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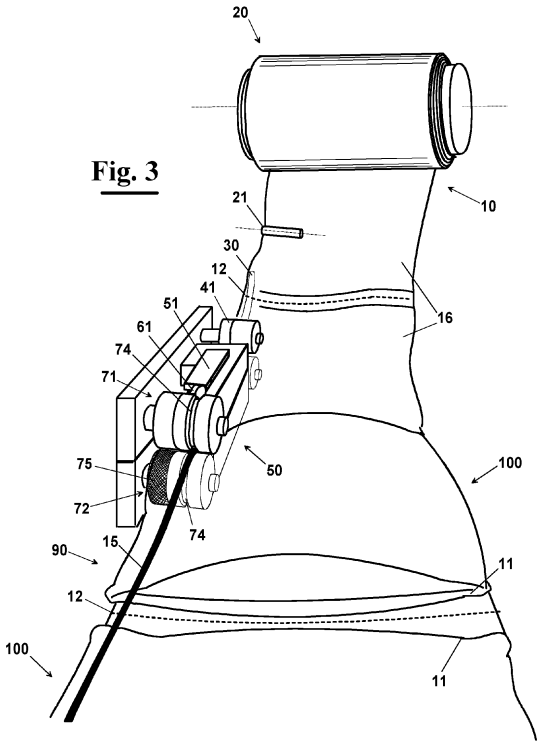
(54) Improved machine for producing packaging cushions filled with air, or other gas, and method therefore

(57) A machine (1) for making packaging material in the form of cushions (100) of air, or other gas, comprises feeding rollers (21, 22) arranged to bring a web (10) of thermoplastic material along a longitudinal conveying direction (101). The web (10) comprises two films (10a, 10b) overlapped and can be unwound starting from a roll (20). When starting the machine (1), the web (10) is put on a longitudinal guide (30) arranged downstream of the feeding rollers (21) in the conveying direction of the web (10). The machine (1) comprises a means (50) for heating the web (10), arranged to cause a local melting the thermoplastic material along a longitudinal line (15). More in detail, the heating means (50) comprises at least one heating rod (51, 52), which in use is arranged in contact of the web (10) for causing a local softening to it. The, or each, heating rod (51, 52) comprises an electric resistance (53) coated with an outer layer (54) of a material having a low thermal transmission coefficient, for example less than about 0,5 W/mK such as polytetrafluoroethylene (PTFE), or Teflon.

Fig. 3



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Description

Field of the invention

[0001] The present invention relates to the field of machines for making packaging material, in particular comprising cushions inflated with air or other gas, and precisely it relates to a machine for making this packaging material.

[0002] Furthermore, the invention relates to a method for making such packaging material.

Description of the prior art

[0003] As well known, among the shock resistant packaging material, "cushions" are used of plastic film inflated with air, or other gas.

[0004] Such cushions, made usually of high density polyethylene owing to its mechanical resistance, which is remarkably higher than other plastic materials, can be made as a continuous strip of cushions placed adjacent to one another, used both for wrapping the product to package and for avoiding the movement of the product in a container in which it is housed for being transported.

[0005] A first kind of machines for making these cushions provides overlapping two films of high density polyethylene, unwound from respective coils and conveyed towards heating elements capable of melting locally the plastic material forming on it welding lines.

[0006] More in detail, the film of plastic material are, firstly, welded along longitudinal regularly distant lines, obtaining welding lines parallel to the conveying direction with formation of tubular chambers. During the advancement, the tubular chambers are inflated with air and then are closed hermetically by making transversal welding lines that define the air cushions in combination with the longitudinal lines.

[0007] However, this type of machines provides stopping the web for making each transversal welding, with subsequent low production rate, which is cost-effective only for webs of enough width and for multiple transversal rows of cushions.

[0008] Machines also exist to make, without stopping the web, a single chain of air cushions. These machines start from a web comprising two overlapped films of thermoplastic material with transversal welding lines and a first longitudinal welding line already made in a previous process, in order to define respective chambers open at a side. The machine provides to inflate air between the two films, in order to inflate the chambers defined by the transversal lines and by the first longitudinal line, and to provide at the same time, by means of heating elements, the second longitudinal welding line that was missing and that blocks the air in the chambers, obtaining the air cushions. This way, the machine can operate continuously, i.e. without stopping the web.

[0009] In particular, the web provides the transversal welding lines that are shorter than the width of the web and a third longitudinal welding line external opposite to the first longitudinal welding line, leaving, thus an open passageway for inflating the air. This is carried out introducing longitudinally an inflation tube, and making in the meantime the second longitudinal line by means of longitudinal heating elements after that each cushion is inflated. The welding is made at the inner edge of the passageway, leaving out the inflation tube by cutting the third longitudinal line. The machine also comprises a device for longitudinal movement of the web comprising a plurality of conveying rollers arranged at an edge of the heating elements. Furthermore, from the inflation tube a longitudinal guide protrudes upstream, on which the web is put for engaging the passageway by the inflation tube. When the welding line on the inner edge of the passageway is made, the passageway same is cut at the outer edge by a blade, thus cutting the third longitudinal line, to let the guide and the tube exit from the passageway and to release the web with the formed cushions.

[0010] However, such machines have some drawbacks.

[0011] Firstly, the web is conveyed through the machine by means of belts arranged longitudinally to the web and mounted to a plurality of rollers. The presence of belts requires a frequent change of the same, forcing the operators to maintenance stops and to bear maintenance costs.

[0012] Furthermore, heating the thermoplastic material of the web for making the longitudinal welding line is effected by two heating elements that transmit the heat necessary for softening the thermoplastic material through respective non-stick tapes, made normally of Teflon, that are arranged for transmitting the heat. The non-stick tapes for transmitting the heat have to be moved longitudinally to the web of thermoplastic material at the same speed, in order to avoid the production of folds. However, the presence of these non-stick tapes increases the maintenance costs because it requires a frequent replacement.

[0013] Furthermore, the existing solutions have some limits for achieving high production rates.

[0014] In US2006/0218880 an apparatus is described to provide inflated articles obtained starting from a web consisting of two overlapped films. The apparatus provides a sealing roller that operates in combination with a counter-roller for actuating the web along the machine and for sealing the same. In particular, the external roller sealing surface can be equipped with a groove in which a heating element is housed. A means for conveying the heat can engage the outer surface of the roller.

