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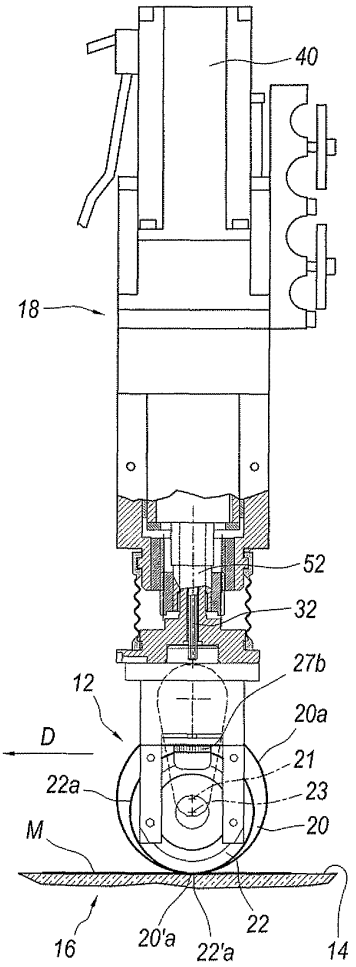
(54) Device for shearing a material

(57) A device (10) for shearing tape-like material, in particular in the form of a fabric, from which respective pieces used in the production of clothing and related products are obtained, comprises a unit (12) for shearing the material which is laid on a surface (14). The device comprises respective means for cutting the material in the form of first means (20) and second means (22) for cutting the material.

FIG. 3



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Description

[0001] This invention relates to a device for shearing a material.

[0002] In particular, the material is in the form of a sheet, swathe or the like, from which respective pieces are obtained, especially for making clothing or related products.

[0003] Preferably, but not exclusively, the material is in the form of a fabric or the like.

[0004] Fabric shearing devices are known which are used to make respective pieces used in the production of apparel or related products. These devices comprise a material shearing unit mounted on the work table on which the material to be cut is laid. The shearing unit comprises means for cutting the material in the form of a revolving blade designed to break the material by pressing it against the rigid opposing surface of the material work table.

[0005] This type of operation performed by revolving blades which break the fabric fibres by compressing the fabric against a corresponding opposing surface below does not, however, always give optimum results, for example when the material to be cut is relatively thick, very elastic, deformable or tough.

[0006] It has been accordingly provided a device for shearing a material, the material being in particular in the form of a sheet or the like, from which respective pieces are obtained, especially for making clothes or the like, the material being preferably in the form of a fabric or the like; the device comprises a unit for shearing the material and in turn comprising respective means for cutting the material mounted on a corresponding surface, and is characterized in that the means for cutting the material comprise first and second means for cutting the material.

[0007] This enables the material to be sheared more effectively.

[0008] In particular, it permits effective shearing of very thick and/or elastic material, that is to say, materials with high toughness properties.

[0009] These and other technical characteristics of the invention are clearly described in the claims below and its advantages are more apparent from the detailed description which follows, with reference to the accompanying drawings which illustrate preferred embodiments, provided merely by way of example without restricting the scope of the inventive concept, and in which:

- Figure 1 is a schematic side view of a first preferred embodiment of the material shearing unit according to this invention;
- Figure 2 is a longitudinal section view of the first preferred embodiment of the shearing device according to the invention;
- Figure 3 is a rear view, partly in cross section, of the first preferred embodiment of the device according to the invention;
- Figure 4 illustrates a rear view of a second preferred embodiment of the material shearing device according to the invention, with the blades rotated on the side opposite that of Figure 3;
- Figure 5 is a longitudinal section view of the second preferred embodiment of the device according to the invention;
- Figure 6 is a cross section view of the second preferred embodiment of the material shearing device according to the invention;
- Figure 7 is a cross section view of the second preferred embodiment of the material shearing device, showing the bottom portion in the detached condition;
- Figure 8 is perspective detail view showing the means for coupling the bottom portion in the second preferred embodiment of the material shearing device according to the invention.

[0010] Figures 1 to 3 illustrate a first preferred embodiment 10 of a device for shearing a material, the latter being preferably in the form of a swathe or sheet extending mainly in two dimensions and made of a fabric or the like and from which suitably shaped pieces used in the production of apparel or related products are obtained by shearing.

[0011] The shearing device 10 comprises a unit 12 for shearing the material M, the latter being supported by a corresponding surface 14 of a work table 16 made of any appropriate material, preferably glass with suitable hardness and physical properties.

[0012] The unit 12 comprises a mounting frame 18 and is mobile in predetermined directions relative to the material M and to the respective work table 16.

[0013] First and second means, respectively labelled 20 and 22 in the accompanying drawings, are advantageously provided for cutting the material and operating on the material at substantially the same shear points.

[0014] Also, advantageously, the second cutting means 22 operate on the material after the first cutting means 20 have operated on it.

[0015] For this purpose, with reference to the feed of the shearing unit 10 relative to the material to be cut, or with reference to the cutting direction D shown in Figure 3, the second cutting means 22 operate on the material in particular immediately downstream of the first cutting means 20.

[0016] In practice, as the cutting unit advances relative to the material M in the direction D, the second cutting means 22 operate on the same point of the material immediately after the first cutting means 20 have operated on it.

[0017] As illustrated, the first and second cutting means 20, 22 are advantageously positioned side by side and are separated from each other by a very small transversal distance or gap, not illustrated in detail in the accompanying drawings, in order to prevent mutual interference or contact.

[0018] Advantageously, the first cutting means 20 are

in the form of means that apply a cutting action on the material, that is to say, that separate the pieces of material by penetrating into the material itself.

[0019] More specifically, the cutting means 20 are in the form of a substantially flat circular blade having a peripheric circumferential cutting edge 20a.

[0020] As illustrated, the blade 20 revolves about an axis 21 parallel to the surface 14 of the work table on which the material is laid.

[0021] Advantageously, the second cutting means 22 are in the form of means designed to apply a compressive action on the material, that is to say, to separate the material by breaking its fibres through application of compressive force against an underlying opposing surface 14 of suitable hardness on which the material to be cut is laid.

[0022] In a preferred embodiment, the work table might be made of glass, as disclosed in patent documents WO 01/39941 and WO 03/103907 in the name of the same Applicant and the device might be installed in an apparatus of the type described in document WO 01/39941. It will be understood that the descriptive contents of the patent documents just mentioned are incorporated herein by reference.

[0023] In this way, it is possible to make the main cut in the material using the first blade 20 and then pass the compressive blade 22 on the same material to cut the remaining fibres that were not cut by the first blade 20.

[0024] Thus, all types of material can be cut. Hence, thick material or material that is difficult to shear by simple compressive or cutting action can be cut.

[0025] The means 22 which apply the compressive action on the material are, as illustrated, in the form of a cupped circular blade that revolves about an axis 23 parallel to the surface 14 of the work table on which the material is laid.

[0026] The blade 22 designed to compress the material therefore has a lower end 22'a for engaging the material and which comes into contact with the work table surface 14 with a suitable compressive force. More specifically, the revolving blade 22 that compresses the material is made to rotate by the shearing unit 12 as the latter advances relative to the material or to the work table surface 14.

[0027] Further, as illustrated, the cutting blade 20 is larger in diameter than the blade 22 that compresses the material.

[0028] As shown in the drawings, the blade 20 that cuts the material revolves about an axis 21 that is suitably spaced from the axis 23 of the blade 22 that compresses the material.

[0029] More specifically, as illustrated, the blade 20 that cuts the material revolves about an axis 21 that is higher up from the work table surface 14 than the axis 23 of the blade 22 that compresses the material.

[0030] Further, the blade 20 that cuts the material revolves about an axis 21 that is further forward relative to the feed direction of the shearing unit 12 than the axis 23 of the blade 22 that compresses the material.

