

Aug. 14, 1934.

J. FITZPATRICK

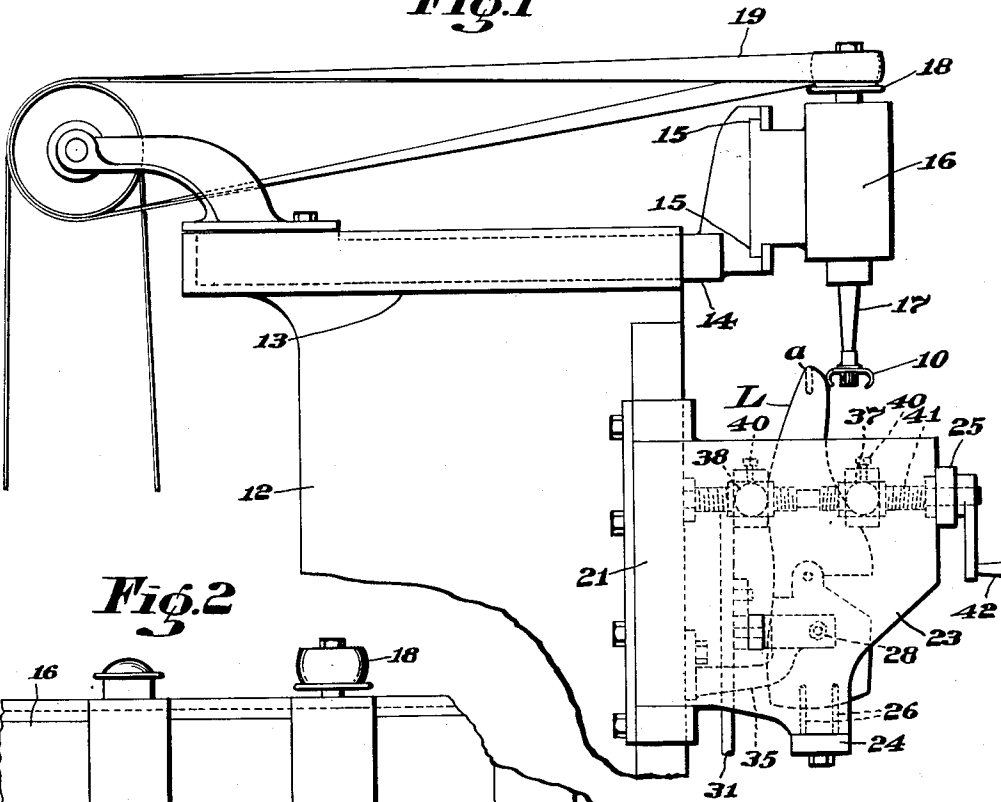
1,969,740

METHOD OF AND MACHINE FOR SHAPING LASTS

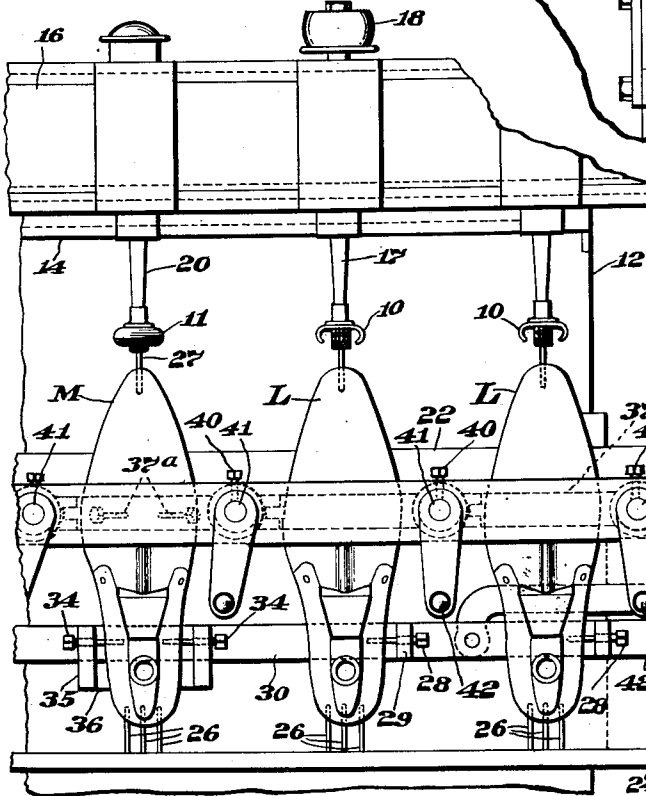
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3 Sheets-Sheet 1

