United States Patent

[11] 3,577,578

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[54] **SHOE LAST REMODELING JIG**
27 Claims, 14 Drawing Figs.

[52] **U.S. Cl.** **12/146,** 12/123
[51] **Int. Cl.** **A43d 3/00**
[50] **Field of Search** ..... 12/123, 146; 12/(Cursory)

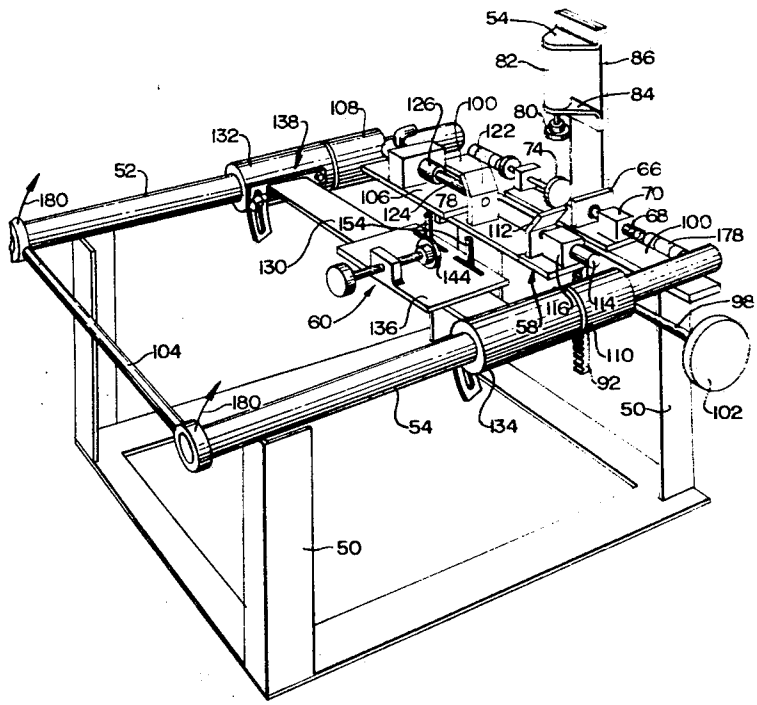
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ABSTRACT: A method and apparatus for fitting, in predetermined registration, a mold cap to the toe end of a last which is supported in a predetermined position and orientation. Gauges, adapted to contact the last at predetermined locations about its bottom pattern, are adjustable to the particular bottom pattern to insure that successive lasts of the same size and style will be supported in the same position and orientation. A mold cap gauge supported is also provided to support successive mold caps repetitively in the same orientation with respect to that of the supported last. The last and mold caps are then combined while in their respective, proper orientations to insure proper and uniform registration.



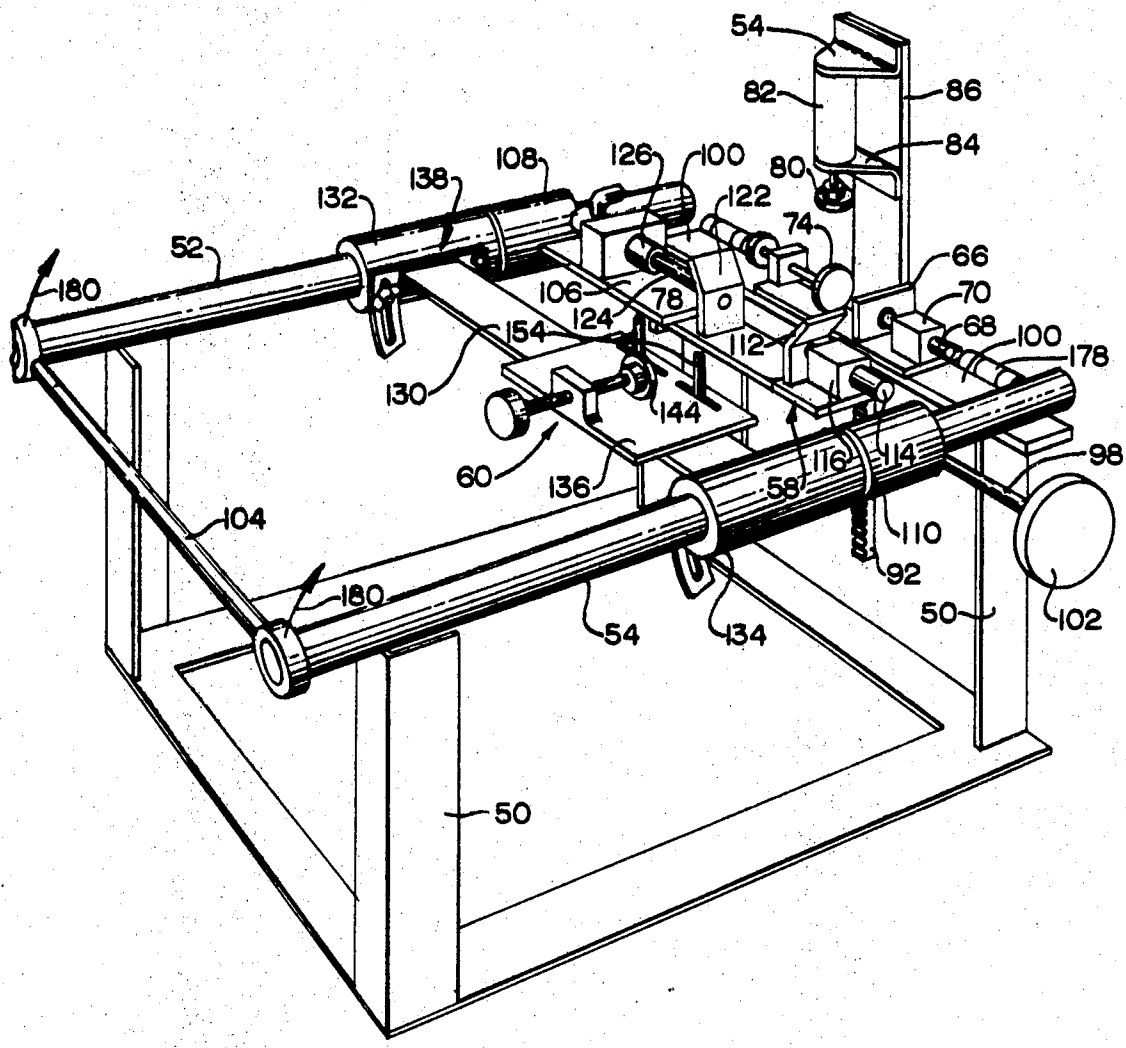


FIG. 1

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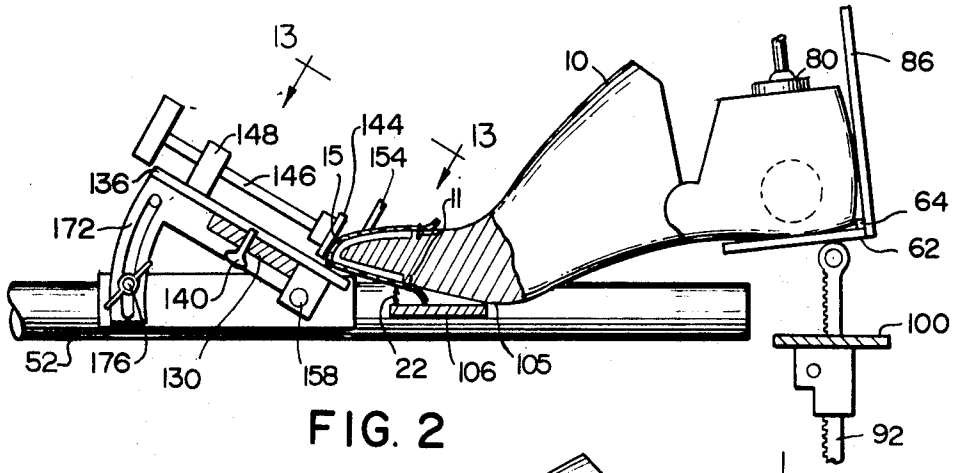