[0031] In particular, the blade 22 that cuts the material by compression has a cutting edge 22a that is positioned, or extends, alongside the flat blade 20 that cuts the material.

[0032] In particular, the blade 22 designed to cut by compressing the material therefore has a lower end 22'a which comes into contact with the material and which extends just downstream of the lower end 20'a of the blade 20 that comes into contact with the material in order to cut it.

[0033] Further, the end of the cutting blade 20 that comes into contact with the material extends in the proximity of but does not touch the surface 14 of the work table.

[0034] As may be clearly inferred from Figure 2, the first cutting means 20 are in the form of a power-driven blade rotationally driven by means comprising a respective electric motor 30, which, through a suitable reduction gear, drives a central, or internal, shaft 32 connected to the shaft 21 that mounts the blade 20. More specifically, the connection is accomplished through a bevel gear 34 and a related belt 36 trained around respective pulleys 28, 40.

[0035] As illustrated, the motor 30 that drives the first cutting means 20 extends above the shearing unit 12.

[0036] A motor 40, also mounted above the shearing unit 12, constitutes means for rotationally driving the cutting means 20, 22 about an axis perpendicular to the work table surface 14.

[0037] Advantageously, the first and second cutting means 20, 22 are mounted on a single block 42, which rotates relative to the main mounting frame 18 of the shearing unit 12 so as to enable the first and second cutting means 20, 22 to rotate about an axis perpendicular to the work table surface 14.

[0038] As illustrated, the motor 40 for rotationally driving the cutting means 20, 22 about an axis perpendicular to the work table surface 14 is positioned longitudinally in line with and behind the motor 30 that drives the cutting blade 20.

[0039] In particular, the rotary block 42 is driven by a shaft 43 that is coaxially outside the shaft 32 that drives the blade 20.

[0040] Thus, the intermediate shaft 43 is a hollow shaft that transmits the drive received from the motor 40 through respective gears 46.

[0041] The cutting means 20, 22 also move up and down relative to the work able surface 14.

[0042] For this purpose, means are provided for driving the cutting means 20, 22 up and down and which comprise a respective motor 50.

[0043] Drive means are also provided for pushing the material compression means 22 against the work table surface 14.

[0044] The drive means that push the compression means against the work table surface 14 comprise the electric motor 50 that lifts and lowers the cutting means

20, 22 relative to the work table surface 14. In particular, the electric motor 50 is in the form of a brushless motor which allows precise adjustment of the pushing action of the cutting and compression means 22 against the work table surface 14.

[0045] These lift/lower means, which push the blade 22 against the work table surface 14, comprise a block 44 located inside, and freely rotatable relative to, a block or cylindrical portion 13 of the main mounting frame 18, said block 13 having a cylindrical inside cavity 15 adapted to house a lead screw 54 that lifts the cutting means relative to the work table 16, as described in more detail below.

[0046] The rotary block 44 is hollow and positioned coaxially inside the fixed block 13 and coaxially outside the drive shafts 43 and 32.

[0047] As illustrated, the brushless motor 50 that lifts and lowers the cutting means 20, 22 and pushes the material compression means 22 is positioned longitudinally in line with the motors 30 and 40, which rotationally drive the cutting blade 20 and which rotationally drive the bottom unit, or head, 42 about an axis perpendicular to the work table, and remains in front of the electrical motor 30.

[0048] In practice, the bottom block 42 is vertically mobile relative to the fixed mounting block 13, since it is mounted on a respective, vertically mobile internal shaft 52 driven by the lead screw 54 fixed to the hollow mounting block 44.

[0049] The lead screw 54 fixed to the hollow block 44 is in turn driven, through a respective gear 56, by the motor 50 which rotationally drives the hollow block 44.

[0050] The rotation of the main part 54a of the lead screw causes the shaft 52 to move up and down, thereby producing a suitable compressive force.

[0051] Means are also provided for holding the cutting means against the work table surface 14 at a predetermined contact pressure.

[0052] More specifically, it is contemplated the provision of means for keeping the contact pressure of the cutting means 22 against the work table surface 14 at a predetermined level, and in particular at a constant level.

[0053] Advantageously, it is contemplated the provision of means for keeping the contact pressure of the cutting means 22 against the work table surface 14 at a predetermined level in response to a change in the level of the respective work table surface.

[0054] For this purpose, the torque of the motor 50 is controlled in order to keep the pressure of the compression blade 22 on the material constant.

[0055] In practice, in this first preferred embodiment, the motor 50 drives the cutting means 20, 22, by means of the lead screw 54, causing them to move down towards a predetermined position relative to the work table surface.

[0056] Next, the control system of the brushless motor 50 is set in such a way as to apply and maintain a suitable force, or torque, on the lead screw 54 so that the compression blade 22 applies a predetermined, substantially constant compressive force against the underlying work table surface 14, this force being maintained at the same level even when the level or height of the work table surface 14 varies.

[0057] In practice, the predetermined compression is maintained at the same level in a manner substantially independent of the level of the work table surface.

[0058] In other terms, any changes in the level or height of the work table surface are detected by the brushless motor 50 control system as a variation in the stress which the revolving compression blade 22 applies to the shaft of the motor 50 and the motor 50 control system accordingly modifies the force applied to the blade 22 in such a way that the pressure of the blade on the material, or rather, on the opposing work table surface 14, is equal or substantially equal to the predetermined and required pressure.

[0059] As mentioned, in this first preferred embodiment, the lead screw 54, or rather, its main part 54a, is integral with the outer rotary drive block 44 and cannot either rotate or translate relative to the latter. In practice, the rotational action which the motor 50 applies to the hollow block 44 causes the main part 54a of the lead screw 54 to rotate, thereby producing a relative movement of the part 52 of the lead screw protruding from the fixed part 54.

[0060] Means 25 are provided for adjusting the distance between the first and second cutting means 20, 22. More specifically, the means for adjusting the distance between the first and second cutting means are designed to allow the first cutting means 20 to move transversally relative to the second cutting means 22.

[0061] The means for adjusting the transversal distance between the first and second cutting means 20, 22 comprise a threaded bush 25 that rotatably accommodates the mounting shaft 21 of the first cutting means 20 through a bearing 25a.

[0062] Means are also provided for adjusting the vertical distance between the first and second cutting means 20, 22. The means for adjusting the vertical distance between the first and second cutting means 20, 22 comprise a threaded hole 27 accommodating respective screw means 27a which connect a bottom block 22b that mounts the compression blade 22 axis 23 to the top of the block 42.

[0063] As illustrated, the threaded hole 27 is made vertically in a top section of the block 42 which mounts the cutting means.

[0064] The reference numeral 27b in Figure 2 denotes a grub screw for adjusting the height or vertical distance of the cutting means 20 and 22.

[0065] The cutting unit 12 and the material M move longitudinally and transversally relative to each other. More in detail, the cutting unit 12 moves relative to the work table surface 14 in a manner substantially as described in international patent application WO 01/39941 in the name of the same Applicant.

[0066] In practice, the cutting unit 12 moves relative to

the material in such a way as to make in the latter predetermined shear lines, preferably according to the principle of cutting the piece being processed completely and then proceeding to the next piece by cutting within, or out of, the same swathe or sheet of material being processed.

[0067] In practice, the shearing unit 10 moves longitudinally in the direction L and is supported by corresponding rollers 80, 82 which extend transversally and which rest on the work table surface 14, the material M being interposed between the latter and the rollers.

[0068] The shearing unit 12 can also move transversally, running on respective mounting means or guides connected to the rollers 80, 82 in such a way as to cut pieces of required, predetermined shape out of the sheet or swathe. The rollers 80 and 82 also constitute means for holding down the material during the cutting process.

