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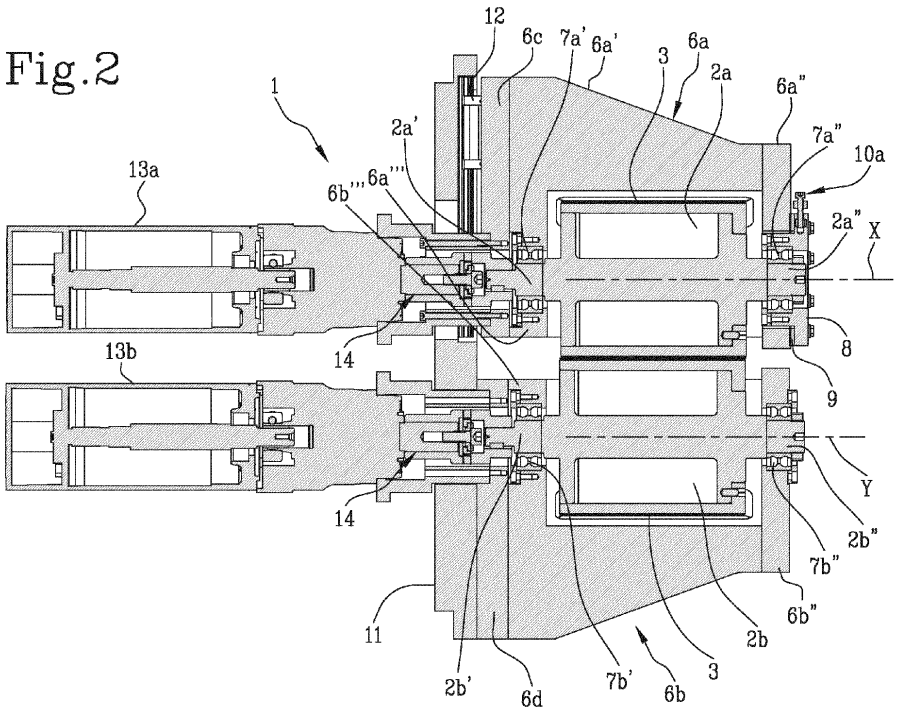
# (54) UNIT FOR CUTTING A CONTINUOUS WEB INTO PARALLEL STRIPS

(57) A unit (1) for cutting a continuous web into parallel strips, comprising a first and a second roller (2a, 2b) between which a continuous web is fed and each of which is provided with a succession of circumferential protrusions and recesses alternated with each other along the axis of rotation (X, Y) of the roller (2a, 2b). The rollers (2a, 2b) are coupled to each other so that the protrusions of one roller (2a) are at least partly inserted into the recesses of the other roller (2b) and vice versa, so that the rollers (2a, 2b) cut the continuous web along parallel longitudinal lines. The unit (1) is characterized in that it also comprises cleaning means configured to promote removal of particles of material released in the recesses by the web during cutting.

Fig.2




EP 3 915 740 A1

## Description

**[0001]** This invention relates to a unit for cutting a continuous web into parallel strips.

**[0002]** This invention also relates to a machine for making segments for smoking articles, in particular smoking articles containing tobacco, comprising the unit, and to a method for cutting the continuous web.

**[0003]** Prior art units comprise rotary rollers defining a through gap which is configured to allow the web from which the strips are obtained to slide between them. As is known, these rollers have contoured profiles, for example, having grooves and ridges capable of cutting the web material to obtain strips of material having straight or contoured edges, depending on the shape of the roller profiles.

**[0004]** As is known, to be able to cut webs of different thicknesses, the units are provided with mechanisms for moving and adjusting the rollers to vary the position of the rollers and the mutual distance between them.

**[0005]** Disadvantageously, prior art units have inherent drawbacks in terms of processing precision and maintenance.

**[0006]** In prior art units, roller alignment performed by the adjustment mechanisms is not very precise and is ill adapted for processing delicate web materials. Imprecise adjustment of the rollers can cause the web material to tear or to be cut into irregular sized strips.

**[0007]** Also, the rollers must be adjusted very often, which means shutting down the unit numerous times, thus increasing cutting times and the related costs.

**[0008]** Another disadvantage is that shreds of the material being processed gets trapped in the contoured profiles of the rollers leading to malfunctioning of the unit. In effect, in this situation, the build-up of residual material prevents the rollers from rotating smoothly, causing mechanical stresses which can lead to failure of components of the unit and imprecision in web processing. For this reason, prior art units are provided with cleaning mechanisms configured to remove the residual material. These mechanisms, however, require the unit to be shut down and, in some cases, the rollers have to be removed, making cleaning operations time-consuming and laborious.

**[0009]** The frequent need for maintenance and the complexity of prior art units make these units particularly expensive and difficult to maintain.

**[0010]** The machines comprising these units, for making segments for smoking articles, specifically cigarettes or the like, also suffer from disadvantages linked with production speed and related costs. Indeed, units shut down for cleaning or adjustment of the rollers result in a bottleneck in the machine production process.

**[0011]** The aim of this invention is to provide a unit for cutting a continuous web into parallel strips and which is easy to maintain in terms of cleaning.

**[0012]** A further aim of this invention is to provide a unit for cutting a continuous web into parallel strips and which allows the rollers to be adjusted easily and precisely.

**[0013]** A further aim of this invention is to provide a machine for making segments for smoking articles and having a high production capacity.

**[0014]** A further aim of this invention is to provide a method for cutting a continuous web into parallel strips and which is quick and efficient.

**[0015]** The technical purpose and aims specified are substantially achieved by a unit for cutting a continuous web into parallel strips, a machine for making smoking articles and comprising such a unit and a method for cutting a continuous web into parallel strips, all comprising the technical features set out in one or more of the appended claims.

**[0016]** The dependent claims correspond to possible embodiments of the invention.

**[0017]** More specifically, the technical purpose is achieved by a unit according to this invention, for cutting a continuous web into parallel strips, comprising a first and a second roller between which the continuous web is made to pass. Each roller is provided with a succession of circumferential protrusions and recesses alternated with each other along the axis of rotation of the roller, the rollers being coupled to each other so that the protrusions of one roller are at least partly inserted into the recesses of the other roller and vice versa, so that the rollers cut the continuous web along parallel longitudinal lines. The unit is characterized in that it also comprises cleaning means configured to promote removal of particles of material released in the recesses by the web during cutting.

**[0018]** In other words, the unit is provided with a first roller having recesses and protrusions configured to engage the recesses and protrusions of the second roller so as to cut the continuous web interposed between the rollers as the rollers rotate.

**[0019]** Preferably, the continuous web is a web made from tobacco. In other embodiments, the web may be made from paper, PLA or, more generally speaking, any generic continuous material without thereby departing from and/or limiting the characteristics of this invention.

**[0020]** While the continuous web is being cut, residues of the web find their way into the recesses of the rollers, causing the recesses to be partly or totally obstructed. When this happens, the protrusions are unable to fit properly into the respective recesses and cutting the continuous web becomes imprecise.

**[0021]** To prevent this from happening, the unit is provided with cleaning means comprising a movement mechanism operating on at least one of the rollers to move the rollers towards and away from each other.

**[0022]** In the preferred embodiment, the movement mechanism operates on the first roller, which is thus moved towards or away from the second roller along a direction perpendicular to that defined by the axes of rotation of the first and the second roller. More in detail, the first roller is moved towards the second roller in order to clean the recesses and is moved away from the second roller to allow the continuous web to be cut.

**[0023]** Preferably, the movement mechanism comprises at least one pushing means, for example, a linear actuator, operating on the first roller to hold the first roller pressed towards the second roller, and an adjustable stop means defining an adjustable stop position of the first roller relative to the second roller. Preferably, the stop means is embodied in the form of a cam or eccentric means whose surface is variable in radius as a function of the angular orientation adopted. Still more preferably, the stop means has a lateral surface that is configured to allow being pressed against a contact part which is mounted on the first roller and which is configured to come into abutment with the stop means to define the stop position.

**[0024]** The cleaning means also comprise a control unit, operating on the movement mechanism to vary temporarily the distance between the rollers and to keep the varied distance for a predetermined angle of rotation of the rollers large enough for the recesses to be cleaned and/or for a predetermined length of time or determined as a duration long enough for the recesses to be cleaned (for example, a duration settable on screen by an operator and, if necessary, managed as a function of the product size or brand).

**[0025]** Preferably, the angle of rotation is greater than 180°, more preferably greater than 360° and/or less than a predetermined maximum angle, preferably between 1 and 100 complete turns and, more preferably between 30 and 50 turns.

**[0026]** Operatively, therefore, when the time comes to clean the rollers, the control unit activates the adjustable stop means which varies the mutual distance between the first and the second roller. More specifically, the pushing means moves the first roller towards the second roller in such a way that the protrusions of the first roller are inserted well into the recesses of the second roller and vice versa so as to remove the web residues therefrom. The mutual distance is determined by the contact part coming into abutment against the adjustable stop means and being held in abutment for a predetermined angle of rotation so to allow the residual material to be completely removed.

**[0027]** While the mutual distance is being held, not only is the residual material present in the roller recesses removed but so is the residual material that has settled on the peripheral portions of each roller located downstream of a zone of tangency between the rollers, that is to say, the zone where the recesses and the protrusions interpenetrate each other.

**[0028]** According to an aspect of the invention, the cleaning means also comprise at least one mechanical removal means, which may be one of the following: one or more brushes, either idle or motor-driven; one or more scrapers operating on the flanks of the protrusions/recesses; one or more extractor hoods. More in detail, the removal means operates on an angular sector of at least one of the rollers between 90° and 180° downstream of the position of tangency between the rollers.

