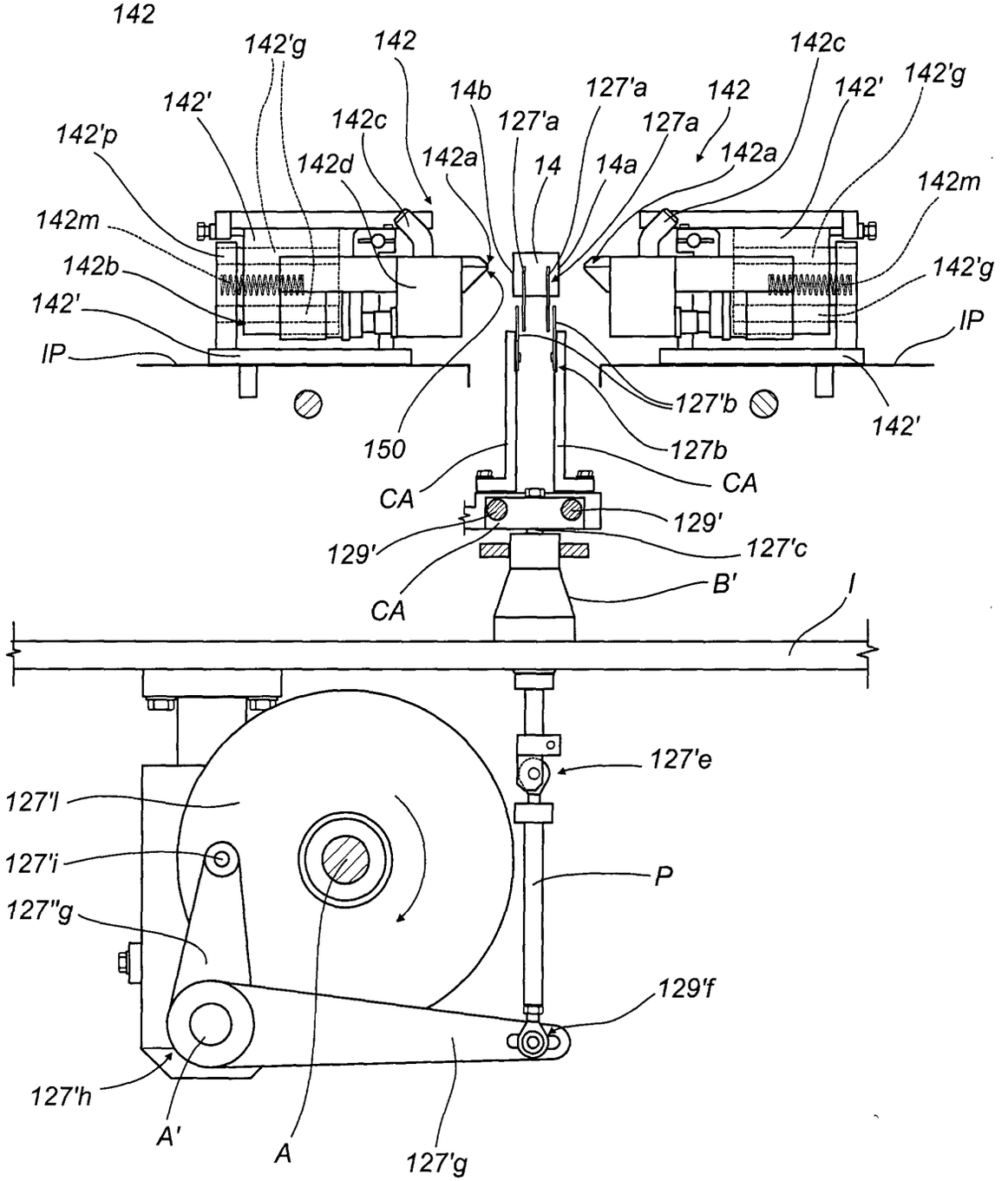

142'g
142
142c
142'
142'g
14b
127'a
142
142'
142'
142c
127'a
127a
142'p
142d
142a
14
14a
142a
142m
142m
142b
142'g
142'
IP
IP
127'b
142'
150
127b
CA
CA
129'
129'
127'c
CA
B'
I
127'e
127'l
127'i
P
127"g
129'f
127'h
A'
A
127'g

