

May 27, 1969

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METHODS AND APPARATUS FOR FORMING AND
PREFORMING SHOE UPPER FOREPARTS

3,445,873

Filed Nov. 17, 1965

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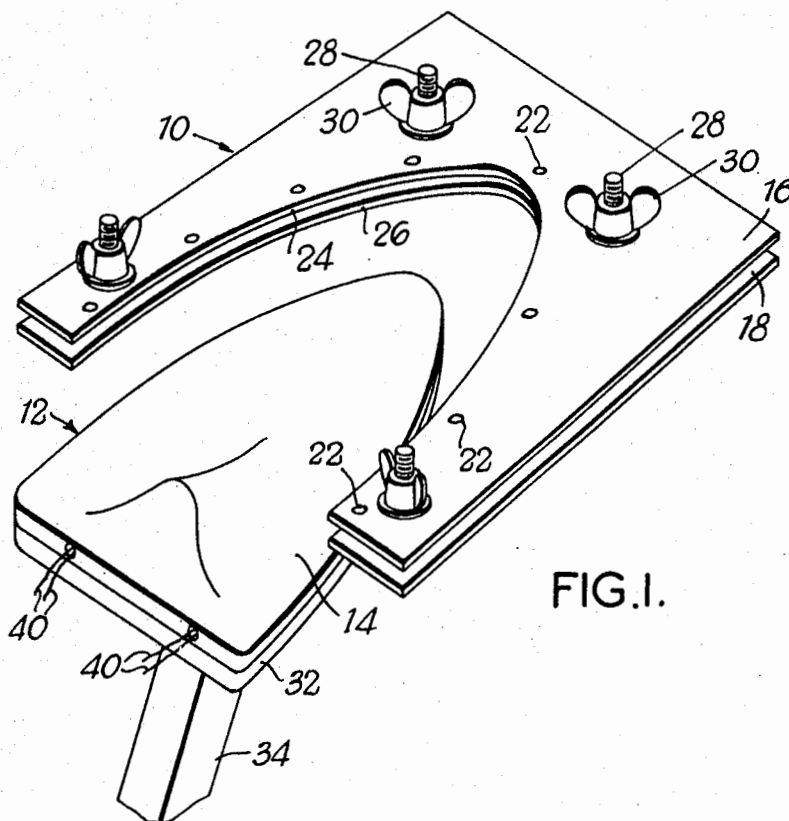


FIG. 1.

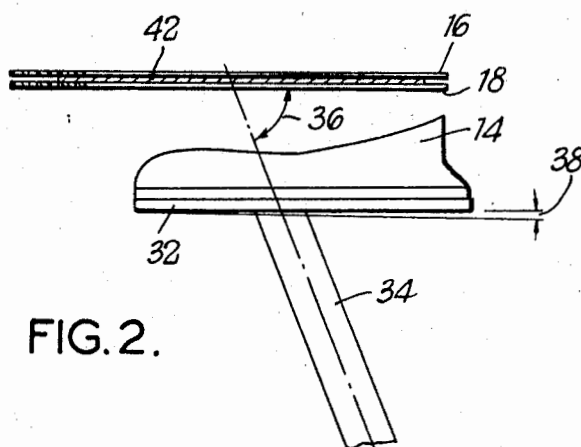


FIG. 2.