**[0029]** In an embodiment, the first and the second roller are provided with a brush, a scraper and an extractor hood so that the residual material removed by the brush and the scraper is immediately extracted by the hood, thus preventing build-up at the base of the rollers or further clogging of the rollers by the material just removed. In other words, when the pushing means is activated, the first roller moves closer to the second roller so that the protrusions of one roller interact with the residual material deposited in the recesses of the other roller and vice versa. At the same time, the removal means scrape the crests of the rollers so as to also remove the residual material deposited on the peripheral portions of the rollers themselves.

**[0030]** When cleaning is over, the adjustable stop means changes its angular position in such a way that the first roller varies its position relative to the second roller to return to the original distance between the first and the second roller. Preferably, while the distance between the rollers is varied to allow cleaning to be carried out, the spacing between the rollers remains suitable for the web to continue being cut. In other words, during cleaning, the cutting process is not interrupted.

**[0031]** Preferably, when cleaning is over, the adjustable stop means changes its position in such a way that the first roller moves away from the second roller.

**[0032]** Advantageously, the simplicity of the movement mechanism by which the first roller is moved relative to the second roller greatly facilitates cleaning operations, reducing the time needed and the related costs.

**[0033]** Advantageously, the movement mechanism and the mechanical removal means act in conjunction to make cleaning quick and easy without having to dismantle any part of the machine.

**[0034]** Advantageously, the movement mechanism and the removal means allow cleaning to be carried out at frequent, periodic intervals without having to shut down the unit.

**[0035]** In a variant embodiment, the at least one mechanical removal means is provided for only one of the two rollers.

**[0036]** According to a further aspect of this invention, the variation of the mutual distance between the rollers set by the movement mechanism may be permanent, in which case the adjustment is performed for the purposes of web format changeover, for example, a changeover due to the type or thickness of the material the web is made of or due to a change of process. The rollers are thus spaced apart or moved closer together and hold their position during the whole period the continuous web is processed.

**[0037]** Advantageously, the possibility of adapting the unit to a format or process changeover makes the unit highly versatile and suitable for materials of different kinds and sizes (especially in terms of thickness).

**[0038]** Furthermore, in an embodiment, the cleaning means are embodied exclusively as a mechanical removal means, without using the movement mechanism

for the purposes of cleaning.

**[0039]** To allow the first roller to be moved towards and away from the second roller during cleaning operations, the first roller is mounted inside the unit on a movable frame which is operated on by the pushing means and the adjustable stop means. The movable frame is in turn mounted on a fixed vertical wall by means of a linear guide that allows the pushing means, when activated, to move the first roller towards and away from the second roller.

**[0040]** In other words, when the pushing means is activated, the frame runs along the linear guide, causing the first roller to move towards or away from the second roller.

**[0041]** During normal operation of the unit, it is essential that the recesses and protrusions precisely interpenetrate the respective recesses and protrusions of the second roller so that the strips made are all the same size and shape.

**[0042]** In this situation, therefore, it is important that the rollers occupy a predetermined position relative to each other, where they are axially aligned and their axes of rotation are parallel.

**[0043]** For this purpose, the unit comprises axial adjustment means configured to axially align the rollers and transverse adjustment means configured to adjust the inclination between the rollers. In the preferred embodiment, the adjustment means operate on the first roller, while the second roller remains fixed inside the unit, acting as a reference for the adjustment.

**[0044]** More specifically, for axial adjustment, the first roller is mounted on the respective frame through a pair of bearings, at least one of which is axially fixed relative to the roller. This bearing is adjustably mounted to the frame through a spacer whose thickness is selected to compensate a desired adjustment distance.

**[0045]** In other words, at the time of installation, a spacer is fitted between the frame and the fixed bearing to create the right thickness to ensure the rollers are axially aligned with each other. That way, axial misalignment, if any, is compensated by the presence of the sensor.

**[0046]** Advantageously, the axial adjustment allows the rollers to make strips of the same width, preventing part of the web material from sliding on the peripheral zone of the rollers and being incorrectly cut.

**[0047]** For transverse adjustment, on the other hand, the unit comprises a first and a second adjustment screw, preferably differential screws, operating between the frame and a floating plate configured to fix the first roller to the frame.

**[0048]** Preferably, the first and the second adjustment screw operate along two directions which are transverse to each other, and still more preferably, perpendicular to each other, to ensure that the axis of rotation of the first roller is parallel to the axis of rotation of the second roller.

**[0049]** Operatively, therefore, before activating the unit, the first roller is adjusted relative to the second roller in such a way that it is axially aligned with the second roller and its axis of rotation is parallel to the axis of rotation of the second roller.

**[0050]** Advantageously, the adjustment is performed once before starting to cut the continuous web since neither the cleaning operations nor the removal of the first roller, if necessary, has the effect of modifying the settings applied to the first roller. In effect, the cleaning operations only involve moving the first roller towards or away from the second roller, hence without any axial movements of the first roller or other movements which could make the axis of rotation of the first roller not parallel with the axis of rotation of the second roller. Similarly, removing the first roller does not upset the adjustment of the first roller because the roller is removed together with the frame it is mounted on. In effect, on removal, the frame and the first roller are removed from the supporting wall in one piece so as not to alter the settings of the roller relative to the frame. Removal and subsequent remounting in this way is possible thanks to a unique positioning system of the frame relative to the supporting wall.

**[0051]** In other words, the frame is mounted on the fixed wall in such a way that it can be removed from the supporting wall and subsequently remounted without having to change the adjustment of the first roller. Once adjusted, the first roller is no longer moved relative to the frame, even when the roller is removed from the frame. Therefore, the frame and the first roller never vary their position relative to each other when the frame is removed from, and remounted on, the supporting wall.

**[0052]** Advantageously, the unique positioning system allows the first roller to be removed and remounted without altering the settings applied during adjustment of the position of the first roller.

**[0053]** In the preferred embodiment, to speed up operations for assembling and disassembling the unit, the second roller is also mounted on a frame which is in turn attached to the supporting wall by the unique positioning system. Preferably, the unique positioning system is made in the form of a plug or a quick coupling.

**[0054]** Also an object of this invention is a machine for making segments for smoking articles, specifically tobacco, comprising means for unwinding at least one roll of web material and configured to feed a continuous web along a longitudinal feed direction and a unit as described in the foregoing, located downstream of the unwinding means, for cutting the continuous web into parallel strips. The machine also comprises gathering and conveying means configured to gather and convey the processed continuous web from the processing unit and to make at least one continuous stream. The machine also comprises a rod forming beam configured to receive the continuous stream and to progressively wrap it in a continuous web of wrapping material (for example paper, plastic, aluminium or other materials) to make at least one continuous rod and cutting means for cutting the continuous rod, located downstream of the forming beam and configured to cut the continuous rod into a plurality of seg-

ments.

**[0055]** Another object of this invention is a method for cutting a continuous web into parallel strips, implemented by a unit as described in the foregoing.

**[0056]** The method comprises the step of feeding the continuous web through a gap defined between the first and the second roller so that the web is cut by the interaction between the circumferential protrusions and recesses present on the rollers. More in detail, the rollers are coupled to each other in such a way that the protrusions of one roller are at least partly inserted into the recesses of the other roller and vice versa, so that as the rollers rotate, they cut the continuous web along parallel longitudinal lines.

**[0057]** Preferably, the step of feeding the web is preceded by a step of mounting the first and the second roller, together with their respective frames, on the fixed supporting wall. Preferably, during this step of the method, the frames are mounted on the fixed wall by means of the unique positioning system configured to obtain a unique position of the frame relative to the wall.

**[0058]** After the step of mounting, the method comprises a step of axially and transversely adjusting the first roller relative to the second roller so that the axes of the rollers are parallel and the rollers themselves are axially aligned. Preferably, the axial adjustment is achieved by inserting the spacer whose thickness compensates a desired adjustment distance. The transverse adjustment, on the other hand, is carried out with the first and the second adjustment screw.

**[0059]** Preferably, the method also comprises a step of adjusting the rollers towards and away from each other so as to adapt the gap between them to the thickness of the continuous web to be processed. Preferably, this step is carried out by sliding the movable frame along the linear guide mounted between the movable frame and the supporting wall.

**[0060]** The method also comprises a step of cleaning the rollers by removing the material released in the recesses by the web during cutting.

**[0061]** More in detail, the step of cleaning is carried out by varying the distance between the rollers, specifically by increasing the degree of interpenetration between the protrusions and the recesses. During this step, the pushing means moves the first roller closer to the second roller so that the protrusions of the first roller penetrate more deeply into the recesses of the second roller. At the same time, the scrapers and the brushes operate on both of the rollers to remove the residual material from the peripheral portions of the rollers.

**[0062]** The step of varying the distance between the rollers is accomplished temporarily and at a controlled or regular rate during the normal operation of the rollers, specifically through a predetermined angle of rotation of the rollers large enough for the recesses to be cleaned by mechanical interaction between the protrusions and recesses. Preferably, the predetermined angle of rotation is greater than 180°, more preferably greater than 360° and/or less than a predetermined maximum angle, preferably between 1 and 100 complete turns and, more preferably between 30 and 50 turns.

**[0063]** Advantageously, to clean the rollers, hence to ensure they operate correctly, there is no need to stop the machine, which means maintenance times and costs are reduced.

**[0064]** Advantageously, the possibility of cleaning the rollers at a regular rate prevents the mechanical stresses that would be created by the build-up of residual material on the rollers.

