

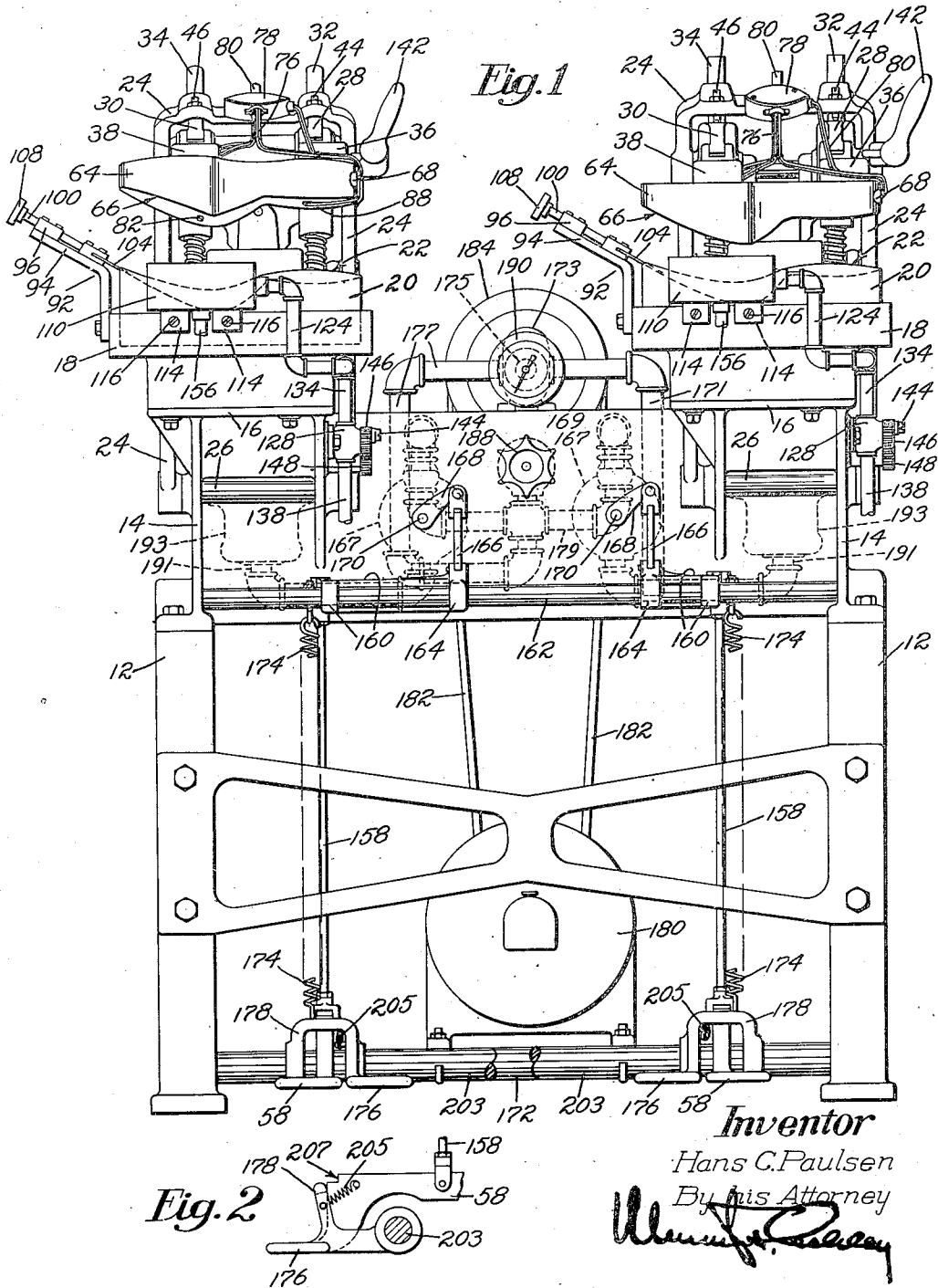
June 22, 1948.

H. C. PAULSEN
METHOD AND MACHINE FOR USE IN PREPARING SOLES
FOR CEMENT ATTACHMENT TO SHOE BOTTOMS

2,443,693

Filed June 23, 1945

5 Sheets-Sheet 1



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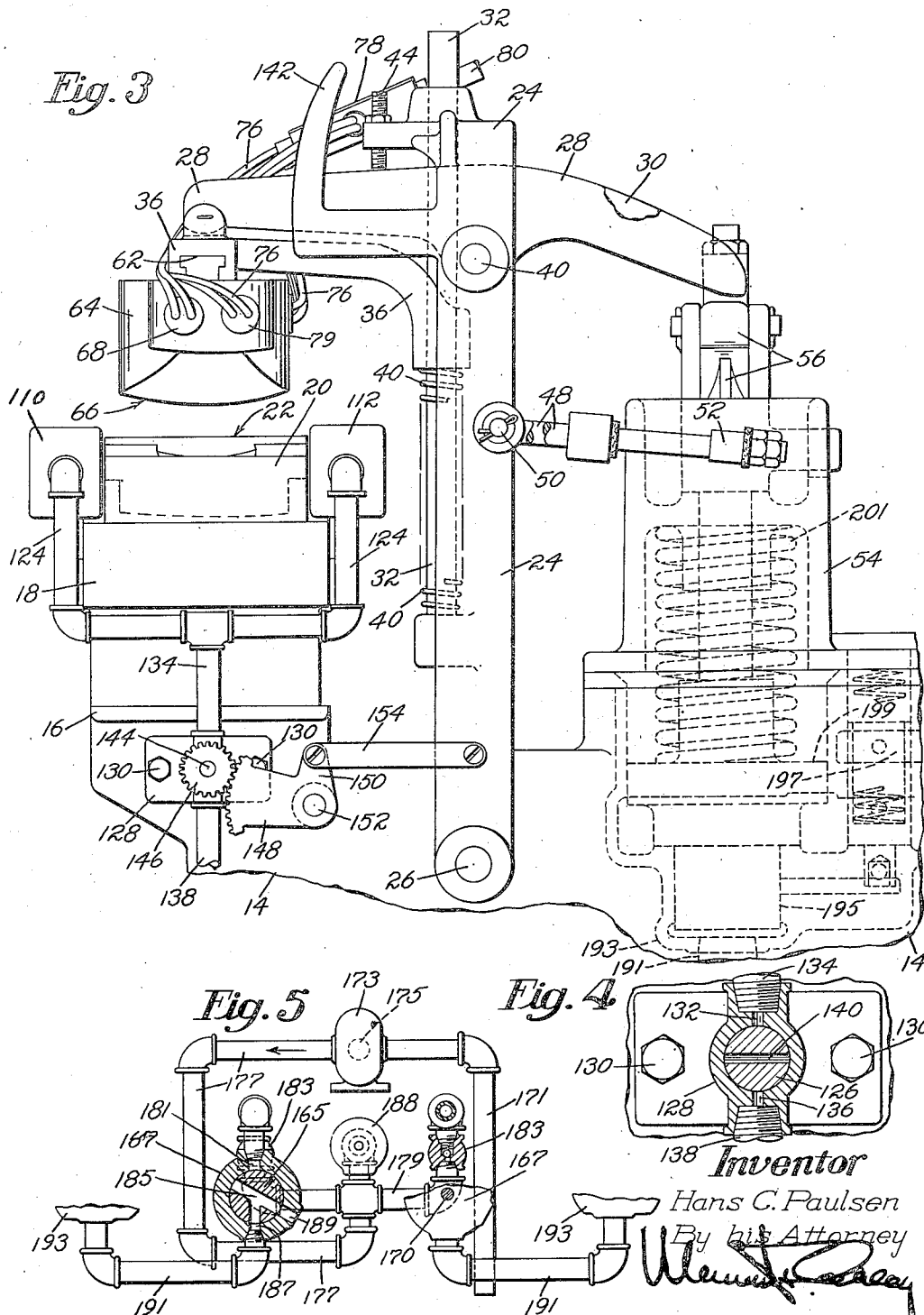
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Fig. 6

