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(54) Device for positioning and clamping shaped elements and machine equipped with this device

(57) Machine for processing insoles (2) of sandals and the like, comprising at least one fixed support frame (1), an assembly (10; 110) for positioning and clamping the insole (2), mounted on a table (20) movable in a plane (X,Y), an assembly (30) for supporting and positioning the tool (3) relative to the insole, an assembly (40) for actuating the tool (3), and means (1000;2000) for programming and controlling the cycle sequences of the machine.

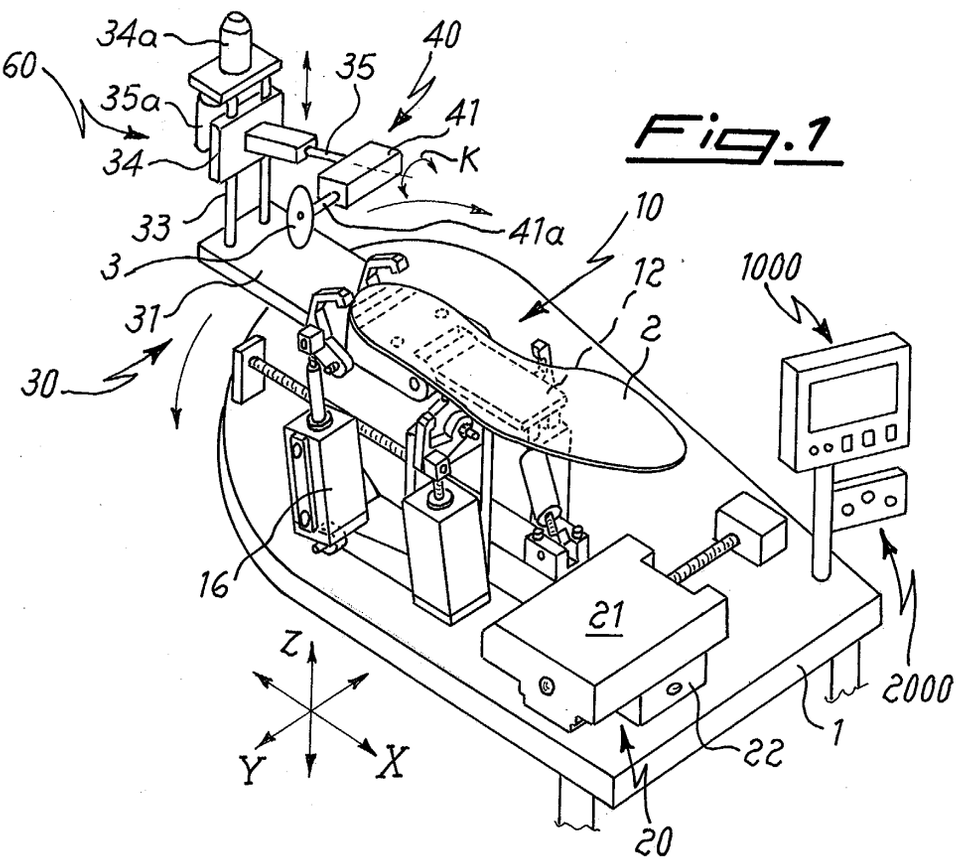

Fig.1

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Description

[0001] The present invention relates to a device for positioning and clamping shaped elements and a machine for processing said shaped elements such as insoles of sandals and the like.

[0002] It is known in the technical sector relating to the production of the inner sole or insole of shoes and in particular sandals that there is a need to carry out numerous successive processing operations on these insoles in order to form the seats for receiving the internal ends of the sandal closing straps, the reference marks for subsequent processing operations, flattening of predetermined zones corresponding, for example, to the position for insertion of the front band of the sandal, profiling of the perimetral edge, and removal of a thin layer of material from the bottom surface of the insole in order to ensure a greater adhesiveness of the glues for fastening the insole to the outer sole.

[0003] It is also known that these processing operations are performed in a substantially manual manner and are therefore subject to the defects associated with this form of processing: low level of repeatability, need for expert personnel, poor productivity and high percentage of rejects.

[0004] The technical problem which is posed therefore is that of providing a machine which is able to perform semiautomatically and automatically, all the processing operations required for correct preparation of an insole, in particular for sandals.

[0005] These results are obtained according to the present invention by a positioning and clamping device for shaped elements according to the characteristic features of Claim 18 and by a machine for processing shaped elements such as insoles of sandals and the like, which comprises at least one fixed support frame, an assembly for positioning and clamping the insole, mounted on a table movable in a plane, an assembly for supporting and positioning the tool relative to the insole, an assembly for actuating the tool, and means for programming and controlling the cycle sequences of the machine.

[0006] Further details may be obtained from the following description of a non-limiting example of embodiment of the subject of the present invention, provided with reference to the accompanying drawings, in which:

- Figure 1 shows a schematic, partially sectioned perspective view of the machine according to the present invention;
- Figure 2 shows a perspective view of the detail of the means for clamping the insole according to the present invention;
- Figure 3 shows a partially sectioned side view of the machine according to Fig. 1;
- Figure 4 shows a partially sectioned front view of the machine according to Fig. 1;
- Figure 5 shows a schematic view, from above, of the different positions and angles which the working tool may assume;
- Figure 6 shows a schematic view, from above, of a processed insole;
- Figure 7 shows a cross-section along the plane indicated by VII-VII in Fig. 6;
- Figure 8 shows a first example of embodiment by way of a variant of the machine according to Fig. 1;
- Figure 9 shows a schematic view, from above, of a second example of embodiment of the machine according to Fig. 1;
- Figure 10 shows a schematic and partial side view of the tool assembly of the machine according to Fig. 9;
- Figure 11 shows a schematic and partial side view of the insole clamping assembly of the machine according to Fig. 9; and
- Figure 12 shows a plan view of the centering and alignment means of the machine according to Fig. 9.