FIG. 2

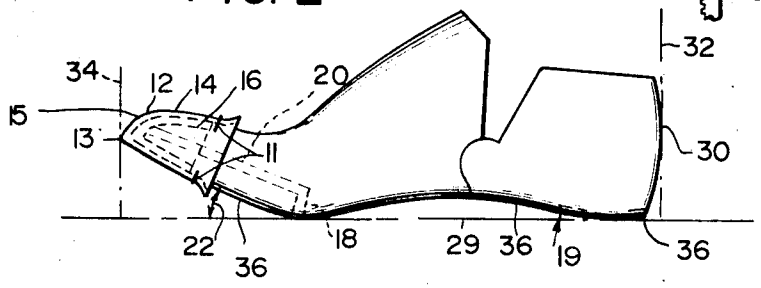


FIG. 3

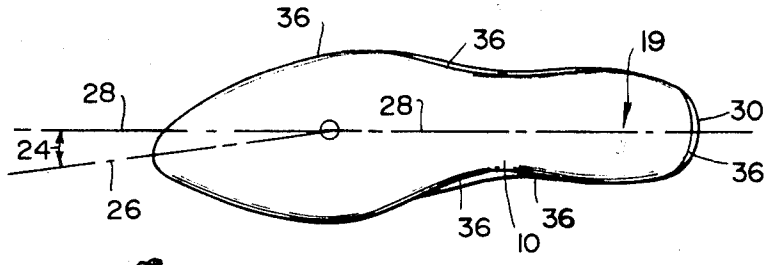


FIG. 4

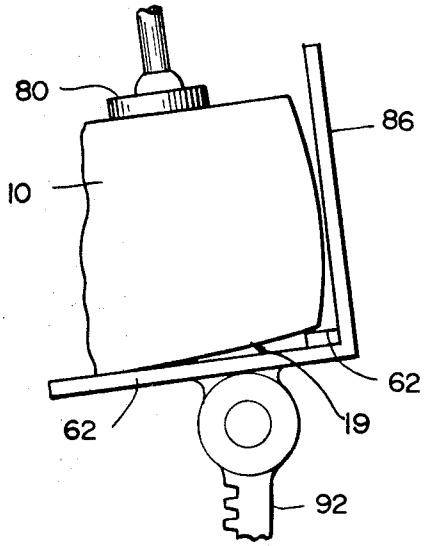


FIG. 5

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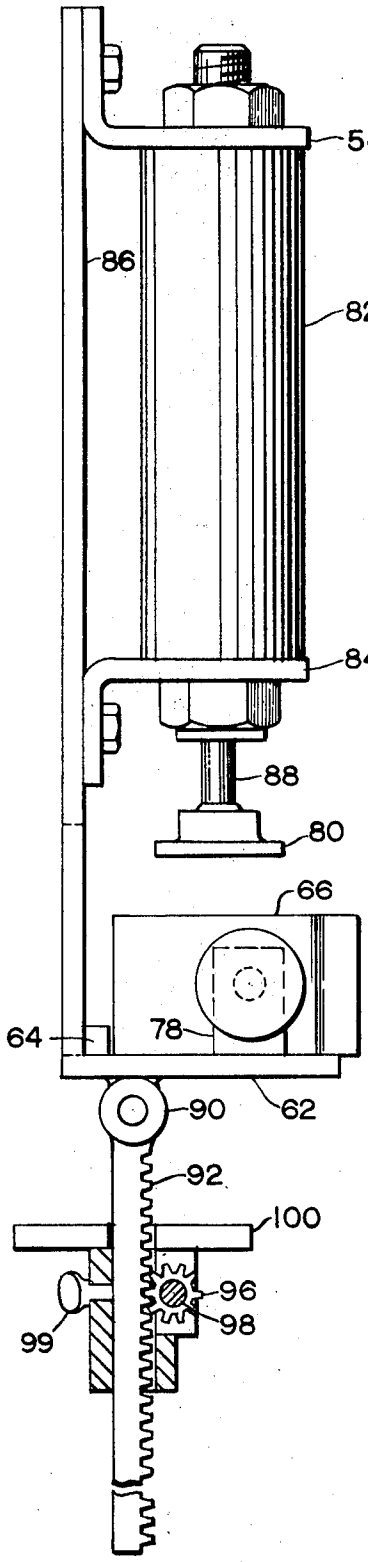