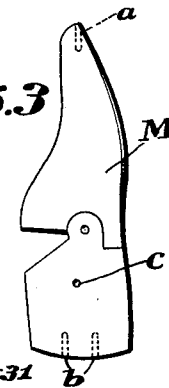
**Fig. 1**



**Fig. 2**



**Fig. 3**



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3 Sheets-Sheet 2

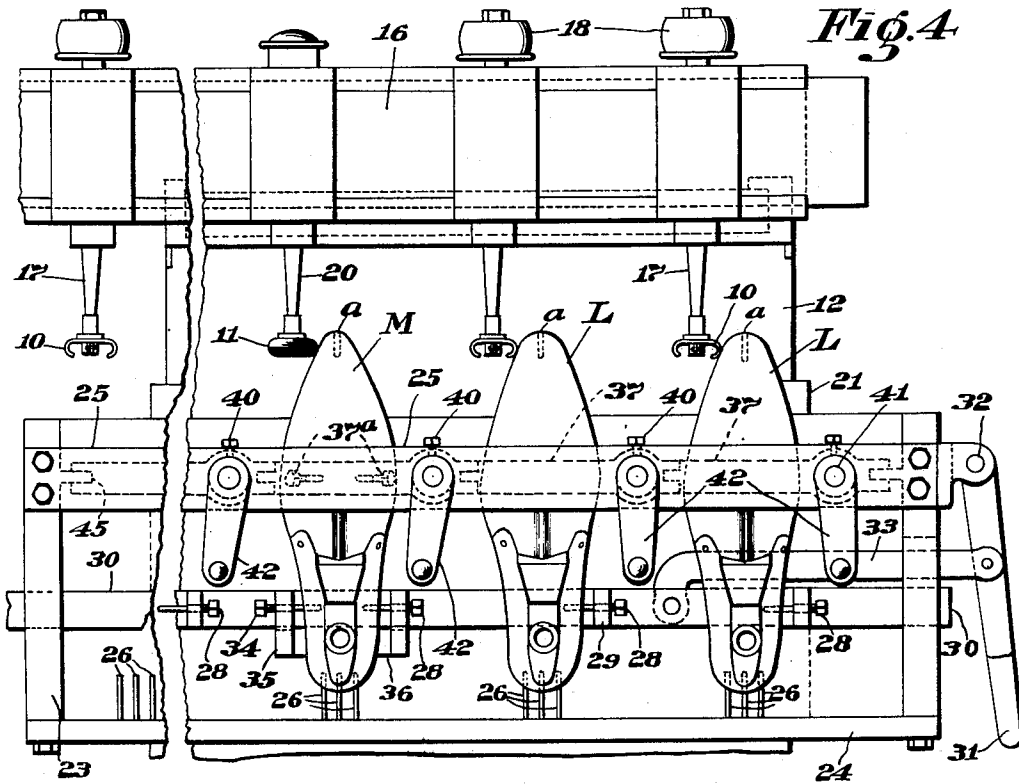


Fig. 4

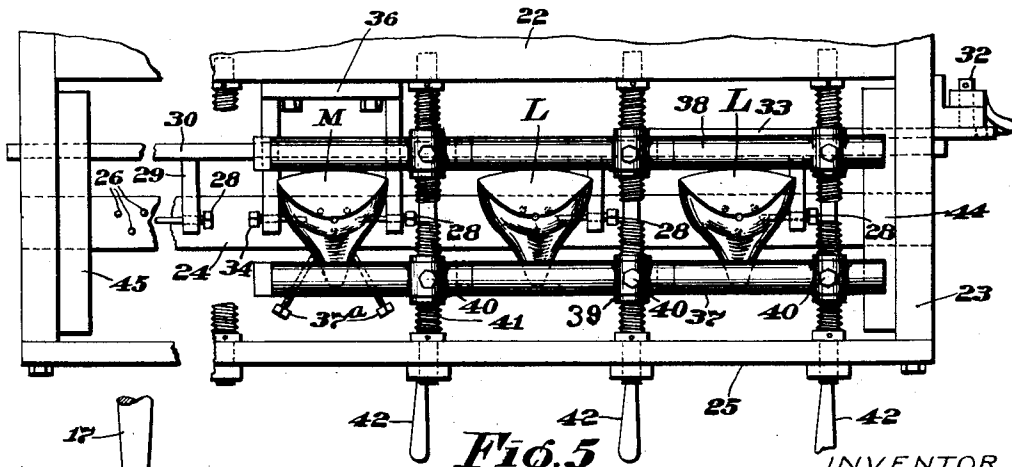


Fig. 5

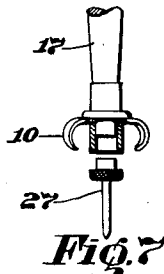


Fig. 7

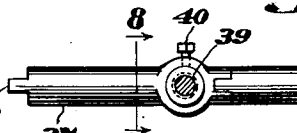


Fig. 6

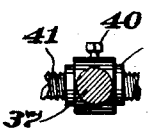


Fig. 8

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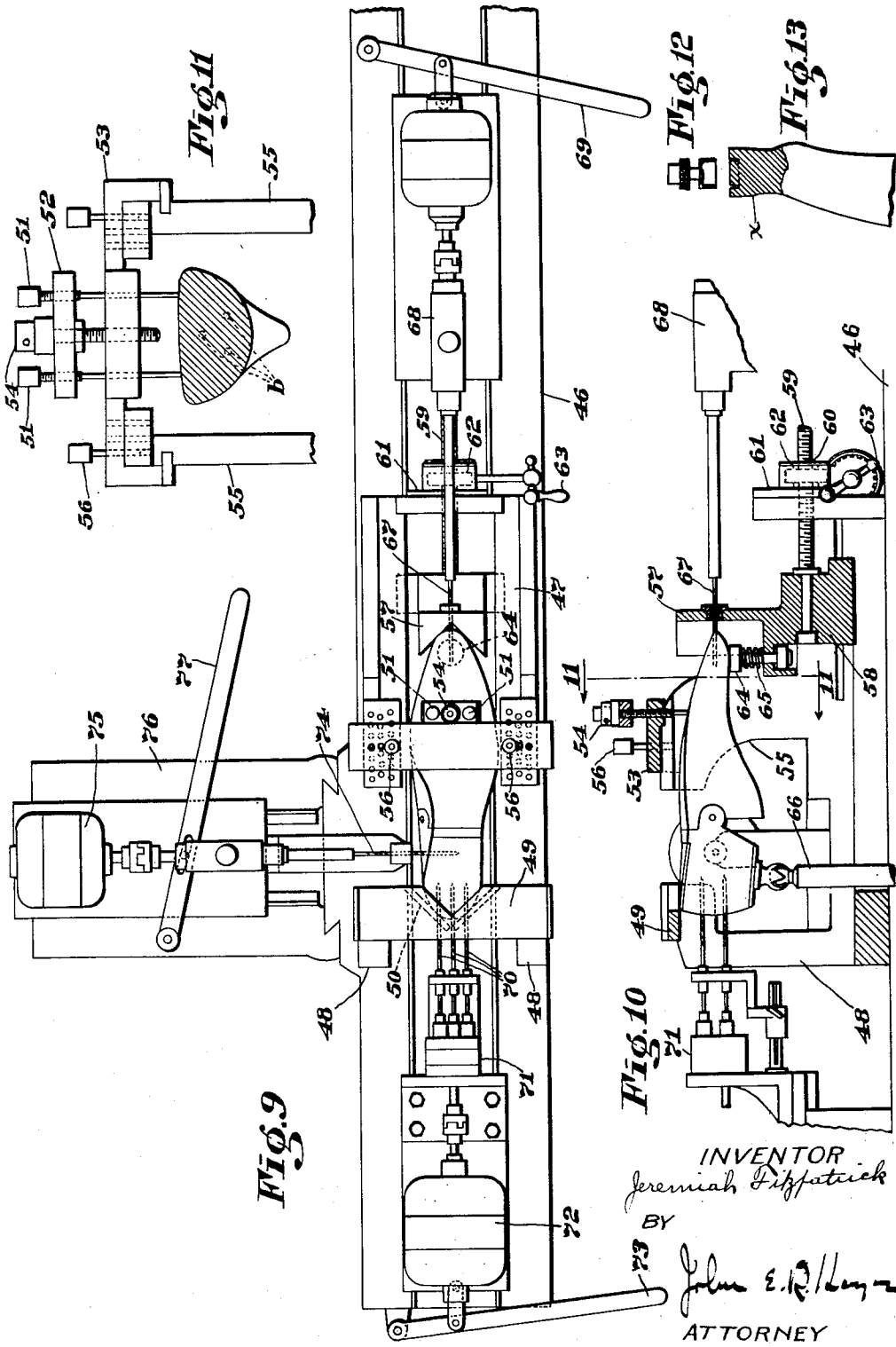


FIG. 9

FIG. 10

FIG. 11

FIG. 12

FIG. 13

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# UNITED STATES PATENT OFFICE

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## METHOD OF AND MACHINE FOR SHAPING LASTS

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Application July 26, 1933, Serial No. 682,265

17 Claims. (Cl. 144—144)

This invention relates to a method of finishing or reforming lasts for boots and shoes, and to a shaping machine of the type employing a model follower adapted to carry out the present invention.

