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A. B. LEWIS
VULCANIZING PRESS

2,525,609

Filed June 28, 1947

4 Sheets-Sheet 1

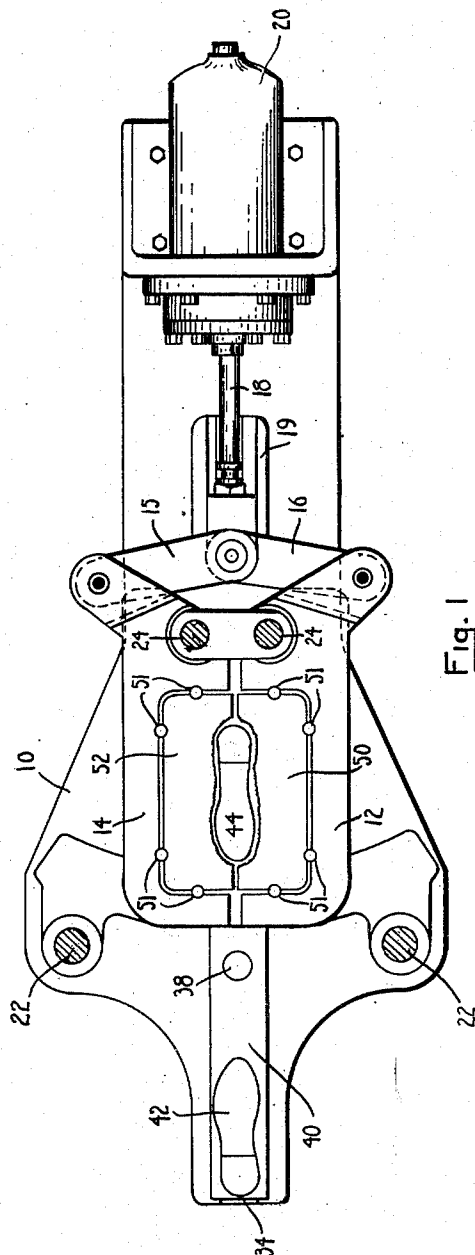


Fig. 1

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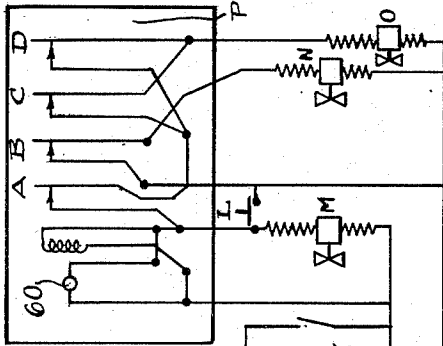


Fig. 5.