FIG. 7

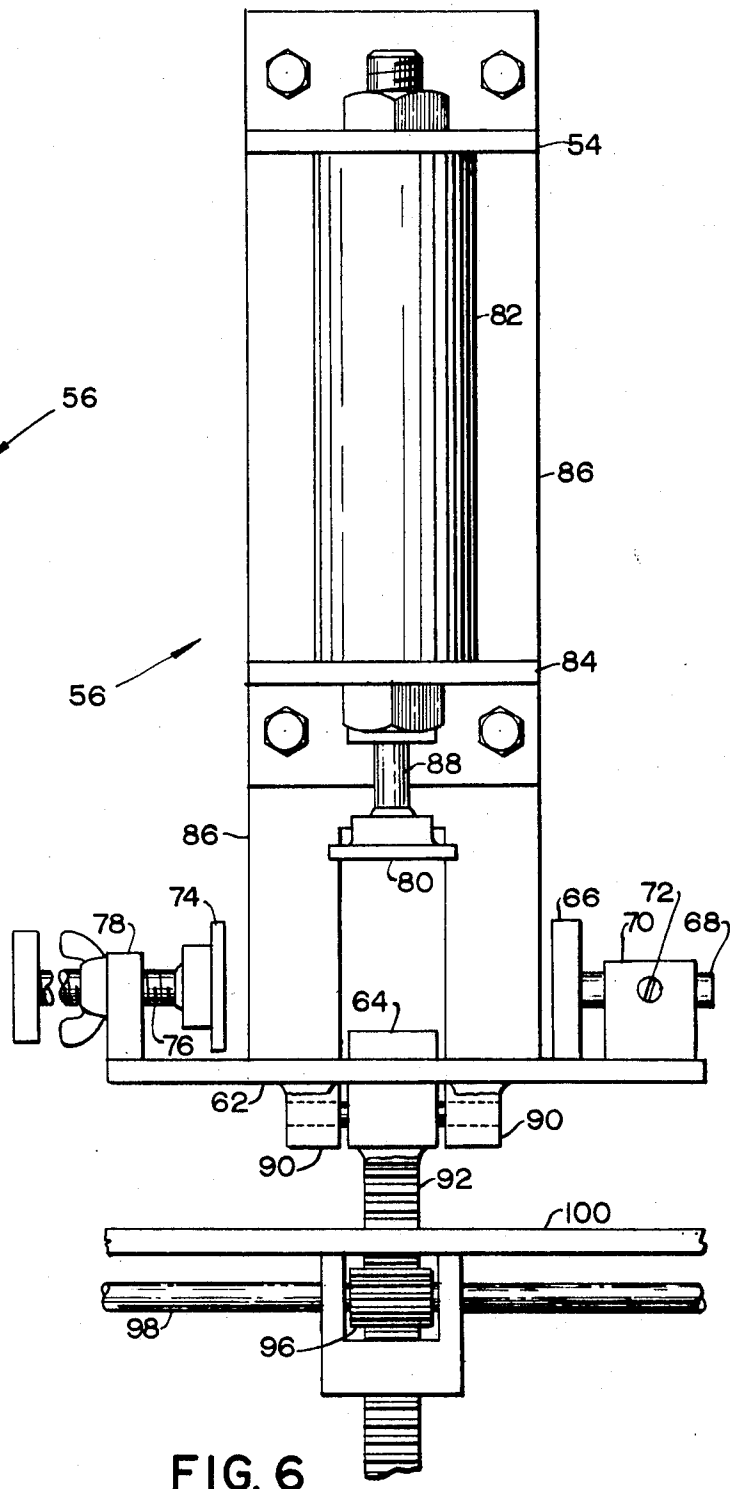


FIG. 6

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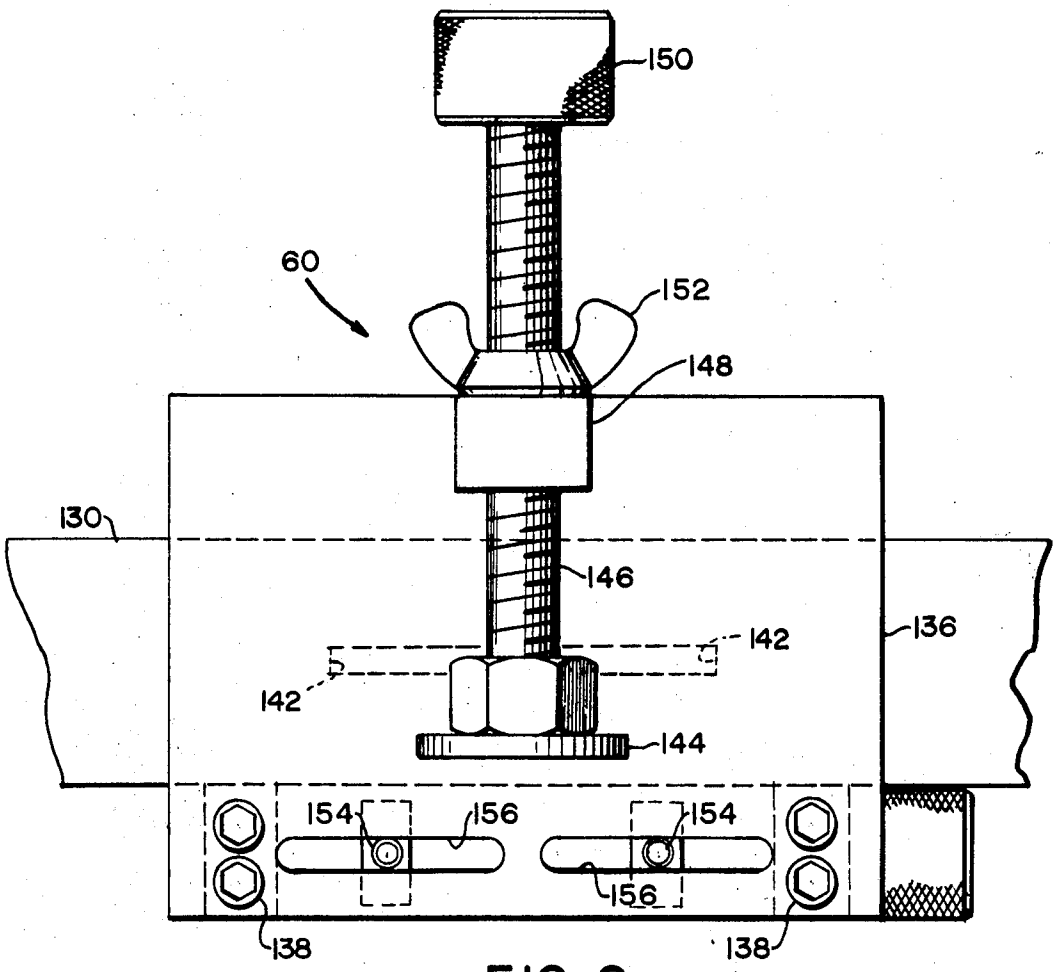


FIG. 8

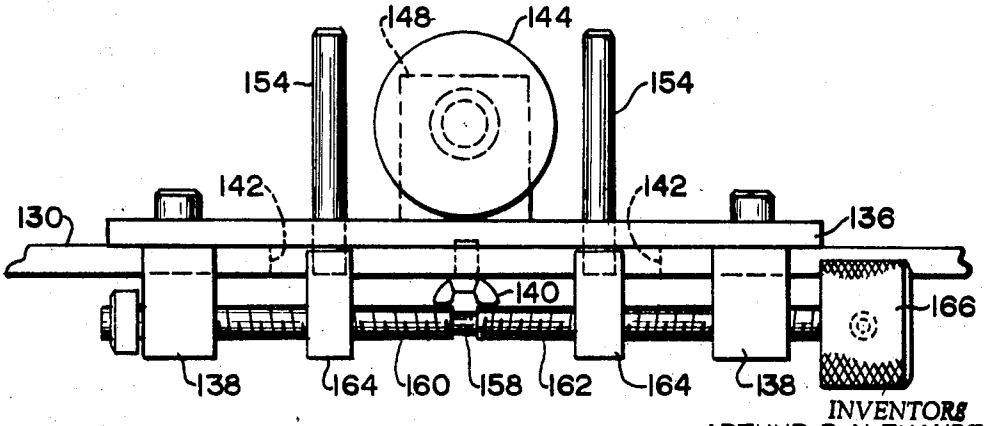


FIG. 9

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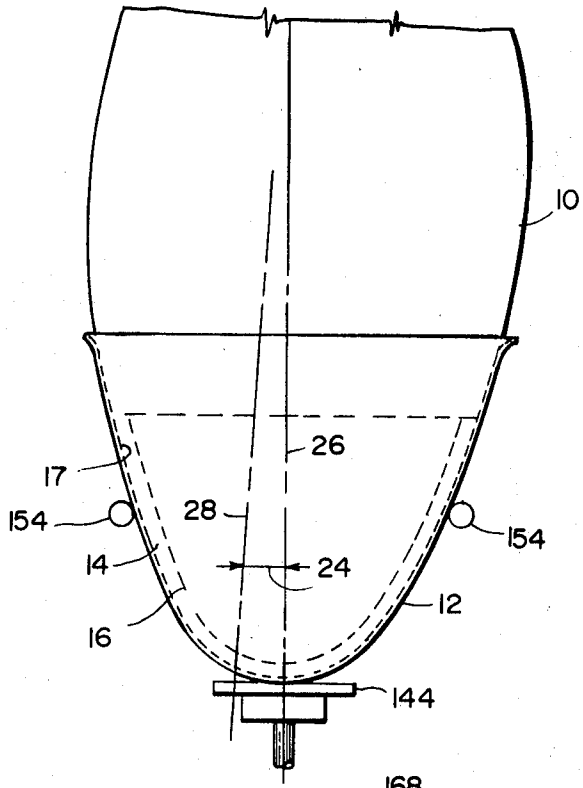


FIG. 13

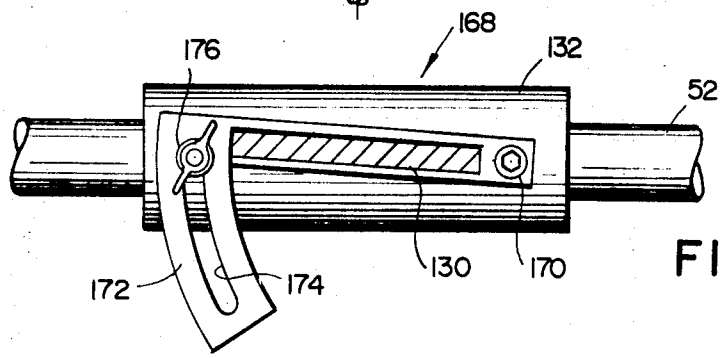


FIG. 12

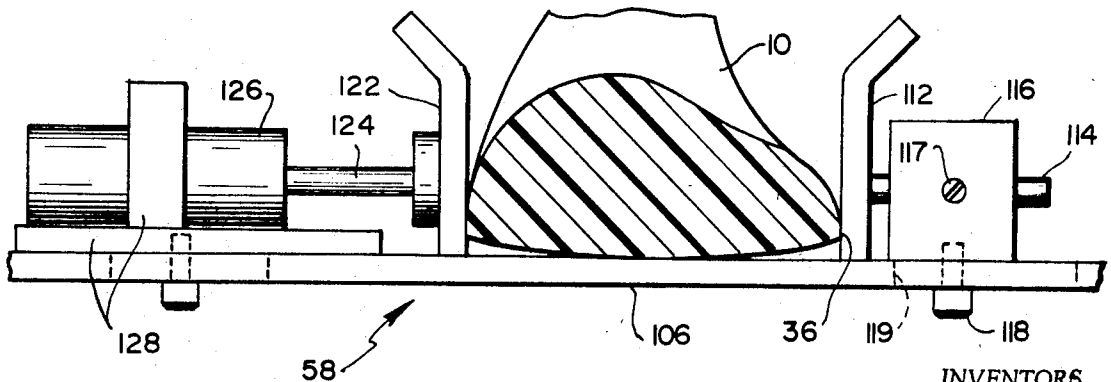


FIG. 10

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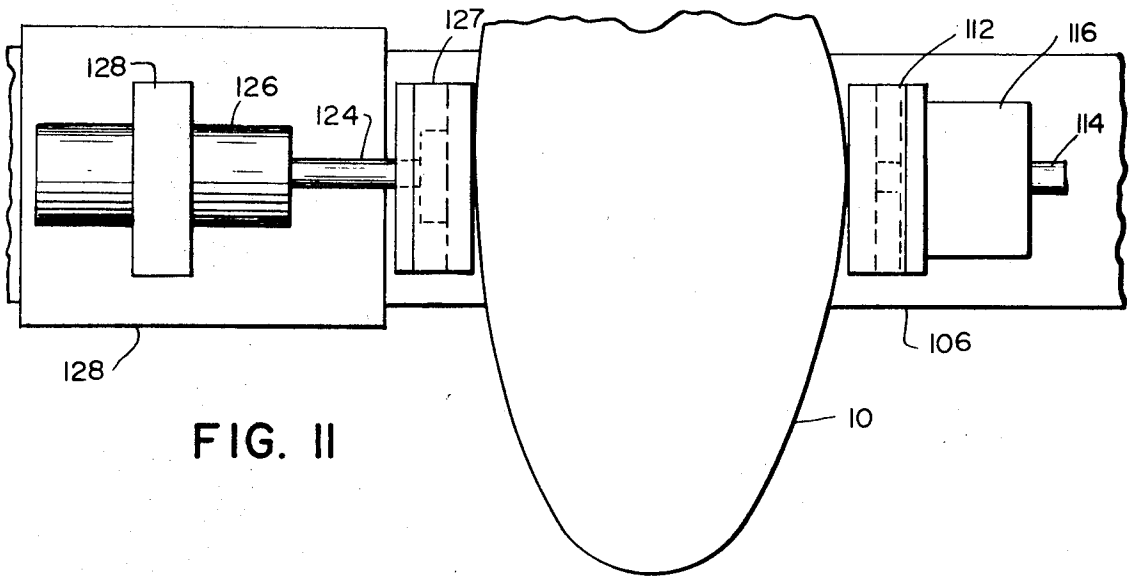