INVENTOR
Alfred Alexander Staden
BY
Johnson and Kline
ATTORNEYS

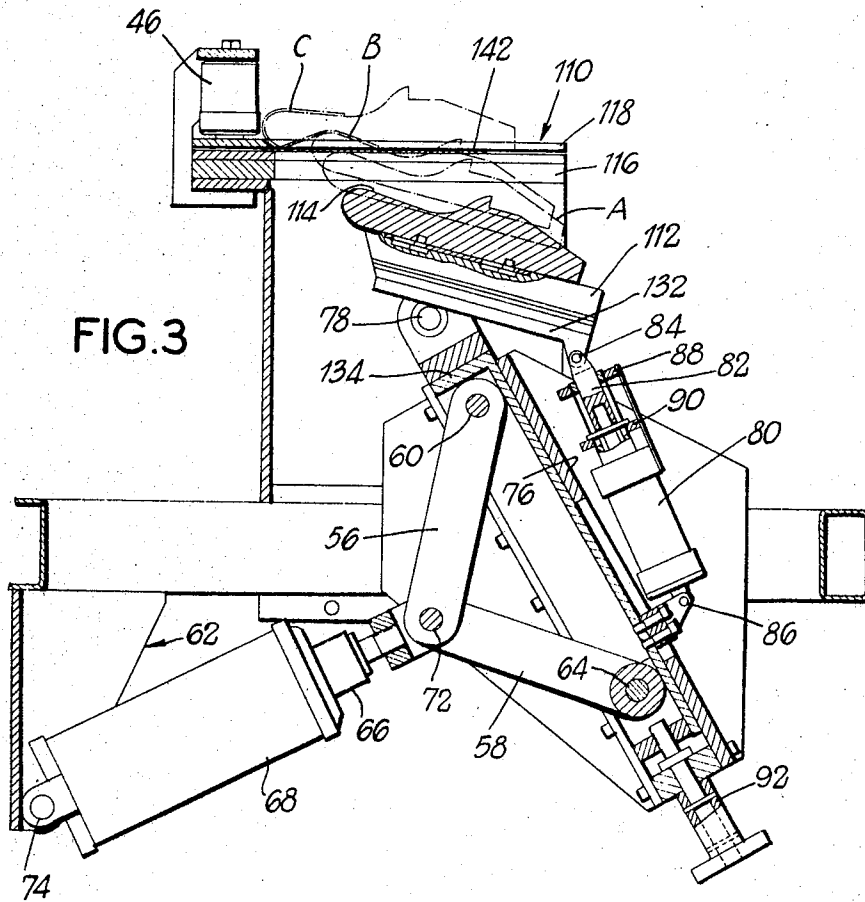
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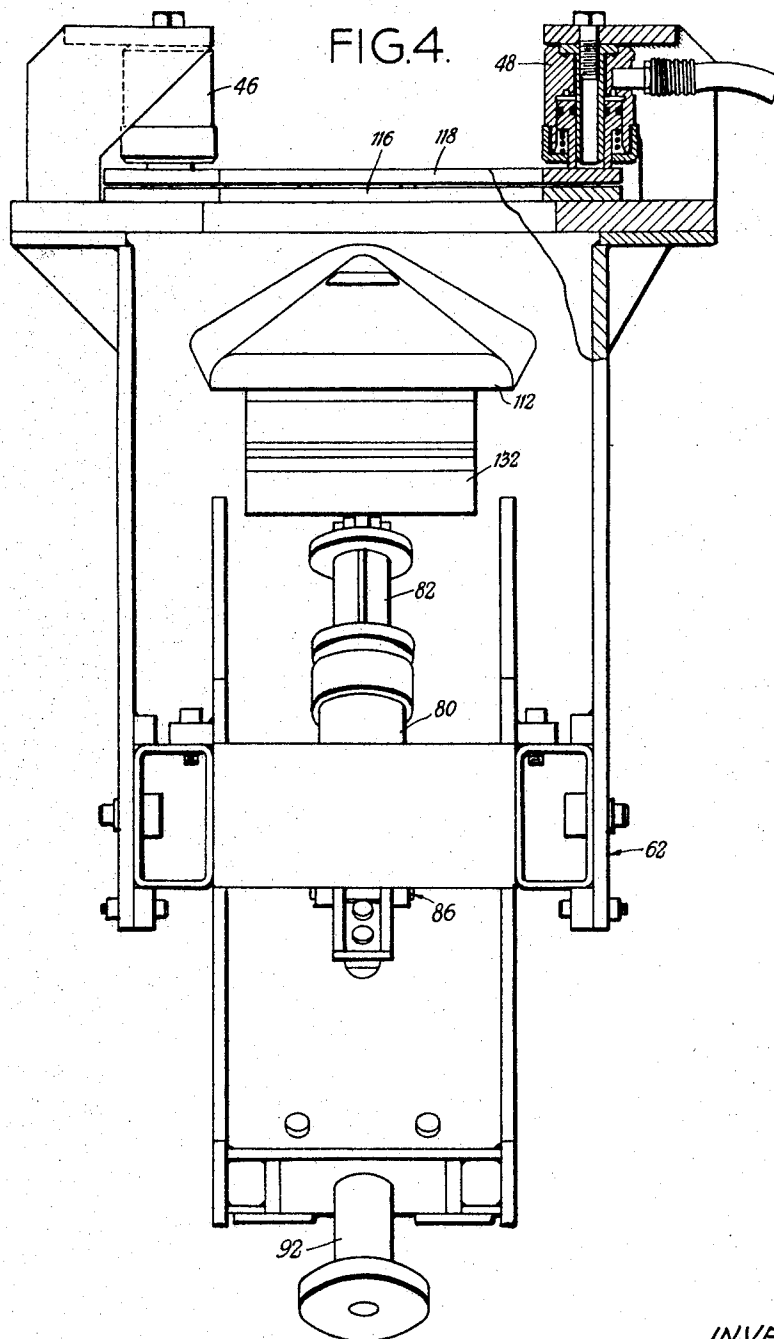
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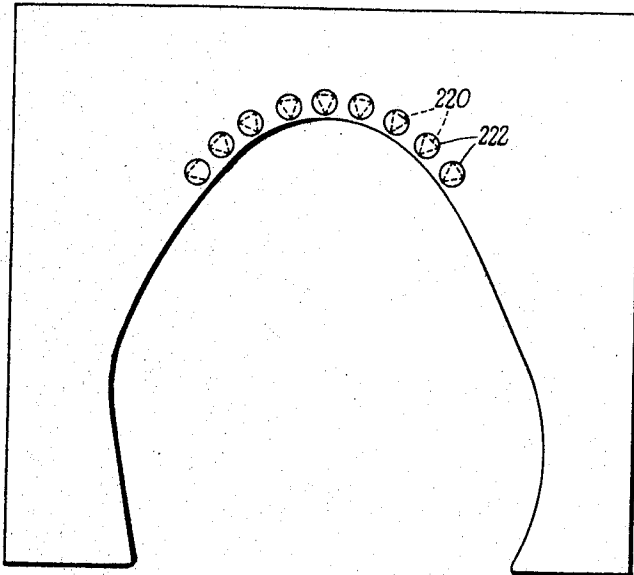


