June 30, 1936. S. J. FINN 2,045,705

APPARATUS FOR VULCANIZING RUBBER SOLES ON SHOES

Original Filed March 19, 1931 4 Sheets-Sheet 1

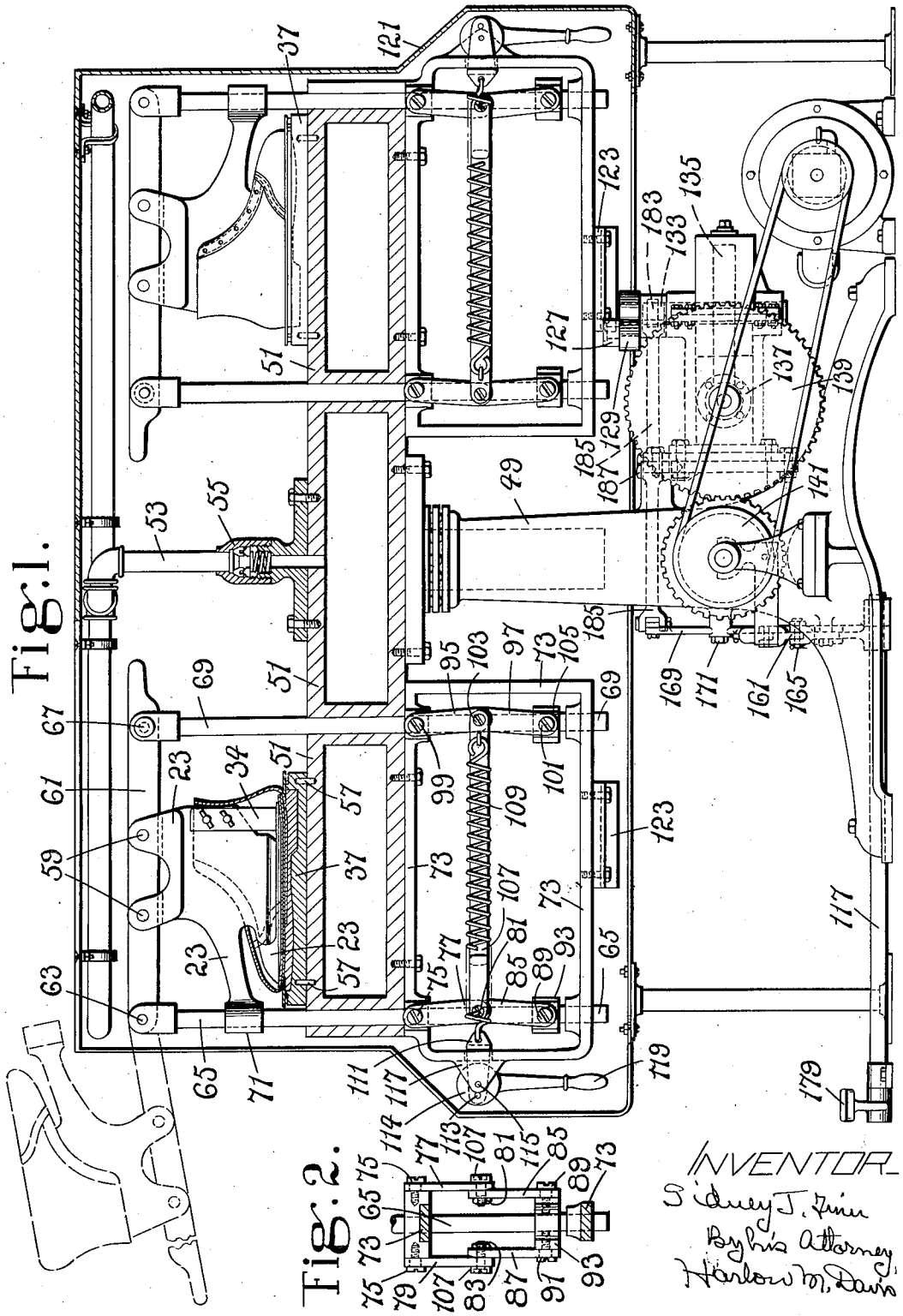


Fig. 1.

Fig. 2.