FIG. 11

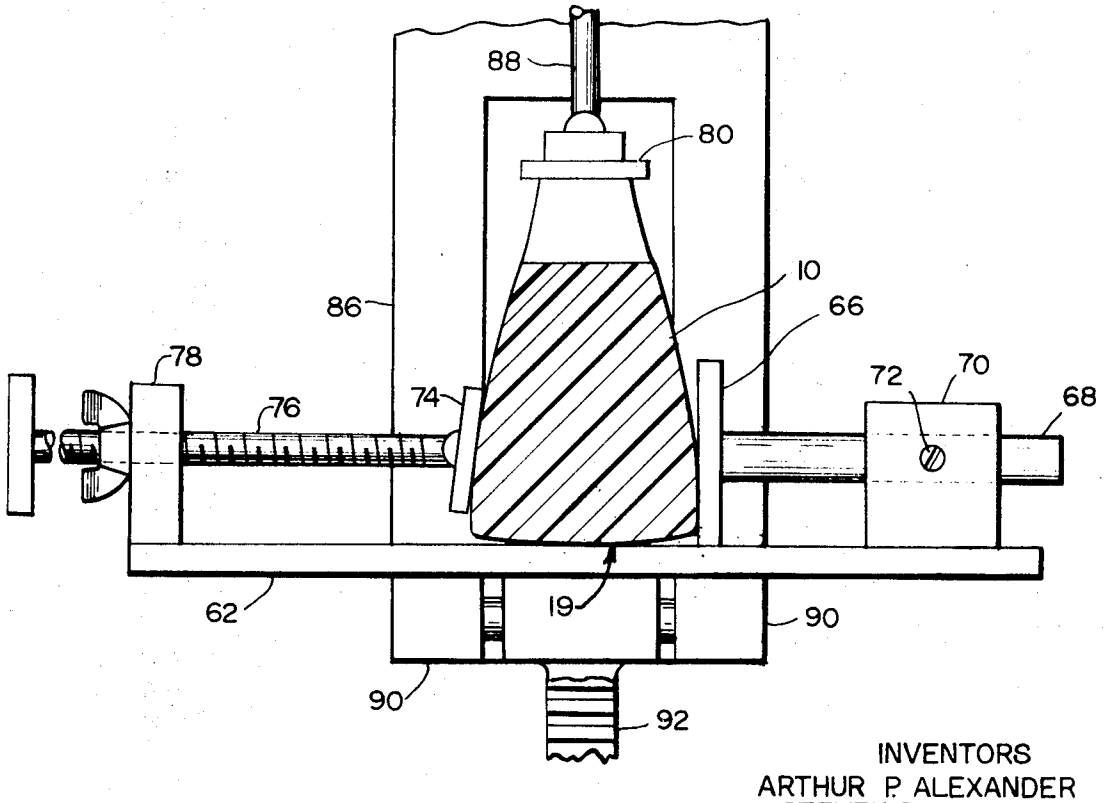


FIG. 14

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SHOE LAST REMODELING JIG

SUMMARY OF THE INVENTION

This invention relates to the manufacture of shoes and more particularly to a method and apparatus for restyling shoe lasts. Because of the style conscious nature of the shoe industry and the tendency to change styles at regular and frequent intervals a different set of lasts, corresponding to the new style, must be provided each time a style or shape is to be changed. In some instances this has required that a completely new set of lasts be manufactured according to the desired style. This practice is relatively expensive and, in addition, requires the shoe manufacturer to maintain a relatively large inventory of lasts. In an attempt to reduce the cost of manufacturing completely new lasts and maintaining large inventories, it has become common practice to reshape existing lasts to conform to the new style. When the change in style is not of a major nature and does not require extensive modification of the existing lasts, restyling has been found to be feasible economically. On the other hand, when the new style requires considerable and extensive modification to the existing lasts there may be little economic advantage to restyling the existing lasts and the most economical procedure may be to manufacture a completely new set of lasts according to the current style.

In a great number of instances a new style will require that the shape of the last be modified only in the toe region and, under these circumstances, restyling of existing lasts has been found to cost considerably less than manufacturing a completely new set of lasts. Accordingly, a number of methods have been proposed in the prior art for restyling and reshaping the toe ends of the lasts. One of the more commonly employed techniques is to completely sever the toe end of the last and then attach an oversized block or mass of material, such as wood or plastic, to the last in place of the severed toe portion. With the block attached rigidly, the last is then placed in a machine similar to that employed in manufacturing new lasts, such as the Reid Toemaking Machine, in which a last of the desired shape and size is machined with reference to a master last which the machine utilizes as a reference guide. Although this method of restyling the toe end of the last is considerably less expensive than manufacturing a completely new last, it is nevertheless wasteful of material and time in that the restyled last must be subjected to a time consuming machining operation.

Our invention is directed to a method and apparatus for molding or casting a toe of the desired style directly to and in proper registry with the last in a shape corresponding to the desired style thus eliminating the necessity of elaborate machining operations. The only finishing operation required is that of grinding away any flash that exists at the joined surfaces of the last and molded toe.

In accordance with our invention a master last is fabricated to conform to the newly desired style and a female mold cap is made of the toe end of the master last. The mold cap may be made by any number of acceptable methods. For example, I have found that a suitable mold may be formed simply by applying a sheet of polypropylene to the toe end of the master last and then vacuum molding the polypropylene sheet about the toe end of the master last. The last to be restyled is cut down about its toe end so that when the mold cap is placed in proper registry over the toe of the last to be restyled a void will exist between the internal surface of the mold and the cut down surface of the toe end to be restyled. In some instances it will not be necessary to cut down the toe end of the last. This is particularly true when the new style is larger at the toe than the last to be restyled. In that case the internal surface of the mold will be spaced naturally from the mold. Conduits are formed within the last to enable a suitable molding material to flow into the void.

A number of practical problems have been found to exist when employing the aforementioned molding or casting technique for restyling lasts. Among the primary problems is

the difficulty in aligning properly the mold cap with the last, particularly when the mold cap is made from a relatively flexible material such as polyethylene sheet. It will be appreciated that when the cap is in proper position on the last only a small, marginal portion of the cap will actually engage the last, the internal surface of the mold cap being spaced from the cut down surface of the toe or the last. Because of the flexibility of the sheet from which the cap is formed and the dimensional discrepancies between lasts, even when of the same size and style, there is little assurance that the cap will fit on the last in the proper orientation. Thus, it will be appreciated that in order to employ the advantageous casting or molding technique, reliable means must be provided for repeatedly and accurately aligning the mold cap with the last to be restyled. It is among the primary objects of our invention to provide such a means.

It should be noted that other attempts have been proposed in the prior art to align the mold cap with the last. These attempts generally have proven unsuccessful, primarily because of the dimensional variations between supposedly identical lasts. These discrepancies are accentuated further by reason of the normal handling of lasts during shoe manufacturing operations which frequently are abusive and damage the last. For example, lasts which have been subjected to normal use in shoe manufacturing operations have been found, as a result of abusive handling, to vary in length as much as ¼ inches as measured from the tip of the toe to the heel curve, commonly referred to as "stick length." This results from the abusive treatment to which the heel curve region of the last is subjected. The devices employed in the prior art to align the last with the mold cap have employed the heel curve portion of the last as a reference which, as will be understood more fully from the following disclosure, has resulted frequently in misalignment of the mold cap and last.

In accordance with our invention, a jig is provided which is adapted to engage those portions of the last which display little or no variation from last to last and which are not readily damaged in the course of normal handling. In particular, our invention employs a jig which is adapted to engage the "bottom pattern" of the last which does not vary from last to last to a degree which would impair repeated and accurate registration of the mold cap with the last.

The jig is set initially with reference to the bottom pattern of a master last of a particular size and style. After the jig has been set up with reference to the master, it may receive the subsequent lasts to be remodeled and will engage them at their bottom patterns so that the lasts to be restyled will be oriented in the same position as was that of the master.

