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(54) **APPARATUS FOR THE CONTINUOUS PACKAGING OF ITEMS WITH A RESPECTIVE WRAPPING SHEET, AND METHOD OF PRODUCING A WRAPPING DEFINING A CAVITY ADAPTED TO INCLUDE AN ITEM**

(57) An apparatus for the continuous packaging of items with a wrapping sheet, comprising a continuously rotating forming wheel (10) provided with a plurality of peripheral forming assemblies (12) articulated thereto, and a continuously rotating drawing wheel (16) provided with a plurality of peripheral drawing assemblies (18) articulated thereto; the forming wheel (10) cooperates with the drawing wheel 16 so that the rotational movement of each wheel, in combination with the oscillatory movement of the respective drawing and forming assemblies (12, 18), periodically brings a forming seat (14) into a position facing and coaxial with a drawing member (22),

wherein, in said coaxial position, a wrapping sheet is transferred onto the forming seat (14) and the drawing member (22) draws the sheet into said seat (14); the apparatus further comprises a conveyor (24) for the items to be packaged, which cooperates with the forming wheel (10) to insert the item into a respective drawn sheet following its forming; a sealing station (42), positioned downstream of the forming wheel (10), is configured to receive the wrapping sheets containing the respective items from the forming wheel (10) and apply respective sealing elements (S) to said wrapping sheets.

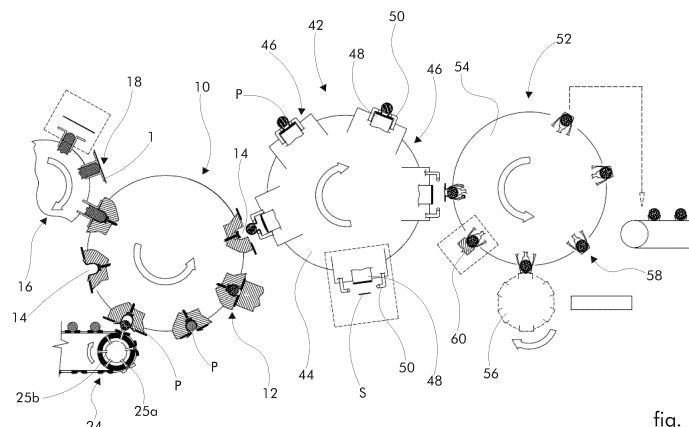


fig. 1

Description

Technical field

[0001] The present invention generally relates to the field of machines for packaging items; in particular, the invention refers to an apparatus for the continuous packaging of items with a respective wrapping sheet and to a method for producing a wrapping defining a cavity adapted to include an item.

Summary of the invention

[0002] Apparatuses for packaging items (for example, cosmetic or food products) by wrapping them in films or sheet wrappings are known.

[0003] However, these apparatuses and technologies (commonly referred to in the sector as "bunch wrapping") prove difficult or impossible to use when the item to be wrapped is particularly delicate or otherwise susceptible to damage if subjected to overly vigorous handling.

[0004] This is the case, for example, with confectionery products (such as chocolate pralines, sugared almonds, etc.) that have a soft consistency and may therefore become deformed if wrapped using the aforementioned methods.

[0005] One purpose of the present invention is to overcome the aforementioned problems by providing an apparatus and a packaging method that preserve the integrity of the packaged items while simultaneously ensuring high production volumes with reduced overall footprints.

[0006] To achieve this result, an apparatus and a method for packaging items, according to an embodiment of the invention, provide that the wrapping is pre-formed before the insertion of the item, so that the latter does not itself serve as the forming element of the wrapping (as in the case of wrapping by "bunch wrapping"), thereby preventing damage to the item due to handling.

[0007] In particular, the packaging of items according to the invention can be carried out continuously by means of a pair of wheels that cooperate to pre-form a wrapping sheet so as to define a cavity into which a conveyor inserts the respective item.

[0008] The two wheels carry a plurality of respective assemblies, provided with complementary forming members and forming seats, which are periodically brought into mutual engagement by the rotation of the wheels.

[0009] The assemblies of the two wheels, oscillating around axes parallel to the rotation axes of the respective wheels, are configured so that the forming members (carried by one wheel) are periodically aligned with corresponding forming seats (carried by the other wheel). In this position, the aligned forming member and forming seat (between which a wrapping sheet is interposed) interpenetrate, drawing the wrapping sheet, which assumes a concave shape so as to define an open cavity into which the item can be inserted.

[0010] A conveyor device may be provided, cooperating with the forming wheel to insert the item into a respective drawn wrapping sheet, and/or a sealing station, preferably arranged downstream of the forming wheel and configured to receive (preferably from said forming wheel) the wrapping sheets containing the respective items and to apply respective sealing elements to said sheets, which, together with the wrapping sheets, define respective closed cavities containing the items.

[0011] In this way, the item can be inserted into an already partially formed wrapping, without said wrapping being shaped around the item itself, and then sealed. Since the item remains substantially untouched, its integrity is ensured while also achieving a significantly improved production yield compared to known techniques.

[0012] The above-mentioned and other objects and advantages are achieved, according to one aspect of the invention, by an apparatus and a packaging method having the characteristics defined in the appended claims.

Brief description of the drawings

[0013] The functional and structural characteristics of some preferred embodiments of an apparatus and a method for packaging items according to the invention will now be described. Reference is made to the accompanying drawings, wherein:

- Figure 1 is a schematic representation of a packaging apparatus according to an embodiment of the invention, also including optional packaging members that lead to the creation of a specific packaging wrapping, which may constitute an embodiment;
- Figure 2 is a schematic representation of a package achievable with the apparatus according to the invention;
- Figure 3 is an exploded schematic representation of the package shown in Figure 2;
- Figures 4A-4F are schematic representations of the operational sequence carried out by the forming wheel in cooperation with the drawing wheel, according to an embodiment of the invention;
- Figures 4G-4L are schematic representations of two sequential operating steps performed by a sealing wheel, according to an embodiment of the invention;
- Figures 4M and 4N are schematic representations of two sequential operating steps involving an optional finishing wheel of the packaging wrapping, cooperating with the sealing wheel, according to an embodiment of the invention;
- Figure 5 is a schematic representation of a portion of the apparatus, wherein the drawing and forming wheels are visible, according to an embodiment of the present invention;
- Figure 6 is a schematic representation of the mutual engagement region between the drawing and form-

- ing wheels, wherein cam actuators for oscillating the assemblies of the drawing wheel are visible, according to an embodiment of the present invention; and
- Figure 7 is a schematic representation of the mutual engagement region between the drawing and forming wheels, wherein cam actuators for the axial displacement of the drawing or holding members carried by the drawing wheel are visible, according to an embodiment of the present invention.

Detailed description

[0014] Before detailing multiple embodiments of the invention, it should be clarified that the invention is not limited in its application to the structural details and component configurations presented in the following description or illustrated in the drawings. The invention can take other embodiments and be implemented or realized in different ways. It should also be understood that the phraseology and terminology used are descriptive and should not be considered as limiting.

[0015] With reference to the drawings, the diagram in Figure 1 relates to a packaging apparatus according to the invention, which allows, for example, the production of a package C of the type illustrated by way of example in Figures 2 and 3.

[0016] Packages of the type mentioned above are known per se and described, for example, in EP 3160864 B1, EP 2064119 B1, and EP 2665653 B1.

[0017] Such a package C comprises an item P, specifically a praline of substantially spherical shape, wrapped in a packaging comprising a first and a second wrapping sheet 1, 2 and an optional cup-shaped container 3 (paper ramekin).

[0018] The first wrapping sheet 1, which encloses the praline P, is shaped in an omega-like configuration, so as to define a cavity that includes the item and a terminal flange or rim 4; the second wrapping sheet 2 is in the form of a disc and is connected, for example, by sealing or gluing to the flange 4, thus forming a closed wrapping which, as shown in Figure 2, is inserted into a cup-shaped container 3, whose bottom wall 5 is preferably adhered to the second wrapping sheet 2 in the form of a disc.

[0019] It is understood that the Ω -shaped configuration of the first sheet 1, which features a necking of the sheet and results in a narrowed opening and improved adhesion of the sheet to the external surface of the item, is purely optional. The packaging apparatus according to the invention may actually also be used to obtain packages wherein the first wrapping sheet is configured in a U-shape, wherein the head portion is complementary to the external surface of the item, whatever its shape may be, such as a hemispherical or flattened cap.

[0020] To produce a package of the type illustrated in Figure 2, the packaging apparatus may comprise: a forming wheel 10 for the first wrapping sheet; a drawing wheel 16 that cooperates with the forming wheel 10; and a conveyor device 24 for the items to be packaged, which

cooperates with the forming wheel to insert the item into the first wrapping sheet 1 after its forming.

[0021] The forming wheel continuously rotates around its own rotation axis, preferably horizontal, and comprises a plurality of forming assemblies 12, arranged near the peripheral edge of the wheel 10 and angularly spaced. Each forming assembly 12 comprises a forming seat 14, which forms the wrapping sheet into a configuration adapted to receive the item.