[0007] As shown in Fig. 1, the machine for processing insoles 1 according to the present invention comprises essentially:

- a fixed support frame 1 resting on the ground;
- an assembly 10 for positioning and clamping the insole 2, which assembly is mounted on:
- a table 20 comprising two horizontal surfaces 21,22 which are respectively movable in a first, longitudinal, direction (X) and a second, transverse, direction (Y) perpendicular to each other;
- an assembly 30 for moving the tool 3, essentially comprising a first arm 31 movable rotationally about an axis (W) perpendicular to the plane containing said table 20 and in turn carrying an essentially vertical column 33 forming the element for guiding:
- a slide 34 movable in both senses in a vertical direction (Z); said slide 34 having, joined thereto:
- a spindle 35 substantially perpendicular to said vertical axis (Z) and carrying the assembly 40 for rotational actuation of the tool 3;
- said spindle 35 also forming an axis (K) of rotation for said assembly 40 actuating the tool 3 in order to allow positioning of the latter in inclined directions with respect to the vertical direction (Z).

[0008] According to the invention it is envisaged moreover that the machine is equipped with means for controlling the working sequences, which may be formed by semi-automatic control devices 2000 or by a numerical control programmer 1000.

[0009] In greater detail and as illustrated in the figures:

- said surfaces 21, 22 of the table 20 may be moved by means of endless screws, conventional per se, actuated by respective motors connected to the

control devices 1000/2000 which apply interpolation methods able to allow positioning of the said surfaces in any point of a reference plane (X,Y);

- the surface 21 has, joined thereto, the assembly 10 for positioning and clamping the insole 2, which comprises (Fig. 2): a support 11 which is essentially U-shaped and fixed to a bracket 11a for joining to the said table 21; the arms of the U (for the sake of convenience of the description below a conventional front orientation corresponding to the front of the machine and rear orientation corresponding to the opposite side will be assumed) pivotably support, by means of an axis of rotation 12a, a projecting member 12 extending in a substantially longitudinal direction (X-X) and movable rotationally about said pin 12a upon operation of associated actuating means which are illustrated in the figure as a cylinder 12b.

[0010] Fig. 11 shows an alternative embodiment of the projecting member 112 which is formed by means of elements 112c which are hinged together on pins 112a in a similar manner to the links of a chain; in this way the projecting member 112 allows a shaped support surface to be provided with a profile corresponding to that of the insole, improving the processing stability and precision.

[0011] A preferred embodiment also envisages the presence of a sensor 18 able to detect the inclination of the projecting member 12 and send a corresponding signal to the programming and control means which may store the data for possible re-use of the model subsequently and supply it to the angle adjusting cylinder 12b which may position the projecting member at the correct angle programmed for a specific model.

[0012] The fixed surface 11 and the pivoted projecting member 12 form the support surface for the insole 2 which may thus be arranged with its rear part (corresponding to the heel) substantially flat, resting on the surface 11 and with its front part (tip), which is usually inclined, resting on the free end of the suitably inclined projecting member 12, thus being stably supported.

[0013] In order to facilitate positioning of the insole 2 on the support 11, rear locating elements 13a are preferably envisaged, being substantially parallel to the transverse direction Y-Y, together with lateral locating elements 13b, which are substantially parallel to the longitudinal direction X-X.

[0014] As illustrated in Fig. 11 and 12 and for the purposes of ensuring alignment of the longitudinal axis of the insole 2 in a direction parallel to the longitudinal axis X-X of the machine, it is envisaged that rear locating means are associated with the support 11, said means consisting of pins 113a which can be displaced by means of a microcylinder 113c in a direction parallel to the vertical direction Z-Z from a position projecting from the support 11 for contact with the insole 2, into a concealed position within the thickness of the support 11 and therefore able to allow operation of the clamping means 14 without interference.

[0015] Said alignment means are completed by a further front pin 113b in turn actuated by a microcylinder 180 in turn integral with the surface 21 of the table 20; in this way said front pin is able to come into contact with the tip of the insole 2 so as to bring the latter into parallel alignment with the longitudinal axis X-X of the machine.

[0016] The microcylinder 180 is furthermore integral with actuating means 181 for performing displacement, by means of a screw in the example illustrated, in a direction parallel to the longitudinal axis X-X so as to allow positioning thereof in relation to the greater/shorter length of the insole.

[0017] The positioning assembly 10 also comprises means for clamping the insole, consisting of a plurality of lever arms 14, the fulcrum of which consists of a fixed pin 14a integral with the surface 11 and the power point of which is formed by a second pin 15b integral with the free end of the rod 16a of a cylinder 16 actuated by the control means 1000/2000.

[0018] In this way the free end of the clamping arm 14 is able to move from an anti-clockwise rotated - opening - position, which allows positioning of the insole 2, into a clockwise rotated - clamping - position, which allows the arrangement in position of the insole.

[0019] The said clamping elements 14 are entirely independent of each other so as to allow varied opening/closing thereof.

[0020] The rotating arm 31 of the positioning assembly 30 extends (Figs. 1,3) in a substantially longitudinal direction towards the rear part of the machine and has one end constrained to a substantially vertical axis of rotation (W) formed by the shaft 32a of an actuating motor 32 controlled by the control devices 1000/2000.

