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(54) **Machine and method of producing accessories for the shoe industry**

(57) A machine (1) for producing accessories, in particular prototypes for the shoe industry;

the machine being characterized by having:

- rotary means (11) for gripping a blank (4); and
- means (3, 5) for selectively translating the blank (4) and a rotary tool (6) along three coordinate axes (X, Y, Z) perpendicular to one another, and for selectively rotating the blank (4) about a first vertical axis (C₁) and the rotary tool (6) about a second vertical axis (C₂);

the present invention also relating to a method of producing an accessory, in particular a prototype, from a blank.

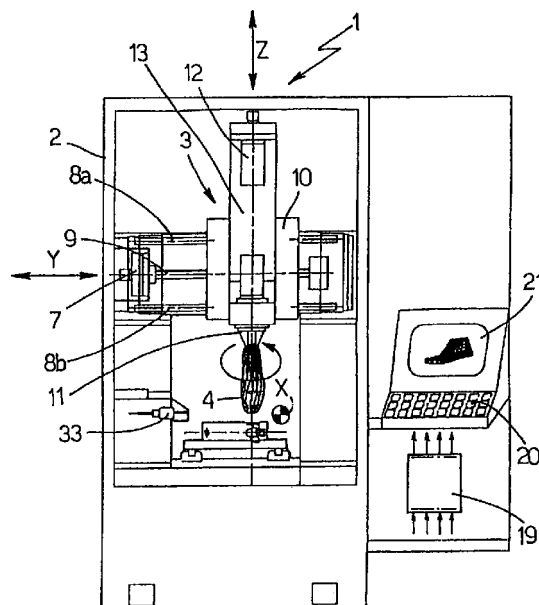


Fig.2

EP 0 990 399 A2

Description

[0001] The present invention relates to a machine for producing accessories for the shoe industry.

[0002] Purely by way of example, the following description refers to the making of prototypes from which to produce models at model shops, from which in turn to produce shoes at the actual shoe factory.

[0003] The machine according to the present invention is designed to meet the requirements of model shops and shoe factories as regards the construction of prototype models of shoes for eventual mass production.

[0004] A well known problem in the shoe industry, in fact, is the making of prototypes of models from which shoes are manufactured at the actual production stage.

[0005] The prototype stage represents a weak link in the chain between the designer - who, as is known, conceives the original shoe design - and actual mass production of the shoe at the factory. The current practice, in fact, commences with preliminary drawings - possibly made by the designer with the aid of a CAD station - which are followed by a prototype made by hand by a modelmaker from a blank, normally of wood. As such, any and invariably continual alterations made by the designer to the initial prototype of the design must be made by hand by the modelmaker, thus resulting in considerable loss of time.

[0006] Considerable advantage is therefore to be gained, both by designers and modelmakers, from a machine which is easy to use and which provides for producing, in a three-dimensional prototype and in the space of only a few minutes, what has so far only been possible in the form of graphic representation. The machine according to the present invention enables the designer - possibly assisted by skilled personnel - to produce a number of prototypes from which to produce trial shoes and so actually visualize the original abstract idea.

[0007] In Italy, such prototypes are normally made to size N°37 for women's shoes and N°42 for men's.

[0008] Once a final prototype is achieved which simultaneously meets the aesthetic requirements of the designer, the anatomical requirements of the wearer, and the technical and economic requirements of the maker, the electronic file containing the selected shoe design may be used by the modelmaker to clone the models from which to produce the shoe at the factory.

[0009] The models will of course be produced at the model shop in the full range of sizes required for that particular design.

[0010] The electronic file may also be transmitted electronically to the model shop (via modem, Internet, etc.).

[0011] The machine according to the present invention also provides for producing prototypes with fully finished toes and heels, thus eliminating subsequent finish processing to remove any undesired extra thickness

which would remain if the blank were to be gripped by a gripping device acting on these two portions of the blank.

[0012] The machine according to the present invention, in fact, employs a gripping system involving only the upper reference surface of the blank.

[0013] The blank gripping system, the particular arrangement of the rotary tool, and the number of work axes along which the rotary tool and the blank travel provide for obtaining a prototype in one single machining cycle with no intervention on the part of the operator, who simply enters input data electronically from a keyboard.

[0014] The present invention consists in a novel combination of the relative movements of the blank and a toroidal rotary tool. A further novel characteristic lies in the particular way in which the blank is gripped.