[0022] According to an embodiment of the invention, a drawing wheel 16 is also present, continuously rotating around an axis parallel to the axis of rotation of the forming wheel 10, and comprising a plurality of peripheral drawing assemblies 18, articulated to the drawing wheel 16 in angularly spaced positions and oscillating about an axis parallel to the rotation axis of the drawing wheel 16.

[0023] Each drawing assembly 18 comprises: a wrapping sheet holding member 20; and a punch drawing member 22. At least one of the holding member 20 of the wrapping sheet and the punch drawing member 22 is movable relative to the other, between: a passive configuration, wherein the punch drawing member 22 does not protrude radially from the holding member 20; and an active configuration, wherein the punch drawing member 22 protrudes radially from the holding member 20.

[0024] The drawing wheel 16 is driven in rotation in a direction opposite to that of the forming wheel 10, and cooperates with the forming wheel 10 such that the rotational movement of each wheel 10, 16, in combination with the oscillatory movement of the respective drawing and forming assemblies 12, 18, periodically brings a forming seat 14 into a position facing a drawing member 22 and coaxial therewith, wherein this coaxial position, the wrapping sheet is transferred onto the forming seat 14, and the drawing member 22 is in the active configuration, thereby drawing the wrapping sheet within said seat 14.

[0025] According to an embodiment, the forming wheel 10 and/or the drawing wheel 16 are driven in rotation by handling members, configured to operate on the respective wheels 10, 16 either independently and in a coordinated manner (e.g., by electric motors associated with each wheel 10, 16, operable separately from the other motor) or in a driven manner (e.g., by a single motor unit, which may be directly connected to one wheel and indirectly connected to the other, or indirectly connected to both wheels 10, 16 via belts or other transmission elements).

[0026] According to an embodiment, the number of drawing assemblies 18 is equal to the number of forming assemblies 12.

[0027] By way of example, Figures 4A to 4D schematically illustrate a sequence of drawing a wrapping sheet, according to an embodiment of the invention. In particular, the following are visible: adhesion steps of the first wrapping sheet 1 to the holding member 20; the relative motion between the latter and the drawing member 22; penetration thereof into the forming seat 14, causing the

drawing of the wrapping sheet 1 interposed between the holding member 20 and the corresponding forming assembly 12, and the consequent formation of an annular flange 4 of the wrapping sheet (interposed between the forming seat 14 and the corresponding holding member 20); thereafter insertion of the item P by the conveyor device 24 into the cavity of the drawn wrapping sheet.

[0028] As illustrated by way of an example in Figure 5, one operating mode of an apparatus according to an embodiment of the invention involves the steps of rotating the forming and drawing wheels 10, 16 in opposite directions; the forming and drawing assemblies 12, 18, upstream of the line joining the centers of the forming and drawing wheels 10, 16 (at least starting from a preset angular direction of the center of oscillation of the assembly with respect to said line joining the centers of the wheels 10, 16, for example when the line between the centre of the wheel and the centre of oscillation of the respective assembly is at $+90^\circ$ from the line joining the centers of the wheels 10, 16), are further rotated relative to their respective wheels 10, 16 (due to being supported in an oscillatable manner), in a direction concordant with the rotation direction of the respective wheels 10, 16, until the alignment of the axes of a drawing member 22 with a corresponding forming seat 14 is completed. In this configuration, such alignment occurs therefore upstream of the line joining the centers of the forming and drawing wheels 10, 16, because the rotation of the wheels 10, 16 is combined with the rotation of the assemblies 12, 18 with respect to them, so that the rotation of the wheels 10, 16 causes the drawing member 22 and the corresponding forming seat 14 to interpenetrate.

[0029] Starting from this configuration, the forming and drawing assemblies 12, 18 are further rotated, relative to the respective wheels 10, 16, in a direction opposite to the rotation direction of the respective wheels 10, 16 (which, in the meantime, continue to rotate in their respective initial rotation directions), so as to maintain the alignment condition of the axes of the drawing member 22 and the corresponding forming seat 14 until the drawing member 22 has reached the maximum penetration depth in the corresponding forming seat 14 and has then been at least partially extracted. Preferably, the alignment condition of the axes of the drawing member 22 and the corresponding forming seat 14 is maintained by rotating the assemblies 12, 18 in the opposite direction to the rotation direction of the respective wheels 10, 16 until the profile of the drawing member 22 becomes tangential to an edge or an entry section of the corresponding forming seat 14.

[0030] According to a preferred embodiment, the peripheral forming assemblies 12 and/or the peripheral drawing assemblies 18 are oscillatable around their respective axes, which are parallel to the rotation axes of the respective wheels 10, 16, with an angular excursion between 5° and 50° .

[0031] According to a preferred embodiment, the holding member 20 of the wrapping sheet is translatable along its own axis between said active and passive

configurations. This allows the axial retraction of the holding member 20, exposing the drawing member 22 for insertion into the corresponding forming seat 14 and preventing possible mechanical interference with the latter.

[0032] Furthermore, each peripheral forming assembly 12 may comprise a guiding and ejection member 15, which includes a head 15a counter-shaped to match an axial end portion of the punch drawing member 22. The head 15a is also carried by a plunger 15b slidably housed within the respective forming seat 14 of the wrapping sheet.

[0033] According to a preferred embodiment, the forming seat 14 of the wrapping sheet is carried by the respective peripheral forming assembly 12 in a manner that allows translation along its own axis.

[0034] According to an embodiment, the forming assemblies 12 and/or the drawing assemblies 18 are oscillatable relative to the corresponding forming wheels 10 and/or drawing wheels 16 via primary actuation means configured to operate on the respective assemblies 12, 18 independently (for example, via electric motors associated with each assembly 12, 18 and individually operable separately from the other motors) or in a driven manner. In the latter case, the primary actuation means may, for example, include pulleys or other equivalent components, rotationally integral with the respective assemblies 12, 18, and rotated by means of belts or other transmission components connected to a central motor (conveniently, the component that drives into rotation the respective forming and/or drawing wheels 10, 16), and/or additional actuation means associated with other assemblies 12, 18.

[0035] According to an embodiment, the holding member 20 of the wrapping sheet and/or the punch drawing members 22 and/or the guiding and ejection members 15 and/or the forming seats 14 of the wrapping sheet are radially extendable and retractable relative to the corresponding forming wheels 10 and/or drawing wheels 16 by means of secondary actuation means configured to operate on the respective members or seats 14, 15, 20, 22 independently (for example, via linear actuators of hydraulic, electric, pneumatic type, etc., associated with each member or seat and individually operable separately from the other actuators) or in a driven manner. In the latter case, the secondary actuation means may, for example, include cam actuators or other equivalent components configured to impart an alternating translation movement to the respective members or seats and actuated in rotation via belts or other transmission components connected to a central motor (conveniently, the component that drives the rotation of the respective forming and/or drawing wheel 10, 16), and/or to additional secondary actuation means associated with other members or seats 14, 15, 20, 22.

[0036] According to an embodiment (exemplarily illustrated in Figure 6), the forming assemblies 12 and/or the drawing assemblies 18 are oscillatable relative to the

corresponding forming wheels 10 and/or drawing wheels 16 by means of primary cam mechanisms 26.

[0037] Preferably, each primary cam mechanism 26 comprises a primary rod 28 having a first end fixed to the respective assembly 12, 18 and a second end hinged to a primary roller 30 that engages a primary guide 32 on the respective wheel 10, 16, the profile of which varies in the radial direction of the wheel. This profile of the primary guide 32 may conveniently be shaped so that the oscillation of the respective assembly 12, 18 is performed in accordance with the operating mode described above with reference to Figure 5.

[0038] According to an embodiment, the holding members 20 of the wrapping sheet and/or the punch drawing members 22 and/or the guiding and ejection members 15 and/or the forming seats 14 of the wrapping sheet are radially extendable and retractable relative to the corresponding forming wheels 10 and/or drawing wheels 16 by means of secondary cam mechanisms 34.

[0039] A possible operating mode of an apparatus according to the invention, exemplarily illustrated in Figure 7, may conveniently provide that the holding member 20 is in a condition of maximum axial extension (relative to the respective assembly 18) when the said holding member 20 (specifically, the corresponding holding head 21a) comes into contact with an entry section of the corresponding forming seat 14, then is retracted relative to the respective assembly 18 until the drawing member 22 has reached the maximum penetration depth in the corresponding forming seat 14, and subsequently, the holding member 20 is again axially extended (following the displacement of the forming seat 14 due to the mutual rotation of the wheels 10, 16) until it detaches from the entry section of the corresponding forming seat 14.

[0040] Preferably, each secondary cam mechanism 34 comprises a secondary rod 36 having a first end hinged to the respective assembly 12, 18 and a second end hinged to a secondary roller 38 that engages a secondary guide 40 on the respective wheel 10, 16, having a profile that varies in the radial direction of the wheel 10, 16. The secondary rod 36 is also connected to a respective holding member 20 or a drawing member 22, or forming seat 14 of the wrapping sheet, at a point between said ends, so that the oscillatory motion of the secondary rod 36 produces a translation of the holding member 20, or drawing member 22, or forming seat 14 along their respective axes. The profile of the secondary guide 40 may conveniently be shaped so that the axial excursion of the respective holding member 20 is performed according to the operating mode described above with reference to Figure 7.