[0021] The said column 33 is integrally joined to the opposite end of the arm 31 and carries the slide 34 supporting the tool assembly 40 which comprises:

- a support 35 extending in a direction substantially parallel to the longitudinal axis X-X and carrying the assembly 40 consisting of a motor 41 with associated tool actuating shaft 41a, since the support 35 also forms an axis of rotation (K) about which the assembly 40 can rotate, being moved by an associated motor 35a, the tool 3 being able to be arranged at different angles of inclination with respect to the axis (Z) perpendicular to the insole 2.

[0022] The slide 34 is moved along the axis Z by an associated motor 34a.

[0023] According to a preferred embodiment it is envisaged that the tool movement assembly 30 also supports a device 60 for supplying a marker fluid, for example ink or the like, able to indicate the reference lines 2f on the insole 2.

[0024] In greater detail (Fig. 8), said supplying device 60 comprises a supplying element 61 mounted on a cor-

responding arm 62 integral with corresponding means 63 for adjusting its position along the axes Z and Y, in turn joined to the assembly 40 of the tool 3.

[0025] The operating principle of the machine is as follows:

- a template corresponding to the final form of the insole of smallest size in a homogeneous series is prepared;
- a sequence of movements of the tool is performed by starting a program which can be self-memorised by the machine which, detecting the different values, is set so as to perform subsequently the processing operations envisaged;
- the operation is repeated with a template corresponding to the final form of the insole of largest size in the same series;
- at this point the machine is able to manage the entire production of the insoles of an intermediate size between the smallest and largest size and is set for operation;
- an insole 2 is positioned in the positioning assembly 10 and once correct centering has been achieved the clamping means 14 are activated;
- the working sequence is activated and, under the control of the program which adjusts the various control axes, positions the tool in the various working positions in order to perform incisions 2b (Fig. 6,7) or flattened areas 2c or profiling 2d of the perimetral edge of the insole 2;
- the insole will be positioned so as to obtain supplying of the marker fluid in order to mark on the insole the references 2f necessary for the subsequent operations.

[0026] Although described in connection with a totally automatic cycle, it is envisaged that the working sequence may also be performed in a semi-automatic manner, allowing a greater degree of interaction between machine and operator.

[0027] According to preferred embodiments, it is envisaged also that the assembly 110 for clamping the insole 2 consists of one or more magnetic elements 111 which are of the permanent type or can be activated/deactivated by the control system 1000/2000 and are able to interact with corresponding metal elements 2g inserted in the insole 2.

[0028] According to a further embodiment (Fig. 8), it is envisaged that the machine is equipped with insole centering means 70 comprising a source for emission of a light ray able to be projected in a direction substantially parallel to the axis Z on the insole 2 in order to allow collimation with corresponding reference points 2i marked on the insole.

[0029] A similar centering element 170 may be envisaged in association with the tool 3 as illustrated.

[0030] As illustrated in Figs. 9 and 10, the arm 35 has, integral therewith, two optical projectors 200 arranged on opposite sides of the tool 3 and in a position such as to cause the associated light beam to coincide with the end (in the case of the figure with the tangent) of the cutting tool 3 itself; these projectors 200 allow the operator to simulate, during the self-memorisation stage, the real measurement of the milling operation to be performed subsequently by means of the tool.

[0031] In a preferred embodiment (Fig. 10) it is envisaged moreover that the milling cutter 3 has, arranged alongside it, feelers 300 which have the function of detecting the height in the direction Z-Z of the zone where milling is to be performed; in this way it is possible, for each operation, to detect and program the actual zero height from where the actual depth of milling performed by the tool 3 will be measured.

[0032] In greater detail and in the example of mechanical embodiment in Fig. 10, said feelers are supported by a frame comprising two columns 310 movable in the direction Z-Z with respect to the tool support arm 35 and connected transversely by a cross-piece 311 acted on by a downwardly pushing spring 312 and a cylinder 313 able to raise the feelers at the end of detection in order to move them outside the dimensions of the milling cutter.

[0033] Although illustrated and described in mechanical form, it is envisaged that the feelers may also be of the optical or similar type.

[0034] It is therefore obvious how the machine according to the invention enables all the operations which are currently performed manually to be carried out in a highly reliable and repetitive manner, with obvious advantages in terms of low cost, reliability and productivity.

Claims

1. Machine for processing shaped elements such as insoles (2) of sandals and the like, **characterized in that** it comprises at least:

   - a fixed support frame (1),
   - an assembly (10;110) for positioning and clamping the insole (2), mounted on a table (20) movable in a plane (X, Y) ,
   - an assembly (30) for supporting and positioning the tool (3) relative to the insole,

   an assembly (40) for actuating the tool (3),
   means (1000;2000) for programming and controlling the cycle sequences of the machine.

2. Machine according to Claim 1, **characterized in that** said table (20) is formed by two horizontal surfaces (21,22) respectively movable in a first, longitudinal, direction (X) and a second, transverse, direction (Y) perpendicular to each other.

3. Machine according to Claim 1, **characterized in**

that said assembly (10) for positioning and clamping the insole (2) comprises a substantially U-shaped support (11) fixed to a bracket (11a) for joining to the said table (21).

4. Machine according to Claim 3, **characterized in that** the arms of the "U" of the support (11) pivotably supports, by means of an axis of rotation (12a; 112a), a projecting member (12;112) extending in a substantially longitudinal direction (X-X) and movable rotationally about said axis (12a;122a).

5. Machine according to Claim 4, **characterized in that** said projecting member (112) comprises a plurality of elements (112c) hinged together about transverse pins (112a).

6. Machine according to Claim 4, **characterized in that** said projecting member (12;112) is movable rotationally upon operation of associated actuating means (12b).

7. Machine according to Claim 1, **characterized in that** said assembly (10) for positioning the insole (2) comprises rear locating elements (13a;113a) substantially parallel to the transverse direction (Y-Y).