Other objects and advantages of our invention will be apparent from the foregoing detailed description, with reference to the accompanying drawings wherein:

FIG. 1 is a perspective view of the complete jig;

FIG. 2 is a somewhat schematic side elevation illustrating a last and mold cap supported in the jig;

FIG. 3 is a side elevation, partly in section of a last having a reduced toe region and a mold cap secured to and about the toe region;

FIG. 4 is an illustration of the bottom pattern of a last;

FIG. 5 shows, somewhat schematically, improper gauging of the heel end of the last;

FIG. 6 is a front elevation of the heel gauge unit;

FIG. 7 is a side elevation of the heel gauge unit;

FIG. 8 is a plan view of toe gauge unit;

FIG. 9 is a front elevation of the toe gauge unit;

FIG. 10 is a front elevation of the ball gauge unit illustrating the manner in which the last is contacted by the gauge;

FIG. 11 is a plan view of the ball side gauge;

FIG. 12 is a view of the arrangement for enabling the toe gauge unit to be tilted as seen along the line 12–12 of FIG. 1;

FIG. 13 is a substantially schematic view of the toe gauge unit when gauging a mold cap and as seen from the line 13–13 of FIG. 2; and

FIG. 14 is a somewhat diagrammatical front elevation of the heel gauge unit illustrating the manner in which it contacts the heel end of the last.

As shown in FIG. 3 the last 10 to be restyled is reduced about its toe to remove an outer layer so that when the mold cap 12 is placed, in proper registry, over the reduced toe end of the last 10 a void or mold cavity 14 will be defined between the reduced surface 16 of the toe and the inner surface of the mold cap 12. As mentioned earlier, it may not be necessary to cut down the toe end of the last to provide the void 14. For example, when it is desired to restyle a last having a sharp pointed toe to one having a relatively wide or broad toe, the dimensions of the pointed toe are naturally less than those of the mold cap 12. As described herein, the term "reduced toe" is intended to means both a toe that has been cut down and a toe which is naturally smaller than the mold cap 12 and which provides the desired void 14. After the cap is registered with and secured to the last, as by the staples 11 the void 14 is filled with a suitable molding material, through the conduits 18, 20. The last then is set aside to enable the molding material to cure.

As mentioned above, one of the primary difficulties encountered in this method of restyling lasts is that of orienting properly the mold cap 12 with respect to the last 10. Care must be taken to insure that the finished, molded toe has the desired toe spring (the angle at which the bottom forepart of the last makes with a reference plane as indicated by the reference character 22 in FIG. 3). Care must also be taken to insure that the molded, restyled toe will be offset at the proper gun (the angle, indicated by the reference character 24 in FIG. 4, that the centerline 26 of the toe portion makes with the general centerline 28 of the last). Finally, the lengthwise location of the mold cap 12 on the last 10 must be determined accurately to insure that the finished, restyled lasts will be of uniform and accurate length. It will be appreciated that, if repeated and uniform accuracy in positioning the mold cap 12 on the last is to be achieved, purely manual fitting of the caps 12 to the last 10 will be ineffective. Our jig provides a simple and accurate means for registering properly the mold cap 12 and its associated last 10 with repeated acceptable accuracy.

As shown in FIG. 1, the jig employs a toe gauge unit 60 which is effective to support each identical toe cap 12 in the same position. A heel gauge unit 56 and ball gauge unit 58 are provided and are adjustable to support and align properly the last 10 with respect to the mold cap 12 when the mold cap 12 is supported by the toe gauge unit 60. The heel and ball gauge units 56, 58 enable a number of lasts to be aligned properly with their respective mold caps 12 even if the lasts have been somewhat damaged or display some of the more common dimensional variations which occur between lasts.

One of the more common last measurements which is subject to a considerable degree of variation between lasts of the same size and style is that dimension commonly referred to as "stick length." "Stick length" is used frequently to measure the length of a last and is determined by placing the last on a flat surface 29, as shown in FIG. 3, and then measuring the distance between the heel curve 30 and the tip of the toe (i.e. between the lines 32 and 34 in FIG. 3). When the stick length measurement is used as a standard, a number of lasts which are of the same style and size may exhibit considerable variations in length, some being in the order of one-fourth inch. One of the common causes for this variation is that the heel curve region 30 of lasts generally is subjected to abusive treatment, for example, by tacks driven into the heel curve 30 to secure a shoe upper in place during the lasting operation. From this it will be appreciated that if a last is aligned by gauging its position with reference to the heel curve 30, repeated accurate positioning of the last will not be obtainable. In contrast to the gauging techniques heretofore utilized, our jig gauges the last with reference to the bottom pattern 36 as shown in FIG. 4. The bottom pattern 36 of the last 10, may be considered as the edge that extends about and defines the bottom of the last. Variations in the bottom pattern of lasts of the same size and style are relatively infrequent and, as such, the bottom patterns provide a more reliable standard for gauging and aligning the last.

The jig shown in FIG. 1, is supported on a frame 50 and includes a pair of parallel rails 52 and 54. In operating the jig, the operator is intended to be located at the left of the jig as viewed in FIG. 1 and the direction toward the operator will be referred to as forward while the direction away from the operator will be referred to as rearward. The heel gauge unit 56, ball gauge unit 58 and toe gauge unit 60 are cooperative to engage the last 10 about its bottom pattern 36. As shown more clearly in FIGS. 2 and 3 the heel gauge unit 56 includes a heel seat plate 62 to which a heel gauge block 64 is secured. When inserting a last into the heel gauge unit 56, the heel seat plate 62 and the last is urged rearwardly into engagement with the heel gauge block 64. It should be noted that the dimensions of the heel block 64 should be such that it engages the lower region of the heel curve 30 as close as is practically possible to the bottom pattern 36 of the last. It will be appreciated that although the ideal conditions of operation would be to construct the heel gauge block 64 so that it engages the last exactly at the bottom pattern, this would require more careful placement of the last in the jig to insure that the heel seat 11 of the last 10 does not ride up over the heel gauge block 64 as shown, somewhat schematically, in FIG. 5. In order to minimize the likelihood of such placement errors, the heel gauge block 64 is adapted to engage the last just above the bottom pattern 36 but at a location that is removed substantially from the center of the heel curve 30 which may have been damaged in the course of normal shoe manufacturing operations. For example, I have found that if the heel gauge block 64 contacts the heel curve 30 approximately one-eighth inch above the bottom pattern 36, satisfactory results are obtained.

The heel seat plate 62 extends laterally from the heel gauge block 64 and a heel side gauge 66 is supported on the heel seat plate 62 to the right of the heel gauge block 64 as shown in FIGS. 1 and 6. The heel side gauge 66 is secured to a slide 68 which is mounted in a bushing 70 for lateral movement that is towards and away from the side of the last 10. The bushing 70 is welded or otherwise secured to the heel seat plate 62 and a means, such as a set screw 72 is provided for locking the slide 68 and thus the heel side gauge 66 in a desired lateral position. The other, laterally extending, end of the heel seat plate supports a clamp 74 which is mounted for lateral movement towards and away from the other side of the last by a rod 76 which is threaded into a bracket 78 that is secured to the heel seat plate 62. The clamp 74 is preferably swiveled to the rod, so that it may be self-accommodating to the contour of the particular last in the jig. After the heel end of the last has been placed in the heel gauge unit 56 in proper abutment with the heel gauge block 64, the clamp 74 is screwed inwardly to urge the last firmly against the heel side gauge 66. As shown in FIG. 14 the heel side gauge 66 engages the last in close proximity to its bottom pattern 36.

When initially setting up the jig, with reference to the master last, the position of the heel side gauge 66 should be adjusted so that when the master last is clamped in the heel gauge unit 56, the centerline 26 of the toe end of the last will be aligned in a forward-rearward direction. It should be noted further that the exact lateral position end of the heel side gauge 66 is not critical as long as its position remains unchanged while the jig is used with the same size and style of last. In addition to the clamping between the side gauge 66 and the clamp 74, the last is clamped vertically by an additional top clamp 80. The top clamp 80 is operated by an air cylinder 82 which is supported, by means of brackets 84, to an upwardly extending support 86. The support 86 is secured to and extends upwardly from the rear of the heel seat plate 62 to position the clamp 80 above the last. The clamp 80 is preferably swiveled to the piston rod 88 on the cylinder 82 to enable the clamp 80 to seat itself firmly on the last. Thus the heel gauge unit is effective to grip firmly the heel end of the

last in a position determined by engagement of the heel gauge block **64** and heel side gauge **66** with the bottom pattern **36** at the heel end of the last.