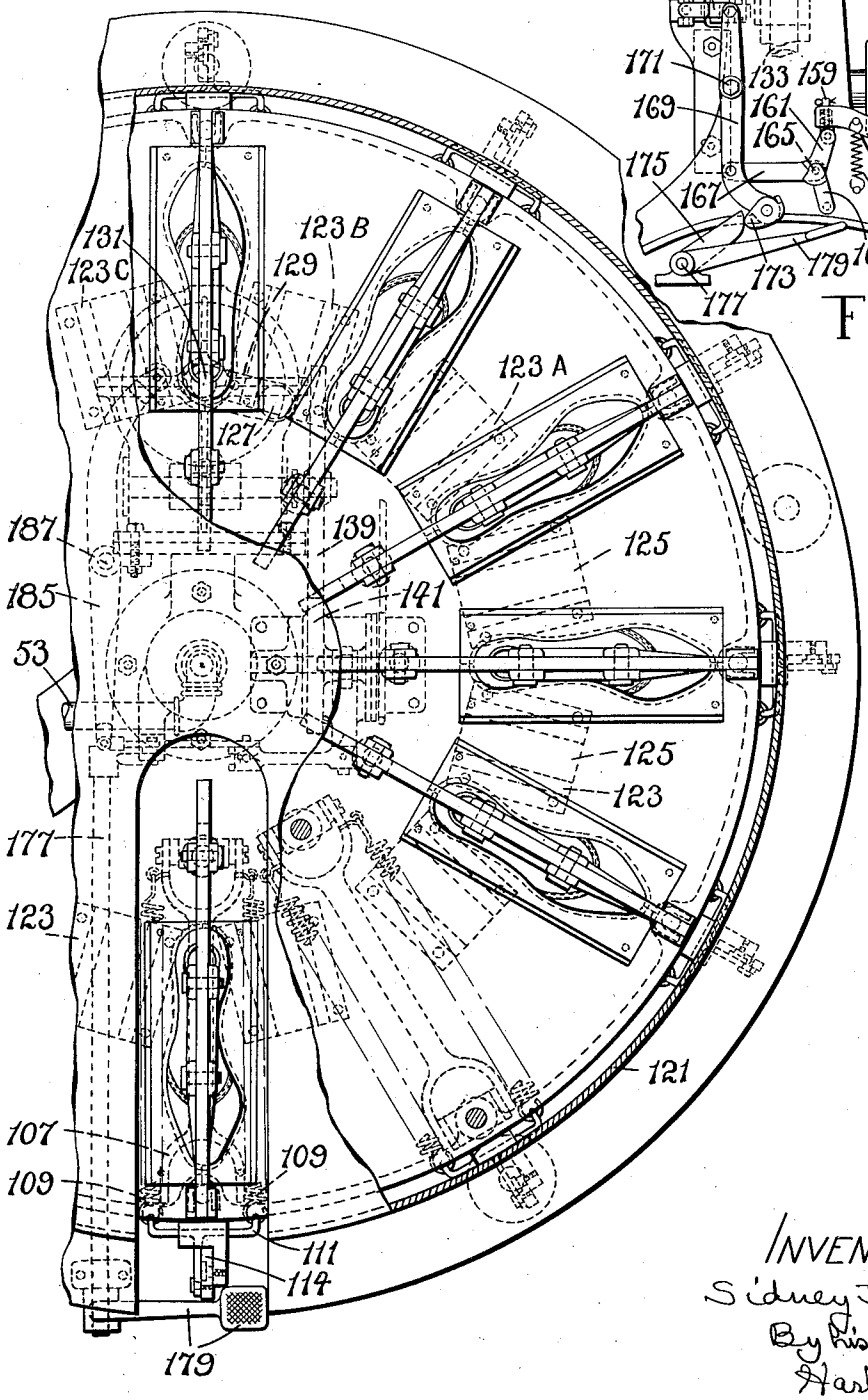
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APPARATUS FOR VULCANIZING RUBBER SOLES ON SHOES

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Fig. 3.



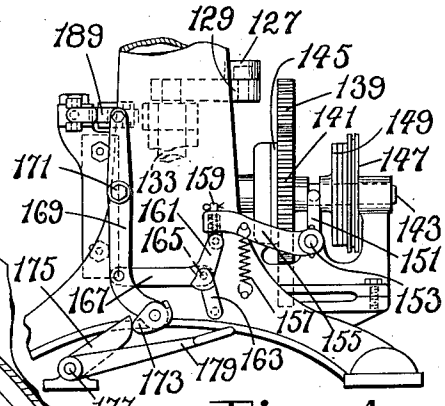


Fig. 4.

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Fig. 5.

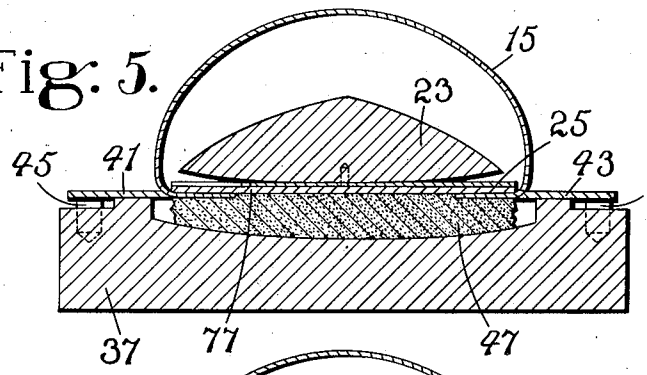
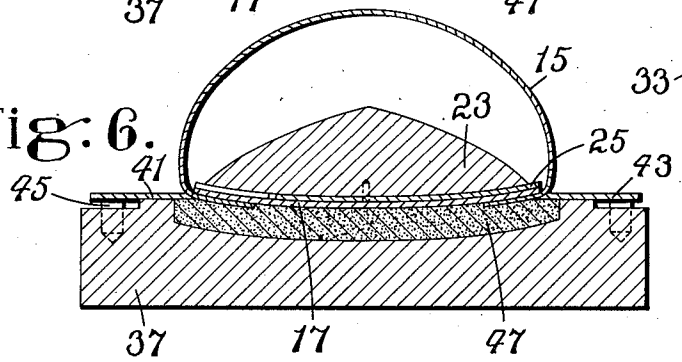


Fig. 6.



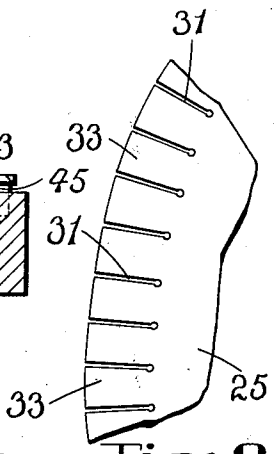


Fig. 8.

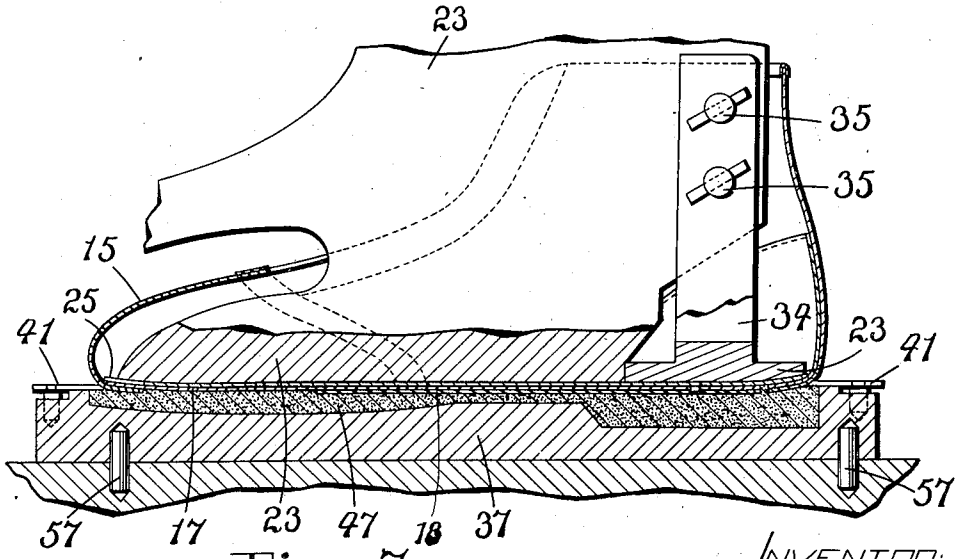


Fig. 7.