FIG. 5a

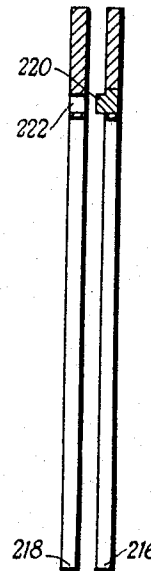


FIG. 5b

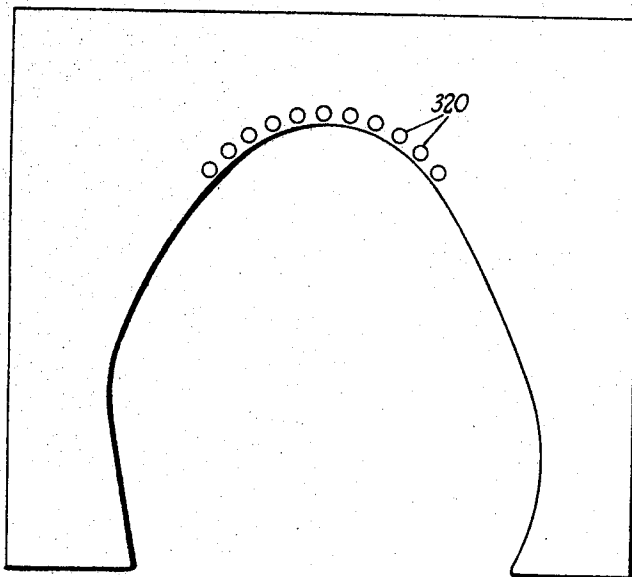


FIG. 6a

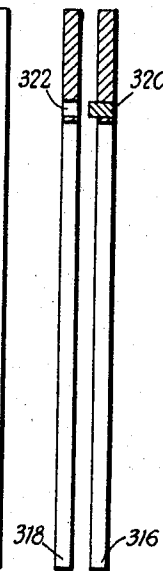


FIG. 6b

INVENTOR
Alfred Alexander Staden
BY
Johnson and Kline
ATTORNEYS

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METHODS AND APPARATUS FOR FORMING AND PREFORMING SHOE UPPER FOREPARTS

Alfred Alexander Staden, Kettering, England, assignor to Shoe and Allied Trades Research Association

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Int. Cl. A43d 95/00, 11/12

U.S. Cl. 12—146

20 Claims

ABSTRACT OF THE DISCLOSURE

A shoe upper forepart blank is deformed to facilitate lasting by being clamped at its margins in taut condition while a mould, having a shape intermediate the original flat shape of the blank and the shape to be had after lasting, is thrust into the clamped blank preferably while imparting rocking movement to the mould, the final shape of the forepart being obtained by a lasting operation, and the intermediate shape of the mould being determined by partially flattening a thin shell originally corresponding to the eventual shape of the shoe upper forepart while keeping the margins of the shell substantially in one plane.

The invention relates to shoe manufacture and in particular to the production of the upper or upper foreparts of a shoe.

