United States Patent

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[33] **Germany**
[31] **P 18 03 131.7 and P 18 17 539.8**

[54] **METHOD FOR CONSTRUCTING SHOES**
4 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **12/145**
[51] **Int. Cl.** **A43d 21/00**
[50] **Field of Search** 12/10.1, 145

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ABSTRACT: Shoes are constructed on a last by loosely placing an upper over the last and properly centering it thereon by bringing marks on the upper and the last into registration, loosely pulling the centered upper over the last, clamping the upper to clamping implements, successively stretching the upper longitudinally and laterally by the implements, and attaching the lip of the upper to the insole on the last.

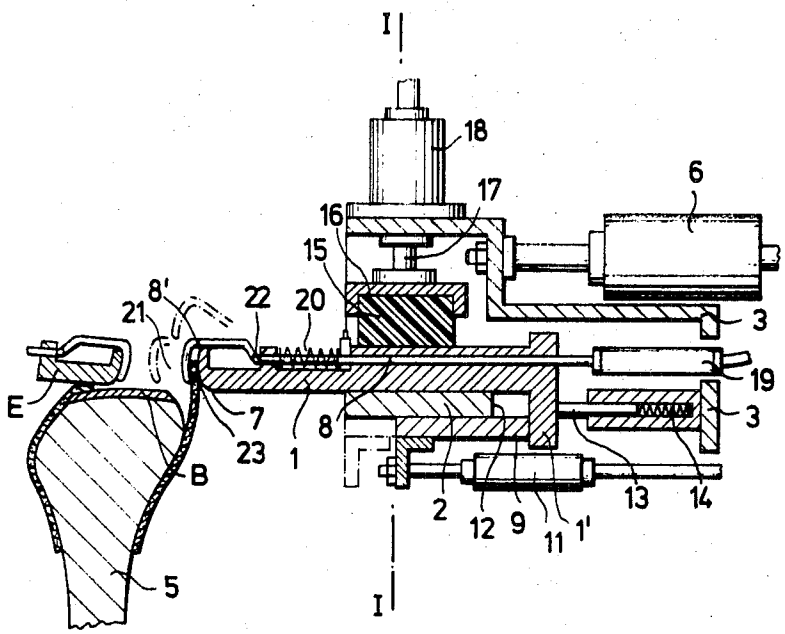


FIG. 1

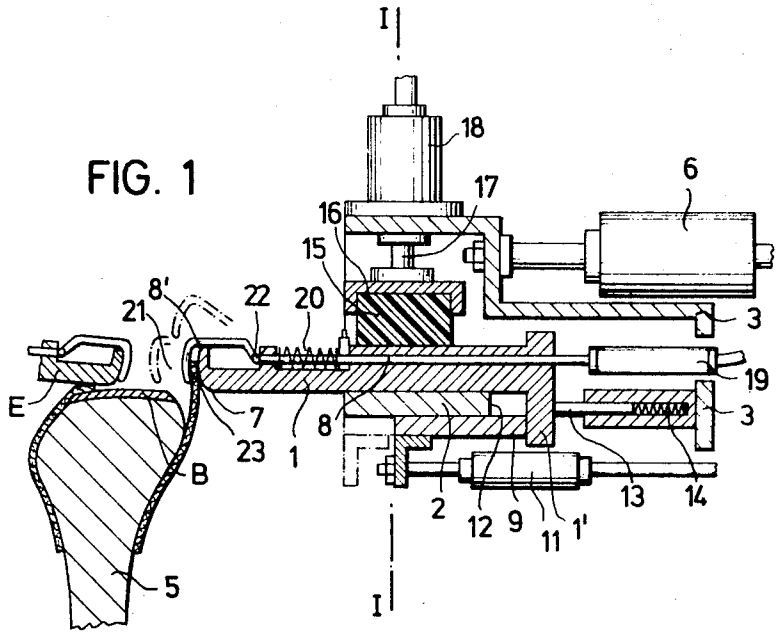
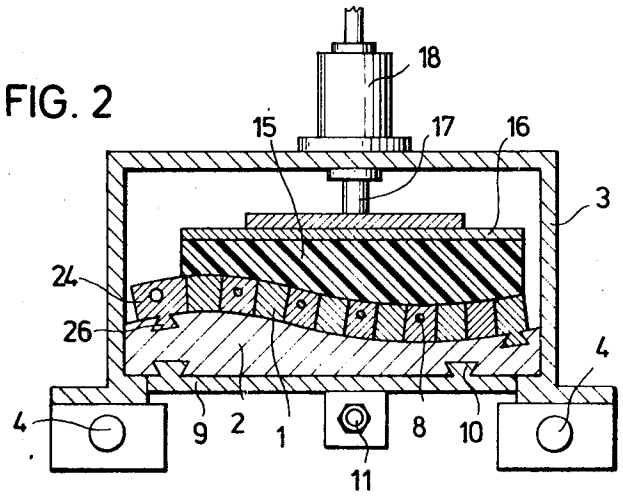