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APPARATUS FOR VULCANIZING RUBBER SOLES ON SHOES

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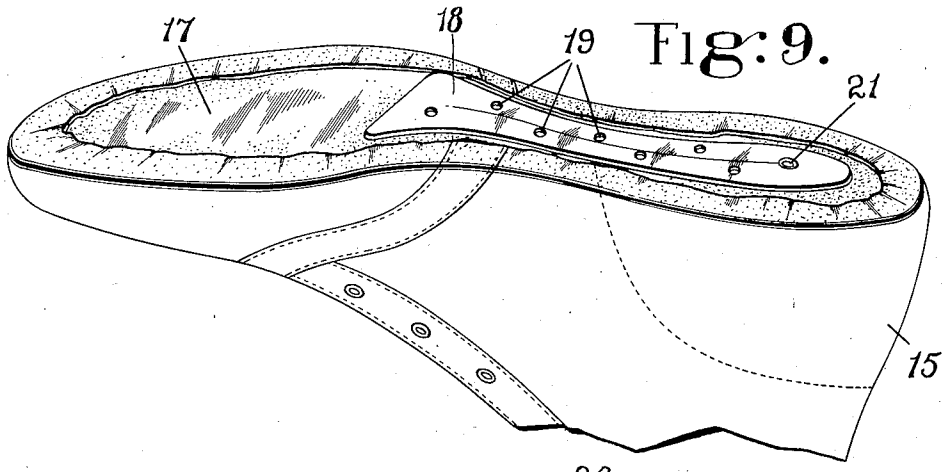


Fig: 9.

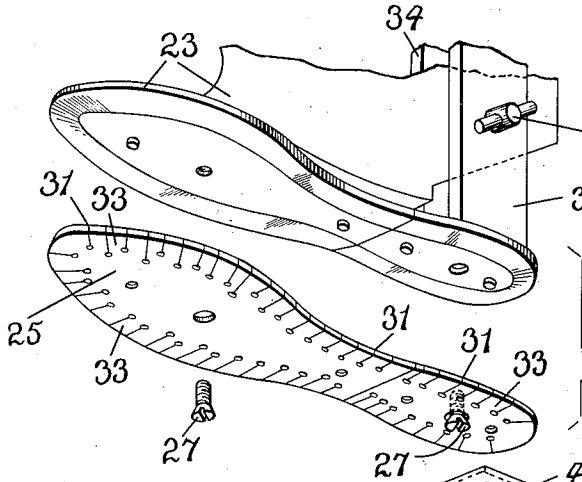


Fig:10.

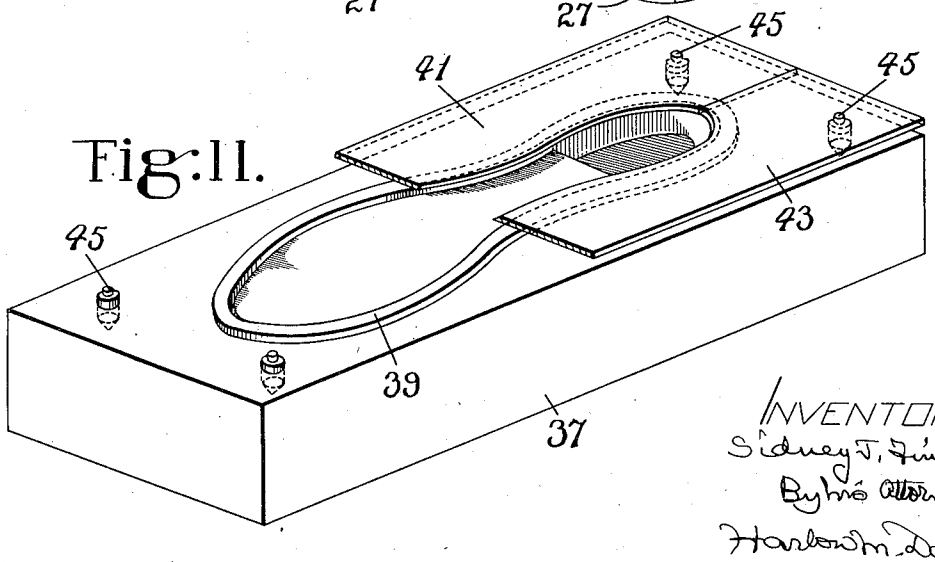


Fig:11.

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Patented June 30, 1936 2,045,705

UNITED STATES PATENT OFFICE

2,045,705

APPARATUS FOR VULCANIZING RUBBER SOLES ON SHOES

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Original application March 19, 1931, Serial No. 523,822. Divided and this application June 28, 1934, Serial No. 732,892

17 Claims. (Cl. 18—17)

This invention relates to a machine for vulcanizing a rubber sole to a shoe and is a division of application Serial No. 523,822, filed March 19, 1931.

In the manufacture of a certain type of shoes having uppers made usually in part or in whole of fabric, a sole blank or "biscuit" of unvulcanized rubber is placed in a mold; and the bottom of a previously lasted shoe is pressed against the sole blank to cause it to fill the mold and to be pressed against the bottom of the shoe, this pressure being maintained while heat is being applied to vulcanize the rubber. The bottom of a lasted shoe is curved longitudinally; and it has been considered necessary hitherto to make the upper portion or the top of the sole mold of a longitudinal curvature to correspond exactly to that of the bottom of the particular shoe to which a rubber sole is to be vulcanized. It has thus been necessary to provide a mold with an accurately curved upper portion or top for each size and style of shoe; and the production of such a large number of molds, each of which must have the longitudinal curvature of its top very accurately formed, has involved so considerable an expense that shoes of the kind under discussion have not been made in large quantities.