The upper of a shoe has somehow to be permanently deformed from its original generally planar state to the shape of the curved surface of a last. This deformation is usually produced by the process of lasting in which the upper is drawn tightly over the surface of a last and there caused to acquire a degree of permanent set. The shape produced by the lasting operation is the result of considerable tensile forces applied to selected regions of the periphery of the upper and of compressive forces applied to the regions around the toe and heel.

Because most shoemaking materials, and leather in particular possess stretch properties which are somewhat unpredictable, it is necessary, when determining the starting shape of the blank for the forepart, to provide sufficient material to ensure that even the least extensible uppers are large enough to cover the last with a sufficiently large margin for attachment. This often results in an excess of material in the lasted margin and deformation of styling features of the upper when a blank of more extensible material is lasted.

In order to produce the required shape from the smallest area of material and with desirable consistency it is necessary that the shaping operations shall comply with at least two requirements:

(1) The shaping must be the result of stretching or displacement of the material of the blank and not the result of compression.

(2) The margin of the blank which will ultimately be used to fasten the shaped component to the sole portions of the shoe must be of a predetermined width, irrespective of the ductility of the material being formed.

Neither conventional lasting methods nor any known

upper shaping techniques have formerly met these requirements.

To fulfill these requirements, the blank can be clamped at its edges while the inner area is deformed in a process preparatory to the actual lasting operation.

However, the line of junction between the upper and the sole portion of a shoe, known as the feather edge, usually lies not in a flat plane, but on a variably undulating surface. The feather edge moreover has a contour which may differ with each style of last or size of shoe. The difficulty thus arises that during preforming, the edge of the blank has to be gripped by clamping means conforming with this complicated contour. Such clamping means are inevitably complicated and therefore expensive. They must be elaborately adjustable or a different clamping means has to be provided for each shape of upper to be preformed. There arises the further difficulty that certain parts of the feather edge of a finished shoe lie within the periphery of the plan view of the shoe upper parts.

To preshape the blank to the full shape of the forepart of a last down to the feather edge, therefore, means are required for producing an inward curvature of the material, particularly in the regions of the inside and outside waist. Parts of the clamping means must therefore be capable of controlled movement to produce this inward curvature.

The object of the invention is accordingly to provide a relatively much simpler method and means for preforming the upper forepart of a shoe, including the toe. The invention also has as an object a simple method of producing a mould for use in such a preforming method.

The invention accordingly provides a method of preforming a blank intended for use as a shoe upper forepart, in which the blank is deformed from a generally planar or multiplanar shape into a shape more readily deformable into the shape subsequently required. The invention also provides a method of preforming a blank intended for use as a shoe upper forepart, the method having the steps of securing the blank so as to lie generally in a single plane, or in a small number of planes, and then deforming the blank into a shape intermediate between the shape when so secured and the shape subsequently required. The shape subsequently required will of course normally be that of the last. The shape imparted to the blank can be rendered more or less permanent by a number of known methods, which are not the subject of the present invention.

Moreover the invention provides apparatus for preforming the method of the invention, comprising a clamping device arranged to secure the blank to lie generally in a single plane, or in a small number of planes, and a mould having a moulding surface corresponding to the shape to which the blank is to be deformed, the mould and clamping device relatively movable to engage the moulding surface with a blank secured in the clamping device. In such apparatus, the mould is preferably arranged to move to engage the clamped blank in a direction making an angle of about 70° with the plane of the blank or the plane in which the major part lies. The mould can be given a rocking movement so that one part

of it overlies a portion of the blank at the end of the preforming operation.

The invention further provides a method for the production of a mould for use in the apparatus, the method having the steps of making a shell of deformable material having the shape subsequently required, deforming the shell to have a shape with edges lying in one or a small number of planes, and modelling the mould from the deformed shell. The shell can be made by moulding directly onto the last. The mould can be modelled to correspond precisely to the deformed shell, or to be a developed form of it.

The invention can thus provide for the preforming of a blank for a shoe upper forepart, not into the shape of the last but into a shape, conveniently one intermediate between the initial and final shapes, which enables simple clamping apparatus to be used and which can be readily made to conform to the shape of the last. The line around which the blank is clamped will usually correspond to the feather edge and will lie in a single plane or in two or three planes at an angle to one another.

The invention will be better understood from the following description of illustrated embodiments thereof and from reference to the accompanying drawings. In the drawings:

FIGURE 1 is a perspective view of a first form of apparatus according to the invention;

FIGURE 2 is a side view, partly in section, of the apparatus of FIGURE 1;

FIGURE 3 is a side view, partly in section, of a second form of apparatus for performing the invention;

FIGURE 4 is a front view of the apparatus of FIGURE 3;

FIGURES 5(a) and (b) are respectively plan and sectional side views of a second modification of the clamping device; and

FIGURES 6(a) and (b) are respectively plan sectional side views of a third modification of the clamping device.

