United States Patent [19]

Condamine et al.

[11] **3,790,978**

[45] **Feb. 12, 1974**

[54] **METHOD AND APPARATUS FOR MAKING LASTS**

[75] Inventors: **Armand Eloi Condamine**, Sainte Foy Les Lyon; **Rene Jean Jacques Philippe Rigal**, Lyon, both of France

[73] Assignee: **Centre Technique Du Cuir**, Lyon, France

[22] Filed: **June 19, 1972**

[21] Appl. No.: **264,283**

[30] **Foreign Application Priority Data**

June 18, 1971 France 71.23387

[52] **U.S. Cl.** ..... **12/146 L**

[51] **Int. Cl.** **A43b 00/00**

[58] **Field of Search** ..... 12/1 R, 146 R, 146 L

[56] **References Cited**

UNITED STATES PATENTS

2,666,464	1/1954	Spencer	12/146 L
3,241,166	3/1966	Jonas	12/146 L
3,315,290	4/1967	Ishii	12/146 L

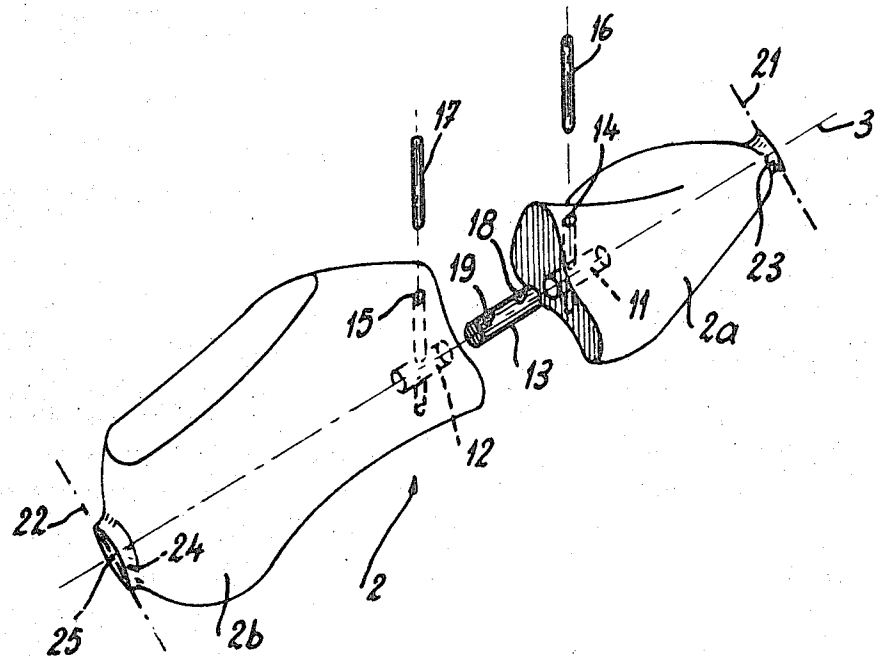
Primary Examiner—Patrick D. Lawson

Attorney, Agent, or Firm—Eric H. Waters

[57] **ABSTRACT**

This method of manufacturing shoe lasts made of several detachable elements, i.e., a basic standardized element and at least one interchangeable element dependent upon fashion, consists in marking the trace of the turning axis on the ends and on each joint plane of the model elements and of the lasts deriving therefrom, and using said trace for laying out means for the relative connection and positioning of said interchangeable elements and of said standardized elements of the model and of said lasts.