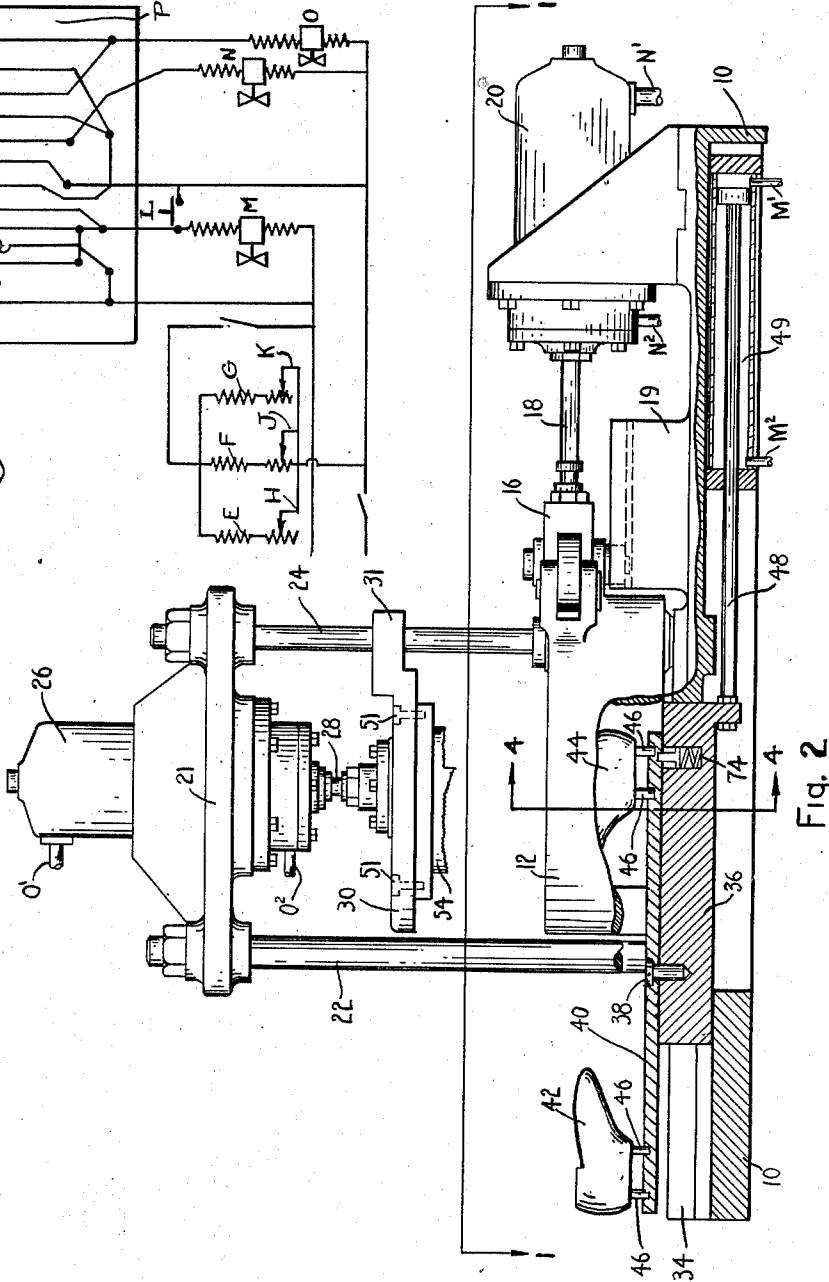


Fig. 2

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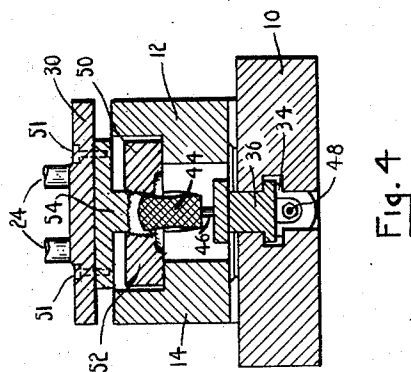