[0069] Advantageously, these roller means have at least one end and, in this particular embodiment, a first and second end, opposite each other, which are covered, circumferentially and to a certain extent transversally, with a shock absorbing layer, in particular a layer of rubber, which rests directly on the work table surface 14, on the outside of the area occupied by the swathe of fabric to be cut.

[0070] In practice, the respective rollers 80, 82, which extend transversally of the work table 16 substantially for the latter's full width, have intermediate sections 80', 82' that rest on and simultaneously hold down the material M, and respective rubber-coated lateral ends which rest directly on the work table surface 14 which the material is laid on. A rubber-coated, or shock absorbent end portion is schematically illustrated in Figure 1 and is labelled G.

[0071] This eliminates vibrations due to the to and fro motion of the shearing unit in the longitudinal direction.

[0072] Figures 4 to 8 illustrate a second preferred embodiment of the device for shearing a material. The second embodiment is substantially the same as the first preferred embodiment and is not therefore described in detail. The parts of the second preferred embodiment that are similar to those of the first preferred embodiment are denoted by the same numerical references.

[0073] The second preferred embodiment differs from the first preferred embodiment in that the motor 50 that lifts and lowers the cutting means 20, 22 is, in the second preferred embodiment, designed to drive a respective lead screw 154 that compresses a spring 155 constituting elastic means for pushing the cutting means 22 against the work table surface 14.

[0074] Turning the lead screw 154 compresses the spring 155, which is mounted at its lower end on an annular member that is operatively connected to, and vertically aligned with, the lead screw 154.

[0075] In practice, these elastic pushing means 155 are in the form of compressed elastic means, and more specifically, in the form of a cylindrical helical spring mounted coaxially with the means for rotationally driving the cutting blade and with the means for rotationally driving the cutting means 20, 22 about an axis perpendicular to the work table surface 14.

[0076] In this embodiment, therefore, the lead screw 154 constitutes means for preloading the elastic pushing means 155, which are in any case advantageously mounted in a preloaded condition, or at least in a slightly compressed condition in order to compensate for play.

[0077] In this way, it is possible to suitably vary the thrust, or pushing action, applied by the compression means 22 on the material to be sheared. In the second preferred embodiment, the motor 50 first positions the cutting means against the work table and then proceeds to lowering the cutting means in such a way that the lead screw 154 is lifted relative to the outer block 144, relative to which it is connected in vertically mobile manner, thereby compressing the spring 155 to a predetermined extent.

[0078] In practice, in the second preferred embodiment, the main body of the lead screw 154, from which the vertically mobile part 152 protrudes downwardly, is connected by a splined coupling having respective radially protruding fins 154a which engage corresponding vertical fins 144a extending radially into the outside block 144. Thus, the main body of the lead screw 154 turns as one with the outer block 144 and, starting from a position where the bottom is in contact with a corresponding ring 144b, moves vertically relative to the outer block 144 itself.

[0079] In practice, the motor 50 rotates the block 144 which coaxially houses the spring 155 and the lead screw 154, which can move translationally within the hollow block 144 but not rotationally relative to the block 144.

[0080] The rotation of the outer block 144, also rotationally drives the lead screw 154, which vertically moves the screw shaft that mounts the protruding portion 152 which in turn mounts the cutting means 20, 22.

[0081] During the downstroke, the rotation of the lead screw 154 causes the downward movement of the means that mount the cutting means 20, 22.

[0082] Once the cutting body 22 is in contact with the work table surface 14 below it, the continued rotation of the lead screw 154 causes the bush 154' with which the lead screw 154 itself is integral to move upwards and to compress the spring 155 mounted on the bush 154' to a required, predetermined level. In practice, the spring 155 makes it possible to compensate for changes in the height of the work table, so to keep the compression on the work table surface 14 at the required level.

[0083] As illustrated, the radial fins 154a extend outwardly from the bush 154', which is integral with the lead screw 154.

[0084] As illustrated, the top of the spring 155 is in contact with a corresponding ring 144b of the intermediate block 154.

[0085] Means are also provided for removably connecting the cutting means 20, 22 from the shearing unit.

[0086] These removable connecting means comprise

respective lock/release handles, labelled 90 and 92 in Figures 6, 7 and 8. In particular figure 6 shows the handle 90 in the released condition whilst the handle 92 is in the locked condition.

[0087] Fastening pins 91, 93 that lock to respective sockets 90', 92' in the top part of the device are located at the top ends of respective plates 91a, 93a, having the general shape of an S, and which, at their other ends, are pivoted at 91b, 93b to the handles 90, 92 in turn pivoted to the bottom block 42 by pins 95, 97.

[0088] The handles 90, 92, having the general shape of a U, drive the pins 91, 93 associated with the bottom unit that mounts the cutting means 20, 22, in such a way as to engage and retain and to disengage the corresponding horizontal sockets 90' 92' in the upper block of the device.

[0089] Thus, the cutting means 20, 22 can be rapidly released and, if necessary, replaced with other tools, such as punches or labellers for example, stored in a tool magazine of the machine or apparatus in which the shearing device is installed.

[0090] In practice, the bottom part 142 that mounts the cutting means is detached en bloc from the top part of the device, as well illustrated in Figure 7.

[0091] The device is very compact.

[0092] In practice, it is contemplated a method for shearing the material comprising a first step of shearing the material performed by cutting the material and a second step of shearing the material performed by compressing the material.

[0093] More specifically, the compressive action is applied to the parts of the material that have already been cut.

[0094] The device is particularly suitable for cutting tape-like material, that is, flexible material extending mainly in two dimensions, be it a woven fabric, a non-woven fabric, plastic, paper material, and other materials.

[0095] In particular, the device is suitable for cutting material that must be appropriately shaped, for example to make clothing or other products of various different kinds.

[0096] In practice, it is contemplated the provision of respective drive or transmission means 32, 43, 44 for the first embodiment, and respective drive or transmission means 32, 43 and 144 for the second embodiment, which allow the cutting unit to perform the necessary working movements, and in particular, the rotational movement of the blade 20, the rotational movement of the cutting means 20, 22 about an axis perpendicular to the work table surface 14, and the vertical, up and down movement to press the blade 22 against the work table surface 14, said drive or transmission means being coaxially positioned relative to each other to create a shearing device with a particularly compact structure.

[0097] Said drive and shearing means are housed coaxially within a fixed block 13.

[0098] The invention described is susceptible of industrial application and may be modified and adapted in several ways without thereby departing from the scope of the inventive concept. Moreover, all the details of the invention may be substituted by technically equivalent elements.

Claims

1. A device (10) for shearing a material, the material being in particular in the form of a sheet or the like, from which respective pieces are obtained, especially for making clothes or the like, the material being preferably in the form of a fabric or the like; the device comprising a unit (12) for shearing the material and which in turn comprises respective means for cutting the material mounted on a corresponding surface (14), and being **characterized in that** the means for cutting the material comprise first means (20) and second means (22) for cutting the material.

2. The device according to claim 1, **characterized in that** the first and second cutting means (20, 22) operate on the material at substantially the same shear points.

3. The device according to any of the foregoing claims, **characterised in that** the second cutting means (22) operate on the material after the first cutting means (20) have operated on it.

4. The device according to any of the foregoing claims, **characterised in that** the first and second cutting means (20, 22) are mounted side by side.

5. The device according to any of the foregoing claims, **characterised in that** the first cutting means (20) are in the form of means that apply a cutting action on the material.

6. The device according to claim 5, **characterized in that** the means (20) that apply a cutting action on the material are in the form of a circular blade.

7. The device according to any of the foregoing claims, **characterised in that** the second cutting means (22) are in the form of means that apply a compressive action on the material.