[0015] Moreover, using a toroidal rotary tool enables fairly high cutting speeds (around $V_t=25$ mt/sec) with a rotation speed of 8000 rpm, thus enabling a finished prototype to be obtained fairly rapidly (15-20 minutes) from a pressed blank, i.e. of much larger overall size than the finished prototype. Using a traditional cutter, on the other hand, the cutting speed would not be sufficient to reduce machining time to the same extent.

[0016] Moreover, the machine according to the present invention, and in-particular the toroidal rotary tool, provides for obtaining prototypes with an acceptable surface finish. This is extremely important in view of the fact that it is this surface which eventually supports the leather from which the specimen shoe is made. Processing of the leather is therefore obviously improved by a higher degree of surface finish of the prototype model.

[0017] In addition to the rotary tool head, the machine is also equipped with a measuring tracer, which is used to:

- (a) digitize the initial blank to automatically determine a series of machining cycles by which to obtain the desired prototype;
- (b) possibly real-time control the shape of the blank in the course of the various machining stages;
- (c) digitize the finished prototype.

[0018] The latter possibility is particularly interesting by enabling the modelmaker, once the work on the machine according to the present invention is completed, to make any finishing touches by hand to the prototype; the prototype may then be set up again on the machine to determine the final form using the measuring tracer; and the final form may be converted into an electronic file for transmission, for example, via Internet to the model shop for use in producing the models.

[0019] The machine according to the present invention is controlled by an electronic computer, which, besides controlling the movements of the blank and rotary tool along the work axes, also has a powerful

integrated CAM.

[0020] The electronic computer:

- calculates, from a CAD system file, the linear path of the rotary prototype machining tool;
- controls the prototype measuring cycle and automatically generates characteristic measurements in conformance with UNI standards;
- digitizes the prototype, including the toe and heel, and possibly transmits the digitized data back to the CAD system and/or to the modelmaking machines at the model shop; and
- perfects the work cycle by adjusting the relative movements of the blank/rotary tool.

[0021] The blank gripping system, the particular arrangement of the rotary tool, and the number of work axes along which the rotary tool and the blank travel make for a machine differing totally from the profiling machines traditionally used for making shoemaker's models.

[0022] The machine according to the present invention is a combined lathe-milling machine by simultaneously providing for moving the blank to and from a rotary tool - typical of a turning operation - and moving the rotary tool to and from the blank - typical of a milling operation.

[0023] According to the present invention, there is provided a machine for producing accessories for the shoe industry;

the machine being characterized by comprising:

- means for gripping a blank; and
- means for selectively translating the blank and a rotary tool along three coordinate axes perpendicular to one another, and for selectively rotating the blank about a first vertical axis, and the rotary tool about a second vertical axis.

[0024] According to the present invention, there is also provided a method of producing accessories for the shoe industry; the method being characterized by comprising the steps of:

- gripping a blank at an upper reference surface of the blank;
- translating the blank along a first and a second coordinate axis perpendicular to each other, and rotating the blank about a third vertical axis; and
- translating a rotary tool along a fourth axis perpendicular to the first and second axis; the rotary tool shaping the blank to produce the accessory.

[0025] A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a first overall view of the machine according to the present invention;

Figure 2 shows a second overall view of the Figure 1 machine;

Figure 3 shows in more detail the way in which the blank, from which the finished prototype is obtained, is gripped on the Figure 1 and 2 machine; Figures 4a, 4b show two sections of the rotary tool used on the Figure 1 and 2 machine.

[0026] As shown in Figures 1 and 2, the machine 1 according to the present invention comprises a substantially parallelepipedal casing 2 housing most of the devices described in detail below.

[0027] In Figures 1 and 2, number 3 indicates an actuating device for moving a blank 4, e.g. a pressed blank, and 5 indicates a tool table for moving a tool 6 along an axis X.

[0028] By means of actuating device 3 - which comprises a motor 7, two horizontal guides 8a, 8b, and a recirculating-ball screw 9 - a carriage 10 is moved along an axis Y defining a direction perpendicular to that of the X axis, but not lying in the same plane as X axis. Carriage 10 is obviously moved along axis Y in conventional manner by recirculating-ball screw 9 being rotated by motor 7 and engaging a nut screw (not shown) inside carriage 10.

[0029] Actuating device 3 also comprises a motor reducer 12 which, by means of a conventional transmission system (not shown), provides for translating along an axis Z a carriage 13 fitted with rotary gripping means 11 for gripping blank 4.

[0030] Rotary gripping means 11 will be described in detail later on, with reference in particular to Figure 3.

[0031] The Z axis defines a direction perpendicular to those of the X and Y axes, but does not lie in the same plane as either of X and Y axes.