[0015] This solution does not allow, however, to provide a precise sealing and can damage the web owing to the rotation of the sealing element during the sealing step. Furthermore, it is necessary to work at a low production rate for reducing the above described drawbacks.

[0016] A similar solution is described also in US2008/250753.

[0017] In 74980449, supports of ceramic material are

provided having apertures through which heating elements irradiate the heat to melt the web. Even this solution does not provide a precise melting of the web owing to the distance of the heating elements from the web and to the distance between the different heating elements that cause a non-uniform heating of the web.

Summary of the invention.

[0018] It is a feature of the invention to provide such a machine to overcome the difficulties of the machines of the prior art.

[0019] It is another feature of the present invention to provide a machine for making packaging material in the form of air cushions or other gas that achieves a high production rate.

[0020] It is also a feature of the invention to provide such a machine for ensuring a correct arrangement of the web in all the sections of the machine, in particular at the heating elements.

[0021] These and other features are accomplished with one exemplary machine, according to the invention, for making packaging material, in particular cushions filled with air, or other gas comprising:

- a feeding means for feeding a web of thermoplastic material, said web comprising a first and a second sheet overlapped to each other;
- an inflating means that is arranged to inflate a gas between said sheets, said inflating means, in use, having an inflating portion arranged between said first and second sheets;
- a heating means for heating said web, arranged to cause a local melting of said thermoplastic material along a longitudinal line, in order to provide a longitudinal welding line;
- a moving means for moving the web of thermoplastic material along a feeding direction, said moving means arranged to cause the movement of the web of thermoplastic material while said heating means causes said local heating;

whose main feature is that said heating means comprises:

- at least one heating rod arranged to contact said web for causing a local softening of said thermoplastic material, said heating rod comprising an electric resistance for heating up to a predetermined temperature;
- an outer layer that coats said heating rod, said outer layer arranged in use between said heating rod and said thermoplastic material and being made of a material having a thermal transmission coefficient less than about 0,5 W/mK, in order to cause said local softening of said thermoplastic material and to provide said longitudinal welding line, but avoiding in the meantime the adhesion of said heating rod to said thermoplastic material.

[0022] In particular, the, or each, heating rod is fixed. This provides a uniform heating of the web melting it to obtain a welding line with high precision. Advantageously, said coating material has a thermal conductivity coefficient less than about 0, 3 W/mK.

[0023] In particular, the coating outer of the heating rod can be made in polytetrafluoroethylene (PTFE), or Teflon.

[0024] Advantageously, the means for moving said web of thermoplastic material comprises at least a first and a second counter rotating rollers arranged downstream of said heating means and at opposite sides with respect to said web of thermoplastic material, said first and second counter rotating rollers having respective gripping surfaces configured to be put adjacent to said first and to said second film of said web, respectively, in order to apply a pulling action on said web and to drag it along said feeding direction.

[0025] In particular, the counter rotating rollers have a high friction surface.

[0026] Advantageously, the counter rotating rollers are made of a high friction material selected from the group consisting of:

- synthetic rubber;
- natural rubber;
- an elastomeric rubber, in particular Vulcolan®.

[0027] Advantageously, the counter rotating rollers have a irregular surface, for example rough, or knurled, in order to increase the gripping force on said web of thermoplastic material.

[0028] In particular, at least one of the counter rotating rollers comprises a first portion which is made of a high friction material, such as rubber, or an elastomeric material, and a second portion of a metal material.

[0029] Advantageously, the portion of a metal material has said irregular surface, for example rough, or knurled. In particular, it is the metal surface that, in use, produces the gripping action on the web.

[0030] Advantageously, at least one of the gripping surfaces of said first and of said second counter rotating rollers has a circumferential groove, at said circumferential groove aligned, in use, said longitudinal welding line made by said heating means. This way, it is avoided that the still hot thermoplastic material can stick to the gripping surface of said first and/or of said second roller.

[0031] Advantageously between said moving means and said heating means a level means is provided for levelling said softened thermoplastic material, in order to finish said longitudinal welding line.

[0032] In particular, the level means can comprise a pushing element arranged on one side of said web and an abutment surface located opposite to the pushing element with respect to the web of thermoplastic material, said pushing element arranged to compress said ther-

moplastic material locally softened against said abutment surface, in order to finish the welding line.

[0033] Advantageously, the abutment surface is made on a disc movable along a direction substantially orthogonal to said longitudinal direction of said web biased by resilient means, for example a spring.

[0034] In particular, the pushing element can comprise a disc having a flat surface that is arranged, in use, next to said locally softened web to provide said welding line.

[0035] Advantageously, the heating rod comprises a main body and a heating portion protruding from said main body, said heating portion arranged, in use, to provide a longitudinal strip of softened material on said web.

[0036] In particular, upstream of said heating means a stretching means can be provided for stretching the web of thermoplastic material before it reaches said heating means. This way, it is ensured that the heating means make correctly the welding line on the thermoplastic material.

[0037] Advantageously, the stretching means comprises a first stretching roller and a second stretching roller arranged at opposite sides with respect to the web.

[0038] In particular, the first and second stretching rollers squeeze the web avoiding also that the gas jet, for example air, emitted by the blowing means reaches the heating means jeopardizing the correct operation.

[0039] Advantageously, furthermore, a longitudinal guide is provided on which said web is put, for example manually by an operator, before starting the machine.

[0040] In particular, the longitudinal guide is adapted, in use, to cross a longitudinal passageway made in said web of thermoplastic material. More in detail, the longitudinal passageway is defined through a plurality of transversal welding lines that separate a plurality of tubular bodies defined between said first and second sheets.

[0041] In particular, the transversal welding lines define a plurality of tubular bodies. More precisely, the transversal lines have a length less than the transversal width of the web of thermoplastic material, in order to form said passageway in which in use said guide is put. Once inflated by the gas between the two films of thermoplastic material the passageway is closed by making said longitudinal welding line and then closing the above described tubular bodies. This way, it is eventually obtained the formation of chambers in which a certain amount is present of gas closed hermetically by the transversal welding lines and by said longitudinal welding line. The first and the second sheet of the web can be defined through a folding line made on a single sheet of thermoplastic material and therefore the only edge that was longitudinally open is that in which the longitudinal welding line is made by the heating means. In an exemplary embodiment, the web of thermoplastic material, opposite to the welding line, has a longitudinal welding line made in a preliminary step.