8. The device according to claim 7, **characterized in that** the means (22) that apply a compressive action on the material are in the form of a blade with a circular cutting edge.

9. The device according to claim 8, **characterized in that** the means that apply a compressive action on the material have a cupped shape.

10. The device according to any of the foregoing claims,

characterized in that the second cutting means (22) have a lower end for engaging the material and which comes into contact with the work table surface (14).

11. The device according to any of the foregoing claims, **characterized in that** the second cutting means (22) are made to rotate by the shearing unit (12) as the latter advances relative to the material.

12. The device according to any of the foregoing claims or according to the preamble to claim 1, **characterised in that** it comprises means (50, 54) for holding the cutting means against the work table surface (14) at a predetermined contact pressure.

13. The device according to claim 12, **characterised in that** it comprises means (50, 54) for keeping the contact pressure of the cutting means against the work table surface (14) at a predetermined level.

14. The device according to claim 13, **characterised in that** it comprises means (50, 54) for keeping the contact pressure of the cutting means against the work table surface (14) at a predetermined level in response to a change in the level of the respective work table surface.

15. The device according to any of the foregoing claims, **characterized in that** it comprises means (50) for driving the material compression means (22) and which push the latter against the work table surface (14).

16. The device according to any of the foregoing claims, **characterised in that** the second cutting means (22) operate on the material immediately downstream of the first cutting means (20).

17. The device according to any of the foregoing claims, **characterized in that** the cutting blade (20) is larger in diameter than the blade (22) that compresses the material.

18. The device according to any of the foregoing claims, **characterized in that** the blade (20) that cuts the material revolves about an axis (21) that is suitably spaced from the axis (23) of the blade (22) that compresses the material.

19. The device according to any of the foregoing claims, **characterized in that** the blade (20) that cuts the material revolves about an axis (21) that is higher up from the work table surface (14) than the axis (23) of the blade (22) that compresses the material.

20. The device according to any of the foregoing claims, **characterized in that** the blade (20) that cuts the material revolves about an axis (21) that is further forward relative to the feed direction of the shearing unit (12) than the axis (23) of the blade (22) that compresses the material.

21. The device according to any of the foregoing claims, **characterized in that** the blade (22) that compresses the material has a cutting edge (22a) that is positioned alongside the blade (20) that cuts the material.

22. The device according to any of the foregoing claims, **characterized in that** the blade (22) that compresses the material has an end which comes into contact with the material and which extends just downstream of the material contact end of the blade (20) that cuts the material.

23. The device according to any of the foregoing claims, **characterized in that** the blade (20) that cuts the material has an end which comes into contact with the material and which extends in the proximity of but does not touch the surface (14) of the work table.

24. The device according to any of the foregoing claims or according to the preamble to claim 1, **characterised in that** it comprises means for rotationally driving respective cutting means (20) designed to cut the material.

25. The device according to claim 24, **characterized in that** the means for driving the first cutting means (20) comprise an electric motor (30).

26. The device according to claim 24 or 25, **characterised in that** the means (30) for driving the blade (20) are designed to drive a central shaft (32).

27. The device according to any of the foregoing claims from 24 to 26, **characterized in that** the motor (30) for driving the first cutting means (20) extends above the shearing unit (12).

28. The device according to any of the foregoing claims or according to the preamble to claim 1, **characterized in that** it comprises means (40) for rotationally driving the cutting means (20, 22) about an axis perpendicular to the work table surface (14).

29. The device according to claim 28, **characterized in that** the means for rotationally driving the cutting means (20, 22) about an axis perpendicular to the work table surface (14) comprise a respective electric motor (40).

30. The device according to claim 28 or 29, **characterized in that** the first and second cutting means (20, 22) are mounted on a single block (42) which rotates

about an axis perpendicular to the work table surface (14).

31. The device according to any of the foregoing claims from 28 to 30, **characterized in that** the motor (40) for rotationally driving the cutting means (20, 22) about an axis perpendicular to the work table surface (14) extends above the shearing unit (12).

32. The device according to any of the foregoing claims from 28 to 31, **characterized in that** the motor (40) for rotationally driving the cutting means (20, 22) about an axis perpendicular to the work table surface (14) is longitudinally in line with the motor (30) that drives the cutting means (20).

33. The device according to any of the foregoing claims from 28 to 32, **characterized in that** the means for rotationally driving the cutting means (20, 22) about an axis perpendicular to the work table surface (14) comprise a shaft (43) that is coaxially positioned relative the shaft (32) that drives the cutting blade (20).

34. The device according to any of the foregoing claims, **characterised in that** the first and second cutting means (20, 22) are transversally spaced.

35. The device according to any of the foregoing claims from 6 to 34, **characterized in that** the blade (20) that cuts the material is in the form of a flat blade.

36. The device according to any of the foregoing claims, **characterized in that** the first cutting means (20) revolve about an axis parallel to the work table surface (14).

37. The device according to any of the foregoing claims, **characterized in that** the second cutting means (22) revolve about an axis parallel to the work table surface (14).

38. The device according to any of the foregoing claims or according to the preamble to claim 1, **characterised in that** it comprises drive means (50) for lifting and lowering the cutting means (20, 22) relative to the work table surface (14).

39. The device according to any of the foregoing claims from 15 to 38, **characterized in that** it comprises means for adjusting the pushing action of the compression means (22) against the work table surface (14).

40. The device according to any of the foregoing claims from 15 to 39, **characterized in that** the drive means for pushing the cutting means against the work table surface (14) comprise an electric motor (50).

41. The device according to any of the foregoing claims from 15 to 40, **characterized in that** the electric motor (50) constitutes drive means for lifting and lowering the cutting means (20, 22).

42. The device according to any of the foregoing claims from 15 to 41, **characterized in that** the drive means for pushing the cutting means against the work table surface comprise a brushless electric motor (50).

43. The device according to any of the foregoing claims, **characterized in that** a bottom block (42) that mounts the cutting means (20, 22) is vertically mobile relative to a fixed block (13).

44. The device according to claim 43, **characterized in that** the bottom block (42) that mounts the cutting means (20, 22) is mounted on shaft (52) driven by a lead screw (54) fixed to the fixed mounting block (13).

45. The device according to any of the foregoing claims, **characterized in that** the drive means for pushing the cutting means against the work table surface comprise elastic pushing means (155).

46. The device according to claim 45, **characterized in that** the elastic pushing means are compressed elastic means (155).

47. The device according to claim 45 or 46, **characterized in that** the elastic pushing means are in the form of a spring.

48. The device according to any of the foregoing claims from 45 to 47, **characterized in that** it comprises means for preloading the elastic pushing means.

49. The device according to any of the foregoing claims from 45 to 48, **characterized in that** the means for preloading the elastic pushing means comprise lead screw means (154) driven by respective means (50) and a portion (156) which engages one end of the elastic means and which is connected to the lead screw means (154).

50. The device according to any of the foregoing claims from 45 to 49, **characterized in that** the elastic pushing means are coaxially positioned around the means (32, 43) that drive the cutting means.

51. The device according to any of the foregoing claims from 12 to 50, **characterized in that** the drive motor (50) for pushing the cutting means is longitudinally in line with the motor (30) that drives the cutting blade.

52. The device according to any of the foregoing claims from 12 to 51, **characterized in that** the drive motor

(50) for pushing the cutting means is longitudinally in line with the motor (40) that rotationally drives the cutting means about an axis perpendicular to the work table surface (14).

53. The device according to any of the foregoing claims, **characterised in that** it comprises means (25) for adjusting the distance between the first and second cutting means (20, 22).

54. The device according to claim 53, **characterized in that** the means (25) for adjusting the distance between the first and second cutting means are designed to allow the first cutting means (20) to move relative to the second cutting means (22).

