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(54) **CRIMPING UNIT**

(57) This invention relates to a crimping unit for crimping a web (100) of material used to make tobacco industry products, comprising:

- a crimping station (20) which comprises a first crimping roller (21) and a second crimping roller (22) operatively coupled to make a plurality of longitudinal easy folding lines on the web (100) in transit between the two crimping rollers (21, 22);

- a gathering station (30), located downstream of the crimping station (20) and configured to receive the web (100) and progressively gather it in order to give it a substantially cylindrical shape;

the gathering station also comprises:

- a pre-shaping member (31) whose cross-sectional shape transverse to the feed direction of the web (100) is curved and shaped and configured to give the web (100) a shape substantially like that of a U;

- a shaping device (32) provided with a shaping duct (32a).

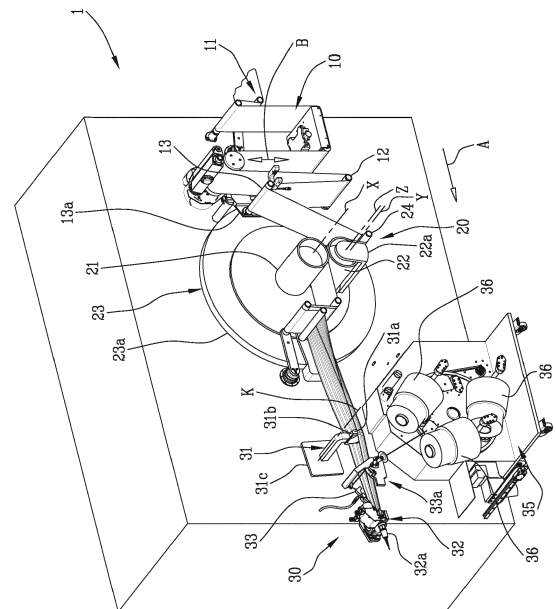


Fig.1

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Description

[0001] This invention relates to a machine for crimping a web of material used to make tobacco industry products.

[0002] In particular, this web can be used in the tobacco industry to make traditional filter cigarettes, that is, cigarettes which can be smoked by burning the end of the cigarette opposite the filter, or electronic cigarettes such as, for example: heat not burn, electronic-cig, mixed electronic-cig and tobacco.

[0003] Known in the art are crimping systems, as described in document WO 2016/071267 A1, designed to create corrugations on the web which can subsequently be compacted to create a longitudinal stream containing the crimped web; it was found, however, that the articles made according to this solution are not uniformly compacted but tend to become loose.

[0004] The Applicant has found that the articles obtained according to the teachings of the prior art are not optimally compacted and tend to loosen up when subjected to subsequent processes. As a result, the end products may also be non-uniform and of poor quality.

[0005] In this context, the technical purpose which forms the basis of the present invention is to propose a crimping unit which overcomes at least some of the above mentioned disadvantages of the prior art.

[0006] More specifically, this invention has for an aim to provide a crimping unit capable of optimizing the process of crimping a web of material used to make tobacco industry products in order to improve the quality of the end product made using the web.

[0007] The technical purpose indicated and the aims specified are substantially achieved by a crimping unit comprising the technical features described in one or more of the accompanying claims.

[0008] This invention discloses a crimping unit for crimping a web of material used to make tobacco industry products, comprising:

- a crimping station which comprises a first crimping roller and a second crimping roller operatively coupled to make a plurality of longitudinal easy folding lines on the web in transit between the two crimping rollers;
- a gathering station, located downstream of the crimping station and configured to receive the web and progressively gather it in order to give it a substantially cylindrical shape;
- the gathering station also comprises:
- a pre-shaping member whose cross-sectional shape transverse to the feed direction of the web is curved and shaped and configured to give the web a shape substantially like that of a U;
- a shaping device provided with a shaping duct.

[0009] Thanks to this feature, the web of material used to make tobacco industry products can be subjected to

a pre-shaping process which ensures that the web is correctly transferred to the next shaping step, while also improving the structure of the easy folding lines.

[0010] Thus, the web can be gathered more easily during the steps of gathering, conveying and forming, so as to create a high-quality continuous stream in which the web is optimally compacted to make an end product of high quality and strength.