[0041] According to a preferred embodiment, each holding member 20 of the wrapping sheet comprises a holding head 21a, supported by a tubular body 21b wherein the respective drawing member 22 is coaxially housed. The holding head 21a is shaped as an annular flange protruding radially from the respective drawing wheel 16 and includes an external surface configured

to come into contact with a respective wrapping sheet.

[0042] Preferably, the holding head 21a of each holding member 20 of the wrapping sheet is connected or connectable to a pneumatic suction source to hold by suction the respective wrapping sheet, that has adhered to the respective external surface.

[0043] According to an embodiment, schematically illustrated in Figures 4D to 4F, each forming seat 14 of the wrapping sheet comprises a diaphragm device 17 configured for radially necking the wrapping sheet and increase its adhesion to the surface of the product when the product has been introduced into the respective drawn sheet. The diaphragm 17 is preferably configured to close around the neck of the drawn wrapping sheet in a position interposed between the flange 4 and the forming seat 14, necking the sheet and increasing its adhesion to the external surface of the product. Conveniently, the forming seat 14 may be configured to retract axially (relative to the respective assembly 12) so as to detach from the corresponding holding member 20 by a sufficient distance to allow the insertion, between said forming seat 14 and said holding member 20, of the diaphragm device 17 when the first sheet 1 has been drawn, to neck its top portion.

[0044] Downstream of the introduction of the item into the respective drawn sheet, there may be the operational step of providing a pressure member 19, arranged to exert pressure on the flange 4 when the latter is interposed between the pressure member 19 and the diaphragm 17.

[0045] According to a preferred implementation (schematically illustrated in Figure 4F), once the diaphragm 17 has been actuated to neck the flange 4 onto the product, or simultaneously with such actuation of the diaphragm 17, the pressure member 19 is pressed against the flange 4, using this diaphragm 17 as a counter-support, this causes the squashing of the flange 4 and the elimination of wrinkles or creases resulting from the drawing action of the wrapping sheet and/or the necking by the diaphragm 17. A similar configuration is known from document EP 2665653 B1.

[0046] Preferably, each forming seat 14 of the wrapping sheet has a substantially "U"-shaped cross-section and a bottom portion shaped as a hemispherical cap.

[0047] According to an embodiment, each punch drawing member 22 has an axial end counter-shaped to match a bottom portion of a respective forming seat 14.

[0048] Conveniently, the axial end of the drawing member 22 may have an ogive or semi-elliptical shape.

[0049] The conveyor device 24 may comprise a plurality of containment seats 25a, configured to transport respective items, and one or more movable ejectors 25b, associated with respective containment seats 25a and configured to push the items toward respective forming seats 14 of the peripheral forming assemblies 12 when said containment seats 25a of the conveyor 24 face said forming seats 14.

[0050] As an alternative or in combination with the

embodiments described and illustrated above, the apparatus may comprise a sealing station 42, preferably positioned downstream of the forming wheel 10 and configured to receive (preferably, from the forming wheel 10) the wrapping sheets containing the respective items and to apply respective sealing elements S to said wrapping sheets, said sealing elements S being adapted to define, together with said wrapping sheets, respective closed cavities containing the items. For example, in the case of the product illustrated in Figures 2 and 3, the sealing elements S are configured as discs 2 made of sheet material, adhered (by sealing, gluing, etc.) to the annular flanges 4 of corresponding first wrapping sheets 1 containing the item. According to an alternative not illustrated, the sealing elements S may instead be configured as pleated paper cups 3 (also known as "paper ramekins"), so that the annular flange 4 directly adheres to a flat bottom surface 5 of the cup 3. Similar solutions are known, for example, from documents EP 2 665 653 B1, EP 2 064 119 B1, EP 1 046 579, and EP 2 197 747 B1.

[0051] Preferably, the sealing station 42 comprises a sealing wheel 44, positioned downstream of the forming wheel 10 and continuously rotating around an axis of rotation parallel to the axis of rotation of the drawing wheel 16. The sealing wheel 44 comprises a plurality of angularly spaced peripheral sealing assemblies 46, each including a sealing head 48, radially movable relative to the sealing wheel 44 and comprising an exposed surface configured to allow receive respective sealing elements S, and an abutment assembly 50 adapted to provide the abutment of the sealing head 48. The sealing head 48 and the abutment assembly 50 are movable from a mutually spaced configuration, wherein the abutment assembly 50 is in a position allowing loading/removal of a wrapping on the sealing head 48, to a close configuration, wherein the sealing head 48 is configured to apply the sealing element to the respective wrapping sheet. The sealing station 42 further comprises a delivery device for the sealing elements S, adapted to supply said sealing elements S to the respective sealing heads 48 before the corresponding sealing assemblies 46 receive the respective wrapping sheets containing the items exiting from the forming wheel 10.

[0052] Preferably, the sealing elements S are configured as second wrapping sheets 2, and each sealing head 48 comprises a welding device suitable for contacting, supporting, and transmitting heat to a second wrapping sheet 2 until reaching a predetermined welding temperature, so that the two wrapping sheets 1, 2 are interposed between the sealing head 48 and the abutment assembly 50 and are heat-sealed along a welding region that at least partially surrounds the cavity containing the item.

[0053] Figures 4G to 4I schematically illustrate a possible operating mode of a sealing wheel 42 according to an embodiment of the invention, starting from a configuration wherein a sealing assembly 46 receives a first wrapping sheet 1 containing the item P from the forming

wheel 10, by closing the abutment assembly 50 around the annular flange 4. Then, the sealing head 48, which has been previously supplied with the sealing element S (in the illustrated example, a second wrapping sheet 2 in the form of a disc), presses the sealing element S against the abutment assembly 50, applying heat to the second sheet 2 until sealing it to the flange 4 of the first sheet 1.

[0054] As an alternative or in combination with the embodiments described and illustrated above, a finishing station 52 may be provided, preferably positioned downstream of the sealing station 42 and comprising a finishing wheel 54 configured to receive (preferably, from the sealing wheel 44) the sealed wrappings containing the respective items, and/or a delivery device 56, adapted to delivery cups 3 and preferably cooperating with the finishing wheel 54 to apply and mutually integrally secure said cups 3 to said sealed wrappings.

[0055] Preferably, the finishing wheel 54 comprises a plurality of peripheral gripping assemblies 58, arranged on the finishing wheel 54 in angularly spaced positions. Each peripheral gripping assembly 58 is configured to receive from the sealing station 42 and hold a sealed wrapping having an Ω -shaped form, so that the annular flange 4 of the sealed wrapping is exposed outward from the finishing wheel 54. In this case, the dispensing device 56 is configured to dispense the paper cups 3 so that the flat bottom surface 5 of each paper cup 3 adheres to a respective annular flange 4 of a sealed wrapping.

[0056] The finishing station 52 may further comprise a squashing means 60 cooperating with the finishing wheel 54 upstream of the delivery device 56, such squashing means 60 comprises a concave portion facing the finishing wheel 54 and is movable between a radially distal position with respect to the finishing wheel 54 and a radially proximal position with respect to the finishing wheel 54. The squashing means 60 cooperates with the forming wheel 10 so that, when a peripheral gripping assembly 58 carrying a sealed wrapping is aligned with said concave portion, the squashing means 60 is in the radially proximal position to the finishing wheel 54, and its concave portion imparts a deformation to the annular flange of the sealed wrapping (as exemplarily illustrated in Figure 4M). Subsequently, a cup 3 may be applied to the sealed wrapping, adhering it to the annular flange 4 deformed by the squashing means 60 (as exemplarily illustrated in Figure 4N).

[0057] According to a further aspect of the invention, a method for producing a wrapping defining a cavity suitable for containing an item may comprise the steps of providing an apparatus according to any of the embodiments described above; continuously feeding wrapping sheets to respective holding members 20 on the forming assemblies of the rotating forming wheel 10; in a condition wherein a forming seat 14, due to the rotation of the forming and drawing wheels 10, 16, is positioned facing and coaxial with a respective drawing member 22, transferring the wrapping sheet by relative movement of the forming seat 14 with respect to the drawing member 22,

so that said drawing member 22 inserts into the forming seat 14 and draws the wrapping sheet.

[0058] According to an embodiment, an apparatus or method according to the present invention is configured or implemented so as to produce at least 400 packages/min (more preferably, at least 800 packages/min). Indeed, an apparatus or method configured or implemented according to the invention enables achieving high production volumes due to optimized operating modes and an improved machine architecture.

[0059] Although the apparatus according to the invention has been described with reference to the implementation example wherein the forming device 10, the drawing device 16, the conveyor device 24, the sealing station 42, and the finishing station 52 cooperate with one another to obtain a packaging wrapping of the type illustrated in Fig. 2, it is understood that the wrapping configuration in Fig. 2 is not binding, as other final or intermediate configurations are possible. Thus, the forming device 10 and the drawing device 16 may be used to obtain a shaped wrapping made from a single open sheet including the item, as resulting from the combined use of the forming device 10 and the drawing device 16 as defined in claim 1.

