PATENT SPECIFICATION 714,241

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COMPLETE SPECIFICATION.

Improvements in the Manufacture of Shoes and the like.

We, THE BRITISH BATA SHOE COMPANY LIMITED, a British Company, of East Tilbury, Essex, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement :—

This invention relates to the manufacture of shoes, slippers, boots and the like (hereinafter called " shoes ") of the type having a sole composed of a porous rubber, such as sponge rubber, or equivalent material (hereinafter called " porous sole material ").

The invention comprises a vulcanising sole-forming mould which is composed of parts relatively movable to-and-from one another to separated and united positions, and a part which serves as a base whereon said parts move, the surface of the base part in all longitudinal sections being shaped to conform with the ground-engaging shape of the sole, but in all cross sections being straight, and said relatively movable parts having their surfaces formed as counterparts to the base-part surface where they bear upon it, so that said relatively movable parts are slidable across the base part but are locked against longitudinal movement, and all said parts forming an interior which receives vulcanisable porous sole material and the bottom of which is closed by the base part, and said relatively movable parts having an open mouth with a lip against which a lasted upper-and-insole sock can abut as an airtight closure to the mouth.

The invention also comprises a machine incorporating a vulcanising sole-forming mould as aforesaid.

The invention also comprises a method of making a shoe by use of a mould such as aforesaid, the method consisting in placing outsole material in the mould to line the bottom of the sole-forming interior, partly filling said interior with a vulcanisable porous rubber mixture, closing said interior by applying a lasted upper-and-insole unit, or sock, to the lipped mouth, an air cavity being left above the mixture, pressing the last towards the base component so that the lasted upper-and-insole unit makes seal with the lipped mouth and applying heat so that the mixture is vulcanised and swells to fill the entire interior and bind itself to the said unit and outsole material, the rubber becoming porous by diffusion through it of the gases generated during vulcanisation, such gases being trapped in the mould interior by the sealing action.

The upper-and-insole unit may be composed of any appropriate material, for example textile material, felt or leather or any combination of any two or all three of these materials.

The invention also comprises a shoe when made by the aforesaid method.

The accompanying drawings illustrate an example of a composite shoe-making machine by which the method of making shoes is performed, and they include diagrams of a finished shoe. In the drawings :—

Fig. 1 is a front elevation and Fig. 2 a plan of the composite machine consisting of a battery of component machines, parts being broken away.

Fig. 3 is a section approximately on the line 3—3 of Fig. 1, showing a side-by-side pair of component machines.

Fig. 4 is a view in the same direction as Fig. 1, being partly a section on the line 4—4 of Fig. 3.

Figs. 5 and 6 are views corresponding to portions of Figs. 3 and 4, respectively, but showing the parts differently positioned.

[*Price 2s. 8d.*]

Fig. 7 is a section on the line 7—7 of Fig. 3.

Figs. 8 and 9 are plans of two side-by-side moulds showing one of them fully closed and the other fully opened, respectively.

Figs. 10 and 11 are longitudinal and cross sections, respectively, showing the materials of the upper-and-insole unit and of the sole structure of a shoe in relation to the last and the mould. Fig. 10 being a section on the line 10—10 of Fig. 11 and Fig. 11 being a section on the line 11—11 of Fig. 10.

The composite machine is built up as a battery of any number of pairs of component machines, each of which pairs is a complete unit. The composite machine comprises a long frame 20 surmounted by a longitudinal endless-belt conveyor 21 for removal of the shoes. Each component machine according to the example incorporates two side-by-side moulds, the machine being controlled by a lower hand-lever 22, an upper hand-lever 23 and a foot-lever 24. As Figs. 1 and 2 show, two rows of such machines are incorporated in the composite machine, the machines of one row being at the opposite side of the frame 20 from, and facing oppositely to, the machines of the other row.

Each lower hand-lever 22 is provided for the work of opening and closing the two side-by-side moulds of one component machine.

