

PATENT SPECIFICATION

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(54) FOOTWEAR, PROCESS AND DEVICE FOR THE PRODUCTION THEREOF

(71) We, SANIPED FUSSKOMFORT GESELLSCHAFT MIT BESCHRÄNKTER HAFTUNG, an Austrian Company, of 7503 Grosspetersdorf, Federal Province of Burgenland, Austria, 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:-

The invention relates to footwear, such as sandals, sport shoes, and house shoes or the like, and to processes and devices for the production thereof.

Footwear of the known type having a foot bed optimally adapted to the arch of the foot, the so-called foot form bed, supplies the natural support required for the human foot and to a large extent prevents malformation of the foot, i.e. of permanent deviations from the normal shape of the foot, such as flat or splay foot or the like, which impede the function of the foot. This type of footwear often has the form of sandals, especially exercise sandals, which are marketed provided with various coatings or also in the uncoated state. The foot form bed adapted to the arch of the foot consists entirely of wood or entirely of plastics.

The advantages of the foot form bed made of wood are the image of the natural product, high breaking strength and the ability to absorb moisture and thus prevent perspiration. The disadvantages of wood are its comparatively high specific gravity, and the many processing operations required in production, such as sawing, milling, grinding and polishing. The advantages of the foot form bed made of plastics are elasticity, low specific gravity and few processing operations required in production. The disadvantages are impermeability to moisture and the need to embed reinforcements for stiffening in many cases.

It is the object of the invention to provide footwear which is compatible to the shape of the foot and at the same time wear-resistant and easy to produce.

According to the invention there is provided an article of footwear such as a sandal, sport shoe, or house shoe, comprising a foot form bed made of plastics material and a top sheet made of wood, leather, or fibrous material, said top sheet being connected to the foot form bed and adapted in shape and size thereto wherein the foot form bed and top sheet are curved to conform to the arch of the foot and are provided with preformed complementary beads and depressions adapted to underlie the arch of the toes of the wearer's foot.

In one embodiment, the article of footwear consists of two nondeformable and connected parts the grip, porosity and sweat-absorbing capacity of which provide excellent tread and walking properties and give appropriate strength to the footwear. On the upper surface of the top sheet below the arch of the toes the bead starts at the outer edge of the sole, rises towards the middle toe and then steeply drops again and merges with, a depression provided for the ball of the big toe.

According to one embodiment of the invention, the top sheet is thin-walled in comparison to the foot form bed. The wall thickness of the foot form bed is preferably uniform throughout, but it can also vary, for instance in order to achieve greater flexibility in the area of the ball than the joint.

In order to improve the connection between the top sheet and the foot form bed, it is practical in many instances to provide the top sheet on its underside facing the foot form bed with reinforcing materials, for instance plastics materials reinforced with fibres, for example textile, glass or polyester fibres, in the form of a coating.

According to a preferred embodiment the top sheet is fixedly connected, as by moulding, to a foot form bed which consists of foamed or expanded plastics materials. The underside of this form bed may have an outsole secured thereto.

It is also possible to connect the top sheet to

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the foot form bed by form-fitting or friction means. For this purpose, it is practical to provide the surface of the top sheet which abuts the foot form bed with projections and/or recesses such as pegs, nubs or the like which are engageable with corresponding recesses and/or projections in the upper side of the foot form bed. These formations have the additional advantage that the two individual parts making up the foot form bed can be produced, stored and shipped completely independent from one another. Moreover, the top sheet and foot form bed can be simply replaced if necessary.

According to the invention there is also provided a process for the production of an article of footwear according to the invention wherein liquid working material intended for the production of the foot form bed is poured into an open-topped mould and a preformed top sheet is then placed onto the open mould so that the top sheet forms a seal for the mould cavity, the top sheet is preferably formed slightly larger than the mould cavity to form the seal. The top sheet may be shaped by means of hot pressing. This method is known *per se* for the processing of wood.

Alternatively the top sheet may be shaped by applying a vacuum. This process step has the advantage that the sheet of wood is dried during the shaping, since the water content is sucked off by means of the vacuum to a large extent and within a short time without having to apply much heat to the mould.

A further possibility is to apply a coating of liquid synthetic resin and optionally a reinforcement to the top sheet and subsequently pressing it.

The invention also contemplates a process for the production of the footwear according to the invention using a mould which is filled in the closed state from the outside through a pouring channel, wherein the top sheet is produced and preformed separately from the foot form bed by hot-pressing, shaping by means of vacuum or pressing with synthetic resin, then the preformed top sheet is placed into the mould cavity and the foot form bed is moulded onto the top sheet by means of injection of plastics material into the mould cavity. This means that the top sheet itself forms one of the definitions of the mould cavity, which greatly simplified matters. This also applies to the process mentioned in the first place.