According to the present invention, the insole of a previously lasted or otherwise assembled shoe is distorted, for example, by changing its longitudinal curvature; and a rubber sole is vulcanized to it while so distorted. The distortion of the insole distorts the upper and other parts which may be present, so that stresses are set up in the partly finished shoe tending to return it to its original shape. When, therefore, after the completion of the vulcanization the insole is freed, the stresses referred to react to impart longitudinal curvature to the rubber sole.

It is no longer necessary when this procedure is used to provide molds the longitudinal curvatures of the tops of which correspond respectively to the longitudinal curvatures of the bottoms of the shoes with which they are to be used. Any suitable longitudinal curvature may be imparted to the top of a mold; and preferably the top of each mold will be a plane surface. Thus a partly finished shoe including, among other possible parts, an assembled upper and insole, is first prepared conveniently by assembling the desired parts of the shoe upon a last and then removing the last. A rubber sole blank or "biscuit" is now placed in a sole-shaped cavity and the blank is forced to take on the shape of the cavity and, at the same time, the overflow of rubber over the rim of the cavity is prevented, by forcing the bottom of the lasted shoe against the top of the sole blank or biscuit and against the rim of the cavity. The pressure described above distorts the insole, and with it other parts, thus setting up stresses in the shoe which tend to return it to its original shape. Vulcanization now takes place; and then the pressure is removed to permit these stresses to return the shoe more or less to its original shape and thereby to impart longitudinal curvature to the rubber sole.

The degree to which the shoe will resume its original shape depends upon the constituents of the partly finished shoe to the bottom of which the sole is vulcanized, and the degree of the distortion. For example, the assembled parts of the shoe may include an elastic shaping member of some kind, such, for example, as a shank piece consisting of a thin, perforated spring-steel plate attached to the bottom of the insole and normally curved longitudinally, which is flattened when the insole is flattened and tends very strongly, when the pressure upon it is released, to return to its original shape; or such a shaping member may be placed upon the unvulcanized sole blank before the bottom of the shoe is pressed against the blank.

In order to ensure a still better appearance in the finished shoe, whether or not an elastic shaping member is present, the shoe, after the vulcanization of the rubber and while the vulcanized sole is still hot, may be reshaped, for example, by being relasted, and maintained in its reshaped condition for a suitable interval to permit the rubber to cool and set. There is thus provided a shoe having a longitudinally curved rubber sole the curvature of which is due in part at least to stresses caused by distortion of another part of the shoe; and it is possible to manufacture such a shoe so cheaply as to permit it to compete with or to displace the cheap grade of shoes commonly known as sneakers or tennis shoes.

According to one feature of the invention, there are provided means for exerting pressure upon the insole of a partly finished shoe to distort the insole, means for vulcanizing a rubber sole to the bottom of the distorted shoe, and means for thereafter removing the pressure. In the illustrated construction there is provided a mold for a sole blank of unvulcanized rubber having a substantially flat top provided with a sole-shaped opening slightly smaller in outline than that of the finished shoe and a form for holding the shoe and for pressing the extreme margin of its bottom against the rim of the opening. While the

pressure is maintained, the sole is vulcanized, and thereafter the pressure is removed.

The pressure exerted by the form upon the shoe and through the shoe upon the unvulcanized sole blank is very considerable so that there is a strong tendency for some of the rubber to escape through the joint between the bottom of the shoe and the mold. In order to seal this joint securely before and during the time that the maximum pressure is applied, there is provided, according to another feature of the invention, means acting first to seal the joint securely before the maximum pressure is reached. In the illustrated construction this means takes the form of a thin flexible plate fastened to the bottom of the form along its longitudinal middle and spaced around its margin from the margin of the form so that, during the first part of the descent of the form, the yielding margin of this plate presses the margin of the bottom of the shoe yieldingly against the rim of the opening in the mold, and, during the latter part of the descent of the form when gradually increasing pressure is being applied to the sole blank to cause it to fill the mold, the pressure of the plate is also gradually increased until, by the sufficient upward bending of the margin of the plate it contacts with the form and the pressure becomes positive.

Further features of the machine, including a turret having a heated plate to receive a plurality of circularly arranged pressing mechanisms, and other details of construction will be described as embodied in an illustrative machine.

Referring now to the accompanying drawings,

Fig. 1 is an elevation, partly in section, of a machine by which certain steps of the method may be conveniently practiced;

Fig. 2 is a detail, partly in section, of two pairs of the toggle levers of the pressing mechanism;

Fig. 3 is a plan of a portion of the machine, the cover being shown in section;

Fig. 4 is a detail in elevation of part of the mechanism for imparting intermittent rotation to the turret;

Fig. 5 is a vertical section through the forepart of the shoe, the form and the mold showing the position of parts at the time that pressure is first being applied to press the margin of the bottom of the shoe against the rim of the opening in the mold;

Fig. 6 is a similar section showing the final position of the same parts when maximum pressure is being applied;

Fig. 7 is a side elevation of the parts in the same positions as they are shown in Fig. 6, the lower portion of the shoe and the form, and all of the mold and the sole being shown in vertical longitudinal section;

Fig. 8 is a detail in plan of a portion of the flexible plate;

Fig. 9 is an elevation of a partly finished shoe ready to have a sole vulcanized to its bottom;

Fig. 10 is a perspective of the form and its flexible bottom plate in spaced relation; and

Fig. 11 is a perspective of a mold, the two top plates of which have been broken away to show more clearly the flat-topped rib on which they rest.

Referring first to Figs. 5 to 11, inclusive, an upper **15** (Fig. 9) and an insole **17** are assembled, preferably upon a last, with the margin of the upper laid over upon and cemented or otherwise fastened to the margin of the insole. The last is now removed. If an elastic shaping member or shank piece **18** is to be used, it will preferably be made of spring steel and perforated at a plurality of places, as at **19**, to permit the rubber of the sole to enter it and will be normally curved longitudinally so as to aid in imparting to the rubber sole the desired longitudinal curvature. This shaping member may, if desired, extend along substantially the whole length of the insole and is preferably fastened to the insole, conveniently by means of an eyelet **21** inserted after the last has been removed.

