

Oct. 13, 1936.

C. K. MacDONALD

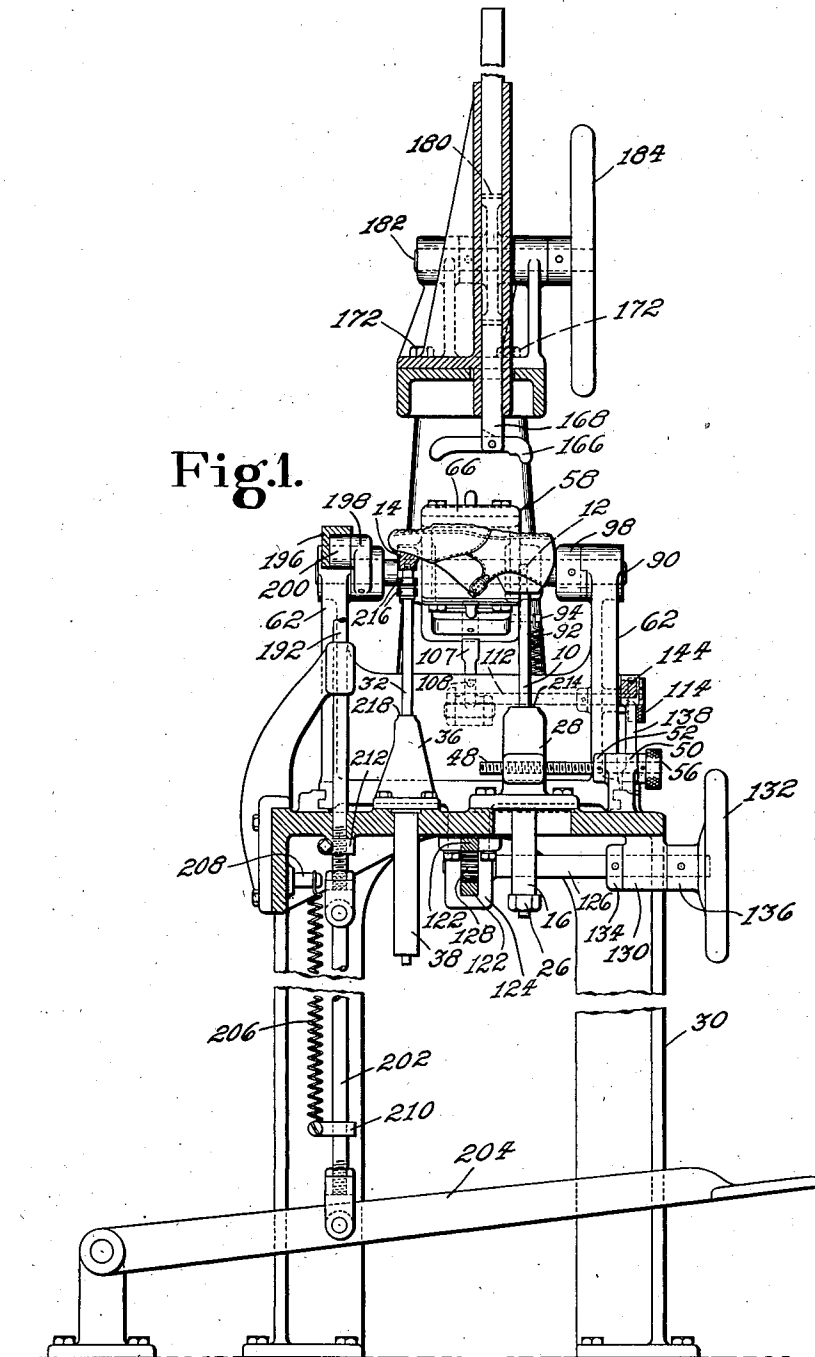
2,057,040

METHOD OF AND MEANS FOR LASTING SHOES

Filed July 23, 1935

6 Sheets-Sheet 1

Fig.1.



INVENTOR
Clifford K. MacDonald
By his Attorney
Victor Cobb

Oct. 13, 1936.

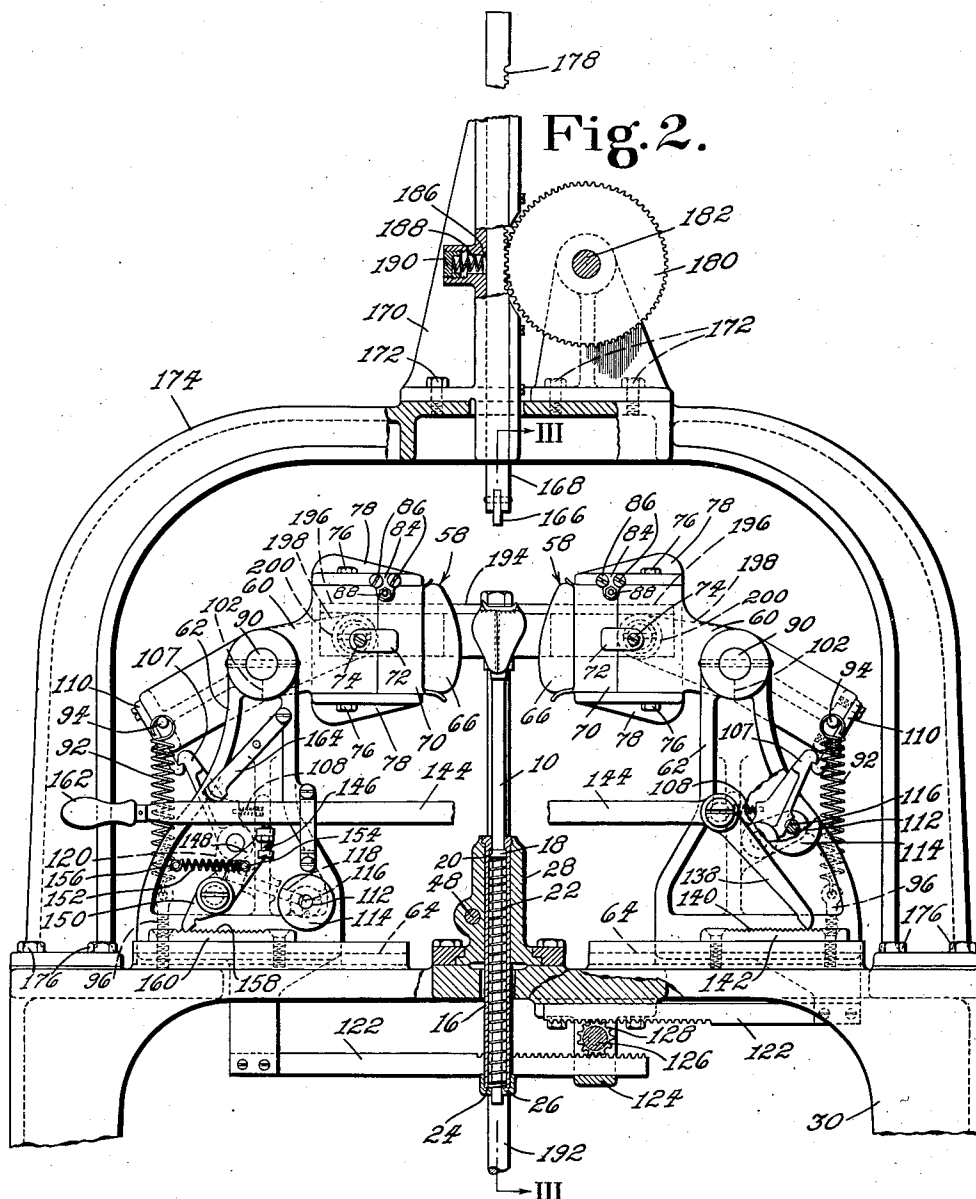
C. K. MacDONALD

2,057,040

METHOD OF AND MEANS FOR LASTING SHOES

Filed July 23, 1935

6 Sheets-Sheet 2



INVENTOR
Clifford K. MacDonald
By his attorney
Walter Cobb.

Oct. 13, 1936.