[0060] The sealing station 42, as defined in claims 13 or 13 and 14, may be used independently and thus not necessarily downstream of and in cooperation with a forming wheel 10 but in cooperation with feeding means feeding the pre-shaped wrapping sheets (cup-shaped or Ω -shaped) including an item in their cavity, the wraps are not necessarily obtainable using the forming wheel 10, to apply a sealing element to the mouth of such a wrapping. Similarly, a finishing station 52, as defined in claims 19 or 19 and 20, may be used independently and thus not necessarily in cooperation with a sealing station as defined in claims 13 or 13 and 14 but in cooperation with feeding means, preferably wheel-based, that feed a wrapping, such as the one illustrated in Figure 4L, for applying a paper cup to the base of such a wrapping.

[0061] Likewise, the conveyor device 24, as defined in claim 1, may be used not necessarily in combination with a forming wheel 10 associated with a drawing device 16 (as defined in claim 1), but in combination with a forming wheel provided with assemblies wherein a pre-shaped wrapping sheet is present.

[0062] Various aspects and embodiments of an apparatus and method for packaging items according to the invention have been described. It is understood that each embodiment may be combined with any other embodiment. Furthermore, the invention is not limited to the described embodiments but may be modified within the scope defined by the appended claims.

Claims

1. An apparatus for the continuous packaging of items with a respective wrapping sheet, comprising:

- a forming wheel (10), continuously rotating around its own axis of rotation, comprising a plurality of peripheral forming assemblies (12), articulated to the forming wheel (10) in angularly spaced positions and oscillating around an axis parallel to the axis of rotation of the wheel, each forming assembly (12) comprising a seat (14) for forming the wrapping sheet in a configuration adapted to receive the item,
- a drawing wheel (16), continuously rotating around an axis of rotation parallel to the axis of rotation of the forming wheel (10), comprising a plurality of peripheral drawing assemblies (18), articulated to the drawing wheel (16) in angularly spaced positions and oscillating about an axis parallel to the axis of rotation of the drawing wheel (16),

each drawing assembly (18) comprising a wrapping sheet holding member (20) and a punch drawing member (22), at least one of said wrapping sheet holding member (20) and punch drawing member (22) being movable with respect to the other between a passive configuration, wherein the punch drawing member (22) avoids protruding radially from the holding member (20), and an active configuration, wherein the punch drawing member (22) protrudes radially from the holding member (20), said drawing wheel (16) being driven in rotation in a direction opposite to the direction of rotation of the forming wheel (10) and cooperating with the forming wheel (10) in such a way that the rotational movement of each wheel, in combination with the oscillatory movement of the respective drawing and forming assemblies (12, 18), leads periodically a forming seat (14) to a position facing and coaxial with a drawing member (22), wherein, in said coaxial position, the wrapping sheet is transferred onto the forming seat (14) and the drawing member (22) is in the active configuration for drawing the sheet inside said seat (14),

- a conveyor device (24) for the items to be packaged, cooperating with the forming wheel (10) to insert the item in a respective drawn sheet following its forming; and
- a sealing station (42), arranged downstream of the forming wheel (10) and configured to receive from the forming wheel (10) the wrapping sheets containing the respective items and applying to said respective wrapping sheets sealing elements (S) able to define, together with said wrapping sheets, respective closed cavities containing the items.

2. The apparatus according to claim 1, wherein the holding member (20) of the wrapping sheet can be moved along its axis between said active and pas-

sive configurations.

3. The apparatus according to claim 1 or 2, wherein each peripheral forming assembly (12) comprises a guide and ejection member (15), comprising a head (15a) counter-shaped to an axial end portion of the punch drawing member (22), said head of the guide and ejection member being carried by a plunger (15b) slidably received in the respective forming seat (14) of the wrapping sheet. 5 10
4. The apparatus according to any of the preceding claims, wherein the forming seat (14) of the wrapping sheet is carried by the respective peripheral forming assembly (12) in a translatable manner along its own axis. 15
5. The apparatus according to any of the preceding claims, wherein the forming assemblies (12) and/or the drawing assemblies (18) are oscillatable with respect to the corresponding forming wheels (10) and/or drawing wheels (16) by means of primary cam mechanisms (26). 20
6. The apparatus according to claim 5, wherein each primary cam mechanism (26) comprises a primary rod (28) having a first end fixed to the respective assembly (12, 18) and a second end hinged to a primary roller (30) which engages a primary guide (32) on the respective wheel (10, 16) having a variable profile in the radial direction of the wheel. 25 30
7. The apparatus according to any of the preceding claims, wherein the wrapping sheet holding members (20) and/or the punch drawing members (22) and/or the guiding and ejection members (15) and/or the seats (14) for forming the wrapping sheet are radially extractable and retractable with respect to the corresponding forming wheels (10) and/or drawing wheels (16) by means of secondary cam mechanisms (34). 35 40
8. The apparatus according to claim 7, wherein each secondary cam mechanism (34) comprises a secondary rod (36) having a first end hinged to the respective assembly (12, 18) and a second end hinged to a secondary roller (38) which engages a secondary guide (40) on the respective wheel (10, 16) having a variable profile in the radial direction of the wheel (10, 16), said secondary rod (36) being furthermore connected to a respective holding member (20) of the wrapping sheet or to a drawing member (22) or to a forming seat (14) in a point between said ends, so that the oscillatory motion of the secondary rod (36) produces a translation of the holding member (20) or drawing member (22) or of the forming seat (14) along their respective axes. 45 50 55
9. The apparatus according to any of the preceding claims, wherein each holding member (20) of the wrapping sheet comprises a holding head (21a), carried by a tubular body (21b) wherein the respective drawing member (22) is coaxially received and shaped as an annular flange protruding radially from the respective drawing wheel (16), said holding head (21a) including an outer surface adapted to come into contact with a respective wrapping sheet.
10. The apparatus according to claim 9, wherein the holding head (21a) of each holding member (20) of the wrapping sheet is connected or connectable to a pneumatic suction source so as to hold the respective wrapping sheet adhered by suction to the respective outer surface.
11. The apparatus according to any of the preceding claims, wherein each forming seat (14) of the wrapping sheet comprises a diaphragm device (17) configured to radially necking the wrapping sheet when the product has been introduced into the respective drawn sheet.
12. The apparatus according to any of the preceding claims, wherein each forming seat (14) for the wrapping sheet has a substantially "U"-shaped section and a bottom portion shaped like a hemispherical cap.
13. The apparatus according to any of the preceding claims, wherein each punch drawing member (22) has an axial end counter-shaped to a bottom portion of a respective forming seat (14).
14. The apparatus according to claim 13, wherein said axial end has an ogive or semi-elliptical configuration.
15. The apparatus according to any of the preceding claims, wherein the peripheral forming assemblies (12) and/or the peripheral drawing assemblies (18) are oscillatable around the corresponding axes parallel to the rotation axes of the respective wheels (10, 16) in an angular range between 5° and 50°.
16. The apparatus according to any of the preceding claims, wherein the conveyor device (24) comprises a plurality of containment seats (25a), suitable for transporting respective items, and one or more movable ejectors (25b), associated with respective containment seats (25a) and configured to push the items towards the respective forming seats (14) of the peripheral forming assemblies (12), when said containment seats (25a) of the conveyor (24) face onto said forming seats (14).
17. The apparatus according to any of the preceding