Means are provided, for reasons described below, to permit adjustment of the heightwise position of the entire heel gauge unit **56** and to permit tilting adjustment of the heel gauge unit **56** about a lateral, horizontal axis. The adjusting mechanism includes a vertically movable rack **92** which is connected to and supports the underside of the heel seat plate **62** by the hinge **90**. The heel gauge unit **56** may be locked in the desired tilted position about the hinge **90** by the setscrew **94**. Vertical movement of the rack **92** is effected by a pinion gear **96** which is mounted securely to a laterally extending shaft **98**, which in turn is rotatably supported beneath a laterally extending heel bar **100**. A knob **102** is fixed conveniently to a laterally protruding end of the shaft **98** to facilitate adjustment. Means such as setscrew **99** are provided for locking the rack and thus the heel gauge unit **56** in the desired heightwise position. The rails **52** and **56** are secured, at their rearward ends, to the lateral ends of the heel bar **100** and additional rigidity for the rails **52, 54** is provided by a laterally extending forward brace **104** which is secured to the forward ends of the rails **52, 54**.

The vertical and tilted position of the heel gauge unit **56** is determined by the size and shape of the particular last to be restyled. The position of the heel gauge unit **56** is adjusted so that the ball and toe regions of the last properly engage the ball gauge and toe gauge units **58, 60** respectively. As shown in FIG. **1** and more clearly in FIGS. **10** and **11** the ball gauge unit **58** is supported on a laterally extending ball bar **106** which includes slides **108, 110** that are supported on the rails **52, 54** respectively to enable the ball bar **106** and ball gauge unit **58** to move in unison forwardly and rearwardly along the rails **52, 54**. Means such as a setscrew, are provided for locking the ball bar **106** in the desired forward-rearward position to accommodate the particular size and style of last. The ball gauge unit **58** includes a ball side gauge **112** which is fixed to the end of the laterally extending rod **114**. The rod is slidably mounted in a bushing **116** which in turn is supported on the ball bar **106**. The position of the ball side gauge may be adjusted by adjusting and locking the rod **114** in a selected position by means of a setscrew **117**. The bushing **116** is fastened to the ball bar **106** by a bolt **118** which extends upwardly through a lateral slot **119**, formed in the ball bar **106**. This provides an additional coarse adjustment for positioning the ball side gauge should this be desired.

The ball gauge unit **58** also includes means for urging the last against the ball gauge **112** further to grip the last in the proper position in the jig. This is accomplished by means of a ball clamp **122** which is secured to the piston rod **124** of an air cylinder **126**. The air cylinder in turn is mounted to the other end of the ball bar **106** by the support member **128**. In the preferred embodiment of our invention the ball side gauge **112** should be mounted on the ball bar to engage the same side of the last as does the heel side gauge **66**. The support member **128** is provided with the same lateral adjusting feature of the bushing **116** to permit lateral adjustment along the ball bar **106** for accommodation of a particular size and style of last. When there is no last in the jig, the air cylinder **126** is in its retracted position to retract the side clamp **122** and permit a last to be inserted between the clamp **122** and ball side gauge **112**. After the last has been inserted, the cylinder **126** is activated to extend the piston rod **124** so that the clamp **122** will urge firmly the bottom pattern **36** of the ball of the last against the ball side gauge **112**.

When setting up the jig to accommodate a particular size and style of last, a master last, having a mold cap **12** properly positioned about its toe, is placed in the jig and the heel gauge and ball gauge units **56, 58** are adjusted as described below. The ball bar **106** is moved to a forward-rearward position along the rails **52, 54** so that when the master last is gripped and supported by the heel gauge unit **56**, the ball region of the last bottom will bear against the rearward edge **105** of the ball bar **106**. The height and tilting angle of the heel gauge unit **56** are adjusted with relation to the position of the ball bar **106** so that the last engages the rearward edge **105** of the ball bar **106** with the toe end of the last inclined upwardly at a slight toe spring angle **22'** to the horizontal ball bar **106**, as shown in FIG. **2**. With the master last in position the toe gauge unit **60** is moved rearwardly into engagement with the mold cap **12** of the master last and is adjusted, as described below, to a predetermined spacial orientation about the toe cap **12**. After the toe gauge unit **60** has been locked in place, it will receive successive, identical mold caps **12** in the same spacial orientation and in the same position. The heel gauge and ball gauge units **56, 58** similarly insure that each successive last will be supported in the same position and orientation as was the master. By maintaining continually each last to be restyled in the same proper spacial orientation with respect to the toe cap **12**, repeated and accurate registration is achieved.

As shown in FIG. **2**, when the toe gauge unit **60** is in use it generally is inclined at an angle to the horizontal. It is preferable that the toe gauge unit **60** is not inclined at too steep an angle and the heel gauge unit **56** is adjusted to a heightwise and tilted position in which the last and mold cap will be properly aligned without requiring an excessive inclination of the toe gauge unit **60**. Thus it will be appreciated that in those last styles in which there is little or no natural toe spring angle **22** there will be correspondingly little or no necessity for raising and tilting the heel gauge unit **56**. Conversely when the last style has a relatively large natural toe spring angle **22**, as would be the case with high heeled lasts, the heel gauge unit **56** must be raised and tilted forwardly to reduce the natural toe spring angle **22** to the toe spring angle **22'** of the jig.

The advantages in providing a jig that gauges a last by reference to its bottom pattern, as opposed to its stick length, should be apparent. For example, when the last is gauged according to its stick length, the heel curve **30** is used as a gauging point. Because the stick length (the distance between the heel curve **30** and the toe of the last) tends to vary from last to last, the lengthwise position of the toe end of the lasts will vary accordingly. Thus, if the jig were set up to gauge the last with reference to the stick length of the last, placement of a last having a relatively short stick length would result in that last, including its toe end, being disposed in a more rearward position than that of the master. This excessive rearward positioning would cause the ball of the last to be shifted rearwardly with respect to the ball bar thus reducing the toe spring angle **22'** of the last with respect to that at which the toe cap **12** is supported in the toe gauge unit **60**. Furthermore, rearward displacement of the last may also cause the centerline **26** of the toe end of the last to be displaced laterally, thus affecting the gun angle **24** of the last with respect to the forward-rearward centerline **26** of the toe cap **12** supported to the toe gauge unit **60**. This discrepancy in the gun angle **24** results from the curved configuration of the side of the last which is engaged by the ball side gauge **112**.

As shown in FIGS. **1, 8** and **9**, the toe gauge unit **60** is supported on a laterally disposed toe bar **130** which in turn is slidably supported on the rails **52, 54** by the slides **132, 134**. The toe gauge unit **60** includes a toe plate **136** which is mounted for lateral adjustment on the toe bar **130** by means of a pair of laterally spaced, depending brackets **138** which engage one edge of the bar **130** and a fastener, such as a wing bolt **140** which extends upwardly through a lateral slot **142** formed in the toe bar **130** and which is screwed into the underside of the toe plate **136**. The toe gauge unit **160** also includes a toe stop **144** which is mounted for forward and rearward adjustment by means of a screw **146** which is threadably engaged with an upstanding lug **148** secured to the toe plate **136**. The screw **146** may be provided with a knob **150** and lock nut **152** to facilitate adjustment and locking of the screw **146** and thus the toe stop **144**. A pair of laterally spaced upstanding gauge pins **154** protrude upwardly through laterally disposed slots **156** formed in the top plate **136**. The lateral spacing of the gauge pins **154** is adjustable by a shaft **158** that is rotatably supported between the brackets **138** and which has oppositely

threaded portions **160, 162**. Screw blocks **164** are in threaded engagement with each of the threaded portions **160, 162** of the shaft **158** and the gauge pins **154** are secured to the screw blocks **164**. Thus, when the shaft **158** is rotated, as by the knob **166**, the gauge pins **154** will be adjusted to the desired lateral spacing.

The inclination of the entire toe gauge unit **60** is adjustable by means of a pivotal mounting arrangement **168**, shown in FIGS. **1** and **12** which connects the toe bar **130** to the slides **132** and **134**. The pivotal mounting arrangement **168** includes a pin **170** which is secured to and extends inwardly from the slide **132**, the end of the toe bar **130** being pivotally mounted to the pin **170**. A guide plate **172** is secured to the toe bar **130**, forwardly of the pin **170** and has an arcuate slot **174**, which receives a locking bolt **176** that screws into the slide **132**. An identical arrangement is provided at the other end of the toe bar **130** in association with the slide **134**. Thus the toe bar **130** and toe gauge unit **60** may be adjusted to a desired inclination by loosening the bolts **176** pivoting the toe bar **130** about the pins **170** to the desired position and then retightening the bolts **176**.