FIG. 10

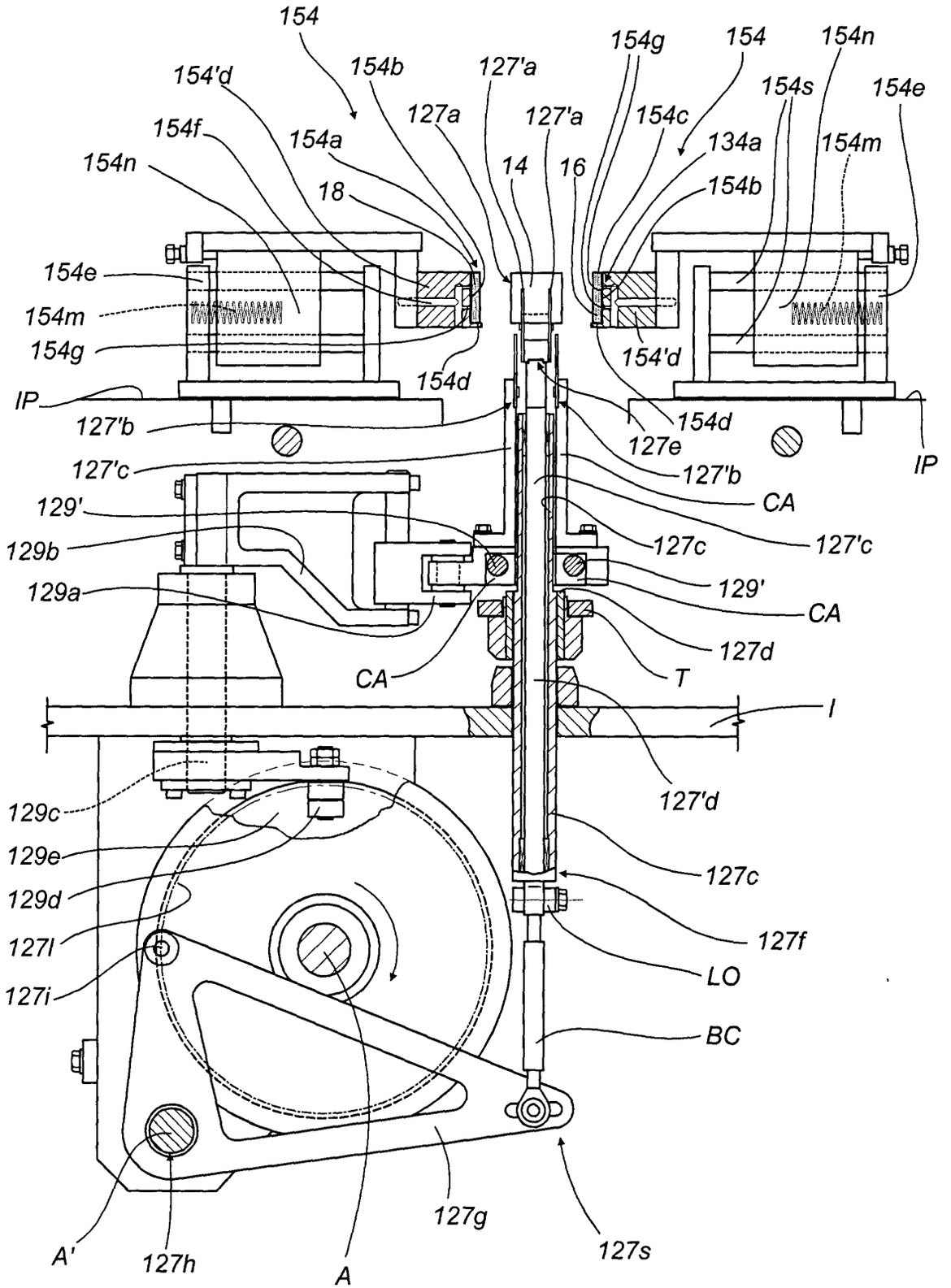

154
154b
154'd
127'a
154g
154
154n
154s
154e
127a
127'a
154c
154f
154a
134a
154m
154n
14
16
18
154b
154e
154m
154g
154'd
154d
IP
127'b
154d
127e
IP
127'c
127'b
CA
129'
127c
127'c
129b
129'
129a
CA
127d
CA
T
I
127'd
129c
127c
129e
129d
127f
127l
LO
127i
BC
127g
A'
127h
A
127s