8. Machine according to Claim 7, **characterized in that** said rear locating means associated with the support (11) consist of pins (113a) which can be displaced by means of actuator means (113c) in a direction parallel to the vertical direction (Z-Z) from a position projecting from the support (11) where they interfere with the insole (2) to a concealed non-interfering position.

9. Machine according to Claim 7, **characterized in that** it comprises front alignment means consisting of a front pin (113b) displaced by an associated actuator (180) in a direction parallel to the vertical direction (Z-Z) from an extracted position interfering with the tip of the insole (2) to a retracted position where it does not interfere therewith.

10. Machine according to Claim 9, **characterized in that** said actuator means (180) are associated with means (181) for displacement in a direction parallel to the longitudinal axis (X-X).

11. Machine according to Claim 1, **characterized in that** said assembly (10) for positioning the insole (2) comprises lateral locating elements (13b) substantially parallel to the longitudinal direction (X-X).

12. Machine according to Claim 1, **characterized in that** said means (10) for clamping the insole (2) consist of a plurality of lever arms (14), the fulcrum of which consist of a fixed pin (14a) integral with the surface (11) and the power point of which consists of a second pin (15b) integral with the free end of associated actuating means (16).

13. Machine according to Claim 12, **characterized in that** said means (16) for actuating the clamping means (14) consist of a rod (16a) of a controlled cylinder (16).

14. Machine according to Claim 12, **characterized in that** said assembly (110) for clamping the insole (2) comprises one or more magnetic elements (111) able to interact with corresponding metal elements (2g) inserted in the insole (2).

15. Machine according to Claim 1, **characterized in that** said assembly (30) for positioning the tool (3) comprises a first arm (3) movable rotationally about an axis (W) perpendicular to the plane containing said table (20) and in turn supporting a substantially vertical column (33) forming the element for guiding a slide (34) movable in both senses in the vertical direction (Z), a support (35) substantially perpendicular to said vertical axis (Z) and carrying said assembly (40) for actuating the tool (3) being joined to said slide (34).

16. Machine according to Claim 15, **characterized in that** the said support (35) also forms an axis (K) of rotation for said assembly (40) actuating the tool (3), able to allow positioning of the latter in directions inclined with respect to the vertical direction (Z).

17. Machine according to Claim 1, **characterized in that** it comprises means (70) for centering the insole (2), comprising a source for emission of a light ray able to be projected onto the insole (2) in a direction substantially parallel to the axis (Z).

18. Machine according to Claim 1, **characterized in that** it comprises means (170) for centering the tool (3), comprising a source for emission of a light ray able to be projected onto the insole (2) in a direction substantially parallel to the axis (Z).

19. Machine according to Claim 1, **characterized in that** it comprises a device (60) for supplying a marker fluid, able to mark reference lines (2f) on the insole (2).

20. Machine according to Claim 19, **characterized in that** said supplying device comprises a supplying element (61) mounted on a corresponding arm (62) integral with means (63) for adjusting its position, in turn joined to the tool actuating assembly (40).

21. Machine according to Claim 1, **characterized in**

that it comprises means (200) able to simulate, during the self-memorisation stage, the real measurement of the milling operation to be performed.

22. Machine according to Claim 21, **characterized in that** said simulation means comprise at least two optical projectors (200) arranged parallel to the vertical direction (Z-Z) on opposite sides with respect to the tool (3) and in a position such as to cause the associated light beam to coincide with the edge of the said tool (3).

23. Machine according to Claim 1, **characterized in that** it comprises means (300) for detecting the actual depth of the milling operation performed by the tool (3).

24. Machine according to Claim 23, **characterized in that** said detection means (300) are of the optical type.

25. Machine according to Claim 23, **characterized in that** said detection means (300) are of the mechanical type.

26. Machine according to Claim 25, **characterized in that** said detection means (300) consist of a pair of feelers (300) supported by a frame (310,311,312) movable parallel to the vertical direction (Z-Z) upon actuation of associated actuators (312,313).

27. Device for positioning and clamping shaped elements such as an insole (2), **characterized in that** it comprises a substantially U-shaped support (11) extending in a longitudinal direction (X-X) parallel to that of the shaped element and fixed to a bracket (11a) for joining to a movable table (21).

28. Device according to Claim 27, **characterized in that** the arms of the "U" of the support (11) pivotably support between them, by means of a transverse axis of rotation (12a;112a), a projecting member (12;112) extending in a substantially longitudinal direction (X-X) and movable rotationally about said axis (12a;112a).

29. Device according to Claim 28, **characterized in that** said projecting member (112) comprises a plurality of elements (112c) hinged together about transverse pins (112a) in the form of chain links.

30. Device according to Claim 28, **characterized in that** said projecting member (12) is movable rotationally upon operation of associated actuating means (12b).

31. Device according to Claim 27, **characterized in that** it comprises rear locating elements (13a;113a) substantially parallel to the transverse direction (Y-Y).

32. Device according to Claim 27, **characterized in that** it comprises lateral locating elements (13b) substantially parallel to the longitudinal direction (X-X).

33. Device according to Claim 31, **characterized in that** said rear locating means associated with the support (11) consist of pins (113a) which can be displaced by means of actuator means (113c) in a direction parallel to the vertical direction (Z-Z) from a position projecting from the support (11) where they interfere with the insole (2) to a concealed non-interfering position.

34. Device according to Claim 27, **characterized in that** it comprises front alignment means consisting of a front pin (113b) displaced by an associated actuator (180) in a direction parallel to the vertical direction (Z-Z) from an extracted position where it interferes with the tip of the insole (2) to a retracted position where it does not interfere with the said tip.