[0032] Rotary gripping means 11 may also be acted on in conventional manner by a motor reducer 14 (Figure 1) carried by carriage 13 and by which gripping means 11, and hence blank 4, are rotated about a vertical axis of rotation C_1 normally differing from the vertical Z axis.

[0033] That is, rotary gripping means 11 for gripping blank 4 may be translated by motor 7 along the Y axis and by motor 12 along the Z axis, and may be rotated about axis C_1 by motor reducer 14.

[0034] Tool table 5 may be translated, as stated, along the X axis by means of a motor 15, which rotates a worm 16 engaging a lead nut 17 integral with tool table 5, which obviously slides along two horizontal guides (not shown); and rotary tool 6 is rotated, as explained in detail later on with particular reference to Figure 4, about a vertical axis C_2 by a motor 18 fitted to tool table 5.

[0035] Blank 4 is therefore cut to produce the finished prototype by the combined relative movements of blank 4 itself and rotary tool 6. As stated, blank 4 may be

moved along the Y and Z axes and rotated about axis C_1 , while rotary tool 6 may translate along the X axis and rotate about axis C_2 . Being relative movements, rotary tool 6 may obviously, at least in theory, be assigned certain movements which, in the Figure 1 and 2 embodiment, are assigned to blank 4.

[0036] The translatory movements along the X, Y and Z axes, rotation of blank 4 about axis C_1 , and rotation of rotary tool 6 about axis C_2 enable the whole of blank 4 to be machined, including the toe 4b and heel 4c (Figure 3), thus eliminating the high-cost finishing operation to remove any extra material left on the toe and heel portions of the prototype. Moreover, as stated, using a preferably toroidal rotary tool 6 with high cutting speeds, a finished prototype can be obtained from blank 4 in the space of 15-20 minutes; and combining such a rotary tool 6 with an adequate number of passes provides for obtaining prototypes ensuring satisfactory shaping of the specimen shoe.

[0037] All the operations, the movements along the X, Y, Z axes, rotation about axes C_1 , C_2 , the number of passes, etc. are controlled by a dedicated CAM derived from a CAD file and housed in an electronic central control unit 19 operator-controlled by a keyboard 20 and video 21.

[0038] Figure 3 shows the rotary gripping means 11 for gripping blank 4, and which also constitute an innovation in the field of prototype construction.

[0039] To begin with, the operator makes in blank 4 at least two through holes 4d, the axes of which are substantially parallel to the upper reference surface 4a of blank 4, and through which are inserted two corresponding bushes 22 having threaded transverse through holes 22a in which are screwed two corresponding screw connecting members 23 for locking a plate 11a onto upper reference surface 4a of blank 4. The head 23a of each connecting member 23 is insertable bayonet-fashion inside a respective seat 11b in which respective pneumatic lock means 11c operate to make blank 4 integral with a support 11d of rotary gripping means 11.

[0040] As shown, in particular in Figure 3, rotary gripping means 11 maintain upper reference surface 4a tilted at an angle α of 30° with respect to axis C_1 .

[0041] With reference also to Figures 4a, 4b, rotary tool 6 integral with tool table 5 is rotated by motor 18 about axis C_2 by means of a belt 24 inserted inside a groove 25 on a toroidal rotary support 26, which in turn comprises a shaft 26a supported on a pair of bearings 27, and a toroidal member 26b supporting at least three substantially truncated-cone-shaped cutters 28 (Figure 4b), the cutting edges 28a of which project slightly with respect to toroidal member 26b.

[0042] Bearings 27 supporting shaft 26a are in turn supported by a fork 29 integral with tool table 5, which, as stated, is movable along the X axis and obviously also supports motor 18 (Figure 1) for rotating rotary tool 6 by means of belt 24 and groove 25.

[0043] As shown in Figure 4b, each cutter 28 is fitted to toroidal member 26b by a bolt 30 and a corresponding nut 31, which grip two intermediate members 32a, 32b resting respectively on shoulders 28b, 26c of cutter 28 and toroidal member 26b respectively. Nut 31 is therefore simply screwed onto respective bolt 30 to reversibly lock cutter 28 to toroidal member 26b.

[0044] With reference to Figure 2, machine 1 also comprises a measuring tracer 33, which also provides for digitizing the finished prototype, i.e. touched up by the modelmaker, and which in turn comprises in known manner tracing means activated by an appropriate known mechanical system.

[0045] Measuring tracer 33 has some very interesting applications. In fact, once the machining work on machine 1 is completed, the semifinished prototype may be removed from machine 1 and touched up by hand, and the finished prototype set up again on machine 1, again retained as before by rotary gripping means 11.