FIG. 2



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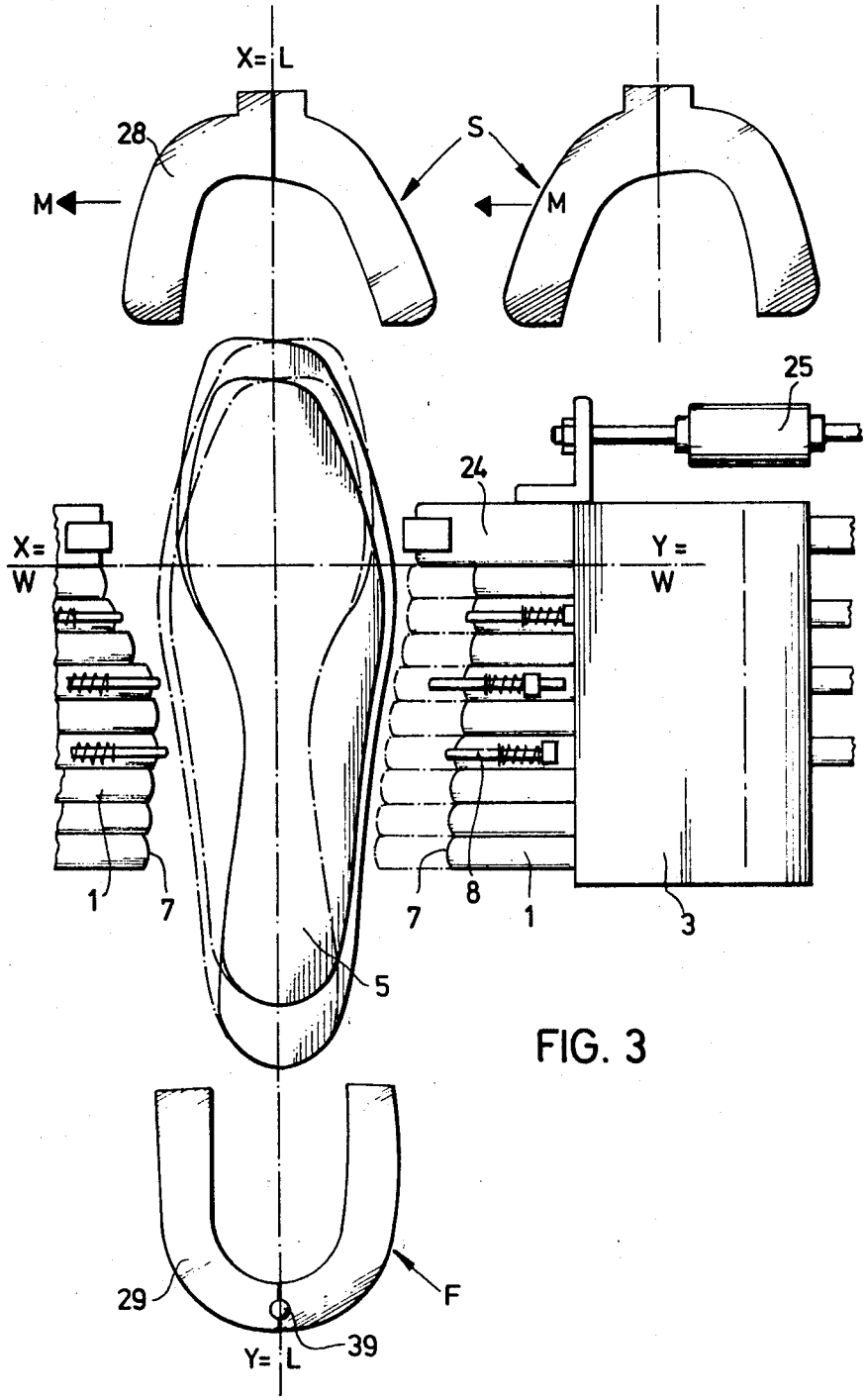