[0042] In particular, a means can be provided for cutting said web of thermoplastic material arranged to provide a longitudinal cut to open longitudinally said passageway, to make it possible an arrangement of the inflating portion between said sheets and to make it possible a movement of the web with chambers inflate and sealed.

[0043] In particular, the cutting means longitudinally cuts the tubular web of thermoplastic material at the portion of the web without the transversal welding lines.

[0044] Advantageously, a sealing means is provided arranged to avoid the outlet of air, or other gas, through the longitudinal cut made by the means for cutting, during the inflation by the gas.

[0045] Advantageously, the cutting means is arranged upstream of the heating means.

[0046] In particular, between two consecutive chambers of the web of thermoplastic material tear lines can be provided that assist the separation between two air cushions.

Brief description of the drawings

[0047] The invention will be now shown with the following description of an exemplary embodiment thereof, exemplifying but not limitative, with reference to the attached drawings in which:

- Fig. 1 diagrammatically shows an elevational side view of the improved machine, according to the invention, for making packaging material in the form of air cushions, or other gas;
- Fig. 2 diagrammatically shows a top plan view of the machine of Fig. 1 for highlighting the layout of the main parts and, in particular, their position with respect to the processed web;
- Fig. 3 diagrammatically shows a perspective front view of the machine of Fig. 1 in operating conditions;
- Fig. 4 diagrammatically shows a perspective view of the main construction elements of the machine of Fig. 1;
- Fig. 5 shows a cross sectional view of the heating rod of the machine of Fig. 1 highlighting some structural features;
- Fig. 6 shows the machine of Fig. 4 in operating conditions;
- Fig. 7 shows a perspective elevational side view of the machine of Fig. 1.

Description of the preferred exemplary embodiment

[0048] With reference to Fig. 1, a machine 1 for making packaging material in the form of cushions 100 of gas, according to the invention, for example air cushions, comprises feeding rollers 21 and 22 arranged to bring a web 10 of thermoplastic material along a longitudinal conveying direction 101. Web 10 comprises, as well known, two films 10a and 10b overlapped and can be unwound starting from a roll 20.

[0049] As also shown in Fig. 2, web 10 can comprise two longitudinal welding lines 13a and 13b and a plurality

of transversal welding lines 11, in order to define a plurality of transversal tubular bodies 16 arranged to be insulated pneumatically from one another. Alternatively, the tubular bodies 16 can be obtained folding a single sheet of thermoplastic material and obtaining a single longitudinal welding line at the edges to connect.

[0050] Between two consecutive tubular bodies 16 transversal tear lines 12 can be provided between two consecutive transversal welding lines 11. More precisely, transversal tear lines 12 extend for all the width of web 10 and assist the separation of a cushion 100 from the next one when they are used. The transversal welding lines 11 have in particular length less than the transversal width L of web 10, in order to define between welding line 13b and their beginning point a open passageway 18.

[0051] More in detail, when starting machine 1, web 10 is put at passageway 18 on a longitudinal guide 30 arranged downstream of feeding rollers 21 in the conveying direction of web 10. In one exemplary embodiment of the figures, guide 30 is arranged next to inflating means 35 having a hole 35a through which a predetermined amount of gas, for example air, can be put into the passageway 18, so that air inflates the chamber of each tubular body 16. Hole 35 is in pneumatic connection with a source of a gas flow, for example a fan not shown in the figures.

[0052] At guide 30 a cutting blade 80 is present that can make a longitudinal cut 14 on web 10. This allows the movement of transversal portion 35b of the inflating means 35 during the movement of web 10 through machine 1.

[0053] Downstream of cutting blade 80 a heating means is provided 50 for heating web 10, arranged to cause a local melting of the thermoplastic material along a longitudinal line 15. More in detail, the heating means 50 comprise at least one heating rod 51, and/or rod 52, can be in particular a elongated rod, that, in use, stops and is arranged in contact of web 10 for causing it to a local softening.

[0054] In particular, two heating rods 51 and 52 can be provided arranged at opposite sides with respect to web 10. Furthermore, a means can be provided for approaching, or withdrawing, two heating rods 51 and 52. More precisely, the means for approaching, or withdrawing are adapted to withdraw the two heating rods 51 and 52 to allow web 10 to be arranged easily between thereof. Then, the means for approaching, or withdrawing are adapted to approach the two heating rods 51 and 52, in order to be put adjacent, or near to, the respective surfaces of web 10.

[0055] According to the invention, and as shown in detail in Fig. 5, the, or each, heating rod 51, and/or 52, comprises an electric resistance 53 coated with an outer layer 54 of a material having a low thermal transmission coefficient, for example less than about 0,5 W/mK such as polytetrafluoroethylene (PTFE), or Teflon. This way, the heating rod 51, or 52, causes the softening of the thermoplastic material of web 10 to provide the longitudinal welding line 15 avoiding at the same time that it can adhere to the heating rod 51, or 52.

[0056] This particular technical solution avoids the use of the welding tapes used in the apparatus of the prior art for conveying the heat by a heater to the thermoplastic material of the web, simplifying remarkably the machine and reducing therefore both the maintenance time that the costs of the same.

[0057] Downstream of the heating means 50, furthermore, a feeding means is provided 70 comprising a first and a second counter rotating rollers 71 and 72 arranged at opposite sides with respect to web 10. More in detail, the counter rotating rollers 71 and 72 apply directly on web 10 a tension which causes it to be fed through machine 1. This is possible since rollers 71 and 72 have a high friction surface. Rollers 71 and 72 can be made of a high friction material such as rubber, or in an elastomeric material, such as Vulcolan ®. This technical solution allows also to avoid that the thermoplastic material of web 10, still hot near the longitudinal welding line 15, can adhere to the surface of rollers 71 and 72. For increasing further the grip on the web, rollers 71 and 72 have a irregular surface, for example rough, or knurled. At least one of counter rotating rollers 71, or 72, for example the roller next to the lower face of web 10 in movement along machine 1, may comprise a portion 75 made of a metal material and equipped with a knurled surface. Such particular exemplary embodiment avoids the use of conveyor belts commonly used for causing the movement of the web in the machines of the prior art. In an exemplary embodiment at least one among the first and the second counter rotating rollers 71, 72, comprises a first portion 73 made of a high friction material selected from the group consisting of: a synthetic rubber, a natural rubber or an elastomeric material, and a second portion 75 of a metal material. This, in particular, can be equipped with a knurled surface.