**[0065]** Further features and advantages of this invention are more apparent in the indicative, hence non-limiting description set out below with reference to the accompanying drawings which are provided solely for purposes of non-limiting illustration and in which:

- Figure 1 is a side view of a cutting unit according to this invention for cutting a continuous web;
- Figure 2 is a cross sectional view of a cutting unit according to this invention;
- Figures 3A and 3B show, respectively, a front view and a cross sectional view of a portion of the cutting unit;
- Figure 4 shows a perspective view of the cutting unit of this invention;
- Figure 5 shows a cross section of Figure 4;
- Figure 6 is another perspective view of the cutting unit;
- Figure 7 shows a cross sectional view of a portion of the cutting unit of this invention;
- Figure 7A shows a structural detail from Figure 7;
- Figures 8A and 8B show different embodiments of a structural detail of the cutting unit of this invention.

**[0066]** With reference to the accompanying drawings, the numeral 1 denotes a cutting unit for cutting a continuous web (not illustrated) into parallel strips. In the preferred embodiment, the continuous web is made from tobacco. In other possible embodiments, the continuous web may be made from paper, PLA or, more generally speaking, any other web material, without in any way limiting the scope of the invention.

**[0067]** The unit 1 comprises a first and a second roller 2a, 2b, with parallel axes, between which the continuous web to be cut is made to pass in such a way as to obtain the desired result from the unit 1 (that is, a plurality of parallel strips).

**[0068]** In the embodiment in the accompanying drawings, the first roller 2a is disposed above the second roller 2b and their axes of rotation X, Y are horizontal. Preferably, each roller 2a, 2b has two shaft portions 2a', 2a"; 2b', 2b" disposed on opposite sides of each roller 2a, 2b and centred on the respective axes of rotation X, Y to support each roller 2a, 2b on both sides.

**[0069]** The rollers 2a, 2b are supported by respective frames 6a, 6b which are in turn mounted on a fixed or stationary, vertical wall 11. As shown in Figures 1 and 2,

the frames 6a, 6b each has an internally hollow structure to partly enclose a respective roller 2a, 2b so that only a part of the rollers 2a, 2b, in proximity to the zone of interpenetration, is exposed. The two frames 6a, 6b each comprise a covering element 6a', 6b', mounted removably on the vertical wall 11 and open at the front on the side opposite to the vertical wall 11, and an external plate 6a", 6b" applied on the front of the covering element 6a', 6b' and perpendicular to the axis X, Y of the respective roller 2a, 2b.

**[0070]** On the side facing towards the vertical wall 11, the covering element 6a', 6b' is provided with a coupling flange 6a"', 6b"', also perpendicular to the axis X, Y and anchorable to the vertical wall 11 by a respective mounting plate 6c, 6d. The mounting plate 6c, 6d and the coupling flange 6a"', 6b"' are parallel to each other.

**[0071]** Each coupling flange 6a"', 6b"' receives a first shaft portion 2a', 2b' of the respective roller 2a, 2b through respective first bearings 7a', 7b', while the external plate 6a", 6b" receives the second shaft portion 2a", 2b" through respective second bearings 7a", 7b". Each roller 2a, 2b is provided with a succession of circumferential protrusions and recesses alternated with each other along the axis of rotation X, Y and differently shaped. For example, the protrusions and recesses may be triangular or curved in cross section or, more preferably, as shown in Figure 8A, rectangular or square in cross section. Figure 8A shows a detail view of the outside surface 15, for example of the first roller 2A, with rectangular protrusions and recesses.

**[0072]** Operatively, the protrusions of one roller 2a are at least partly inserted into the recesses of the other roller 2b and vice versa, so as to cut the continuous web along parallel longitudinal lines.

**[0073]** Preferably, the rollers 2a, 2b each have a peripheral mantle 3 provided with the above mentioned succession of protrusions and recesses. In an embodiment, illustrated in Figure 8A, the peripheral mantle 3 is defined by a monolithic part, while in a variant embodiment, illustrated in Figure 8B, the mantle 3 is defined by axially juxtaposing a plurality of annular portions 16, each having a plurality of crests, so as to make strips having one straight edge and one curved or zig-zagged edge. The number of annular portions 16 is less than the number of crests (for example, a submultiple), so that, for example, each annular portion 16 contains a number of crests between 1 and 350, preferably between 5 and 70.

**[0074]** In a further embodiment, each crest may be defined by a respective disc (not illustrated).

**[0075]** Operatively, the continuous web is fed through the gap defined by the first and the second roller 2a, 2b which, as they rotate so that the recesses of the first roller 2a engage the protrusions of the second roller 2b, and vice versa, cut the continuous web along the aforesaid parallel, longitudinal lines.

**[0076]** During cutting operations, part of the material the continuous web is made of inevitably settles in the recesses of the first and second rollers 2a, 2b and totally or partly obstructs the recesses.

**[0077]** To remove the particles of web material from the recesses, the unit 1 comprises specific cleaning means.

**[0078]** According to the invention, the cleaning means are embodied by a plurality of technical solutions.

**[0079]** As shown in Figure 4, the cleaning means comprise a movement mechanism 4 operating on at least one of the rollers 2a, 2b to produce a movement of the rollers 2a, 2b towards and away from each other such as to vary the extent to which the crests and recesses of the rollers 2a, 2b are interpenetrated, so that the flanks of the crests interact with each other to facilitate detaching any waste material that has accumulated.

**[0080]** Preferably, the movement mechanism 4 operates on the first roller 2a, while the second roller 2b is fixed; the same concept can, however, be applied to the second roller 2b or to both. In this situation, the movement mechanism 4 moves the first roller 2a closer to the second roller 2b so as to increase the extent to which the recesses and the protrusions of the rollers 2a, 2b penetrate each other. Next, the movement mechanism 4 moves the first roller 2a away from the second roller 2b so that the rollers 2a, 2b return to a previous condition where the recesses and protrusions on them penetrate each other to an extent suitable for cutting the continuous web.

**[0081]** In other words, the movement mechanism 4 temporarily varies the mutual distance between the first and the second roller 2a, 2b so it departs from the optimum value corresponding to the format being processed and allows removing the residual web material from each recess in the first and the second roller 2a, 2b. Preferably, the movement of the rollers 2a, 2b towards and away from each other is performed along a direction passing through the axes of rotation X, Y of the rollers 2a, 2b.

**[0082]** In the embodiment shown in the accompanying drawings and in detail in Figures 4 and 5, the movement mechanism 4 comprises at least one pushing means 4a embodied as a linear actuator and configured to keep the first roller 2a pressed towards the second roller 2b. The pushing means 4a might, however, be embodied in a different way, for example, as a passive means (a helical spring or a gas spring) or as an electric linear actuator.

**[0083]** The movement mechanism 4 also comprises an adjustable stop means 4b defining an adjustable stop position of the first roller 2a relative to the second roller 2b.

**[0084]** Preferably, the stop means 4b is embodied as an eccentric or a cam having a surface whose radius is variable as a function of the angular position adopted.

**[0085]** In other words, in the embodiment shown in the accompanying drawings, the pushing means 4a causes the first roller 2a to move relative to the second roller 2b, in particular to create at least a working configuration, in which the rollers 2a, 2b are close together and interpenetrated, and an inactive configuration (not illustrated), in which the rollers 2a, 2b are spaced apart to allow maintenance, disassembly or initial loading of the web to be

carried out. The extent of penetration of the rollers 2a, 2b, hence the "fine tuning" of the distance of the first roller 2a relative to the second roller 2b is, on the other hand, determined by a contact part 4c, which is integral with the first roller 2a, coming into abutment against the adjustable stop means 4b, preferably through an interposed supporting rod 4c' guided in translation and provided at the bottom of it with a cam follower 4c" (all shown in detail in Figure 5). During the pushing movement imparted to it by the pushing means 4a, the first roller 2a is stopped closer to, or further from, the second roller 2b depending on the angular orientation adopted by the adjustable stop means 4b.

**[0086]** Preferably, the contact part 4c, integral with the first roller 2a, is disposed on a portion of the frame 6a of the first roller 2a, specifically on the coupling flange 6a'" or on the anchoring plate 6c.

**[0087]** To achieve this movement, the frame 6a is slidably mounted on the vertical wall 11 by means of a linear guide 12 in such a way that the first roller 2a can be moved towards or away from the second roller 2b during the cleaning operations. Preferably, the linear guide 12 is disposed between the vertical wall 11 and the anchoring plate 6c, and the coupling flange 6a'" is fixed to the anchoring plate 6c.

**[0088]** The cleaning means also comprise a control unit (not illustrated) operating on the movement mechanism 4, hence on the pushing means 4a and on the adjustable stop means 4b to activate the movement mechanism so it can move the first roller 2a towards or away from the second roller 2b. The control unit is thus configured to vary temporarily the distance between the rollers 2a, 2b and to keep the varied distance for a predetermined angle of rotation of the rollers 2a, 2b large enough for the recesses to be cleaned. Preferably, the angle of rotation is greater than 180°, more preferably greater than 360° and/or less than a predetermined maximum angle, preferably between 1 and 100 complete turns and, more preferably between 30 and 50 turns.

**[0089]** In use, therefore, the control unit activates the adjustable stop means 4b which moves the first roller 2a closer to the second roller 2b so as to increase the extent to which the recesses and the protrusions of the rollers 2a, 2b penetrate each other. The distance of the first roller 2a from the second roller 2b is determined by the contact part 4c, which is mounted on the first roller 2a, when it comes into abutment against the adjustable stop means 4b. The first roller 2a is held at the position close to the second roller 2b for a predetermined angle of rotation so as to optimize removal of the residual web material. Next, the control unit returns the first roller 2a to a distance from the second roller 2b suitable for processing (cutting) the web material.

**[0090]** Preferably, in addition or alternatively to the movement mechanism 4, the cleaning means also comprise, for each of the rollers 2a, 2b, a mechanical removal means 5 which faces the mantle 3 and is configured to apply a mechanical cleaning action on the crests and/or on the recesses.