According to these processes, the dimensions of the preformed top sheet are, preferably all round, slightly larger than the dimensions of the foot form bed. The top sheet thus simultaneously secures a seal for the mould cavity and prevents the working material injected into the mould cavity from escaping to the upper surface, i.e. the treading surface, of the top sheet.

It is preferable that the curves of the

preformed top sheet on inserting it into the mould cavity are more pronounced, preferably in all directions, than the curves in the mould cavity. This makes possible an expansion compensation so that a largely tension-free connection between top sheet and foot form bed is achieved. This also applies to the process first mentioned.

A device according to the invention for carrying out the process first mentioned above, has at least one upper mould and at least one lower mould, movable with respect of one another and is characterised in that the mould cavity is formed in the lower mould and is adapted for filling molten plastics and the underside of the upper mould is shaped complementary to the upper surface of the top sheet, the upper side of the lower mould being provided along the edge of the mould cavity with a peripheral depression serving as a support for the periphery of the top sheet.

The device according to the invention for carrying out the process second mentioned above has a mould which is fillable in the closed state from the outside through a pouring channel and comprising at least one upper mould and at least one lower mould arranged movably in respect of one another in a moulding frame, and is characterised in that the upper side of the lower mould is formed complementary to the upper surface of the top sheet and is provided with a peripheral depression serving as a support for the periphery of the top sheet.

These devices secure a simple connection between the top sheet and the foot form bed or the forming of the foot form bed onto the top sheet.

In order that the invention may be more fully understood embodiments in accordance therewith will now be described by way of example with reference to the accompanying drawings in which:-

Figure 1 shows a top sheet for a first embodiment of an article of, footwear;

Figure 2 shows the uncoated foot form bed associates with the top sheet according to Figure 1, also in perspective,

Figure 3 is a plan view of the article of footwear consisting of the top sheet according to Figure 1, and the foot form bed according to Figure 2;

Figure 4 a section along line IV-IV in Figure 3,

Figure 5 a section along line V-V in Figure 3,

Figure 6 a section along line VI-VI in Figure 3,

Figure 7 a section along line VII-VII in Figure 3,

Figure 8 a top sheet for a second article of footwear;

Figure 9 the foot form bed associates with the top sheet according to Figure 8 in perspective,

Figure 10 the foot form bed according to

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Figure 9, but without a coating,

Figure 11 the footwear, in plan view, consisting of the top sheet according to Figure 8 and the foot form bed according to Figure 9,

Figure 12 is a section along line XII-XII in Figure 11,

Figure 13 is a detail of Figure 12 in enlarged scale,

Figure 14 is a section along line XIV-XIV in Figure 11,

Figure 15 is a section along line XV-XV in Figure 11,

Figure 16 is a section along line XVI-XVI in Figure 11,

Figure 17 is a section of a first embodiment of a device for the production of the article of footwear shown in the drawings, and

Figure 18 is a section of a second embodiment of a device for the production of the article of footwear.

The article of footwear shown in Figures 1 to 7 has the form of an uncoated sandal and consists of a top sheet 1 of wood foil or wood veneer, a foot form bed 2 of plastics material and a strap (not shown) by means of which the foot form bed is held to the foot. The top sheet 1 is thin-walled in comparison to the foot form bed, and like the upper surface of the foot form bed 2, matches the arch of the foot. The top sheet 1 and the foot form bed 2 are provided with complementary beads 3 starting at an outer edge of the sole, rising towards the middle toe and steeply dropping off into, and merging with, depressions 4 provided for the ball of the big toe. A shallow depression 5 is provided for the heel. The beads 3 and depressions 4 are adapted to support the arch of the toes of the wearer of the footwear.

The top sheet 1 is adapted in shape and size to the foot form bed and is connected to the foot form bed 2 by direct moulding, optionally under use of an adhesive agent. To improve the stiffness, it is possible to coat the top sheet 1 on its lower surface abutting the foot form bed 2 with reinforcing materials prior to this operation. It is essential that the top sheet 1 be shape-retaining and preformed and preferably that the wall thickness of the top sheet 1 is uniform throughout though it can also have walls of varying thickness, for instance in order to achieve greater flexibility in the area of the ball than in the joint.

The top sheet 1 preferably has a thickness of 0.5 to 3 mm, in the case of wood veneer, of in particular 0.5 to 1.2 mm, preferably 0.5 to 0.7 mm, when in the form of a sheet of plastics material, in particular of 1 to 3 mm.