Preforming apparatus (1)

As shown in FIGURE 1, the preforming means consists essentially of two parts, a clamping device 10 for the starting material, and a mold or former 12 having a generally convex upper working surface 14 corresponding to or developed from the desired intermediate shape.

The device 10 is for a simple intermediate shape, with the edge lying in a flat plane. The device comprises an upper clamping plate 16 and a lower clamping plate 18 guided for clamping and release movements towards and away from one another whilst remaining parallel by a plurality of guide pins projecting normally from the lower plate 18 to be received in registering apertures 22 in the plate 16. The plates are externally generally rectangular but have corresponding generally U-shaped cutouts from one shorter edge. The shape of cutouts is determined from the desired intermediate shape and their edges 24 in the upper plates 16 and 26 in the lower plate 18 corresponding to the feather edge or to a line between the feather edge and the edge of the vamp or blank of the material to be preformed. Means for applying clamping pressure are provided in the form of threaded studs 28 projecting normally from the plate 18 to pass through registering apertures in the plate 16 so that clamping and unclamping can be effected by turning wing nuts 30 threaded on the free end of the studs.

The mould 12 is mounted on a platform 32 carried on an end of a thrust shaft 34 which is capable of sufficient longitudinal movement, upwardly as shown in FIGURE 2, to bring the moulding surface 14 into the cutouts region of the clamp plates 16 and 18. The thrust shaft 34 can be carried by a piston slidable within a hydraulic or pneumatic actuator cylinder. As will be clear from FIGURE 2, the upward movement of the mould 12 is combined with a forward movement by inclining the thrust shaft towards the toe portion of the upper at an

angle 36, suitably of the order of 70°, with the plane of the clamp plates. A degree of control over the shape to be moulded can be obtained by mounting the mould 12 on the platform 32 so as to be adjustable through a small angle 38 to incline the longitudinal axis of the mould with respect to the plane of the clamp plates. The mould 12 can additionally or instead be mounted on the plate 32 for adjustment to incline the transverse axis of the plane of the mould with respect to the plane of the clamp plates.

The mould 12 is provided with heating means in the form of internal electric heating elements supplied with current by flexible leads 40.

The preforming operation is carried out by first positioning a blank or vamp 42 of the material to be preformed loosely between the plates 16, 18 of the clamping device 10 so as to overlie the cutout and the adjacent edges 24, 26 of the plates by a predetermined and generally uniform amount, which is controlled by the position of the pins in holes 22. The plates are then brought together by tightening the nuts 30 on the studs 28 so that the plate firmly grips the margin of the vamp. The heated mould 12 is then moved by longitudinal upward movement of the shaft 34 to engage and then deform the vamp. A stop (not shown) is provided to limit this advance of the thrust shaft. When the vamp has been sufficiently set, the shaft 34 is withdrawn to carry the mould back below the clamping device 10. The preformed upper can then be released from between the clamping plates.

Preforming apparatus (2)

It will be appreciated that the apparatus described in FIGURES 1 and 2 is a very simple embodiment of the invention. A more advanced form of the apparatus, shown in FIGURES 3 and 4, comprises a clamping device 110 which corresponds generally to the clamping device 10 of FIGURES 1 and 2. The device 110 comprises apertured plates 116 and 118 of which the upper plate 118, as shown in FIGURE 3, can be raised or lowered whilst remaining parallel to the lower plate 116 by a pair of hydraulic or pneumatic actuator cylinders 46 and 48.

The apparatus also comprises a mould 112 with a working surface 114, again essentially similar to the mould 12 with its working surface 14, as described in connection with FIGURES 1 and 2. The mould 112 is arranged to engage the vamp from below, as shown in FIGURE 3, and is accordingly mounted on a platform 132 carried on an end of a thrust shaft 134. The shaft 134 is moved by a toggle linkage comprising a pair of levers 56 and 58 of which the lever 56 is pivotally connected to the thrust shaft 134 by a pivot pin 60, the lever 58 being pivotally connected to a portion of a framework 62 for the apparatus by a pivot pin 64. The levers 56 and 58 are pivotally connected together and to a thrust shaft 66 of a pneumatic or hydraulic cylinder 68 by means of a pivot pin 72. The cylinder 68 is pivotally connected to a further portion of the framework 62 by a pivot pin 74. To provide the mould 112 with a component of movement towards the toe portion of the vamp the shaft 134 is guided by guide means 76 connected with the framework 62 for movement in a direction at an angle of about 70° to the plane of the clamping device 110.