C. K. MacDONALD

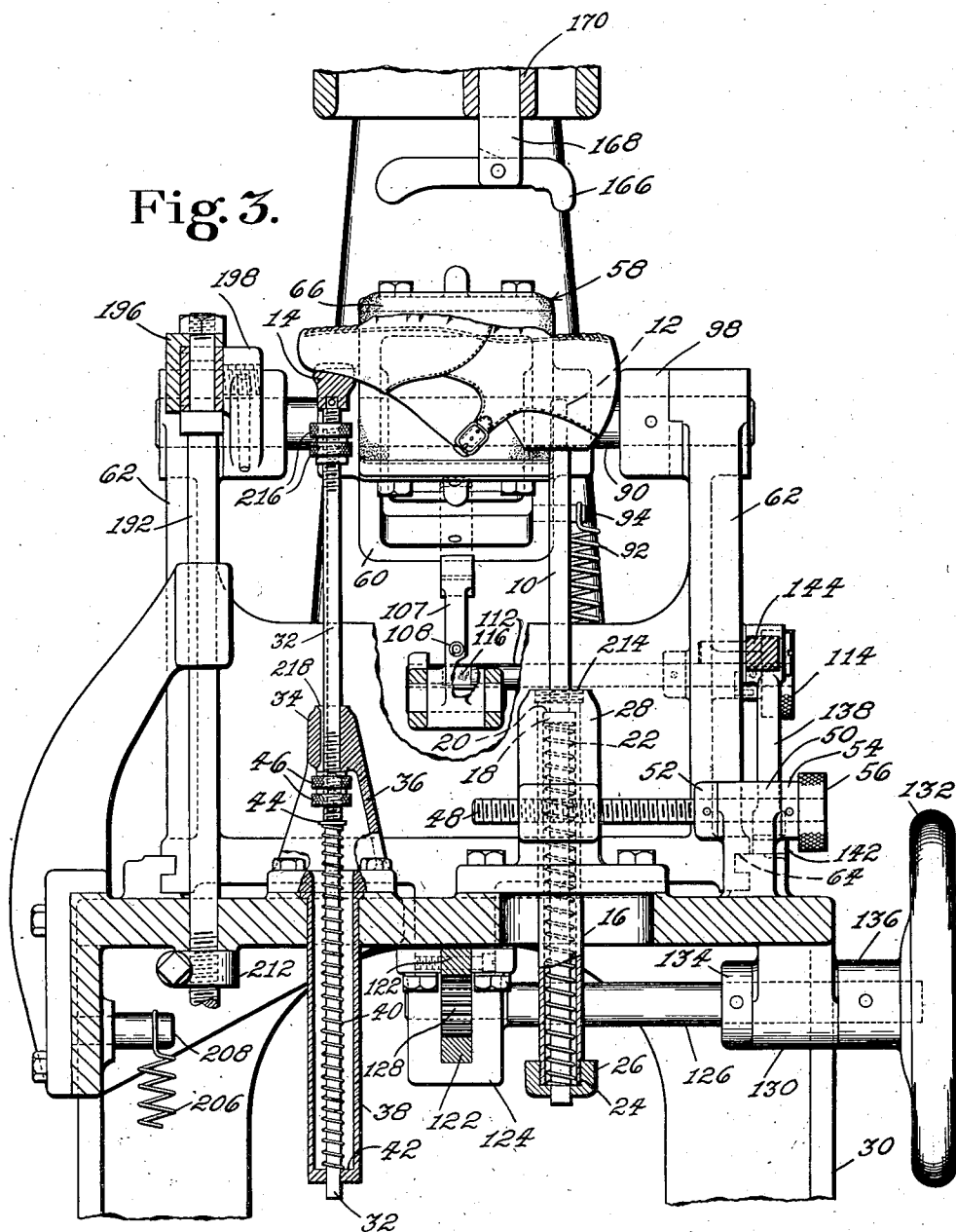
2,057,040

METHOD OF AND MEANS FOR LASTING SHOES

Filed July 23, 1935

6 Sheets-Sheet 3

Fig. 3.



INVENTOR
Clifford K. MacDonald
By his attorney
Victor Cobb

Oct. 13, 1936.

C. K. MacDONALD

2,057,040

METHOD OF AND MEANS FOR LASTING SHOES

Filed July 23, 1935

6 Sheets-Sheet 4

Fig. 4.

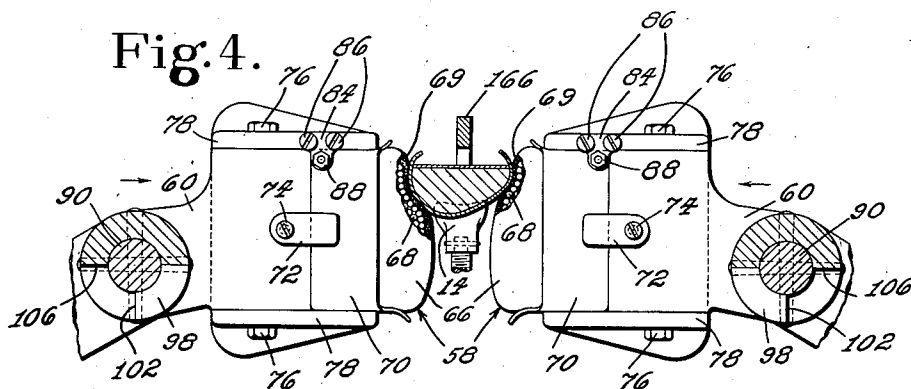


Fig. 5.

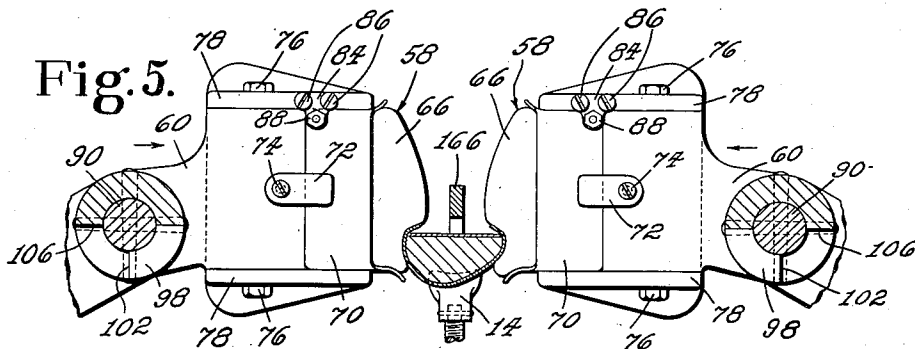
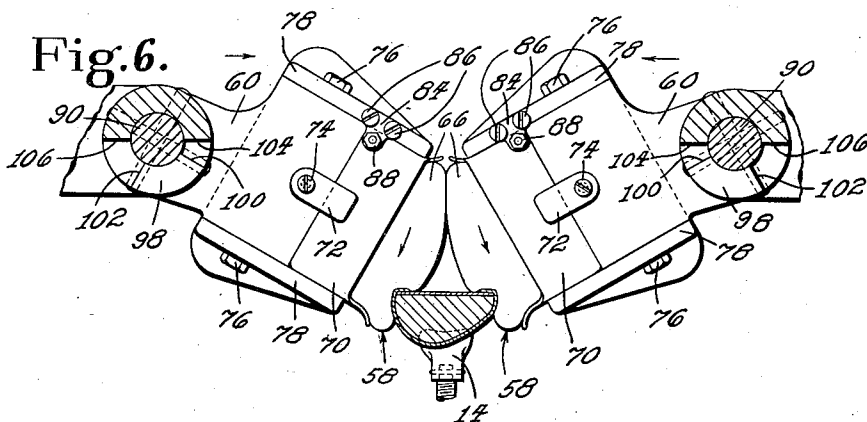


Fig. 6.



INVENTOR
Clifford K. MacDonald
By his Attorney
Victor Cobb

Oct. 13, 1936.