20 Claims, 7 Drawing Figures



Patented Feb. 12, 1974 3,790,978

2 Sheets-Sheet 1

FIG.1

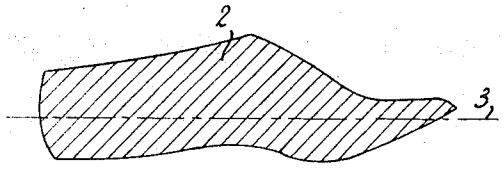


FIG.2

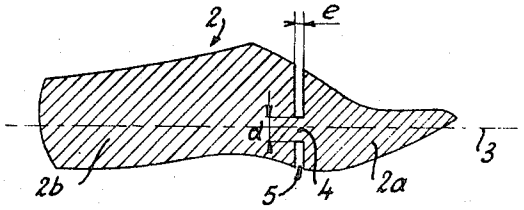


FIG.3

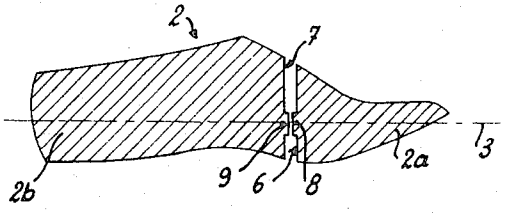


FIG.4

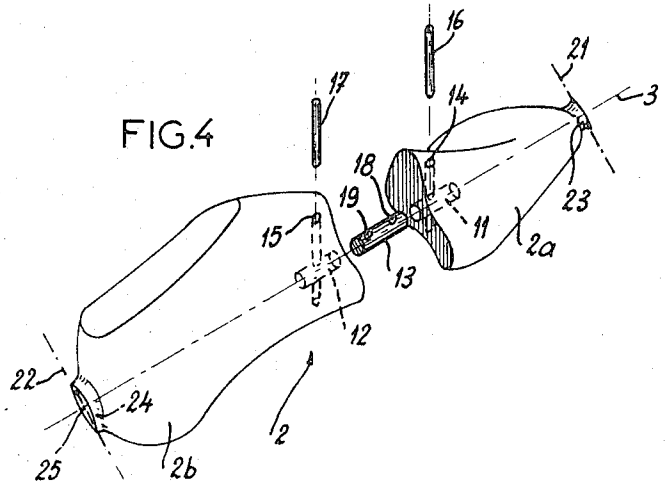


FIG 6

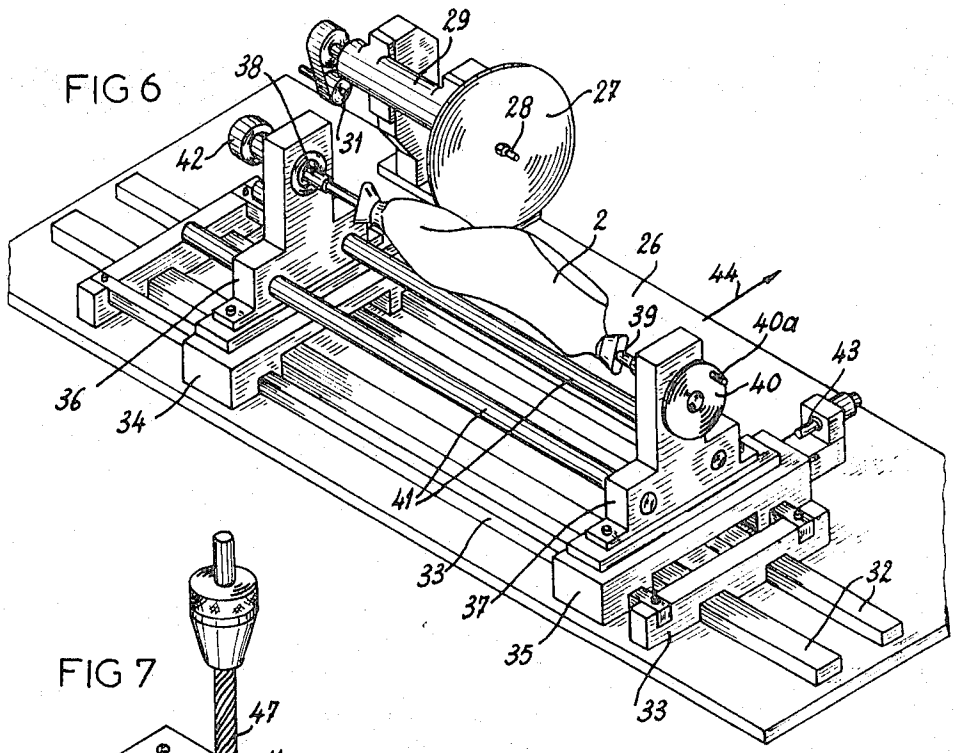


FIG 7

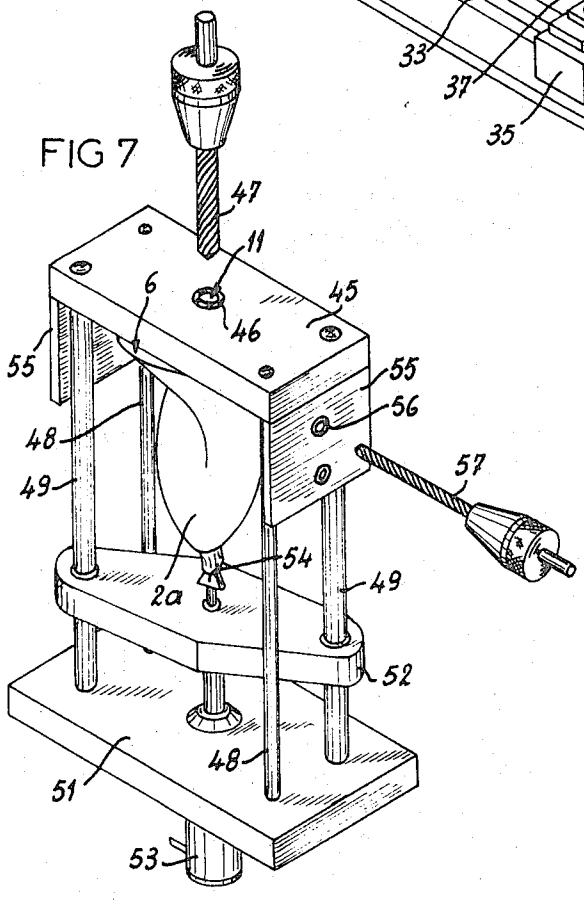
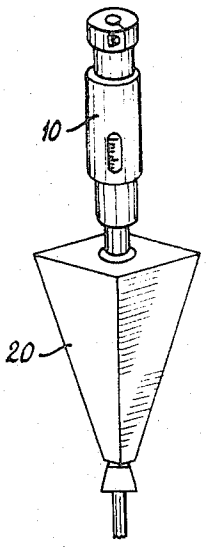


FIG.5



METHOD AND APPARATUS FOR MAKING LASTS

BACKGROUND OF THIS INVENTION

The present invention relates to the making of shoe lasts in general and has specific reference to an improved method of manufacturing a shoe last consisting of a plurality of assembled elements, and also to apparatus for carrying out this method.

Many methods of this character have already been proposed, which differ from each other especially by the mode of assembling the elements, constituting the last. However, all these known methods are based on the making of last components by moulding. Obviously, these methods require a considerable number of moulds for, in a two-section or two-element last, each pair and size of shoe require four moulds.

Of course, each time a change appears in the shoe fashion, the moulds must be replaced by new ones, and consequently the number of lasts produced with these moulds is not sufficient for absorbing the cost of said moulds.

However, it would be sound practice to have a standardized last element or section that can be preserved independently of fashion, so that this section could be reproduced by moulding. On the other hand, it has not been possible, so far, to manufacture the other elements dependent upon fashion and therefore manufactured in small series or quantities, by using the turning technique employed heretofore for making one-piece lasts. Yet this possibility would be greatly appreciated since it would permit from a single type of lathe equipped with interchangeable parts, to turn the corresponding elements of the lasts for all the shoe sizes corresponding to this model, by using a double pantagraph capable of reproducing a pattern by the method of bidimensional similarity in relation to the axis of rotation.

SUMMARY OF THE INVENTION

It is the primary object of this invention to fill in this blank. To this end, the method according to this invention consists in marking the path of the turning axis on the ends and on each joint plane of the elements or sections constituting the model or pattern and of the lasts deriving therefrom, and to use this path for laying out the means for obtaining the relative connection and positioning of the interchangeable elements and of the standardized element, or of a compensating member, of the model or pattern and of the lasts, deriving therefrom.