FIG. 11

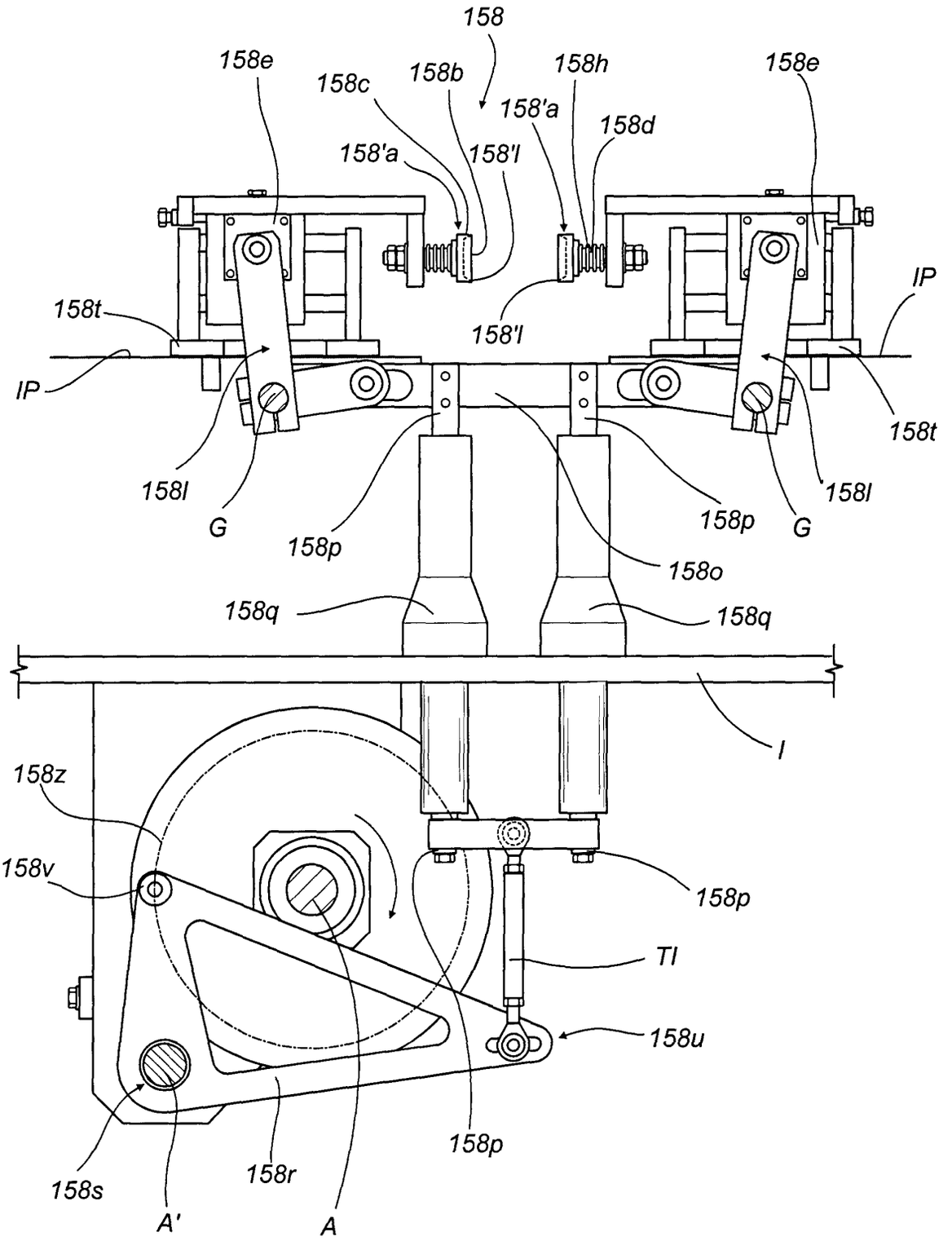
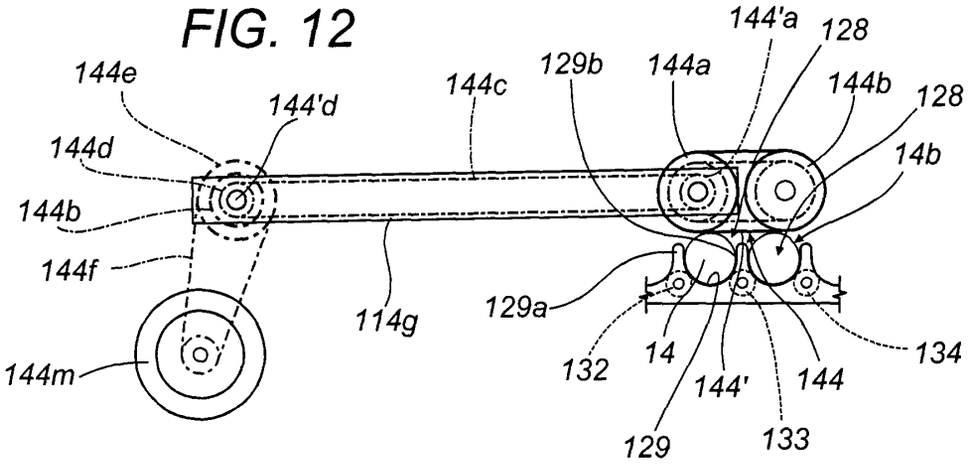