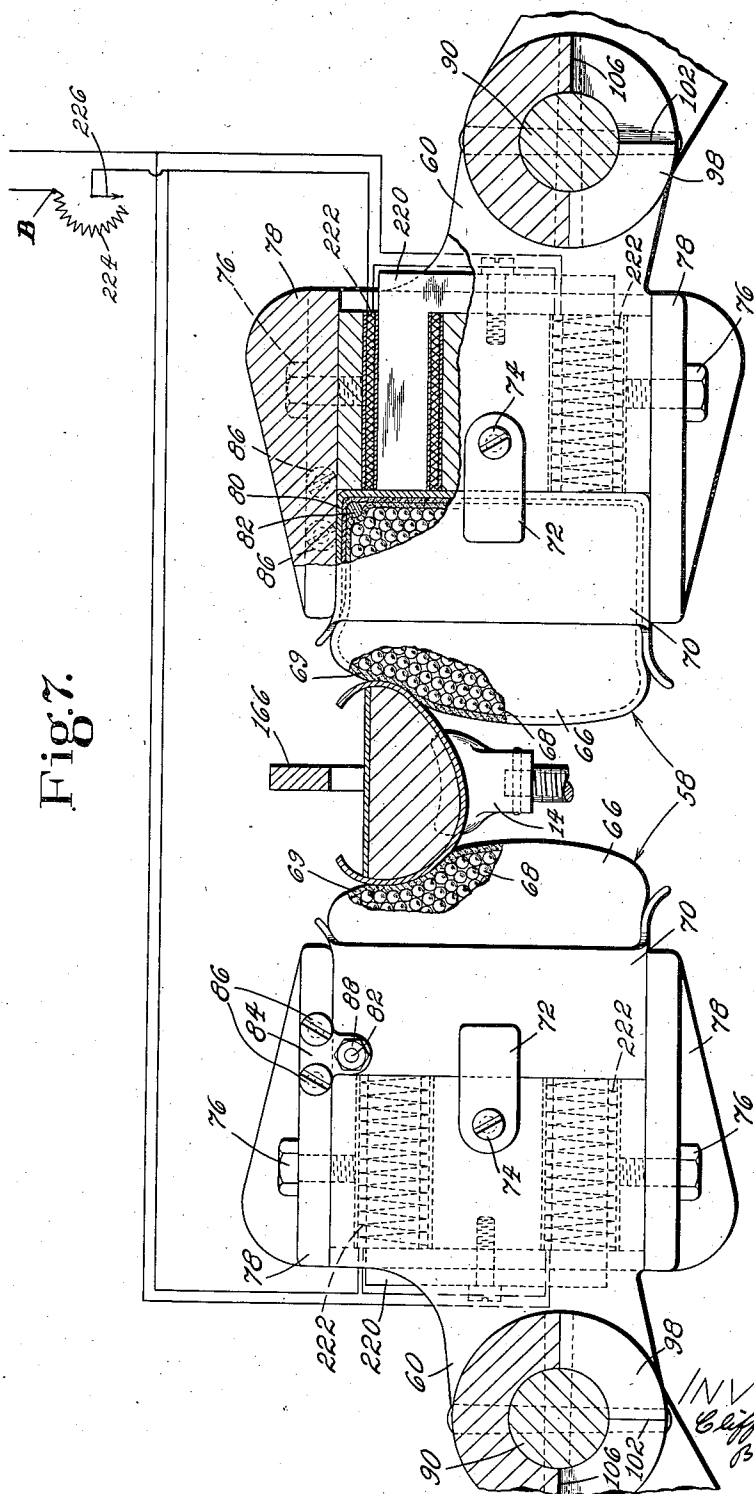
C. K. MacDONALD

2,057,040

METHOD OF AND MEANS FOR LASTING SHOES

Filed July 23, 1935

6 Sheets-Sheet 5



INVENTOR
Clifford K. MacDonell
By his attorney
Victor Colb

Oct. 13, 1936.

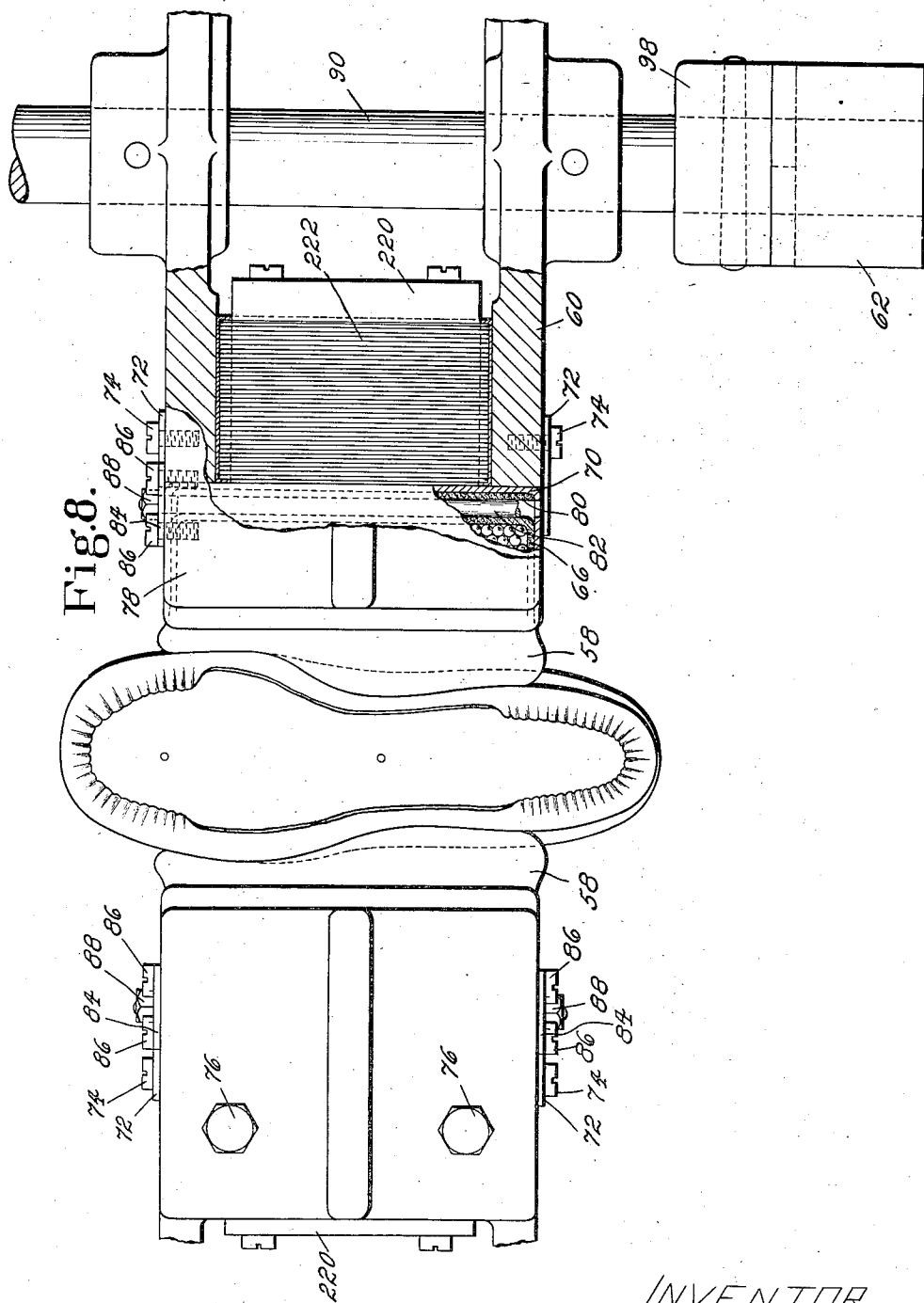
C. K. MacDONALD

2,057,040

METHOD OF AND MEANS FOR LASTING SHOES

Filed July 23, 1935

6 Sheets-Sheet 6



INVENTOR-
Clifford K. MacDonald
By his Attorney
Victor Galt

UNITED STATES PATENT OFFICE

2,057,040

METHOD OF AND MEANS FOR
LASTING SHOES

Clifford K. MacDonald, Brockton, Mass., assignor
to United Shoe Machinery Corporation, Paterson,
N. J., a corporation of New Jersey

Application July 23, 1935, Serial No. 32,766

40 Claims. (Cl. 12—7)

This invention relates to methods of and means for lasting shoes, and is herein illustrated by reference to the lasting of the opposite sides of shoes, between the toe and heel-end portions, in the manufacture of which the upper materials are secured in lasted position by cement, although it will be understood that the invention is not limited to the manufacture of that kind of shoe, nor limited in respect to the portion of the shoe upon which the operation is performed.

The invention in one aspect provides a novel method whereby shoe upper materials (hereinafter referred to inclusively as the upper) are tensioned heightwise of a last toward its bottom face and the marginal portions of the upper materials are laid inwardly over an insole on the last by the use of a flexible lasting member having therein a group of loose elements that adjust themselves in accordance with the shape of the last. In accordance with the illustrated practice, the upper is pressed into conformity to the contour of the last by the flexible lasting member, which is preferably elastic, and is then worked tightly over the last and its marginal portion laid inwardly over an insole on the last by relative movement of the lasting member and the last. As herein further illustrated, there are utilized flexible elastic lasting members arranged to engage and act on the upper at the opposite sides of the last between its toe and heel end portions. Each lasting member comprises a container having therein a plurality of loose articles, illustrated as iron balls and having an upper-engaging wall of flexible elastic material such, for example, as rubber, through which the iron balls act to press the upper into conformity to the contour of the last. The last, as herein shown, is moved relatively to the containers in a direction heightwise of the last, after which tipping movements toward the bottom face of the last are imparted to the containers to cause them to lay the marginal portion of the upper inwardly over the insole and to press it upon the insole.

Preferably, force is exerted on the iron balls during the relative heightwise movement of the containers and the last to increase the frictional pull of the containers on the upper and preferably also this force is maintained or it may be increased as the containers are tipped relatively to the last toward its bottom face to insure that the upper will be held tightly and smoothly conformed to the contour of the last close to the edge of the last bottom as the marginal portion of the upper is laid inwardly over the insole and

pressed into position to adhere to the insole. It is contemplated that in order further to increase the frictional pull of the lasting member or members on the upper, the metallic articles within each member may be magnetized to cause them to cohere. Thus, in addition to their resistance to displacement due to the friction between them, their resistance to displacement is further increased by their magnetic attraction for one another, so that greater force is required to effect a relative movement of the member or members and the last to work the upper tightly over the last. The pressure of the lasting member or members on the upper is thereby increased and as a result a greater frictional pull is exerted on the upper. In operating upon shoes the uppers of which are of relatively heavy and stiff material, or if conditions otherwise render it desirable, as in lasting shoes provided with scant uppers, the frictional pull of the lasting member or members may thus be further increased to render them still more effective in working the upper tightly and smoothly over the last.