Fig. 4

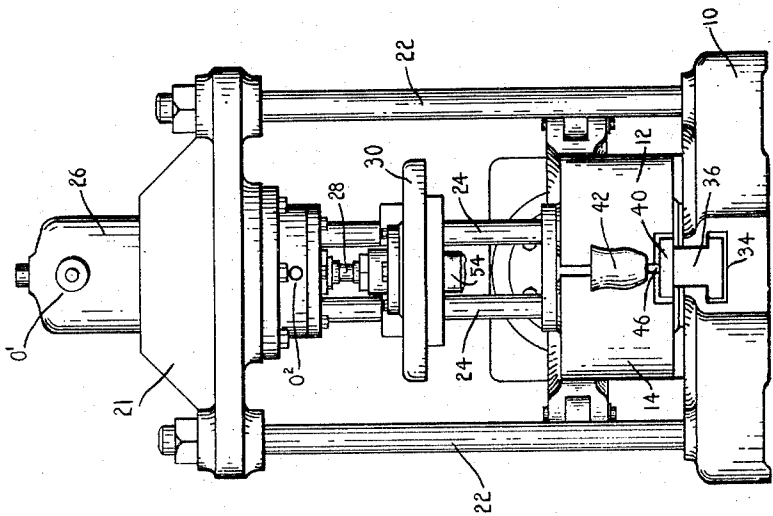


Fig. 3

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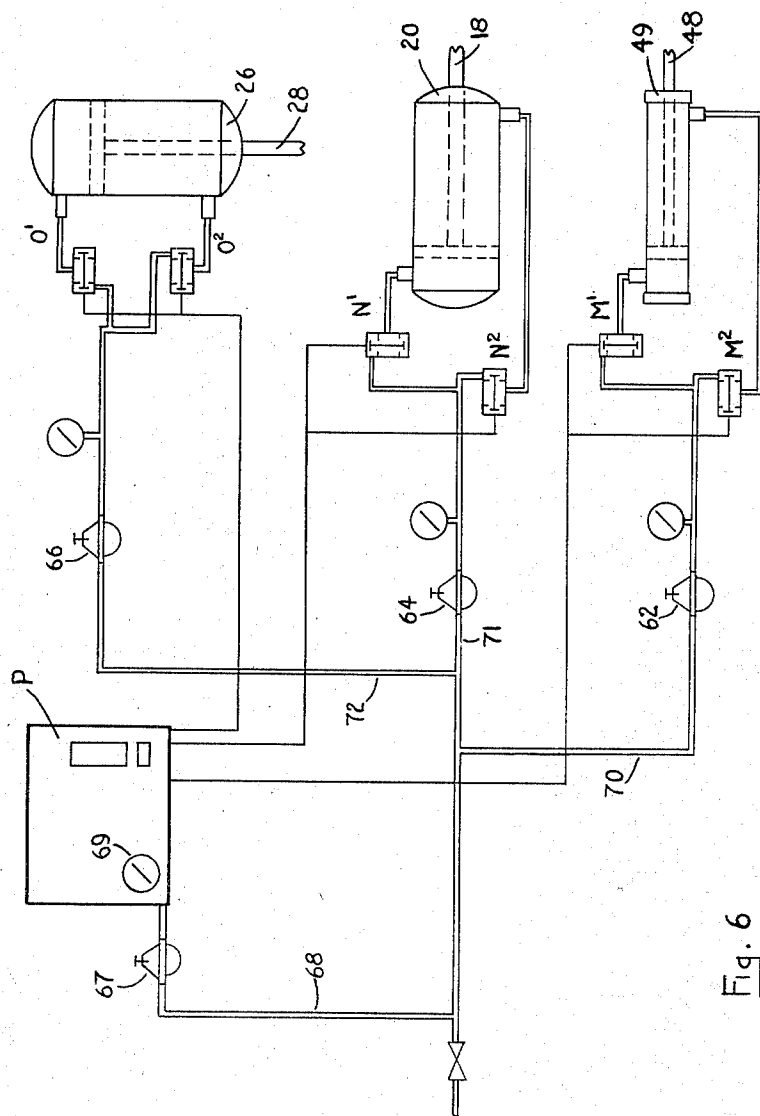
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VULCANIZING PRESS

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In Canada March 25, 1947

11 Claims. (Cl. 18—17)

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Introduction

This invention relates to an improved automatic footwear vulcanizing apparatus, and more particularly to one which is adapted to automatically vulcanize rubber soles to fabric uppers.

In the art of manufacturing footwear having fabric uppers and rubber soles, it has been necessary to perform the majority of the operation manually, such as first coating the fabric with a solvent or latex cement to promote adhesion and applying a foxing strip, which ultimately forms the finished edge between the sole and the upper. The many subsequent manual operations not only prolonged the time needed to complete the assembling operation, but raised the cost of the finished article, and due to the human element used in placing different parts, it is almost impossible to produce a run of identical articles.

The preformed soles used had to be calendered with a roll capable of imprinting a design, and then cut to an exact shape, generally with a beveled edge. This operation is costly, and the resultant quality and wear of the finished product depends greatly upon this operation.

Objects

It is an object of this invention to provide an apparatus which will be completely automatic from the time the last is charged until the last has been discharged from the vulcanizing apparatus carrying the finished shoe.

A further object of this invention is to provide a means whereby the last may be charged and placed in such a position that the balance of the vulcanizing operation is carried out automatically.