The moulds are all similar to one another, being illustrated best by Figs. 4, 6, 8, 9, 10 and 11. As shown therein, each mould comprises the following parts: two transversely slidable parts 25 and 26, which may be called an inner part and an outer part, respectively; a base part 27 upon which the parts 25, 26 can slide and which is a stationary fixture on a bed-plate 28 secured to the frame 20. Each hand-lever 22 has a stationary fulcrum 29 secured to the frame 20 (Fig. 5). The lever is connected to the parts of the two moulds which are operated by a toggle link-and-lever mechanism consisting of the following components which are seen best in Figs. 4, 5 and 6: a vertically movable post 30, which has a pin-and-slot connection 31 with the lever 22; four upright levers 32, 32 and 33, 33, each of which has a stationary fulcrum 34 on the frame and a universal connection 35 with one of the four mould parts; a pair of links 36 connecting the inner levers 32 to the post 30; a pair of links 37 connecting the outer levers 33 to the opposite inner levers 32 (*i.e.* the outer lever 33 of each mould is connected to the inner lever 32 of the other mould). The arrangement is such that when the lever 22 is lowered, as in Figs. 5 and 6, the inner and outer parts 25, 26 of each mould are pulled apart (*i.e.* the moulds are open) and when the lever 22 is raised, the toggle links 36 are straightened as Fig. 4 shows, so that mould parts are forced hard together (*i.e.* the moulds are closed).

Each foot-lever 24 has a stationary fulcrum 38 and is attached by a rod 39 of adjustable length to an upper lever 40, which is fulcrumed at 41 on a bracket 42 on the frame 20. The rod 39 is continually pulled upwards by a spring 39A (Fig. 3). The lever 40, at its outer end, carries a cross bar 43 with a pair of clamps 44 at its opposite ends. These clamps are for the purpose of holding down lasts in the moulds, Fig. 3 showing one of the clamps 44 engaging a last 45 indicated in dot-dash outline with an upper-and-insole unit 46 on it. These clamps also serve to apply a preliminary pressure to the lasts in order to prepare them for a subsequent heavy pressure.

Each upper hand-lever 23 is provided for the purpose of applying the requisite heavy pressure to a pair of lasted shoes in two side-by-side moulds. Each of these levers is attached to a pressure-applying cam 47, the two cams 47 forming pairs of moulds at opposite sides of the machine being journalled on a single stationary pin 48, as Fig. 3 shows. Each cam 47, with its hand-lever 23, is urged by a tension spring 49 with anchorages 49A towards the inoperative position, in which the cam lies clear of its follower 50. This follower is a roller on the inner end of the associated lever 40. The arrangement is such that when each lever 40 is inoperative, holding its clamps high above the lasts (as shown at the right-hand side of Fig. 3), its follower (not seen in Fig. 3) lies idly below the pressure-applying surface 47A of the associated cam 47. However, when each lever 40 is operative, holding its clamps applied to the associated lasts (as shown at the left-hand side of Fig. 3) its follower 50 is at a raised level suitable for engagement by the pressure-applying surface 47A of its cam. This cam is now movable by its lever 23 into the position of engagement, in which the cam for the left-hand lasts in Fig. 3 is therein shown, and accordingly heavy pressure can now be applied to the pair of lasted units 46 by the operator pulling the associated lever 23 with adequate strength.

With reference now to each three-part mould 25, 26, 27, Fig. 10 shows the shape of the upper surface 51 of the base part 27. It will be seen that the shape is of the longitudinal contour required by the ground-engaging surface of the sole, including a step 52. This shape is the same at all longitudinal sections, in transverse view, Fig. 11, the upper surface 51 is horizontal at all cross-sections from end to end. The two transversely slidable parts 25, 26 are shaped as regards their lower surfaces 53, 54 (see also Fig. 5) so that these are the exact counterpart of those portions of the surface 51

Fig. 7 is a section on the line 7—7 of Fig. 3. Figs. 8 and 9 are plans of two side-by-side moulds showing one of them fully closed and the other fully opened, respectively.

Figs. 10 and 11 are longitudinal and cross sections, respectively, showing the materials of the upper-and-insole unit and of the sole structure of a shoe in relation to the last and the mould, Fig. 10 being a section on the line 10—10 of Fig. 11 and Fig. 11 being a section on the line 11—11 of Fig. 10.

The composite machine is built up as a battery of any number of pairs of component machines, each of which pairs is a complete unit. The composite machine comprises a long frame 20 surmounted by a longitudinal endless-belt conveyor 21 for removal of the shoes. Each component machine according to the example incorporates two side-by-side moulds, the machine being controlled by a lower hand-lever 22, an upper hand-lever 23 and a foot-lever 24. As Figs. 1 and 2 show, two rows of such machines are incorporated in the composite machine, the machines of one row being at the opposite side of the frame 20 from, and facing oppositely to, the machines of the other row.