[0011] The dependent claims, which are incorporated herein by reference, correspond to different embodiments of the invention.

[0012] Further features and advantages of the present invention are more apparent in the detailed description below, with reference to a preferred, but non-exclusive, embodiment of a crimping unit, as illustrated in the accompanying drawings, in which:

- Figure 1 is a perspective view of the crimping unit according to this invention;
- Figure 2 is a detail view showing a pre-shaping member of a gathering station;
- Figure 3 is a view showing the pre-shaping member engaging the web 100;
- Figure 4 is a perspective view of some components of the gathering unit.

[0013] With reference to the accompanying drawings, the numeral 1 denotes a crimping unit in its entirety, hereinafter referred to simply as unit 1.

[0014] The unit 1 comprises a feed station 10 configured to feed to the crimping unit 1 a web of material 100 used to make tobacco industry products, a crimping station 20 equipped with crimping rollers 21, 22 and a gathering station 30 located downstream of the crimping station 20.

[0015] The unit 1 comprises feed means 11 for feeding the web 100 of material, for example of tobacco based material, filter paper or PLA, used to make tobacco industry products.

[0016] The web 100 is adapted to be unwound along a longitudinal feed direction, indicated by the arrow "A" in Figure 1.

[0017] Together with the feed means 11, the machine 1 preferably also comprises one or more systems for adjusting the tension of the web 100 (for example, an unwinding feedback sensor) and/or one or more systems for centring the web 100.

[0018] To ensure the web 100 is correctly transferred to the further processing stations of the unit 1, the feed means 11, too, are equipped with tensioning devices 12 for tensioning the web 100, embodied for example by dancer rollers.

[0019] The feed station 10 comprises at least one infeed diverting roller 13 mounted on a movable supporting device 13a.

[0020] The movable supporting device 13a is configured to move the infeed diverting roller 13 along a pre-determined path "B" in such a way as to vary the infeed

position of the web in the crimping station 20, specifically varying the orientation of the web being fed to the crimping rollers 21, 22.

[0021] The path "B" is preferably straight and the movable supporting device 13a comprises a carriage which mounts the diverting roller 13 and which is movable along a respective straight guide, for example disposed vertically in such a way as to define a substantially vertical path "B".

[0022] The presence of the at least one diverting roller 13 thus makes it possible, also in use, to modulate the angular portion of the crimping rollers 21, 22 intercepted by the web 100, in particular when entering the crimping station 20, thus helping to lengthen/shorten the stretch of path which the web 100 travels in contact with the surface of the crimping rollers 21, 22.

[0023] The crimping station 20 comprises a first crimping roller 21 and a second crimping roller 22 operatively coupled to make a plurality of longitudinal easy folding lines on the web 100 in transit between the two crimping rollers 21, 22.

[0024] The crimping rollers 21, 22 have a wavy profile, with respective protrusions and recesses, configured to condition the material in such a way as to make easy folding lines at each interface between protrusion and recess of the two crimping rollers 21, 22.

[0025] Advantageously, the crimping station comprises a supporting element 23 for supporting the crimping rollers 21, 22 and configured to adopt variable position and/or orientation in such a way as to vary the geometry of the path followed by the web 100 in the crimping station 20; the supporting element 23 thus comprises motor means acting on the supporting element 23 to vary the position and/or orientation of the supporting element 23.

[0026] In other words, the supporting element is movable in such a way as to be able to modify the arrangement of the crimping rollers 21, 22 associated therewith, changing their arrangement within the crimping unit 1 so as to make the web 100 follow a different path defined by the specific arrangement adopted by the crimping rollers 21, 22.

[0027] In a preferred embodiment, the supporting element 23 is rotatable about an axis of adjustment "X" to allow turning the crimping station 20 in such a way as to modify, by increasing or decreasing, the winding angle of the web 100 on the first and/or the second crimping roller 21, 22.

[0028] Preferably, the supporting element 23 is embodied by a vertical plate 23a which is supported rotatably about the axis of adjustment "X".

[0029] Also in this preferred embodiment, the first crimping roller 21 is supported by the supporting element 23 and is connected thereto at its centre of rotation, while the second crimping roller 22 is supported by the supporting element 23 and connected thereto in a zone outside its centre of rotation.