FIG. 3

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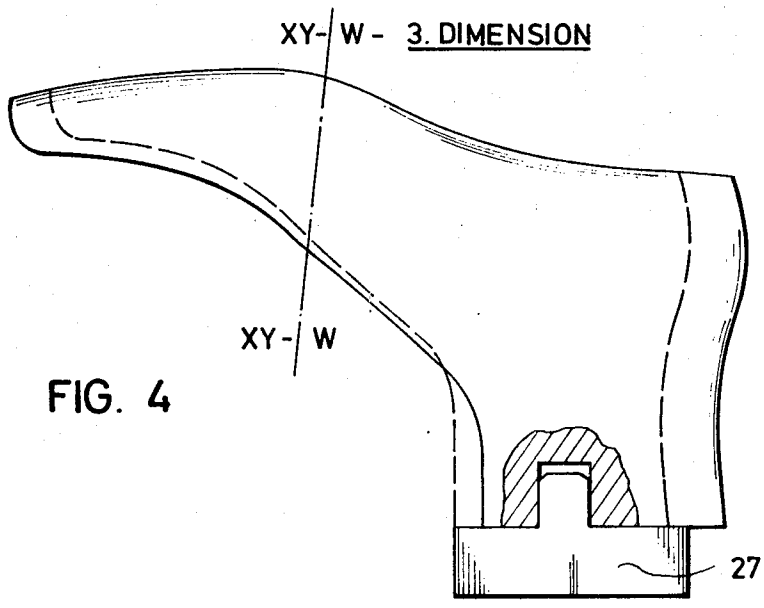

FIG. 4

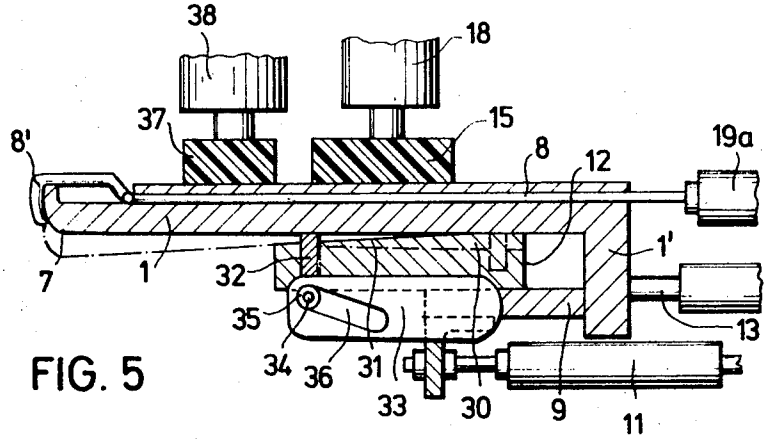

FIG. 5

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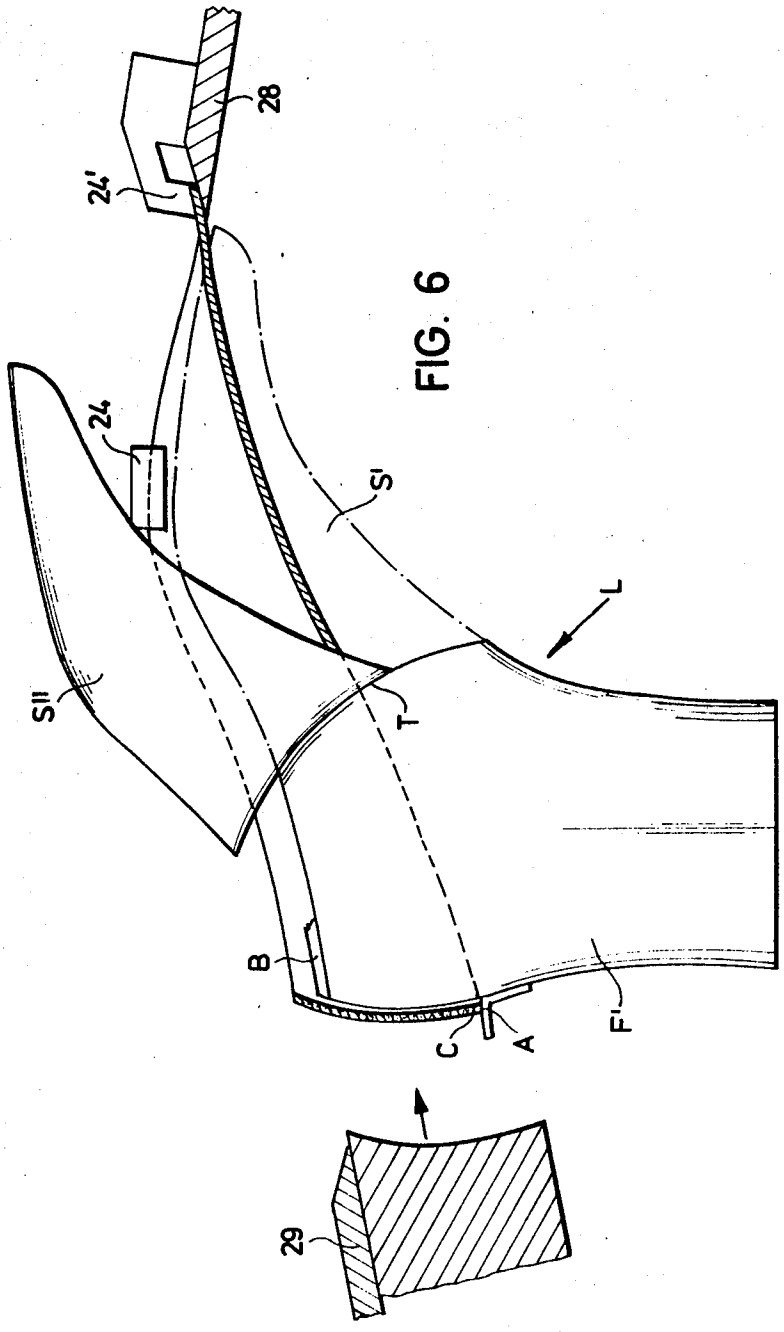