It has been proposed heretofore to shape or reform the toe and heel of lasts by acting upon the last with a cutter that travels around the last under the control of a model follower engaging a model last, but in order to do good work it is important that the lasts to be shaped be accurately positioned with respect to the model last which the model follower engages.

Attempts have been made heretofore to employ various shaped clamps to secure the lasts to be finished or reformed upon the work support in the proper relation to the model last, but the curvature of the surface of a last is such that it is difficult to clamp a last in a definite position with a high degree of accuracy. Furthermore the lasts to be reformed may have shrunk or become warped while in use or may be battered out of their original shape, so that clamps engaging the outer surface of a last cannot be relied upon to position the last with a high degree of accuracy.

Having in mind the difficulties experienced heretofore in using clamps to accurately position the lasts to be finished or reformed, the present method contemplates the step of forming positioning bores in the lasts to be finished or reformed so that these bores will occupy a definite predetermined relation to the longitudinal axis in each last.

Another important step of the present method resides in mounting a bored last in an accurate predetermined position relative to the model last by introducing positioning pins in said bores. In this manner each last may be mounted with a high degree of accuracy in the position in which it is to be acted on by a model controlled cutter, and may be rigidly held in this position by clamps that supplement the holding action of the positioning pins.

In carrying out the present invention the positioning bores are preferably formed at the opposite ends of the lasts, and may also be formed in a side of the last, and one positioning pin is preferably supported by the cutter spindle while the last is being secured in place upon the work support. The others pins may be mounted upon the work support.

The model last preferably is likewise provided with positioning bores so that positioning pins may be employed to accurately position the model last and each last to be shaped or reformed.

An extremely important result secured by the use of the positioning bores and co-operating positioning pins above mentioned is obtained by forming one of these bores in the end of the last where the cutter is to act so that this end of the last will be accurately positioned. The clamps are then engaged with an intermediate portion of the last to firmly hold it in the position determined by the positioning pins, whereupon the pin engaging the end of the last to be acted on by the cutter may be removed so that it will not interfere with the engagement of the cutter with the last.

One feature of the machine of the present invention resides in a table or work support provided with positioning pins engageable with the positioning bores of the lasts to accurately position the lasts.

Another feature resides in a centering pin adapted to be removably secured to the cutter, and in clamps for firmly holding the last in the position defined by said pin so that the pin carried by the cutter may be removed prior to the cutting operation.

The method of the present invention and one form of apparatus for carrying out the method will be more fully understood from the following description when read in connection with the accompanying drawings wherein:

Fig. 1 is a view in side elevation of the upper part of a woodworking machine adapted to carry out the present invention.

Fig. 2 is a front elevation of part of the machine of Fig. 1, showing how the lasts are accurately positioned on the work support.

Fig. 3 is a side view of a last having its ends and side bored for a purpose to be described.

Fig. 4 is a view similar to Fig. 2 but shows the cutters acting upon the lasts to be reformed.

Fig. 5 is a top plan view of the work supporting table showing the means for clamping the lasts in place thereupon.

Fig. 6 is a detail view showing one last engaging clamp and the co-operating end of a second clamp.

Fig. 7 is a sectional view through one of the cutters mounted upon its spindle, and shows a centre pin adjacent the cutter.

Fig. 8 is a section taken on line 8—8 of Fig. 6.

Fig. 9 is a top plan view of a machine for drilling the positioning bores in the lasts.

Fig. 10 is a longitudinal sectional view of the machine of Fig. 9.

Fig. 11 is a sectional view taken on the line 11—11 of Fig. 10.

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Fig. 12 is a side view of a last positioning centre; and

Fig. 13 is a side view of the toe part of a last having the centre supporting portion projecting therefrom.

In describing the present invention it is assumed that the last M is a model last and that the other lasts L are old lasts the toes of which are to be reformed in conformity with the model last.

The present invention may however be employed to reform old lasts which have been built up so that they may be cut to the desired new shape. It may also be employed to finish new lasts by cutting away the projecting centre support that remains at the completion of a lathe turning operation.