The previously lasted, or otherwise assembled, shoe is now placed upon an iron form **23** the purpose of which is to exert pressure upon the insole of the shoe. This pressure is exerted through a normally flat spring-steel plate **25** which is fastened along its longitudinal middle to the longitudinal middle of the bottom of the form **23** by one or more screws **27**. The middle portion of the bottom of the form is flat, but the margin of the bottom is curved upwardly, as best shown in Figs. 5, 6, 7 and 10. Th margin of the plate extends beyond the margin of the bottom of the form, its outline being coincident, or approximately so, with that of the insole **17**. In order to ensure that the margin of this plate shall press the margin of the insole at all points firmly against the rim of the sole-shaped opening in the top of the mold in a manner presently to be described, the margin of the plate is slotted at **31** to provide a series of spring-tongues **33** all around its edge.

As thus far described, the form and the plate have been referred to as though they were each made of a single part. They are, however, each made of two parts, a heel part and a forepart. It is desirable that the form be made in two parts so as to facilitate its insertion in and removal from a shoe. To this end the heel part has a pair of spaced upright stems **34** which are fastened to the adjacent upright thin flat portion of the other part of the form **23** by removable pins **35**. After these pins have been removed, the heel portion may be swung in a counterclockwise direction, as viewed in Figs. 7 and 10, and pushed up out of the way so that it will not interfere with the insertion of the form into a shoe. When the form has been thus inserted, the heel portion is returned to the position shown, and the pins **35** replaced. Because of this two-part construction of the form, the plate **25** on its bottom also consists of two parts, as shown, the heel part of the plate being fastened at or near its middle to the heel part of the form.

The mold (Fig. 11) comprises a base portion **37** having a rib **39** enclosing a sole-shaped opening, all points in the top of the rib being located in a common plane. In order to provide an extension edge on the sole, two flat plates **41**, **43** rest upon the flat top of the rib and upon shoulders on pins **45** which are carried by the base **37** and the reduced upper ends of which extend through holes in the plates. These two plates are cut away so as to provide between them a sole-shaped opening having a slightly smaller outline than that of the bottom of the shoe to which a sole is to be attached. When a sole blank of unvulcanized rubber has been placed in the mold, and the bottom of the shoe has been pressed down, as will presently be described, into its final position (Figs. 6 and 7) the edges of these plates will extend into the crease between the upper and and the sole. It is desirable, in order to produce a sightly crease, that the edges of these plates be thin; but since the plates must withstand a considerable amount of pressure, their thin edges should be strong. The plates are therefore com-

paratively thick, but have thin beveled edges around the sole-shaped opening.

In using the apparatus described above, the previously lasted or otherwise assembled insole and upper, with or without an elastic shaping member, is placed upon the form **23** with its bottom coated with vulcanizing cement; and a sole blank or biscuit of unvulcanized rubber is placed in the mold. The form is then moved downward to cause the yielding margin of the plate **25** to press the extreme margin of the bottom of the shoe against the continuous beveled edge of the plates **41**, **43** which forms the rim of the sole-shaped opening of the mold enclosed by said plates. The position of the parts at this stage is indicated in Fig. 5 in which the sole blank is indicated at **47**. The margin of the bottom of the shoe is pressed into contact with the rim of the sole-shaped opening in the plates; and the portion of the bottom of the shoe within the margin, which would naturally be convex widthwise, has been flattened by pressure against the sole blank. At this time the pressure is not great. As the form, however, is forced down into the position shown in Fig. 6, the pressure is greatly increased, the margin of the bottom of the shoe being pressed firmly against the beveled edges of the plates **41**, **43** so as to seal the joint between the shoe and the mold against escape of rubber, the bottom of the shoe being bent into convex shape widthwise, and the rubber blank being caused to fill the mold. The mold is maintained hot at all times, and the shoe is held under heat and pressure until the sole is vulcanized.

When the shoe is forced into the position shown in Fig. 5, the insole is distorted and lies flat; and when it has been forced into its final position (Figs. 6 and 7) it is bent up slightly at its ends but is still substantially flat lengthwise, that is, a vertical plane passed through the insole longitudinally would intersect the upper and lower faces of the insole in lines which are straight except at their extreme ends. The distortion of the shoe, including the elastic shaping member if that is present, sets up stresses in the shoe which tend to return it to its original shape; and when, after the pressure which holds the shoe in its distorted condition is removed, these stresses act to return the shoe more or less to its original shape and, at the same time, to impart longitudinal curvature to the rubber sole. The extent to which a distorted shoe will regain its shape and impart curvature to the sole depends upon the constituents of the shoe, that is, upon the materials of which the upper and the insole are made, and upon the presence or absence of an elastic shaping member. The final shaping of the distorted shoe and the flat sole is facilitated, however, by the fact that the hot sole fresh from the mold is comparatively flexible and will of itself retain more or less the curvature then imparted to it if that curvature is maintained for a sufficient interval. A strong elastic shaping member, if used, will return the insole approximately to its original longitudinal curvature and, being vulcanized to the sole and to the insole, will impart to the sole the same curvature.

In case it is desired further to improve the appearance of the finished shoe, the upper of the shoe with the hot sole vulcanized to its bottom may be dampened, immediately relasted, and allowed to stand for a suitable interval. This added step, which may be practiced whether or not an elastic shaping member is present, not only imparts a better shape to the upper but also improves the curvature of the sole by maintaining the hot sole in exactly the desired shape for a suitable interval to permit the rubber to cool and set.