When the jig is initially set up, a master last having a mold cap **12** properly secured in registry to its toe, is placed in the heel gauge unit **56** which is raised and tilted, if necessary to bring the ball of the last into engagement with the rearward edge **105** of the ball bar **106** as shown in FIG. **2**, the side of the last being simultaneously positioned in engagement with the ball side gauge **112**, to align the toe centerline in a fore and aft direction. As shown in FIG. **10**, the ball side gauge **112** contacts the side of the last in close proximity to the bottom pattern **36** in accordance with the invention. After the master last is positioned in the heel gauge and side gauge units **56, 58**, the air cylinders **82** and **126** are actuated to clamp the master last in this position. The toe gauge unit **60**, which was previously in a forward, out-of-the-way position so as not to interfere with the insertion of the last into the jig, is then urged rearwardly towards and into engagement with the mold cap **12** on the master last. The lateral spacing of the gauge pins **154**, the position of the toe stop **144** in the inclination of the toe bar **130** and thus the toe plate **136** are then adjusted so that they will engage the mold cap **12** as shown in FIGS. **2** and **13**. When the toe gauge unit **60** is set up properly, in accordance with the invention, the toe plate **136** is inclined at an angle at which the bottom edge of the tip-toe **13** in the only portion of the mold cap **12** in contact with the toe plate **136**. The gauge pins **154** are adjusted inwardly toward the sides of the mold cap **12** so that they embrace and contact the mold cap only at the bottom peripheral edge **17** of opposite sides of the mold cap **12**. The toe stop **144** is screwed inwardly until it just contacts the toe break region **15** of the mold cap. Thus, when properly adjusted to the particular size and style of mold cap **12**, the toe gauge unit **60** will contact the mold cap **12** at four points. In order for another, identical mold cap to engage the same four points of the toe gauge unit **60** it necessarily must be disposed in the same orientation as was that of the mold cap on the master last. After the toe gauge has been set up to this spacial orientation, the entire toe bar is withdrawn forwardly along the rails **52, 54** with the orientation of the toe gauge maintained to enable a last to be restyled to be placed in the jig.

Thus after the heel and ball gauge units **56** and **58** have been set up with reference to the bottom pattern of the master last, successively presented lasts of the same style and size as that of the master will be supported by the heel and ball gauge units **56, 58** in identical orientation. Additionally, it is insured that each successively presented mold cap **12** when contacted at the aforementioned four points will be in the same orientation as was that of the mold cap that was secured to the master in setting up the jig. In operation, the last to be restyled is placed in the heel and ball gauge units **56, 58**. The mold cap **12** then is placed into the toe gauge units **60** with the aforementioned four point contact and is held in that position manually by the operator as he simultaneously slides the toe bar, toe gauge and mold cap toward the last. The most accurate results are obtained when the ball gauge unit **58** is initially adjusted to a lateral position on the ball bar in which the centerline **26** of the toe portion of the last and its associated mold cap is oriented in a forward-rearward direction and is in substantial alignment with the screw **146** of the toe gauge unit **60**.

After the toe gauge unit **60** has been moved rearwardly to engage and properly align the mold cap **12** with the toe end of the last, a staple is driven through the top marginal portion of the mold cap **12** to secure it to the last. The bottom of the mold cap also is secured, at its marginal, overlapping portion, to the last by means of staples. In order to provide access to the bottom of the last while retaining the last and mold cap in proper alignment in the jig, a hinge **178** is provided at the rearward portion of the jig to connect pivotally the heel bar and rails **52, 54** to the frame **50**. This hinging arrangement permits the entire jig, including the rails **52, 54** to pivot upwardly about the hinge **178** as indicated by the arrows **180** in FIG. **1**. The rails **52, 54** may be pivoted to a vertical position thus exposing the bottom of the last and mold cap to permit stapling. After the mold cap has been stapled to the last, the air cylinders are deactivated to free the last from the jig. The combined last and mold cap are then ready to be injected, through the conduits **18, 20**, with a suitable molding material.

Thus it will be appreciated that our invention provides a method and apparatus in which lasts of substantially the same size and style may be supported, with repeated accuracy in the same position and spacial orientation, and that this objective is achieved by positioning the last with reference to selected points about its bottom pattern. In addition the invention employs a method and apparatus for orienting identical mold caps repeatedly in the same orientation with respect to the last supported in the jig so that the last and mold cap may be combined while in their proper, respective spacial orientations, thus to insure that they will be combined at the proper toe spring angle, gun, etc.

From the foregoing description, of our invention, other embodiments and modifications of our invention may be apparent to those skilled in the art without departing from its spirit. For example, in the interest of clarity our jig has been described in connection with the registration of a single last and mold cap. It will be appreciated that when employed in a conventional manufacturing environment it will be desirable to employ a number of such jigs. Thus one or more pairs of jigs may be provided to operate side-by-side, for example, one of the jigs operating on a left last and the other operating on a right last. In addition a plurality of jigs may be supported on the same frame by providing a single pair of rails which support a single heel bar, ball bar and toe bar, so that each heel, ball and toe bar may support a number of heel, ball and toe gauge units respectively.

Having thus described our invention, what we desire to claim and secure by Letters Patent is:

We claim:

1. In a jig for aligning the reduced toe end of a last with a mold cap, the improvement comprising, in combination:

means for supporting, in a predetermined position, a last adapted to receive a mold cap in registry on the toe end thereof, said support means including last gauge means adapted to engaged engage at least three points about the bottom pattern of said last, said last gauge means being arranged to effect disposition of said last in said predetermined position and in a predetermined spacial orientation;

toe gauge means adapted to engage and contact selected portions of said mold cap and to assume a spacial orientation in which said engaged mold cap may be combined in registry, with the toe end of said supported last, thereby to enable said mold cap to be secured in registry to said last;

means mounting said toe gauge means for movement between a first position in which said engaged mold cap is in said registry with the toe end of said supported last and a second, remote position in which said toe gauge is

withdrawn to an out-of-the-way position thereby to enable a subsequent, identical mold cap to be engaged by said toe gauge means;

whereby another last having a substantially identical bottom pattern may be supported in said predetermined position and spacial orientation, and said toe gauge means may be returned to said first position thereby to combine said another last and subsequent mold cap in the same registration.

2. A jig as defined in claim 1 wherein said means for supporting said last comprises:

means for supporting the heel portion of said last;

means for supporting the ball portion of said last; and wherein said last gauge means comprises:

a heel end gauge secured to said heel support means and in a position to engage the heel end region of the bottom pattern of said last when said last is supported on said heel support, thereby to define the heelward position of said last;

a heel side gauge mounted to said heel support in a position to bear against one side of the heel portion of the bottom pattern of said last while said last is supported on said heel support to define the lateral position of said heel end of said last;

a ball side gauge mounted to said ball support means to engage the ball side of the bottom pattern of said last,

said points of said engagement of said heel and end gauge, said heel side gauge and said ball side gauge comprising said at least three points; and

means for clamping said last to maintain rigidly said last in contact with said gauges.

3. A jig as defined in claim 2 wherein said means for supporting the heel portion of said last comprises a heel seat plate, and wherein said heel and gauge comprises:

a heel gauge block secured to the rearward end of said heel seat plate and extending upwardly therefrom to a level such that when the heel seat of said last rests on said heel seat plate, said heel gauge block may engage the heel end of said last at a point that is just above the edge of the bottom pattern of said last thereby to determine the rearwardmost position of said last; said heel seat plate having a laterally extending portion;

said heel side gauge being mounted to said laterally extending portion of said heel seat plate.

4. A jig as defined in claim 3 wherein said means for clamping said last comprises:

means engageable with the top of the last to force the heel end of said last downwardly into firm engagement with said heel seat plate; and

means for urging firmly said last laterally against said heel side gauge

5. A jig as defined in claim 2 wherein said ball supporting means comprises:

a laterally extending ball bar disposed forwardly of said heel supporting means; and

means mounting said ball side gauge to said ball bar to engage said last on the same side as does said heel side gauge.

6. A jig as defined in claim 5 further comprising: means mounting said ball bar for movement in a forward-rearward direction that is toward and away from said heel supporting means to enable said ball side gauge to be positioned for accommodation of lasts of varying sizes.

7. A jig is defined in claim 6 further comprising: means mounting said heel supporting means for heightwise adjustment and for tilting adjustment about a lateral, horizontal axis to enable said supported last to be adjusted to an orientation wherein the ball of said last bears against said ball supporting means with the toe spring of the last being oriented at a predetermined angle in relation to said ball bar.

8. A jig as defined in claim 1 wherein said toe gauge means comprises:

a toe plate adapted to contact the tip toe of said mold cap;

a toe stop mounted to said toe plate having a gauge portion disposed above said toe plate, said gauge portion being adapted to contact the toe break of said mold cap when said toe plate is in engagement with said tip toe region; and

a pair of laterally spaced gauge pins secured to and extending upwardly from said toe plate, said gauge pins being adapted to contact opposite side edges of the bottom pattern of said mold cap.

9. A jig as defined in claim 8 further comprising:

means mounting said toe stop for movement in a forward-rearward direction;

means for locking said toe stop in a position along said range of movement thereof; and

means mounting said gauge pins for lateral movement toward and away from each other.