35. Device according to Claim 34, **characterized in that** said actuator means (180) are associated with actuating means (181) for displacement in a direction parallel to the longitudinal axis (X-X).

36. Device according to Claim 27, **characterized in that** said clamping means consist of a plurality of lever arms (14), the fulcrum of which consists of a fixed pin (14a) integral with the surface (11) and the power point of which consists of a second pin (15b) integral with the free end of associated actuating means (16).

37. Device according to Claim 36, **characterized in that** said means (16) for actuating the clamping devices (14) consist of the rod (16a) of a controlled cylinder (16) .

38. Device according to Claim 27, **characterized in that** it comprises one or more magnetic elements (111) able to interact with corresponding metal elements (2g) inserted in the shaped element (2).

39. Device according to Claim 27, **characterized in that** it comprises a sensor (18) able to detect the angle of inclination of the projecting member (12) and send a corresponding signal to the programming and control means.

40. Device according to Claim 39, **characterized in that** the angle adjusting means (12b) are controlled by the said angle sensor (18).

41. Device according to Claim 27, **characterized in that** said shaped element is an insole (2) of sandals and the like.

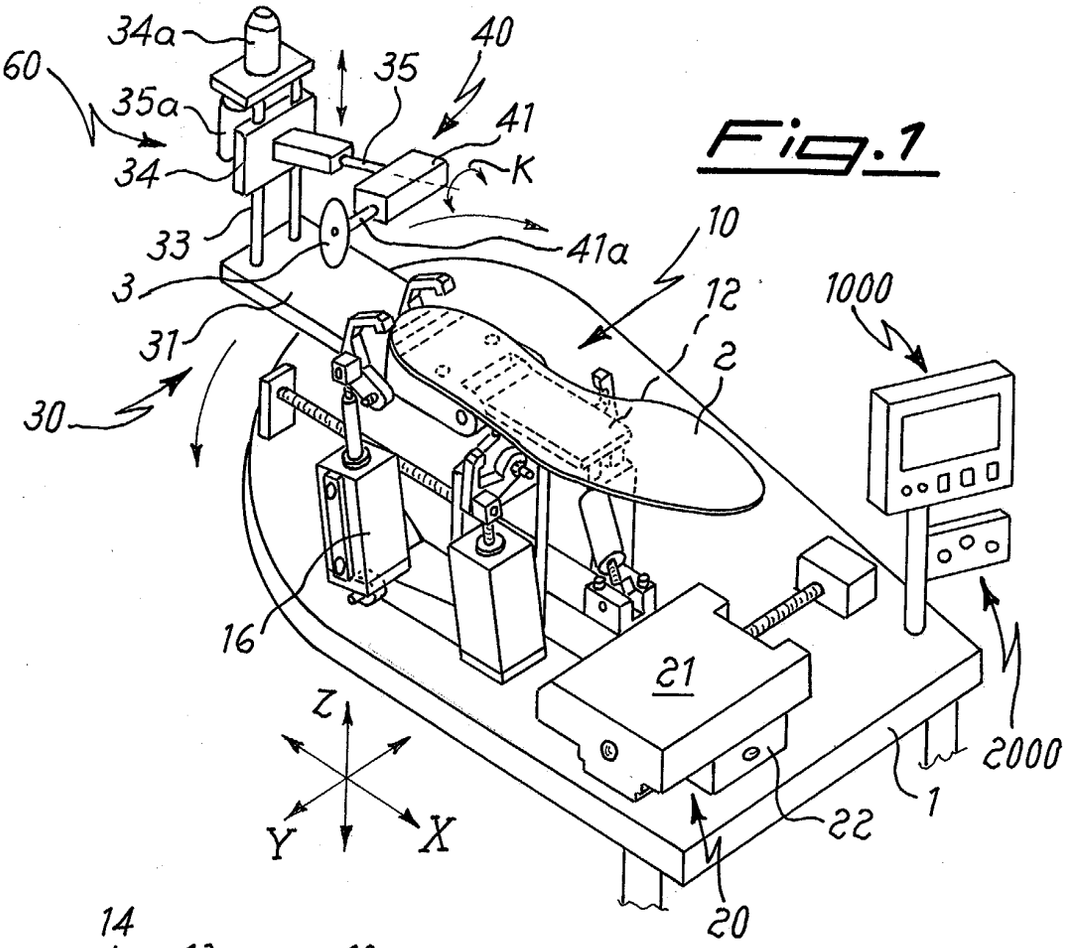
34a
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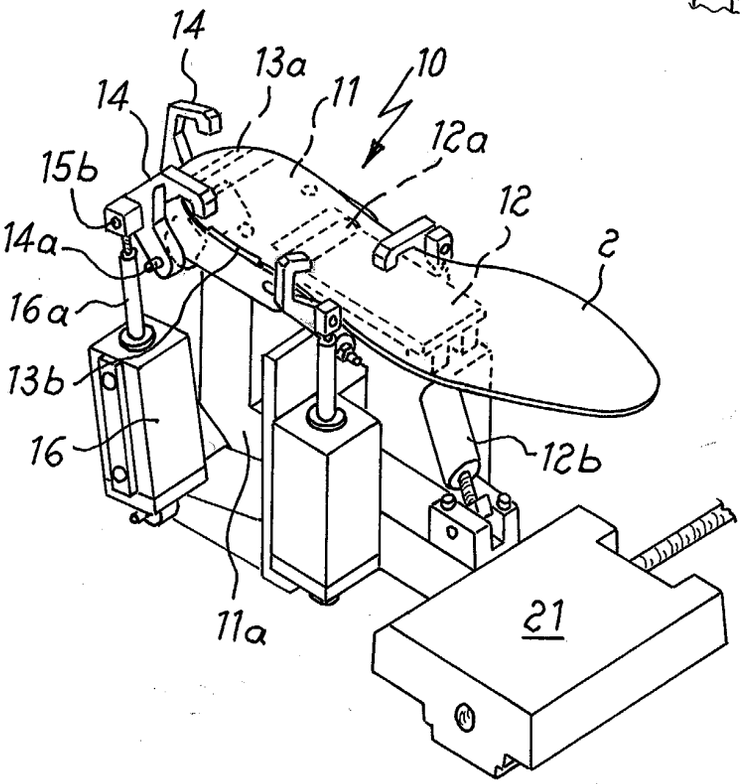
Fig.1