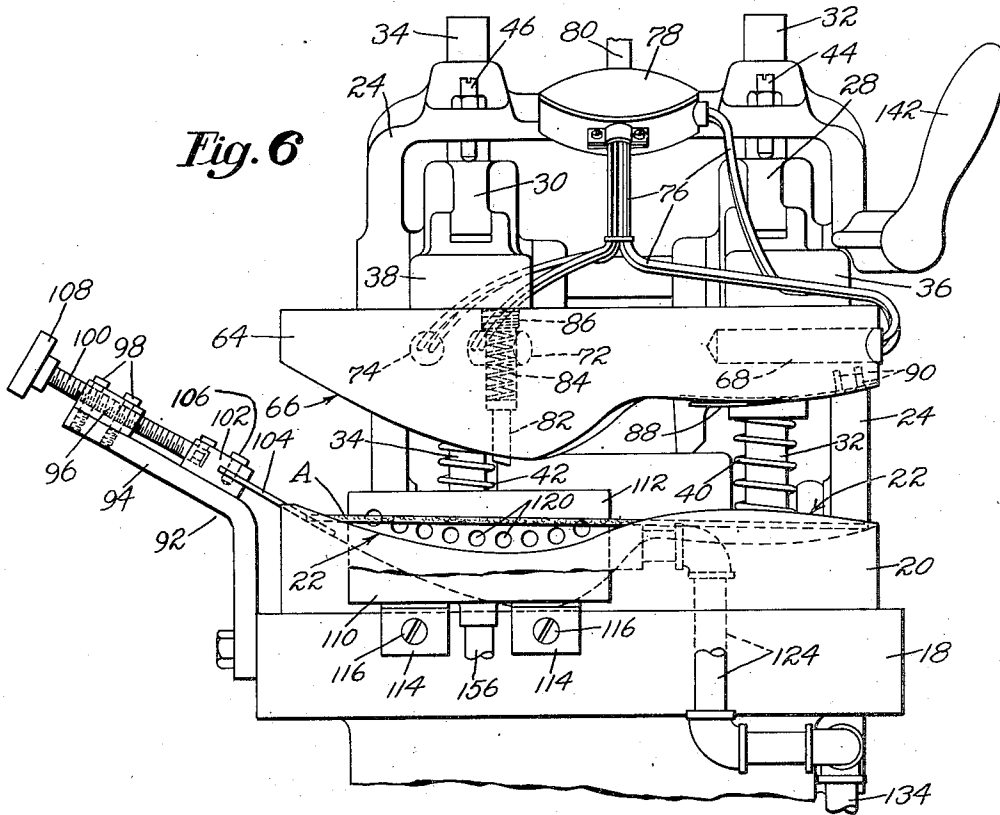
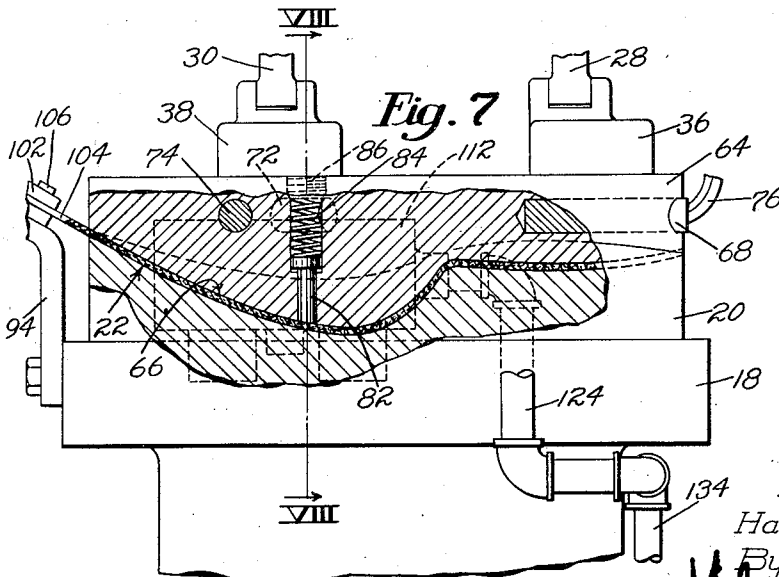


Fig. 7



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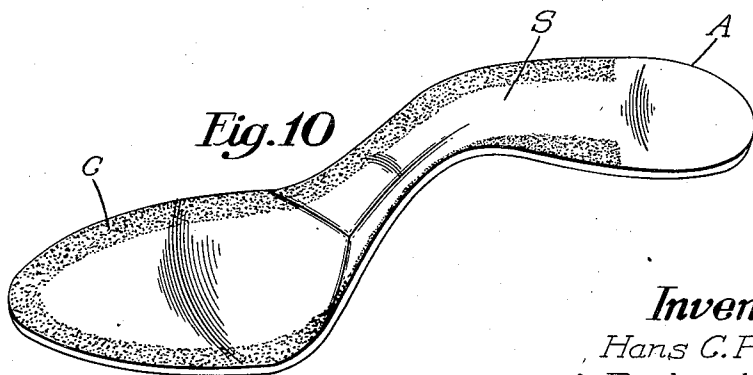
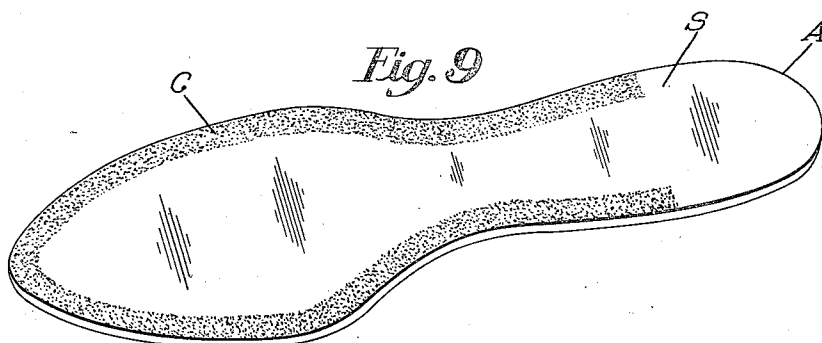
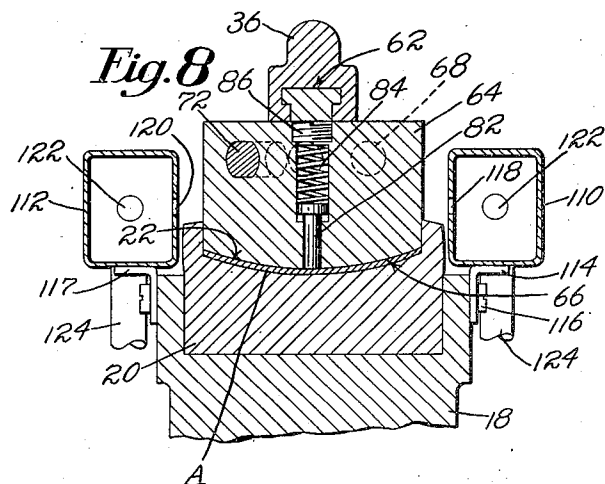
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5 Sheets-Sheet 4