It is a still further object of this invention to provide a machine adapted to form a roughly preformed mass of vulcanizable elastomer into a sole and affix the sole by impregnation to a fabric sock.

It is also an object of this invention to provide a vulcanizing machine capable of automatically carrying out the various motions needed to form a rubber sole with design and affix it to a fabric upper of a piece of footwear.

It is also an object of this invention to provide a vulcanizing machine capable of vulcanizing soles of different thickness without a change of dies.

It is a further object of this invention to eliminate the use of inflammable cements in the manufacture of fabric-top shoes, thereby greatly reducing the fire hazard constantly present in the manufacture of said type of rubber footwear.

It is a still further object of this invention to

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provide a vulcanizing machine in which the dies can be quickly changed in order to make a different style or size of shoe.

Preferred structure

A preferred structure according to the invention which is adapted to accomplish the above objects, includes a base and a superstructure which will carry the necessary electrical, hydraulic, and mechanical apparatus.

Slidably operable in the base is a controlled slide member upon which is pivotally mounted a beam carrying a pair of lasts, one at each end. This beam is adapted to pivot on its centre, thus placing one of the lasts within the superstructure of the machine, while the other last is outside in a convenient position for charging by the operator. To enable the beam to be swung 180° to reverse the position of the lasts the mounting for the beam is slidable sufficiently to free the lasts of the superstructure. A double-acting ram, automatically controlled, is workably attached to this slide to draw the last into the vulcanizing position and to eject the last from the machine.

Pivoted on the base to the rear of the aforementioned slide are a pair of laterally pivoting side presser plates carrying side vulcanizing dies, which are operated by means of a ram. Mounted on the superstructure is a double-acting ram which is adapted to raise and lower the sole die which is detachably fixed to the piston of the ram. The sole die is adapted to be lowered under yielding pressure to register with the side dies, which form a mold cavity when closed, and to be stopped by the reverse pressure of the charge. This feature allows for the thickness of the finished article to be set by the quantity of the charge. Thus it is not necessary to have different dies for different thicknesses of finished article.

Timing cycle

To insure that the vulcanizing cycle is carried out identically in each case, an automatic timing device synchronizes the movement in the following order:

Assuming that the vulcanizing machine has just completed a full cycle and the operator has charged the outermost last and is ready to start a new vulcanizing cycle, he swings the pivotally mounted last beam through 180°, so that the the newly charged last is closest to the open side presser plates, and the shoe just finished is close to the operator. From this point on the complete vulcanizing action is automatic and

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timed by the timing device. The following sequence takes place:

1. The operator presses the momentary contact button, starting the automatic timing device.

2. The automatic timing device, through an electrical circuit and a four-way solenoid-operated diaphragm valve causes a ram to draw the charged last into vulcanizing position coincident to the vulcanizing dies.

3. The timer through a second circuit and valve causes a second ram to close the side presser plates and the side dies onto the charged die.

4. Through a third circuit and another valve the timer causes a third ram to lower the sole pressure plate and sole die under yielding pressure into coincidence with the charged last and the side dies, the charge stopping the downward motion of the die.

5. After a predetermined time the automatic timer causes the last-mentioned ram to momentarily lift the sole die free of the charged die, thus releasing any trapped air or gases. The ram, actuated by the timer, then lowers the sole die by yielding pressure into vulcanizing position for the duration of the vulcanizing period. After the vulcanizing period has elapsed the timer reverses the procedure causing—

6. The sole presser plate and die to lift clear of the last,

7. The side presser plates and dies to open, and

8. The last to be moved forward clear of the dies and superstructure, thus completing the vulcanizing cycle, the last setting of the timer stopping the mechanism of the timing device.

The operator, having charged the free last during the aforementioned vulcanizing cycle, then rotates the beam 180° and the vulcanizing operation is ready to be started again merely by pushing the momentary contact button. While the vulcanizing operation is in progress, the operator removes the finished shoe from the free last and charges it again, ready for the subsequent vulcanizing cycle.