Each lower hand-lever 22 is provided for the work of opening and closing the two side-by-side moulds of one component machine.

The moulds are all similar to one another, being illustrated best by Figs. 4, 6, 8, 9, 10 and 11. As shown therein, each mould comprises the following parts: two transversely slidable parts 25 and 26, which may be called an inner part and an outer part, respectively; a base part 27 upon which the parts 25, 26 can slide and which is a stationary fixture on a bed-plate 28 secured to the frame 20. Each hand-lever 22 has a stationary fulcrum 29 secured to the frame 20 (Fig. 5). The lever is connected to the parts of the two moulds which are operated by a toggle link-and-lever mechanism consisting of the following components which are seen best in Figs. 4, 5 and 6: a vertically movable post 30, which has a pin-and-slot connection 31 with the lever 22; four upright levers 32, 32 and 33, 33, each of which has a stationary fulcrum 34 on the frame and a universal connection 35 with one of the four mould parts; a pair of links 36 connecting the inner levers 32 to the post 30; a pair of links 37 connecting the outer levers 33 to the opposite inner levers 32 (*i.e.* the outer lever 33 of each mould is connected to the inner lever 32 of the other mould). The arrangement is such that when the lever 22 is lowered, as in Figs. 5 and 6, the inner and outer parts 25, 26 of each mould are pulled apart (*i.e.* the moulds are open) and when the lever 22 is raised, the toggle links 36 are straightened as Fig. 4 shows, so that mould parts are forced hard together (*i.e.* the moulds are closed).

Each foot-lever 24 has a stationary fulcrum 38 and is attached by a rod 39 of adjustable length to an upper lever 40, which is fulcrumed at 41 on a bracket 42 on the frame 20. The rod 39 is continually pulled upwards by a spring 39A (Fig. 3). The lever 40, at its outer end, carries a cross bar 43 with a pair of clamps 44 at its opposite ends. These clamps are for the purpose of holding down lasts in the moulds, Fig. 3 showing one of the clamps 44 engaging a last 45 indicated in dot-dash outline with an upper-and-insole unit 46 on it. These clamps also serve to apply a preliminary pressure to the lasts in order to prepare them for a subsequent heavy pressure.

Each upper hand-lever 23 is provided for the purpose of applying the requisite heavy pressure to a pair of lasted shoes in two side-by-side moulds. Each of these levers is attached to a pressure-applying cam 47, the two cams 47 forming pairs of moulds at opposite sides of the machine being journalled on a single stationary pin 48, as Fig. 3 shows. Each cam 47, with its hand-lever 23, is urged by a tension spring 49 with anchorages 49A towards the inoperative position, in which the cam lies clear of its follower 50. This follower is a roller on the inner end of the associated lever 40. The arrangement is such that when each lever 40 is inoperative, holding its clamps high above the lasts (as shown at the right-hand side of Fig. 3), its follower (not seen in Fig. 3) lies idly below the pressure-applying surface 47A of the associated cam 47. However, when each lever 40 is operative, holding its clamps applied to the associated lasts (as shown at the left-hand side of Fig. 3) its follower 50 is at a raised level suitable for engagement by the pressure-applying surface 47A of its cam. This cam is now movable by its lever 23 into the position of engagement, in which the cam for the left-hand lasts in Fig. 3 is therein shown, and accordingly heavy pressure can now be applied to the pair of lasted units 46 by the operator pulling the associated lever 23 with adequate strength.

With reference now to each three-part mould 25, 26, 27, Fig. 10 shows the shape of the upper surface 51 of the base part 27. It will be seen that the shape is of the longitudinal contour required by the ground-engaging surface of the sole, including a step 52. This shape is the same at all longitudinal sections, in transverse view, Fig. 11, the upper surface 51 is horizontal at all cross-sections from end to end. The two transversely slidable parts 25, 26 are shaped as regards their lower surfaces 53, 54 (see also Fig. 5) so that these are the exact counterpart of those portions of the surface 51

where they bear upon it. Thus, the parts 25, 26 are freely slidable transversely in relation to the base part 27 but they are locked against relative longitudinal movement.

Figs. 10 and 11 also show how the slidable mould parts 25, 26 are each formed with a boundary wall 55 which is somewhat hollowed out and which is surmounted by an overhanging lip 56 with a bevelled upper surface 57. Thus it will be manifest that the mould parts 25, 26, 27 form an interior the bottom of which is closed by the base part 27 and which has an open mouth bounded by the upwardly surfaced lip 56.