14
13a
14
11
10
12a
15b
12
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2
16a
13b
16
12b
11a
21

Fig.2

Fig.3

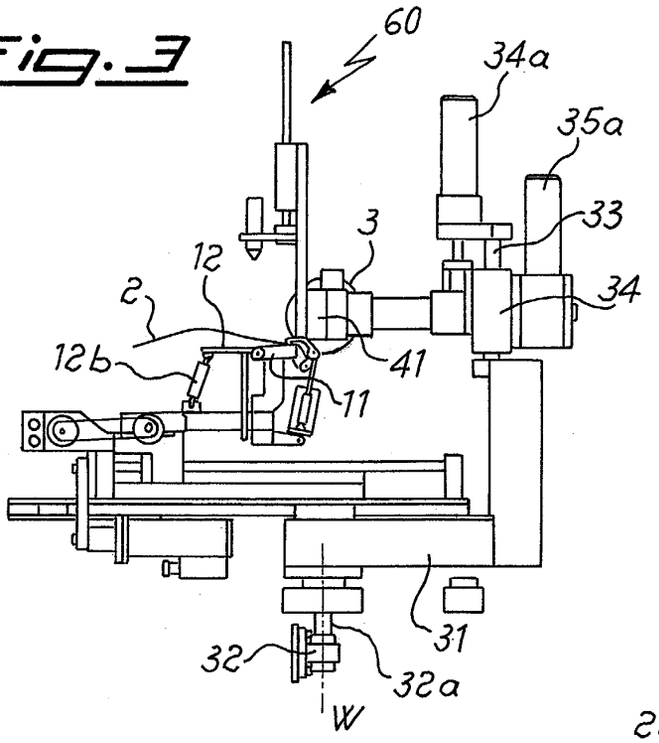


Fig.4

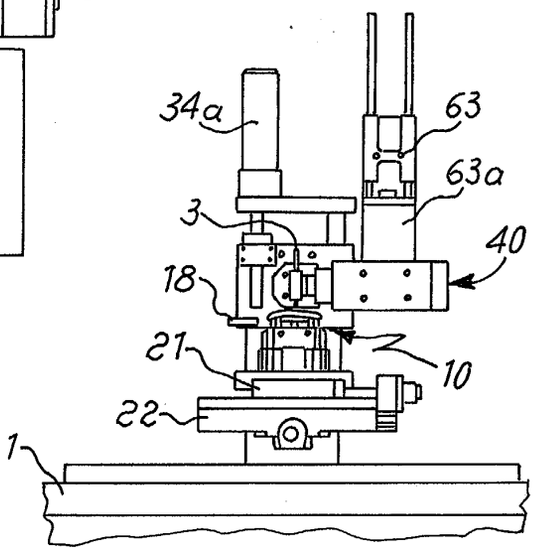


Fig.5