At present, the lasts are secured at their ends to the reproducing lathes, and this procedure obviously prevents the machining of these ends which must therefore be hand-finished by using special templets.

Moreover, the application of the method of this invention is advantageous in that it permits of machining completely the last ends because each element can be firmly secured by means of its joint or assembling plane.

According to a first form of embodiment of the method of this invention, the first interchangeable element is obtained by cutting the original model or pattern, the successive or subsequent elements being obtained by modifying the first element or machining blanks.

According to another method of carrying out the method of this invention, the pattern is cut simultaneously with the impression of a rotational movement

to the model or pattern about the turning axis, by using a cutting tool having a predetermined thickness, and subsequently, while a cylindrical "bridge" of material interconnecting the two pattern elements coaxially to the turning axis, subsists the cutting tool is replaced by a thinner tool and said bridge of material is cut substantially along its median plane, whereby a cylindrical boss coaxial to the turning axis subsists in the cutting plane of each one of the two elements, thus affording an easy detection or location of this axis.

In order to obtain, after the separation of the elements, a pattern width consistent with the width demanded by the user, the cutting operation is accomplished on a last having dimensions slightly greater than those contemplated and of which the machining is completed after the assembling step.

This operation is not necessary in case the standardized model element is available, for no cutting step is required, the pattern maker having to change for example an element as a function of fashion, by making from a block having any geometric shape adapted according to the turning axis to the model standardized element, the novel element which may then be used independently for reproducing all the shoe sizes.

According to a specific form of embodiment of this method, for determining the position of the turning axis in the cutting plane of a last element, use is made of the hollow cylindrical guide socket for a drilling tool, the bore of said socket having the same diameter as the aforesaid cylindrical boss, and being engaged by this boss which is then drilled along said axis.

Thus, each turning pattern element may be used separately for manufacturing corresponding elements throughout the range of shoe sizes fo the same model and for the same foot (right or left), provided only that the missing element be replaced by a compensating member os same length in the selected shoe size of the model and of the last element obtained by reproduction.

This possibility is thus particularly advantageous in the case of last elements varying according to a seasonal or other fashion, such as the toe end of a shoe.

The drilling made coaxially to the turning axis from the cutting plane of each element may of course be used for positioning an assembling stud adapted to be locked in position by using suitable cross pins.

The transverse holes for receiving the lock pins holding the assembling stud on the last elements are positioned on the end elements with the assistance of the plane defined by the edge formed by the edges of the spindles of the reproducing lathe.

In the case of intermediate elements, the positioning may be obtained by using marks made accordingly on the adjacent elements, of the turning model and therefore reproduced on the turned elements.

According to a simple form of embodiment of this invention, the cutting apparatus for carrying out this method comprises on the one hand a circular saw having its rotatably driven shaft supported by a fixed frame structure and on the other hand a pair of bearings having a common axis parallel to that of said shaft, each bearing supporting a spindle for holding and rotatably driving about the turning axis a lathe model ; means for adjusting the relative spacing of the spindle ends and the distance between the bearing supporting said spindles, other means permitting the simultaneous movement of the two bearings in directions parallel and

transverse, respectively to the axis of rotation of said circular saw, and further means for angularly positioning said spindles with respect to each other.

Advantageously, the bearings are interconnected by at least one rod solid with one of them and along which the other bearing is adapted to slide or be locked in a selected axial position, each bearing being mounted on a slideway perpendicular to the axis of rotation of said saw.

The apparatus for drilling an end element of the model along the turning axis comprises on the one hand a fixed plate having a socket fitted therethrough, the diameter of the socket bore corresponding to that of the cylindrical boss formed on each cutting plane of each pattern element and acting as a guide to a twist drill for drilling the cavity intended for the stud assembling the model elements, and on the other hand a plate movable towards the fixed plate, or vice-versa, said last-mentioned plate supporting coaxially to said socket a three-point spindle identical with the spindle of the reproduction lathe, lateral plates provided with guide sockets perpendicular to the common axis of the first socket aforesaid and of said three-point spindle being provided for guiding the twist drill utilized for drilling the holes receiving the assembling stud locking cross-pins.