[0046] As stated, measuring tracer 33 may be used to determine the final shape of the prototype and, with the aid of electronic central control unit 19, convert the final shape into a file, which may be transmitted, e.g. by means of an electronic data transmission network, to the model shop for use in producing the models.

Claims

1. A machine (1) for producing accessories for the shoe industry;

the machine (1) being characterized by comprising:

- means (11) for gripping a blank (4); and
- means (3, 5) for selectively translating said blank (4) and a rotary tool (6) along three coordinate axes (X, Y, Z) perpendicular to one another, and for selectively rotating said blank (4) about a first vertical axis (C_1), and said rotary tool (6) about a second vertical axis (C_2).

2. A machine (1) as claimed in Claim 1, wherein:

- said means (11) grip said blank (4) at an upper reference surface (4a);
- said means (3) translate said blank (4) along two coordinate axes (Y, Z) perpendicular to each other, and rotate said blank (4) about a vertical axis (C_1); and
- said means (5) translate said rotary tool (6) along a third axis (X) perpendicular to said two axes (Y, Z); said rotary tool (6) shaping said blank (4) to form said accessory.

3. A machine (1) as claimed in Claim 2, wherein said

means (11) maintain the upper reference surface (4a) tilted at an angle (α) of 30° with respect to said axis (C_1).

4. A machine (1) as claimed in Claim 1 or 2, wherein said accessory is a prototype for use in the construction of shoe models. 5
5. A machine (1) as claimed in Claim 2, wherein said means (3, 5) and said rotary tool (6) work both the toe (4b) and heel (4c) of said blank (4) to obtain a prototype with a finished toe and heel. 10
6. A machine (1) as claimed in any one of the foregoing Claims, wherein said rotary tool (6) rotates about an axis (C_2) parallel to said axes (Y , C_1). 15
7. A machine (1) as claimed in Claim 6, wherein said rotary tool (6) is a toroidal tool (6) comprising at least one cutter (28) fitted to a toroidal member (26b). 20
8. A machine (1) as claimed in Claim 7, wherein said at least one cutter (28) is substantially truncated-cone-shaped, and wherein the cutting edge (28a) is located at the major base of said truncated-cone. 25
9. A machine (1) as claimed in any one of the foregoing Claims, wherein the operations performed by said means (3, 5) and by said rotary tool (6) are controlled by an electronic central control unit (19). 30
10. A machine (1) as claimed in Claim 9, wherein said electronic central control unit (19) processes data from a system (CAD) via a system (CAM). 35
11. A machine (1) as claimed in Claim 10, wherein said system (CAM) determines and controls the movements of said means (3, 5) and of said rotary tool (6) on the basis of the upper reference surface (4a) of said blank (4). 40
12. A machine (1) as claimed in any one of the foregoing Claims, characterized by also comprising a measuring tracer (33) for digitizing the finished prototype. 45
13. An accessory for the shoe industry, characterized by being produced on a machine (1) as claimed in any one of the foregoing Claims. 50
14. A prototype for models for the manufacture of shoes, the prototype being characterized by being produced on a machine (1) as claimed in any one of Claims 2 to 12. 55
15. A method of producing accessories for the shoe industry; the method being characterized by com-

prising the steps of:

- gripping a blank by an upper reference surface of the blank;
 - translating said blank along a first and a second coordinate axis perpendicular to each other, and rotating said blank about a vertical third axis; and
 - translating a rotary tool along a fourth axis perpendicular to said first and second axis; said rotary tool shaping said blank to produce said accessory.
16. A method as claimed in Claim 15, wherein said accessories are prototypes for the construction of shoe models.