FIG. 6

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METHOD FOR CONSTRUCTING SHOES

The present invention relates to improvement in the series production of shoes, and more particularly to improvements in lasting.

Conventional lasting involves highly skilled and accordingly expensive labor, long production times and complex quality controls.

It is the primary object of this invention to overcome these disadvantages in a lasting system in which the upper is loosely placed over a stationary last by hand, is accurately centered on the last by means of registering marks, and is subsequently clamped to clamping implements, stretched, and finally attached to the insole in an automatic sequence of steps without interruption due to changes in shoe size within a predetermined range of sizes and/or to the production of right and left shoes.

In the method of the invention, an upper is loosely placed over the last so that the upper is completely loose in a first direction extending along a longitudinal axis and a second direction extending transversely thereof along a laterally extending axis intersecting the longitudinal axis. The longitudinal axis defines marks on the toe and heel portions of the last and the transverse axis defines lateral marks on the last. The upper has four marks corresponding to the marks on the last and is loosely placed on the last so that the corresponding marks on the upper and on the last are in registry. The upper is then pulled down until a lip of the upper projects beyond a circumferentially extending edge of the sole of the last, and the lip is clamped to clamping implements, with the lip projecting beyond the edge of the last sole. The upper is successively stretched longitudinally and laterally by the implements, the lip of the upper is then edged over the circumferential edge of the insole placed on the sole of the last, and the lip of the upper is attached to the insole. The transverse axis defines marks in the ball region of the last, and the upper is preferably clamped along the longitudinal and transverse axes.

By selecting the marks along the axes, it is possible to obtain a uniform clamping of left and right shoe uppers so that all shoes have the same proportions. These axes pass preferably through the toe and heel, on the one hand, and the ball region, on the other hand. An adjustable stop on the heel portion of the last positions the heel portion of the upper thereon, and this stop may also have a mark for centering the heel portion of the upper on the last.

In the lasting method of this invention, the upper is clamped to the lateral clamping implements in the ball region and the toe of the upper is clamped to an endwise implement and pulled against the ball region. Stretching of the upper may be effected by movement of the last in respect of the clamping implements or by movement of one last part in respect of another last part, and/or by movement of the clamping implements in respect of the last.

According to another aspect of this invention, each clamping implement along the transverse axis comprises a series of adjacently positioned clamping fingers. Each finger has a working end for clamping the upper to the last and a support guide is provided for the clamping fingers. The support guide has a curved support surface the curvature of which corresponds to the average profile of the sole portion of a range of last sizes. The support guide is mounted in a housing and means is provided for reciprocating the support guide housing in respect to the last. Camming means cooperates with the ends of the fingers opposite the working ends thereof for aligning the working ends of the fingers in correspondence to a respective lateral edge of the sole portion of the last.