Hitherto in the manufacture of shoes of the general type discussed above in which a sole blank is forced into a mold and vulcanized to the bottom of the shoe, it has been necessary to provide a sole blank of exactly the right volume or content, this volume or content being conveniently determined by the weight of the blank. It is, of course, necessary to provide a blank having a content sufficient, when pressure is applied to it, to cause it to fill the mold; but, if the blank was of greater content, more or less overflow of rubber has occurred which has necessitated a trimming operation after the sole has been vulcanized. With the present construction, however, a blank having a considerably greater content than is necessary for it to fill the mold may be used so that it is no longer necessary to provide a sole blank of an exact content or weight for a given shoe. Referring to Fig. 5, a sole blank of the right content to fill the mold is shown, said blank being shown in Fig. 6 after pressure has been applied to it through the form **23** and plate **25** to cause it to fill the mold. The pressure which is applied to the form, as will presently appear, is applied through a heavy spring so that, if the sole blank had been of a greater content than the one shown, the middle portion of the blank after the final pressure has been put upon it, would have been somewhat thicker than the one shown in Fig. 6. In such case, however, there would have been no escape of rubber because the yielding margin of the plate **25** would have held the joint between the shoe and the mold tight against escape of rubber. With the present construction, therefore, the roughly shaped sole blank. which is placed in the mold, need not be of such a content that it will, upon application of pressure. just fill the mold, but may be, to a variable extent, of a somewhat greater content. In such case, the inside of the finished shoe will be slightly smaller than would otherwise be the case; but the excess rubber will be distributed throughout the whole upper surface, so to speak, of the sole so that the decrease in size of the inside of the shoe will be practically negligible. Just how much over-size a given sole blank may be without resulting in either overflow of rubber or unpractical decrease in the size of the inside of the shoe may be inferred from the fact that the sole blank for a No. 3 shoe, which is required to be of a weight of 160 grams in order to fill the mold in the manner shown in Fig. 6, could be increased to 180 grams without producing undesirable results.

Thus far, in order to promote brevity, reference has been made merely to a rubber sole the top of which is substantially flat lengthwise as it lies in the mold during the vulcanization. It will be understood, of course, that the sole may include a heel if desired, as is shown in the drawings, and that the bottom of the mold may have any desired contour. With regard to the term "rubber sole blank or biscuit", this is intended to include a suitable mass of any suitable composition of rubber and other ingredients which is capable of being vulcanized.

Referring now more particularly to Figs. 1, 2 and 3, a machine for conveniently pressing the bottom of the shoe against the mold and the sole blank and for vulcanizing the blank will be described.

Rotatably mounted on a pedestal 49 is a turret comprising a hollow hot plate 51. Steam is caused to flow through the interior of this plate from a steam pipe 53 connected to the interior of the plate through a coupling 55 which permits rotation of the turret, a suitable outlet, not shown, permitting escape of steam and water. This plate is provided with a plurality of stations each of which has means for locating a mold upon it and means for applying pressure through a form to a shoe. Inasmuch as these stations are alike, only one of them will be described in detail.

Referring more particularly to Figs. 1 and 3, the station at which the operator stands will be described, this being the left-hand station shown in Fig. 1 and the station at the bottom of Fig. 3. The hot plate 51 has set into it two locating pins 57 to receive properly located holes in the bottom of the mold 37. The form 23 is fastened by two pins 59 to a hand lever 61 which is pivoted at one end at 63 to a yoke at the upper end of a vertical slide-rod 65 and is fastened near its other end by a removable pin 67 to a yoke at the upper end of a second vertical slide-rod 69. When the pin 67 has been removed, the lever may be swung into the position shown in dotted lines in Fig. 1 to permit ready removal from and replacement of a shoe upon the form. In order to steady the form during its vertical movement, presently to be described, the form 23 has a forward extension of its upper part to provide a guide portion 71 which straddles the upright rod 65.

The vertical rods 65, 69, which thus carry the form, are slidable in vertical bores formed in the hot plate 51 and in a frame 73 which is fastened to the under side of the hot plate. Pivoted to the left-hand end of the frame about the alined axes of screws 75 are the upper ends of two toggle levers 77, 79, the lower ends of these levers being pivoted respectively at 81 and 83 to the upper end of two toggle levers 85, 87, the lower ends of the two last-named levers being pivoted respectively about screws 89, 91 to a collar 93, which is fastened by the same screws to the rod 65. The vertical rod 69 is connected at its lower end to two sets of toggle levers exactly like those to which the vertical rod 65 is connected. Two of these toggle levers are indicated respectively at 95 and 97 in Fig. 1, the upper lever (and the one behind it, not shown) being pivoted to the frame 73 about the axis of the screw 99, the lower lever (and the one behind it, not shown) about the axis of the screw 101; and the two levers being pivoted together about the axis of the screw 103. The screw 101 (and the one behind it, not shown) serve to fasten the collar 105 to the rod 69. The knuckles of the toggle levers are connected by a rod 107 having a yoke at each end; and two heavy tension springs 109 (only one of which is shown in Fig. 1) are connected at their right-hand ends, as viewed in that figure, to the right-hand yoke and at their left-hand ends to a small yoke 111 the stem of which passes through the frame 73 and is pivoted at 113 to a disk 114 which in turn is pivoted at 115 to an ear 117 formed on the frame 73. A handle 119 on the disk provides means for turning it.

In the position of parts shown in Fig. 1, the springs 109 are under tension; and the form 23 has been forced down into the position shown in Figs. 6 and 7. It should be understood that the construction is such that the toggle levers are not completely straightened and that the spring is still exerting a yielding but very considerable pressure upon the form. The parts remain in this position until the rubber sole is vulcanized, whereupon the handle 119 is rotated through about 180° to relieve the tension upon the springs 109 and to cause the form, with the shoe upon it, to rise vertically from the mold. With regard to the action of the springs in straightening and breaking the toggles, these springs, as has been stated, are heavy ones; and, when they are extended as shown in the drawings, the coils are only very slightly separated. When the handle 119 is swung in a clockwise direction, as viewed at the left-hand portion of Fig. 1, the effect of the first part of such swinging movement is to permit the coils of the springs to contact with one another, while, during the latter part of said swinging movement, the springs act as links to break the toggles. The pin 67 may now be removed and the hand-lever 61 swung into the dotted line position to permit the operator to remove the shoe and to place upon the form another shoe. When the form, with the shoe upon it, is swung into the dotted line position shown in Fig. 1, the thin plates 41, 43 are carried with it and are removed by the operator and placed again in position on the mold. A sole blank or biscuit is then placed in the mold, the hand-lever 61 swung back into the full-line position, the pin 67 replaced, and the hand-lever 119 swung into the position shown. The first effect produced by tensioning the springs 109 is to move the form 23 with the shoe into the position shown in Fig. 5, as has been described. Then, as the springs 109 continue to contract, the form and the shoe are moved farther down to a position, like that shown in Fig. 6, which depends upon the size or content of the sole blank. Although, as has been stated above, the pressure which the springs 109 exert when under tension is very considerable and more than is sufficient to flatten a strong spring steel shaping member, nevertheless this member does not with its free end penetrate the sole blank but is merely embedded in the top of the blank, substantially no rubber at all being forced between the shaping member and the insole.