**[0091]** Preferably, as shown in Figures 3A and 3B, the mechanical removal means 5 comprises a brush 5a, a scraper 5b and/or a suction hood 5c.

**[0092]** The brush 5a may be configured to operate on the free ends of the crests (opposite to the axis X, Y) or on the bottom of the recesses or on both. The scraper 5b may be configured to directly scrape the lateral surfaces (parallel or convergent) of the crests and, if necessary, also the working surfaces of the crests. The suction hood 5c is configured to extract the material removed by the brush 5a, the scraper 5b and/or by the movement mechanism 4.

**[0093]** Preferably, during cleaning operations, the mechanical removal means 5 operates on the respective rollers 2a, 2b in an angular sector of the respective roller 2a, 2b between 90° and 180° downstream of the zone of interaction between the rollers 2a, 2b, preferably at around 135°.

**[0094]** Further, the mechanical removal means 5 is mounted on the respective frame 6a, 6b, specifically on the covering element 6a', 6b', preferably at a through opening so that the mechanical removal means 5 is accessible from the outside without having to remove the frame 6a, 6b and/or the roller 2a, 2b from the frame 6a, 6b.

**[0095]** The cleaning means thus made are mechanically simple and capable of efficiently removing the residual web material.

**[0096]** Furthermore, the cleaning means allow performing temporary cleaning of the rollers 2a, 2b at a controlled or regular rate during normal operation of the rollers 2a, 2b without resorting to time-consuming and costly shutdowns of the cutting process.

**[0097]** Moreover, during cleaning operations, the rollers 2a, 2b do not need to be removed from the unit 1 but are simply moved just a little way towards or away from each other. That means that after each cleaning operation, the first and the second roller 2a, 2b do not have to be remounted in the unit 1 and their mutual position readjusted to be able to continue working on the web correctly. In the unit 1 of this invention, the mutual position of the rollers 2a, 2b is adjusted only once, at the beginning of the cutting process and not after each cleaning operation.

**[0098]** To suitably adjust the mutual position between the first roller 2a and the second roller 2b, the unit 1 comprises specific adjustment means.

**[0099]** In the embodiment shown in the accompanying drawings, in particular Figure 2 and Figure 7A, the adjustment means comprise axial adjustment means 9 and transverse adjustment means 10a, 10b which are configured, respectively, to adjust the rollers 2a, 2b axially and to adjust the inclination of the rollers 2a, 2b. The axial adjustment means 9 and the transverse adjustment means 10a, 10b can be used independently of each other, without necessarily using them all in combination.

**[0100]** Preferably, the adjustment means operate on the first roller 2a in such a way that the first roller 2a is

axially aligned with the second roller 2b and/or the axis of rotation X of the first roller 2a is parallel to the axis of rotation Y of the second roller 2b.

**[0101]** The second roller 2b, on the other hand, is preferably mounted on the respective frame 6b with its axis Y fixed relative to the frame 6b and at a fixed position along the axis Y to act as a reference for adjusting the first roller 2a and thus being able only to rotate about the axis Y.

**[0102]** With reference to Figure 2, the first roller 2a is mounted on the respective frame 6a by the related pair of bearings 7a', 7a", one of which (the one disposed on the side of the vertical wall 11) is axially fixed to the wall 11, specifically integral with the coupling flange 6a'" and with the anchoring plate 6c, while the other (the one mounted on the external plate 6a") is integral with the outer shaft portion 2a", hence axially integral with the first roller 2a.

**[0103]** According to the invention, the outer bearing 7a" can be adjustably mounted in the axial and/or transverse direction to adjust the position and/or the inclination of the first roller 2a relative to the second roller 2b, respectively.

**[0104]** In order to perform this axial and/or transverse adjustment, the adjustable bearing 7a" is mounted on the frame 6a by means of a floating plate 8 which is in turn adjustably mounted on the outer plate 6a". In use, the outer plate 6a" is fixed and every movement to adjust the floating plate 8 relative to the outer plate 6a" adjusts the axial alignment or the inclination of the first roller 2a. Furthermore, the adjustable bearing 7a" is mounted in such a way that its inner ring is axially fixed to the respective shaft portion 2a", while the outer ring of the bearing 7a" is fixed in position relative to the floating plate 8.

**[0105]** The axial adjustment means 9 are preferably embodied as a spacer 9, preferably in the shape of a plate, interposed between the floating plate 8 and the frame 6a (outer plate 6a") and whose thickness is selected in such a way as to set the first roller 2a at a desired axial position. The unit 1 might thus be provided with a plurality of spacers 9 having different thicknesses, each selectable and usable as a function of the axial distance to be adjusted.

**[0106]** In this situation, the axial movement of the first roller 2a is allowed by a minimum clearance of the inner shaft portion 2a', housed in the axially fixed bearing 7a' and/or by a clearance which allows movement between the axially fixed bearing 7a' and a respective receiving seat made in the frame 6a (coupling flange 6c).

**[0107]** As shown in Figure 2, the thickness of the spacer 9 is thus selected in such a way that once the first roller 2a has been mounted in the frame 6a, the first roller 2a is axially aligned with the second roller 2b so that the crests on it are centred relative to the recesses of the second roller 2b, and vice versa.

**[0108]** Figures 3A and 7A, on the other hand, show the transverse adjustment means 10a, 10b, which operate at the outer shaft portion 2a" of the first roller 2a, preferably directly on the floating plate 8.

**[0109]** Preferably, the transverse adjustment means 10a, 10b comprise a first and a second adjustment screw 10a, 10b, preferably differential screws. Preferably, the first and the second adjustment screw 10a, 10b operate along directions which are transverse, preferably perpendicular, to each other to adjust the axis of rotation X of the first roller 2a and the axis of rotation Y of the second roller 2b so they are parallel to each other. The transverse adjustment thus corrects the angle made by the axis X of the first roller 2a with the axis Y of the second roller 2b and this angle variation (of very small extent) is made possible by the clearances at the axially fixed bearing 7a' (which may be configured as a swivel bearing).

**[0110]** Preferably, to achieve this, as shown in Figure 7A, each adjustment screw 10a, 10b is housed with transverse clearance (in a plane perpendicular to the working axis of the screw itself) inside a guide hole 8' made in the floating plate 8. More in detail, the adjustment screw 10a has a central shank portion 10a" inserted with clearance in the hole 8' and, opposite to the end 10a' which is engageable by an adjustment tool, an end portion 10a'", wider in cross section and inserted in a socket of the floating plate 8 by means of an undercut so that even if the screw 10a, thanks to the transverse clearance, is moved relative to the hole (when the other screw 10b is operated), the screw 10a does not come loose from the floating plate 8. Figure 7A is the detail view showing the first adjustment screw 10a but the structure just described is also applicable to the second adjustment screw 10b.

**[0111]** Operatively, therefore, before setting the rollers 2a, 2b in rotation, the first roller 2a is adjusted using the axial adjustment means 9, defined by the spacer, and the transverse adjustment means comprising the adjustment screws 10a, 10b operating between the frame 6a and the floating plate 8. Advantageously, the possibility of adjusting the first roller 2a relative to the second roller 2b allows achieving greater web processing precision and obtaining strips of better, more uniform quality.

**[0112]** Advantageously, adjustment is carried out only once, before starting to work on the continuous web and, thereafter, only in the case of a size or product changeover.

**[0113]** To help maintain the position and/or alignment of the first roller 2a relative to the frame 6a according to the adjustments made, the frame 6a is removably mounted on the fixed supporting wall 11 by means of a unique positioning system configured to obtain a unique position of the frame 6a relative to the supporting wall 11.

**[0114]** Preferably, the frame 6b for the second roller 2 is mounted on the supporting wall 11 also by a unique positioning system, as shown in Figure 2.

**[0115]** Preferably, the unique positioning system is made in the form of quick couplings or plugs.

**[0116]** In the embodiment shown in the accompanying drawings, where the frame 6a on which the first roller 2a is mounted, is mounted directly on the supporting wall

11 by means of the linear guide 12, the first roller 2a can be removed by removing the frame 6a from the wall 11. More in detail, the coupling flange 6a''' is removed from the mounting plate 6c and, in this configuration, the unique positioning system is made between the coupling flange 6a''' and the mounting plate 6c.

**[0117]** As shown in detail in Figures 2, 4 and 6, a first and a second motor 13a, 13b, configured to set the rollers 2a, 2b in rotation about their axes X, Y, are also mounted on the vertical wall 11, on the side opposite the first and the second roller 2a, 2b.

**[0118]** Preferably, the first and the second motor 13a, 13b are associated or associable with the respective rollers 2a, 2b by mechanical couplings 14 embodied as captive screws or quick couplings.

**[0119]** Advantageously, the unique positioning system and the mechanical couplings 14 make mounting and removing the rollers 2a, 2b quick and easy, without having to adjust the first roller 2a relative to the second roller 2b again every time the first roller 2a is removed or mounted from or to the unit 1. In effect, removing the coupling flanges 6a''', 6b''' from the mounting plates 6c, 6d disengages the mechanical couplings 14 and makes it possible to move the rollers 2a, 2b from the vertical wall 11.

**[0120]** According to an aspect of this invention, the cutting unit 1 can be installed in a machine for making segments for smoking articles, in particular smoking articles containing tobacco. More in detail, the cutting unit 1 is installed in the machine downstream of the unwinding means which unwind the continuous web and which are configured to feed the continuous web along a longitudinal feed direction. The continuous web is therefore fed to the unit 1 in such a way as to be inserted between the first and the second roller 2a, 2b to cut the web into longitudinal strips.