The above and other objects, advantages and features of the present invention will become more readily apparent from the following detailed description of certain presently preferred embodiments thereof, taken in conjunction with the accompanying drawing wherein

FIG. 1 is a vertical section of one embodiment of an apparatus for attaching the welt of a shoe upper to an insole;

FIG. 2 is a transverse section of the apparatus along line I—I of FIG. 1;

FIG. 3 is a schematic top view of a last and apparatus for clamping the tip, side and heel portions of a shoe upper on the last, the chain-dotted lines indicating the movements of the clamping fingers within a predetermined range of shoe sizes, left-foot lasts of the largest and smallest size within this range being shown in full lines and corresponding right-foot lasts being shown in chain-dotted lines;

FIG. 4 is a side view of the last position, the largest size being shown in full lines and the smallest size in broken lines;

FIG. 5 is a vertical section similar to FIG. 1 of a modified embodiment of an apparatus according to this invention; and

FIG. 6 is a schematic side view of one embodiment of a last in its relative position to the shoe upper shaping and clamping devices.

Referring now to the drawing and first to FIGS. 1 and 2, there is shown a shoe upper U having a circumferential edge portion or lip 23 which is to be attached to insole B on the last 5, the upper having been pulled over the last and the last being centered between a pair of like implements for clamping the lateral parts of the lip of the upper to the insole. Each of these implements comprises a series of adjacently positioned edging or clamping fingers 1 laterally directed against a respective lateral part of the insole, the downwardly facing surfaces of the series of fingers defining a curved plane substantially conforming to, and slightly above, the curved plane of the insole. As is clearly shown in FIG. 2, the curve of this plane is determined by a support guide 2 having a support surface on which the clamping fingers 1 are mounted, the curvature of the guide surface corresponding to the average profile of the lasts of all shoe sizes in a predetermined range of sizes for which the apparatus is to be used. The support guide 2 is fixedly mounted in a housing 3 which is glidably journaled on guide rods 4, 4 for transverse reciprocation in respect of last 5. In the illustrated embodiment, the reciprocating means for housing 3 is a jack 6 whose piston rod is attached to the housing while the cylinder is attached to a machine frame (not shown) so that the clamping implement may be moved between a rest position shown on the right in FIG. 1 and a clamping position E shown in FIG. 1 on the left, in which position the downwardly facing surfaces of the clamping fingers lap the lip 23 over the insole B. In the end position of the clamping implement, the working ends 7 of the clamping fingers are at a distance of about 3–4 cm. from the lateral sides of the last.

As is best seen in FIG. 3, the working ends of the clamping fingers define a curving line corresponding to the lateral parts of the circumference of the insole. This curving line is determined by either a first camming surface on slide 9 or a second camming surface 12. The first camming surface is formed along the edge of slide 9 which is mounted in dovetailed grooves in support guide 2 by means of guide rails 10 extending transversely of last 5. The slide 9 may be reciprocated by jack 11 between the positions indicated respectively by chain-dotted and full lines in FIG. 1, the camming surface of slide 9 acting upon the shoulders 1′ of the clamping fingers 1 when the slide is moved backwardly against the shoulders into the operating position of the implement. The curvature of the first camming surface on slide 9 corresponds to the lateral outside of the insole or last as shown on the right in FIG. 3.

The curving line defined by the working ends 7 of the clamping fingers 1 may be changed in conformity with the inner lateral side of the insole or last, as shown in FIG. 3 on the left, by moving slide 9 inwardly so that it assumes the position shown in chain-dotted lines in FIG. 1 so that the rear edge of the support guide 2 defines the second camming surface 12. Accordingly, the jack 11 moves the slide 9 towards the last, permitting a rod 13 to press the shoulder 1′ of each finger against the camming surface 12 under the pressure of compression spring 14. The rods 13 are guided in a channel member projecting from housing 3 and accommodating spring means 14. In this manner, the working ends 7 of the fingers 1 will be aligned according to the instep edge of the insole for

clamping the welt of the upper thereto. To permit this movement, the clamping fingers 1 are glidingly mounted on the support guide 2.

This gliding movement of the fingers 1 on support guide 2 may be blocked and the fingers may be locked into an operating position by pressing an elastic cushion 15 into frictional engagement with the fingers 1. The cushion may be of natural or synthetic rubber, polyurethane or like resilient material. It is mounted in a U-shaped holder 16 which is attached to piston rod 17 of a cylinder 18 which is mounted on top housing 3 so that the cushion may be reciprocated for blocking and unblocking the movement of the clamping fingers on support guide 2.