In a further aspect, the invention provides novel means adapted for use in the practice of the above-mentioned method. For the purpose in view there is provided, as herein illustrated, a novel organization of means for shaping uppers over lasts by the use of containers having flexible elastic upper-engaging walls and each having a plurality of loose articles, preferably balls, of magnetizable material therein adjustable in accordance with the shape of the last. In the machine herein shown the last and shoe are supported by depressible toe and heel rests between containers which are arranged to engage the upper at the opposite sides of the last over an area extending both heightwise and lengthwise of the last between its toe and heel-end portions. Mechanism is provided for effecting relative movement of the containers and the last in a direction heightwise of the last to cause the containers by frictional contact with the upper to work it tightly over the last, after which inward tipping movements are imparted to the containers to cause them to lay the marginal portion of the upper inwardly over the insole and to press it upon the insole. In the construction shown, each container, illustrated as a rubber bag, is filled with small iron balls and is partially enclosed by a rigid holder which is secured to a carrier pivotally connected to a support for swinging movements about an axis extending

lengthwise of the shoe. The supports are movable toward each other widthwise of the shoe into different positions to vary the pressure of the containers on the upper and means is provided for locking the supports in adjusted positions against outward return movement. As herein shown, there is provided a holddown for forcing the last and shoe and the rests downwardly between the containers, and means for locking the carriers against swinging movements relatively to their supports to permit the containers by frictional contact with the upper to draw it tightly over the last, the last and shoe being positioned at the end of the downward movement of the holddown with the bottom face of the insole below the pivotal connections of the carriers to their supports. Thereafter the carriers are unlocked from their supports and are swung in directions to impart inward tipping movements to the containers to lay the marginal portion of the upper inwardly over the insole, the last and shoe and the rests being further depressed against the resistance of spring means in response to the inward tipping movements of the carriers, and the supports being preferably moved also farther inwardly at this time to maintain or to increase the pressure of the containers on the upper. The upper is thus held conformed tightly and smoothly to the contour of the last at the opposite sides as its marginal portion is laid inward and pressed upon the insole, and in order that the pressure of the containers on the overlaid margin of the upper may be increased, means is provided for limiting the depression of the last and shoe.

In accordance with a further feature there is provided electrical means for magnetizing the loose articles or balls in the containers to cause them to cohere and to resist displacement and thereby to increase the frictional pull of the containers on the upper in the relative movement of the containers and the last to work the upper tightly over the last. As herein shown, each carrier is so formed as to receive a U-shaped magnet in the form of an electro-magnet and the soft iron cores of each magnet are surrounded by coils connected to a rheostat for varying and controlling the strength of the current passing through these coils. The electro-magnets are mounted in the carriers so that when the current is turned on magnetic fields will be set up between the cores of the magnets that will have lines of force passing through the spaces occupied by the balls. The carriers and the parts associated therewith are made of non-magnetizable material so that the density of the magnetic fields may be concentrated in the spaces occupied by the balls. By varying the strength of the current passing through the electro-magnets the resistance of the balls to displacement may be varied to vary the frictional pull of the containers on the upper as may be necessary in operating upon shoes of different kinds.

The above and other features of the invention, including various novel details of construction and combinations of parts and also the novel method aspects of the invention will now be more particularly set forth by reference to the accompanying drawings and pointed out in the claims.

In the drawings,

Fig. 1 is a view partly in side elevation and partly in section of a machine adapted for use in carrying out the novel method and embodying novel features of the invention;

Fig. 2 is a view partly in front elevation and

partly in section on an enlarged scale of the head of the machine shown in Fig. 1;

Fig. 3 is a section on the line III—III of Fig. 2; Figs. 4, 5, and 6 are detail views illustrating the positions of the lasting members and the hold-down at different stages of the lasting operation;

Fig. 7 is a view partly in front elevation and partly in section on an enlarged scale of the lasting members and their supports and illustrating the electrical means which may be mounted in the supports for magnetizing the steel balls within the lasting members; and

Fig. 8 is a view looking from above in Fig. 7 with parts broken away.

In the illustrated machine the shoe is supported by a heel post 10 having a pin 12 at its upper end to enter the spindle hole in the last and by a toe rest 14 arranged to engage the top of the forepart of the shoe (Figs. 1 and 3). The heel post 10 is vertically movable in a sleeve 16 20 (Figs. 2 and 3) and is upheld with a collar 18 on the post in engagement with a shoulder 20 on the sleeve by a spring 22 which surrounds the post between the collar 18 and a shoulder 24 formed on a cap 26 threaded on the lower end of the sleeve 16, the post 10 extending downwardly through an aligned opening in the cap. The sleeve 16 is carried by a bracket 28 which is slidably mounted for movements in directions lengthwise of the shoe in ways formed on the base 30 of the machine. The toe rest 14 is secured to the upper end of a toe post 32 (Fig. 3) which is slidably mounted for movements in directions heightwise of the shoe in a bearing 34 formed in a bracket 36 fast to the base 30 and extends downwardly through an opening in the lower end of a tubular member 38 secured to the base 30, the opening in the end of the tubular member being in alignment with the bearing 34 of the bracket 36. Surrounding the lower reduced end portion of the toe post 32 is a spring 40 which bears at its lower end against a shoulder 42 formed on the tubular member 38 and at its upper end against a washer 44 engaging a shoulder on the post, the spring 40 acting to uphold the post with an adjustable nut and lock nut 46 threaded on the post in engagement with the lower end face of the bearing 34. By adjustment of the nut and lock nut 46 the heightwise position of the toe rest 14 may be varied relatively to the heel post 10 to accommodate shoes of different styles and sizes. For adjusting the heel post 10 toward and from the toe rest 14 to accommodate shoes of different lengths there is adjustably threaded in the bracket 28 a rod 48 rotatably mounted in a bearing 50 on the base 30 and held against endwise movement relatively to the bearing 50 by collars 52 and 54 pinned to the rod and engaging the opposite end faces of the bearing, the collar 54 having an enlarged knurled portion 56 by means of which the rod 48 may be turned to impart movement to the heel post 10 toward or from the toe rest 14.

For lasting the opposite sides of shoes the machine herein shown is provided with conformable lasting members 58 (Figs. 2, 4, 5 and 6) which are supported, one at each side of the shoe, by carriers 60 pivotally connected for swinging movements about axes extending lengthwise of the shoe to supports 62 which are slidably mounted in ways 64 (Fig. 2) formed in the base 30 of the machine for movements toward or from each other widthwise of the shoe. Each lasting member 58 is of such length as to extend from the toe-end portion to the heel-end portion of the shoe and

to overlap more or less these different end portions which preferably, although not necessarily, will have been lasted before the shoe is presented to the machine. Each lasting member 58 comprises a container or bag 66 of flexible elastic material, such as rubber, completely filled with loose spherical articles, such as small metal balls 68, preferably of about one sixteenth of an inch in diameter (Fig. 4). Each container 66 is partially inclosed in a metal casing 70 having arms 72 formed integral therewith and secured to the carrier 60 by screws 74 (Figs. 2 and 8). Engaging the top and bottom faces of the metal casing 70 and secured to the carrier 60 by screws 76 are supporting plates 78. Extending through openings in the opposite side walls of each casing 70 and through a loop formed at the upper corner of each container 66 by a rubber strip 80 vulcanized to the container is a rod 82 the opposite end portions of which are supported by clamps 84 secured by screws 86 to the top plate 78. Each rod 82 is held against endwise movement by nuts 88 threaded on the opposite end portions of the rod and engaging the clamps 84 (Fig. 8).

Each carrier 60 is fast to a rockshaft 90 (Figs. 1 and 3) rotatably mounted in bearings formed in the supports 62 and is urged in a direction to impart upward swinging movement to the lasting member 58 supported thereon by a spring 92 (Fig. 2) connected at one end to a pin 94 in the carrier and at the other end to an adjustable eye-bolt 96 threaded in the support 62. Fast on each rockshaft 90 is a collar 98 provided with shoulders 100 and 102 (Fig. 6) which are arranged to engage, respectively, shoulders 104 and 106 formed on the supports 62 to limit upward and downward swinging movements of the carriers 60 relatively to the supports 62. For locking each carrier against downward swinging movement with the shoulder 100 in engagement with the shoulder 104 there is pivotally connected to each support 62 a latch 107 which is urged by a spring 108 (Fig. 2) in a direction to engage the hook-shaped end of a plate 110 fast to the carrier 60. For moving the latches 107 against the resistance of the springs 108 in directions to release the carriers 60 for downward swinging movement there is rotatably mounted in each support 62 a rod 112 fast to the outer end of which is a small hand wheel 114 for turning it. The rod 112 mounted in the right-hand support 62 (Fig. 1) has formed thereon a cam surface 116 which is arranged to engage the latch 107 pivotally connected to that support. The rod 112 mounted in the left-hand support has formed thereon a similar cam surface 116 engaged by one end of a pin 118 slidably mounted in the support and engaging at its other end a downwardly extending arm 120 of the latch 107 pivotally connected to the left-hand support. As the rods 112 are rotated by the small hand wheels 114 the cam surfaces 116 act to swing the latches 107 out of engagement with the plates 110.