The article of footwear according to Figures 8 to 16 is a sandal provided with a coating, it consists of a top sheet 11 which is made of wood foil or wood veneer, a foot form bed 12 made of plastics material and a strap (not shown) for holding the foot form bed to the foot. The top sheet 11 is thinwalled and is shaped to match the arch of the foot just like

the upper surface of the foot form bed 2. Just like in the preceding embodiment, the top sheet 11 or the foot form bed 12 is provided, underneath the arch of the toes, with a bead 13 starting at an outer edge of the sole, rising towards the middle toe and then steeply dropping off into, and merging with, a depression 14 for the ball of the big toe. A shallow depression 15 is provided for the heel.

The foot form bed 12 is provided with a cover or coating 16 consisting of plastics material, fabric or cloth on those lateral surfaces of the sandal which are visible in the finished sandal. This coating 16 is folded over on the edges of the upper and lower surfaces of the foot form bed. The foot form bed is provided for this purpose, along the entire edge of its lower and upper surface, with respectively peripheral depressions 18 and 17 into which the coating is placed. Care should be taken to ensure that the depression 17 provided on the upper surface of the foot form bed 12 does not extend all the way out to the edge, but instead be spaced peripherally so that a ledge 19 remains circumferentially on the edge. The height of the ledge 19 is such that after the coating 16 is folded over and the top sheet 11 is applied to the foot form bed 12, a ridgeless transition between the top sheet 11 and the coating 16 covering the ledge 19 is provided. The steps (c.f. Figures 5, 6 and 14, 15) provided on the lower surface of the foot form bed serve, on the one hand, to receive the coating or cover pulled down into the area of the sole and, on the other hand, to receive the ends of the straps or edges of the cover, so that the finished footwear is provided with an approximately plane outsole.

A device for the production of the article of footwear shown in Figure 17 is a two-part casting mould consisting of an open-topped lower mould 21 and an upper mould 22. The bottom plate and the closing device for closing the mould are of a form known *per se* and therefore not shown in detail. The mould cavity 23 is formed in the lower mould 21. A peripheral depression 24 is provided along the entire edge of the mould cavity 23. The upper mould 22 is provided in the area of the open top side of the mould cavity 23 with projections forming the upper definition of the mould cavity and complementarily corresponding in shape to the upper surface of the foot form bed to be produced.

In order to produce the article of footwear the mould is supported with the open top in a substantially horizontal plane and an appropriately measured amount of plastics material is poured into the mould, and the preformed top sheet 1 or 11 is placed onto the lower mould or attached to the upper mould by means of catch pins. A further possibility is the attaching on the upper mould by vacuum suction. The top sheet 1 or 11 in this case is slightly larger so that it is supported by the

peripheral depression 24 and clamped fast between upper mould 21 and lower mould 22, so that it forms a seal for the mould cavity. The mould is then closed by means of the upper mould 22 and the liquid plastics mass is hardened, which operation at the same time connects the top sheet 1 or 11 onto the foot form bed. After removal of the footwear from the mould, the protruding edge of the top sheet 1 or 11 is severed or ground off.

As for the device for the production of the article of footwear as shown in Figure 18 this comprises a mould frame 30 having a bottom plate 31, a lower mould 32 and an upper mould 33 connected with the die or piston 34 of a closing cylinder not shown. The mould cavity 35 is formed in the upper mould 33 which is provided with an intake channel 36 for injection of the plastics material. The upper surface of the lower mould 32 matches the upper surface of the finished footwear, but is formed complementarily to this. Along the edge of the mould cavity 35, a peripheral depression, similar to the depression 24, serves as a support for the top sheet 1 or 11 is provided in the lower mould 32.

For producing the article of footwear, the top sheet 1 or 11 is first placed into the mould. In this case, the top sheet 1 or 11 is slightly larger in its dimensions all round than the dimensions of the finished article of footwear, so that it is abuttingly supported on the said peripheral depression, clamped fast by lowering of the upper mould 33 between it and the lower mould 32 and thus serves as a seal for the mould cavity 35. The curves of the top sheet 11, 1 can be more pronounced in all directions than is intended in the finished article of footwear. The foot form bed is then formed by injecting the liquid plastics material and the top sheet 1, 11 is moulded onto it. The curves of the top sheet might deform slightly so that a largely tensionless connection is achieved between the foot form bed and top sheet. This also applies to the embodiment according to Figure 17. Once the injection operation is finished, the protruding edge of the top sheet can be cut away just like in the preceding embodiment.