[0030] In other words, the axis of rotation of the first crimping roller 21 is coaxial with the axis of adjustment

"X", while the axis of rotation "Y" of the second crimping roller 22 is eccentric relative to the axis of adjustment "X".

[0031] Thus, during rotation of the supporting element 23, the position of the first crimping roller 21 remains substantially unchanged, while the second crimping roller 22 performs a movement of revolution around the first crimping roller 21.

[0032] The supporting element 23 is rotatably supported at a peripheral portion by means of a curved guide which extends around at least one stretch of a circle concentric with the axis of adjustment "X".

[0033] The curved guide 25 can define a closed path or, alternatively, an open stretch, depending on the range of angular adjustment around the axis of adjustment "X".

[0034] The supporting element 23 also comprises guide means, such as, for example, roller pairs, sliders or other, which are slidably engaged on the curved guide.

[0035] The supporting element 23 also comprises motor means, preferably embodied by a rack and pinion drive mechanism disposed in proximity to the curved guide and associated therewith in such a way as to allow it to perform a movement, specifically a rotation, about the axis of adjustment "X".

[0036] The second crimping roller 22 is adjustably mounted on the supporting element 23 in such a way as to allow varying its position relative to the first crimping roller 21.

[0037] This technical feature allows moving the second crimping roller 22 towards/away from the first crimping roller 21 in such a way as, for example, to allow inserting the web 100, facilitate maintenance and repairs on the crimping station 20 or allow adapting the distance between the crimping rollers 21 and 22 as a function of the height or other features of the web 100 to be crimped.

[0038] More specifically, the second crimping roller 22 is mounted on the supporting element 23 by means of an eccentric, rotatable roller bracket 22a.

[0039] The roller bracket 22a is configured to rotate about a respective axis of rotation "Y" parallel to the axis of adjustment "X" and the second crimping roller 22 is mounted on the roller bracket 22a rotatably about a respective axis of rotation "Z" parallel and eccentric relative to the axis of rotation "Y" of the roller bracket 22a.

[0040] That way, the rotation of the roller bracket 22a about its axis of rotation "Y" causes displacement of the axis of rotation "Z" of the second crimping roller 22 and hence, displacement of the crimping rollers 21, 22 relative to each other.

[0041] The roller bracket 22a is associated with an actuator configured to rotate the roller bracket 22a by a fine adjustment movement about the respective axis of rotation "Y".

[0042] In other words, the supporting element 23 comprises an actuator which allows rotating the roller bracket 22a in such a way as to cause the second crimping roller 22 mounted thereon to rotate eccentrically, thereby moving it towards/away from the first crimping roller 21.

[0043] In order to optimize adjustment of the rotational

movement of the roller bracket 22a, the supporting element 23 comprises a limit stop device which defines a limit to the rotational movement of the roller bracket.

[0044] The limit stop device may be embodied, for example, by an adjustment screw or a rotary lead nut and screw coupling, so as to allow the angular stroke of the roller bracket 22a to be adjusted very precisely.

[0045] Preferably upstream of the crimping rollers 21, 22 relative to the feed direction "A" of the web 100, the crimping station 20 also comprises a guide roller 24 mounted on the supporting element 23 eccentrically relative to the axis of adjustment "X".

[0046] More specifically, the guide roller 24 is associated with the supporting element 23 in such a way as to intercept and divert the stretch of the web 100 between the exit of the infeed station 10, specifically from the diverting roller 13, and the crimping rollers 21, 22 when the supporting element 23 is in a first position interval, and so as not to intercept the web 100 when the supporting element 23 is in a second position interval, different from the first interval, thus moving to a non-operating position.

[0047] In particular, in the preferred embodiment where the supporting element 23 is a plate rotatable about the axis of adjustment "X", the first position interval is a first interval of angular positions, while the second position interval is a second interval of angular positions.

[0048] In other words, the supporting element 23 is configured to rotate between a plurality of possible positions where the guide roller 24 intercepts or does not intercept the web 100.