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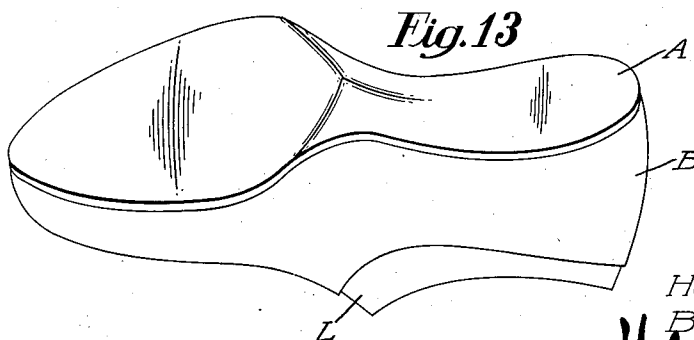
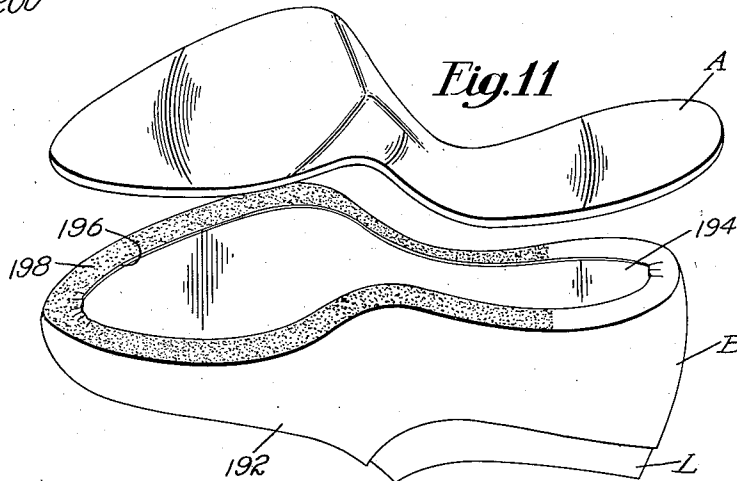
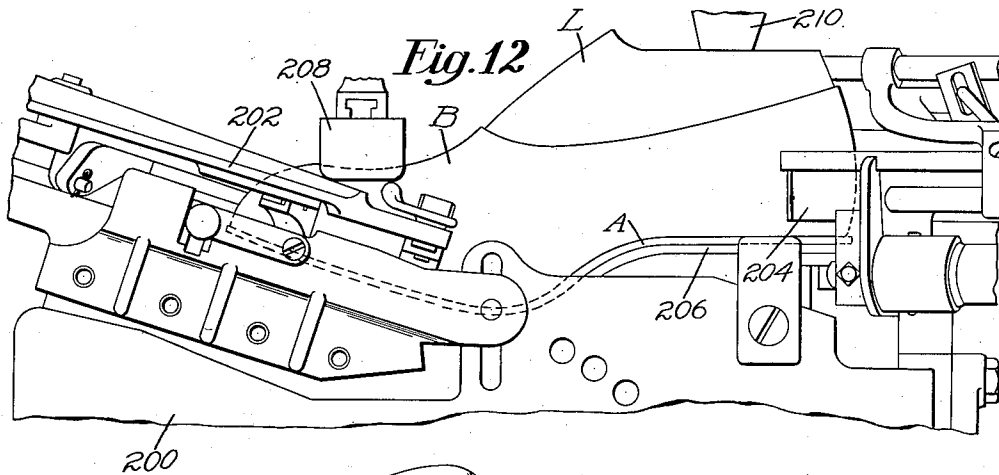
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UNITED STATES PATENT OFFICE

2,443,693

METHOD AND MACHINE FOR USE IN PREPARING SOLES FOR CEMENT ATTACHMENT TO SHOE BOTTOMS

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23 Claims. (Cl. 12—1)

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This invention relates to methods and machines for use in preparing soles for attachment to shoe bottoms and is illustrated herein with particular reference to the attachment of outsoles to shoe bottoms by cement.

In cement attaching soles to shoe bottoms, the outsoles or other sole members in the better grades of shoes are usually premolded or conformed to approximately the shape desired in the finished shoes or, in some instances, beyond that shape so that the soles will fit readily into substantial conformity to the shoe bottoms when the sole-attaching pressure is applied. In order to mold or over-mold a sole member of leather or similar material to the extent indicated, it is desirable to put the sole into a condition sufficiently pliable to stand bending due to the sole-molding pressure without cracking under the strain, particularly at the outer, grain or tread surface of the outsole adjacent to the break or ball line. An outsole may be so conditioned by subjecting it to water or moisture for a predetermined length of time, or by subjecting it to steam or hot water vapor for a considerably shorter time.

Thermoplastic or heat-activatable cements are coming into use more and more for cement-attaching soles to shoe bottoms and many of these cements are best activated by heat applied directly to the surfaces to which the cement has been applied. Some cements used today are truly thermoplastic in character such as cements containing vinyl resins as a base. Other cements, based on neoprene (chloroprene), Perbunan (Hycar) or other rubber-like synthetic materials, are activatable by heat but are not thermoplastic in the sense in which that term is usually used. Accordingly, the term "heat-activatable" is used herein as applicable to any cements which, when heated in a dry or nontacky condition, are activated to such an extent that the cemented surfaces will unite under pressure to form a strong, permanent bond.

Thermoplastic or heat-activatable cements are usually applied to the attaching surface of a flat, unmolded sole member and allowed to dry before the sole is put into a condition for molding. After the sole has been molded into the shape desired, it is still necessary to activate the cement thereon before sole-attaching pressure is applied to the sole and shoe. Since thermoplastic or heat-activatable cements are relatively quick setting, the activation of such a cement by heat should preferably be done just before the sole-attaching pressure is applied in order to obtain

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the best results. This procedure often involves difficulties not only in applying heat to all portions of the cemented surface of the premolded sole, but also because the application of sufficient heat to activate the cement directly to such surface may have a tendency to alter the shape into which the sole was originally molded.

Objects of the present invention are to overcome the difficulties referred to in preparing soles for attachment to shoe bottoms, and to provide better and quicker methods and machines for accomplishing such results.

To these ends, the invention provides, in accordance with one of its aspects, an improved method of preparing sole members for attachment to shoe bottoms which comprises simultaneously applying heat and sole-molding pressure to a flat unmolded sole having a heat-activatable cement thereon, thereby molding the sole into a predetermined shape while simultaneously activating the cement thereon. As herein illustrated, the sole-molding pressure is applied with the aid of a yielding flexible pad and a form cooperating with the pad. The pad is preferably overmolded to a shape beyond that desired on the sole in the finished shoe. The form is likewise overmolded so that its sole-engaging surface is complementary in shape to the overmolded surface of the pad.

In order to apply heat directly to the attaching surface of the sole simultaneously with the sole-molding pressure, the invention further provides, in accordance with the method herein illustrated, a form composed of heat conducting material so that it can be readily heated to a predetermined temperature sufficient to activate the heat-activatable cement on the sole during the overmolding operation. In the present method, therefore, the sole is overmolded to a predetermined shape and the cement on its attaching surface is simultaneously activated, these operations being accomplished in a manner which ensures that all the cement on the attaching surface will be fully activated, and which eliminates the danger of altering the shape of the premolded sole while the cement is being activated.

As indicated above, it is also desirable to put the sole member into a sufficiently pliable condition before it is subjected to molding pressure to prevent the grain surface of a leather sole or the convex face of a plastic sole from cracking during the overmolding operation, particularly at the ball portion where the greatest strains take place. The present method further provides for steaming the leather sole to put it into a proper

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condition for molding before the sole-molding pressure is applied thereto. Moreover, soles of most synthetic materials are rendered more readily moldable by heat. As illustrated herein, steam or hot water vapor is introduced around the flat unmolded sole member for a relatively short period of time to soften the material of the sole, particularly at its tread or grain face, if of leather, just prior to the application of the overmolding pressure. Preferably, the steam is shut off before the molding pressure is applied; although it could, if desired, be introduced continuously around the sole simultaneously with the overmolding and cement activating operations without detrimental results.

In accordance with another feature, the invention provides an improved machine for use in operating upon soles having, in combination, a yielding pad provided with a molded surface for supporting a sole member, a form cooperating with the pad and having a surface complementary to the surface of the pad, mechanism for relatively moving the pad and form to apply sole-molding pressure to a sole on the pad, and means for heating the form to apply heat directly to a cemented surface of the sole simultaneously with the sole-molding operation. As illustrated, the surface of the pad is preferably overmolded beyond the shape or contour desired in the finished shoe, thereby ensuring that the marginal portions of the sole will fit snugly against the shoe bottom, the complementary surface on the form being overmolded to the same degree. The form is preferably composed of heat-conducting material such as metal so that its sole-engaging surface can be readily heated to a temperature sufficient to activate the cement on the sole during the overmolding operation, means being also provided for locating the unmolded sole on the pad prior to the molding operation.