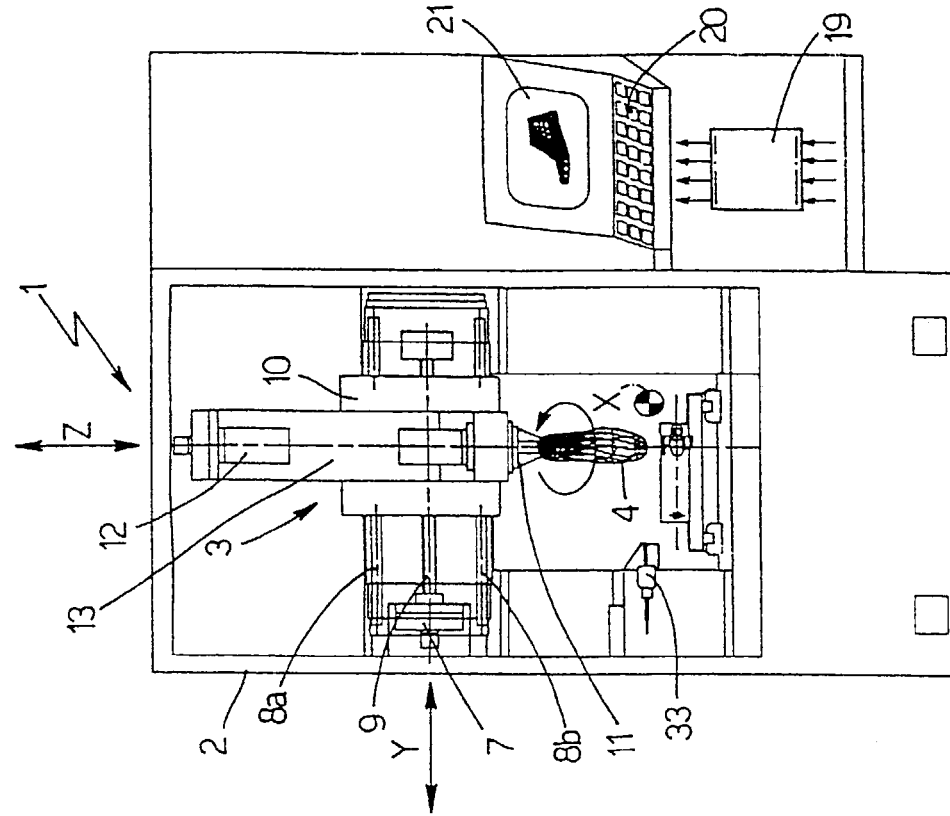


Fig.2

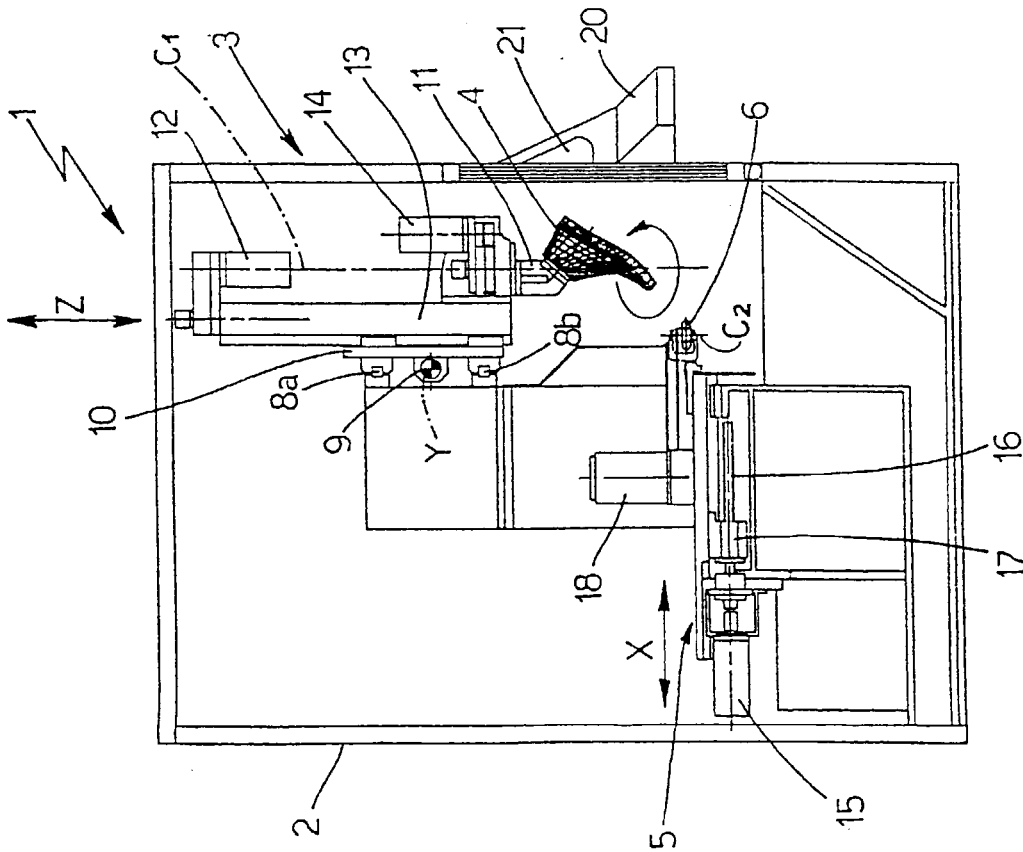


Fig.1