[0049] In use, therefore, as it passes from the feed station 10 to the crimping station 20 and before it engages the crimping rollers 21, 22, the web may or may not intercept the guide roller 24.

[0050] When the web 100 engages the guide roller 24, the latter provides a reference point which determines the point of engagement of the web 100 with the crimping rollers 21, 22 independently of the diverting roller 13, if any, of the feed station 10, and thus allowing stably fixing the geometry of the path followed by the web 100 entering the crimping station 20 and at the same time keeping the possibility of modifying the path at the exit by moving the supporting element 23.

[0051] The guide roller 24 is selectively engageable in such a way as to allow fixing or not fixing the geometry of the path followed by the web 100 entering the crimping station 20 depending on whether or not it is necessary to modulate only the path of the web 100 at the exit of the crimping station 20.

[0052] Preferably, the guide roller 24 is rotationally at a fixed position on the supporting element 23.

[0053] The crimping unit 1 also comprises a gathering station 30 configured to receive the web 100 and progressively gather it in order to give the web a substantially cylindrical shape.

[0054] More specifically, along the feed direction "A" of the web 100, the gathering station 30 comprises a pre-shaping member 31 whose cross-sectional shape trans-

verse to the feed direction "of the web 100 is curved and shaped to give the web 100 a shape substantially like that of a U.

[0055] In other words, the shape of the pre-shaping member 31 is such as to allow the web 100 from the crimping station 20 to be deformed by simultaneously closing the web on itself to obtain an at least partly cylindrical shape of the web 100, preferably according to the above mentioned substantially U shaped form, and folding the web on at least some of the longitudinal fold lines.

[0056] The gathering station 30 also comprises a shaping device 32 configured to receive the pre-shaped web 100 from the pre-shaping member 31 and having a convergent shaping duct 32a, described in more detail below, to give the web 100 the substantially cylindrical shape.

[0057] More specifically, the pre-shaping member has an outside surface 31a which is adapted to come into contact with the web 100 and which comprises a succession of protrusions and recesses adapted to engage the web 100 at respective longitudinal easy folding lines in such a way as to pre-fold the web 100 along the longitudinal easy folding lines.

[0058] Preferably, the protrusions and recesses are distributed along the entire outside surface 31a of the pre-shaping member 31.

[0059] Still more preferably, the protrusions and recesses are distributed non-uniformly along the outside surface 31a of the pre-shaping member 31.

[0060] More specifically, the spacing between adjacent protrusions for engaging a portion of the edge of the web 100 is greater than the spacing between adjacent protrusions intended to engage a central portion of the web 100.

[0061] This structure allows obtaining a particularly functional distribution of the pressure on the web 100, transferring the latter in optimum manner to the shaping device 32 in such a way as to improve the structural quality of the continuous stream resulting from the step of gathering the web 100.

[0062] The outside surface 31a of the pre-shaping member 31 extends along an open line joined by a supporting portion 31b configured to keep the pre-shaping member 31 suspended at a predetermined position.

[0063] In other words, the pre-shaping member 31 comprises a supporting portion 31b which supports and connects it to the body of the crimping unit 1 in such way that it can, in use, remain in the correct position to engage the web 100.

[0064] The crimping unit also comprises adjustment means 31c, associated with the supporting portion 31b, for adjusting the position and/or orientation of the pre-shaping member 31.

[0065] The presence of the adjustment means 31c allows moving the pre-shaping member to dynamically modify its position and/or orientation, in particular relative to the web 100.

[0066] This movement is accomplished preferably by a translation in a direction perpendicular to the feed direction of the web 100 around the pre-shaping member 32 and may adopt a vertical orientation when the web 100 passes horizontally over the pre-shaping member 32.

[0067] This movement may also be accomplished by a rotation about an axis of rotation "K" transverse to the feed direction of the web 100 and preferably horizontal. This rotation can therefore be added to the aforementioned translational movement and is preferably controllable independently thereof.

[0068] That way, it is possible to vary both the force applied by the pre-shaping member 31 on the web 100 and the extent of the outside surface of it 31a which comes into contact with the web.

[0069] In a preferred embodiment shown in the accompanying drawings, the pre-shaping device 31 is configured to be positioned above the web 100 and to tension it by applying a downwardly directed force.