According to another form of embodiment of this method, the element to be drilled transversely is positioned with reference to marks reproduced on the turned element. In this case, the three-point spindle may be replaced by any other suitable spindle, but preferably this other spindle should be the same as the lathe spindle.

The same apparatus may be used for drilling the last elements before or after the turning operation.

The member for compensating the missing element of the model or last during the turning operation comprises a rod of a length adjustable with precision and having one end adapted to be fitted to the model element or to the last element blank coaxially to the turning axis, the other end of this rod being adapted to be fitted to one of the spindles of the reproduction lathe.

DESCRIPTION OF THE DRAWING

A clearer understanding of this invention will be had if reference is made to the accompanying drawing illustrating diagrammatically by way of example a typical form of embodiment of the method constituting the subject matter thereof. In the drawing:

FIGS. 1 to 4 illustrate the different steps of the manufacture of a two-element last according to this method ;

FIG. 5 illustrates the element for compensating the missing element of the model, pattern or last ;

FIG. 6 shows a typical form of embodiment of the cutting apparatus for carrying out this method, and

FIG. 7 is a typical form of embodiment of the apparatus for drilling the elements according to the method of this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT :

From a basic last 2 of conventional shape, intended for use as a model on a reproduction lathe for manufacturing lasts corresponding to the shoe sizes of the same model, the method of this invention, assuming that the position of the trace of the turning axis 3 of this model at the ends thereof is actually known consists in cutting the pattern in the desired separation plane of the future front and rear elements 2*a* and 2*b*, respectively, while marking the trace of the turning axis in each cutting plane of these two elements. A typical form of embodiment of this method consists in cutting the pattern 2 while causing same to pivot about the axis 3 and performing said cutting operation in two steps as illustrated in FIGS. 2 and 3, respectively.

During the first step, the cutting operation is discontinued in order to reserve a cylindrical "bridge" 4 of material between the element 2*a* and 2*b*, said bridge having a diameter *d* and being concentric to the turning axis, of course. This first step will thus cause a groove 5 having a width *e* to be cut circularly in the pattern 2.

During the second step, the bridge 4 is cut by using a narrower tool than the tool used for cutting the groove 5, and this second cutting operation is performed substantially in the median plane of bridge 4.

As a result, after separating the elements 2*a* and 2*b* of the pattern 2 from each other each plane formed by these cutting operations, (i.e., planes 6 and 7 respectively) comprises a cylindrical boss (i.e., 8 and 9) concentric to the turning axis 3.

Under these conditions, it is obvious that finding and locating the centre of these bosses 8 and 9 is a relatively simple matter and the determination of the trace of the turning axis 3 In faces 6 and 7 of elements 2*a* and 2*b* is also easy.

FIG. 4 illustrates a mode of assembling elements 2*a* and 2*b* of lathe model 2. In the cutting of sawing planes 6 and 7 of these elements (FIG. 3) a pair of cylindrical bores 11 and 12 concentric to the turning axis 3 and adapted to receive an assembling stud 13 are formed. Moreover, a transverse hole 14, 15 is drilled through each element 2*a*, 2*b*, respectively for receiving one of the cross-pins 16, 17, respectively, for locking the stud 13 in said element 2*a* and 2*b*.

Therefore, this stud 13 is provided beforehand with a pair of transverse holes 18, 19 permitting the passage of cross pins 16 and 17.

Of course, to ensure a strict coincidence of the perimeters of sawing planes 6 and 7 of elements 2*a* and 2*b*, the orientation of holes 14 and 15 in relation to the turning axis 3 must be determined very accurately. However, this orientation can be determined very easily in relation to the lines 21 and 22 traced on the front and rear bosses 23 and 24, respectively, by the three points 25 impressed by the turning spindles.

As the turning axis 3 are marked on each element 2*a* and 2*b* it will be an easy matter use each use of them as a turning model and therefore to reproduce this model independently of the other on a reproducing lathe, provided however, that it is asscіated with the other element or to a replacement member adjustable longitudinally with the maximum precision.