55. The device according to claim 53 or 54, **characterised in that** the means (25) for adjusting the distance between the first and second cutting means are designed to allow the first cutting means (20) to move transversally.

56. The device according to any of the foregoing claims from 53 to 55, **characterised in that** the means for adjusting the distance between the first and second cutting means (20, 22) comprise a threaded bush (25) that accommodates the mounting shaft (21) of the first cutting means (20).

57. The device according to any of the foregoing claims, **characterised in that** it comprises means (27) for adjusting the vertical distance between the first and second cutting means (20, 22).

58. The device according to claim 57, **characterized in that** the means (27) for adjusting the vertical distance between the first and second cutting means comprise a bottom block (42) which mounts the shaft (23) of the material compression means (22) and which is vertically mobile relative to the top part of the means that mount the cutting means (20, 22).

59. The device according to claim 57 or 58, **characterized in that** the means (27) for adjusting the vertical distance between the first and second cutting means comprise a threaded hole (27) accommodating respective screw means (27a) extending from a bottom block (42) which mounts the shaft (23) of the means (22) that compress the material.

60. The device according to any of the foregoing claims, **characterized in that** the cutting unit (12) and the material can move relative to each other.

61. The device according to any of the foregoing claims, **characterized in that** the cutting unit (12) and the material can move relative to each other to define predetermined shear lines.

62. The device according to any of the foregoing claims or according to the preamble to claim 1, **characterised in that** it comprises roller means (80, 82) for supporting the shearing unit (12).

63. The device according to claim 62, **characterized in that** the roller means (80, 82) have at least one end (G), and in particular a first and a second end opposite each other, which is covered with a shock absorbing layer that engages the work table surface (14).

64. The device according to claim 63, **characterized in that** the shock absorbing layer that engages the work table surface (14) is made of rubber.

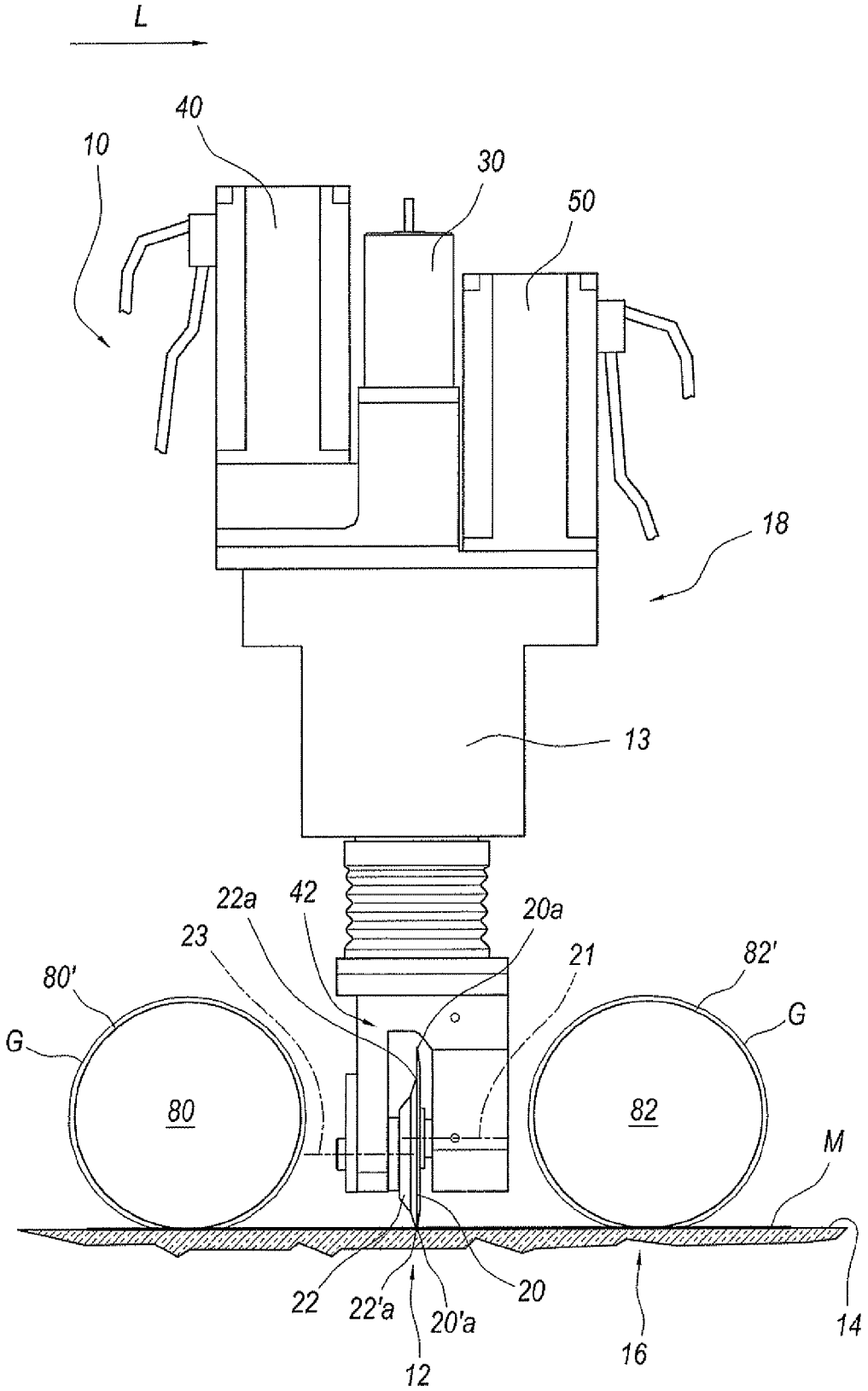
65. The device according to any of the foregoing claims or according to the preamble to claim 1, **characterized in that** it comprises means (90, 92) for removably connecting the cutting means (20, 22) to the shearing unit.

66. The device according to claim 65, **characterized in that** it the means (90, 92) for removably connecting the cutting means (20, 22) to the shearing unit are located between a bottom part (142) and a top part of the mobile means that mount the cutting means (20, 22).

67. The device according to any of the foregoing claims, **characterized in that** it comprises drive or transmission means (32, 43, 44, 144) which allow the cutting unit to perform the necessary working movements and which are coaxially positioned relative to each other.

68. A method for shearing a material, **characterized in that** it comprises a first step of shearing the material performed by cutting the material and a second step of shearing the material performed by compressing the material.