Each or at least some of the fingers 1 have journaled therein for reciprocating motion a pin 8. A compression spring 20 is connected to the pin and so biased as to retain the pin normally in the closed position shown in full lines in FIG. 1 wherein a clamping hook 8', which is pivoted to the outer end of the pin, engages the working end 7 of the clamping finger. Before the implement is moved into the operating position indicated by chain-dotted lines on the right of FIG. 3 by moving housing 3 by means of jack 6, jack 17, 18 is operated to block the fingers in the aligned position determined by the first camming surface on slide 9, and the unidirectionally operating miniature jacks 19 move the pins 8 against the bias of springs 20 into open position 21 shown in chain-dotted lines in FIG. 1. In this clamping position of the implement, the opened pins press against the lip 23 of the upper with the front faces of their hooks 8'. These hooks are pivoted to the outer ends of the pins at 22 and will be upwardly pivoted about pivot 22 as jacks 19 move the pins against lip 23 into the chain-dotted position shown in FIG. 1 so that the hooks 8' readily glide over the lip 23. As soon as the fingers 1 have reached the clamping position, i.e. the lip of the upper is positioned between the hooks 8' and the working ends 7 of the fingers the pressure in jacks 19 is relieved, causing the springs 20 to pull the pins and hooks back so that the lip 23 will be clamped tight. Depending on operating conditions, all or only some of the clamping fingers may be provided with clamping pins, FIG. 2 showing four such pins.

The bias of spring 20 may be adjusted by a setscrew according to desired working conditions. The spring force will determine the extent to which the upper is pulled by the lip 23.

After the lip is clamped tight, the fingers of the implements on both sides of the last are moved into the final position E. This produces a pull on the upper over the last and simultaneously laps the lip 23 over the insole B, a vertical pressure exerted between the clamping fingers and the last causing the overlapping lip of the upper to be firmly pressed against the insole edge. The upper may now be attached to the insole by a suitable adhesive, for instance a cement which may be sprayed between the overlapping edges or which may have been applied beforehand to the edge of the insole. After the upper has thus been bonded to the insole, the implements are moved into their rest position.

The support guide 2 of each clamping implement also glidably carries a clamping slide 24 arranged to lap the lip 23 of the upper over the insole edge in the region of the ball. As shown in FIG. 3, a jack 25 is mounted on housing 3 and connected to the slide 24 for reciprocating movement of the slide. The slide has a dovetailed guide rail 26 moving in a corresponding groove in support guide 2 (see FIG. 2) so that the slide may be adjusted with its clamping end in suitable alignment with the working ends 7 of the clamping fingers 1. In this aligned position, the clamping slide 24 is moved with the housing 3 into the operative position of the implement so that the upper lip is lapped over the ball region of the insole at the same time that the lip of the upper is clamped over the longitudinally extending, lateral portion of the insole by fingers 1.

FIG. 3 illustrates the position of two different sizes of lasts between the two implements arranged to lap the laterally extending lip parts of the upper over the insole edge for attachment thereto, the left-foot lasts being shown in full lines while the right-foot lasts are shown in chain-dotted lines. As may be observed, the position of the coordinate axes XY–L and XY–W, which form the coordinate system determinative of the marking, remains unchanged in respect of the pair of clamping implements, regardless of the size of the last. In other words, the marking points at the toe portion or tip, the heel portion and the ball portion of the last and correspondingly of the upper are determined by a single coordinate system which remains unchanged for different last sizes within the selected range of shoe sizes.

In view of this, it is very simple and easy accurately to position the shoe upper on the last in relation to the respective markings. This assures that a series of sequentially produced shoes, whether right or left and of any size within the selected range, will be shaped uniformly on the last and clamped to the insole in a uniform manner.

As will be appreciated from the view of FIG. 3, the working ends 7 of the implements may be aligned into the correct position in relation to a left or right last and the instep and outside lateral edges of the last by camming the shoulders 1' of the fingers either by the first camming surface on slide 9 or the second camming surface along the rear edge of support guide 2.

FIG. 4 illustrates the mounting of the different-sized lasts on socket 27 in such a manner that the difference in the side profile between the largest and the smallest size last is as little as possible.

In the embodiment of FIG. 5, like reference numerals designate like parts operating in a like manner so as to obviate redundancy in the description. In this embodiment, the miniature jack 19*a* is double acting for reciprocation of the pin 8, thus obviating the need of return spring 20 of the embodiment of FIG. 1. After the fingers 1 have been aligned in the desired operating position, an elastic or resilient pressure cushion 37 is pressed vertically against the working ends 7 of the fingers by jack 38 so as to hold the fingers in the adjusted position. The pressure in jack 18 is then relieved so that the individual clamping fingers press independently of each other against the last while automatically equalizing minor differences. Thus, the completed shoe attains a well-shaped side profile.

The camming arrangement for aligning the fingers of the implements in respect of the lateral edges of the last differs from that of the first-described embodiment in that it provides for more extensive differences between the profiles or configurations on the instep and outside. This is the case particularly where the last is designed for shaping orthopedic shoes.