The whole apparatus which has thus far been described is enclosed in a thin casing 121 which is open only adjacent to the station in front of which the operator stands; and it is necessary, therefore, to provide mechanism for rotating it at will to bring the next station to that which has been described into a position accessible to the operator. Any suitable mechanism may be employed; and consequently the illustrated mechanism will be only briefly described. Fastened to the bottom of each frame 73 is a block 123 having formed in its under side a straight groove or track 125 which is radial to the vertical axis of rotation of the turret. In Fig. 3 three of these blocks are indicated for purposes of explanation as 123A, 123B and 123C. In the position of parts shown, a roll 127 (Fig. 3) at the outer end of an arm 129, which may be caused at will to make one revolution about its vertical axis of rotation 131, is at rest in the inner end of the radial groove in the block 123B. If now one revolution of the arm 129 with its roll 127 is caused to take place in a counterclockwise direction, as viewed in Fig. 3, the turret will be rotated just far enough to move each station upon it into the position previously occupied by the station ahead of it. As the arm 129 rotates, the roll 127 will move the station which corresponds to the block 123B into the position occupied by the station which corresponds to the block 123C. In doing so, the roll 127 will

travel first outwardly in the groove in the block 123B and then inwardly until it leaves the inner end of the groove. The roll will then continue its rotation until it comes to rest in the inner end of the groove in the block 123A which will then occupy the position previously occupied by the block 123B.

In order to impart, when desired, one revolution to the arm 129 any suitable mechanism preferably of the non-repeat type, may be used. In the illustrated mechanism the arm 129 (Fig. 1) is fast to the upper end of a vertical shaft 133 having near its lower end a worm wheel 135 driven by a worm 137 on a horizontal shaft which has fast to it a large gear 139, said large gear being in turn driven by a smaller gear 141. This gear 141 is slidably keyed to a horizontal shaft 143 (Fig. 4) and has a friction brake disk 145 on its left-hand face which, in the position of parts shown in Fig. 4, is being held against a vertical plane face formed upon a stationary part of the machine. Loose on the shaft 143 is a continuously driven pulley 147 which may be caused to drive the shaft 143 by moving to the right a friction clutch member 149 which is slidably keyed to the shaft. The friction clutch member 149 and the gear 141 are held in the position shown, in which the clutch is inoperative and the brake disk 145 is operative, by a yoke 151 the depending stem of which is fast to a horizontal rock-shaft 153. Also fast to this rock-shaft is an arm 155 which a tension spring 157 tends at all times to pull down. The free end of the arm 155 carries a spring pin 159 to the lower end of which is pivoted the upper end of a toggle lever 161. A second toggle lever 163 is pivoted at its lower end to the frame of the machine and at its upper end to the lower end of the toggle lever 161 about a pivot 165 which forms the knuckle of the toggle. A link 167 is pivoted at one end to this knuckle and at the other end to an upright lever 169 which is pivoted at 171 to the frame of the machine and carries at its lower end a hardened block 173 which lies in the path of one end of an arm 175 the other end of which is fast to a long rock-shaft 177. A treadle 179 is also fast to this rock-shaft. When the treadle is depressed, the arm 175 swings the lever 169 clockwise, as viewed in Fig. 4, thereby pushing the knuckle of the toggle levers slightly past dead center, whereupon the tension spring 157 holds the toggle in its straightened position. Straightening of the toggle raises the arm 155, thereby freeing the brake disk 145 and throwing in the friction clutch so that the pulley 147 begins to rotate the shaft 143, and, through it and the connecting gearing, to rotate the vertical shaft 133 to which the arm 139 which carries the roll 127 is fast. The hardened block 173 is pivoted to the lower end of the lever 169 and is provided with a lug which normally engages a lug formed on the lever. When, therefore, the arm 175 in its downward movement strikes the block, the lever 169 is swung in a counterclockwise direction. If, however, the treadle is immediately released as is usually the case and rises to the position shown under the influence of the usual spring, the arm 175 merely rocks the block 173 on its pivot and imparts no movement to the lever 169. The clutch is therefore of the non-repeating type.

In order to bring this arm to rest at the end of one revolution, the vertical shaft 133 (Fig. 1) carries a small cam 183 which, at the proper time, engages one end of a horizontal lever 185 pivoted at 187 to the frame of the machine and swings this lever about its pivot. The end of this lever remote from the cam 183 is connected by a short horizontal link 189 (Fig. 4) to the upper end of the lever 169 and thus swings said lever in a clockwise direction, as viewed in Fig. 4, to break the toggle, thereby disconnecting the friction clutch member 149 from the driving pulley 147 and causing the brake disk 145 to become operative.

The shoe and the method of making it are not herein claimed but form the subject-matter of the parent application identified above.

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

1. A machine of the class described having, in combination, a mold for a rubber sole blank, said mold comprising a base having a sole-shaped cavity therein and a plurality of thin plates having formed in them a sole-shaped opening of smaller size than the opening of the cavity, and means for first yieldingly pressing marginal portions of the bottom of a partly finished shoe against the rim of the opening in the plates and for thereafter positively pressing other portions of the bottom against a rubber sole blank in the mold.