[0070] In other words, the outside surface 31a of the pre-shaping member 31 has an upward facing concavity and the adjustment means 31c are configured to lower the pre-shaping member 31 to engage the web 100 by pushing it downwards or to lift the pre-shaping member 31 to reduce the force it applies on the web 100 until it is disengaged from the web.

[0071] It is stressed, however, that the adjustment means 31c might also be configured to perform only the rotational movement about the axis "K" without necessarily being structured to perform the translational movement, and vice versa.

[0072] In use, therefore, the web 100 leaving the crimping station 20 enters the gathering station 30, first engaging the pre-shaping member 31 and then moving into the shaping device 32.

[0073] Advantageously, the pre-shaping member assists the shaping device 32 in gathering the web 100, thereby improving the structural features of the finished product.

[0074] In particular, the pre-shaping member starts the shaping process by at least partly shaping the web 100 and at the same time, thereby contributing to the deformation of the web around the longitudinal fold lines.

[0075] The gathering station 30 also comprises a shaping duct 32a and an inserting device 33 configured to insert an additional component "C" into the stream formed by the gathered web 100.

[0076] More specifically, the inserting device 33 comprises an inserting duct 34 for inserting the additional component "C" placed inside the shaping duct 32a, preferably coaxially therewith.

[0077] That way, the additional component "C" is positioned centrally in the rod formed by gathering the web 100.

[0078] Advantageously, the shaping duct 32a is convergent in shape along the feed direction of the additional component "C" which substantially coincides with the

feed direction "A" of the web 100, at least in the stretch of path through the gathering station 30.

[0079] In a preferred embodiment, the shaping duct 32a has a frustoconical profile.

[0080] Preferably, the additional component "C" is a flavouring component which allows giving the web 100 a specific aroma to modify the flavour of the smoke produced by the end product made using the web 100.

[0081] More specifically, the flavouring component may comprise a thread made of or impregnated with a flavouring material.

[0082] To ensure the flavouring thread is correctly transferred into the web 100, the inserting device 33 comprises tensioning members 33a adapted to keep the flavouring thread under tension.

[0083] The inserting device may further comprises a roll holder 35 configured to support a plurality of rolls of additional component "C" and to adopt variable positions and/or orientations in such a way as to change the position of the rolls.

[0084] The presence of the roll holder 35 optimizes the production process of the rod from the web 100 comprising the additional component "C" because it allows automating the switch from one roll to another in such a way as to allow replacing depleted rolls with new rolls without interrupting the production process of the crimping unit 1.

[0085] In other words, this ensures that there is at least one roll of additional material "C" present at all times for use in the production of the end product.

[0086] More specifically, the roll holder 35 comprises a plurality of supports 36 associable with respective rolls of additional material "C" and rotatable to move the respective rolls towards or away from the forming duct 32a.

[0087] The roll holder 35 is thus configured to move a single support 36 containing a roll of additional material "C" to the forming duct 32a and, when the roll is nearly depleted, to move it away from the forming duct 32a and to automatically replace it with a new roll on another support 36.

[0088] In the light of the above, this invention achieves the preset aims and overcomes the abovementioned disadvantages of the prior art by providing a crimping unit which allows optimizing the process of crimping the web 100 and making a continuous rod from that web of material to produce products of the tobacco industry.

Claims

1. A crimping unit for crimping a web of material (100) used to make tobacco industry products, comprising:
 - a crimping station (20) comprising a first crimping roller (21) and a second crimping roller (22) operatively coupled to make a plurality of longitudinal easy folding lines on the web (100) in transit between the crimping rollers (21, 22);

- a gathering station (30), located downstream of the crimping station (20) and configured to receive the web (100) and progressively gather it in order to give the web (100) a substantially cylindrical shape;

characterized in that the gathering station comprises, along the feed direction of the web (100):

- a pre-shaping member (31) whose cross-sectional shape transverse to the feed direction of the web (100) is curved and shaped to give the web (100) a shape substantially like that of a U; and

- a shaping device (32) configured to receive the pre-shaped web (100) from the pre-shaping member (31) and having a shaping duct (32a) to give the web (100) the substantially cylindrical shape.

