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(54) SECOND-COLOUR INSERT MOULDING

(71) We, THE BRITISH BATA SHOE COMPANY LIMITED, a British Company, of East Tilbury, Grays, Essex, RM18 8RL, 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 a method of injection molding soles onto shoes, especially two-coloured soles.

The injection molding of shoes soles onto the base of a lasted upper has been practised for some time. The sole of a conventional sports shoe, e.g., a basketball, or a so-called running shoe or sneaker includes two portions, namely an inner sole or insole which forms the top portion of the sole and may be associated with a foxing strip extending around the periphery of the sole overlapping the bottom of the shoe upper and the second sole portion; and the second sole portion or outer sole, which forms the base of the sole and is embraced by the downwardly extending skirt defined by the foxing strip.

Normally, a shoe sole of the above described type is molded of two differently coloured portions of thermoplastic material, e.g., polyvinyl chloride. The inner sole is formed first in a mold cavity defined by a mold piston forming the bottom of the mold, side molds and the lasted upper, which closes the top of the mold. A first colour thermoplastic material is injected into the mold cavity and, after a suitable cooling period during which the first colour material solidifies, a new mold cavity is formed by moving the mold piston downwardly and a second colour material is injected into the mold cavity to form the sole bottom or insert, i.e., the outer sole.

The conventional method of two colour molding suffers from the disadvantages that a long delay is required between the injection of the first and second colour materials to permit solidification of the first colour. If the first colour material is not sufficiently solid, the second colour material penetrates

or passes through the first colour material. However, even if the first colour material is permitted to solidify completely, the thickness of both materials and the sole design are limited because of flow restriction during the second colour injection. For example, if the sole portions are profiled, i.e., provided with ridges and grooves, the second colour material entering the mold cavity tends to deform the ridges formed on the first colour material during the first injection step, if the first colour material is not sufficiently cured.

Thus, it is seen that the conventional two colour injection molding method is unsatisfactory in that the time required for molding is lengthy, and possibly the quality, i.e., appearance of the finished product may be poor.

The object of the present invention is to overcome or at least partly obviate the above disadvantages by providing a relatively quick two color molding method which affords a relatively high quality finished product.

The present invention consists in a two colour injection molding method for forming a shoe sole of molding material on a lasted upper comprising the steps of molding an outer sole portion in one colour and then molding an inner sole portion in a different colour to interconnect said outer sole portion and said upper, whereby a two-colour shoe sole is formed on said upper, the first and second mold cavities being formed at different locations, and, after formation of said outer sole portion at one location, said outer sole portion being moved to a second location where the second mold cavity is formed with a lasted upper and said outer sole portion.

The present invention also consists in an apparatus for forming a sole of two moldable materials for an article of footwear on a lasted upper, the sole including an inner sole portion and an outer sole portion, said apparatus comprising first mold means defining first a mold cavity for molding said outer sole portion, said first mold means including a mold cylinder, a mold piston

[Price 33p]

Price 75p

reciprocally mounted in said cylinder for movement between mold closing and mold opening positions, said first mold sides for movement between said mold closing and mold opening positions and a mold top for movement between said mold closing and mold opening positions, said mold top including a bottom surface having substantially the same shape as a last bottom, whereby the first mold cavity is formed for receiving a first moldable material for molding said outer sole portion onto said mold piston; and second mold means for defining a second mold cavity for molding said inner sole portion after said first mold cavity has been opened, said second mold means including said mold piston and said outer sole portion, second mold sides and a lasted upper.

The invention will now be defined in greater detail with reference to the accompanying drawings, wherein:

Figures 1 and 2 are schematic cross sectional views of a mold used in a conventional two colour molding method;

Figure 3 is a schematic cross sectional view of a portion of a shoe sole molded according to the conventional two colour injection molding technique;

Figures 4 and 5 are schematic cross sectional views of the molds used for the two colour molding method of the present invention;

Figure 6 is an enlarged schematic cross sectional view of a portion of a shoe sole molded in accordance with the method of the present invention;

Figures 7 and 8 are schematic, partly sectioned end views of an apparatus for performing the method of the present invention; and

Figures 9 to 12 are schematic, cross sectional and views of other forms of apparatus for performing the method of the present invention.