For this purpose, the support guide for the fingers 1 has a rear surface 30 which is curved in correspondence to the profile of the outer side of the last and insole and a forward surface 31 adjacent the last which is differently curved in correspondence to the instep profile of the last and insole. The support surface for the fingers slopes downwardly from the rear towards the forward portion of the surface. The forward portion of the support guide defines a vertical slot which glidably supports a ledge 32 whose upper edge is curved in correspondence to the curvature of the rear surface 30. The lower end of the ledge carries a pin 34 extending laterally from each side thereof, with an antifriction bearing 35 moving in slot 36 of arm 33 mounted on slide 9 on each side of the ledge, one of the arms extending in the direction of the heel of the last and the other arm extending in the direction of the last toe or tip. The slots 36 in the ledge guide arms 33 are downwardly inclined so that, when the fingers are to work on the instep side of the shoe, the slide 9 is moved by jack 11 towards the last. Since the arms 33 move with the slide 9, on which they are fixed, the pins 34 on ledge 32 will be forced to move downwardly along downwardly sloping slots 36 until the upper edge of the ledge 32 is flush with, or below, the forward surface 31 of the support guide for the fingers 1. Thus, the fingers will be moved from a horizontal position shown in full lines in FIG. 5, wherein they are supported on the rear surface 30 and the conforming surface of ledge 32, to an inclined position shown in chain-dotted lines in FIG. 5, wherein the fingers are

supported on the forward surface **31** of the support guide so as to follow the contour of the instep portion. Simultaneously, the inward movement of the slide **9** towards the last enables the shoulder **1'** of the finger to be pressed against the camming surface **12** so as to align the working ends **7** of the fingers in accordance with the lateral instep configuration. In this position of proper alignment in all directions, the fingers are locked in position by actuation of jack **18** which presses the fingers against the surface **31**.

The device S for lapping the toe part of the upper over the insole for attachment thereto is conventional and comprises a pair **28** of pivotally interconnected frames which are moved into engagement with the protruding welt for lapping the welt over the insole in a manner generally shown in FIGS. **3** and **6**. Suitable guide means (not shown) is provided to move the device S along the XY–L axis from a rest into an operating position when the lateral clamping implements are so moved. The same is done with similarly conventional device F for lapping the heel part of the upper over the insole. If these implements are used in an automatic operation with constantly changing shoe sizes, requiring frequent changes of the implement movements in respect of the last, the movement may be suitably programmed and actuated by hydraulic, mechanical or electrical means, including photocell controls and the like.

If the last toe portion is asymmetric, for instance for right and left shoes, a pair of corresponding devices S may be arranged for selective movement transversely of axis XY–L so that one or the other device may be placed into operating position, as indicated by arrow M. In the end or operating position, the devices S and F press the welt of the upper against the toe and heel parts of the insole, a suitable cement being used to bond the upper to the insole.

The heel portion-lapping device F comprises a pair **29** of frames which are pivotally interconnected at **39**, the clamping frames cooperating with a heel-shaping part **29'** which presses against the heel part of the upper when the device F is moved into its end or operating position. The heel-shaping portion may have as close a tolerance as 1/10th of a millimeter in respect to the heel portion of the last. Since the frames may be pivoted about pin **39**, the device may be adjusted to different widths for right and left shoes, respectively.

It is possible to work with all four edge-lapping implements simultaneously, or first to attach the lateral parts of the upper edge to the insole and subsequently to operate devices S and F after the lateral implements have been withdrawn into their rest position.

In the above-described lasting system, it is possible to work with a stationary last. The completely loose shoe upper is very accurately positioned and clamped without difficulty and without special skill. The tensioning of the upper in a longitudinal direction is effected by a force directly applied to the heel part. This makes it possible to shape the upper under minimum tensions, which considerably improves the quality of the lasting. The lasts are heated, which assures rapid stability of the shaped upper. The lip of the upper may be attached to the insole in a single-working cycle. The shoe may then be soled on the same machine without the necessity of removing the last with the upper thereon. All of this provides great economy in the production of high quality shoes.

When lasting in accordance with the present invention, the upper is pulled over a stationary last and positioned thereon according to respective marks on the last and on the upper while completely loose. While loose on the last, the upper is clamped or gripped, and finally attached to the insole under tension exerted by the clamping implements which lap the edge of the upper over the edge of the insole. All the tensioning or stretching of the upper in a longitudinal direction is exerted from the heel.