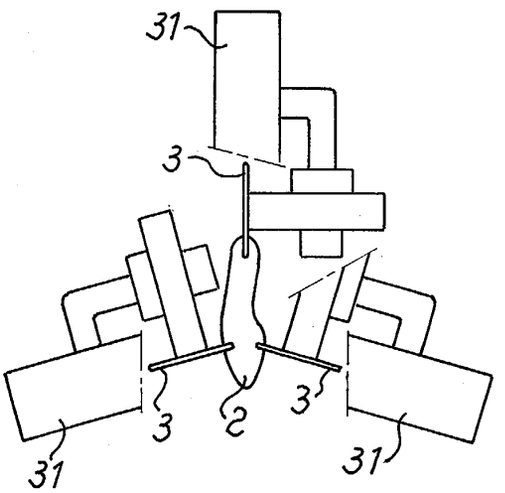


Fig.6

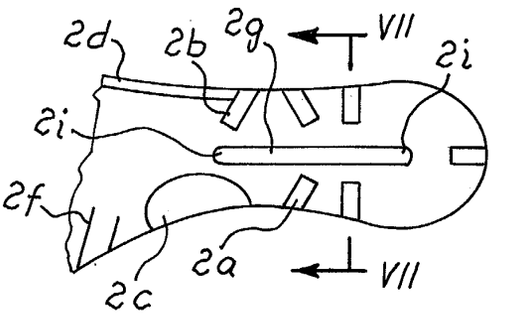


Fig.7

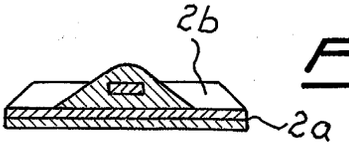


Fig.8

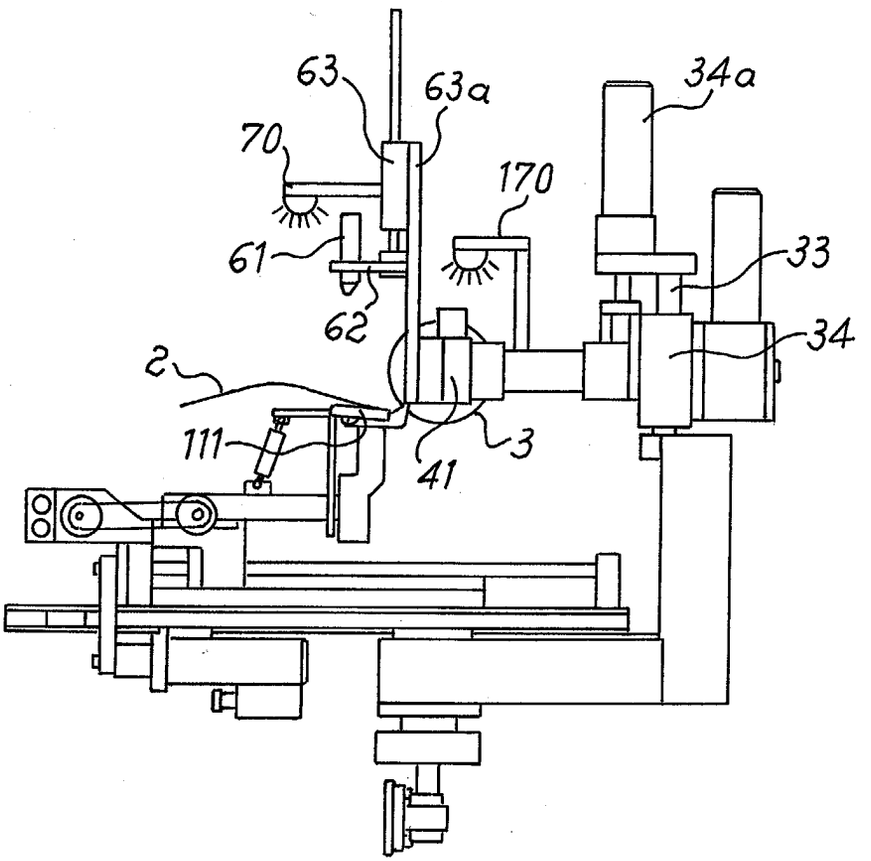
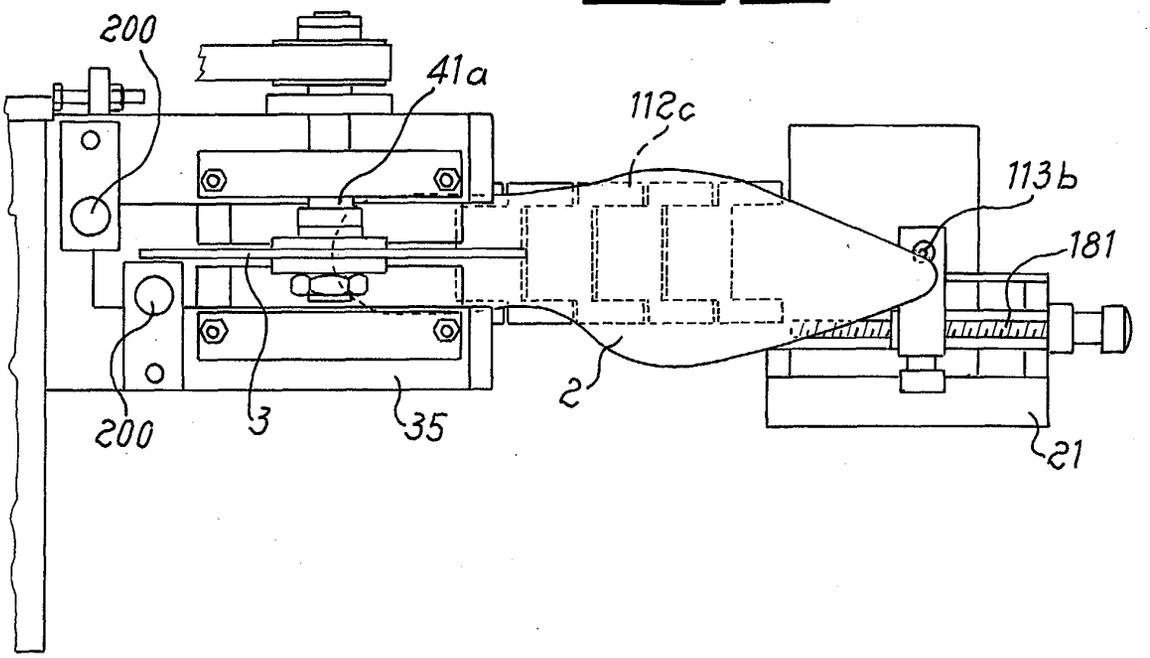