2. The unit according to claim 1, wherein the pre-shaping member (31) has the curved shape on an outside surface of it (31a) designed to come into contact with the web (100), the outside surface (31a) having a cross-sectional shape transverse to the feed direction of the web (100) which is curved and shaped to give the web (100) a shape substantially like that of a U, and which also has, along the outside surface (31a), a succession of protrusions and recesses adapted to engage the web (100) at respective longitudinal easy folding lines in such a way as to pre-fold the web (100) along the longitudinal easy folding lines.

3. The unit according to claim 2, wherein the protrusions and recesses are distributed along the entire outside surface (31a) of the pre-shaping member (31).

4. The unit according to one or both of claims 2 and 3, wherein the protrusions and recesses are heterogeneously spaced along the outside surface (31a) of the pre-shaping member (31), the spacing between adjacent teeth for engaging a portion of the edge of the web (100) being, in particular, greater than the spacing between adjacent teeth for engaging the central portion of the web (100).

5. The unit according to one or more of claims 2-4, wherein the outside surface (31a) of the pre-shaping member (31) extends along an open line joined by a supporting portion (31b), and wherein the supporting portion (31b) is configured to keep the pre-shaping member (31) suspended in a predetermined position.

6. The unit according to claim 5, comprising adjustment means (31c) for adjusting the position and/or orien-

tation of the pre-shaping member (31), the adjustment means (31c) being associated with the supporting portion (31b).

5 7. The unit according to claim 6, wherein the outside surface (31a) of the pre-shaping member (31) has an upward facing concavity and the adjustment means (31c) are configured to lift or lower the pre-shaping member (31).

10 8. The unit according to claim 6 or 7, wherein the outside surface (31a) of the pre-shaping member (31) has an upward facing concavity and the adjustment means (31c) are configured to rotate the pre-shaping member (31) about an axis (K) transverse to the feed direction of the web (100) and preferably horizontal.

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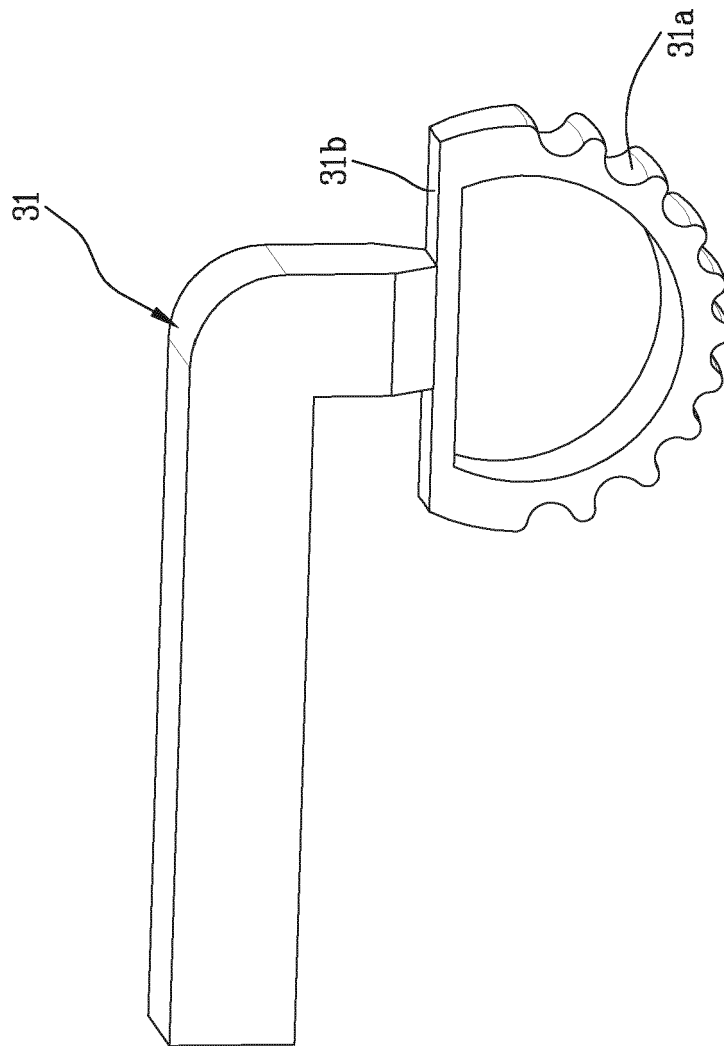
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Fig. 2