A shaping machine provided with a model follower, and with cutters each adapted to travel around the toe or heel portion of a last to act upon it under the control of the model follower is old and is shown, described and claimed in the Norris Patent No. 1,196,716 granted August 29, 1916. In accordance with the disclosure of this patent clamps are provided to position and hold the lasts upon the work support, but as above pointed out clamps can not be relied upon to accurately position the lasts when their shape has become distorted in use. The present invention therefore contemplates a novel method of accurately positioning the lasts that are to be finished or reformed by cutters 10 controlled by a model follower 11.

The mechanism employed for supporting and operating the model follower and cutters may be similar to that of said patent, and as herein shown comprises a hollow standard or main frame 12 which is provided at its upper end with slide-ways 13 adapted to support the slide 14 for movement towards and from the front of the machine. Upon the slide 14 are provided the slide-ways 15 adapted to support the head 16 for movement at right angles to the slide movement. Upon the head 16 are mounted any desired number of cutter spindles 17 having the cutters 10 secured to their lower ends, and these spindles are provided with the operating pulleys 18 driven by the belts 19. The head 16 is also provided with a spindle 20 which carries at its lower end the model follower or tracing wheel 11.

The head 16 is continuously urged by yielding means, which may be similar to that described in said patent, towards a position in which its model carrying spindle lies in axial alignment with the axis of the model last M, and is operated to advance the wheel 11 around the toe of the last M, while the cutters 10 are similarly advanced around the toes of the respective lasts L.

Since the mechanism for operating the cutters 10 and advancing them around the lasts under the control of the model follower 11 may be similar to that described in said patent, a further description of this mechanism is deemed unnecessary herein.

As an important step in the present method each of the lasts L is provided with bores or centres which are accurately positioned in the last, and in the construction shown the model last M is provided with a bore *a* in its toe, three bores *b* in its heel and a bore *c* in a side of the heel portion of the last. These bores are all accurately positioned with respect to the longitudinal axis of the last, and each of the lasts L to be reformed is preferably provided with similar bores posi-

tioned so that they all bear the same definite relation to their longitudinal axis.

These bores are utilized to accurately position the lasts upon the work supporting table 21 mounted below the cutters 10 and supported by the standard 12 for vertical sliding movement. The table or work support 21 is provided with the back plate 22 to which the end plates 23 are secured and to the plates 23 are secured the lower bar 24 and front bar 25.

The lower bar 24 is provided with the last positioning pins 26 adapted to enter the bores *b* of the last to accurately position the heel of each last. The toe of each last is accurately positioned by a centre pin 27 adapted to fit snugly in the lower end of the hub of the adjacent cutter 10 as will be apparent from Fig. 7, and in the hub of the wheel 11. The construction is such that the pins 27 may be inserted in the hubs by hand to fit frictionally therein and are removed after the lasts have been positioned and clamped in place. These pins enter the bores *a* as will be apparent from Fig. 2.

The lasts L are preferably further held in place by pins 28 adapted to enter the side bore *c* of each last. These pins may be secured to brackets 29 mounted upon the sliding bar 30. The arrangement is such that the pins may be inserted in the bores *c* by moving the bar 30 to the left viewing Fig. 2 and withdrawn by moving this bar to the right, and the bar may be operated by the hand lever 31 pivotally supported at 32 and connected to the bar 30 by the link 33.

After the model last M has been properly positioned upon the work support it may remain in this position throughout the reformation of the entire lot of lasts L. The pins 34 for the last M are therefore not supported by the sliding bar 30 but are carried by the arms 35 of a bracket 36 secured to the back plate 22.

It is important that the means for holding the lasts L in place be adapted to be operated quickly so that the finished lasts may be quickly removed and other lasts inserted in place thereof. This is accomplished in the construction shown by providing a pair of holding clamps 37, 38 for each last, one clamp being adapted to engage the ball of the last and the other the instep as best shown in Fig. 5. These clamps may be shaped as shown in Fig. 6 and each is provided with an enlarged portion having a central bore adapted to receive a cylindrical nut or sleeve 39, and a clamp is secured upon its sleeve 39 by a set screw 40.

The clamps 37 and 38 are supported by the threaded shafts 41 journaled in the front bar 25 and rear plate 22 as shown, and each shaft has secured to its outer end an operating crank 42. One portion of each shaft is provided with a right hand thread and the other with a left hand thread as shown so that the clamps 37 and 38 will be moved simultaneously to the clamping position by rotating the crank in one direction and released by rotating the crank in the opposite direction. The proper adjustment of the clamps upon the sleeves 39 may be secured by loosening the set screws 40.