Fig.9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113b
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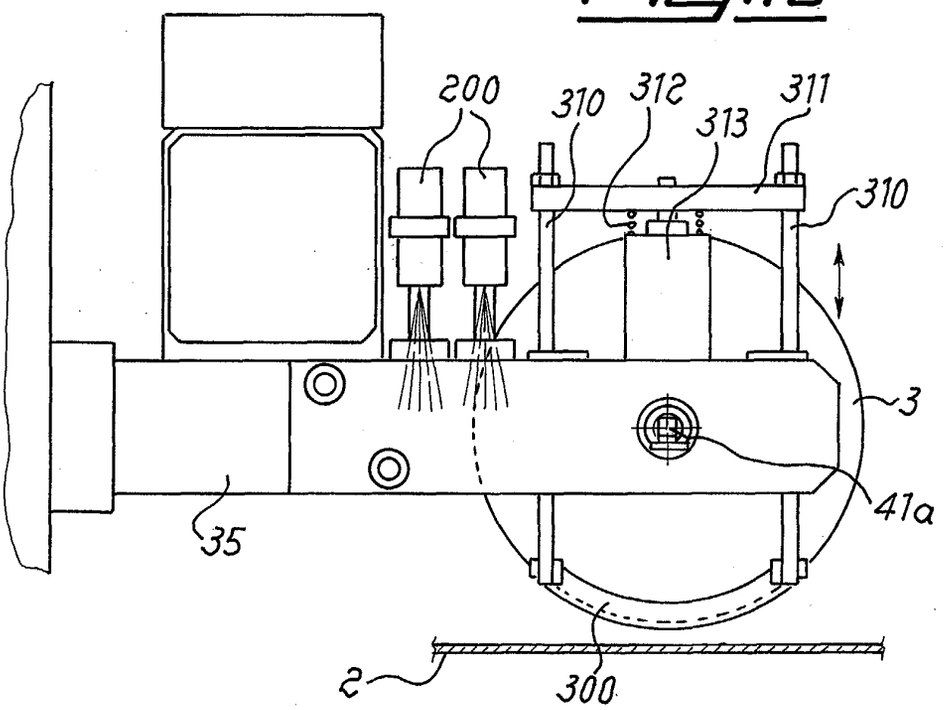
Fig.10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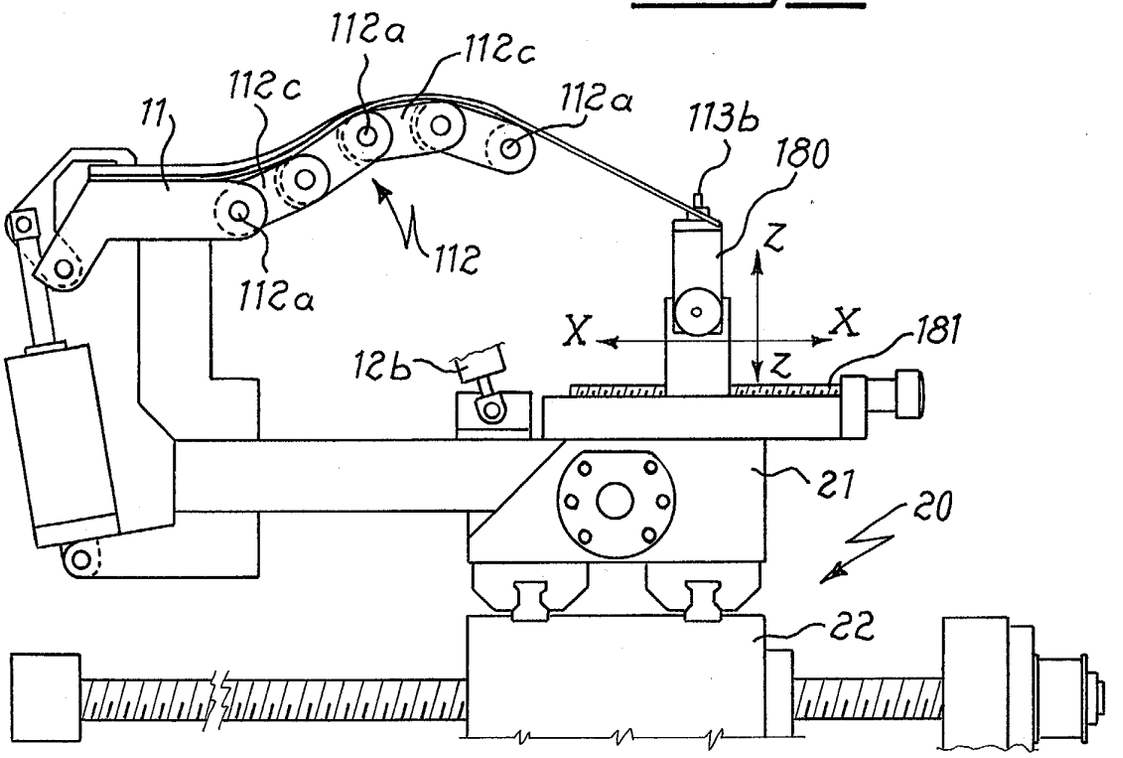
310
312
313
311
310
3
41a
35
2
300

Fig.11


112a
112c
112c
11
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113b
180
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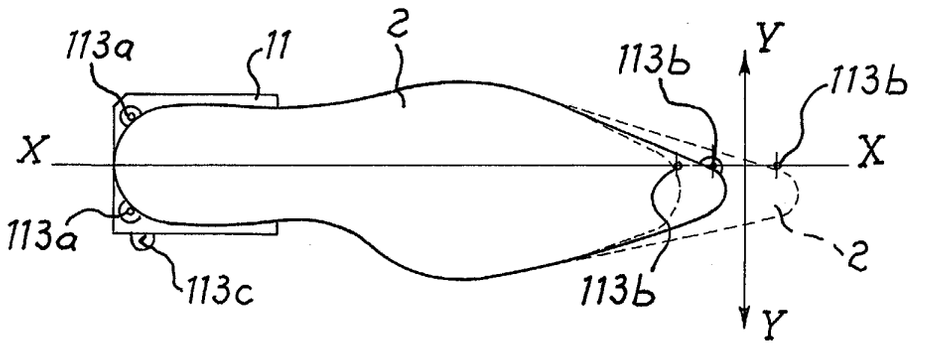
112a
Z
X
X
181
12b
Z
21
20
22

Fig.12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11
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113b
Y
113b
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113c
113b
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European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 03 07 8546

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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A	GB 477 995 A (BRITISH UNITED SHOE MACHINERY; WILLIAM NEIL BRAY) 7 January 1938 (1938-01-07) * claims 1,2; figures *	1	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	8 March 2004	Claudel, B

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
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L : document cited for other reasons

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 03 07 8546

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