Since it is desirable to render the sole pliable before the sole-molding pressure is applied, the present machine is also provided with means for introducing steam or hot water vapor to, and around, the tread or grain surface of the sole on the pad, this means, as herein illustrated, preferably comprising steam chambers or boxes arranged to introduce steam simultaneously from opposite sides of the pad into the space between the grain surface of the unmolded (flat) sole and the pad in the vicinity of the forepart of the sole, thereby insuring that this portion of the sole, particularly the ball portion of the grain surface, will be put into a moldable condition before pressure is applied thereto. As illustrated, the machine is arranged to shut off the steam or hot water vapor prior to the application of the sole-molding pressure although, as stated above, the steam can be introduced continuously, if desired, without any detrimental effect upon the sole.

With the above and other objects and features in view, the invention will now be described with reference to the accompanying drawings and will thereafter be pointed out in the claims.

In the drawings,

Fig. 1 is a front elevation of a machine embodying the present invention;

Fig. 2 is a side view of a portion of the treadle mechanism of the machine;

Fig. 3 is an enlarged side elevation of the upper portion of the machine, as viewed from the right in Fig. 1;

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Fig. 4 is an enlarged detail view, partly in section, of valve mechanism shown in Fig. 3;

Fig. 5 is a detail view, partly in section, of the mechanism for supplying fluid under pressure to the two stations of the machine;

Fig. 6 is an enlarged front elevational view of the pad, form, and associated mechanism of the right-hand station of the machine with a sole member resting on the pad;

Fig. 7 shows the mechanism of Fig. 6 in an operated position with parts of the mechanism broken away or in section;

Fig. 8 is a vertical section taken on the line VII-VIII of Fig. 7;

Fig. 9 is a perspective view of a flat, unmolded sole having dry heat-activatable cement on its inner or attaching surface;

Fig. 10 shows the sole after it has been operated upon by the present machine;

Fig. 11 shows the sole ready to be positioned on a shoe bottom for attachment thereto;

Fig. 12 illustrates one method of applying sole-attaching pressure to the shoe and sole; and

Fig. 13 shows the shoe after the sole has been attached.

The illustrated machine is of duplex construction having right- and left-hand stations for operating respectively on right and left soles. These stations are substantially the same in construction and operation except for the right and left shapes of the sole-engaging instrumentalities and, accordingly, only the right-hand station need be described in detail, it being understood that the left-hand station operates in substantially the same manner. Moreover, the construction and operation of the pressure-applying mechanism of the present machine, as herein disclosed, are substantially the same as that of the machine for pressing soles on shoe bottoms disclosed in United States Letters Patent No. 2,047,185, granted July 14, 1936 on an application filed in the name of Milton H. Ballard et al. to which reference may be had for a more complete description of these mechanisms.

As illustrated in Figs. 1 and 3, the present machine is provided with a base 12 upon which is mounted a frame 14 provided at its opposite sides with forwardly extending plates or shelves 16 upon which are rigidly secured rectangular pad boxes 18. The pad boxes 18 are provided with pads 20 composed of relatively yielding material, such as rubber. The upper surfaces 22 of the pads, which support the soles which are to be operated upon to prepare them for attachment to shoe bottoms, are shaped substantially complementary to the shapes of the bottoms desired on the finished shoes except that these surfaces are overmolded both as to the longitudinal and transverse curvatures of the shoe bottom so that such curvatures in the pads are considerably exaggerated, as illustrated in Figs. 7 and 8.

Rearwardly of the pad boxes 18, the frame 14 supports a pair of swinging frame members 24 pivoted on short horizontal shafts 26 and arranged for forwardly and rearwardly swinging movement into and out of the substantially vertical operative position shown in Fig. 3. Each swinging frame 24, as described in the patent referred to, carries a pair of pressure applying levers 28 and 30 pivoted on a transverse shaft 40 (Fig. 3). Passing loosely through openings in the levers 28 and 30 are rods 32 and 34 which are supported in the swinging frame 24 and are guided therein for rectilinear movement parallel to the swinging frame. The rods 32, 34 have

pinned to their central portions forwardly extending arms 36 and 38 provided with upstanding ears between which the forward ends of the levers 28, 30 are embraced, these forward ends being convex in shape to bear upon flat surfaces formed on the arms. Compression springs 40, 42 surrounding the rods 32, 34, hold the arms 36, 38 upwardly against the levers 28, 30, as shown in Figs. 3 and 6, and upward movement of the levers is limited by adjustable stop screws 44, 46, threaded into lugs on the swinging frame 24. The forward and rearward movement of each swinging frame is limited by a pair of rods 48 (Fig. 3) pivoted to the swinging frame by pins 50 and extending rearwardly through projections 52 formed on the opposite sides of a fixed cylinder 54 fastened to the frame 14, the rods 48 being provided with leather washers and nuts for limiting the forward and rearward swinging movements of the swinging frame 24, as shown in the patent referred to.

As described in the Ballard et al. patent, the cylinder 54 (Fig. 3) of each station is provided with a piston 56 arranged to move upwardly to engage the inner ends of the levers 28, 30 and to force their forward ends downwardly toward the pad 20. The mechanism for applying pressure to a sole on the pad 20, including the cylinder 54 and piston 56, is operated hydraulically by oil, as is disclosed in the Ballard patent, this mechanism being modified for use in a two-station machine as disclosed in United States Letters Patent No. 2,231,963, granted February 18, 1941 on an application filed in the name of Frank E. Stratton and to which reference may be had for a more complete description of this mechanism. The sole-molding pressure is applied to the sole on the pad in each station through the elevation of the piston 56 in the cylinder 54, by depression of a treadle 58 (Figs. 1 and 2), as will later be explained.

The forward ends of the arms 36, 38 are provided with transverse T-slots 62 (Fig. 3) which receive T-shaped projections formed on the upper side of a pressure-applying mold or form 64 which is arranged to cooperate with the yielding pad 20 in applying sole-molding pressure to a sole on the pad. It will be seen from the foregoing that the form 64 is movable forwardly and rearwardly into and out of operative position over the pad by the swinging frame 24 which, in Fig. 3, is shown in its forward or pressure-applying position.

The form 64 is composed of metal, such as iron or steel, and it is preferably chromium plated on its lower side to give it a smoothly polished corrosion free sole-engaging surface 66. The top side of the form, as shown in Figs. 3 and 6, is substantially flat while its sole-engaging surface 66 is substantially complementary in shape to the overmolded upper surface 22 of the pad 20.

The form 64 is provided with means for heating its sole-engaging surface 66 to a predetermined temperature so that the form will apply heat directly to the cemented face of the outsole being operated upon during the sole-molding operation. The means for heating the metal form comprises a heating unit 68, located in a horizontal opening formed in the rear or heel portion of the form, and a pair of heating units 72, 74 mounted in openings in the forepart of the form in the vicinity of the break or ball line portion of an outsole to be operated upon by the form. The heating units are connected by wires

76 through a distributing box 78 to an electric switch (not shown) by wires 80 and a thermostat 79 (Fig. 3) is provided in the form for controlling the degree of heat. The form 64, therefore, is arranged to cooperate with the yielding pad 28 in applying sole-molding pressure to a sole member on the pad, for example, the outsole A shown in Fig. 9, and the form is also adapted to apply heat directly to the upper or attaching surface of the outsole to which a heat-activatable cement has been applied and allowed to dry before the outsole was placed on the pad.

The right outsole A, which is to be prepared for immediate attachment to a shoe bottom, is preferably a leather outsole of usual shape and thickness and it is in a substantially flat or unmolded condition when presented to the machine, as shown in Figs. 6 and 9. The inner or attaching surface of the sole, that is, the flesh side indicated by the letter S in Fig. 9, will have a coating of thermoplastic or heat-activatable cement C applied to its marginal portion, the cement extending rearwardly substantially to the heel seat portion of the sole and inwardly from its edge face a distance approximately equal to the normal lasting margin or allowance of an upper. The heat-activatable cement may be any of the well-known types of synthetic rubber cements in use today for cement-attaching soles to shoe bottoms, an example of such cement being disclosed in Letters Patent of the United States No. 2,061,296, granted November 17, 1936, on an application filed in the name of W. H. Wedger.