The moulds have all provision of any conventional electric-resistance means (or other means) for applying vulcanising heat to the moulds at a temperature of say 140° C. Such means being customary they are not described herein.

In use of the machine, while the moulds are empty and open (Fig. 6 and 9), there are put into each of them the following sole-forming components: an outsole 58 composed of pre-cured rubber; an already cut main sole layer 59 of vulcanisable sponge rubber, this material being formed to fill the heel cavity 59A; Fig. 10; an auxiliary strip 60 (Fig. 10) of vulcanisable sponge rubber applied to the top of the main sole layer near the margin of the heel, leaving an open marginal air space 61 below the lip 56 and around the heel; a top layer 62 of hair felt cut to usual insole size, thus leaving an open marginal air space 63 below the lip 56 and extending from the toe along both sides so as to merge into the space 61.

When each mould is filled the lower side levers 22 are pulled up so that the mould parts 25, 26 are tightly closed together (Figs. 4 and 8). These parts are maintained thus closed by the now straight toggle links 36.

Meantime, upper-and-insole units, or socks, 46 intended to form the uppers and insoles of the shoes being made are put on the lasts 45, and the lasted units are located in the mouths of both moulds. This is the stage illustrated by Figs. 10 and 11.

The foot-levers 24 are operated to bring the clamps 44 down upon the lasts 45 and to lift the cam rollers 50 to the level in which they are engageable by the cams 47. Next the upper hand-levers 23 are operated to bring the pressure-applying cam surfaces 47A into action, and in this way the lasted units 46 are forced hard down upon the mould-enclosed sole materials. The material of the units 46 is squeezed against the bevel surface 57 above the lip 56 of each mould, thus sealing the mouth of the mould. The mould is now closed. Vulcanisation heat is applied for about fifteen to eighteen minutes. In this operation, the gas generated in the sponge rubber mixture expands, so that the sponge rubber swells and completely fills the mould including the air sp[illegible] 61, 63, the air being forced through the sealed mouth and the materials in the mould becoming compressed. The sponge rubber materials 59 and 60 become integrally merged, and this material binds itself to the material of the unit 46. The material 59 also binds itself to the outsole material 58. The hair felt layer 62 becomes encased as an intersole between the sponge rubber material 59, 60 and the insole portion of the unit 46.

Thereafter, the upper hand-levers 23 with their cams 47 are returned to their initial positions, following which the levers 40 with their clamps 44 rise under the pull of the springs 39A. Finally, the lower hand-levers 22 are lowered to open the moulds, following which the shoes are removed and put on the conveyor 21.

It will be manifest that, in the moulding and vulcanising operation, the gases produced become diffused throughout the swelling sponge rubber, rendering it light and porous.

The dense rubber of the outside layer 58 ensures a good wear-resisting quality to the shoe.

What we claim is:—

1. A vulcanising sole-forming mould which is composed of parts relatively movable to-and-from one another to separated and united positions, and a part which serves as a base whereon said parts move, the surface of the base part in all longitudinal sections being shaped to conform with the ground-engaging shape of the sole, but in all cross sections being straight, and said relatively movable parts having their surfaces formed as counterparts to the base-part surface where they bear upon it, so that said relatively movable parts are slidable across the base part but are locked against longitudinal movement, and all said parts forming an interior which receives vulcanisable porous sole material and the bottom of which is closed by the base part, and said relatively movable parts having an open mouth with a lip against which a lasted upper-and-insole sock can abut as an airtight closure to the mouth.

2. A vulcanising sole-forming mould according to Claim 1 in which the relatively movable parts form the wall of the mould interior, said wall being bevelled around its top to present the requisite lip for closure of the mould mouth and to ensure that gases generated by the vulcanising operation are trapped in the mould interior.

3. A vulcanising sole-forming mould substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

4. A machine incorporating a vulcanising

sole-forming mould according to any of the preceding claims, said machine including a toggle-link-and-lever mechanism connected to the relatively movable mould parts for sliding them transversely between open and closed positions and for locking them in the closed position by toggle action.

5. A machine incorporating a vulcanising sole-forming mould according to any of Claims 1 to 4, said machine including a mechanism for clamping a lasted upper-and-insole unit against the lip of the mould in combination with a cam-and-lever mechanism for applying heavy pressure to the clamping means for the vulcanising operation.