10. A jig as defined in claim 8 further comprising: means mounting said toe plate and said gauge members, supported thereon for tilting movement about a horizontal, laterally extending axis to enable said toe plate to be tilted to a position wherein if will contact only the tip toe portion of said mold cap.

11. A jig as defined in claim 8 wherein said means for supporting said last comprises:

means for supporting the heel portion of said last;

means for supporting the ball portion of said last; and wherein said last gauge means comprises:

a heel end gauge secured to said heel supporting means and in a position to gauge the heel of the bottom pattern of said last at the heel end thereof when said last is supported on said heel support, thereby to define the heelward position of said last;

a heel side gauge mounted to said heel support in a position to bear against one side of the heel portion of the bottom pattern of said supported last to define the lateral position of said heel end of said last;

a ball side gauge mounted to said ball support means to engage the ball side of the bottom pattern of said last;

said points of engagement of said heel end gauge, said heel side gauge and said ball side gauge with said last comprising said at least three points; and

means for clamping rigidly said last in said gauged, supported position.

12. A jig as defined in claim 11 wherein said means for supporting the heel portion of said last comprises a heel seat plate and wherein said heel and gauge comprises:

a heel gauge block secured to the rearward end of said heel seat plate and extending upwardly therefrom to a level such that when the heel seat of said last rests on said heel seat plate, said heel gauge block will contact the heel end of said last at a point that is just above the edge of the bottom pattern of said last;

said heel seat plate having a laterally extending portion; and

said heel side gauge being mounted to said laterally extending portion of said heel seat plate.

13. A jig as defined in claim 12 wherein said ball supporting means:

a laterally extending ball bar disposed forwardly of said heel supporting means; and

means mounting said ball side gauge to said ball bar to engage the same side of said last as does said heel side gauge.

14. A jig as defined in claim 12 further comprising: means mounting said ball bar for movement in a forward-rearward direction that is toward and away from said heel supporting means to enable said ball side gauge to be positioned lengthwise of said last thereby to enable said jig to accommodate lasts of varying sizes.

15. A jig as defined in claim 14 further comprising: means mounting said heel supporting means for heightwise adjustment and for tilting adjustment about a lateral, horizontal axis to enable said supported last to be adjusted to an orientation wherein the ball of said last bears against said ball supporting

means with the toe spring of said last being disposed at a predetermined angle in relation to said ball bar.

16. A jig as defined in claim 1 wherein said last supporting means is adapted to orient said last at a predetermined toe spring angle in relation to a horizontal plane and wherein said toe gauge means comprises:

a toe plate;

means mounting said toe plate for tilting movement with respect to the horizontal so that said toe plate may be disposed at a greater angle with respect to the horizontal and said toe spring angle of said supported last so that when said toe gauge is in said first position it may contact only the tiptoe portion of said mold cap;

a toe stop mounted to the forward end of said toe plate and being disposed above said toe plate; said toe stop extending rearwardly from said toe plate to be engageable with the toe break region of said mold cap; and

a pair of gauge pins, mounted to and extending upwardly from said toe plate, said gauge pins being located rearwardly of said toe stop and spaced laterally of said toe stop so as to embrace and be engageable with the bottom edge of opposite sides of said mold cap.

17. A jig as defined in claim 16 further comprising:

means mounting said toe stop for movement in a forward-rearward direction that parallels substantially the plane of said toe plate; and

means mounting said upstanding gauge pins for lateral movement that is toward and away from each other, whereby said gauge pins and said toe stop may be adjusted to accommodate a range of sizes and styles of mold caps.

18. In a jig for aligning the reduced toe end of a last with a mold cap, the improvement comprising, in combination:

a frame;

a pair of laterally spaced, parallel rails, supported on said frame and disposed in a forward-rearward direction;

a laterally extending heel bar secured to and between the rearward ends of said rails;

a laterally extending ball bar, slidably mounted to and between said rails, forwardly of said heel bar for movement in a forward-rearward direction that is toward and away from said heel bar;

a laterally extending toe bar, slidably mounted to and between said rails, forwardly of said ball bar, for movement in a forward-rearward direction that is toward and away from said heel bar and said ball bar;

means mounted to said heel bar, intermediate its ends, for supporting the heel portion of said last, said heel supporting means including heel gauge means adapted to engage the bottom pattern of said last at the heel end and heel side regions of said last;

means mounting said heel supporting means for heightwise adjustment and for tilting adjustment about a horizontal, laterally extending axis to enable said last to be supported in an attitude with respect to said ball bar such that the ball of said last bears against and at a predetermined toe spring angle to said ball bar;

a ball side gauge mounted to said ball bar and being adapted to engage the bottom pattern of said supported last at its ball side; and

toe gauge means mounted to said toe bar intermediate its ends, said toe gauge being constructed to gauge a mold cap in a predetermined spacial orientation such that when said last is supported in said predetermined position and orientation, a mold cap may be oriented by said toe gauge means in said spacial orientation to enable said toe bar, toe gauge and said oriented mold cap to slide rearwardly along the rails into registry with the toe end of said supported last.

19. A jig as defined in claim 18 wherein said heel supporting means and said heel gauge means comprises:

a heel end gauge secured to said heel support means and in a position to engage the heel end region of the bottom pattern of said last when said last is supported on said heel support, thereby to define the heelward position of said last; and

a heel side gauge mounted to said heel support in a position to bear against one side of the heel portion of the bottom pattern of said last while said last is supported on said heel support to define the lateral position of said heel end of said last.

20. A jig as defined in claim 19 wherein said means for supporting the heel portion of said last comprises a heel seat plate, and wherein said heel end gauge comprises:

a heel gauge block secured to the rearward end of said heel seat plate and extending upwardly therefrom to a level such that when the heel seat of said last rests on said heel seat plate, said heel gauge block may engage the heel end of said last at a point that is just above the edge of the bottom pattern of said last;

said heel seat plate having a laterally extending portion; and

said heel side gauge being mounted to said laterally extending end of said heel seat plate.

21. In a method of remodeling a last by securing a mold cap about the reduced toe end of said last to define a mold cavity between said reduced toe and the interior surface of said mold cap, said cavity being adapted to receive a molding material, an improved method of aligning said last and mold cap comprising:

supporting a master last in a predetermined location and spacial orientation which is determined with reference to at least three selected locations on the bottom pattern of said last said master last having a master mold cap secured, in registry, to the toe end thereof;

gauging the position and spacial orientation of said master mold cap while said master last is supported in said location;

substituting a subsequent last to be restyled, in place of said master last so that the corresponding at least three regions of said bottom pattern of said subsequent last are disposed in the same locations as were those of said master last, thereby to support said subsequent last in the same location and spacial orientation as that of said master last; and

supporting a subsequent, substantially identical, mold cap in the same spacial orientation as that of said master mold cap and thereafter positioning said subsequent mold cap in the same position as was said master mold cap with respect to said master last while maintaining said spacial orientation of said mold cap, thereby to combine said subsequent last and subsequent mold cap in registration identical to that of said master last and master mold cap.

22. A method as defined in claim 21 wherein said step of gauging the position of said master mold cap comprises: causing a toe gauge to engage said master mold cap while said master last is supported in said predetermined position, said engagement being effected at selected locations about said mold cap, said locations being such that when an identical mold cap subsequently is inserted into said toe gauge it will be engaged at said selected locations and will be disposed in the same special orientation as was said master mold cap.

23. A method as defined in claim 22 wherein said step of orienting a second identical mold cap in the same spacial orientation as that of said master mold cap comprises:

maintaining said spacial orientation of said toe gauge after said toe gauge has engaged said master mold cap at said selected locations about said mold cap; and

inserting said second, identical mold cap into said toe gauge so that said toe gauge engages said second mold cap at said selected locations.

24. A method as defined in claim 23 wherein said toe gauge is withdrawn from said position of engagement with said master mold cap to a remote position and wherein said second mold cap is inserted into said toe gauge while in said remote position.

25. A method as defined in claim 21 wherein said three selected locations on the bottom pattern of said last comprise:

the heel end of said bottom pattern;
the heel side at one side of said bottom pattern; and
the ball side at said one side of said bottom pattern.

26. A method as defined in claim 25 wherein the position and orientation of said mold cap is gauged with reference to selected location about said mold cap, said selected locations comprising:
the toe tip of said mold cap;
the toe break of said mold cap;
the bottom side edge at one side of said mold cap; and

the bottom side edge at the other side of said mold cap.

27. A method as defined in claim 21 wherein the position and orientation of said mold cap is gauged with reference to selected locations about said mold cap, said selected locations comprising:
the toe tip of said mold cap;
the toe break of said mold cap;
the bottom side edge at one side of said mold cap; and
the bottom side edge at the other side of said mold cap.