When a chloroprene cement is used for attaching a sole to a shoe bottom, the forms 64 should be heated to a temperature that will thoroughly activate the cement which, at the time the sole is operated upon, is in a dry nontacky condition. The degree of heat necessary in the form will vary, of course, with the type of heat-activatable cement being used but in the case of chloroprene, for example, the form should be heated to a temperature of about 174° Fahrenheit in order to activate the cement and render it sufficiently tacky to permit the outsole to be placed immediately in juxtaposition to a shoe bottom and cement-attached thereto. With other types of synthetic rubber cements, the temperature of the form will vary according to the cement being used and these temperatures may be regulated and maintained by the thermostats 79 which control the heat of the forms at both stations of the machine. Since the heat of the form is applied directly to the heat-activatable cement on the attaching surface of the sole for a period of only a few seconds, the cement is activated almost immediately without the heat of the form passing through or penetrating to any appreciable extent the material of the sole, thereby eliminating danger of scorching or burning the outsole or drying out the material thereof to render it too stiff or hard.

Each of the solid metal forms 64 is provided with means for preventing the sole from adhering to the sole-engaging surface of the form after the sole-molding operation has been completed. This means is best illustrated in Figs. 6, 7 and 8 and comprises a spring-pressed plunger 82 located at the forward portion of the form adjacent to the ball line of a sole on the pad, the plunger being slidably mounted in a vertical opening in the form and being pressed downwardly against a shoulder in the opening by a compression spring 84 retained in the opening by a screw 86. The

heel portion of the outsole will be urged away from the surface of the form by means of a leaf spring 88 (Figs. 1 and 6) secured to the center of the rear portion of the form by screws 90.

The outsole must be properly positioned lengthwise of the pad and form so that it will be overmolded in a manner to cause it to fit accurately against the bottom of the shoe to which it is to be attached except for the overmolded condition which will be eliminated in the sole-attaching operation. To this end the pad boxes 18 are provided with sole positioning means, indicated generally in Figs. 1 and 6 by the numeral 92. As shown in Fig. 6, the positioning means 92 comprises a bracket or arm 94 secured by screws to the left-hand end of the pad box 18, the upper portion of the bracket being bent outwardly at substantially the same angle as the inclination of the forward portion of the overmolded surface 22 of the pad 20. The inclined portion of the bracket 94 has a block 96 secured to its upper end by screws 98 and an adjustable screw 100 is threaded through a hole in the block and is rotatably secured by means of a slot-and-screw connection to a sliding block 102, the block being slotted at its lower end to receive a sole gage 104 which is fastened in the sliding block by a clamping screw 106. The adjusting screw 100 is provided with a knurled head 108 whereby it may be rotated to move the gage 104 forwardly or rearwardly of the pad. The lower end of the gage 104 is provided with a V-shaped notch in which the toe end of the outsole A may be placed to locate the sole lengthwise and laterally of the pad.

In addition to performing an overmolding operation on the sole and simultaneously activating the heat-activatable cement on its attaching surface S, the present machine, as herein illustrated, is adapted to put the sole into a sufficiently pliable or moldable condition prior to molding to permit distortion of the sole without cracking under the pressure; the softening operation preferably being discontinued during the overmolding and cement-activating operations. The means for rendering the sole moldable, as herein illustrated, comprises mechanism for introducing steam or hot water vapor around the substantially flat sole as it rests on the pad, as illustrated, for example, in Fig. 6. This mechanism consists of a pair of substantially rectangular steam chambers, or boxes 110, 112 associated with each of the pad boxes 18, the steam box 110 being secured to the forward side of the pad box by a pair of L-shaped brackets 114 held by screws 116, and the box 112 being secured to the rearward side of the pad box by a similar pair of brackets 117 (Fig. 8). The steam boxes 110, 112 are composed of thin sheet material, preferably metal, and are provided respectively on their inner or adjacent side walls, that is, the walls facing the pad, with a series of circular openings 118, 120 which, as illustrated in Fig. 6, are arranged in a downwardly curving arc conforming generally to the contour of the marginal portions of the overmolded surface 22 of the pad 20. Each steam box has another opening 122 (Fig. 8) at its rearward end which is connected by a pipe 124 to any suitable source of supply such, for example, as a steam boiler or other convenient means for providing steam or hot water vapor under sufficient pressure to cause it to circulate through the pipe 124 and out the openings 118, 120.

It has been found in practice that steam may be introduced around a flat unmolded sole on the

pad to put it into a proper condition for molding either in jets or streams under sufficient pressure to cause the steam to flow readily through the openings in the steam boxes or, if desired, it may be introduced more slowly around the sole in the form of hot water vapor under considerably less pressure. Since the rows of oppositely disposed openings 118, 120 in the steam boxes are located below the sole or substantially opposite the open space between the overmolded surface of the pad and the lower surface of the flat outsole, it will be seen that the steam or water vapor will be first introduced into this space and will then flow upwardly against the grain or lower surface of the sole and surround the forepart thereof from about the tip line to a point rearwardly of its break or ball line. Since the steam is introduced from both sides of the pad simultaneously through the plurality of openings which extend in a curve from the toe portion rearwardly to beyond the ball line of the sole, the forepart of the sole will receive a fairly thorough treatment from the steam or hot water vapor even though the period during which it is subjected to the steam may be relatively short. Accordingly, the forepart of the outsole A will be put into a sufficiently soft or moldable condition to render it flexible enough to be overmolded to a considerable degree without cracking the grain or tread surface of the sole at the break or ball line portion where the greatest strains take place.

The introduction of steam or hot water vapor may be controlled manually by the operator or, if desired, it could be turned on manually and left on continuously during the overmolding and activating operations at both stations of the machine. However, it has been found preferable in practice to introduce the steam to the sole for a relatively short period of time before the overmolding takes place because, as stated above, this procedure renders the sole sufficiently pliable to stand the overmolding pressure without cracking, and yet the steam is not applied long enough to stain or spot the grain surface of the outsole or to moisten the sole sufficiently to interfere with the dry cement on its attaching surface. Moreover, since the steam is applied against the lower or grain surface of the sole for only a short period of time, it does not have time to penetrate through the sole to its upper or attaching surface to heat said surface sufficiently to activate the cement thereon. The amount of steam or hot water vapor which flows around the sole is not sufficient to activate the cement on said attaching surface. Accordingly, as herein disclosed, the application of steam or hot water vapor to the outsole is for only a relatively short period of time before molding pressure is applied and the steam is then shut off, this being accomplished in each station of the machine by movement of the swinging frames 24 from their rearwardly inclined positions into their substantially vertical positions shown in Fig. 3, in which the forms 64 are located in operative relation to the pads 20.

The means for controlling the introduction of steam to the soles is best illustrated in Figs. 3 and 4, and comprises a rotary valve 126 mounted in a casing 128 secured by screws 130 to the frame 14, the pipes 124 from the opposite steam boxes 110, 112 being connected to an upper port 132 in the valve casing by an inlet pipe 134, and a lower port 136 in the valve casing being connected by a pipe 138 to the source of supply. A passage 140 in the rotary valve 126 is so arranged that when the swinging frame 24 is located in its rear-

wardly inclined position, the valve is open and steam can flow through to the pad. Movement of the swinging frame forwardly into its vertical or operative position, shown in Fig. 3, rotates the valve 126 90° in a clockwise direction and closes the valve, as shown in Fig. 4. Rotation of the valve 90° in a reverse or counterclockwise direction by return movement of the swinging frame will connect the inlet port 132 with the supply port 136 and permit steam to pass into the steam boxes, thereby introducing steam to the pad and sole when the swinging frame is located in its rearwardly inclined or inoperative position. As disclosed in the Ballard patent, the swinging frames 24 are arranged to be moved from their rearwardly inclined positions into their forward positions by the operator by means of handles 142 formed on the upper portions of the swinging frames in position to be grasped by the operator.

The rotary valve 126 carries a stud 144 (Fig. 3) which extends outwardly through the casing 128 and has a pinion 146 secured thereto which meshes with a gear segment 148 pivoted on a shaft 152 mounted in the frame 14, an upwardly extending arm 150 of the segment 148 being pivotally connected by a link 154 to the swinging frame 24. As stated, the arrangement is such that movement of the swinging frame from its rearwardly inclined to its forward position will rotate the valve 126 approximately 90° in a clockwise direction to close the valve, as shown in Fig. 4, before any sole molding pressure is applied to the sole on the pad. Any condensation of the steam or water vapor in the steam boxes 110, 112 is carried back to the source of supply by a pipe 156 located at the bottom of each box (Figs. 1 and 6).