- claims, wherein the sealing station (42) comprises a sealing wheel (44), arranged downstream of the forming wheel (10) and continuously rotating around an axis of rotation parallel to the axis of rotation of the drawing wheel (16), the sealing wheel (44) comprising a plurality of angularly spaced peripheral sealing assemblies (46), each including a sealing head (48), radially movable relative to the sealing wheel (44) and comprising an exposed surface configured to receive respective sealing elements (S), and an abutment assembly (50) suitable for providing an abutment to the sealing head (48), the sealing head (48) and the abutment assembly (50) being movable from a mutually spaced configuration, wherein the abutment assembly (50) is in a position suitable for allowing the loading-removal of a wrapping on the sealing head (48), and a close configuration, wherein the sealing head (48) is configured to apply the sealing member to the respective wrapping sheet, the sealing station (42) further comprising a device for delivery the sealing elements (S), adapted to feed said sealing elements (S) to the respective sealing heads (48) before the corresponding sealing assemblies (46) receive the respective wrapping sheets containing the items leaving the drawing wheel (16).
18. The apparatus according to claim 17, wherein the sealing elements (S) are configured as second wrapping sheets, and wherein each sealing head (48) comprises a welding device adapted to come into contact with, support a, and transmit heat until a predetermined welding temperature is reached to a second wrapping sheet, so that the two wrapping sheets are interposed between the sealing head (48) and the abutment assembly (50), and heat-sealed along a sealing region that surrounds, at least in part, the cavity containing the item.
19. The apparatus according to any of the preceding claims, comprising a finishing station (52), arranged downstream of the sealing station (42) and comprising a finishing wheel (54) configured to receive from the sealing wheel (44) the sealed wrappings containing the respective items, and a delivery device (56), suitable for delivering cup-shaped containers (3) and cooperating with the finishing wheel (54) to apply and make said cup-shaped containers (3) mutually integral with said sealed wrappings.
20. The apparatus according to claim 19, wherein the finishing wheel (54) comprises a plurality of peripheral gripping assemblies (58), arranged on the finishing wheel (54) in angularly spaced positions, each of said peripheral gripping assemblies (58) being configured to receive from the sealing station (42) and hold a sealed wrapping having an Ω shape, such that the annular flange of the sealed wrapping is exposed to the outside of the finishing wheel (54), the delivery device (56) being configured to deliver the cup-shaped containers (3) such that the bottom planar face of each cup-shaped container (3) adheres to a respective annular flange of a sealed wrapping.
21. The apparatus according to claim 20, comprising a squashing means (60) cooperating with the finishing wheel (54) upstream of the delivery device (56), said squashing means (60) comprising a concave portion facing the finishing wheel (54) and being movable between a position radially distal with respect to the finishing wheel (54) and a position radially proximal with respect to the finishing wheel (54), the squashing means (60) cooperating with the forming wheel (10) in such a way that, when a peripheral gripping assembly (58) carrying a sealed wrapping is aligned with said concave portion, the squashing means (60) is in the position radially proximal to the finishing wheel (54) and the relative concave portion impresses a deformation to the annular flange of the sealed wrapping.
22. A method of producing a wrapping defining a cavity adapted to include an item, comprising the steps of:
- a) providing an apparatus according to any of claims 1 to 16;
 - b) continuously feeding wrapping sheets to respective holding members on the forming assemblies of the rotating forming wheel (10);
 - c) in a condition wherein a forming seat (14) is, by virtue of the forming and drawing wheels (10, 16) rotation, in position facing and coaxial with a respective drawing member (22), transferring the wrapping sheet by relative movement of the forming seat (14) with respect to the drawing member (22), so that said drawing member (22) is inserted into the forming seat (14) and draws the wrapping sheet;
 - d) inserting the item in a respective drawn sheet following its forming; and
 - e) transferring the wrapping sheets containing the respective items from the forming wheel (10) to the sealing station (42) and applying to said wrapping sheets respective sealing elements (S) adapted to define, together with said wrapping sheets, respective closed cavities containing the items.
23. The method according to claim 22, wherein step c) comprises the sub-steps of:
- c1) rotating the forming and drawing wheels (10, 16) in opposite directions;
 - c2) further rotating, with respect to the respective wheels (10, 16) and in a direction being the same as the direction of rotation of the latter, the

forming and drawing assemblies (12, 18) upstream of the line joining the centers of said forming and drawing wheels (10, 16), up to the complete alignment of the axes of a drawing member (22) with a corresponding forming seat (14);

c3) axially retracting the holding member (20) of the wrapping sheet and/or axially extracting the punch drawing member (22) with respect to the corresponding drawing assembly (18), until at least a partial interpenetration between the drawing member (22) and the corresponding forming seat (14); and

c3) further rotating the forming and drawing assemblies (12, 18), relative to the respective wheels (10, 16), in a direction opposite to the direction of rotation of the latter, in such a way as to maintain the alignment condition of the axes of the drawing member (22) and of the corresponding forming seat (14) until the drawing member (22) has reached the maximum penetration depth into the corresponding forming seat (14) and then was at least partially extracted.

24. The method according to claim 23, wherein step c3) is carried out in such a way that the alignment condition of the axes of the drawing member (22) and of the corresponding forming seat (14) is maintained, by rotating the drawing and forming assemblies (12, 18) in a direction opposite to the direction of rotation of the respective wheels (10, 16), until the profile of the drawing member (22) becomes tangent to an edge or to an inlet section of the corresponding forming seat (14).

25. The method according to any of claims 22 to 24, further comprising the steps of:

f) providing an apparatus according to any of claims 17 to 21; and

g) transferring the sealed wrapping containing the respective items from the sealing station (42) to the finishing wheel (54), and delivering cup-shaped containers (3) to the finishing wheel (54) in such a way as to apply and mutually make integral said cup-shaped containers (3) with said sealed wrappings.