FIG. 1


L
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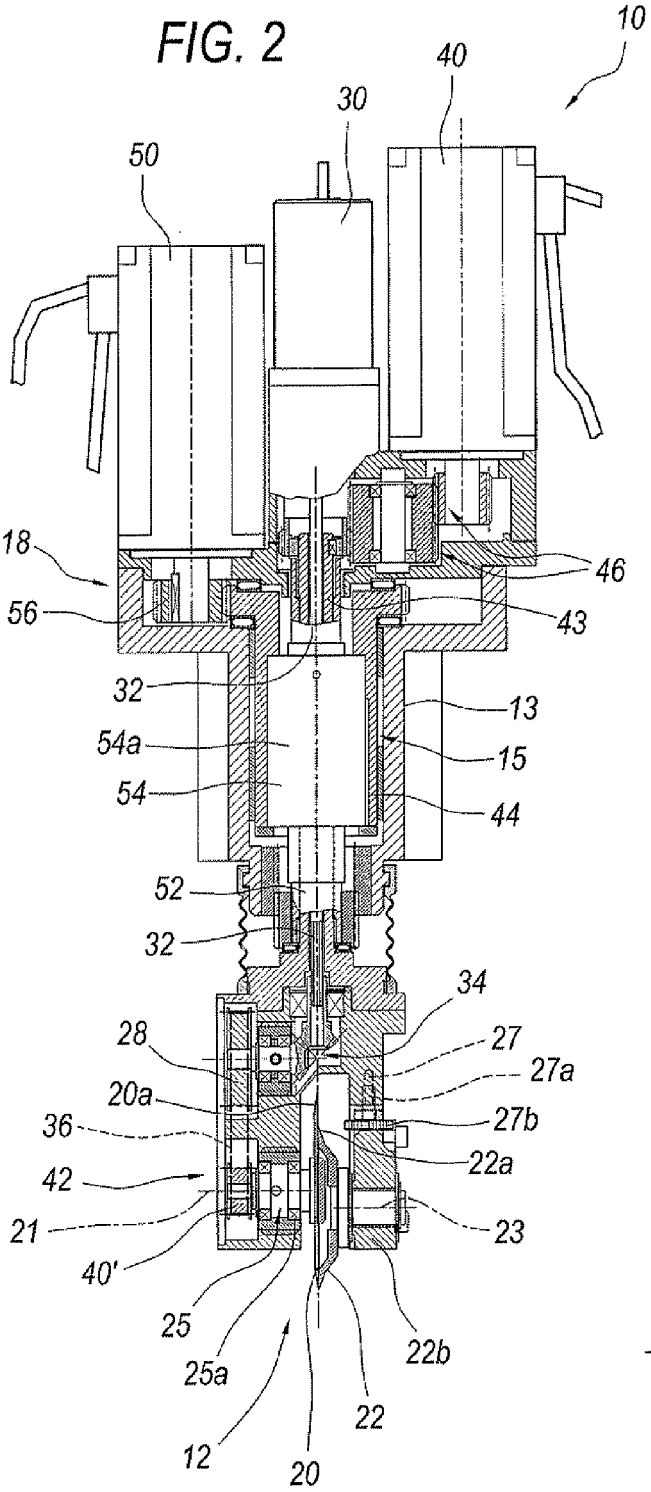
10
30
50
18
13
22a
42
20a
23
21
82'
80'
G
G
80
82
M
22
22'a
20'a
20
16
14
12

FIG. 2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18
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43
32
13
54a
15
54
44
52
32
34
28
27
27a
20a
27b
36
22a
42
23
21
40'
25
25a
22b
22
12
20