[0058] Furthermore, at least one of rollers 71 and 72 has a circumferential groove 74 to which, in use, the longitudinal welding line 15 made by the heating means 50 on web 10 can align. This way, it is avoided that welding line 15, which has the shape of a bead and is still at a softening temperature, enters directly into contact with the surface of rollers 71 and 72. This way, it is avoided that the thermoplastic material still hot can damage the rubber surface, or elastomeric surface, of counter rotating rollers 71 and/or 72.

[0059] Between counter rotating rollers 71 and 72 and the heating means 50 a level means can be provided 60 for levelling the softened thermoplastic material, in order to complete the longitudinal welding line 15. More in detail, the heating means 50 have a heating portion 55 of the thermoplastic material protruding from a main body 56 towards web 10. In particular, the heating portion 55 has a short small width, for example set between 1 mm and 2 mm, that is arranged to form a longitudinal strip of softened material 17 on web 10 of width substantially corresponding to about 1-2 mm. The strip of softened

material 17 is brought, then, to the level means 60 that cause it to be squeezed and therefore an increase of the width up to 2-4 mm obtaining welding line 15.

[0060] As shown in detail in Figs. 5 and 6, the means 60 for levelling can comprise a pushing element 61 arranged on one side of web 10, and an abutment surface 62 located opposite to the pushing element 61 with respect to the web of thermoplastic material 10. More in detail, the pushing element 61, for example at a flat surface 66, compresses the thermoplastic material, softened by the heating means 50, against the abutment surface 62, in order to level the softened material of welding line 15. The abutment surface 62 can be made, for example, on a disc 65 movable along a direction 160 substantially orthogonal to the longitudinal direction of web 10, biased by resilient means, for example a spring 63. The abutment surface 62 is, in particular made of a heat-resistant material for example in Polyphenylene sulfide, for example Techtron ®.

[0061] Upstream of the heating means 50 a stretching means can be provided 40 arranged to stretch web 10 of thermoplastic material before it is subjected to local heating. The stretching means 40 can comprise a first stretching roller 41 and a second stretching roller 42 arranged at opposite sides with respect to web 10. The first and second stretching rollers 41 and 42 squeeze against each other web 10 avoiding also that the gas jet, for example air, emitted by the blowing means 35 arranged upstream of the stretching means 40 can arrive at the heating means 50 jeopardizing the correct operation.

[0062] The foregoing description of specific exemplary embodiments will so fully reveal the invention according to the conceptual point of view, so that others, by applying current knowledge, will be able to modify and/or adapt in various applications the specific exemplary embodiments without further research and without parting from the invention, and, then, it is meant that such adaptation and modifications will have to be considered as equivalent to the specific embodiment. The means and the materials to realise the different functions described herein could have a different nature without, for this reason, departing from the field of the invention. It is to be understood that the phraseology or terminology that is employed herein is for the purpose of description and not of limitation.

Claims

1. Machine (1) for making packaging material, in particular cushions (100) of air, or other gas, comprising:

- a means (21, 22) for feeding a web (10) of thermoplastic material, said web (10) comprising a first and a second overlapped sheet (10a, 10b);
- an inflating means (35) arranged to inflate a gas between said sheets (10a, 10b), said inflating means (35), in use, having an inflating portion arranged between said first and second sheets (10a, 10b);
- a heating means (50) for said web (10), arranged to cause a local melting of said thermoplastic material along a longitudinal line, in order to provide a longitudinal welding line (15);
- a moving means (70) arranged to cause the movement of said web (10) of thermoplastic material along a conveying direction (101), said moving means (70) arranged to cause the movement of said web (10) of thermoplastic material while said heating means (50) causes said local heating;

characterised in that said heating means (50) comprises:

- at least one fixed heating rod (51, 52) arranged to contact said web (10) for causing a local softening of said thermoplastic material, said heating rod (51, 52) comprising an electric resistance for heating up to a predetermined temperature;
- an outer layer (54) that coats said heating rod, said outer layer arranged in use between said heating rod and said thermoplastic material and being made of a material having a thermal transmission coefficient less than about 0,5 W/mK, in order to cause said local softening of said thermoplastic material and to provide said longitudinal welding line (15), but avoiding in the meantime the adhesion of said heating rod (51, 52) to said thermoplastic material.

2. Machine, according to claim 1, wherein said outer layer (54) of said heating rod (51, 52) is made of a material having a thermal conductivity coefficient less than about 0, 3 W/mK.

3. Machine, according to claim 1, wherein said moving means (70) of said web (10) of thermoplastic material comprises at least a first and a second counter rotating rollers (71, 72) arranged downstream of said heating means (50) and at opposite sides with respect to said web (10) of thermoplastic material, said first and second counter rotating rollers (71, 72) having respective gripping surfaces arranged to engage with said first and said second film (10a, 10b) of said web (10), respectively, in order to apply a pulling action on said web (10) and to convey it along said conveying direction (101)

4. Machine, according to claim 3, wherein at least one among said first and said second counter rotating rollers (71, 72) has a high friction surface.

5. Machine, according to claim 3, wherein at least one among said first and said second counter rotating

rollers (71, 72) is made of a high friction material selected from the group consisting of:

- synthetic rubber;
- natural rubber;
- an elastomeric material, in particular Vulcolan®.

6. Machine, according to claim 3, wherein at least one among said first and said second counter rotating rollers (71, 72) comprises:

- a first portion (73) made of a high friction material selected from the group consisting of: a synthetic rubber, a natural rubber and an elastomeric material;
- a second portion (75) of a metal material, said second portion (75) being equipped with a knurled surface.

7. Machine, according to claim 3, wherein at least one of said gripping surfaces of said first and of said second counter rotating rollers (71, 72) has a circumferential groove (74), with said circumferential groove (74) aligning, in use, said longitudinal welding line (15), or bead, made by said heating means (50), to avoid that the still hot thermoplastic material can stick the gripping surface of said first, or of said second, roller (71, 72).

8. Machine, according to claim 1, wherein between said heating means (50) and said moving means (70) a level means is provided (60) for levelling said softened thermoplastic material, in order to finish said longitudinal welding line (15).