The mechanism for applying the sole-molding pressure to the sole is fluid pressure operated and is similar to the pressure applying mechanism of the machine disclosed in the Ballard et al. patent, modified substantially as disclosed in the Stratton Patent No. 2,231,963 above referred to. The pressure applying mechanism at each station of the machine is set into operation by depression of the treadle 58 at that station. Each treadle 58 is connected by a rod 158 (Fig. 1) to a yoked lever 160 pivoted on a fixed shaft 162 extending transversely of the frame 14, another arm 164 of the yoked lever being pivotally connected by a link 166 to an arm 168 secured to a shaft 170. The shaft 170 extends inwardly into a tank or reservoir 169 containing a fluid pressure medium, such as oil, and the shaft has a rotary valve member 165 (Fig. 5) secured to its inner end, the valve member being rotatably mounted in a valve casing 167 secured in the fluid tank or reservoir. The fluid or oil is drawn upwardly from the reservoir 169 through a pipe 171 by means of a constantly operating oil pump 173 driven by a shaft 175 and connected by a pipe line 177 to a cross pipe 179 located rearwardly of the rotary valves 167 and the opposite ends of which extend upwardly and forwardly and are connected with inlet ports 181 (Fig. 5) located at the top of each valve 167. Rearwardly of each valve the cross pipe 179 carries a check valve 183 of the usual ball and spring arrangement so that fluid coming from the reservoir into each valve cannot return through the check valve, thereby causing the fluid pressure in each station to be maintained when that station is operating regardless of whether or not the other station is operating. The shaft 175 for operating the oil pump 173 is driven by a motor 180

(Fig. 1) connected by a belt 182 to a pulley 184 fastened to the shaft 175.

Each rotary valve 165 is provided with a Y-shaped passage 185 (Fig. 5) and the casing 167 has an outlet port 187 on its lower side and also an adjacent exhaust port 189, the outlet port 187 being connected by a pipe 191 to the lower end of a small cylinder chamber 193 forming a part of the piston and cylinder arrangement 54, 56 referred to above. As disclosed in the Stratton patent, the fluid pressure medium enters the small chamber 193 when the rotary valve 165 is rotated by depression of the treadle 58 into a position in which the valve is open, that is, in which the inlet port 181 is connected by the passage 185 to the outlet port 187 and the exhaust port 189 is closed, the fluid medium then building up pressure in the small chamber 193 to raise a small piston 195 rapidly in the chamber and thereby lower the form 64 quickly into engagement with the sole on the pad. When the pressure in the small chamber reaches a predetermined amount, which is registered on a pressure gage 190 (Fig. 1), an auxiliary or relief valve 197 (Fig. 3) is operated to open a port in the large cylinder chamber 54 located above the small chamber and thereby to permit fluid under pressure to enter the large chamber 54 to elevate a large piston 199 slidably mounted therein against the pressure of a compression spring 201, the large piston 199 having the upper portion 56 for engaging the pressure applying levers 28 and 30 (Fig. 3). The large chamber 54 fills with oil through suction caused by the vacuum created in the chamber when the large piston 199 is elevated with the small piston 195, so that only a very small amount of fluid is needed in the large chamber to transmit the full pressure of the pressure medium immediately to the large piston 199 and, through it, to the form 64. As stated above, this fluid pressure applying mechanism, including the double piston arrangement and the auxiliary valve connecting the large and small chambers, is fully disclosed in the Stratton patent to which reference may be had for a more complete description thereof, the pistons in the Stratton patent, however, being in a reverse position and moving downwardly instead of upwardly.

Depression of either treadle 58, therefore, moves the valve controlling lever 168 of that station in a clockwise direction, as viewed in Fig. 1, and, through the mechanism referred to, opens the rotary valve 167 to cause fluid pressure to be built up in the small cylinder chamber 193 and subsequently in the large chamber 54. When fluid pressure is applied to the large chamber, the piston is elevated to engage the pressure-applying levers 28, 30 and to force their forward ends downwardly to move the form 64 downwardly under substantial pressure into operative engagement with the sole on the pad 20, thereby applying relatively heavy sole-molding pressure to the sole.

The treadles 58 are fulcrumed on a transverse shaft 172 mounted in the rear portion of the base 12, the treadles being normally held in an elevated position by tension springs 174 secured at their lower ends to the treadles and at their upper ends to hooks in the shaft 162. It is desirable to have each treadle 58 remain in depressed position without attention from the operator until he is ready to release it, for example, to permit the loading and operating of one station of the machine while the other is operating. For this

purpose an auxiliary latching treadle 176 is provided at each station fulcrumed on a forward shaft 203 and having a U-shaped yoked portion 178 which straddles the treadle 58 and is urged rearwardly by a spring 205 against a projection on the treadle 58. The yoke 178 snaps over the upper surface of the lever against a shoulder 207 (Fig. 2) on the projection of the treadle 58 when the latter is depressed and thus latches it in a depressed position. Consequently, either treadle 58 will remain in its depressed position without further attention while the operator is working at the other station of the machine and it may be released when desired by depressing its auxiliary or latching treadle 176, the pressure-applying instrumentalities, of course, being then released through the opening 189 of the rotary valve 167 which permits the fluid pressure medium to exhaust through the valve.

In order to regulate the molding pressure applied to the sole, the present machine is provided with a hand wheel 138 which adjusts a pressure control valve (not shown) similar to that illustrated in the Ballard et al. patent, the pressure being indicated, as stated above, by the pressure gage 190.

In carrying out the method of the present invention, with the aid of the machine described above, the operator selects an unmolded sole member, such as the outsole A (Fig. 9), which has had a thermoplastic or heat-activatable cement C such, for example, as chloroprene, applied to the marginal portion of its inner or attaching face, the cement being in a dry or non-adhesive condition at that time. He places the sole flesh side up on the overmolded surface 22 of one of the yieldable pads 20, for example, the right-hand pad, and locates it by means of the gage 104. The power for operating the motor 180 having been turned on, and the electric current for the heating units also being turned on so that the forms 64 are heated to the required temperature, the operator moves the swinging frame 24 of the right-hand station forwardly into its vertical or operative position. Movement of the swinging frame into such position closes the rotary valve 126, as shown in Fig. 4, thus preventing further steam or hot water vapor from passing into the steam boxes 110, 112 and under the sole A; the steam, as stated, having been flowing between the sole and pad while the swinging frame was in its rearwardly inclined position and while it was being moved forwardly, thereby putting the sole, particularly its outer or grain surface, into a sufficiently moldable condition to withstand the sole-molding operation without cracking even though the sole is to be overmolded a substantial amount. When the swinging frame reaches its vertical position, the operator depresses the treadle 58, which becomes latched in its depressed position by the auxiliary treadle 176, and thereby opens the rotary valve 167 of the right-hand station to cause the form 64 to be moved downwardly toward the pad under the pressure applied by the large piston 199 in the chamber 54. The form 64 in cooperation with the yielding overmolded pad 20 applies the sole-molding pressure to the sole while the heated surface 66 of the form simultaneously applies heat directly to the attaching face of the sole, thereby activating the heat-activatable cement C thereon simultaneously with the overmolding operation. In other words, the outsole A is first put into a condition for molding by the introduction of the steam and then, with the aid of the present appara-

tus, it is subjected to relatively heavy sole-molding pressure by members shaped to overmold the sole a predetermined amount and simultaneously to activate the heat-activatable cement on its attaching face. When the molding pressure has been applied for a period sufficient to accomplish the desired results, for example, a few seconds, the pressure-applying mechanism is shut off by release of the treadle 58 and the metal form 64 returns to its elevated position shown in Figs. 3 and 6, leaving the overmolded outsole A on the pad with the cement on its attaching surface in a sufficiently activated condition to be placed immediately in juxtaposition to a shoe bottom and receive sole-attaching pressure to cement attach the outsole permanently to the shoe. Fig. 10 illustrates the outsole A after it has been overmolded as described above and has had the heat-activatable cement on its attaching surface simultaneously activated, the sole having first been put into a pliable or moldable condition by steaming, as described above.