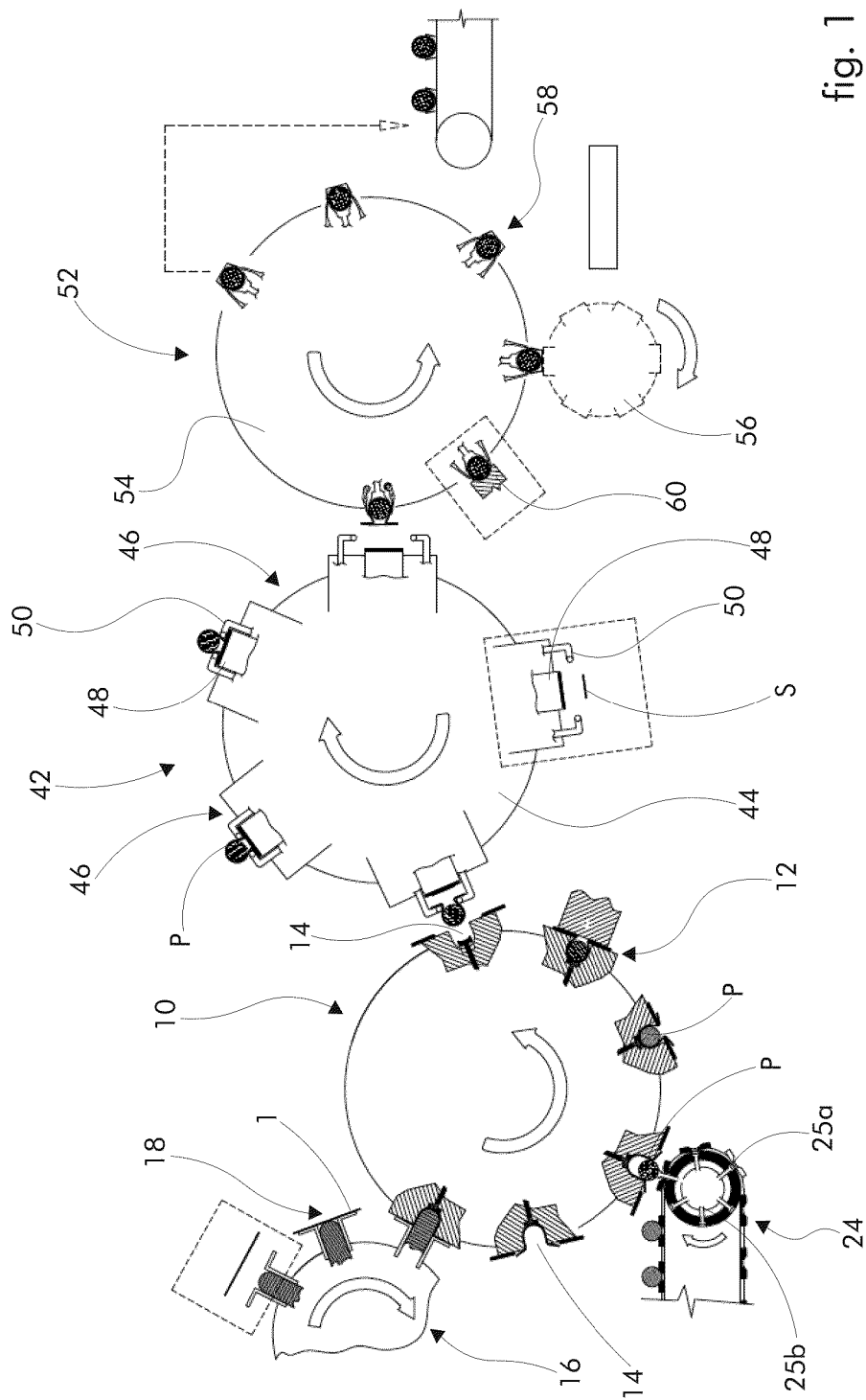


fig. 1

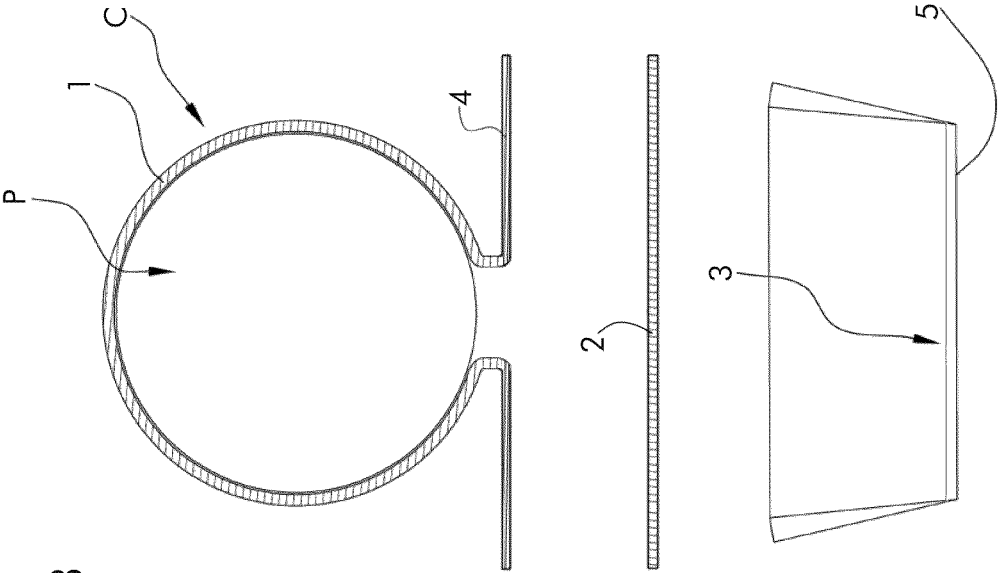


fig. 3

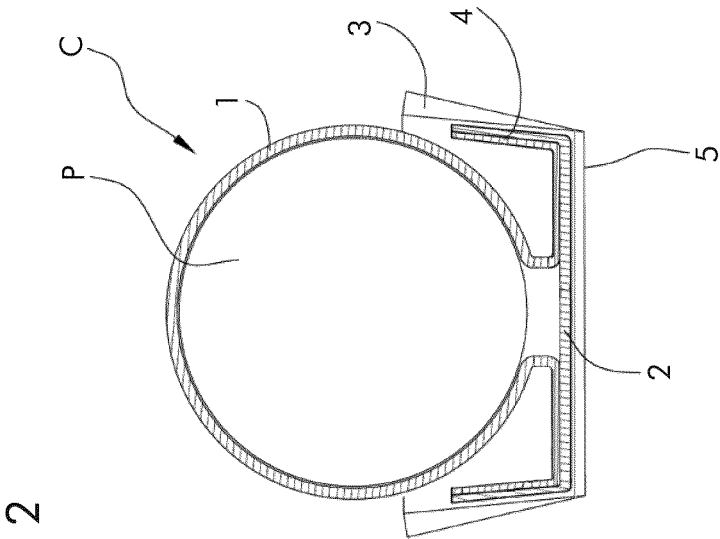


fig. 2

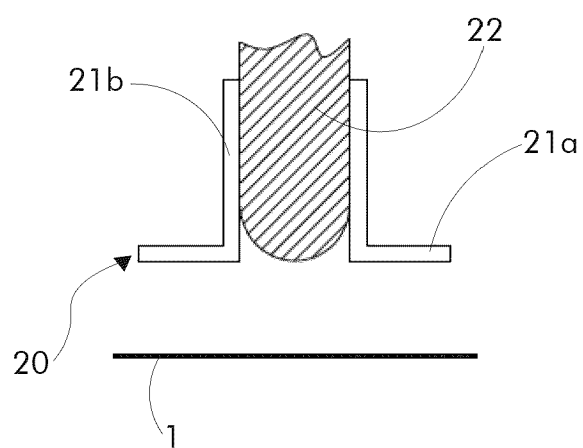


fig. 4A

fig. 4B

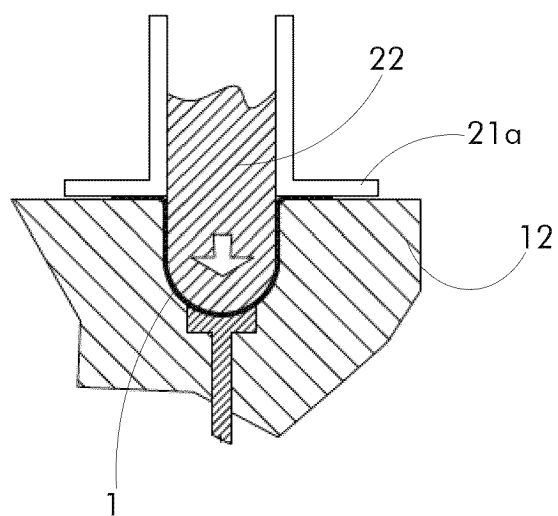
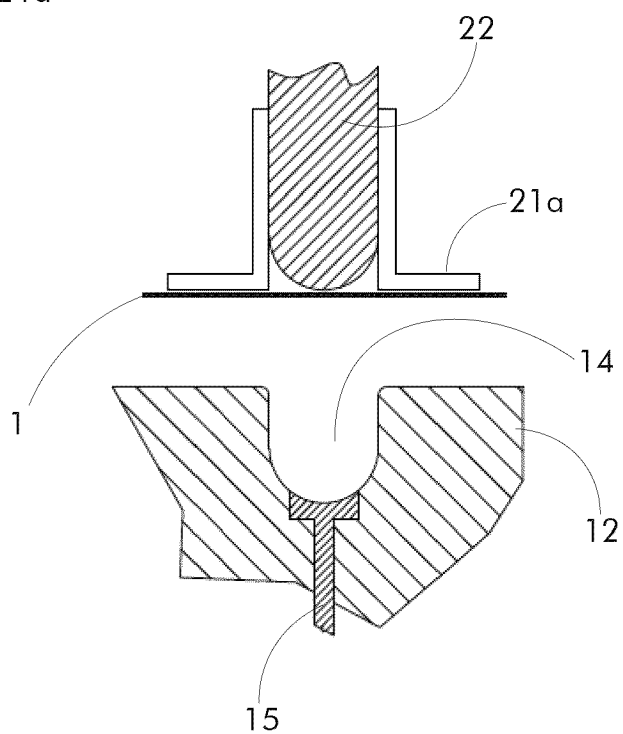
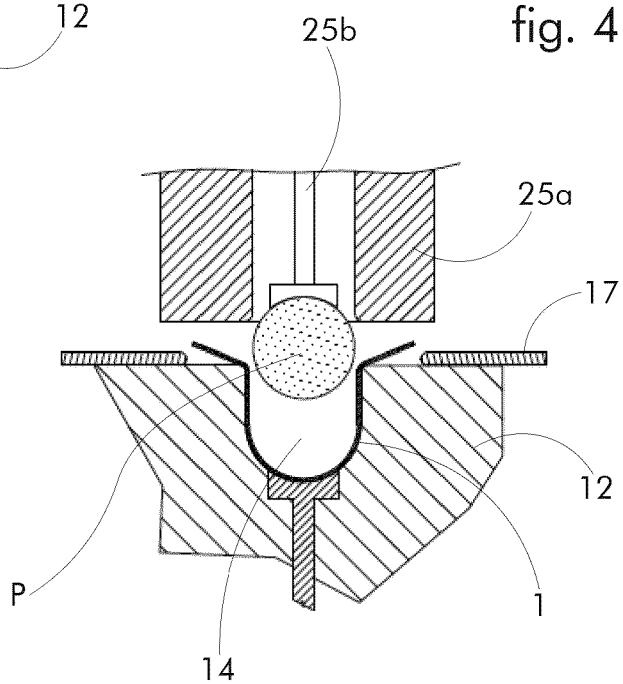
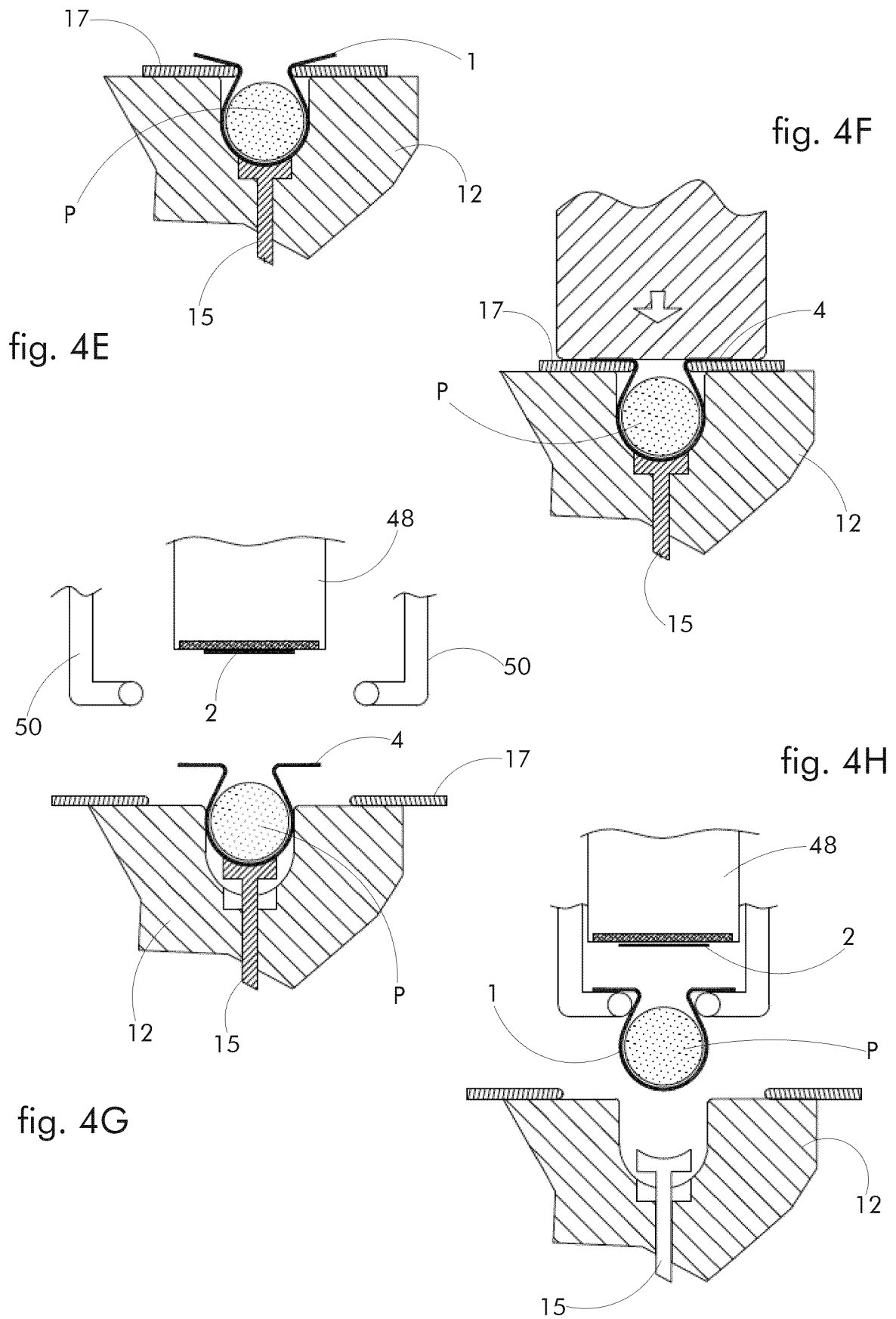