6. A machine incorporating a vulcanising sole-forming mould substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

7. A method of making a shoe by use of a mould according to any of Claims 1 to 3, the method consisting in placing outsole material in the mould to line the bottom of the sole-forming interior, partly filling said interior with a vulcanisable porous rubber mixture, closing said interior by applying a lasted upper-and-insole unit to the lipped mouth, an air cavity being left above the mixture, pressing the last towards the base component so that the lasted upper-and-insole unit makes seal with the lipped mouth, and applying heat so that the mixture is vulcanised and swells to fill the entire interior and bind itself to the unit and outsole material, the rubber becoming porous by diffusion through it of the gases produced and the gases generated during vulcanisation being trapped in the mould interior by the sealing action.

8. A shoe when made by the method according to the preceding claim.

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PROVISIONAL SPECIFICATION.

Improvements in the Manufacture of Shoes and the like.

We, THE BRITISH BATA SHOE COMPANY LIMITED, a British Company, of East Tilbury, Essex, do hereby declare this invention to be described in the following statement :—

This invention relates to the manufacture of shoes slippers, boots and the like (hereinafter called "shoes") of the type having a sole of a porous rubber such as sponge rubber.

The invention comprises a vulcanising mould having one component with a sole-forming interior open both at the mouth and at the bottom and another component which serves as a base to seal said bottom with outsole material sandwiched between the components, the sole-forming component having a lip adapted to receive a lasted upper-and-insole sock unit as an airtight closure to its mouth.

The invention also comprises a method of making a shoe by use of a mould such as aforesaid, the method consisting in placing outsole material between the mould components to close the bottom of the sole-forming interior, filling only partly said interior with a rubber mixture, closing said interior by applying a lasted sock unit to the lipped mouth, an air cavity being left above the mixture, pressing the last and the base component so as to seal the interior airtight, and applying heat so that the mixture is vulcanised and swells to fill the entire interior and bind itself to the sock unit and outsole material, the rubber becoming porous by diffusion with the entrapped air and the gases produced.

The invention also comprises a shoe when made by the aforesaid method. Such a shoe may have a sole comprising a main layer of porous rubber, a layer of textile material bound to the bottom of the porous rubber layer and, preferably, a thin outer layer of wear-resisting dense rubber bound to the textile layer.

In an example, the upper of a house shoe is composed of felt and it is stitched to a soft flexible sock lining which forms with it a unit and which serves as the insole. The sock lining is narrower than the sole width, so that when the unit is force-lasted the stitching follows a line parallel to and inside the outer limit of the last, the stitched edges projecting downwards.

The two components of the mould are hinged together, and they are formed with a cross step to give a heel formation. The top component is cut out to the shape of the desired porous rubber sole. Pins on the top component register with holes in the base component to locate the components in precise register with each other.

In use of the mould, while it is open, a piece of textile sheet cut larger than the sole size and provided with a vulcanised coat of dense rubber on the lower face is placed on the base component in such a position that a margin is left all around the proposed sole outline; and the upper component is closed so that it sandwiches the margin of

the rubberized textile. A layer of vulcanisable sponge rubber mixture cut to the size of the mould interior is put into the mould, the thickness of the layer being such that the mould is rather less than half filled. The upper unit, fully stretched to shape on an extending last, is now placed upon the mouth of the mould, the felt coming close against the entire lip and the stitched edges projecting down into the mould interior.

The last-and-mould assembly is put into a press and clamped tightly, so that the mould is sealed airtight. Heat is applied at a temperature of about 140° C., for about fifteen to eighteen minutes, so as to swell and vulcanise the mixture. Thus, the rubber expands purely upwards, completely filling the mould and binding itself to the interstitched upper and sock lining above and to the textile below.

By virtue of the airtight sealing of the mould, the air and such gases as are produced inside are trapped and become diffused through the swelling sponge rubber, rendering it light and porous.

The mould and lasted shoe are removed from the press, the mould is opened, the lasted shoe is removed, and the last is contracted and withdrawn from the shoe.

The textile layer, the margin of which is trimmed off, serves to prevent the sponge rubber from spreading when the shoe is worn and thus maintains the shape and appearance of the shoe.

The dense rubber outside layer ensures a good wear-resisting quality to the shoe.

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