Fig. 11 shows the outsole A in position above the bottom of a shoe B mounted on a last L and comprising an upper 192 and an insole 194, the margin of the upper having been secured in overlapped relation to the insole, as shown at 196, by any suitable means such, for example, as cement. The overlapped marginal portion 196 of the upper has been roughened in the usual manner and coated with cement 198 similar to that used on the sole. The overmolded outsole is located at once in juxtaposition to the shoe bottom and put under sole-attaching pressure immediately to cement attach the outsole permanently to the shoe bottom.

The sole-attaching pressure may be conveniently applied, as illustrated in Fig. 12, with the aid of a pad box of the type disclosed in the Ballard et al. patent, this pad box, indicated by the numeral 200, being provided with forepart sole and shoe positioning gages 202, and heel end sole and shoe positioning gages 204 for locating the sole and shoe relatively to each other on the pad 206. The sole-attaching machine of the Ballard patent is provided with a forepart pressure-applying abutment 208 and a rear or last-engaging abutment 210 and the sole-attaching pressure is applied in the manner disclosed in the patent for a period of time sufficient to cause the outsole A to become permanently attached to the shoe bottom; this period, in the Ballard machine, usually being about 70 seconds which is approximately the time it takes each pad box to travel around the turret of the machine.

The sole and shoe may, if desired, be placed in some other type of sole-attaching machine or press to receive the sole-attaching pressure provided this pressure can be applied immediately after the outsole is removed from the machine of the present invention. A convenient arrangement, for example, would be to have a two station machine for cement-attaching soles to shoe bottoms located opposite the present machine, one station of the sole-attaching machine being for right shoes and the other for left shoes, such a machine being disclosed in United States Letters Patent No. 2,356,756, granted August 29, 1944, on an application filed in the name of Sidney J. Finn. By such an arrangement, in carrying out the present method the operator could place a sole in the right-hand station of the present machine and trip that station by the treadle 58; and he could then place a left sole in the left-hand station and operate that station. The

operator could then release the right-hand station and remove the prepared right sole therefrom and position it in the sole-attaching machine together with a shoe and place the sole and shoe under sole-attaching pressure immediately, after which he could reload the right-hand station of the present machine. By such a procedure, an operator would be able to prepare soles for attachment to shoe bottoms and place them under sole-attaching pressure immediately or as fast as he could operate so that there would be no appreciable lapse of time between preparing the sole and placing it with a shoe under sole-attaching pressure. In this way there would be no opportunity for the heat-activatable cement on the sole to become cool or lose its tackiness, and there would also be no loss of time in performing the sole-attaching operation which, with a fast-setting heat-activatable cement, could probably be accelerated considerably by a fast experienced operator.

Fig. 13 shows the shoe B after the outsole A has been permanently attached to the shoe bottom by heat-activatable cement in accordance with the present method. It will be noted in this figure that the overmolded outsole, as illustrated in Figs. 10 and 11, is less convex after its attachment to the shoe bottom under the sole-attaching pressure applied in the pad box 260. The marginal or edge portions of the sole, however, hug the upper closely around the periphery of the shoe bottom, particularly in the shank portion where the curvatures are more pronounced, so that there will be no openings or gaps between the upper and outsole after the latter has been attached to the shoe bottom. As stated above, an outsole prepared in accordance with the present method may be placed immediately in juxtaposition to a shoe bottom and put under sole-attaching pressure without any appreciable loss of time. There will be no danger of weaknesses developing in the cement bond between the sole and the shoe bottom by this procedure, however, because the sole and shoe were placed under sole-attaching pressure immediately after the sole was prepared, that is, while the heat-activatable cement thereon was in its most active or adhesive condition. A separate cement-activating operation after the sole leaves the present machine is of course dispensed with and, since heat-activated cements ordinarily set more rapidly than those activated by a solvent, the length of time during which the sole and shoe must remain under sole-attaching pressure to insure a strong cement bond may be substantially reduced.

Having thus 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 preparing soles for cement attachment to shoe bottoms which comprises providing an unmolded outsole having heat-activatable cement on one surface thereof, applying heat directly to said surface to activate said cement and render it adhesive without heating the rest of the outsole to any appreciable extent, and applying sole-molding pressure to the entire outsole simultaneously with the application of heat to said surface, thereby molding the outsole while activating said cement.

2. That improvement in methods of preparing soles for cement attachment to shoe bottoms which comprises providing a single-ply outsole having heat-activatable cement on its attaching surface, and simultaneously applying sole-molding pressure to the entire outsole and heat directly

to said attaching surface in such a manner that the heat does not penetrate the material of the outsole to any appreciable degree, thereby molding the outsole into a predetermined shape while simultaneously activating the cement on said attaching surface to put the cement into an adhesive condition without scorching the outsole.

3. That improvement in methods of preparing soles for attachment to shoe bottoms which comprises providing an unmolded outsole of integral material having heat-activatable cement on one surface thereof, applying molding pressure to the outsole to mold it beyond the shape desired in the finished shoe, and applying heat directly to the cement on said surface without heating the material adjacent said surface to an appreciable degree to activate the cement on said surface simultaneously with the application of said molding pressure, thereby rendering said heat-activatable cement adhesive while simultaneously overmolding the sole.

4. That improvement in methods of preparing outsoles for attachment to shoe bottoms which comprises providing an unmolded outsole having heat-activatable cement on its attaching surface, applying molding pressure to the outsole with the aid of members adapted to mold it beyond the shape desired in the finished shoe, and simultaneously applying heat directly to said attaching surface to activate said cement without heating the material below said surface to any appreciable extent, thereby overmolding the outsole and simultaneously activating the heat-activatable cement on its attaching surface without drying out the outsole.

5. That improvement in methods of preparing soles for attachment to shoe bottoms which comprises applying steam to one surface of a sole having heat-activatable cement on its other surface for a sufficient time to put the sole into a moldable condition without affecting the cement on said other surface, and applying additional heat and sole-molding pressure simultaneously to the sole, thereby activating the heat-activatable cement while molding the sole without changing its position to the desired shape.

6. That improvement in methods of preparing soles for attachment to shoe bottoms which comprises providing an unmolded sole having heat-activatable cement thereon, placing the sole in a predetermined position, steaming the sole to render it moldable without cracking, and applying sole-molding pressure to the sole without changing its position to mold the sole beyond the shape desired in the finished shoe.

7. That improvement in methods of preparing outsoles for attachment to shoe bottoms which comprises providing an unmolded outsole having heat-activatable cement on its attaching surface, applying steam to only the tread surface of the outsole thereby to render the outsole moldable without cracking, and simultaneously applying sole-molding pressure to the outsole and heat to its attaching surface, thereby molding the outsole into the desired shape while simultaneously activating the cement on its attaching surface.

8. That improvement in methods of preparing outsoles for attachment to shoe bottoms which comprises providing an unmolded outsole having heat-activatable cement on its attaching surface, steaming the forepart of the outsole by applying steam to the tread surface thereof thereby rendering it more readily moldable without activating the cement on said attaching surface, applying sole-molding pressure to the outsole with the

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aid of a yielding molded pad and a complementary solid form adapted to mold the outsole into a predetermined shape, and simultaneously applying additional heat directly to said attaching surface by means of said form, thereby activating the heat-activatable cement on said surface simultaneously with the molding operation.

9. That improvement in methods of preparing soles for attachment to shoe bottoms which comprises providing an unmolded sole having heat-activatable cement on one surface thereof, applying steam to the sole, and applying additional heat directly to the cemented surface only while applying sole molding pressure to the entire sole in a single operation, thereby activating the cement on the sole and molding the sole into a desired shape simultaneously.

10. That improvement in methods of preparing soles for attachment to shoe bottoms which comprises providing a leather sole having dry heat-activatable cement on its attaching surface, and applying steam to the grain surface of the sole, heat directly to said attaching surface, and sole-molding pressure to the sole adapted to overmold said sole in a single operation, thereby rendering the sole more readily moldable, overmolding it into a predetermined shape, and activating the heat-activatable cement on its attaching surface substantially at the same time.