Rocking movement of the clamps 37 and 38 upon the shafts 41 is prevented by providing each clamp with a slot at one end and with a key 43 at its opposite end as shown in Fig. 6. A key or guide bar 44 secured to one end plate 23 engages the slot in the end clamps 37 and 38 and a bar 45 at the other end of the work support guides the other end clamps. This constitutes a simple

means for slidably supporting the clamps for movement in a horizontal plane towards and from the work. The model last M may be further secured in place by the set screws 37\* carried by the front clamp 37.

In practicing the method of the present invention, the last M is preferably bored so that the hole *a* is formed at the longitudinal axis of the last and the bores *b* are preferably equally spaced from this axis. The side hole *c* should be definitely located with respect to this axis, and all of the lasts L of the lot to be reformed should be bored so that the bores *a*, *b* and *c* will bear the same relation to the axis of each last L as the bores of the last M bear to the axis of that last.

If all the lasts are bored in the manner just described they can be quickly secured upon the work support in the proper position by lowering the work support 21 clear of the cutters so that each spindle will return to its normal central position. Then a centre pin 27 is secured in the manner above described to the lower end of each spindle. The heel of the model last M and other lasts L may then be engaged with the positioning pins 26, whereupon the table 21 is raised to introduce the centre pins in the bores *a*. This serves to accurately position each last. The pins 28 and 34 may then be inserted, and the clamps 37 and 38 engaged with the work by operating the crank handles 42. The table 21 may now be lowered so that the pins 27 may be removed from the spindles, and the lasts may then be reformed by driving the cutters and raising the table to cause the cutters 10 to act upon the lasts L under the control of the model follower 11.

Various means may be provided to form the last positioning bores in the lasts, but it is important that all lasts be bored alike so that the bores may be relied upon to accurately position the lasts in the toe forming machine.

In the boring mechanism shown the last supporting mechanism and drills are mounted upon a bed plate 46 which may be supported by means (not shown) at the desired height from the floor. A last supporting frame 47 is mounted on the bed plate 46 so that it may be adjusted lengthwise of the bed plate relative to the side drill, to be described. The frame 47 is constructed to support the last to be drilled upside down as shown, and is provided with V-blocks adapted to engage the heel and toe of the last to centre it longitudinally. To this end the frame 47 is provided at its rear end with the upright posts 48 having secured thereto the transverse bar 49, to the under face of which are secured the blocks 50 arranged to centre the heel with the metal heel plate of the last resting against the under face of the bar 49.

The ball of the last is leveled up transversely by sole engaging pins 51 having threaded engagement with the transverse bar 52. This bar is supported by the bridge plate 53 and may be adjusted relative thereto by the bolt 54. The bridge plate 53 is mounted upon the upright posts 55 so that it may be adjusted towards and from the heel positioning means to accommodate different length lasts. This plate may be secured in the different positions of adjustment by pins 56 extending through holes in the plate 53 into holes in the top of the posts 55.

The V-block 57 for engaging the toe of the last has the supporting base 58 slidably mounted upon the bed plate 46 and may be moved towards and from the last by the adjusting screw 59

projecting from the base through a threaded sleeve 60 rotatably supported by a bracket 61. This sleeve may be rotated by a gear 62 operated by the crank handle 63. The toe of the last rests upon a yielding support 64 mounted upon the base 58 for vertical sliding movement and is urged upwardly by the spring 65.

The arrangement is such that when a last is to be drilled it is placed in the last supporting frame 47 so that the heel plate of the last rests against the under face of the bar 49, and it is held against this bar by a plunger 66 that engages the lower face of the heel block as shown. The plunger may be forced upwardly by a foot treadle (not shown). The toe engaging block is moved into engagement with the toe of the last by operating the crank handle 63, and the toe of the last is adjusted vertically by operating the screw 54 to raise or lower the position pins 51 until the intersection of the toe surfaces is opposite the point of the drill.

Having secured the desired adjustment of the last supporting frame 47 each last of the lot may be quickly and accurately drilled. To form the bore *a* in the toe of the last a drill 67 driven by the motor 68 is provided and the base of this motor is slidably mounted on the bed plate 46 and is moved towards and from the last by operating the hand lever 69. The bores *b* are formed in the heel of the last by the drills 70 operated by gears in the chuck or drill head 71 driven by the motor 72. This motor and chuck are slidably mounted upon the bed plate 46 and are moved towards and from the work by the lever 73. The side bore *c* is formed by the drill 74 driven by a motor 75 slidably mounted upon the supporting plate 76 and is moved towards and from the work by the lever 77.