Suitable working materials for the top sheet are particularly wood foil, wood veneer, leather or fibrous material. The shaping of the top sheet can be effected in various ways. The wood foil or wood veneer can be hot-pressed in a process of the known type, or shaped by applying a vacuum, or it may be first coated with liquid synthetic resin, and optionally with a reinforcement, and then cold pressed. The wood foil can also be coated with plastics material prior to shaping.

A particularly suitable working material for the foot form bed is polyurethane foam.

WHAT WE CLAIM IS:-

1. An article of footwear comprising a foot form bed made of plastics material and a top

sheet made of wood, leather, or fibrous material, said top sheet being connected to the foot form bed and adapted in shape and size thereto, wherein the foot form bed and top sheet are curved to conform to the arch of the foot and are provided with preformed complementary beads and depressions adapted to underlie the arch of the toes of the wearer's foot.

2. An article of footwear according to claim 1; wherein the top sheet is thin-walled in comparison to the thickness of the foot form bed.

3. An article of footwear according to claim 1 or 2 wherein the top sheet is provided on its lower surface abutting the foot form bed with reinforcing materials, for example coatings of plastics materials reinforced with fibres, for example textile, glass or polyester fibres.

4. An article of footwear according to one of the claims 1 to 3, wherein the top sheet is moulded onto the foot form bed by means of casting or injection, and the foot form bed is made of foamed or expanded plastics material.

5. An article of footwear according to any one of claims 1 to 3, wherein the top sheet is connected to the foot form bed by adhesive.

6. An article of footwear according to any one of claims 1 to 3, wherein the top sheet is form-fittingly or frictionally connected to the foot form bed.

7. An article of footwear according to claim 6, wherein the surface of the top sheet which abuts the foot form bed is provided with projections and/or recesses, for instance pegs, nubs or the like, which are engageable with corresponding recesses and/or projections provided on the upper surface of the foot form bed.

8. An article of footwear according to any of the claims 1 to 7, wherein the top sheet is arranged within a peripheral ledge provided on a coating or covering of the foot form bed, with an essentially ridgeless transition from the coating or covering extending to include the ledge to the top sheet.

9. An article of footwear according to any of claims 1 to 8 provided with an outsole secured to the underside thereof.

10. A process for the production of an article of footwear according to any one of claim 1 to 9, wherein liquid working material for the production of the foot form bed is poured into an open-topped mould and a preformed top sheet is then placed onto the open mould, so that the top sheet forms a seal for the mould cavity.

11. A process according to claim 10, wherein the top sheet is pre-shaped by means of hot-pressing.

12. A process according to claim 10, wherein the top sheet is pre-shaped by means of application of a vacuum.

13. A process according to claim 10, wherein the top preformed sheet is first coated



peripheral depression 24 and clamped fast between upper mould 21 and lower mould 22, so that it forms a seal for the mould cavity. The mould is then closed by means of the upper mould 22 and the liquid plastics mass is hardened, which operation at the same time connects the top sheet 1 or 11 onto the foot form bed. After removal of the footwear from the mould, the protruding edge of the top sheet 1 or 11 is severed or ground off.

As for the device for the production of the article of footwear as shown in Figure 18 this comprises a mould frame 30 having a bottom plate 31, a lower mould 32 and an upper mould 33 connected with the die or piston 34 of a closing cylinder not shown. The mould cavity 35 is formed in the upper mould 33 which is provided with an intake channel 36 for injection of the plastics material. The upper surface of the lower mould 32 matches the upper surface of the finished footwear, but is formed complementarily to this. Along the edge of the mould cavity 35, a peripheral depression, similar to the depression 24, serves as a support for the top sheet 1 or 11 is provided in the lower mould 32.

For producing the article of footwear, the top sheet 1 or 11 is first placed into the mould. In this case, the top sheet 1 or 11 is slightly larger in its dimensions all round than the dimensions of the finished article of footwear, so that it is abuttingly supported on the said peripheral depression, clamped fast by lowering of the upper mould 33 between it and the lower mould 32 and thus serves as a seal for the mould cavity 35. The curves of the top sheet 11, 1 can be more pronounced in all directions than is intended in the finished article of footwear. The foot form bed is then formed by injecting the liquid plastics material and the top sheet 1, 11 is moulded onto it. The curves of the top sheet might deform slightly so that a largely tensionless connection is achieved between the foot form bed and top sheet. This also applies to the embodiment according to Figure 17. Once the injection operation is finished, the protruding edge of the top sheet can be cut away just like in the preceding embodiment.