With reference to Figures 1 and 2, the conventional method of injection molding a two colour shoe sole includes the steps of forming a mold cavity 1 with side molds 2, a vertically movable mold piston 3 and a lasted upper 4. The mold cavity 1 thus formed is filled during a first molding step with a first colour or inner sole portion 6, which forms an insole 7 and a foxing strip 8 of the finished shoe. The inner sole portion 6 is cooled, i.e., partially cured, and then a new mold cavity is formed by moving the mold piston 3 downwardly. In a second molding step (Figure 2), a new or enlarged mold cavity 10 is filled with a second colour or outer sole portion 11, which forms the base of the finished sole.

The method described with reference to Figures 1 and 2, is intended for producing a profiled sole using a single mold piston

3 including a profiled upper surface provided with ridges 14 having grooves 15 therebetween. If the inner sole portion 6 is not sufficiently solidified when the outer sole portion is being injected into the mold cavity 10 the ridges are distorted by hot, liquid thermoplastic material flowing into the mold cavity 10 to form the outer sole portion 11. Moreover, flow of the second colour material into the mold cavity 10 is restricted by the ridges 14 and those on the inner sole portion 6. Finally, if the thermoplastic material forming the inner sole portion 6 is insufficiently cured, the second colour material may pass through the first colour material, thus forming an unsightly finished product.

Referring now to Figures 4 and 5, the method of the present invention utilizes a mold cavity 20 formed by side molds 21, a vertically movable mold piston 23 and a top mold 24. An essential difference between the two methods is that an outer sole portion 26 is formed first in the mold cavity 20 and, after curing of sole portion 26, a new mold cavity 28 is formed to receive a second colour, inner sole portion 30.

In forming the mold cavity 20, it must be remembered that the outer sole portion 26 is not molded to the base of a lasted upper. Accordingly, the top of the mold cavity 20 is closed by a top mold 24, e.g., a dummy last, the bottom surface of which has a configuration similar to that of a shoe insole.

In order to form the second mold cavity 28, the top mold portion is replaced by a lasted upper 32, which cooperates with the side molds 21 and the mold piston 23 in forming such second mold cavity. Thus, the outer sole portion 26 is molded first, and the inner sole portion 30 is molded between the lasted upper 32 and the outer sole portion 26. The thermoplastic material flowing into the mold cavity 28 to form the inner sole portion encounters minimal resistance, since the top surface 34 (Figure 6) of the outer sole portion 26 is in general smooth. Thus, the possibility of an unsightly finished product is reduced, as is the time required for molding.

A suitable apparatus for performing the method of the present invention is shown in Figures 7 and 8, and includes a pair of mold pistons 35 and 36 slidably mounted in a pneumatic cylinder 38. The cylinder 38 is pivotally mounted for rotation about a horizontal axis defined by a shaft 40. In the first molding step, i.e., the molding of the outer sole portion 26, one mold piston 35 co-operates with a lower mold 41 for forming the mold cavity 20 at a first molding station 42. The lower mold 41 is mounted on the upper end of a piston and cylinder arrangement 43, whereby the lower mold 41 can be moved from the molding position

shown in Figure 7 to a lower position (Figure 8) to permit rotation of the cylinder 38 and mold pistons 35 and 36 with the shaft 40.

After the outer sole portion 26 has been molded, the lower mold 41 is moved downwardly and the cylinder 38 is rotated to move the mold piston 35 to a second molding station, generally indicated at 44. At the second molding station 44, the second mold cavity 28 is formed for molding the inner sole portion 30. The second mold cavity is defined by the outer sole portion 26 on the piston 35, side molds 46 and a lasted upper 47.

While effecting the second molding step at the second molding station 44, a new first molding step is being performed at the first molding station 42. Thus, after the first moulding operation at molding station 42, the method can be carried out continuously, with simultaneous formation of first and second sole portions at different molding stations. Upon completion of the second molding step at molding station 44, the second mold is opened (Figure 8), and the lasted upper is moved upwardly for removal of the lasted upper and sole formed thereon.