In order that the presser plates may be kept at the proper heat, thermostatic control is included so that the electric heating elements in the dies are at all times controlled to a set heat.

Detailed description

Still other features will be apparent in the course of the following detailed description in which reference is made to the accompanying drawings, in which:

Figure 1 is a plan view of the vulcanizing apparatus showing the side presser plates closed and the sole presser plate above the section line.

Figure 2 is a side elevation of the vulcanizing apparatus partly in section with the sole presser plate open and the side presser plates closed.

Figure 3 is a front elevation of the apparatus with the side presser plates closed and the sole presser plate open.

Figure 4 is a section taken on the line 4—4, Figure 2, showing the side and sole presser plates closed in vulcanizing position and illustrating the position of the heated molds to the presser plates.

Figure 5 is a wiring diagram of one of the methods for controlling the separate motions of various automatically movable parts.

Figure 6 is a diagrammatic layout showing the control of the hydraulic system operating the various automatic motions of the vulcanizing press.

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With reference to the drawings, the apparatus is mounted on a base 10, which is supported at operating height by floor legs or other suitable means, which are not shown. A pair of side presser plates 12 and 14 are each pivotally mounted adjacent one end for horizontal swinging movement on one of a pair of spaced apart vertical supporting members 24. The side presser plates 12 and 14 include extended portions adjacent the pivotally mounted ends which are linked by means of link bars 15 and 16 to a piston rod 18. This piston rod is operated by a hydraulic ram 20 and guided in the piston guide 19.

Superimposed above the base 10 is the superstructure 21 supported by the pairs of vertical members 22 and 24. Mounted on this superstructure is a second hydraulic ram 26 which operates vertically, the piston 28 of the ram 26 being connected to a sole presser plate 30. The presser plate 30 is guided in its vertical travel by a tail portion 31 which is formed to encompass the two rear vertical members 24.

Towards the front and centrally located is a slide member 36 which is slidably mounted in a groove 34 formed in the base 10. Situated to the rear of the base 10 and attached to the slide member 36 by means of a piston 48 is a third hydraulically operated ram 49. The action of this ram 49 is to slide the member 36 in and out as controlled by the timer. Pivotaly mounted by the pin mounting 38 to the slide member 36 is the last beam 40 upon which are detachably mounted a pair of lasts 42 and 44 which are held in a substantially upright position by mounting pins 46.

Detachably mounted to the side presser plates 12 and 14 are electrically-heated vulcanizing dies 50 and 52 which are shaped to form the side portions of the vulcanized sole. These side dies are detachably mounted to the side presser plates 12 and 14 by means of Allen screws 51 or the like which facilitate quick removal and accurate linking. The side dies 50 and 52 are shaped to punch off the upper border and foxing line and to pattern the side portion of the sole during the vulcanizing action. The uppermost portion (as illustrated) of the dies have inside walls which are substantially vertical and are adapted to mate with the sole die 54.

Detachably mounted by Allen screws 51 to the sole presser plate 30 is an electrically-heated sole die 54 which is shaped to fit into a cavity formed when the side dies are in the closed position. This die 54 is adapted to form the shape and pattern on the sole.

The timing and operation of the presser plates form a vulcanizing cycle, which will be outlined later, and illustrated in Figure 5 is the wiring diagram of an electrical timing device which may be used to control the sequence of movement of the hydraulic system operating the rams.

Illustrated in Figure 6 is the hydraulic system including the pipe lines and their hook-up to the automatic timing device. It will be understood that other circuits or timing devices may be used and the ones illustrated are only for simplicity in describing the motions of the vulcanizing apparatus during the vulcanizing cycle.

With reference to Figure 5 showing a preferred timing circuit, the synchronous motor 60 is adapted to open and close the circuits A, B, C, and D which operate four-way diaphragm-operated solenoid valves M, N, and O, controlling the operation of the individual rams 20, 26 and 49.

Figure 6,

Circuit A, controlling the timer and movement of the sliding member 36,

Circuit B, as well as energizing the timer itself, controlling the movement of the side presser plates 12 and 14,

Circuit C, controlling the movement of the sole presser plate 30, up to and including a bumping action,

Circuit D, controlling the sole presser plate 30 from after the bumping action to the end of the cycle.