9. Machine, according to claim 8, wherein said level means (60) comprises a pushing element (61) arranged at one side of said web (10), and an abutment surface (62) located opposite to said pushing element (61) with respect to said web (10), said pushing element (61) arranged to compress said thermoplastic material, locally softened, on said abutment surface (62), in order to finish said longitudinal welding line (15).

10. Machine, according to claim 9, wherein said abutment surface (62) is made on a mobile disc, biased by resilient means (65), along a direction (160) that is substantially orthogonal to said longitudinal direction (101) of said web (10).

11. Machine, according to claim 1, wherein upstream of said heating means (50) a stretching means is provided (40) for stretching arranged said web (10) of thermoplastic material before it reaches said heating means (50), in order not to affect the formation of said longitudinal welding line (15) on said web (10) by said heating means (50).

12. Machine, according to claim 11, wherein said stretching means comprises a first stretching roller (41) and a second stretching roller (42) arranged at opposite sides with respect to said web (10).

13. Machine, according to claim 1, wherein said heating rod (51, 52) comprises a main body (56) and a heating portion (55) protruding from said main body (56), said heating portion (55) arranged, in use, to provide a longitudinal strip of softened material (17) on said web.

14. Machine, according to claim 1, comprising, furthermore, a longitudinal guide that is adapted, in use, to enter a longitudinal passageway made in said web of thermoplastic material, said longitudinal passageway defined through a plurality of transversal welding lines that separate a plurality of tubular bodies defined between said first and second sheets.

15. Machine, according to claim 14, comprising, furthermore, a cutting means for cutting said web of thermoplastic material to provide a longitudinal cut to open longitudinally said passageway, and to make it possible an introduction of the inflating portion between said sheets and to make it possible a movement of the web after that the chambers have been inflated and sealed.

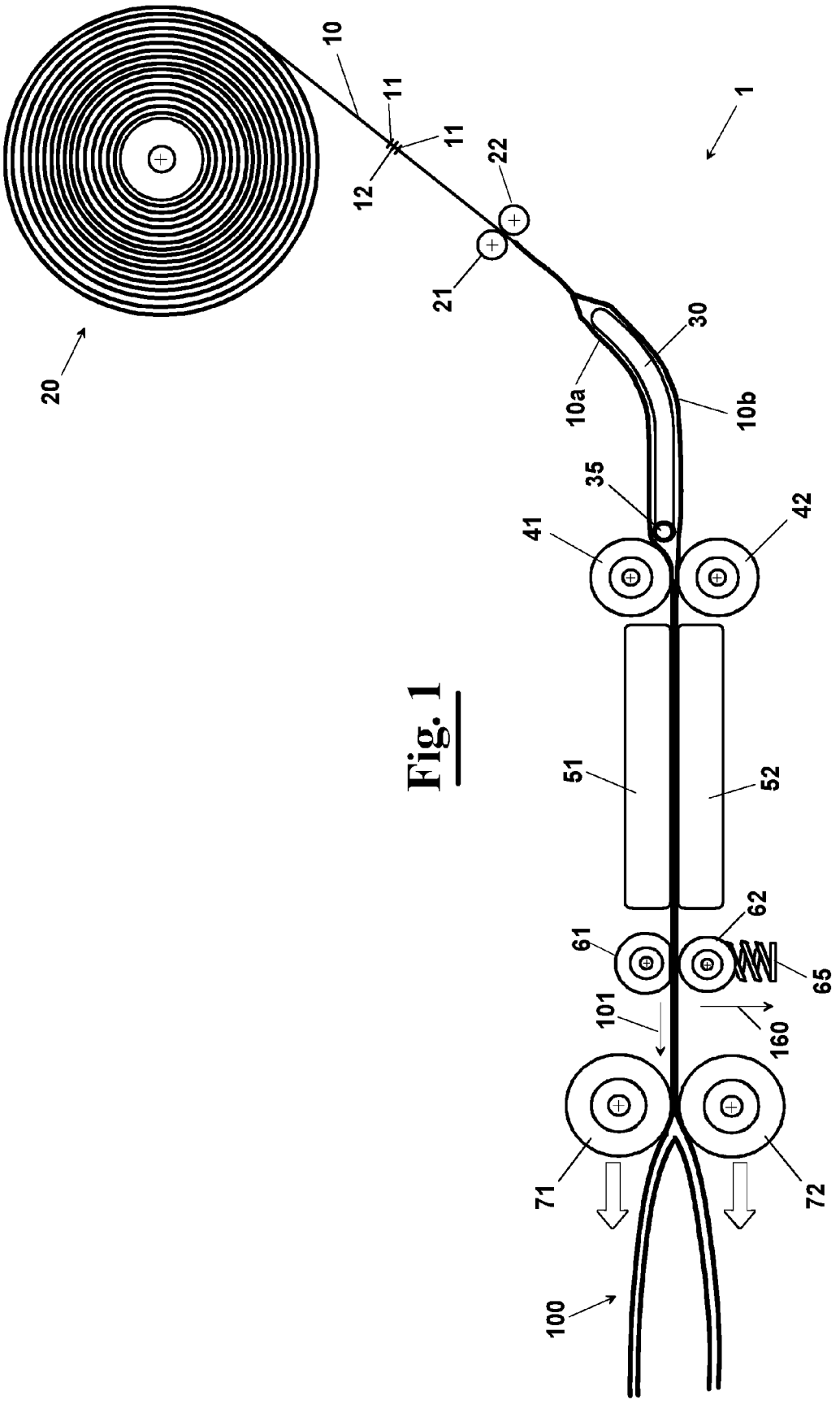
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Fig. 1