11. That improvement in methods of preparing soles for attachment to shoe bottoms which comprises providing a single ply unmolded outsole having heat-activatable cement on its attaching surface, applying outsole-molding pressure to the sole with the aid of a yielding overmolded pad and a correspondingly overmolded form, thereby molding the outsole beyond the shape desired in the finished shoe, and simultaneously applying heat directly to the attaching surface of the outsole for a period of time sufficient to activate said cement but insufficient to heat the material of the outsole beyond said attaching surface, thereby activating the heat-activatable cement on said attaching surface and rendering it adhesive simultaneously with the overmolding of the outsole.

12. That improvement in methods of preparing outsoles for attachment to shoe bottoms which comprises providing an unmolded outsole having dry, heat-activatable cement on its attaching surface, steaming the tread surface of the outsole to put the outsole into a moldable condition without effecting said cement on said attaching surface, applying sole-molding pressure to the outsole with the aid of a yielding overmolded pad and a heated, heat-conducting form complementary in shape to said pad, thereby overmolding the outsole a predetermined amount, and simultaneously applying additional heat directly to the attaching surface of the outsole by means of said complementary form to activate the cement on said surface during the overmolding operation.

13. A machine for use in operating upon soles having, in combination, a yieldable pad having a molded surface thereon for supporting the tread surface of an outsole having heat-activatable cement on its attaching surface, a form having a surface thereon complementary in shape to the surface of the pad, mechanism for relatively moving the pad and form to apply sole-molding pressure to the outsole on the pad, and means for heating the form without heating the pad to cause said form to apply heat directly to the attaching surface of the outsole to render the cement thereon adhesive without causing it to set or dry

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simultaneously with the sole molding operation, said form applying heat to said attaching surface without heating the other portions of the outsole to any appreciable extent.

14. A machine for use in operating upon soles having, in combination, a yielding pad having a molded surface thereon for supporting the tread surface of a single ply outsole having heat-activatable cement on its attaching surface, a solid form rigidly supported opposite the pad and having a surface thereon complementary to the molded surface of the pad, mechanism for moving the form relatively to the pad to apply molding pressure to the outsole on the pad, and means carried by the form for heating said complementary surface to cause it to apply heat directly to the cement on said attaching surface of the outsole to render said cement adhesive while simultaneously molding the outsole, said form operating only to activate the cement on said attaching surface without heating the other portions of the outsole to any appreciable degree.

15. A machine for use in operating upon soles having, in combination, a yielding pad provided with an overmolded surface for supporting a single ply unmolded outsole having heat-activatable cement on its attaching surface, a heat-conducting form having a surface facing the pad substantially complementary in shape to said overmolded surface, mechanism for effecting relative movement of the form and pad to apply sole-molding pressure to the outsole on the pad, and means carried by the form for heating said complementary surface to cause it to apply heat directly to the attaching surface of the outsole and thereby activate the cement thereon and render it tacky simultaneously with the overmolding of the outsole, said form operating to apply heat only to said attaching surface without heating the rest of the outsole to any substantial degree.

16. A machine for use in operating upon soles having, in combination, a yielding pad having a surface thereon for supporting a sole, a form having a surface thereon complementary to the surface on the pad and arranged to cooperate therewith, mechanism for effecting relative movement of the pad and form to apply sole-molding pressure to the sole between the pad and form, and means for introducing steam around the sole on the pad to condition the sole for molding before the sole-molding pressure is applied.

17. A machine for use in operating upon soles having, in combination, a yielding pad having a molded surface thereon for supporting an unmolded sole, a form having a surface thereon complementary to the molded surface on the pad and arranged to cooperate therewith, mechanism for effecting relative movement of the pad and form to apply sole-molding pressure to the sole on the pad, and means carried by the pad for applying steam to the sole before said relative movement is effected, thereby conditioning the sole for molding prior to the sole-molding operation.

18. A machine for use in operating upon soles having, in combination, a yielding pad provided with an overmolded surface for supporting an unmolded sole, a form having a surface thereon complementary to said overmolded surface and arranged to cooperate therewith, mechanism for relatively moving the form and pad to apply overmolding pressure to the sole on the pad, and means for introducing steam around the un-

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molded sole just prior to the overmolding operation, said means being constructed and arranged to introduce steam from opposite sides of the pad under the unmolded sole to put the sole into a more readily moldable condition before the overmolding operation takes place.

19. A machine for use in operating upon soles having, in combination, a yielding pad having a molded surface thereon for supporting an unmolded sole, a form having a surface complementary to the molded surface on the pad, mechanism for relatively moving the pad and form to apply sole-molding pressure to the sole, means for introducing steam between the sole and pad to put the sole into a moldable condition, and means operated by relative movement of the pad and form for controlling the introduction of steam between the sole and pad.

20. A machine for use in operating upon soles having, in combination, a yielding pad provided with a molded surface for supporting an unmolded sole, a form having a surface thereon complementary to the surface on the pad, mechanism for moving the form relatively to the pad to apply sole-molding pressure to the sole, means for introducing steam between the pad and sole to put the sole into a more readily moldable condition, and means operated by movement of the form relatively to the pad for controlling the introduction of the steam between the sole and pad in predetermined timed relation to the application of the sole-molding pressure.

21. A machine for use in operating upon soles having, in combination, a stationary pad provided with a molded surface for supporting an unmolded sole, a form having a surface thereon complementary to the molded surface of the pad and adapted to cooperate therewith to apply molding pressure to the sole, said form being movable forwardly and rearwardly of the machine into and out of operative position over the pad, mechanism for moving the form toward the pad to apply molding pressure to the sole, means for introducing steam between the sole and pad to put the sole into a condition for molding, and means operated automatically by movement of the form forwardly into position over the pad for controlling the introduction of steam between the sole and pad, said means being constructed and arranged to permit steam to be introduced prior to the application of molding pressure to the sole but to shut off the steam before molding pressure is applied.

22. A machine for use in operating upon soles having, in combination, a yielding pad having an overmolded surface thereon for supporting an un-

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molded sole having thermoplastic cement on its attaching surface, a metal form provided with a surface complementary in shape to the overmolded surface of the pad for engaging said attaching surface, mechanism for relatively moving the form and pad to apply overmolding pressure to the sole on the pad, means for applying steam to the sole before the overmolding pressure is applied, thereby putting the sole into a moldable condition, and means for heating the complementary surface of the form to a predetermined temperature to cause it to apply heat directly to the attaching surface of the sole and thereby to activate the cement on said surface simultaneously with the overmolding operation.

23. A machine for use in operating upon soles to prepare them for attachment to shoe bottoms having, in combination, a yielding pad provided with an overmolded surface for supporting an unmolded sole having a heat-activatable cement on its attaching surface, a metal form provided with a sole-engaging surface complementary in shape to the overmolded surface on the pad, mechanism for relatively moving the pad and form to apply overmolding pressure to the sole on the pad, means carried by the pad for introducing steam around the sole before molding pressure is applied to the sole to put the sole into a more readily moldable condition, said means being constructed and arranged to introduce steam simultaneously from opposite sides of the pad into the space between the sole and the surface of the pad, and heating means carried by the form for heating the complementary surface thereon to a predetermined temperature to cause it to apply heat directly to the attaching surface of the sole and thereby activate the cement thereon simultaneously with the application of overmolding pressure to the sole, thereby preparing the sole for immediate attachment to a shoe bottom after the overmolding operation is completed.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,713,550	Perry	May 21, 1929
2,134,100	Bray	Oct. 25, 1938
2,213,066	Donovan	Aug. 27, 1940
2,226,769	Heather et al.	Dec. 31, 1940
2,242,818	Donovan	May 20, 1941
2,298,037	Crandell	Oct. 6, 1942
2,377,208	Card	May 29, 1945

Certificate of Correction

June 22, 1948.

Patent No. 2,443,693.

HANS C. PAULSEN

It is hereby certified that errors appear in the printed specification of the above numbered patent requiring correction as follows: Column 14, lines 45 and 46, claim 5, strike out the words "without changing its position"; column 15, line 34, claim 11, for "outsole-molding" read *sole-molding*; line 35, for "sole" read *outsole*; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 23rd day of November, A. D. 1948.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.