fig. 4C

fig. 4D





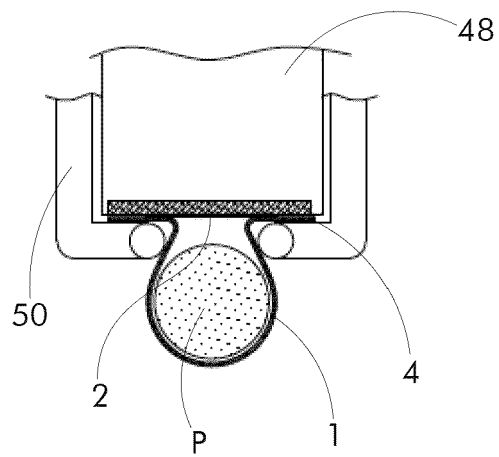


fig. 4I

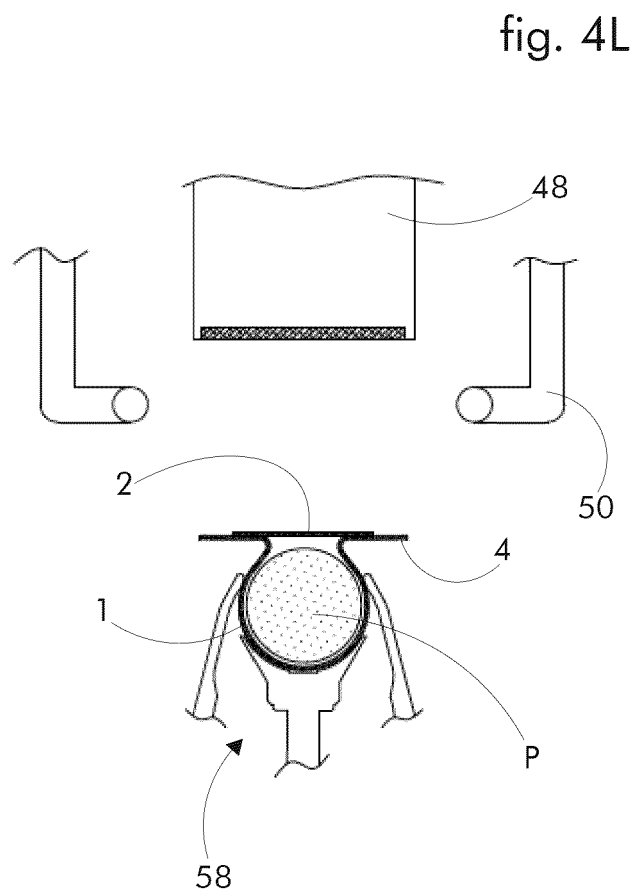


fig. 4L

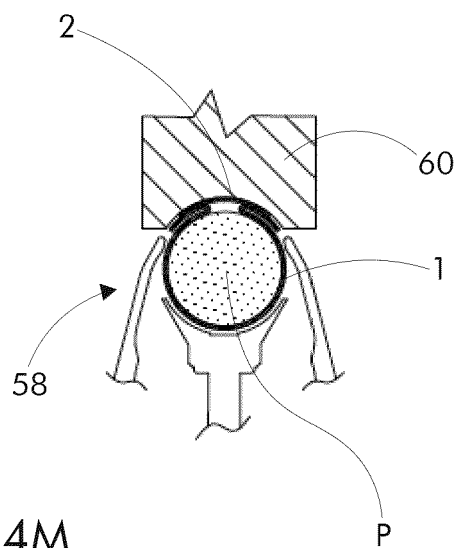


fig. 4M

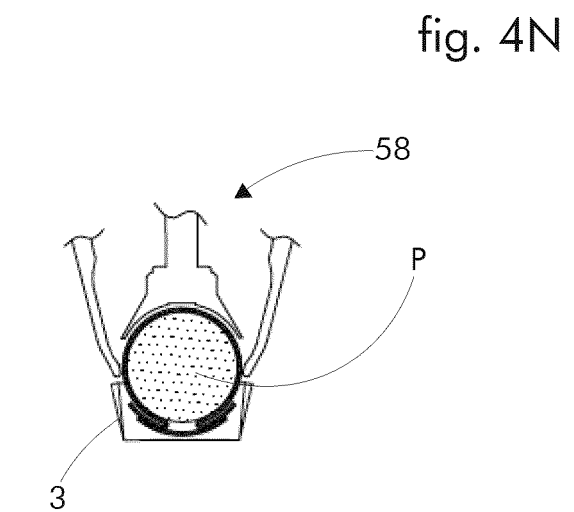


fig. 4N