The apparatus of FIGURE 3 provides for a rocking movement of the mould 112, and to this end the platform 132 is pivotally connected to the shaft 134 by pivot pin 78. The mould is thus able to pivot on the shaft 134 about a transverse axis.

The pivotal movement of the mould 112 is imparted by an auxiliary actuator cylinder 80 which has a thrust shaft 82 pivotally connected to the platform 132 by a pivot pin 84. The lower end of the auxiliary actuating cylinder 80 is pivotally connected to the thrust shaft 134 by a pivot pin 86.

The platform 132 and the thrust shaft 134 thus form the first and second sides of a triangle and the thrust shaft

82 with the cylinder 80 form the third side. The triangle is movable as a whole axially of thrust shaft 134 by actuation of the cylinder 68 and can be altered in shape independently by actuation of the cylinder 80 which changes the length of the third side and thus the angles at the apices, in particular that between the first and second sides.

The mould 112 is maintained at a suitably high temperature during operation, for example, by means of electric heating elements incorporated therein.

At the start of the molding operation, the cylinders 46, 48 are actuated to move the clamping plates 116, 118 together to clamp a vamp 142 between them. These actuator cylinders 46, 48 are controlled to operate in coordinated sequence with the cylinders 68 and 80 provided for moving the mould. The thrust shafts 134 and 82 are at this time withdrawn so that the mould 112 is below and out of contact with the vamp. The cylinder 68 is then actuated to advance the thrust shaft 66 and the pivot pin 72. As the pivot pins 64 and 74 are both fixed relative to the framework 62, the cylinder 68 pivots slightly upwardly about the pin 74 and the shaft 134 is caused to advance in the guide means 76 so that the upper toe portion of the mould 112 engages the vamp 142 as shown by line *a* in FIGURE 3. When a certain degree of deformation of the vamp has been effected, as shown by chain-dotted line *b* in FIGURE 3, the further advance of the shaft 134 causes by means not shown, the auxiliary cylinder 80 to be actuated so that the thrust shaft 82 is also advanced. The mould 112 is thus tilted forwardly about the axis of the pivot pin 78 as the thrust shaft 134 continues to advance. The toe portion of the mould thus moves with a forward arcuate motion into the final position, shown by broken line *c* in FIGURE 3, in which the plane of platform 132 has become parallel to the plane originally occupied by the vamp 142. Stops 88 and 90 are provided to limit the movement of the thrust shaft 82. The final position of the shaft 134 is preset by an adjusting device 92 which fixes the position relative to the framework 62 of the lowest pivot pin 64 of the toggle linkage. When the vamp has achieved the required degree of set, the thrust shafts are withdrawn to disengage the mold 112, the order of actuation of the cylinders 68 and 80 being exactly the reverse of that previously described. The clamping device 110 is then likewise opened to release the preformed vamp. It will be understood that the actuation of the hydraulic or pneumatic cylinders of FIGURE 3 can readily be coordinated by suitable control devices.

As indicated by the broken line *c* of FIGURE 3 the rocking movement can be such that the front part of the mould 112 finally overhangs the periphery of the aperture in the clamping device 110, so that the preformed vamp has a re-entrant shape in this region. It will be apparent that the amount of overhang can be predetermined by suitable selection of the strokes of the thrust shafts 134 and 82 the locations of the axes of the pivot pins 78 and 84 and the point at which the mould 112 first makes contact with the vamp, which determines the final relative positions of the mould and the clamping device. In both forms of apparatus so far described, the angle between the plane in which the clamping devices originally hold the vamp and the direction of longitudinal movement of the mould has been described as of the order of 70°, but it will be appreciated that other angles are better suited to some type of shoes and the apparatus is therefore preferably arranged so that this angle can be adjusted. The stops 88 and 90 are likewise preferably adjustable.

It will be understood that any suitable means for advancing the mould with a forward rocking motion could be used in place of the main and auxiliary actuator arrangement described, and that any suitable means can be employed for moving the clamping plates together.

The preformed uppers obtained by use of the apparatus of FIGURES 1 and 2 or that of FIGURES 3 and 4 are then subjected to the lasting operation, only very little

force being required to effect the further deformation of the upper to make it conform exactly to the last. It will be appreciated that the preforming method described offers considerable savings in the leather or other material of the vamp because the lasted margin is precisely defined and the shape is imparted largely by stretch.