The cycle of vulcanizing which includes the above circuit controlled movements of the elements of the apparatus, is initiated by the pressing of the momentary contact button L and the setting of the timer causing the energized circuits to operate solenoid-actuated valves M, N, and O, the valve M actuating the sliding member 36, the valve N, the side presser plates, and the valve O, the sole presser plate. The last setting of the timer is to open the complete circuit at the end of one vulcanizing cycle, stopping the synchronous motor 60.

Heater circuits are also illustrated which include elements in the two side dies and the sole die. These heating elements E, F, and G, are controlled by individual rheostats, H, J, K, the heat of the dies being checked by gauges not shown on drawings.

Figure 6 illustrates diagrammatically an automatic timer P and pneumatic circuits operating the three rams 20, 26 and 49. In this diagram each four-way diaphragm-operated valve of Figure 5 is replaced by two three-way pilot valves M¹-M², N¹-N², O¹-O². Each of the three-way pilot valves is controlled by the timer P, so that for example with the ram 26, the valve O¹ is positioned to allow pressure from the air line to one end of the cylinder, while the valve O² is positioned to allow exhaust from the cylinder. When the operation of the ram is reversed, O² is open to the pressure line and O¹ is positioned to exhaust. Reduction valves 62, 64 and 66 are placed in the individual supply lines for the rams along with gauges in order that the pressure in each line may be adjusted. In the instances when a hydraulic or pneumatic timer device is used, a pressure pipe line 68, including a reduction valve 67 and a pressure gauge 69, is run from the main pressure system to the timer. The feeder pipe lines 70, 71, 72, are run from the main pressure pipe line through the respective pilot valves to the rams.

The vulcanizing cycle

The vulcanizing cycle comprises a series of operating motions of the apparatus which are timed and co-ordinated by a timing device P, which is started by the operator pressing the momentary contact button L in Figure 5.

However, prior to starting the vulcanizing cycle, the operator must first charge one of the lasts 42-44 by placing over the last the pre-formed fabric sock which forms the upper of the footwear to which the rubber sole is to be fixed. A predetermined mass of vulcanizable elastomer is then placed on the sole portion of the sock. The last is now charged and ready for the vulcanizing, the apparatus having finished a vulcanizing cycle and stopped with the moving parts in the following positions. The piston 48 of the ram 49 is extended thereby placing the slide member 36 in its forward position so that the pivotally-mounted last beam 40 is free to swing clear of the superstructure mounting rods

22. The side presser plates 12 and 14 including the dies 50 and 52 mounted thereon, are open with the piston 18 of the ram 20 extended. The sole presser plate 30 with the sole die 54 mounted thereon is lifted and the piston 28 of the ram 26 which operates this presser plate is retracted.

The operator having charged the last as described, swings the last beam 40 through 180° where it is stopped in true alignment by a spring-urged ball catch 74 which is fixed in the sliding member 36. The machine is now ready for the automatic vulcanizing cycle, and the operator presses the momentary contact button L, which in the case of the electrical timer, (Figure 5) starts the synchronous motor 60 which governs the timing and action of the various rams.

The circuit A closed by the timer opens the channel in the valve M, diagrammatically illustrated in Figure 6 as M², causing the retraction of the piston 48 draws the sliding member 36 including the last beam 40 into position so that the charged last 44 (for example) is in proper vulcanizing position coincident with the side dies 50-52 and the sole die 54. Before the piston 48 is fully retracted the circuit B is closed by the timer operating N² of the valve N causing retraction of the piston 18 of the ram 20. The retraction of the piston 18 through the linkage members 15 and 16 close the side presser plates 12 and 14 upon which are detachably mounted the side dies 50-52 into side contact with the charged last 44.