FIG. 3

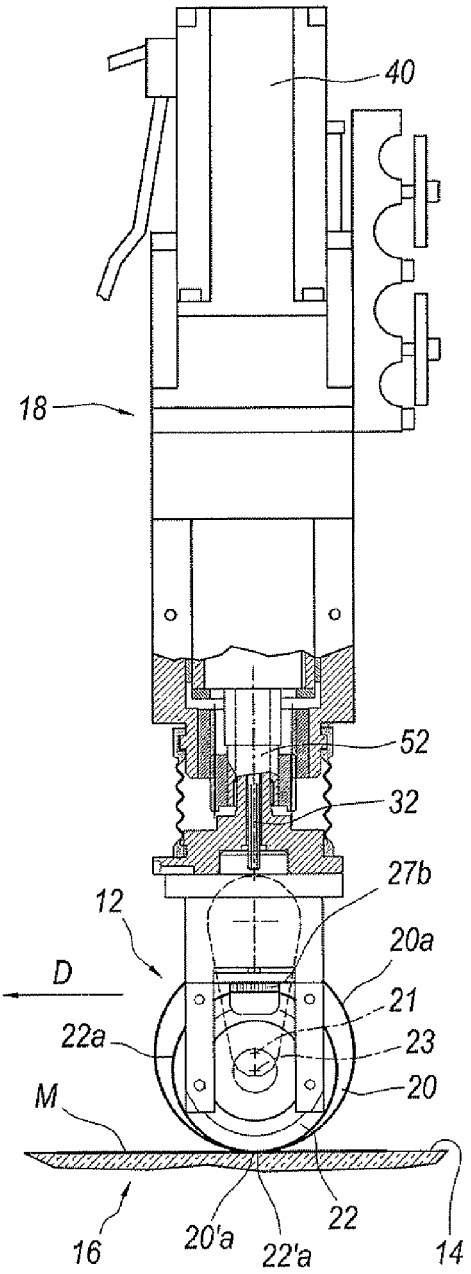

40
18
52
32
27b
12
20a
D
21
22a
23
20
M
16
20'a
22'a
22
14

FIG. 4

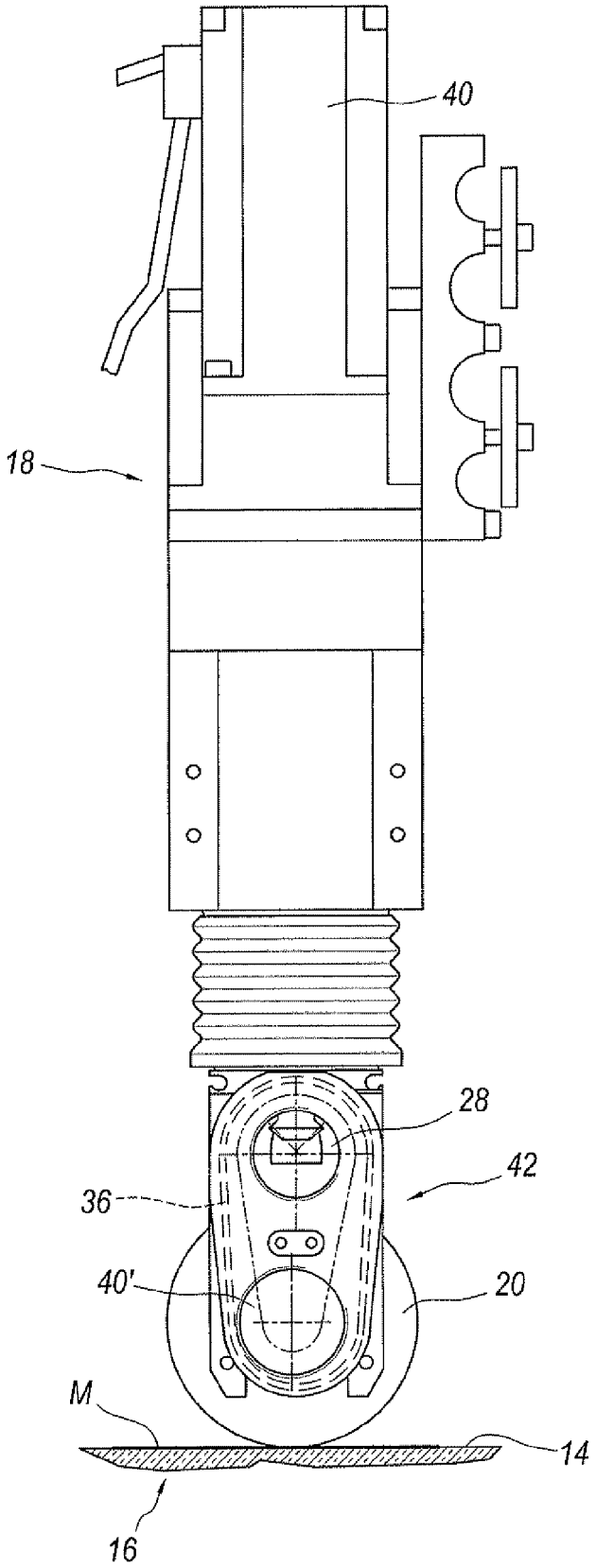
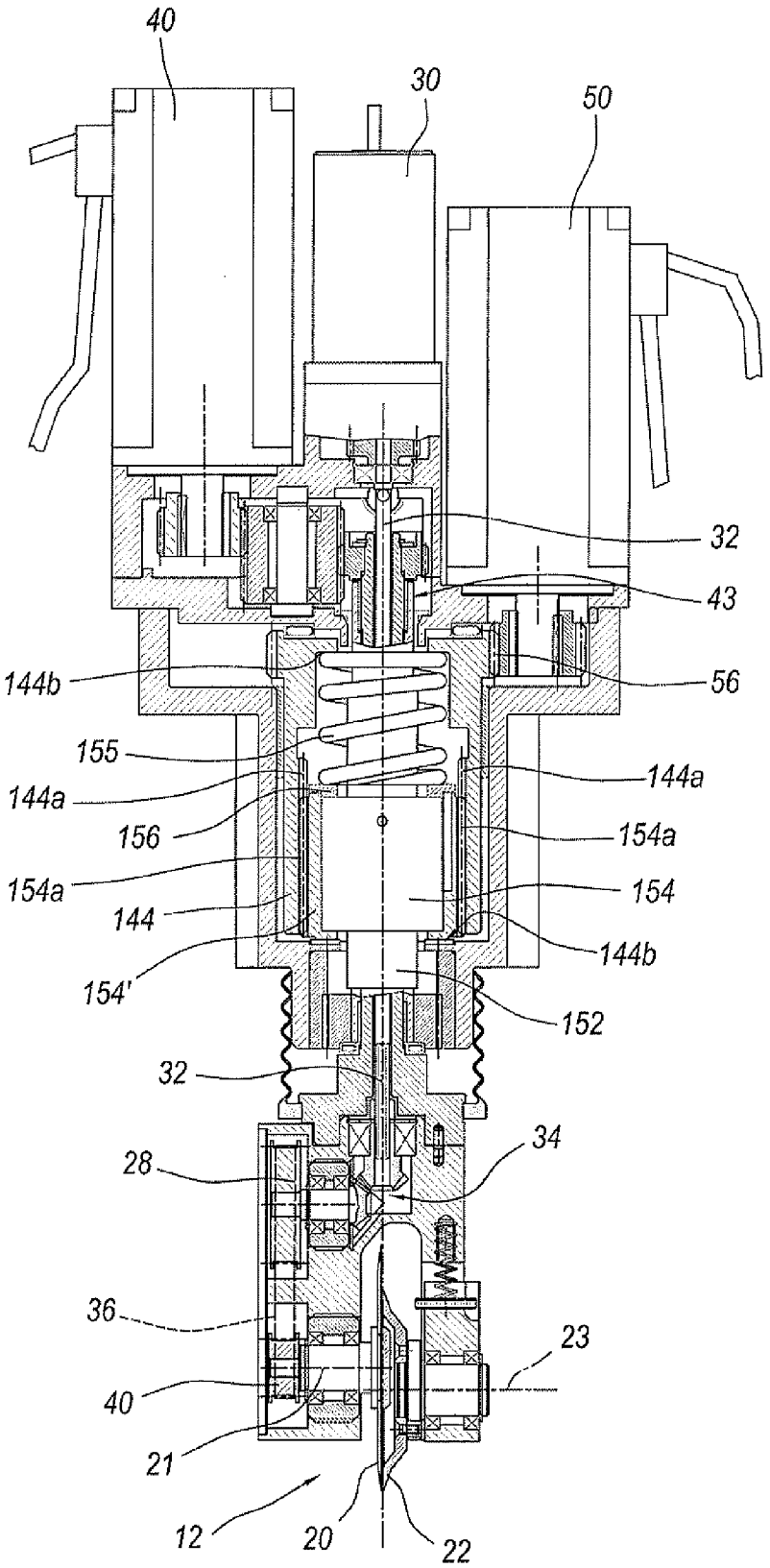


FIG. 5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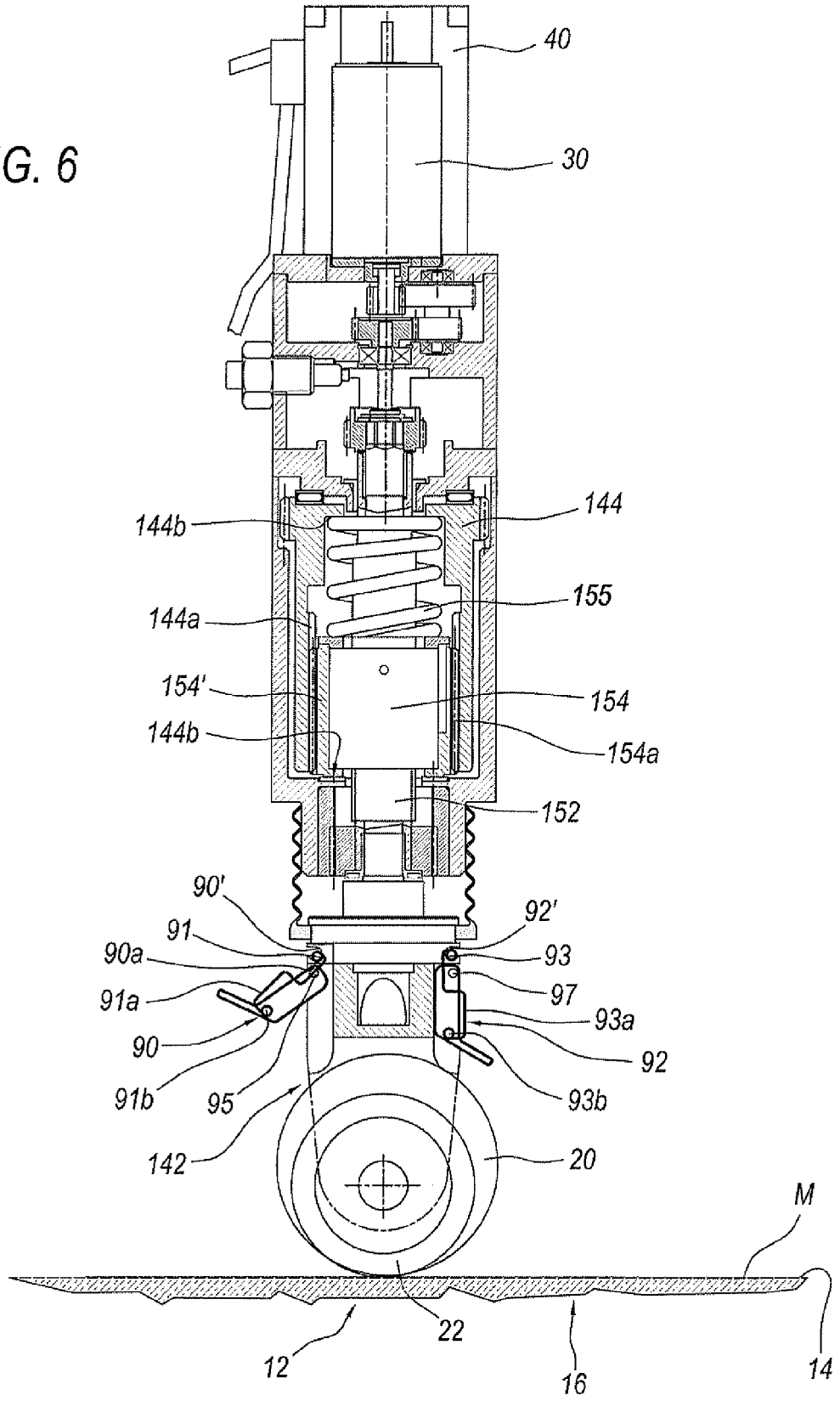
50
32
43
144b
56
155
144a
144a
156
154a
154a
144
154
154'
144b
152
32
34
28
36
23
40
21
12
20
22