Modified preforming apparatus

The clamping device of the invention can be further and otherwise modified in a variety of ways. In particular, when the feather edge of the shell lies in two or more planes, each clamping plate can be in flat sections connected either rigidly or by hinges along lines corresponding to the lines on which adjacent planes cut. In a simple arrangement of this kind, a single hinge line is provided on the longitudinal axis. The clamp plates can be provided with pins or like means arranged to locate the blank precisely with respect to the cutout.

The preforming means can moreover be designed to produce an outward flange of the correct width at the edge of the forepart for use directly as the flange of a shoe of veldtschoen construction. Alternatively, a flange can be produced to be located at a fixed distance below the feather edge of the last, so that subsequent lasting operations, in which the lasted margin is turned under and secured to the insole, will cause the clamped region to be completely concealed by the bottom components when the shoe is constructed.

In another possible variation, the inner edge of one clamp plate is provided with a rib which projects towards the other clamp plate and is designed to improve the grip upon the blank and to define more clearly the line of the feather edge, by impressing a groove in the material. This feature is of particular use in veldtschoen constructions.

FIGURES 5(a) and (b) illustrate a further variation in which apertured clamping plates 216, 218 are provided with a series of triangular punches 220 at the toe region of one plate for reception in registering openings 222 in the other plate. Closure of the plates will punch a series of notches in the gripped margin of the blank. The notches serve to ease subsequent lasting operations at this region.

FIGURE 6 illustrates a further variation in which one of the two clamping plates 316, 318 is provided with a series of punches 320 for reception in registering openings 324 in the other plate, so that closure of the plates causes a series of holes to be pierced in the gripped margin. The punches can remain in the holes during the moulding, thereby affording a positive grip on the margin during the operation. The preformed part thus has a reduced area of lasted margin in subsequent lasting operations, and there is the further advantage that adhesion of moulded-on bottom components may be improved by the mechanical locking of the moulded material of these components onto the holes punched in the lasted margin.

The clamping plates can moreover each be divided into two halves along the longitudinal axis of the shoe and be pivoted together at the toe so that the two halves may be swung apart in their own planes. By this means, adjustment can be provided for blanks or vamps of various sizes. A large blank can be clamped flat with the plates opened and subsequently bent along its longitudinal axis by the requisite amount when the two halves of the clamp are closed to a position to suit the mould.

Mould production

In producing the mould, the last to which it is desired that the upper will ultimately conform is first coated with a settable material. This is allowed to harden so as to form a hard layer with its inner surface corresponding exactly to the contour of the last surface. Conveniently, a sheet of heated thermoplastic material is vacuum-formed over the last and allowed to harden by cooling. The layer of hardened material is then cut to allow removal from the last of a shell, corresponding to the final shape of the upper.

The shell is next partially reshaped as by partial flattening so that the edge, corresponding to the feather edge of the actual upper to be preformed, lies on a flat or substantially flat plane, or in two or more planes making angles between them of less than 180° according to the structure of the clamping device to be employed. The shell then corresponds to the intermediate shape referred to above and is used as a model for the manufacture of the preforming mould, which is used to reproduce the shape of the partially flattened shell from the blank or vamp. It will be appreciated that the deformation which the preformed upper undergoes as it is made to conform to the last effects a reshaping contrary to that applied to the shell in this process between removal from the last and its use as a model for production of the preforming mould. The preformed shape so produced need not necessarily be the exact shape of the partially flattened shell; it can instead be a development of the shell shape. In some instances, for example, exaggeration of the shape in certain respects may be desirable to allow for a degree of recovery of the preformed material after separation from the preforming mould.

The reshaped shell can also be used to determine the shape to which are cut the blanks of the starting material treated in the preforming step.

What is claimed is:

1. A method of preforming a blank intended for use as a shoe upper forepart by deforming the blank from an initial shape into a shape more readily deformable into the shape subsequently required, the steps of clamping the blank along at least two edges so as to lie generally in a single plane, and effecting deformation of the blank by engaging the blank with a mould having a moulding surface with a shape intermediate the initial substantially flat shape of the blank and a shape subsequently required after lasting, and relatively moving the blank so clamped and the mould to cause the mould to engage the blank in a direction having at least a component towards the toe portion of the blank.

2. A method according to claim 1 in which the mould is heated.

3. A method according to claim 1 in which the direction of movement makes an angle of approximately 70° with the initial plane of the blank.

4. A method as claimed in claim 1 in which the mould is tilted forwardly about a transverse axis during said movement in engagement with the blank.