**[0121]** At the exit of the unit 1, the machine comprises gathering and conveying means configured to gather and convey the longitudinal strips in order to create at least one continuous stream. The machine also comprises a rod forming beam configured to receive the continuous stream and to progressively wrap it in a continuous web of wrapping material (for example paper, plastic, aluminium or other suitable material) to make at least one continuous rod. The machine also comprises cutting means for cutting the continuous rod, located downstream of the forming beam and configured to cut the continuous rod into a plurality of segments.

**[0122]** The invention achieves the preset aims overcoming the drawbacks of the prior art.

**[0123]** The cleaning means allow the rollers 2a, 2b to be thoroughly and efficiently cleaned without having to bring the rollers 2a, 2b to a stop. Thanks to the simplicity of the cleaning means, cleaning can be easily carried out periodically at low cost and in a controlled manner.

**[0124]** The adjustment means allow precisely positioning the first roller 2a relative to the second roller 2b so as to obtain a highly precise cut.

**[0125]** Moreover, removing one or both of the rollers for maintenance purposes can be done very quickly because the structure of the unit is such as not to alter the adjustments made previously (specifically between roller and outer plate), which are carried out only on the removable parts.

## Claims

1. A unit (1) for cutting a continuous web into parallel strips, comprising a first and a second roller (2a, 2b) between which a continuous web is fed and each of which is provided with a succession of circumferential protrusions and recesses alternated with each other along the axis of rotation (X, Y) of the roller (2a, 2b), the rollers (2a, 2b) being coupled to each other so that the protrusions of one roller (2a) are at least partly inserted into the recesses of the other roller (2b) and vice versa, so that the rollers (2a, 2b) cut the continuous web along parallel longitudinal lines; cleaning means configured to promote removal of particles of material released in the recesses by the web during cutting; the unit being **characterized in that** the cleaning means comprise a movement mechanism (4), operating on at least one of the rollers (2a, 2b) to move the rollers (2a, 2b) towards and away from each other, and a control unit, operating on the movement mechanism (4) to vary temporarily the distance between the rollers (2a, 2b) and to keep the varied distance for a predetermined angle of rotation of the rollers (2a, 2b) large enough for the recesses to be cleaned, the angle being preferably greater than 180°, more preferably greater than 360° and/or less than a predetermined maximum angle, preferably between 1 and 100 complete turns and, more preferably between 30 and 50 turns.

2. The unit (1) according to claim 1, wherein the variation of the distance between the rollers (2a, 2b) effected by the control unit is a movement of the rollers (2a, 2b) towards each other, specifically along a line passing through the axes of rotation (X, Y) of the rollers (2a, 2b).

3. The unit (1) according to claim 1 or 2, wherein the variation of the distance between the rollers (2a, 2b) can also be effected permanently during use for the purposes of a format or process changeover.

4. The unit (1) according to any one of claims 1 to 3, wherein the movement mechanism (4) comprises at least one pushing means (4a), specifically a linear actuator, operating on the first roller (2a) to hold the first roller (2a) pressed towards the second roller (2b), and an adjustable stop means (4b) defining an adjustable stop position of the first roller (2a) relative to the second roller (2b), the adjustable stop means (4b) being preferably defined by a linear actuator or

a cam or eccentric means whose surface is variable in radius as a function of the angular orientation adopted.

**5.** The unit (1) according to claim 4, wherein the first roller (2a) is mounted on a movable frame (6a) which is in turn slidably mounted on a fixed vertical wall (11) by means of a linear guide (12) and wherein the pushing means (4a) and the adjustable stop means (4b) operate on the movable frame (6a).

**6.** The unit (1) according to any one of the preceding claims, wherein the cleaning means comprise, for at least one of the rollers (2a, 2b), preferably both of the rollers (2a, 2b), a mechanical removal means (5) operating on a peripheral portion of the respective roller (2a, 2b) downstream of a zone of tangency between the rollers (2a, 2b), preferably in an angular sector between 90° and 180° downstream of the zone of tangency between the rollers (2a, 2b).

**7.** The unit (1) according to claim 6, wherein the at least one mechanical removal means (5) is one, or a combination, of the following: one or more brushes (5a), either idle or motor-driven; one or more scrapers (5b), engaged or engageable on flanks of the protrusions/recesses; one or more extractor hoods (5c).

**8.** The unit (1) according to one or more of the preceding claims, further comprising axial adjustment means operating on at least one of the rollers (2a, 2b) to make an axial adjustment between the two rollers (2a, 2b).

**9.** The unit (1) according to claim 8, wherein at least one of the rollers (2a, 2b) is mounted on a respective frame (6a, 6b) by means of a pair of bearings (7a', 7a"; 7b', 7b"), at least one of which is axially fixed relative to the roller (2a, 2b), and wherein the fixed bearing (7a") can be adjustably mounted on the frame (6a) by at least one spacer (9) whose thickness is selected to compensate a desired adjustment distance.

**10.** The unit (1) according to one or more of the preceding claims, further comprising transverse adjustment means operating on at least one of the rollers (2a, 2b) to adjust the inclination between the two rollers (2a, 2b).

**11.** The unit according to claim 10, wherein one of the rollers (2a, 2b) is mounted on a respective frame (6a) by means of a floating plate (8) disposed at one end of the roller (2a), and wherein the transverse adjustment means comprise a first and a second adjustment screw (10a, 10b) operating between the frame (6a) and the floating plate (8) along two directions that are transverse, preferably perpendicular, to each other.

**12.** The unit according to claims 9 and 11, wherein the bearing (7a") that is axially fixed relative to the roller (2a, 2b) is mounted at a fixed position on the floating plate (8) and wherein the floating plate (8) is mounted on the frame (2a) by means of the spacer (9).

**13.** The unit (1) according to one or more of the preceding claims, wherein at least one of the rollers (2a, 2b) is mounted adjustably on a respective frame (6a, 6b) and wherein the frame (6a, 6b) is mounted removably on a fixed supporting wall (11) by means of a fixed positioning system configured so that when the frame (6a, 6b) is mounted on the fixed supporting wall (11), the frame (6a, 6b) is placed at a fixed position relative to the fixed supporting wall (11) and thus the respective roller (2a, 2b) remains adjusted at the same position relative to the frame (6a, 6b).

**14.** The unit (1) according to claim 13, comprising a first motor (13a) and a second motor (13b) mounted on the fixed supporting wall (11) on the side opposite to the rollers (2a, 2b) and associated or associable with the first and the second roller (2a, 2b), respectively, by means of mechanical fasteners (14), preferably in the form of captive screws or quick-disconnect fittings.

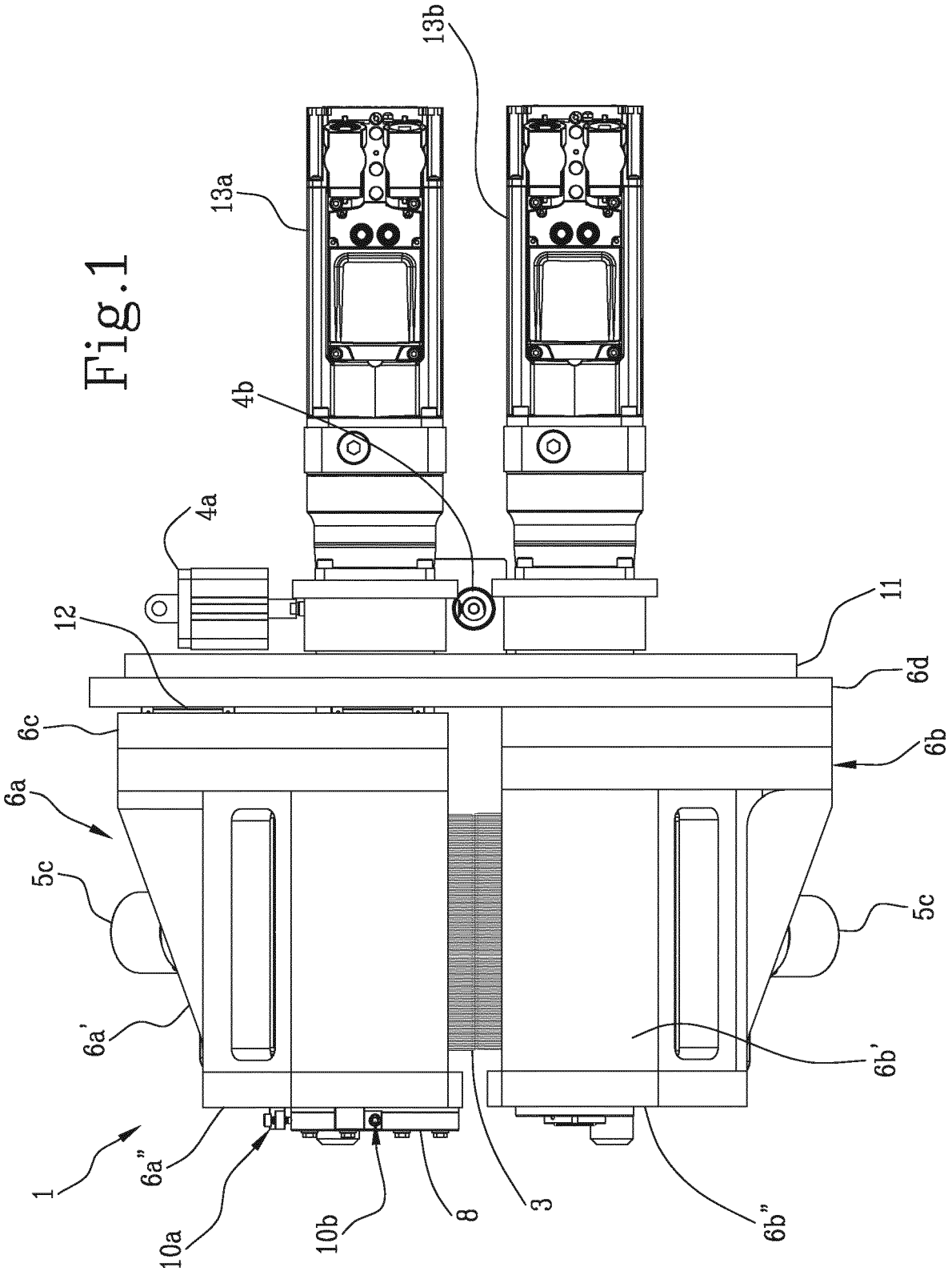
**15.** Machine for making segments for smoking articles, comprising:

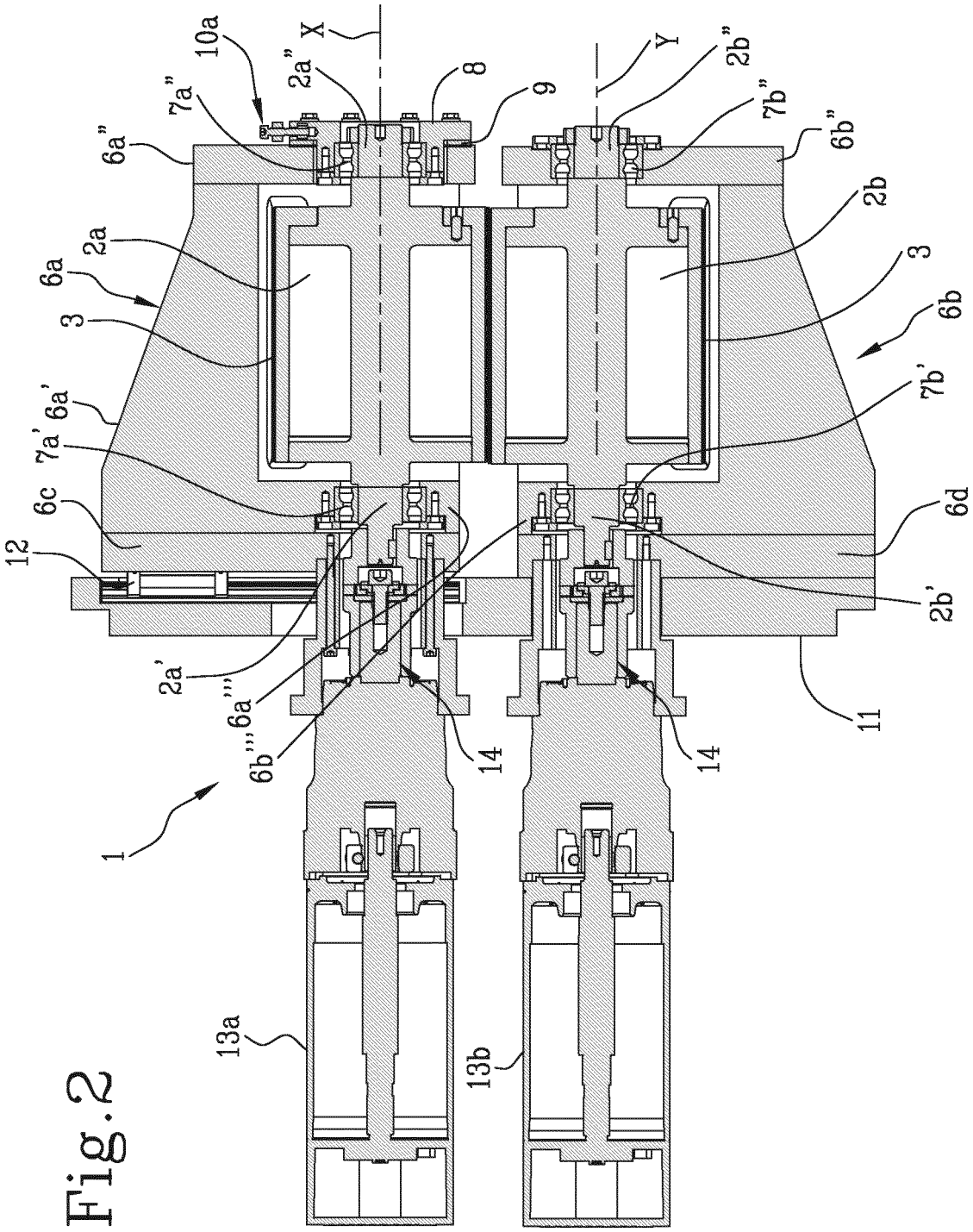
- means for unwinding at least one roll of web material configured to feed a continuous web along a longitudinal feed direction;
- a unit (1) according to one or more of the preceding claims, disposed downstream of the unwinding means;
- gathering and conveying means configured to gather and convey the processed continuous web from the unit (1) and to make at least one continuous stream;
- a rod forming beam configured to receive the at least one continuous stream and to progressively wrap it in a continuous web, preferably of paper, to make at least one continuous rod;
- cutting means for cutting the at least one continuous rod, located downstream of the forming beam and configured to cut the at least one continuous rod into a plurality of segments.

**16.** A method for cutting a continuous web into parallel strips, implemented specifically by a unit (1) according to the claims 1 to 14, comprising
a step of feeding a continuous web through a gap defined between a first and a second roller (2a, 2b), each of which is provided with a succession of circumferential protrusions and recesses alternated

with each other along the axis of rotation (X, Y) of the roller (2a, 2b), and the rollers (2a, 2b) being coupled to each other so that the protrusions of one roller (2a) are at least partly inserted into the recesses of the other roller (2b) and vice versa, and a step of cutting the continuous web along parallel longitudinal lines during a rotation of the rollers (2a, 2b);
cleaning the rollers (2a, 2b) by removing the particles of material released in the recesses by the web during cutting;
wherein at least the first of the rollers (2a) is adjustable towards and away from the second roller (2b), and wherein the step of cleaning is accomplished by varying the distance between the rollers (2a, 2b), specifically by increasing the degree of interpenetration between the protrusions and the recesses, and wherein the step of varying the distance between the rollers (2a, 2b) is accomplished temporarily and at a controlled or regular rate during the normal operation of the rollers (2a, 2b), specifically through a predetermined angle of rotation of the rollers (2a, 2b) large enough for the recesses to be cleaned by mechanical interaction between protrusions and recesses, the angle being preferably greater than 180°, more preferably greater than 360° and/or less than a predetermined maximum angle, preferably between 1 and 100 complete turns and, more preferably between 30 and 50 turns.

Fig.1

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8
9
Y
2b"
7a"
7b"
6a"
6b"
2a
2b
6a
3
3
6b
6a'
7b'
7a'
6c
6d
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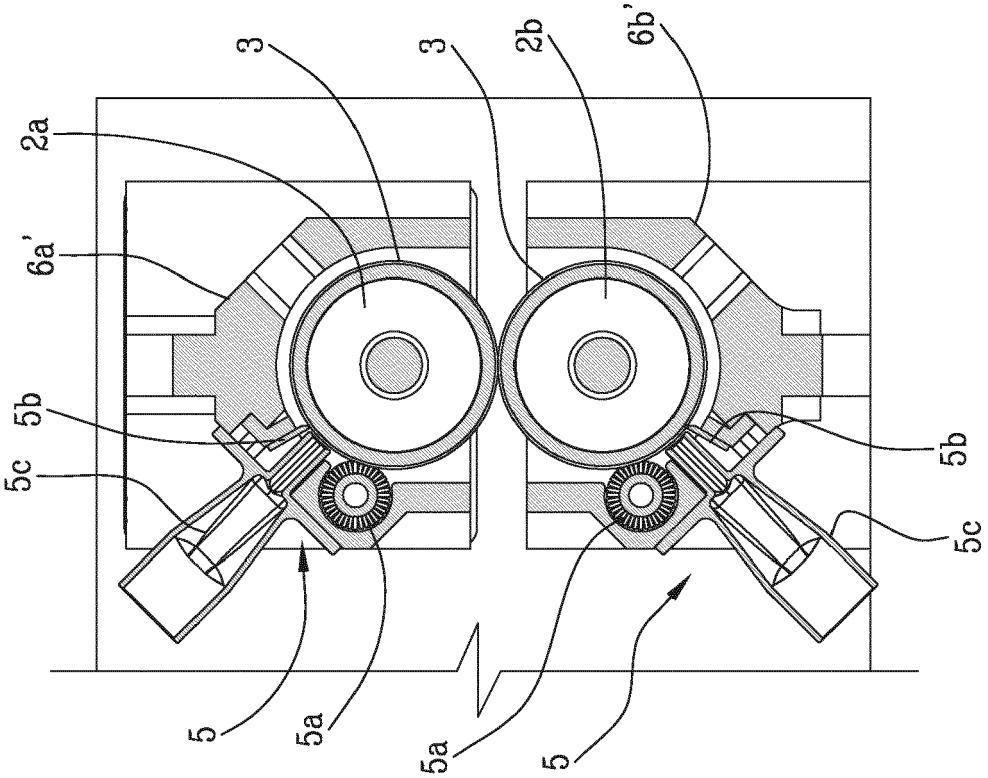
2b'
2a'
6a'''
6b'''
14
14
11
1
13a
13b