In the course of the operation of the machine the carriers 60 and supports 62 are moved toward each other to move the lasting members 58 into engagement with the last and shoe at the opposite sides substantially from its toe to its heel-end portion. It will be understood that as the lasting members 58 are moved into engagement with the last and shoe the metal balls 68 adjust themselves to the contour of the last, and thus act through the rubber containers 66 to press the upper into conformity to the contour of the last. For mov-

ing the supports 62 toward each other there is connected to each support a rack bar 122 (Figs. 1, 2, and 3). The rack bars 122 are movable in ways formed in a bracket 124, depending from the frame 30, and rotatably mounted in the bracket is a shaft 126 having fast thereon a pinion 128 the teeth of which are arranged to engage the teeth of the rack bars 122. The shaft 126 is supported near its outer end (Figs. 1 and 3) by a bearing 130 on the base 30 and has fast to its outer end a hand wheel 132 by means of which it may be turned. For holding the shaft 126 against endwise movement there is pinned to the shaft a collar 134 which bears against the inner end face of the bearing 130 and engaging the outer end face of the bearing is the hub portion 136 of the hand wheel 132. It will be understood that by rotation of the hand wheel 132 movements in opposite directions are imparted to the rack bars 122 through the pinion 128 to move the supports 62 and carriers 60 toward or from each other.

In the illustrated machine there is provided means for locking the lasting members 58 against outward movement away from each other while permitting them to be moved inwardly toward each other to press the upper into conformity to the contour of the last. As shown particularly in Fig. 2, there is pivotally connected to the right-hand support 62 a pawl 138 for engaging any one of a number of ratchet teeth 140 formed on a fixed plate 142 on the base 30. The pawl 138 has a laterally extending arm 144 and engaging this arm is an adjustable screw 146 carried by the upwardly extending arm 148 of a pawl 150 pivotally connected to the left-hand support 62. A spring 152 connected at one end to a pin 154 in the arm 148 and at the other end to a pin 156 projecting from the support acts to hold the pawl 150 in engagement with any one of a number of ratchet teeth 158 formed on a plate 160 fast to the base 30, and through the arm 144 to hold the pawl 138 in engagement with one of the ratchet teeth 140 on the plate 142. Fast on the outer end of the arm 144 is a handle 162 for swinging the arm downwardly to move the pawls 138 and 150 out of engagement with the ratchet teeth 140 and 158. Pivotally connected to the left-hand support 62 is a latch 164 which may be swung downwardly by the operator to lock the arm 144 in its lowermost position against the action of the spring 152 when it is desired to hold the pawls 138 and 150 out of engagement with the ratchet teeth 140 and 158.

For imparting to the last and shoe movement in a direction heightwise of the shoe there is provided a holddown 166 (Figs. 1 and 2) comprising a comparatively narrow plate arranged to extend lengthwise of the shoe and to engage the insole at the forepart and heel end. The holddown is pivotally connected to a slide 168 vertically movable in a guideway formed in a bracket 170 secured by screws 172 to a supporting bracket 174 fastened to the base 30 by screws 176. Formed upon the slide 168 are rack teeth 178 (Fig. 2) arranged to be engaged by the teeth of a gear 180 fast to a shaft 182 rotatably mounted in the bracket 170 and having fast to its outer end a hand wheel 184 for turning it. For holding the slide 168 against free movement in its guideway in the bracket 170 there is provided a friction device comprising a brass plug 186 held yieldingly in engagement with the slide by a spring 188, a threaded plug 190 being provided for centralizing the spring within a recess in the bracket and 75

for varying its tension to vary the pressure of the plug on the slide.

In the illustrated machine the shoe and last are supported initially bottom upward on the heel post 10 and Joe rest 14 with the bottom face of the insole a considerable distance above the pivotal connections of the carriers 60 to their supports 62. After the lasting members 58 have been moved inwardly into the positions shown in Fig. 4 to press the upper into conformity to the contour of the last along its opposite sides, the hand wheel 184 is rotated by the operator in a direction to impart counterclockwise movement to the gear 180, Fig. 2. Counterclockwise movement of the gear 180 acts to impart downward movement to the slide 168 to move the holddown 166 into engagement with the bottom face of the insole. It will be understood that the lasting members 58 at this time are locked against outward movement from the positions shown in Fig. 4 by engagement of the pawls 138 and 150 with the ratchet teeth 140 and 156, respectively. Thereafter the hand wheel 184 is rotated to impart further downward movement to the holddown to move the last and shoe relatively to the lasting members 58, from the position shown in Fig. 4 to the position shown in Fig. 5, in which position the bottom face of the insole is below the axes of the rockshafts 90.

In this movement the containers 66 act by frictional contact with the upper to draw it tightly over the last. It will be understood that the metal balls 68, which have adjusted themselves to the contour of the last in response to movements of the containers into the positions shown in Fig. 4, are displaced relatively to one another as the last and shoe are moved from the position shown in Fig. 4 to the position shown in Fig. 5 and because of their resistance to such displacement due to the friction between them they act through the containers 66 to resist the downward movement of the last and shoe and thus to increase the frictional pull of the containers on the upper. It will also be understood that the balls 68 act to press the upper through the upper-engaging walls 69 (Figs. 4 and 7) of the containers 66 at all times into conformity to the contour of the last and that the layer of balls in engagement with the upper-engaging walls of the containers are embedded more or less in said walls so that there is substantially no stretching of these walls heightwise of the last in the downward movement of the last and shoe. It will further be understood that by varying the positions of the carriers 60 widthwise of the shoe the force exerted on the metal balls 68 may be varied to vary their frictional resistance to displacement and thus to vary the effective pull of the containers on the upper.

With the last and shoe located in the position shown in Fig. 5, the holddown 166 is moved upwardly out of engagement with the shoe bottom by rotation of the hand wheel 184 and the latches 107 are swung, by turning the small wheels 114, in directions to release the carriers 60 for downward swinging movements. For imparting to the carriers 60 their downward swinging movements, there is vertically movable in bearings in the base 30 a rod 192 (Figs. 1, 2, and 3) having secured to its upper end a member 194 provided with laterally extending arms 196. Pinned to each rockshaft is an inwardly extending arm 198 carrying a roll 200 arranged to be engaged by one of the arms 196 of the member 194. Pivotaly connected to the rod 192 is a second rod 202 which is pivotaly connected to a treadle 204. A spring 206 connected at one end to a pin 208 in the base

30 and at the other end to a collar 210 clamped to the rod 202 acts to impart upward movement to the rods 192 and 202; this movement of the rods being limited by engagement of an adjustable collar 212 on the rod 192 with a portion of the base 30. Depression of the treadle 204 acts through the rods 202 and 192 to move the member 194 downwardly and through the arms 198 to impart downward swinging movement to the carriers 60 against the resistance of the springs 92. 10 As the carriers 60 are swung downwardly the lasting members 58 act to depress the last and shoe clamped between them against the resistance of the springs 22 and 40. Depression of the last and shoe is limited by engagement of the top of the cone of the last with the upper face 214 of the bracket 28 and by engagement of a nut and locknut 216 threaded on the upper end of the toe post 32 with the upper face 218 of the bearing 34. As the treadle 204 is depressed to impart 20 downward swinging movement to the carriers 60 the operator by turning the hand wheel 132 moves the supports 62 toward each other to increase the pressure of the lasting members on the upper. It will be seen that as the carriers are swung downwardly about the axes of the shafts 90 tipping movements laterally of the last are imparted to the lasting members 58 and that as they are thus tipped relatively to the last the last and shoe are forced farther into the lasting members 30 in response to the inward movements of the supports 62. The lasting members accordingly act to draw the upper more tightly over the edge of the insole and to lay its marginal portion inwardly over the insole and to press it into position to 35 adhere to the insole, after which as depression of the last and shoe is stopped by engagement of the last with the bracket 28 and the nut and locknut 216 with the bearing 34, the pressure of the lasting members on the overlaid margin 40 of the upper is increased by further depression of the treadle to force the overlaid margin more firmly into adhering relation to the insole. By reference to Figs. 4 and 5 it will be seen that the upper-engaging walls of the lasting members 58 45 are curved upwardly and outwardly away from each other to permit them to be swung relatively to each other from the position shown in Fig. 5 to the position shown in Fig. 6 without any substantial interference between the upper portions 50 of the members.

After the marginal portion of the upper has been thus laid inwardly over the insole and pressed into position to adhere to the insole the operator, by raising the treadle 204 slightly, permits the 55 springs 22 to raise the lasting members 58 sufficiently to relieve the pressure of the lasting members on the overlaid margin of the upper, after which the pawls 138, 150 are swung, by downward movement of the arm 144, in directions to release the supports 62 for outward movement. After the supports 62 have been moved outwardly the treadle 204 is released to permit the springs 92 to swing the carriers 60 upwardly and the last and shoe are removed from the machine. 65

As previously pointed out, the force exerted on the balls 68 through the metal casings 70 by inward movements of the carriers 60 may be varied to vary the frictional pull of the flexible elastic 70 lasting members on the upper as may be necessary in operating upon shoes of different kinds to work the upper tightly over the last and to press it into conformity to the contour of the last.