Coincident with the closing of the side dies, the timer closes the circuit C operating O¹ of the valve O causing the sole presser plate to descend by the expulsion of the piston 28 from the ram 26. The sole die 54 mates with the now closed side dies 50-52 and the heat and pressure generated by the dies causes the vulcanizable elastomer on the charged last to penetrate the fabric of the sock and form the sole fixed to the sock. The stroke of the piston moving the sole die is limited by the amount of stock that is placed on the last. For thicker or thinner soles it is not necessary to change the die, but only to vary the amount of vulcanizable elastomer used when charging the last.

After a predetermined time the timer causes the circuit C to reverse opening the valve O causing the pressure to flow through O² thus lifting the sole die. The timer closes the circuit D causing the sole die to descend again into mating position as before. This last-mentioned action of the sole presser plate and die is known throughout the trade as "bumping," the action being to momentarily lift and then return the sole die to allow the escape of trapped air and gases from the molten rubber which causes defective molding.

The timer allowing sufficient time to complete the vulcanizing of the rubber forming the sole, reverses the procedure by opening the circuit D allowing pressure through O² of the valve O, lifting the sole die and presser plate. Likewise opening circuit B causes the opening of the side presser plates and dies, and lastly opening the circuit A causes the extending of the piston 48 which through the sliding member 36 and the last beam causes the forward movement of the last 44, which carries the finished vulcanized shoe forward clear of the superstructure mounting rods 22, thus completing the vulcanized cycle leaving the sole presser plate up, the side presser plates open, and the last carrying the vulcanized shoe in its forward position and stops the opera-

tion of the timer P at the completion of the cycle.

The operator, during the elapsed time of the vulcanizing cycle just explained, has charged the last 42, which has remained free of the vulcanizing action, and as the sliding member 36 comes to rest in its forward position, swivels the last beam 40 on its pivotal mounting, thus interchanging the position of the lasts 42 and 44. The pressing of the momentary contact button initiates another vulcanizing cycle using the last 42 while the operator removes the finished shoe from the last 44 and charges it again ready for another vulcanizing cycle.

Advantages

Some of the advantages of the applicant's vulcanizing machine are:

1. The machine produces identical shoes, which is not possible by handwork. To amplify this statement, where the operations are performed by hand, one operator will place the foxing high and another low.

2. The resulting shoe is better and stronger because the rubber is impregnated right into the fabric of the sock thus supplying a far stronger bond between the sock and the sole which is important to long life of the shoe.

3. The machine in itself would occupy much less factory space, resulting in greater production from smaller floor space.

4. The automatic cycle of the machine permits one operator to tend several machines, the automatic stopping of the machine and the ejection of the finished shoe from contact with the dies, eliminates any chance of over-curing.

5. The fact of being able to vary the thickness of the vulcanized sole without changing the sole die.

It will be understood that without departing from the spirit of the invention or the scope of the claims, various modifications may be made in the specific expedients disclosed. The latter are illustrative only and not offered in a restricting sense, it being desired that only such limitations shall be placed thereon as may be required by the state of the prior art.

The sub-titles used throughout the specification are merely to simplify reference thereto and should otherwise be disregarded.

I claim:

1. An apparatus for making footwear having at least a sole of vulcanizable elastomer, including a fixed frame, a last for supporting the footwear structure including a sole blank of elastomer in sole-uppermost position, a substantially vertically movable sole die and a pair of substantially horizontally movable side dies, comprising, a supporting means for the last mounted on the frame for horizontal movement into a terminal position to clear the last from the dies for loading and into another terminal position wherein the last is in fixed moulding position within access of said dies, means for moving the side dies into moulding position close to the fixed last to form a die cavity, and means for bringing the sole die down into said cavity into contact with said sole blank on the last while the last remains in fixed position.