2. A machine of the class described having, in combination, a rubber sole mold having an opening, means for pressing the margin of a previously lasted shoe against the rim of the opening and other portions of the bottom against a sole blank in the mold, said means comprising a form having a yielding marginal portion and an unyielding middle portion, and means for vulcanizing the rubber sole blank.

3. A machine of the class described having, in combination, a rubber sole mold having an opening the rim of which is substantially a plane surface, means for pressing the margin of a previously lasted shoe against the rim of the opening and other portions of the bottom against a sole blank in the mold, said means comprising a form having a yielding marginal portion and an unyielding middle portion, and means for vulcanizing the rubber sole blank.

4. A machine of the class described having, in combination, a rubber sole mold having an opening, means for pressing the margin of the bottom of a previously lasted shoe against the rim of the opening and other portions of the bottom against a sole blank in the mold, said means comprising a main portion the bottom of which is convexly curved widthwise, and an elastic plate beneath the main portion having its margin spaced from the margin of the bottom of the main portion, and means for vulcanizing the rubber sole blank.

5. A machine of the class described having, in combination, a rubber sole mold having an opening, means for pressing the margin of the bottom of a previously lasted shoe against the rim of the opening and other portions of the bottom against a sole blank in the mold, said means comprising a main portion of rigid structure and a spring plate beneath the main portion, the edge of the plate extending beyond the edge of the bottom of the main portion, and means for vulcanizing the rubber sole blank.

6. A machine of the class described having, in combination, a rubber sole mold having an opening, means for pressing the margin of the bottom of a previously lasted shoe against the rim of the opening and other portions of the bottom against a sole blank in the mold, said means comprising a main portion and a plate beneath the main portion having a series of spring fingers at its margin, and means for vulcanizing the rubber sole blank.

7. A machine of the class described having, in combination, a rubber sole mold having an opening, means for pressing the margin of the bottom of a previously lasted shoe against the rim of the opening and other portions of the bottom against a sole blank in the mold, said means comprising a main portion the bottom of which is convexly curved widthwise and substantially flat lengthwise, an elastic plate beneath the main portion having its margin spaced from the margin of the bottom of the main portion, and means for vulcanizing the rubber sole blank.

8. A machine of the class described having, in combination, a rubber sole mold having an opening, means for pressing the margin of the bottom of a previously lasted shoe against the rim of the opening and other portions of the bottom against a sole blank in the mold, said means comprising a main portion the bottom of which is convexly curved widthwise and substantially flat lengthwise, and a spring plate beneath the main portion having an outline corresponding approximately to that of the insole of the shoe, the edge of the plate extending beyond the edge of the main portion, and means for vulcanizing the rubber sole blank.

9. A machine of the class described having, in combination, a rubber sole mold having an opening, means for pressing the margin of the bottom of a previously lasted shoe against the rim of the opening and other portions of the bottom against a sole blank in the mold, said means comprising a main portion the bottom of which is convexly curved widthwise and substantially flat lengthwise, and a spring plate beneath the main portion having an outline corresponding approximately to that of the insole of the shoe, the edge of the plate being slotted and extending beyond the edge of the main portion, and means for vulcanizing the rubber sole blank.

10. A machine for vulcanizing a rubber sole to a shoe having, in combination, a mold for holding a sole blank, a form for holding a shoe, a carrier for the form, and means for producing relative movement of approach and separation between the mold and the carrier in a path which maintains the bottom of the shoe in substantially parallel relation to the bottom of the mold, said carrier comprising a pivoted lever to which the form is fastened, whereby the form may be swung to one side of the mold in a position accessible to the operator.

11. A machine for vulcanizing a rubber sole to a shoe having, in combination, a mold for holding a sole blank, a form for holding a shoe, a carrier for the form, and means for moving the carrier toward and from the mold in a path which maintains the bottom of the shoe in substantially parallel relation to the bottom of the mold, said carrier comprising a pivoted lever to which the form is fastened, whereby the form may be swung to one side of the mold in a position accessible to the operator.

12. A machine for vulcanizing a rubber sole to a shoe having, in combination, a mold for holding a sole blank, a form for holding a shoe, and mechanism for producing relative movement between the form and the mold to press the bottom of the shoe against the blank, said mechanism comprising toggle levers and yielding means for straightening said levers.

13. A machine for vulcanizing a rubber sole to a shoe having, in combination, a mold for holding a sole blank, a form for holding a shoe, and mechanism for producing relative movement between the form and the mold to press the bottom of the shoe against the blank, said mechanism comprising toggle levers, a spring connected to the knuckle of the toggle, and means for changing the tension of the spring.

14. A machine for vulcanizing a rubber sole to a shoe having, in combination, a mold for holding a sole blank, a form for holding a shoe above the mold, a carrier for the form comprising a vertically reciprocating rod, and a lever, the form being fastened to the lever and having a portion engaging the rod.

15. A machine for vulcanizing rubber soles to shoes having, in combination, a turret embodying a hollow plate, means for heating the plate, a plurality of sole molds located in a circularly arranged series of stations on the plate, a series of shoe forms normally located above the molds, a cover for the turret having an opening through which a shoe may be removed and replaced, and operator-controlled means located adjacent to the opening for rotating the turret at will an angular distance sufficient to bring the stations successively into a position opposite the opening.

16. A machine for vulcanizing rubber soles to shoes having, in combination, a turret embodying a plate, stationary means for conducting steam to the plate, a plurality of sole molds located in a circularly arranged series of stations on the plate, a series of shoe forms normally located above the molds, a cover for the turret having an opening through which a shoe may be removed and replaced, and operator-controlled means located adjacent to the opening for rotating the turret at will an angular distance sufficient to bring the stations successively into a position opposite the opening.

17. A machine of the class described having, in combination, a mold for a rubber sole blank, said mold having an opening, means acting first to press the margin of the bottom of a partly finished shoe against the rim of the opening to seal the joint between the shoe and the mold against the escape of rubber and thereafter to bend the middle portion of the bottom of the shoe into the mold, and means for vulcanizing the sole blank.

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