In order further to increase the frictional pull 75

of the lasting members on the upper the machine, in accordance with a further feature, may be provided with electrical means for magnetizing the loose balls 68 to cause them to cohere.

Referring now to Figs. 7 and 8, each carrier 60 may be so formed as to receive a U-shaped electro-magnet 220. The soft iron cores of each magnet are surrounded by magnetizing coils 222 and a rheostat 224 is provided for varying and controlling the strength of the current passing through these coils. The rheostat is indicated diagrammatically in Fig. 7 and is adapted to turn the current on and off and to permit only a limited amount of current to pass through the coils 222 so that the strength of the magnetic field can be increased or reduced as desired. It will be understood that in the construction shown in Figs. 7 and 8 the carriers 60 and the parts mounted thereon including the metal casings 70 as well as the rockshafts 90 and the supports 62 will be made of non-magnetizable material, such as aluminum or stainless steel, while the loose balls 68 will be made of magnetizable material such as iron or steel. When the current of the electro-magnets is turned on a magnetic field will be set up between the cores of each electro-magnet which will have lines of force passing through the spaces occupied by the iron balls 68. The balls will accordingly become magnetized and thus tend to cohere and to resist displacement. By moving the arm 226 of the rheostat upwardly toward the terminal B the strength of the current passing through the electro-magnets is increased, thus increasing the density of the magnetic fields set up by the electro-magnets. As a result the balls 68 become more highly magnetized and accordingly greater force is required to displace them. It will thus be evident that in addition to the resistance of the balls 68 to displacement due to the friction between them their resistance to displacement may be increased by magnetizing them so that greater force is required to move the last downwardly between the lasting members. The pressure of the lasting members on the upper is thereby increased and as a result a greater frictional pull is exerted on the upper. By varying the strength of the current passing through the electro-magnets the resistance of the iron balls to displacement may be varied to vary the frictional pull of the lasting members on the upper. It will be understood that the balls 68 may be magnetized at any time during the operation of the machine.

In the operation of the machine, briefly summarized, the operator, after adjusting the heel and toe posts for the size and style of shoe to be operated upon, places a last and shoe on the heel pin 12 and the toe rest 14. Before the shoe is presented to the machine, in accordance with the illustrated practice, the toe and heel ends will have been previously lasted and a suitable adhesive such as latex or pyroxylin cement will have been applied to the margins of the upper materials and also, if desired, to the margin of the insole along the opposite sides of the shoe.

After the shoe has been mounted in the machine as above described, the operator, by turning the hand wheel 132 moves the supports 62 and the carriers 60 toward each other to press the lasting members 58 against the shoe, the lasting members engaging the shoe upper lengthwise of the shoe substantially from its toe-end to its heel-end portion. It will be understood that as the lasting members are pressed against the shoe the iron balls 68 adjust themselves in accordance

with the contour of the last and act through the upper-engaging walls of the lasting members to press the upper into conformity to the contour of the last. Thereafter the operator turns the hand wheel 184 in a direction to lower the hold-down 166 which, by engagement with the insole, moves the last and shoe from the position shown in Fig. 4 to the position shown in Fig. 5. It will be understood that as the last and shoe are thus moved heightwise relatively to the lasting members, the latches 107 act by engagement with the plates 110 to hold the lasting members against swinging movements relatively to their supports so that the lasting members act by frictional engagement with the upper to work it tightly over the last. It will also be understood that the frictional pull of the lasting members on the upper may be varied by varying the positions of the supports 62 and the carriers 60 laterally of the shoe to vary the force exerted on the metal balls 68 through the casings 70 and that the pawls 138 and 150 act by engagement with the ratchet teeth 140 and 158 to hold the supports and the carriers against outward movement from adjusted position. It will further be understood that if electrical means such as shown in Figs. 7 and 8 is provided the frictional pull of the lasting members on the upper may be further increased by magnetizing the iron balls 68 to cause them to cohere more or less and thus further to resist displacement by the last and shoe.

After the last and shoe have been moved into the position shown in Fig. 5 the operator moves the holddown 156 out of engagement with the shoe bottom, turns the small wheels 114 to move the latches 107 out of engagement with the plates 110, depresses the treadle 204 to impart downward swinging movements to the carriers 60 and simultaneously turns the hand wheel 132 in a direction to impart further inward movements to the supports 62 to maintain or to increase the pressure of the lasting members on the upper. As the carriers 60 are swung relatively to their supports 62 by depression of the treadle the lasting members act to impart a further downward movement to the last and shoe clamped between them as they are tipped laterally of the shoe by the swinging carriers and are also moved inwardly by inward movements of the supports. The upper is thus drawn tightly over the last and its marginal portion is laid inwardly over the insole and pressed into position to adhere to the insole. The depression of the last and shoe is limited by engagement of the last with the upper surface 214 of the bracket 28 and by engagement of the nut and lock nut 216 with the upper surface 218 of the bearing 34. Thereafter the pressure of the lasting members on the upper is increased by further downward movement of the treadle, to force the overlaid marginal portion of the upper more firmly into adhering relation to the insole. In the return of the parts to starting positions the treadle is first raised sufficiently to relieve the pressure of the lasting members on the overlaid margin of the upper after which the pawls 138 and 150 are swung upwardly out of engagement with the ratchet teeth 140 and 158 and the lasting members are moved outwardly out of engagement with the shoe. The treadle is then released to permit the springs 92 to swing the carriers 60 upwardly to their initial positions in which positions they are locked by the latches 107 as the small wheels 114 are turned to permit the springs 108 to swing the latches into positions to engage the hook-shaped ends of the plates 110.

the springs 22, 40 moving the toe and heel posts upwardly to their initial positions. The last and shoe are then removed from the machine.

Having described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. That improvement in methods of lasting shoes which consists in pressing an upper into conformity to the contour of a last by the use of a flexible lasting member having therein a group of loose elements adjustable in accordance with the shape of the last in response to pressure of the last on said member, and by relative movement of the lasting member and the last working the upper tightly over the last.

2. That improvement in methods of lasting shoes which consists in pressing an upper into conformity to the contour of a last by the use of a flexible elastic lasting member having therein a plurality of loose articles adjustable in accordance with the shape of the last in response to pressure of the last on said member, and by relative movement of the lasting member and the last working the upper heightwise of the last and laying its marginal portion inwardly over an insole on the last.

3. That improvement in methods of lasting shoes which consists in pressing an upper into conformity to the shape of a last by the use of a flexible container having therein a plurality of loose members adjustable in accordance with the shape of the last in response to pressure of the last on said container, relatively moving the container and the last in a direction heightwise of the last to cause the container by frictional contact with the upper to draw it tightly over the last, and then relatively tipping the container and the last in a direction to cause the container to lay the marginal portion of the upper inwardly over an insole on the last and to press it upon the insole.

4. That improvement in methods of lasting shoes which consists in pressing an upper into conformity to the contour of a last by the use of a container having an upper-engaging wall of flexible elastic material and having therein a plurality of loose spherical articles adjustable in accordance with the shape of the last in response to pressure of the last against said wall, moving the last relatively to the container in a direction heightwise of the last to cause the container by frictional contact with the upper to tension it over the last, and then tipping the container inwardly toward the bottom face of the last to lay the marginal portion of the upper inwardly over an insole on the last and to press it upon the insole.

5. That improvement in methods of lasting shoes in which the marginal portion of the upper is secured in lasted relation to an insole by cement, which consists in pressing the upper at the opposite sides of a last substantially from its toe to its heel-end portion into conformity to the contour of the last by the use of flexible containers each having therein a plurality of spherical articles adjustable in accordance with the shape of the last, relatively moving the last and the containers in a direction heightwise of the last to cause the containers by frictional contact with the upper to draw it tightly over the last, and then while holding the tensioned upper conformed to the contour of the last tipping the flexible containers inwardly over the bottom face of the last to lay the marginal portion of the upper inwardly over an insole on the last and to press it upon the insole.

6. That improvement in methods of lasting shoes which consists in pressing an upper into conformity to the contour of a last by the use of a flexible member having therein a group of metallic articles magnetized to cause them to cohere but adjustable to the contour of the last in response to pressure of the last on said member, and by relative movement of the lasting member and the last working the upper over the last.

7. That improvement in methods of lasting shoes which consists in pressing an upper into conformity to the contour of a last by the use of a flexible container having therein a plurality of metallic articles magnetized to cause them to cohere but adjustable to the contour of the last in response to pressure of the last on said container, and by relative movement of said container and the last working the upper tightly over the last and laying its marginal portion inwardly over an insole on the last.