5. Apparatus for preforming a blank intended for use as a shoe upper forepart, the apparatus comprising a mould having a moulding surface with a shape intermediate the initial shape of the blank and a shape subsequently required after lasting, a clamping device arranged to secure the blank along at least two edges to lie in an initial shape and means for causing relative movement of the clamping device and the mould with at least a component of said movement being towards the toe end of the blank so as to engage the moulding surface with the blank secured in the clamping device to thereby mould the blank into a shape more readily deformable into the shape subsequently required.

6. Apparatus as claimed in claim 5 in which the clamping device comprises a pair of apertured plates, and means for moving the plates to clamp the edges of the blank therebetween around the edges of the apertures and secure the feather edge of the blank against being released from the clamping device while preforming the blank.

7. Apparatus as claimed in claim 6 in which the clamping plates are generally planar, a plurality of guide pins project from one of the plates, and a plurality of holes are provided in the other plates for receiving the pins, the pins serving to keep the plates parallel during the movement to clamp or release the blank and to register the blank with the apertures in the plates.

8. Apparatus as claimed in claim 6 in which the apertures open towards the ends of the plates remote from

the toe portion, and the plates are divided longitudinally into parts, pivot means being provided to pivot the parts together about an axis at right angles to the plane of the blank to allow the separation of the parts to be adjusted according to the size of the blank.

9. Apparatus as claimed in claim 6 having hinge means on the line or lines between adjoining flat sections of each plate.

10. Apparatus as claimed in claim 5 in which the clamping means are generally planar, the apparatus having a thrust shaft, means mounting the mould on the thrust shaft and means for moving the thrust shaft longitudinally to engage the moulding surface of the mould with the clamped blank in a direction inclined to the plane of the blank towards the toe portion of the blank.

11. Apparatus as claimed in claim 10 in which the means for moving the thrust shaft are arranged to effect movement of the thrust shaft at an angle of approximately 70° to the plane of the blank.

12. Apparatus as claimed in claim 10 in which the means mounting the mould on the thrust shaft comprise a connection permitting pivotation of the mould towards the toe portion of the blank, the apparatus including an extensible device, means pivotally connecting the device at one end to the thrust shaft and at the other end to the mould rearwardly of the pivotal connection between the mould and the thrust shaft, and means for effecting extension of the extensible device to effect the pivotation of the mould.

13. Apparatus as claimed in claim 5 in which the clamping device comprises a pair of apertured plates and means for moving the plates to clamp the margin of the blank therebetween around the edges of the apertures, and in which there is a plurality of teeth projecting from one of the clamping plates at the toe portion thereof for forming notches in the clamped margin of the blank.

14. A method of producing a mould for use in preforming a blank intended for use as a shoe upper forepart the method having the steps of making a shell of deformable material having the shape subsequently required, deforming the shell to a shape having edges lying in not more than a small number of planes, and modelling the mould on the deformed shell.

15. A method as claimed in claim 14 in which the shell is moulded on a last having the shape subsequently required.

16. A method as claimed in claim 15 in which the shell is a layer of thermoplastics material vacuum-formed over the last.

17. Apparatus as claimed in claim 5 in which the clamping device comprises a pair of apertured plates and means for moving the plates to clamp the margin of the blank therebetween around the edges of the apertures, and in which there is a plurality of punches projecting from one of the clamping plates for punching holes in the clamped margin of the blank.

18. Apparatus as claimed in claim 5 in which the clamping device comprises a pair of apertured plates and means for moving the plates to clamp the margin of the blank therebetween around the edges of the apertures, and in which there is a rib projecting from one of the clamping plates for impressing a groove in the clamped margin of the blank.

19. A mould for use in preforming a blank intended for use as a shoe upper forepart, the mould having a blank engaging surface shaped to have the approximate form and contour of an upper forepart after lasting but heightwise being intermediate the initial substantially flat shape of the blank and the height of the forepart subsequently required after lasting.

20. The method of forming a shoe upper forepart which includes the steps of providing a mould by making a shell of deformable material on a last or last-shaped body so as to have the shape subsequently desired of the

upper forepart, then deforming the shell by partially flattening the shell, while holding the margins thereof in substantially one plane, to a shape intermediate the shape of the last and the plane of the margins of the shell, casting the mould from the cavitated side of the shell; securing to a support the margin portions of a blank of shoe upper forepart material to cause the blank to be held taut with the margins of the blank in substantially one plane; while the blank is so held, forcing the mould against the blank to cause the blank to assume a shape substantially like that of the mould; and finally imparting to the blank its finished shape in a lasting operation.

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PATRICK D. LAWSON, *Primary Examiner*.

U.S. Cl. X.R.

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