Should it be desired to finish the toe of a last such as shown in Fig. 13 upon the present machine, the centre supporting portion *x* may be employed to accurately position the last upon the work support, whereupon it may be cut away by a cutter 10 under the control of the model follower 11. In this case however the centering pin shown in Fig. 12 should be employed to centre the last instead of the centering pin of Fig. 7.

It will be seen from the foregoing that by employing centering pins that engage the bores *a*, *b* and *c* the lasts may be quickly and accurately centred upon the work support, and as a result the lasts may be finished or reformed more accurately than upon machines which rely upon clamps engaging the outer surfaces of the lasts to properly position them.

Having thus fully described my invention, I claim and desire to secure by Letters Patent of the United States:

1. The method of shaping a lot of lasts, which consists in mounting a model last in position to be engaged by a model follower, boring the ends of the lasts of a lot so that the bores thus formed occupy the same definite relation to the longitudinal axis in each last, mounting a bored last to be shaped in a predetermined position to the model last by introducing positioning pins in said bores, clamping the last in this position whereby it will be held in said predetermined position after an end positioning pin is removed, removing an end positioning pin prior to the cutting operation, and acting upon the last by a cutter under the control of said model follower.

2. The method of shaping a lot of lasts, which consists in mounting a model last in position to

- be engaged by a model follower, boring the side and heel end of each last of a lot of lasts so that the bores thus formed occupy the same definite relation to the longitudinal axis in each last, mounting a bored last to be shaped in a predetermined position to the model last by introducing positioning pins in said bores, clamping the last between its ends to hold it in this position, and acting upon the toe of the last by a cutter under the control of said model follower.
3. The method of shaping a lot of lasts; which consists in mounting a model last in position to be engaged by a model follower, boring the toe and heel of each last of a lot so that the bores thus formed occupy the same definite relation to the longitudinal axis of the different lasts, mounting a bored last to be shaped in a predetermined position to the model last by introducing positioning pins in said bores, clamping the last in this position to hold it in said position after the toe positioning pin is removed, removing the toe positioning pin, and acting upon the toe of the last by a cutter under the control of said model follower.
4. The method of reforming a lot of lasts, which consists in boring the ends of the lasts of a lot and of a model last so that the bores thus formed occupy the same definite relation to the longitudinal axis of each last, mounting the model last and a last to be reformed in a predetermined relation to each other by introducing positioning pins in said bores, clamping the lasts in place to hold them in said predetermined position after an end positioning pin is removed from each last, and acting upon the last that is to be reformed by a cutter under the control of a model follower engaging the model last.
5. The method of shaping elongated objects in conformity with a model, which consists in mounting the model in position to be engaged by a model follower, boring the ends of a lot of the objects so that the bores thus formed occupy the same definite relation to an axis of each object, mounting a bored object in a predetermined position to the model by introducing positioning pins in said bores, clamping the object between its ends in said position to hold it in this position after an end positioning pin is removed, removing an end positioning pin, and shaping the object by a cutter under the control of said model follower.
6. The method of shaping pieces of work to accord with a model engaged by a model follower which comprises, boring each piece of work so that the bores thus formed occupy the same definite relation to the axis in each piece, mounting each bored piece in a determinate position to the model including the introduction of a positioning pin into its bore, clamping the piece whereby it will be held in the determinate position defined by said pin after the removal of said pin and prior to cutting, removing said pin from the piece, and then acting upon said piece by a cutter under the control of the model follower.
7. The method of shaping a lot of lasts to accord with a model last, which consists in mounting a model last in position to be engaged by a model follower, boring each last of a lot so that the bores thus formed occupy the same definite relation to the axis of the lasts, mounting each bored last in a determined position to the model last including the introduction of a positioning pin into its bore, clamping the last whereby it will be held in the position defined by said pin after the removal of the pin and prior to the cutting, removing said pin from the last, and acting upon said last by a cutter under the control of the model follower.
8. In a wood-working machine provided with a model follower mounted to travel around a model, and a cutter mounted to travel around a piece of work under the control of the model follower, a support for the model and work, means for positioning the model and work accurately upon the support in a predetermined relation to each other including positioning pins adapted to engage positioning bores in the opposite ends of the model and work, clamps engageable with an intermediate portion of the model and work to hold each of them in the position defined by said pins, and means whereby a pin may be removed from an end of the work after the work is engaged by the clamps and before the cutting operation.
9. In a wood-working machine provided with a model follower mounted to travel around a model, and a cutter mounted to travel around a piece of work under the control of the model follower, a support for the model and work, clamping means for holding the model upon the support, means for positioning the work upon the support in an accurate predetermined relation to the model including positioning pins adapted to engage positioning bores in the work, and clamps for holding the work in the position defined by said pins whereby a pin may be removed from a portion of the work which is to be acted on by the cutter.
10. In a wood-working machine provided with a model follower and a cutter under the control of the model follower, means for securing a model in position to be engaged by the model follower, a work support, means for positioning the work upon the support in an accurate predetermined relation to the model including positioning pins adapted to engage positioning bores in the ends of the work, and clamps engageable with an intermediate portion of the work to hold the work rigidly in the position defined by said pins so that a pin may be withdrawn from the work and the cutter engaged with the portion of the work from which the pin was withdrawn.
11. In a wood-working machine provided with a model follower mounted to travel around a model last, and a cutter mounted to travel around a last under the control of the model follower, means for securing a model last in position to be engaged by the model follower, a work support, means for positioning a last to be shaped upon the work support in an accurate predetermined relation to the model last including positioning pins adapted to engage positioning bores in the last to be shaped, and clamps for holding this last in the position defined by said pins whereby a positioning pin may be withdrawn from the last and the cutter engaged with the portion of the last from which the positioning pin was withdrawn.
12. In a wood-working machine provided with a model follower mounted to engage a model last, and a cutter under the control of the model follower, means for securing a model last in position to be engaged by the model follower, a work support, means for positioning a last to be shaped upon the work support in accurate predetermined relation to the model last including positioning pins adapted to engage positioning bores in the last, and clamping means for holding the last