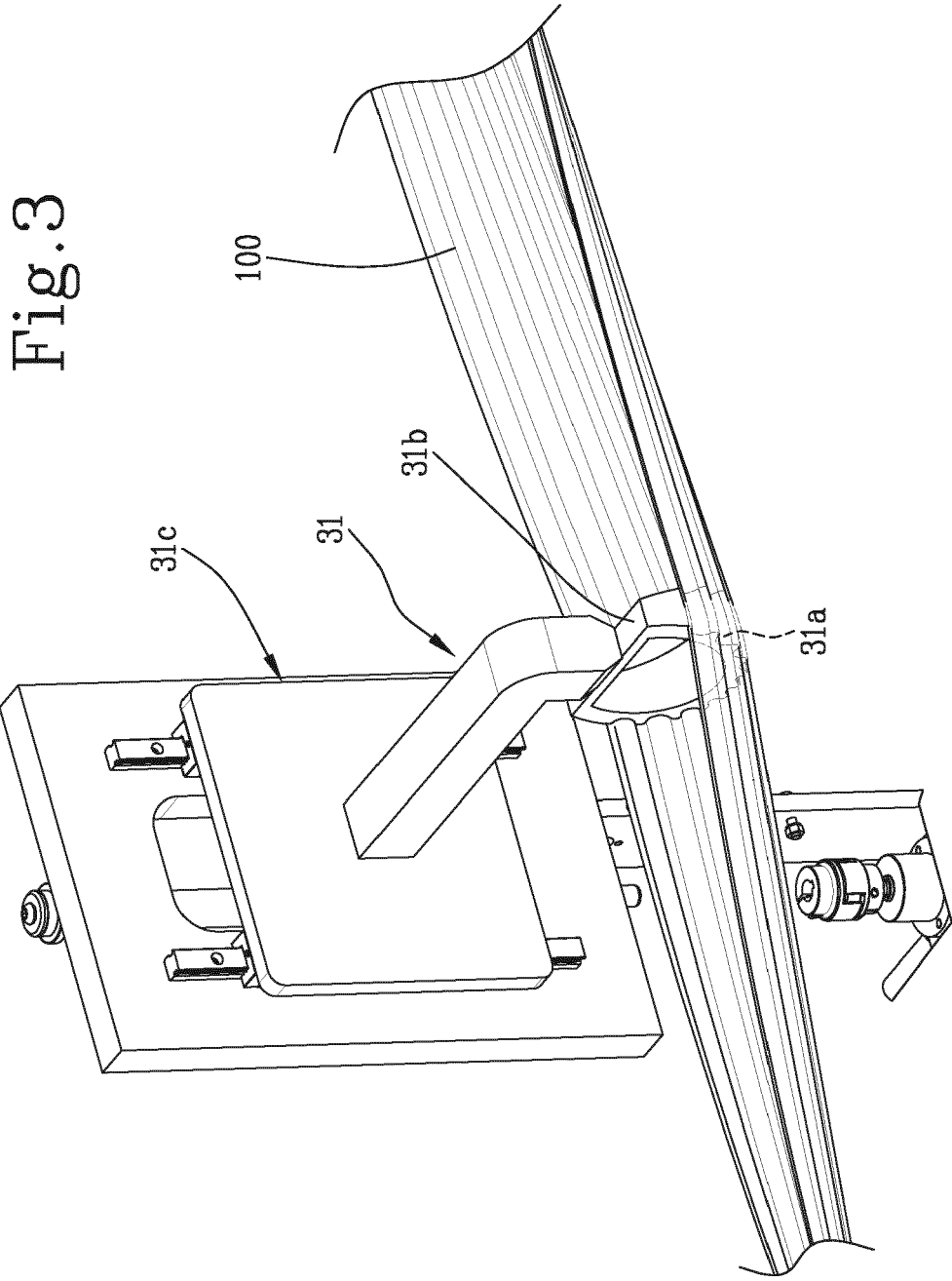
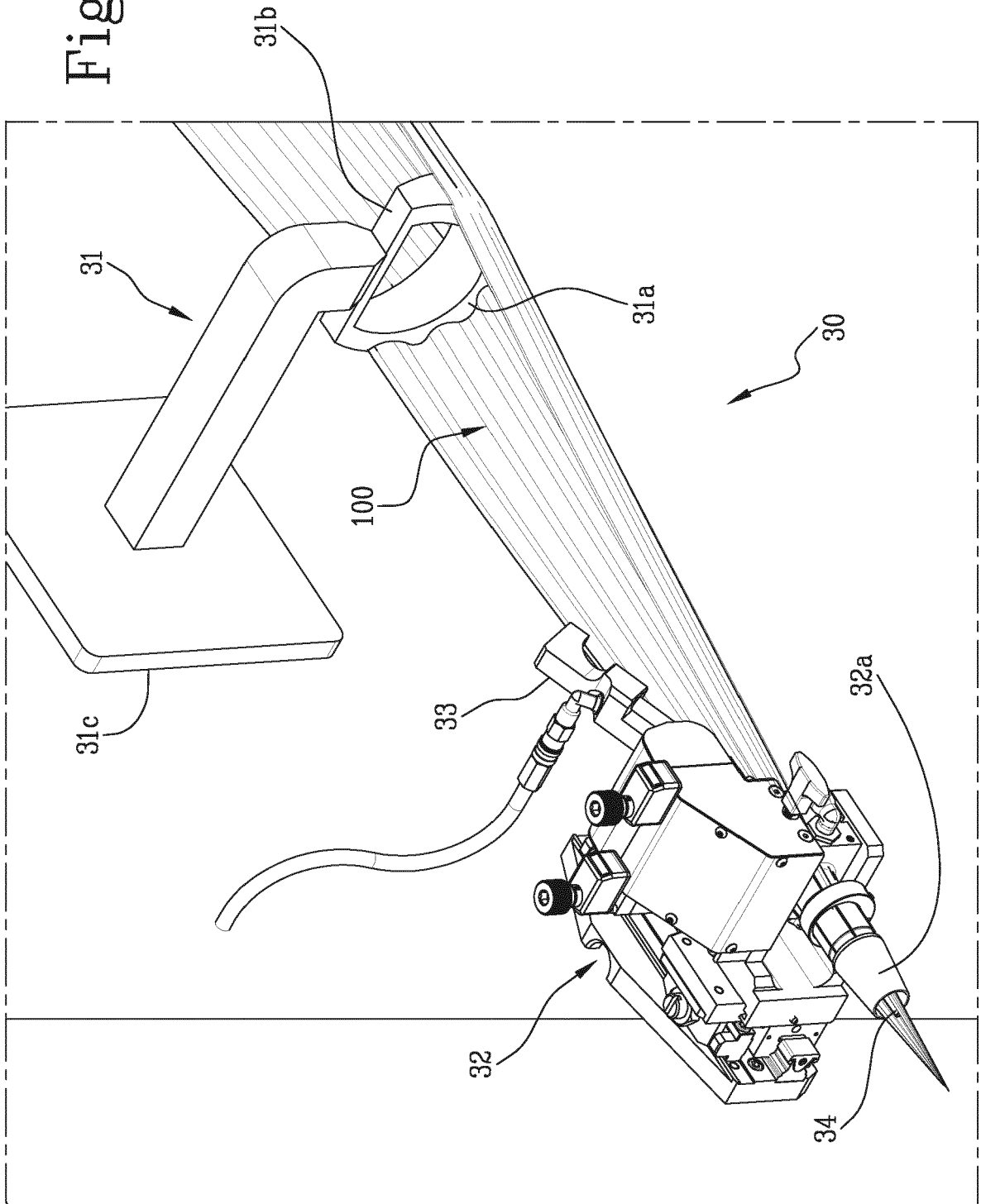


Fig. 4





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Application Number
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The present search report has been drawn up for all claims			
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CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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ANNEX TO THE EUROPEAN SEARCH REPORT
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5 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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