Accordingly, the upper is pulled over the sole of the last and the stationary heel portion of the last, and is positioned on the last by bringing corresponding marks on the upper and the last into registration. The last has two parts which are movable in relation to each other, the forward part of the last being moved upwardly in the direction of the sole of the last to shorten the last before the upper is positioned thereon. The upper is then stretched in a longitudinal direction from the heel portion of the last which is in the shaping position, and additional tension is applied to the upper in the direction of its width by moving the forward part of the last into its original, extended position. This has the advantage that the higher position of the forward part of the last does not interfere with the longitudinal stretching of the upper.

The longitudinal tensioning of the upper is produced either by moving the last part in the direction of the heel or by moving the clamping implements, especially those working in the ball and toe region, in the direction of the toe.

The last may be either internally heated, i.e. the last may be of metal and may carry internal heaters, or subjected to radiated heat from the outside. Such heating is particularly useful with the use of the more recently used porous plastic leather substitutes which are thermoplastic. Exposing such plastics to heat radiation will make them more pliable so as to facilitate their shaping. Once shaped in exact conformity with the shape of the last, the shaped upper will retain this shape upon cooling.

This lasting method is schematically illustrated in FIG. **6**. As will be noted, the last L is divided along an arcuate dividing line T into a heel portion F' and a toe portion S'. The toe portion of the last is glidable in relation to its heel portion along the dividing line which need not be arcuate but must be so shaped that the length of the sole of last L will be shortened when the toe portion is moved along the dividing line in the direction of the sole, i.e. when the sole portion of the toe portion is above the sole portion of the heel portion of the last. This position of the toe portion is shown at S'' in full lines. The heel portion F' is stationary in respect to the shaping and lapping implement **29**, **29'**.

The stationary heel portion of the last carries a stop or shoulder A serving to position the upper edge of the heel portion C of the upper while the forward portion of the upper is pulled over the last sole with the aid of the clamps **24** in the ball region of the last, in accordance with marks on the last and the upper. The clamps are arranged in the plane in which the edge of the upper is lapped over the insole. After the upper has been thus positioned on the last, it is stretched in the longitudinal direction either by moving the last in the direction of the heel or by moving the clamps **24** and **24'** in the toe portion of the last in the direction of the toe while these clamps hold the edge of the upper on the last. The ball and toe region of the upper is subsequently shaped by tensioning or stretching the upper widthwise. This is accomplished by moving the toe portion of the last from the shortened position S'' to the normal position S' along dividing line T, as indicated in chain-dotted lines. This pulls the clamped toe portion of the upper tightly about last portion S' and shapes the same. The sole of the toe portion of the last is then coplanar with the lapping implement **28**.

Thus, the upper is first longitudinally stretched while the heel portion of the upper is shaped about heel portion F' while the last has been shortened. Afterwards, the toe portion of the last is moved down to stretch the upper widthwise in the region of the ball and toes and thus to shape it in those regions.

The sole of the last may have pins or tacks and the insole B may have corresponding holes so that the insole may be properly positioned on the last for attachment of the upper to the insole.

What is claimed is:

1. In a method of constructing a shoe on a last, the steps of

1. loosely placing an upper over the last so that the upper is completely loose in a first direction extending along a longitudinal axis and a second direction extending transversely thereof along a laterally extending axis intersecting the longitudinal axis,
   a. the longitudinal axis defining marks on the toe and heel portions of the last and the transverse axis defining lateral marks on the last,

b. the upper having four marks corresponding to the marks on the last, and

c. the upper being placed on the last so that the corresponding marks on the upper and on the last are in registry;

2. pulling the upper down until a lip of the upper projects beyond a circumferentially extending edge of the sole of the last;

3. clamping the upper to the last, with the lip projecting beyond the edge of the last sole;

4. successively stretching the upper longitudinally and laterally on the last;

5. clamping or edging the lip of the upper over the circumferential edge of an insole placed on the sole of the last; and

6. attaching the lip of the upper to the insole.

2. In the method of claim 1, the transverse axis defining marks in the ball region of the last, and the upper being clamped to the last at said marks.

3. In the method of claim 1, the step of subjecting the upper to heat while on the last.

4. In the method of claim 1, wherein the last comprises a stationary heel portion and a toe portion movable in respect of the heel portion along a dividing line in the direction of the sole of the last, the dividing line being so shaped that the length of the last is shortened when the toe portion is moved in said direction and out of alignment with the heel portion, further comprising the steps pulling the upper over the sole of the last and then over the heel portion of the last while the toe portion is moved to shorten the length of the last before the upper is clamped to the last, the upper is stretched longitudinally with the heel portion of the last in shaping position, and the toe portion is then moved back into alignment with the heel portion of the last to stretch the upper widthwise.