FIG. 6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30
144b
144
155
144a
154'
154
144b
154a
152
90'
92'
91
90a
93
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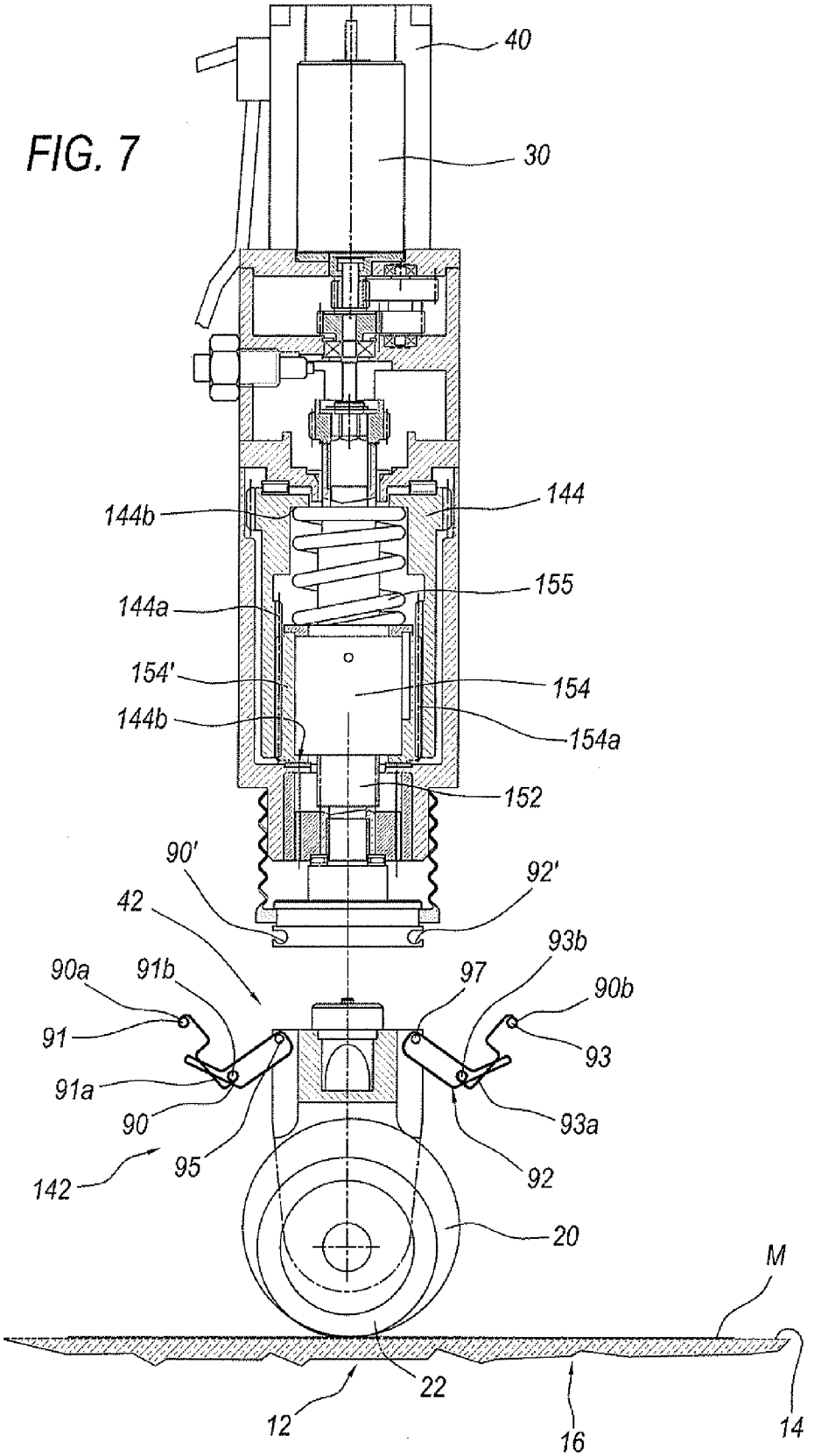
95
93b
142
20
M
22
12
16
14

FIG. 7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30
144b
144
155
144a
154'
154
144b
154a
152
90'
92'
42
93b
90a
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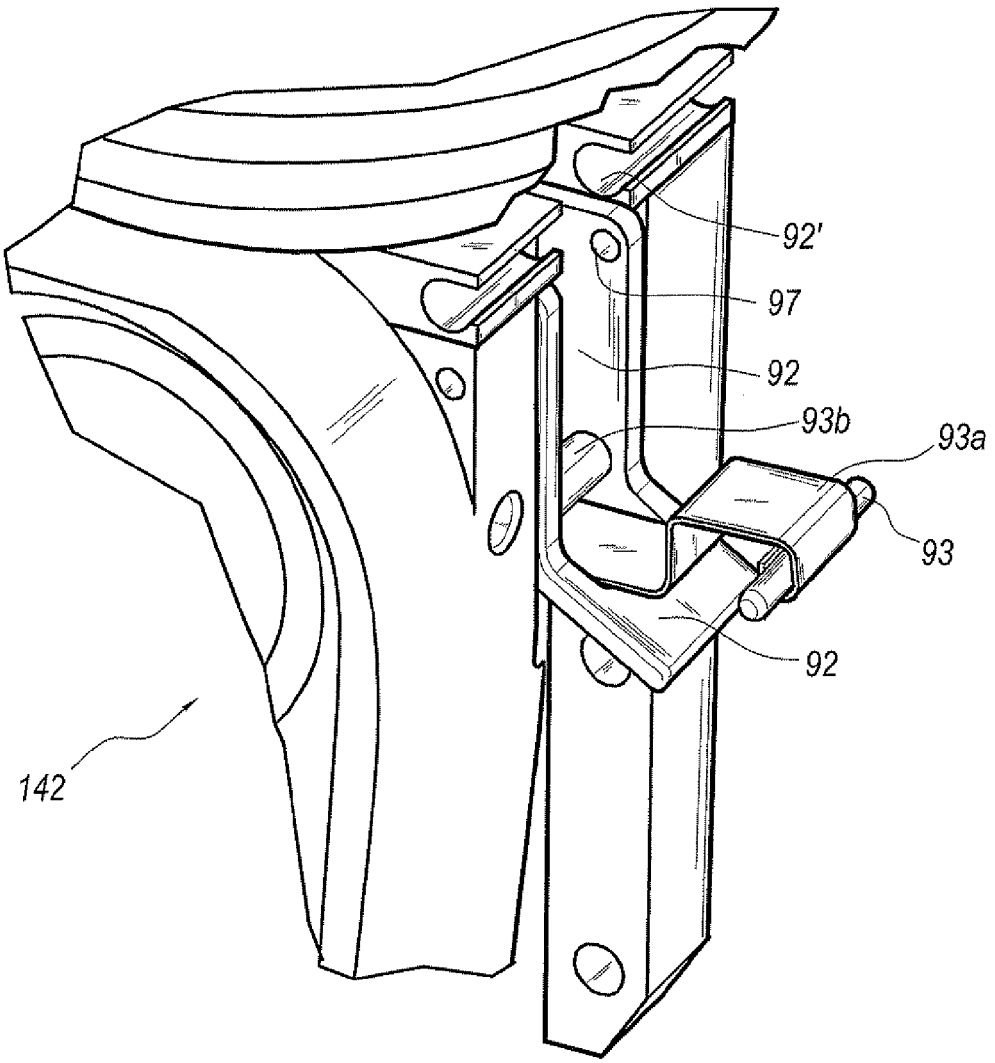
142
95
20
M
22
12
16
14

FIG. 8



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 0139941 A **[0022] [0022] [0065]**
- WO 03103907 A **[0022]**