FIG. 5 shows this member 10 associated with a blank 20 of the last element turned from a model element 2*a*. This member 10, consisting of a rod provided with a micrometric screw permitting the precision adjustable thereof, compensates the absence of the rear element of this last. Thus, only the front element obtained with this blank will be turned, the rear element not modified by the new fashion being maintained. Then the two elements of this last are assembled with each other like the

corresponding elements of the model, i.e., as illustrated in FIG. 4.

A same member 10 may also be used with the model element 2*a* as a substitute for element 2*b*.

As a result, these model elements may be series produces otherwise than by moulding, and thus their cost may be reduced considerably in the case of a production involving small series of articles.

In the above-described example the element 2*a* constitutes the toe end of the last or model and the other element 2*b* constitutes the heel end or main body thereof. Of course, this element 2*b* is substantially not dependent upon the changing fashion and can therefore by mass-produced ; under these conditions, a manufacture by moulding may be contemplated, although two moulds are necessary for each pair and per shoe size for this heel portion of the last or model.

On the other hand the toe element 2*a* which has to adhere to the novel fashion and is liable to frequent changes, will be produced in small quantities. It will therefore be advantageous to manufacture for this toe end only one turned model, from which all the right and left last elements will be made for all the shoe sizes contemplated for this model.

The same toe element may on the other hand disappear (from the standpoint of fashion) during some time, and then become again fashionable; it will be easier for last manufacturers to preserve this front element of lathe or turned model than preserving as many pairs of costly moulds as may be contemplated and necessary for the complete range of shoe sizes of the same model.

The cutting apparatus illustrated diagrammatically in perspective in FIG. 6 comprises a fixed base plate 26 carrying a circular saw 27 having its driving shaft 28 journalled in bearing means fitted in a fixed bracket 29 and driven in turn from an electric motor 31. Slidably mounted on a pair of slideways 32 parallel to said shaft 28 is a rectangular frame structure 33. Also slidably mounted but on the major side members of this frame structure 33, which are parallel to slideways 32, are a pair of cross slides 34, 35 to which are secured for longitudinal sliding movement corresponding brackets 36 and 37 each provided with bearing means for rotatably supporting a three-point spindle 38 and 39, respectively. Means (not shown on the drawing) such as catch or spring-loaded pawls are provided for locking these spindles 38 and 39 against rotation so that all their points lie in a common plane. This locking action is produced when the last or model or pattern 2 to be cut is set between the spindles 38 and 39.

MOreover, the spindle 39 comprises a crankpin 40*a* rigid with a wheel 40 for rotatably and manually driving the spindle. Of course, any other manual or automatic driving means may be provided, if desired.

The brackets 36 and 37, of the bearing means of spindles 38 and 39 are interconnected by a pair of rod 41 parallel to the circular saw shaft 28 and therefore to the slideways 32 and to the major sides of frame structure 33. These rods 41 are rigidly secured to bracket 37 but extend freely through bracket 36, suitable means (not shown) being provided for locking the bracket 36 at any desired point along said rods 41.

The function of spindles 38 and 39 is to support and rotatably drive the lathe model 2 to be cut. To this end, the bracket 36 is moved along the rods 41 until the gap between the spindles 38 and 39 corresponds substantially to the length of model 2, and then the bracket 36 is locked in this position. The mounting of model 2 is then obtained by axially moving the spindle 38 by means of the knurled button 42. Under these conditions the bracket assembly 36, 37 constitutes a rigid assembly adapted to be fed across the axis of shaft 28 along cross slides 34 and 35. An adjustable stop 43 carried by cross slide 35 permits of limiting this movement and therefore that of model 2 towards the saw 27, i.e., in the direction of the arrow 44.

On the other hand, the cross slides 34 and 35 are movable bodily with the frame structure 33 along the slideways 32 to permit the movement of the cutting plane of lathe model 2 until it is coincident with the plane of the circular saw 27. When these various adjustments are completed, the cross-slides 34 and 35 can be locked in relation to frame structure 33 and the latter can be locked in relation to slideways 32. The feed movement is imparted to model 2 towards the saw 27 as explained hereinabove by moving the bracets 36 and 37 in the direction of the arrow 44, along the cross slides 34 and 35. This cutting operation takes place, of course, in conjunction with the movement of rotation imparted to model 2 about its turning axis 3.