158
158e
158c
158b
158h
158e
158'a
158d
158'a
158'l
158t
158'l
IP
IP
158t
158l
G
158p
158p
G
158l
158o
158q
158q
I
158z
158v
158p
TI
158u
158p
158s
158r
A'
A

FIG. 12



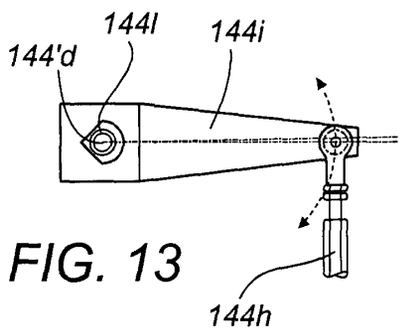


FIG. 13

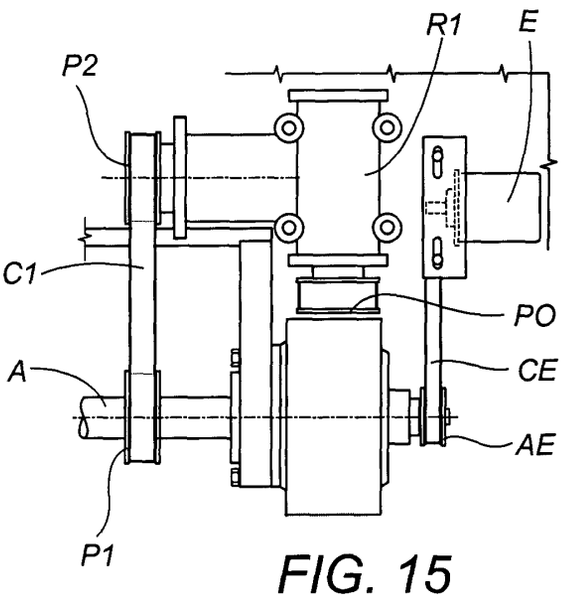


FIG. 15

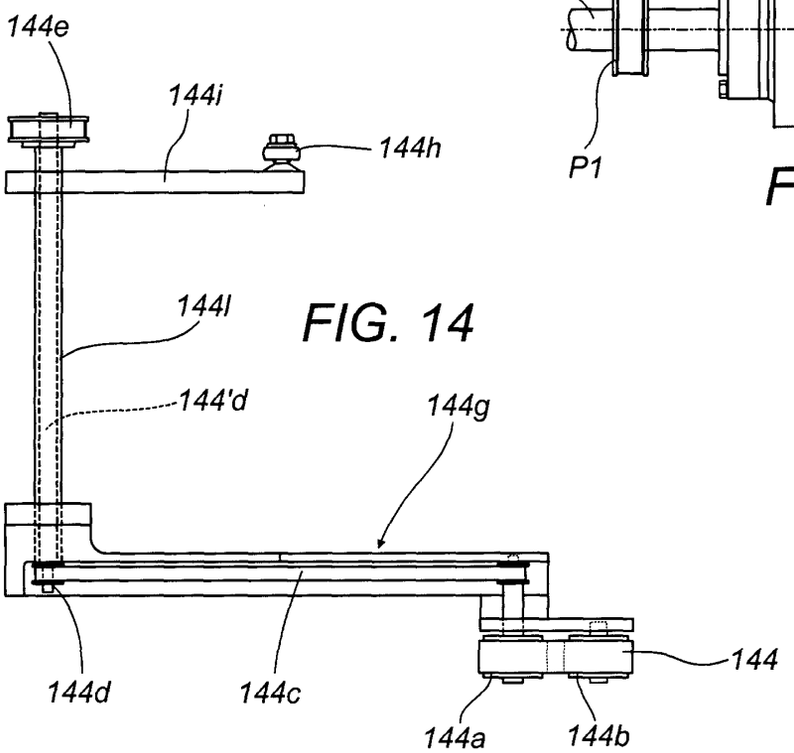


FIG. 14

FIG. 16