2. An apparatus for making footwear having at least a sole of vulcanizable elastomer, including a fixed frame and in which a last supports the footwear structure including a sole blank of elastomer in sole-uppermost position for action thereon of a substantially vertically moveable

sole die and a pair of substantially horizontally moveable side dies, comprising, supporting means for two such lasts mounted on the frame for substantially horizontal movement into a terminal position to clear a last from the dies for loading and into another terminal position in which one of the lasts is in fixed moulding position within access of the dies, said supporting means including a member slidable in the frame and a beam pivotally mounted on said member for rotational movement into ready position in which one of the lasts is in alignment for movement into moulding position, one of the lasts being mounted on each end of said beam whereby one last may be pivoted into said alignment while the other is in loading position and vice versa, means for moving the side dies close to the last in fixed moulding position and holding them there to form a die cavity, and means for bringing the sole die down into the cavity into contact with the sole blank on the last in fixed moulding position.

3. An apparatus, according to claim 2, wherein said member is connected to a hydraulic piston operative within a cylinder, there is a source of pressure for said cylinder, and means for controlling the supply of pressure to the cylinder to move the piston so that said member is moved into and out of moulding position.

4. An apparatus as claimed in claim 2, wherein there is resilient catch means acting between the beam and said supporting member to retain the beam and a last mounted thereon in fixed alignment for movement into moulding position.

5. An apparatus for making footwear having at least a fixed sole of vulcanizable elastomer, including a frame, a last for supporting the footwear structure including a sole blank of elastomer in sole-uppermost position, a substantially vertically movable sole die and a pair of substantially horizontally movable side dies including means for moving the last horizontally into and out of fixed moulding position, wherein one end of each side die is pivotally mounted to the frame whereby the dies are adapted for substantially horizontal swinging movement inwardly towards the fixed last to form the sides of the footwear sole and to form with the last a moulding cavity, means for moving the side dies into moulding position against the last while the last remains in fixed position to form a die cavity, and means for moving the sole die into said die cavity against the sole blank.

6. An apparatus, according to claim 5, wherein the ends of the dies are linked by a toggle to a single source of pressure, and there is controlling means for said source of pressure whereby the piston may be reciprocated to move the side dies into and out of moulding position.

7. An apparatus, according to claim 6, wherein the source of pressure is a fluid-operated piston within a cylinder and means for providing pressure to the cylinder to actuate the piston, and the controlling means is means for controlling said pressure supply to control the operation of said piston.

8. An apparatus for making footwear having at least a sole of vulcanizable elastomer, including a fixed frame, a last for supporting the footwear structure including a sole blank of elastomer in sole-uppermost position, a substantially vertically movable sole die and a pair of substantially horizontally movable side dies, wherein the side-moulding dies are arranged for substantially horizontal movement to a point adjacent the last

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while the last remains in fixed position to form a substantially vertical mould cavity above said blank, and the sole-moulding die is adapted for vertical movement into said cavity against said blank, the sole-moulding die being mounted on a piston operable within a fluid pressure cylinder, a source of fluid pressure to said cylinder, and means for controlling said pressure whereby the sole-moulding member may be reciprocated into and out of position relative to said fixed last.

9. Apparatus, according to claim 8, wherein guiding means is provided whereby said sole die is guided positively throughout its stroke into register with said moulding cavity.

10. An apparatus, according to claim 9, wherein said guiding means includes a pair of upright shafts on the frame, a support mounted on an upper portion of said shafts, said cylinder is mounted on said support and said sole-moulding member is provided with an extended portion having a bearing engaging said shafts.

11. An apparatus for making footwear having at least a sole of vulcanizable elastomer, including a fixed frame, a last for supporting the footwear structure including a sole blank of elastomer in sole-uppermost position, a substantially vertically movable sole die and a pair of substantially horizontally movable side dies, wherein the last is mounted for horizontal movement into one terminal position to clear the last of the dies for loading, and into another terminal position

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wherein the last is moved into fixed moulding position within access of the dies, said side dies are pivoted for horizontal swinging movement towards each other to form therebetween a die cavity surrounding the fixed last, and said sole die is mounted for substantially vertical movement to said cavity and to a position within said cavity for moulding, there is first means for moving said last, second means for moving said side dies, and third means for moving said sole die, controlling means controlling the operation of said first, second and third means, whereby the last is first moved into fixed moulding position then the side dies and then the sole die, and whereby the last and dies are moved out of vulcanizing position in reverse sequence after the vulcanizing operation.

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