Another form of apparatus for carrying out the method of the present invention is shown in Figures 9 and 10. In the apparatus of Figures 9 and 10, a first colour thermoplastic material is molded at a first molding station 50 to form an outer sole portion 26 in a mold cavity defined by a mold piston 51 and side molds 52, which form the sides and top of the mold cavity. The piston 51 is slidably mounted in a cylinder 53 for moving the piston 51 vertically from the first molding station 50 to a second molding station 55 where the second colour thermoplastic material, i.e., inner sole portion 30 is molded onto a lasted upper (Figure 10). After molding of the outer sole portion 26, the side molds 52 are opened and the piston 51 is moved upwardly to the second molding station 55 where side molds 57 and a lasted upper 58 are moved into position to form a second mold cavity for molding the inner sole portion 30.

The apparatus of Figures 11 and 12 is similar to that of Figures 9 and 10, except that the special side molds 52 are replaced by conventional side molds 57, and a dummy last 60 is used to close the top of the mold cavity in the molding of the outer sole portion 26. Thus, the two molding stations are in one location and, after molding of the outer sole portion 26, the only actions required are replacement of the dummy last 60 with a lasted upper 61, and upward movement of the mold piston 51. The dummy last 60 and lasted upper 61 could be mounted on piston rods in a common rotatable cylinder, whereby, after the first molding opera-

tion, the dummy last 60 can be removed from the opened mold, the cylinder rotated and the last upper inserted between the side molds 57.

It will be appreciated that the various apparatuses of the present invention could be incorporated in a turntable or turret head having stations for lasting an upper, molding the outer sole portion, molding the inner sole portion and unloading. In other words, the method of the present invention is readily adaptable to a continuous, cyclical operation, and, depending on the number of stations, a large number of shoe soles can be formed relatively quickly.

WHAT WE CLAIM IS:—

1. A two colour injection molding method for forming a shoe sole of molding material on a lasted upper comprising the steps of molding an outer sole portion in one colour and then molding an inner sole portion in a different colour to interconnect said outer sole portion and said upper, whereby a two-colour shoe sole is formed on said upper, the first and second mold cavities being formed at different locations, and, after formation of said outer sole portion at one location, said outer sole portion being moved to a second location where the second mold cavity is formed with a lasted upper and said outer sole portion.

2. A method according to claim 1 wherein the molding material is a thermoplastic material.

3. A method according to claim 1 or 2, wherein the molding material used is polyvinyl chloride.

4. An apparatus for forming a sole of two moldable materials for an article of footwear on a lasted upper, the sole including an inner sole portion and an outer sole portion, said apparatus comprising first mold means defining first a mold cavity for molding said outer sole portion, said first mold means including a mold cylinder, a mold piston reciprocally mounted in said cylinder for movement between mold closing and mold opening positions, first mold sides for movement between said mold closing and mold opening positions and a mold top for movement between said mold closing and mold opening positions, said mold top including a bottom surface having substantially the same shape as a last bottom, whereby the first mold cavity is formed for receiving a first moldable material for molding said outer sole portion onto said mold piston; and second mold means for defining a second mold cavity for molding said inner sole portion after said first mold cavity has been opened, said second mold means including said mold piston and said outer sole portion, second mold sides and a lasted upper.



* C L M S *

shown in Figure 7 to a lower position (Figure 8) to permit rotation of the cylinder 38 and mold pistons 35 and 36 with the shaft 40.

After the outer sole portion 26 has been molded, the lower mold 41 is moved downwardly and the cylinder 38 is rotated to move the mold piston 35 to a second molding station, generally indicated at 44. At the second molding station 44, the second mold cavity 28 is formed for molding the inner sole portion 30. The second mold cavity is defined by the outer sole portion 26 on the piston 35, side molds 46 and a lasted upper 47.

While effecting the second molding step at the second molding station 44, a new first molding step is being performed at the first molding station 42. Thus, after the first moulding operation at molding station 42, the method can be carried out continuously, with simultaneous formation of first and second sole portions at different molding stations. Upon completion of the second molding step at molding station 44, the second mold is opened (Figure 8), and the lasted upper is moved upwardly for removal of the lasted upper and sole formed thereon.