Suitable working materials for the top sheet are particularly wood foil, wood veneer, leather or fibrous material. The shaping of the top sheet can be effected in various ways. The wood foil or wood veneer can be hot-pressed in a process of the known type, or shaped by applying a vacuum, or it may be first coated with liquid synthetic resin, and optionally with a reinforcement, and then cold pressed. The wood foil can also be coated with plastics material prior to shaping.

A particularly suitable working material for the foot form bed is polyurethane foam.

WHAT WE CLAIM IS:-

1. An article of footwear comprising a foot form bed made of plastics material and a top

sheet made of wood, leather, or fibrous material, said top sheet being connected to the foot form bed and adapted in shape and size thereto, wherein the foot form bed and top sheet are curved to conform to the arch of the foot and are provided with preformed complementary beads and depressions adapted to underlie the arch of the toes of the wearer's foot.

2. An article of footwear according to claim 1, wherein the top sheet is thin-walled in comparison to the thickness of the foot form bed.

3. An article of footwear according to claim 1 or 2 wherein the top sheet is provided on its lower surface abutting the foot form bed with reinforcing materials, for example coatings of plastics materials reinforced with fibres, for example textile, glass or polyester fibres.

4. An article of footwear according to one of the claims 1 to 3, wherein the top sheet is moulded onto the foot form bed by means of casting or injection, and the foot form bed is made of foamed or expanded plastics material.

5. An article of footwear according to any one of claims 1 to 3, wherein the top sheet is connected to the foot form bed by adhesive.

6. An article of footwear according to any one of claims 1 to 3, wherein the top sheet is form-fittingly or frictionally connected to the foot form bed.

7. An article of footwear according to claim 6, wherein the surface of the top sheet which abuts the foot form bed is provided with projections and/or recesses, for instance pegs, nubs or the like, which are engageable with corresponding recesses and/or projections provided on the upper surface of the foot form bed.

8. An article of footwear according to any of the claims 1 to 7, wherein the top sheet is arranged within a peripheral ledge provided on a coating or covering of the foot form bed, with an essentially ridgeless transition from the coating or covering extending to include the ledge to the top sheet.

9. An article of footwear according to any of claims 1 to 8 provided with an outsole secured to the underside thereof.

10. A process for the production of an article of footwear according to any one of claim 1 to 9, wherein liquid working material for the production of the foot form bed is poured into an open-topped mould and a preformed top sheet is then placed onto the open mould, so that the top sheet forms a seal for the mould cavity.

11. A process according to claim 10, wherein the top sheet is pre-shaped by means of hot-pressing.

12. A process according to claim 10, wherein the top sheet is pre-shaped by means of application of a vacuum.

13. A process according to claim 10, wherein the top preformed sheet is first coated



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with liquid synthetic resin and optionally with a reinforcement and is then cold-pressed.

14. A process for the production of an article of footwear according to any one of the claims 1 to 9, using a mould which is filled in the closed state from the outside through a pouring channel, wherein the top sheet is produced and preformed separately from the foot form bed by hot-pressing, shaping by means of vacuum or pressing with synthetic resin, then the preformed top sheet is placed into the mould cavity and the foot form bed is moulded onto the top sheet by means of injection of plastics material into the mould cavity.

15. A process according to claim 14, wherein the dimensions of the preformed top sheet, preferably all round, are slightly larger than the dimensions of the foot form bed.

16. A process according to claims 10, 14 or 15, wherein the curves of the preformed top sheet, preferably in all directions, are more pronounced at the time of insertion of the top sheet into the mould cavity than the curves of the mould cavity.

17. A device for carrying out the process according to any one of the claims 10 to 13, having at least one upper mould and at least one lower mould arranged movable in respect of one another, wherein the mould cavity is formed in the lower mould and is adapted for filling with molten plastics and the underside of the upper mould is shaped complementarily to the upper surface of the top sheet, the upper

side of the lower mould being provided along the edge of the mould cavity with a peripheral depression serving as a support for the periphery of the top sheet.

18. A device for carrying out the process according to any one of claims 14 to 16, having a mould which is fillable in the closed state from the outside through a pouring channel and comprising at least one upper mould and at least one lower mould arranged movably in respect of one another in a mould frame, wherein the upper side of the lower mould is formed complementarily to the upper surface of the preformed top sheet and is provided with a peripheral depression serving as a support for the periphery of the top sheet.

19. An article of footwear substantially as hereinbefore described with reference to Figures 1 to 7, Figures 8 to 16 of the accompanying drawings.

20. A process according to any one of claims 10 to 18 substantially as hereinbefore described with reference to Figure 17 or Figure 18 of the accompanying drawings.

21. A device for the production of an article of footwear substantially as hereinbefore described with reference to the accompanying drawings.

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