The function of the adjustable stop 43 is to limit the feed movement of model 2 so that at the end of the permitted feed movement a cylindrical "bridge" 4 having a diameter *d* be formed or left between the elements 2*a* and 2*b*.

This bridge may subsequently be easily cut by using a cutting tool of a width inferior to the thickness of saw 27.

The apparatus illustrated in FIG. 7 is intended for drilling, in the plane 6 of element 2*a* or in the plane 7 of element 2*b*, the cylindrical cavity 11 or 12 coaxial to the turning axis 3 for receiving the assembling stud 13. This apparatus comprises a fixed plate 45 in which a socket 46 adapted to act as an axial guide member to a twist drill 47 for drilling the cavities 11 or 12 in elements 2*a* or 2*b* is fitted. To permit the proper centering of the boss 8 or 9 in relation to this socket 46 the diameter *d* of said bosses is equal to that of the bore of said socket 46. The plate 45 is carried by two pairs of columns, i.e., two columns 48 and two columns 49 of greater diameter, these columnes being secured to a base plate or frame structure 51 at their ends opposite to plate 45. Slidably mounted on columns 49 is a movable slide 52 controlled by a fluid-operated cylinder and piston unit 53 and supporting on its face registering with plate 45 a spindle 54 similar to spindle 38 or 39 of the cutting apparatus shown in FIG. 6. This three-point spindle is also disposed coaxially to the socket 45 and thus permits of engaging the boss 8 or 9 into this socket 46 ; under these conditions, the hole drilled by means of the twist drill 47, to constitute the bore 11 or 12, will be concentric with the turning axis 3.

Parallel lateral plates 55 secured to said columns 48 and 49 are provided with coaxial guide sockets 56 extending therethrough and having their common axis orthogonal to that of said socket 46. These guide sockets 56 are adapted to centre a twist drill 57 when drilling the holes 14 and 15 for receiving the locking cross-pins 16 and 17.

The marking and positioning of these holes 14 and 15 are obtained automatically by using a spindle 54 identical with the aforesaid spindles 38 and 39 of the cutting apparatus shown in FIG. 6.

It will readily occur to those conversant with the art that this invention should not be construed as being strictly limited to the specific form of embodiment shown and illustrated herein by way of example, since various modifications and variations may be brought thereto without departing from the spirit and scope of the invention as set forth in the appended claims.

What we claim as new is:

1. Method of manufacturing a shoe last made of a plurality of separable elements, including a standardized basic element and at least one interchangeable element dependent upon fashion, said method comprising the steps of marking the trace of the turning axis on the ends, and on each joint plane of the model elements and of the lasts deriving therefrom, and utilizing this trace for laying out means for interconnecting and positioning in proper relationship for interchangeable elements and the standardized element of the model and of the lasts deriving therefrom.

2. Method as set forth in claim 1, wherein the first interchangeable element is obtained by cutting the original model.

3. Method as set forth in claim 2, wherein the other interchangeable elements are obtained by modifying the first element.

4. Method as set forth in claim 2, wherein the other interchangeable elements are obtained separately by machining blanks drilled beforehand along the turning axis.

5. Method as set forth in claim 2, wherein the model is cut, while the same is rotatably driven about the turning axis, by means of a cutting tool of predetermined width, so that after a cylindrical bridge of material has been left between the two model elements coaxially to the turning axis, said cutting tool is replaced by a narrower tool fur cutting said bridge substantially across its median plane, whereby a cylindrical boss coaxial to the turning axis is left in the cutting plane of each one of the two elements for facilitating the detection of said axis.

6. Method as set forth in claim 2, wherein said cutting operation is accomplished on a last having dimensions slightly greater than those contemplated, the machining of said last being completed after the assembling of its component elements.

7. Method as set forth in claim 6, wherein for determining the position of the turning axis in the cutting plane of a last element, the guiding socket of a drilling tool is used, having a bore has the same diameter as said cylindrical boss, the latter being adapted to be fitted into said bore for drilling along said axis.