8. That improvement in methods of lasting shoes which consists in pressing an upper into conformity to the contour of a last by the use of a flexible elastic lasting member having therein a group of metallic articles magnetized to cause them to cohere but adjustable to the contour of the last in response to pressure of the last on said member, relatively moving the last and shoe and the lasting member heightwise of the last to cause the lasting member by frictional contact with the upper to work it tightly over the last, and then tipping the lasting member inwardly toward the bottom face of an insole on the last to cause it to lay the marginal portion of the upper inwardly over the insole.

9. That improvement in methods of lasting shoes which consists in pressing an upper into conformity to the contour of a last by the use of a container having a plurality of magnetized iron balls therein and an upper-engaging wall of flexible elastic material, moving the last heightwise relatively to the container to cause the container by frictional contact with the upper to tension it over the last, and then without relaxing the pressure of the container on the upper relatively tipping the container and the last in a direction to cause the container to lay the marginal portion of the upper inwardly over an insole on the last and to press it upon the insole.

10. That improvement in methods of lasting shoes in which the marginal portion of the upper is secured in lasted position by an adhesive which consists in pressing an upper into conformity to the contour of a last by the use of a flexible container having therein a plurality of magnetized iron balls adjustable in accordance with the shape of the last and moving the last heightwise relatively to said container while exerting force on said iron balls at an angle to the direction of said movement to work the upper tightly over the last, then tipping the container inwardly toward the bottom face of the last and exerting force on said balls in a direction inclined toward the bottom face of the last to cause said balls by their action on the upper through said flexible container to lay the marginal portion of the upper inwardly over an insole on the last and to press it into position to adhere to the insole, and thereafter increasing the pressure of said flexible container on the overlaid margin of the upper to force it more firmly into adhering relation to the insole.

11. That improvement in methods of lasting shoes in which the marginal portion of the upper is secured in lasted relation to an insole by an adhesive, which consists in pressing the upper at

the opposite sides of a last substantially from its toe to its heel-end portion into conformity to the contour of the last by the use of containers each having therein a group of magnetized iron balls that adjust themselves in accordance with the shape of the last and an upper-engaging wall of flexible elastic material, forcing the last downwardly between the containers to cause the containers by frictional contact with the upper to draw it tightly over the last, tipping the containers inwardly over the bottom face of the last without relaxing their pressure on the upper to cause the containers to lay the marginal portion of the upper inwardly over the bottom face of an insole on the last and to press it into position to adhere to the insole, and then increasing the pressure of the containers on the overlaid margin of the upper to press it more firmly into adhering relation to the insole.

12. In a machine for shaping uppers over lasts, conformable lasting means constructed and arranged to act frictionally on an upper mounted on a last to work the upper heightwise of the last in response to relative movement of said means and the last, said conformable lasting means comprising a flexible member, and a plurality of loose elements arranged to act on said member to press it into conformity to the contour of the last and to increase its frictional pull on the upper during said relative movement.

13. In a machine for shaping uppers over lasts, a device for conforming an upper to the contour of a last and for working the upper heightwise of the last in response to relative movement of said device and the last, said device comprising a container having a plurality of loose articles therein adjustable in accordance with the shape of the last and a flexible elastic upper-engaging wall conformable thereby to the shape of the last.

14. In a machine for shaping uppers over lasts, means for conforming an upper to the contour of a last and for working the upper heightwise of the last in response to relative movement of said upper-conforming means and the last, said upper-conforming means comprising a container having a flexible elastic upper-engaging wall, and a plurality of loose articles in said container adjustable in accordance with the shape of the last and arranged to force the upper through said upper-engaging wall against the last at an angle to the direction of said relative movement.

15. In a machine for shaping uppers over lasts, means for engaging an upper frictionally at the side of a last comprising a hollow member of flexible elastic material having a plurality of loose articles therein relatively displaceable to press the upper-engaging face of said member into conformity to the contour of the last in response to pressure of the last on said hollow member, and mechanism for effecting a relative heightwise movement of said hollow member and the last to cause said member to work the upper toward the edge of an insole on the last.

16. In a machine for shaping uppers over lasts, means for pressing an upper into conformity to the contour of a last in response to relative movement of said means and the last, said means comprising a flexible container having a plurality of loose articles therein adjustable in accordance with the shape of the last in response to pressure of the last on said container, and means for increasing the pressure of said flexible container on the upper and for tipping it inwardly toward the bottom face of an insole on the last to cause

it to lay and press the marginal portion of the upper upon the insole.

17. In a machine for shaping uppers over lasts, means for pressing an upper into conformity to the contour of a last and for working the upper heightwise of the last in response to relative movement of said means and the last, said means comprising a flexible container filled with loose spherical articles adjustable in accordance with the shape of the last, and means for tipping said flexible container inwardly toward the bottom face of an insole on the last and for exerting force on said loose spherical articles in a direction inclined toward the bottom face of the insole to cause said spherical articles to act on the upper through said flexible container to lay its marginal portion inwardly over the insole.

18. In a machine for shaping uppers over lasts, means for pressing an upper into conformity to the contour of a last and for working the upper heightwise of the last in response to relative movement of said means and the last, said means comprising a flexible container having a plurality of loose articles therein adjustable in accordance with the shape of the last, means for imparting to said container while pressing it against the upper a tipping movement inwardly toward the bottom face of the last to cause said container to lay and press the marginal portion of the upper upon the bottom face of an insole on the last, and spring means arranged to be tensioned in response to the inward tipping movement of said flexible container for increasing the pressure of said container on the overlaid margin of the upper.

19. In a machine for shaping uppers over lasts, means for pressing an upper into conformity to the contour of a last and for working the upper heightwise of the last in response to relative movement of said means and the last, said means comprising a flexible container having a plurality of loose articles therein adjustable in accordance with the shape of the last in response to pressure of the last on said flexible container, and a support for said flexible container movable relatively to the last into different positions to vary the pressure of said container on the upper during said relative movement and for imparting to said container thereafter a tipping movement laterally of the last in a direction to cause the container to lay the marginal portion of the upper inwardly over an insole on the last and to press it upon the insole.

20. In a machine for shaping uppers over lasts, a flexible elastic member arranged to act frictionally on an upper to work the upper heightwise of a last in response to relative movement of the last and said member, said member having a group of loose articles therein adjustable in accordance with the shape of the last, and means constructed and arranged to exert force on said articles at an angle to the direction of said relative movement.

21. In a machine for shaping uppers over lasts, a flexible container arranged to act frictionally on an upper to work the upper heightwise of a last in response to relative movement of the last and said container, said container having a plurality of loose articles therein adjustable in accordance with the shape of the last, and a holder for enclosing a portion of said container and for exerting force on said articles in directions to increase the frictional pull of the container on the upper.

22. In a machine for shaping uppers over lasts,

a flexible container arranged to act frictionally on an upper mounted on a last to work the upper heightwise of the last in response to relative movement of the last and said container, said container having a plurality of metallic balls therein adjustable in accordance with the contour of the last, and a rigid holder for enclosing a portion of said container and for tipping it relatively to the last inwardly over the bottom of the last to cause the container to lay the marginal portion of the upper inwardly over an insole on the last and to press it upon the insole.

23. In a machine for shaping uppers over lasts, a flexible container arranged to act frictionally on an upper mounted on a last to work the upper heightwise of the last in response to relative movement of the last and said container, said container having a plurality of loose spherical articles therein adjustable in accordance with the shape of the last, a rigid holder for enclosing a portion of said container and for moving it toward the last to press the upper against the last, and means for imparting to said holder a further movement toward the last to force the last and shoe farther into the container and for swinging the holder about an axis located above the last toward its bottom face to cause the container to lay and press the marginal portion of the upper upon an insole on the last.

24. In a machine for shaping uppers over lasts, a device arranged to act frictionally on an upper mounted on a last to work the upper heightwise of the last in response to relative movement of said device and the last, said device comprising a container filled with loose spherical articles and having an upper-engaging wall of flexible elastic material, said loose spherical articles being arranged to act on the upper to press it into conformity to the contour of the last and being displaceable in response to said relative movement while thus pressing the upper against the last, and means for varying the pressure of said loose spherical articles on the upper through said upper-engaging wall to vary the frictional pull of said container on the upper.

25. In a machine for shaping uppers over lasts, a device arranged to act frictionally on an upper mounted on a last to work the upper heightwise of the last in response to relative movement of said device and the last, said device comprising a container of flexible elastic material filled with loose spherical articles arranged to act on the upper through said container to press it into conformity to the contour of the last, said spherical articles being displaceable in response to said relative movement while thus pressing the upper against the last, and a member constructed and arranged partially to enclose said container, said member being movable laterally of the last into different positions to vary the pressure of said spherical articles on the upper and thereby to vary the frictional pull of said container on the upper during said relative movement.

26. In a machine for shaping uppers over lasts, lasting devices at the opposite sides of a last for pressing an upper into conformity to the contour of the last substantially from its toe to its heel-end portion, said devices comprising hollow members of flexible elastic material each having a plurality of loose articles therein adjustable in accordance with the shape of the last in response to pressure of the last on said members, and mechanism for effecting relative movement of the last and said hollow members heightwise of the last to cause said members by frictional con-

tact with the upper to work it tightly over the last.