Fig.2

Fig.3B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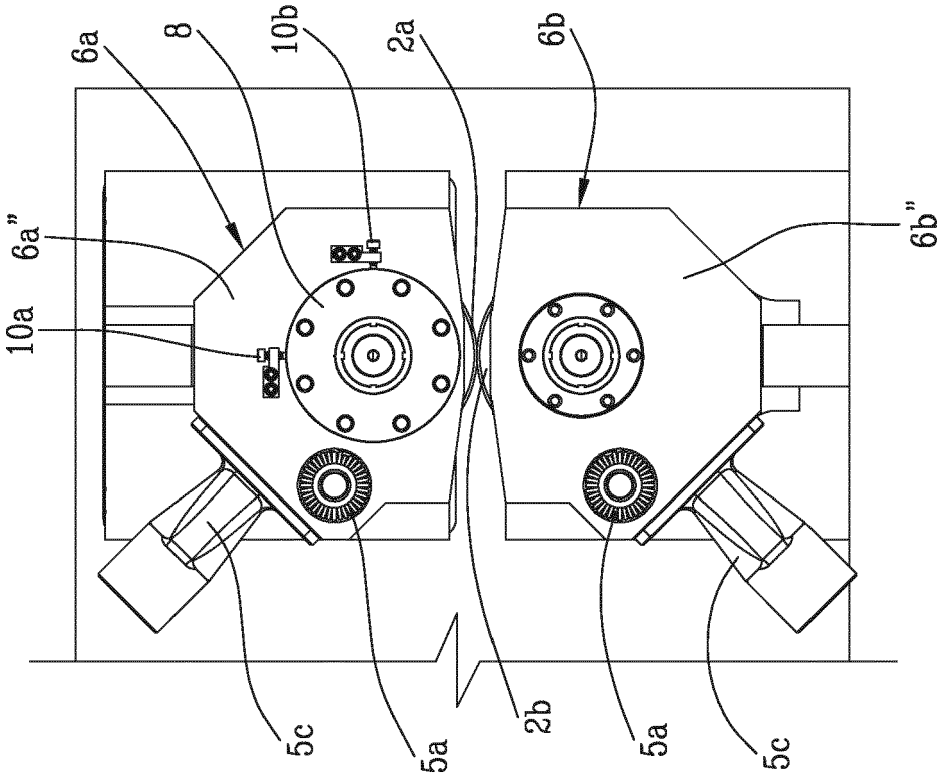
5c
5
5a
5a
5

Fig.3A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6b
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6b"
5c
5a
2b
5a
5c