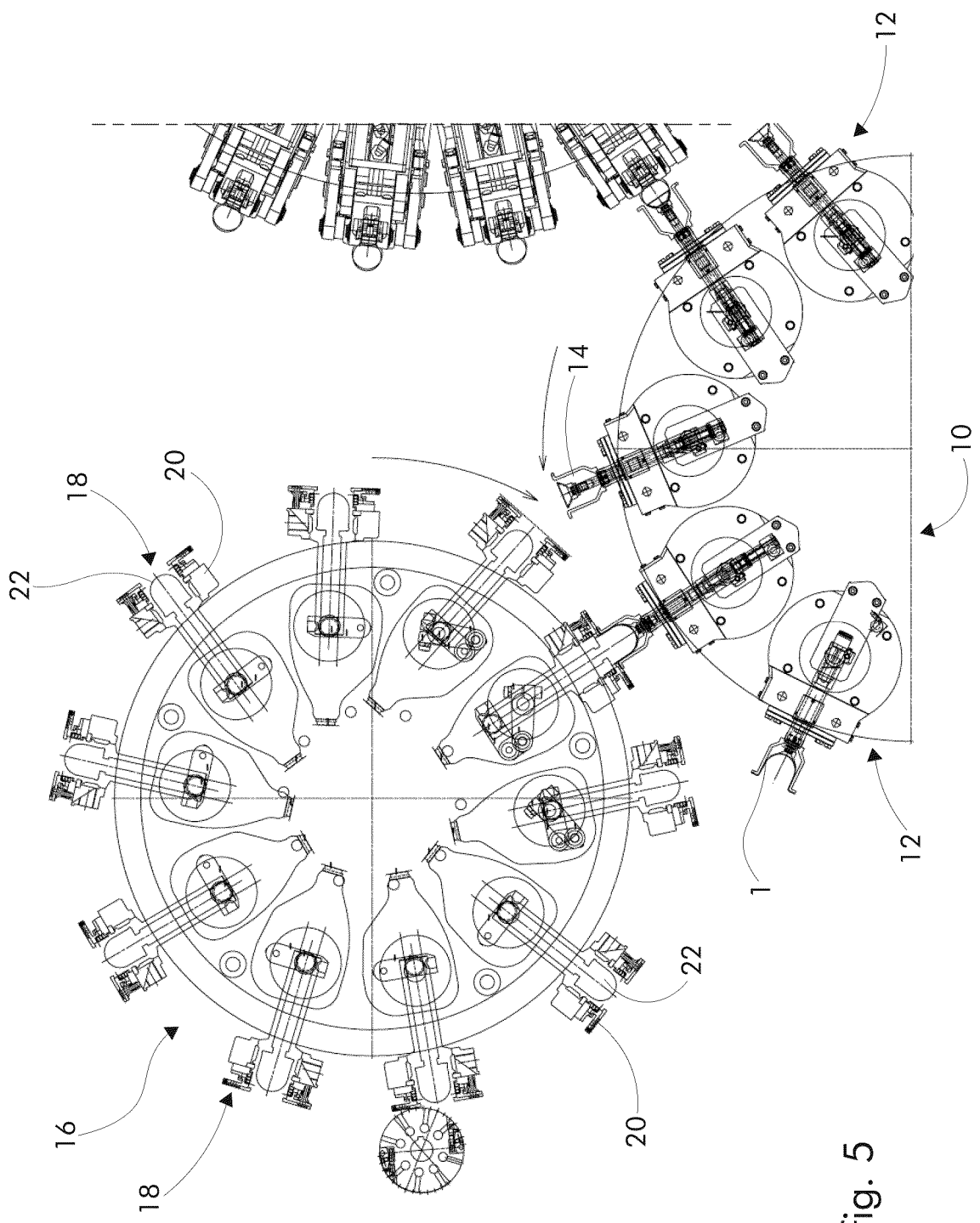
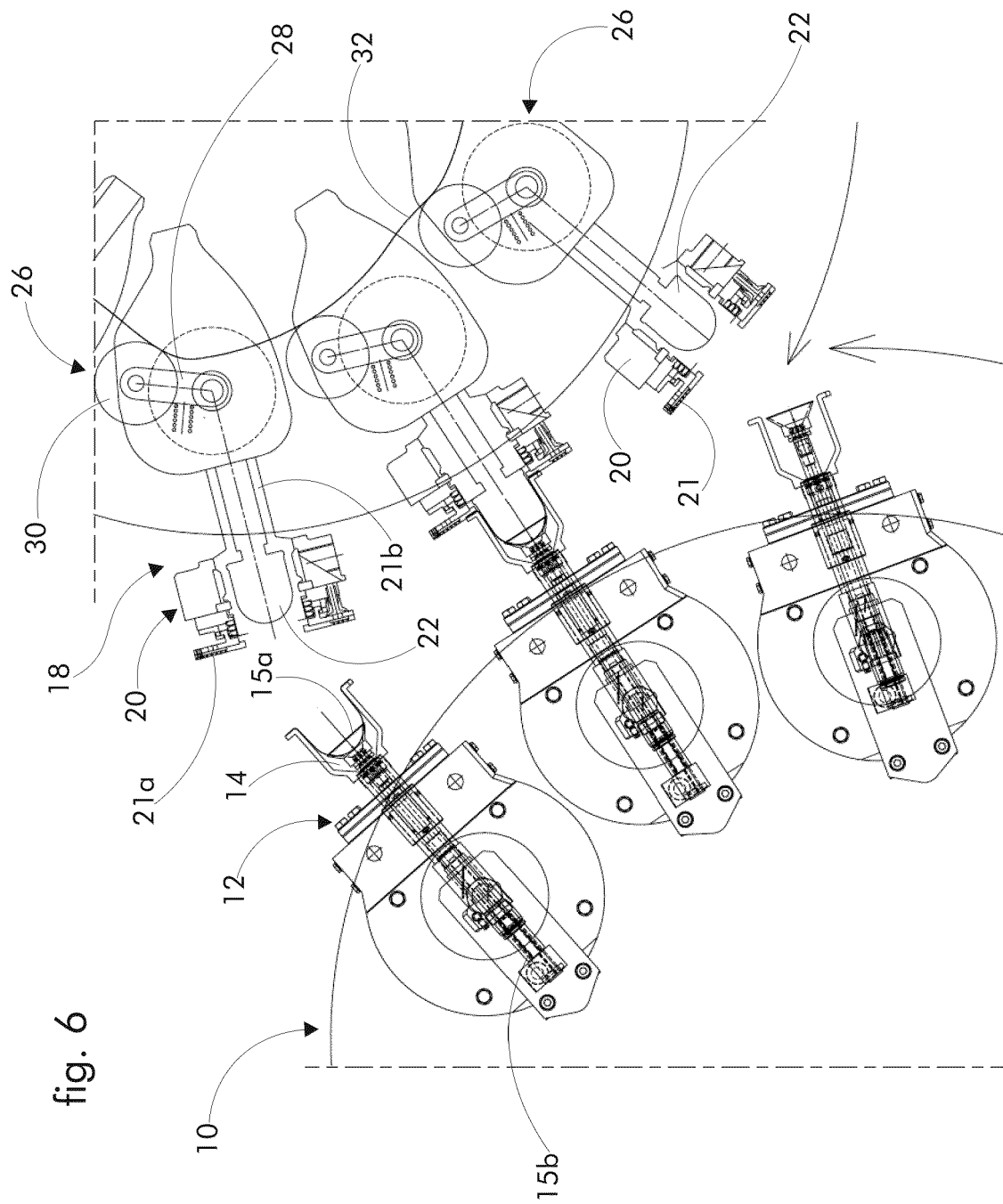


fig. 5



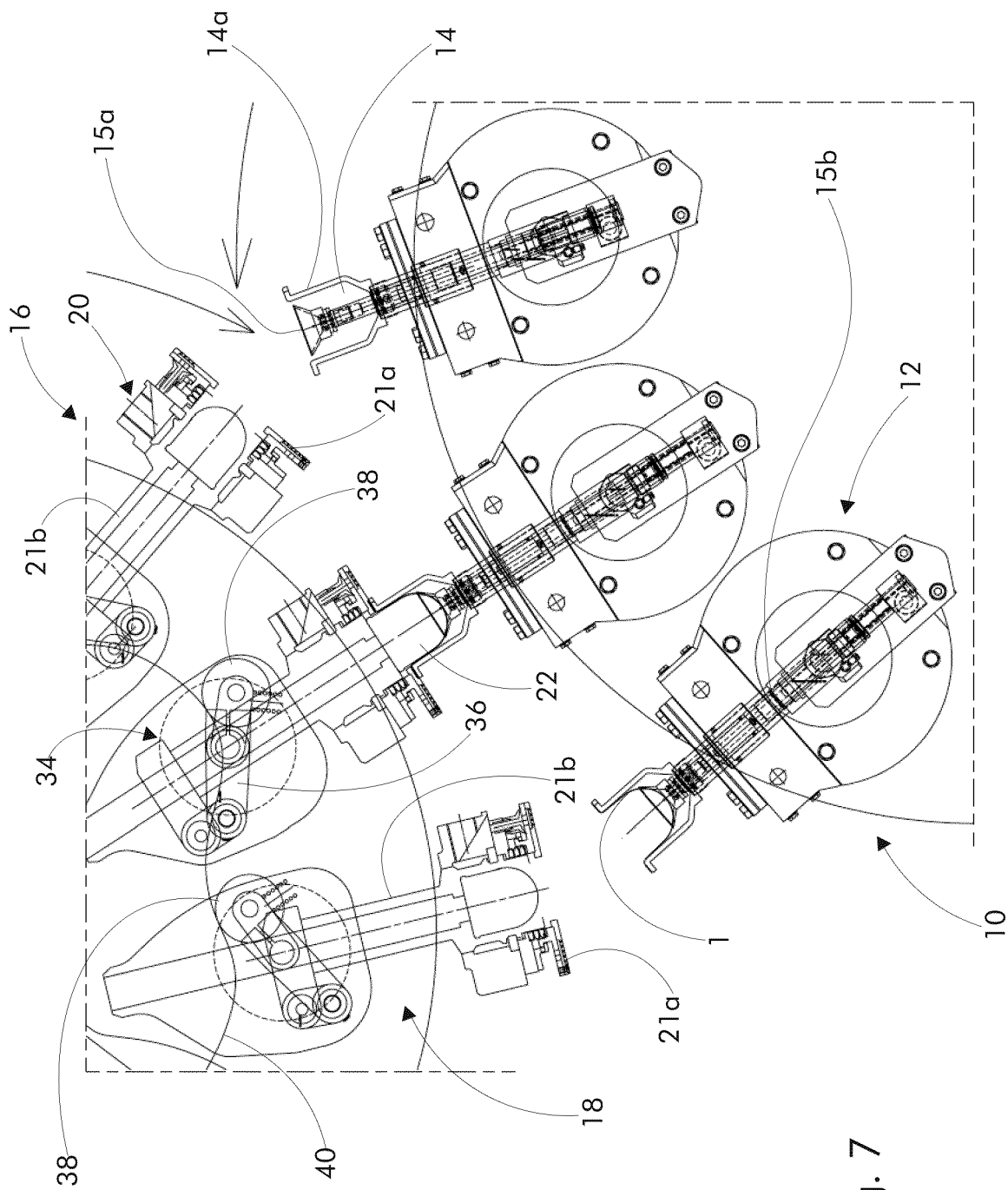


fig. 7

REFERENCES CITED IN THE DESCRIPTION

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