27. In a machine for shaping uppers over lasts, lasting devices for pressing an upper at the opposite sides of a last into conformity to the contour of the last and for working the upper heightwise of the last in response to relative movement of the last and said devices, said devices comprising hollow members of flexible elastic material each having a plurality of loose spherical articles therein and an upper-engaging wall arranged to engage and press the upper over an area extending both lengthwise and heightwise of the last between its toe and heel-end portions, and mechanism for increasing the pressure of said hollow members on the upper and for imparting to said members tipping movements inwardly over the bottom of the last to lay the marginal portion of the upper inwardly over an insole on the last and to press it upon the insole.

28. In a machine for shaping uppers over lasts, lasting devices for pressing an upper into conformity to the contour of a last presented bottom upward while working the upper tightly over the opposite sides of the last in response to relative movement of said devices and the last, said devices each comprising a hollow member of flexible elastic material filled with loose spherical articles and arranged to engage the upper over an area extending both lengthwise and heightwise of the last between its toe and heel-end portions, and carriers for supporting said hollow flexible members, said carriers being mounted for swinging movements about axes located above the last and extending lengthwise of the last to impart to said hollow flexible members tipping movements laterally of the last in directions to cause said members to lay and press the marginal portion of the upper over the bottom of the last.

29. In a machine for shaping uppers over lasts, devices at the opposite sides of a last presented bottom upward for pressing an upper into conformity to the contour of the last, said devices each comprising a container having a plurality of loose spherical articles therein and an upper-engaging wall of flexible material arranged to engage the upper over an area extending both heightwise and lengthwise of the last between its toe and heel-end portions, means for depressing the last by engagement with the bottom face of an insole on the last to cause said containers by frictional contact with the upper to work it tightly over the last, and mechanism for swinging said containers about axes located above the last and extending lengthwise of the last while moving said axes inwardly toward each other to cause said containers by their action on the upper to draw it more tightly over the last and to lay and press its marginal portion upon the insole.

30. In a machine for shaping uppers over lasts, lasting devices at the opposite sides of a last for pressing an upper into conformity to the contour of the last, said devices each comprising a hollow member of flexible elastic material filled with loose spherical articles adjustable in accordance with the shape of the last, each of said devices being arranged to engage the upper over an area extending both heightwise and lengthwise of the last between its toe and heel-end portions, a holddown for moving the last heightwise relatively to said lasting devices to cause said devices by frictional contact with the upper to tension it over the last, carriers for supporting said lasting devices, a pair of supports for moving said carriers inwardly into different positions to vary the pres-

sure of said lasting devices on the upper, said carriers being pivotally connected to said supports, and means for swinging the carriers relatively to their supports to impart to said lasting devices tipping movements relatively to the last in directions to cause said devices to lay and press the marginal portion of the upper upon an insole on the last.

31. In a machine for shaping uppers over lasts, lasting devices at the opposite sides of a last presented bottom upward for pressing on upper into conformity to the contour of the last and for working the upper heightwise of the last in response to relative movement of said devices and the last, said devices each comprising a flexible container and a group of loose spherical articles in said container adjustable in accordance with the shape of the last, mechanism for imparting to said containers swinging movements above axes located above the last and extending lengthwise of the last while moving said axes toward each other laterally of the last to cause inward tipping movements to be imparted to said containers to lay and press the marginal portion of the upper on the bottom face of an insole on the last, and spring means arranged to be tensioned in response to the swinging movements of said containers for increasing the pressure of said containers on the upper.

32. In a machine for shaping uppers over lasts, lasting devices at the opposite sides of a last for pressing an upper into conformity to the contour of the last, said devices each comprising a flexible container filled with metallic balls adjustable in accordance with the shape of the last, carriers for supporting said flexible containers, supports upon which said carriers are pivotally mounted for swinging movements about axes extending lengthwise of the last, depressible toe and heel rests for supporting the last and shoe, means movable to depress the last and shoe and said rests to position the last with the bottom face of an insole on the last below the pivotal connections of said carriers to their supports, means for locking the carriers against swinging movements relatively to their supports during the depression of the last and shoe to cause said flexible containers by frictional contact with the upper to work it tightly over the last, and means for moving said supports inwardly and for imparting to said carriers swinging movements relatively to said supports in directions to impart inward tipping movements to said flexible containers to cause them to lay and press the marginal portion of the upper upon the insole.

33. In a machine for shaping uppers over lasts, means for supporting a last and shoe, and a flexible lasting member for pressing the shoe upper into conformity to the contour of the last and for working the upper over the last in response to relative movement of the lasting member and the last, said flexible lasting member having therein a group of metallic articles magnetized to cause them to cohere but adjustable to the contour of the last in response to pressure of the last on said member.

34. In a machine for shaping uppers over lasts, a flexible container for pressing an upper into conformity to the contour of a last, said flexible container having therein a plurality of metallic articles magnetized to cause them to cohere but adjustable to the contour of the last in response to pressure of the last on said container, and means for effecting relative movement of said container and the last to work the upper tightly

over the last and to lay its marginal portion inwardly over an insole on the last.

35. In a machine for shaping uppers over lasts, a device arranged to act frictionally on an upper mounted on a last to work the upper heightwise of the last in response to relative movement of said device and the last, said device comprising a flexible container having a plurality of metallic articles of magnetizable material therein, said articles being arranged to act on the upper to press it into conformity to the contour of the last and being also relatively displaceable while thus pressing the upper against the last in the relative movement of said device and the last to work the upper heightwise of the last, and electrical means for magnetizing said articles to cause them to cohere and to resist displacement and thus to increase the frictional pull of said device on the upper during said relative movement.

36. In a machine for shaping uppers over lasts, a flexible container arranged to act frictionally on an upper mounted on a last to work the upper heightwise of the last in response to relative movement of said container and the last, said container having a plurality of metallic articles of magnetizable material therein adjustable in accordance with the shape of the last in response to pressure of the last on the container, a member of non-magnetizable material for supporting said flexible container, and a magnet mounted in said supporting member for magnetizing said articles to cause them to cohere.

37. In a machine for shaping uppers over lasts, a flexible container arranged to act frictionally on an upper mounted on a last to work the upper heightwise of the last in response to relative movement of said container and the last, said container having a plurality of metallic articles of magnetizable material therein arranged to act on the upper through said container to press the upper into conformity to the contour of the last, said articles being relatively displaceable while thus pressing the upper against the last in the relative movement of said container and the last to work the upper heightwise of the last, a holder of non-magnetizable material formed partially to enclose said container, a carrier for supporting said holder, and an electro-magnet mounted in said carrier for magnetizing said metallic articles.

38. In a machine for shaping uppers over lasts, devices for engaging an upper frictionally at the opposite sides of a last, said devices each comprising a container of flexible elastic material having a plurality of steel balls therein adjustable in accordance with the shape of the last, a member of non-magnetizable material for supporting each container, said supporting members being movable toward each other to vary the pressure of the flexible containers on the upper, means for effecting a relative movement of the last and said containers in a direction heightwise of the last to cause said containers by frictional contact with the upper to draw it tightly about the last, said steel balls being displaceable in response to said relative movement while pressing the upper into conformity to the contour of the last, and electro-magnets mounted in said supporting members for magnetizing said steel balls to cause them by their magnetic attraction for one another to resist displacement and thereby to increase the pressure of said flexible containers on the upper during said relative movement.

39. In a machine for shaping uppers over lasts,

- a device for pressing an upper mounted on a last into conformity to the contour of the last and for working the upper heightwise of the last in response to relative movement of said device and the last, said device comprising a container having a flexible elastic upper-engaging wall and filled with steel balls movable relatively to one another into positions to press the upper through said upper-engaging wall against the last in response to resistance of the shoe to the pressure applied, a member of non-magnetizable material for supporting said container and for moving it into upper-pressing position, an electro-magnet mounted in said supporting member for magnetizing said steel balls and thus controlling their mobility when a current is passed through the electro-magnet, and means for controlling the current to vary the strength of the electro-magnet.
40. In a machine for shaping uppers over lasts, devices at the opposite sides of a last for pressing an upper into conformity to the contour of the last and for working the upper heightwise of the last in response to relative movement of said devices and the last, said devices each com-

prising a container having a flexible elastic upper-engaging wall, a pair of carriers of non-magnetizable material for moving said containers into upper-pressing positions, said carriers being mounted also for swinging movements in directions to impart inward tipping movements to said containers, a group of steel balls mounted in each of said containers for pressing the upper through said upper-engaging wall against the last, said steel balls being movable relatively to one another while thus pressing on the upper in the relative movement of the containers and the last to work the upper heightwise of the last and being also displaceable laterally of the last in response to the inward tipping movements of the container to lay the marginal portion of the upper inwardly over the bottom face of an insole on the last, an electro-magnet mounted in each of said carriers for magnetizing said steel balls and thus controlling their mobility when a current is passed through the electro-magnets, and a rheostat for controlling the current to vary the strength of the electro-magnets.

CLIFFORD K. MACDONALD. 25