Another form of apparatus for carrying out the method of the present invention is shown in Figures 9 and 10. In the apparatus of Figures 9 and 10, a first colour thermoplastic material is molded at a first molding station 50 to form an outer sole portion 26 in a mold cavity defined by a mold piston 51 and side molds 52, which form the sides and top of the mold cavity. The piston 51 is slidably mounted in a cylinder 53 for moving the piston 51 vertically from the first molding station 50 to a second molding station 55 where the second colour thermoplastic material, i.e., inner sole portion 30 is molded onto a lasted upper (Figure 10). After molding of the outer sole portion 26, the side molds 52 are opened and the piston 51 is moved upwardly to the second molding station 55 where side molds 57 and a lasted upper 58 are moved into position to form a second mold cavity for molding the inner sole portion 30.

The apparatus of Figures 11 and 12 is similar to that of Figures 9 and 10, except that the special side molds 52 are replaced by conventional side molds 57, and a dummy last 60 is used to close the top of the mold cavity in the molding of the outer sole portion 26. Thus, the two molding stations are in one location and, after molding of the outer sole portion 26, the only actions required are replacement of the dummy last 60 with a lasted upper 61, and upward movement of the mold piston 51. The dummy last 60 and lasted upper 61 could be mounted on piston rods in a common rotatable cylinder, whereby, after the first molding opera-

tion, the dummy last 60 can be removed from the opened mold, the cylinder rotated and the last upper inserted between the side molds 57.

It will be appreciated that the various apparatuses of the present invention could be incorporated in a turntable or turret head having stations for lasting an upper, molding the outer sole portion, molding the inner sole portion and unloading. In other words, the method of the present invention is readily adaptable to a continuous, cyclical operation, and, depending on the number of stations, a large number of shoe soles can be formed relatively quickly.

WHAT WE CLAIM IS:—

1. A two colour injection molding method for forming a shoe sole of molding material on a lasted upper comprising the steps of molding an outer sole portion in one colour and then molding an inner sole portion in a different colour to interconnect said outer sole portion and said upper, whereby a two-colour shoe sole is formed on said upper, the first and second mold cavities being formed at different locations, and, after formation of said outer sole portion at one location, said outer sole portion being moved to a second location where the second mold cavity is formed with a lasted upper and said outer sole portion.

2. A method according to claim 1 wherein the molding material is a thermoplastic material.

3. A method according to claim 1 or 2, wherein the molding material used is polyvinyl chloride.

4. An apparatus for forming a sole of two moldable materials for an article of footwear on a lasted upper, the sole including an inner sole portion and an outer sole portion, said apparatus comprising first mold means defining first a mold cavity for molding said outer sole portion, said first mold means including a mold cylinder, a mold piston reciprocally mounted in said cylinder for movement between mold closing and mold opening positions, first mold sides for movement between said mold closing and mold opening positions and a mold top for movement between said mold closing and mold opening positions, said mold top including a bottom surface having substantially the same shape as a last bottom, whereby the first mold cavity is formed for receiving a first moldable material for molding said outer sole portion onto said mold piston; and second mold means for defining a second mold cavity for molding said inner sole portion after said first mold cavity has been opened, said second mold means including said mold piston and said outer sole portion, second mold sides and a lasted upper.



5. An apparatus according to claim 4, wherein said first mold top is integral with said first mold sides.
- 5 6. An apparatus according to claim 4, wherein said first and second mold sides are formed by the same element, and said first mold top is a dummy last.
- 10 7. An apparatus according to claim 6, including first and second piston rods supporting said dummy last and said lasted upper, respectively; and a rotatable cylinder in which said piston rods are reciprocally mounted, whereby, upon completion of the

molding of said outer sole portion and opening of said first mold cavity, said cylinder may be rotated to position said lasted upper above said outer sole portion for forming said second mold cavity.

8. Apparatus according to claim 4, substantially as shown in any of Figures 4—12 of the accompanying drawings.

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