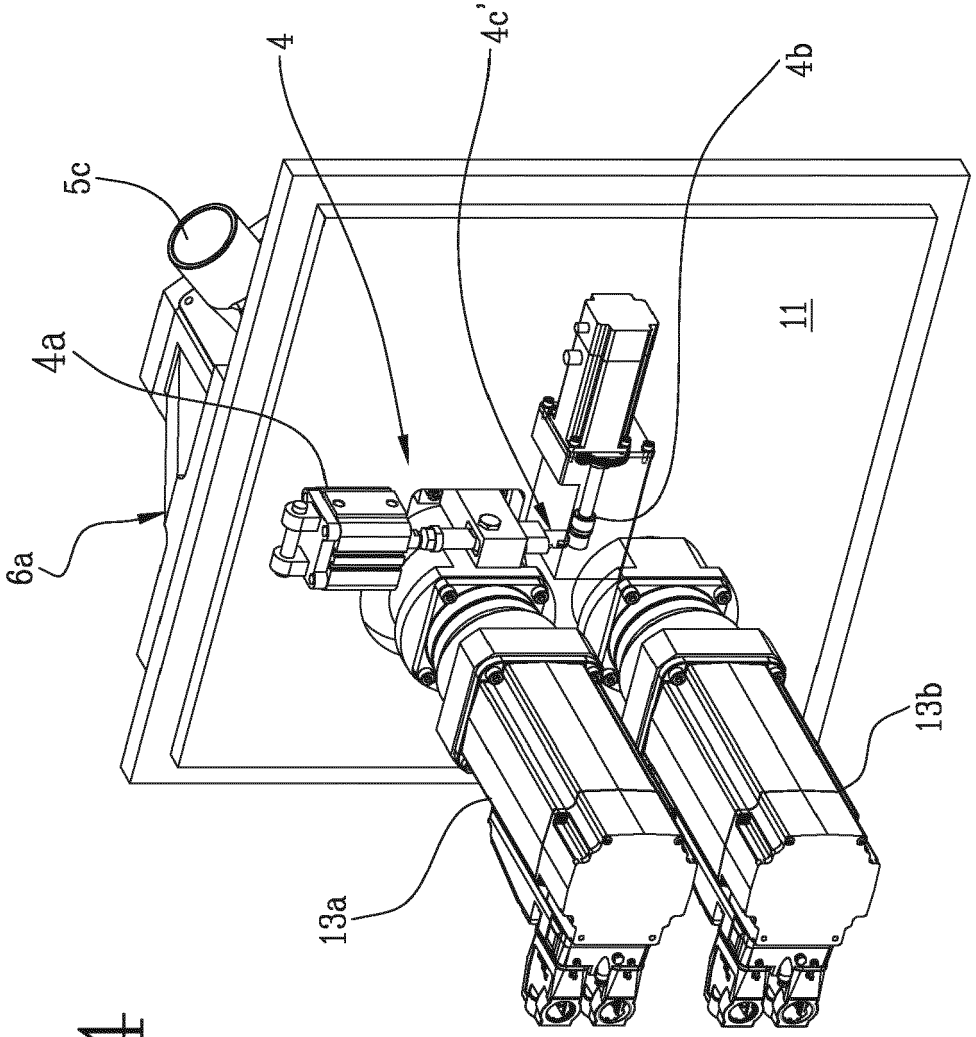



Fig. 4

Fig.6

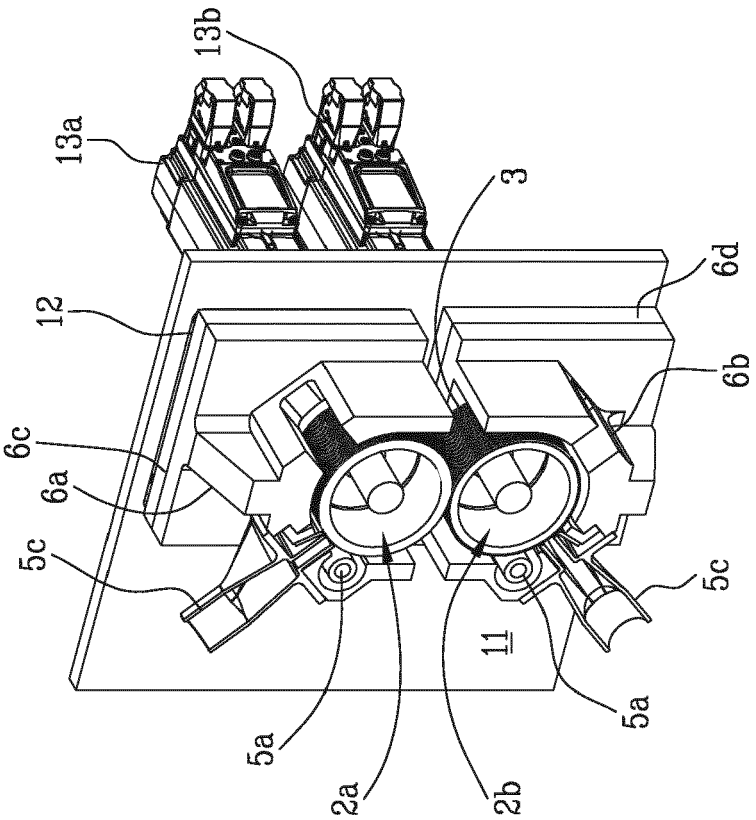



Fig.5

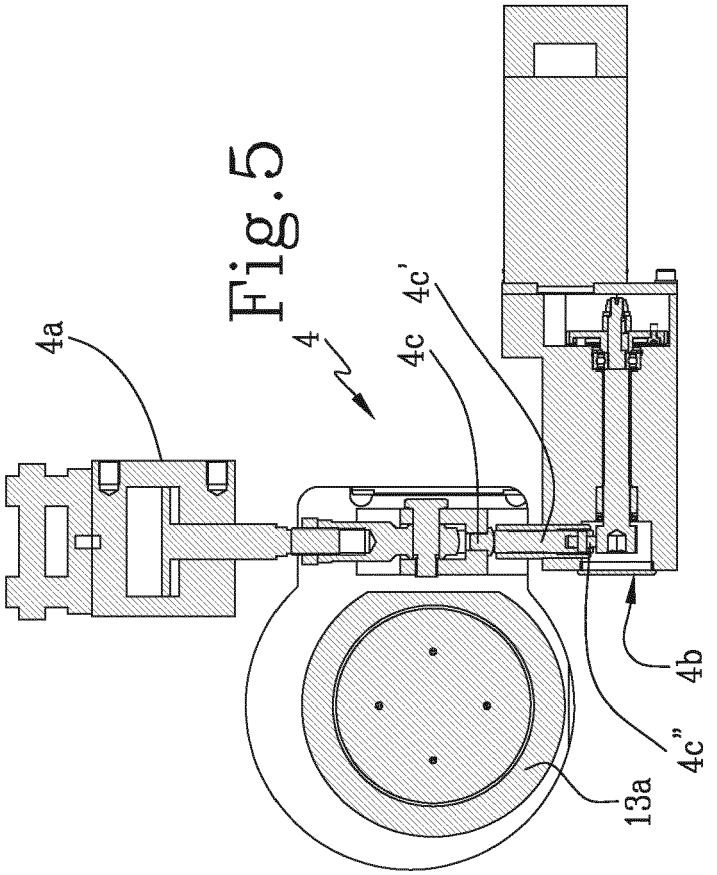
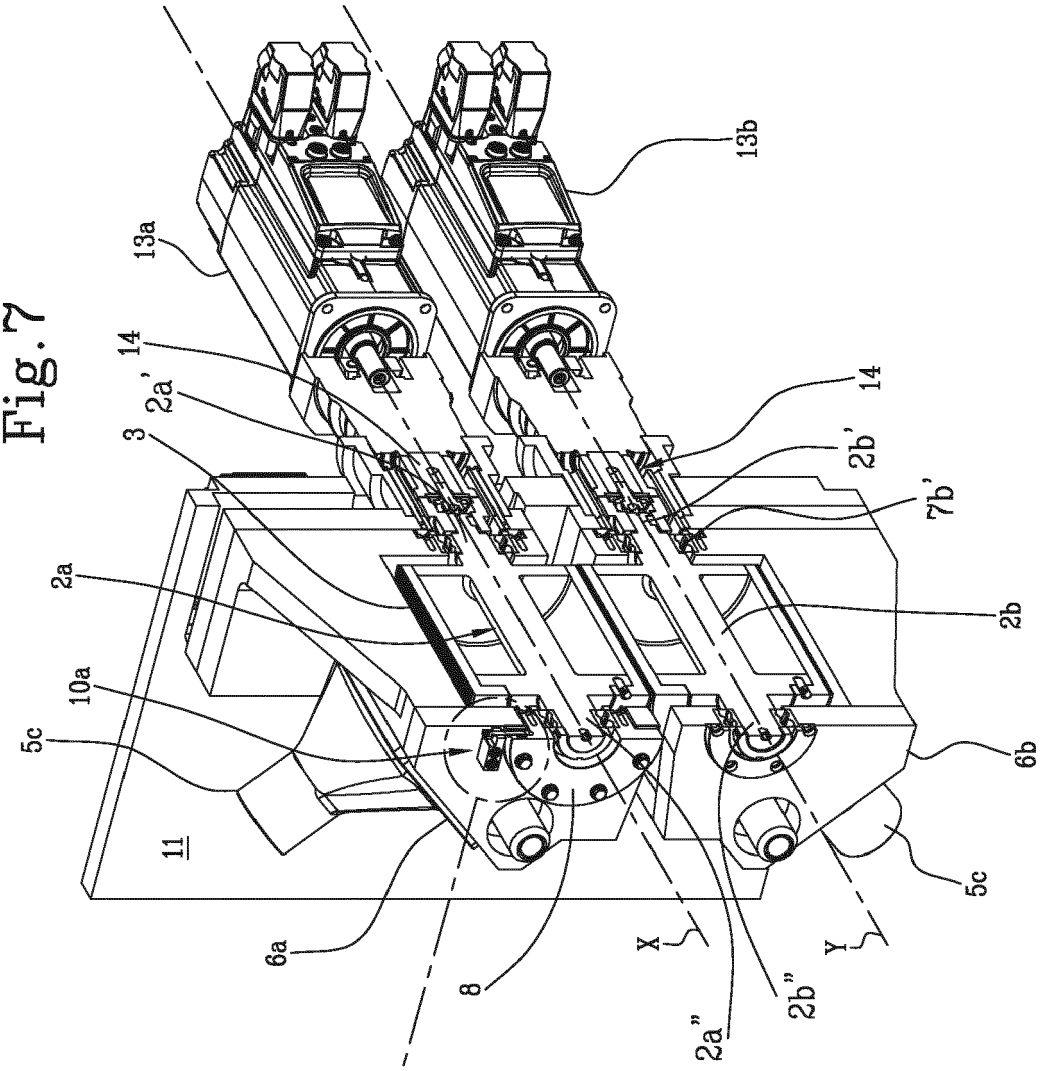


Fig.7


13b
13a
14
2a'
3
2a
10a
5c
11
6a
8
X
Y
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2b"
2b'
7b'
2b
6b
5c

Fig.7A

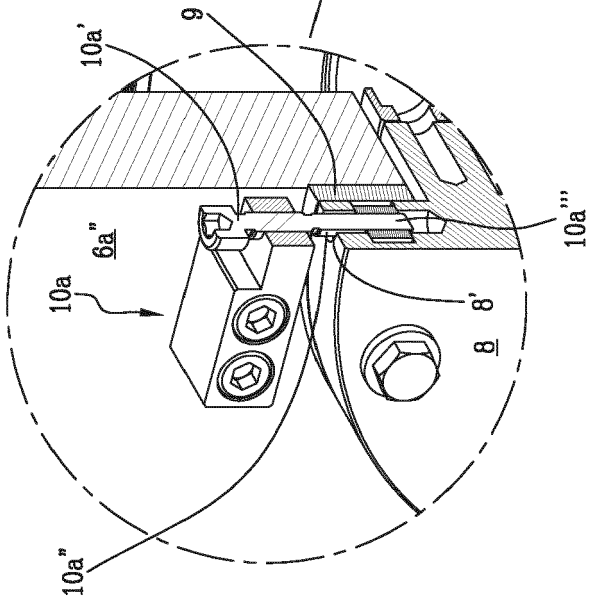

10a'
9
10a"'
6a"
10a
8'
8
10a"

Fig.8A

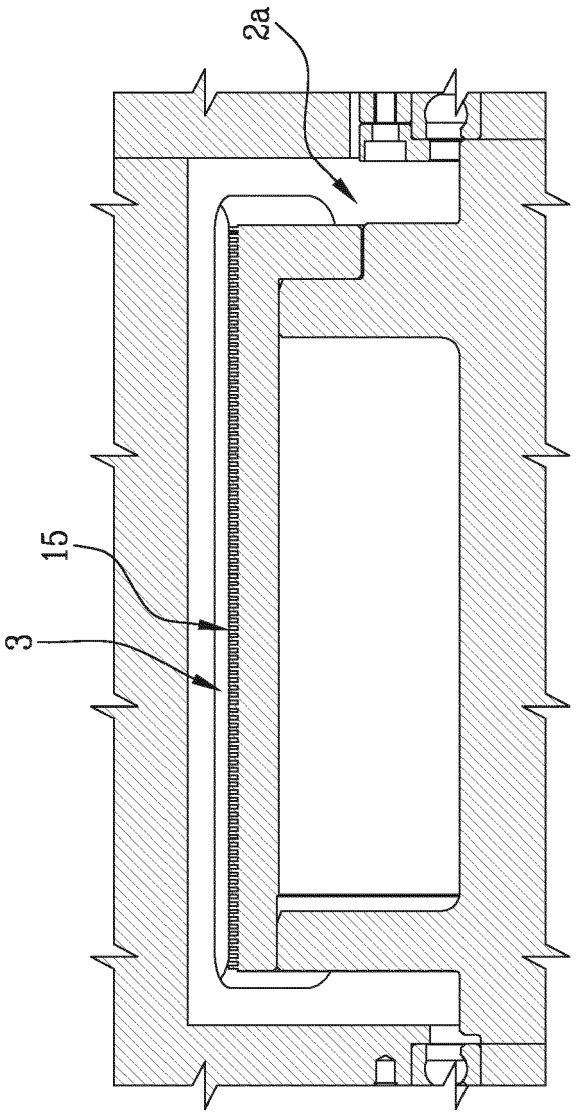
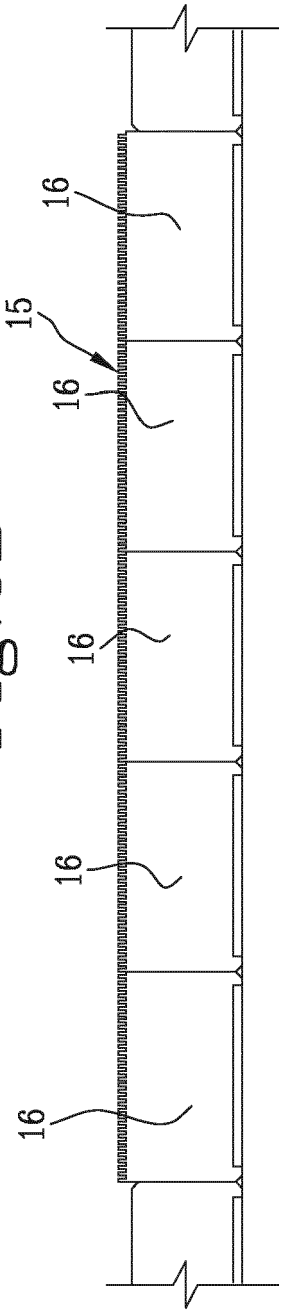



Fig.8B



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# EUROPEAN SEARCH REPORT

Application Number
EP 21 17 5761

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
|---|---|---|---|
| A | EP 1 344 578 A2 (HEIDELBERGER DRUCKMASCH AG [DE]) 17 September 2003 (2003-09-17)<br>* figures 1-3 *<br>----- | 1-16 | INV.<br>B26D1/24<br>B26D7/18 |
| A | US 5 025 814 A (RAKER MARK L [US])<br>25 June 1991 (1991-06-25)<br>* figures 1,3,8 *<br>----- | 1-16 | |
| A | DE 444 041 C (GEORG SPIESS)<br>18 May 1927 (1927-05-18)<br>* figures 4-6 *<br>----- | 1-16 | |

TECHNICAL FIELDS SEARCHED (IPC)

B26D
A24B
A24D

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| Munich | 24 September 2021 | Wimmer, Martin |

CATEGORY OF CITED DOCUMENTS

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EPO FORM 1503 03.82 (P04C01)

## ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 21 17 5761

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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24-09-2021

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| EP 1344578 A2 | 17-09-2003 | DE 10211309 A1 | 25-09-2003 |
| | | EP 1344578 A2 | 17-09-2003 |
| US 5025814 A | 25-06-1991 | NONE | |
| DE 444041 C | 18-05-1927 | NONE | |

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82