rigidly in the position defined by said pins where-  
by a positioning pin may be withdrawn from the  
last and the cutter engaged with the portion of  
the last from which the positioning pin was  
5 withdrawn.

13. In a wood-working machine provided with  
a model follower mounted to engage a model last,  
and a cutter under the control of the model fol-  
lower, means for securing a model last in position  
10 to be engaged by the model follower, a work sup-  
port, means for positioning a last to be shaped  
upon the work support in accurate predetermined  
relation to the model last including positioning  
pins adapted to engage positioning bores in each  
15 end and a side of the last to be shaped, and  
clamping means for holding the last in the posi-  
tion defined by said pins after an end engaging  
pin has been withdrawn.

14. In a wood-working machine provided with  
a model follower mounted to travel around a  
model, and a cutter mounted to travel around a  
piece of work under the control of the model fol-  
lower, means for securing the model in position  
20 to be engaged by the model follower, a work sup-  
port, means for positioning the work upon the  
support in an accurate predetermined relation to  
the model including a centre pin upon the cutter  
and engageable with a positioning bore upon the  
25 work, and clamping means for holding the work  
in the position defined by said pin.

15. In a wood-working machine provided with  
a model follower mounted to travel around a  
model, and a cutter mounted to travel around a  
piece of work under the control of the model  
30 follower, a work support, means for accurately  
positioning the model and work upon the work  
support including centre pins associated with the

cutter and model follower respectively and en-  
gageable with a positioning bore in the work and  
model, and means for clamping the work and  
model upon the support in the position defined by  
the centre pins.

16. In a wood-working machine provided with  
a model follower mounted to engage a model last,  
and a cutter under the control of the model fol-  
lower, means for securing the model last in posi-  
10 tion to be engaged by the model follower, a work  
support, means for positioning a last to be cut  
upon the work support in an accurate prede-  
termined relation to the model last including  
positioning pins engageable with the opposite  
15 ends of the last and a positioning pin engageable  
with a bore in a side of the last, and a clamp  
for holding the last in the position defined by  
said pins whereby an end pin may be withdrawn  
from the last and the cutter engaged with the  
20 portion of the last from which the pin was with-  
drawn.

17. In a wood-working machine provided with  
a model follower mounted to engage and travel  
around a model last and a cutter under the con-  
trol of the model follower, a support for a model  
25 last and last to be acted upon by the cutter,  
means for securing the model last in place upon  
the support, means for securing each last that is  
to be acted upon by the cutter in an accurate posi-  
tion upon the support with its axis parallel to  
30 the axis of the model last, including positioning  
pins engaging positioning bores in a side and the  
heel end of the last, and clamping means for hold-  
ing the last in the position defined by said pins  
while the cutter acts upon the toe of the last.

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