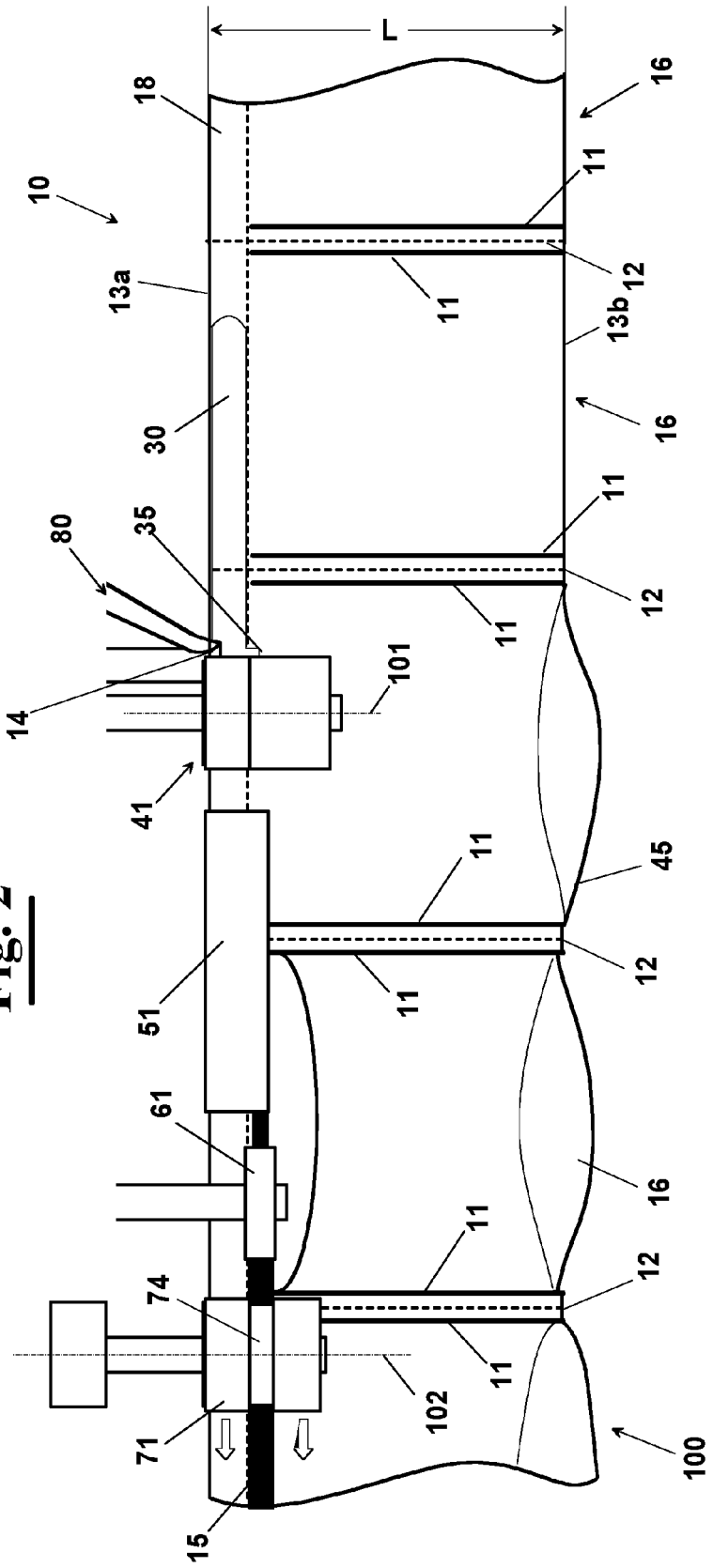
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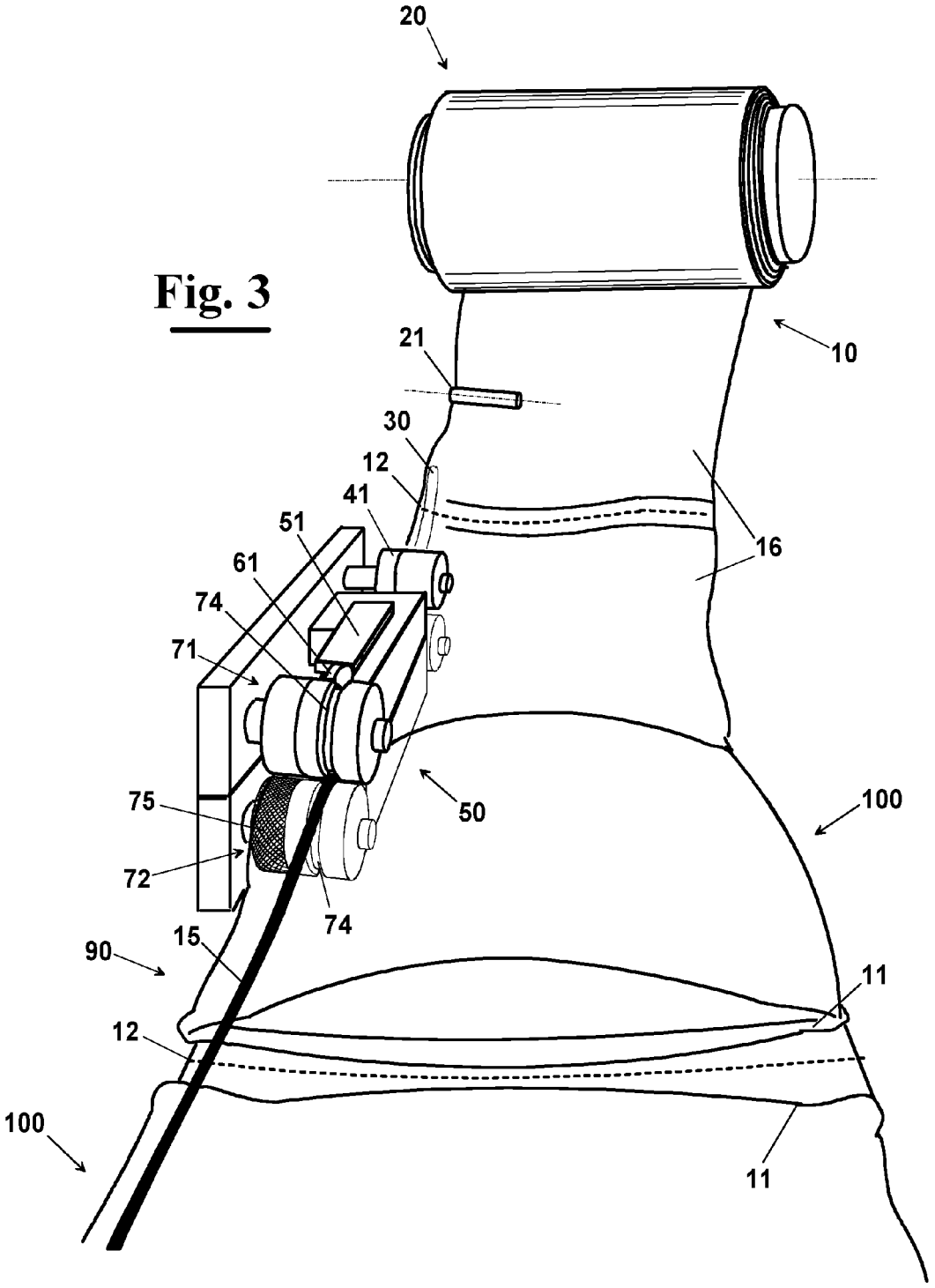
Fig. 2