8. Method as set forth in claim 1, wherein the blank utilized for turning the last element is associated with a compensating member corresponding to the missing element, the length of said member being adjustable very accurately.

9. Method as set forth in claim 1, wherein the model element utilized in the reproduction lathe is assembled with the complementary element of the same model.

10. Method as set forth in claim 1, wherein the model element utilized in the reproduction lathe is associated with a member for compensating the missing element and accurately adjustable in length.

11. Method as set forth in claim 7, wherein the hole drilled coaxially to the turning axis in the cutting plane of each element is utilized for positioning an assembling stud adapted to be locked in position by means of cross-pins.

12. Method as set forth in claim 11, wherein the transverse holes drilled in said last elements for receiving the assembling stud locking cross-pins are positioned on the end elements of the last with the assistance of the plane determined by the edge formed by the three points of the spindles of said reproduction lathe.

13. Method as set forth in claim 11, wherein the transverse holes drilled in said last elements for receiving the assembling stud locking cross-pins are positioned on the end elements of the last with the assistance of the reference marks reproduced on the turned elements.

14. Method as set forth in claim 11, wherein in the case of intermediate elements the holes drilled transversely for receiving the assembling stud locking cross-pins are positioned by means of reference marks made in proper regis-tration with the adjacent elements on the turned model, whereby said marks are reproduced on the turned elements.

15. Method as set forth in any of claim 11, wherein the transverse holes for positioning the transverse cross-pins of the interchangeable elements of the models or lasts turned from blanks are drilled in said blanks simultaneously with, or after, the holes made along the turning axis, that is, before the turning operation.

16. Apparatus for cutting shoe lasts or blanks into elements or sections, according to the method disclosed in claim 2, comprising on the one hand a circular saw having its shaft rotatably driven from suitable power means and journalled in bearings carried by a fixed frame structure and on the other hand a pair of bearings having a common axis parallel to that of said circular saw and said shaft, each bearing of said pair supporting a spindle for holding and rotatably driving about its turning axis a lathe model, means being provided for accurately adjusting the relative distance between the free ends of said spindles and also that of the bearings supporting said lathe model, other means being provided for permitting the simultaneous movement of the two lathe model supporting bearings in direction parallel and transverse, respectively, to the axis of rotation of said circular saw, further means being also provided for rotatably driving at least one of said spindles, complementary means permitting the relative angular position of said spindles.

17. Apparatus as set forth in claim 16, wherein said spindle bearings are interconnected by at least one rod rigid with one of them, the other bearing being adapted to slidde, or be locked in any desired position, along said rod, each bearing being mounted on a slideway extending at right angles to the axis of rotation of said circular saw, the pair of bearing slideways being mounted in turn on a frame structure adapted to slide along longitudinal slideways parallel to said axis of rotation of said circular saw.

18. Apparatus for drilling the end element of a multi-element model along the turning axis thereof, for carrying out the method set forth in claim 7 comprising on the one hand a fixed plate having fitted therethrough a socket having a bore corresponding in diameter to the cylindrical boss left on each joint plane of each model element, said socket being adapted to guide a twist drill for drilling the cavity engageable by the stud for assembling the model elements, and on the other hand a plate

movable towards and away from said fixed plate, and supporting coaxially to said socket a three-point spindle identical with the spindle of the reproduction lathe, side plates provided with guide sockets perpendicular to the common axis of said first socket and said three-point spindle being disposed on either side of said fixed plate for drilling the holes for receiving the assembling stud locking cross-pins.

19. Compensation member for carrying out the method set forth in claim **8** comprising a rod of a length adjustable with precision, said rod being adapted to engage with one end the model element or to the last element blank, coaxially to the turning axis, and with the other end one of the spindles of said reproduction lathe.

20. Compensation member as set forth in claim **17**, wherein its end adapted to engage the turned blank comprises a cylindrical end piece of same diameter as the cavity formed for receiving the assembling stud and provided with a transverse hole permitting the passage of the stud locking cross-pin.

* * * * *