Fig. 3



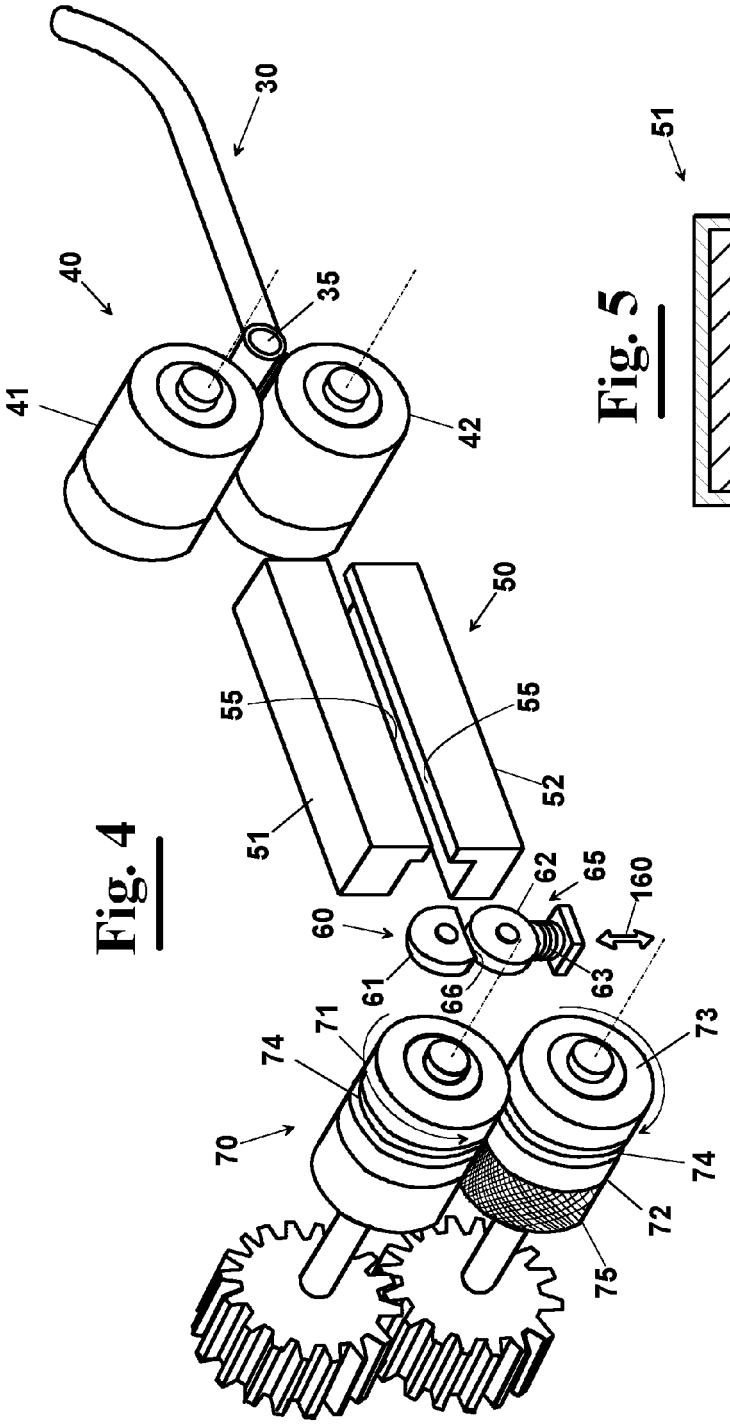

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Fig. 4

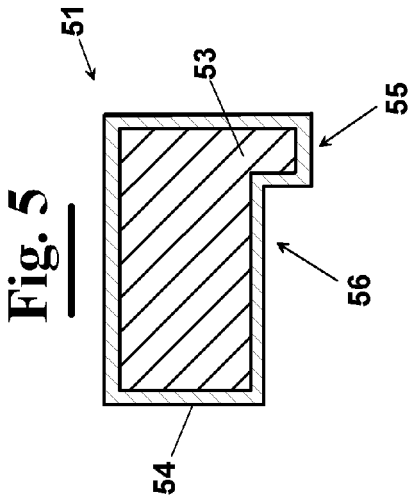
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Fig. 5

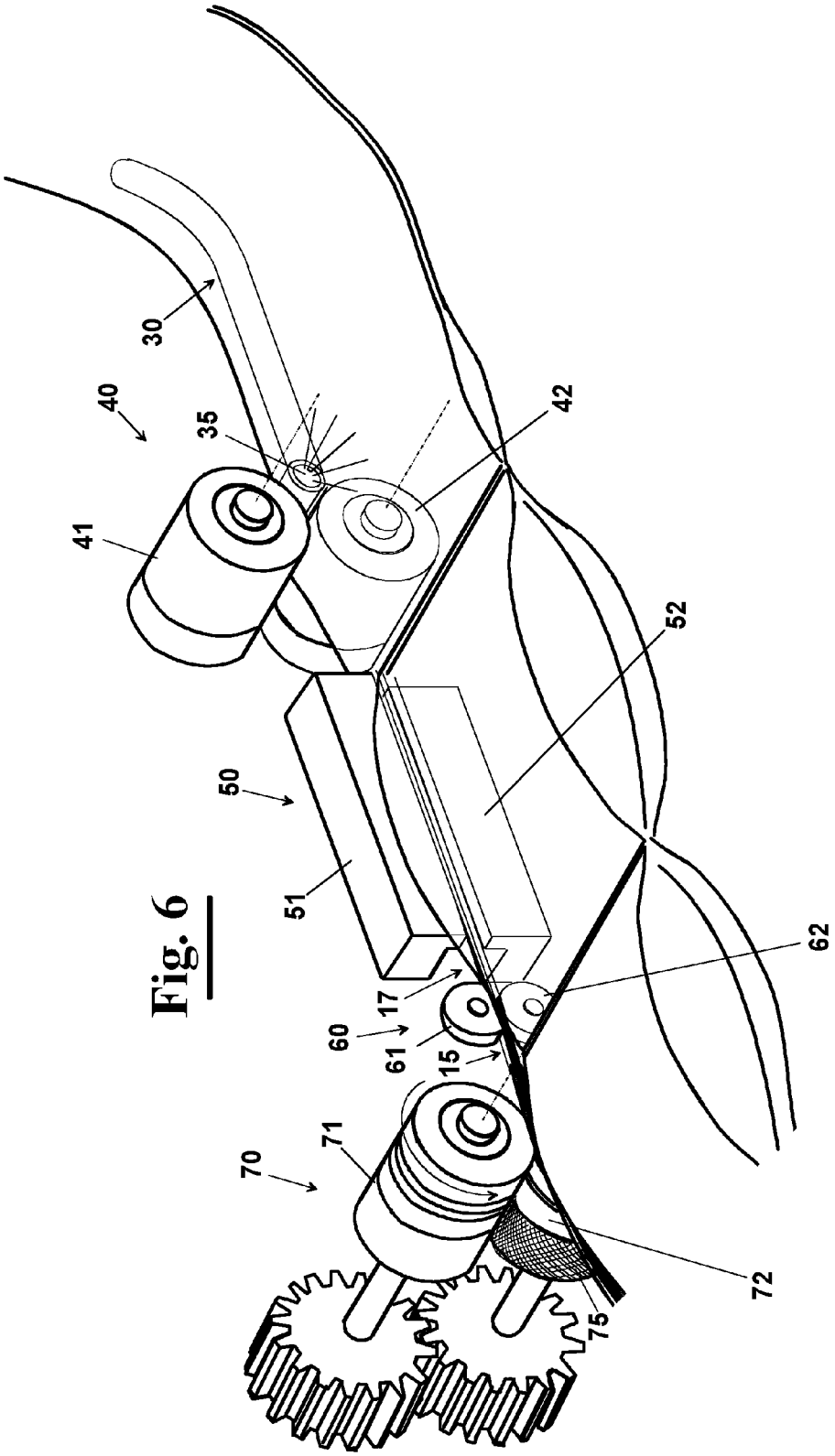
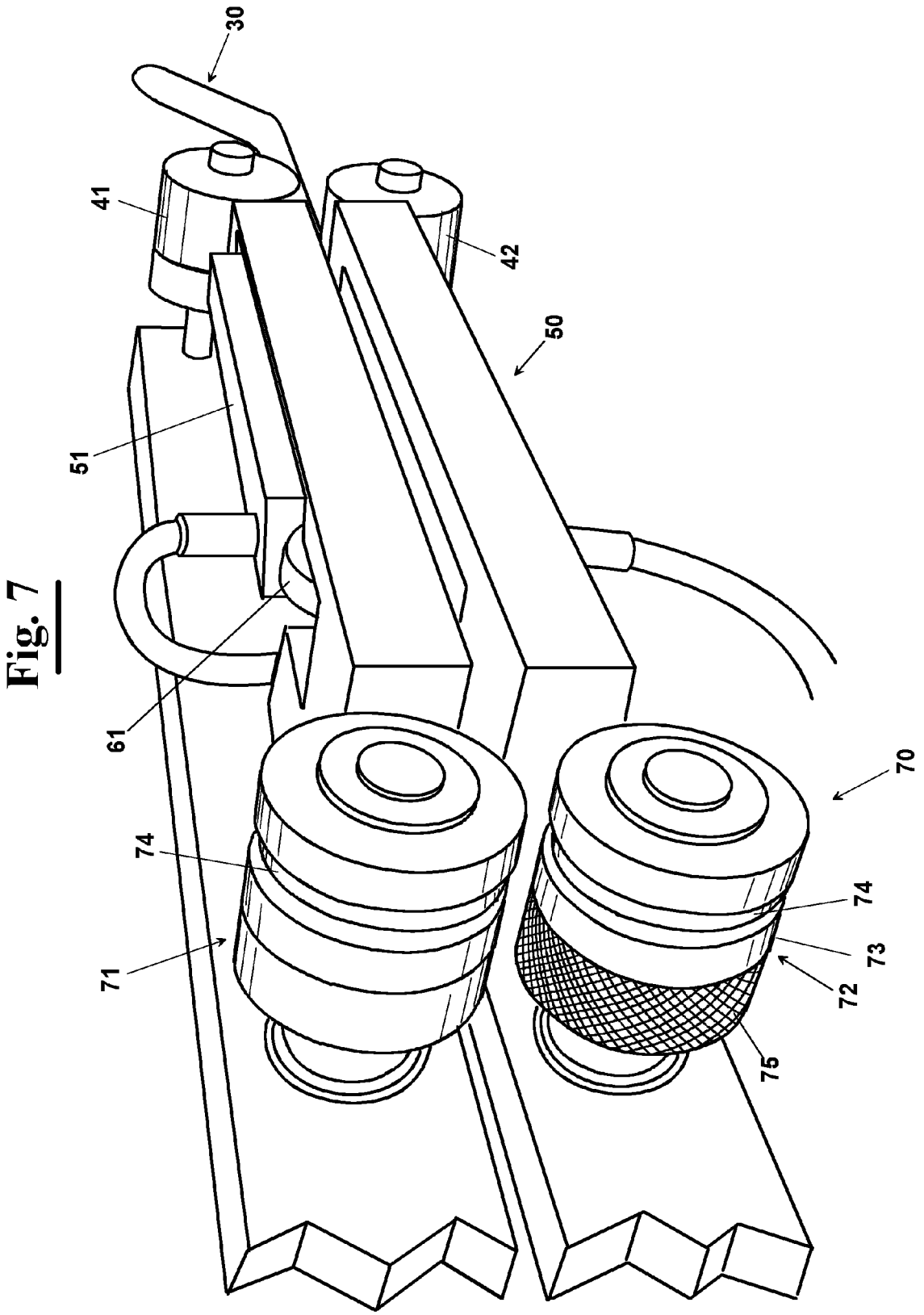


Fig. 6

Fig. 7



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Patent documents cited in the description

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