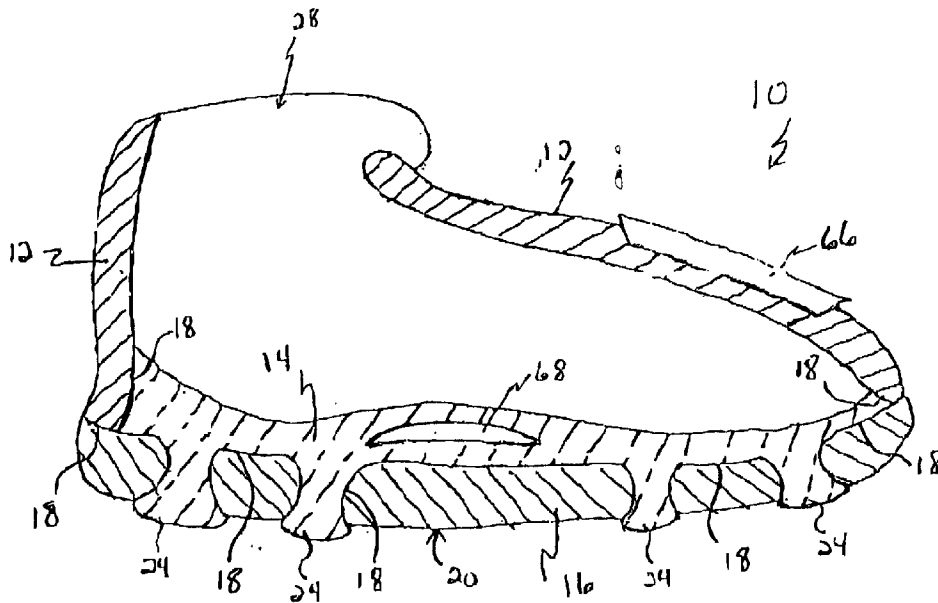


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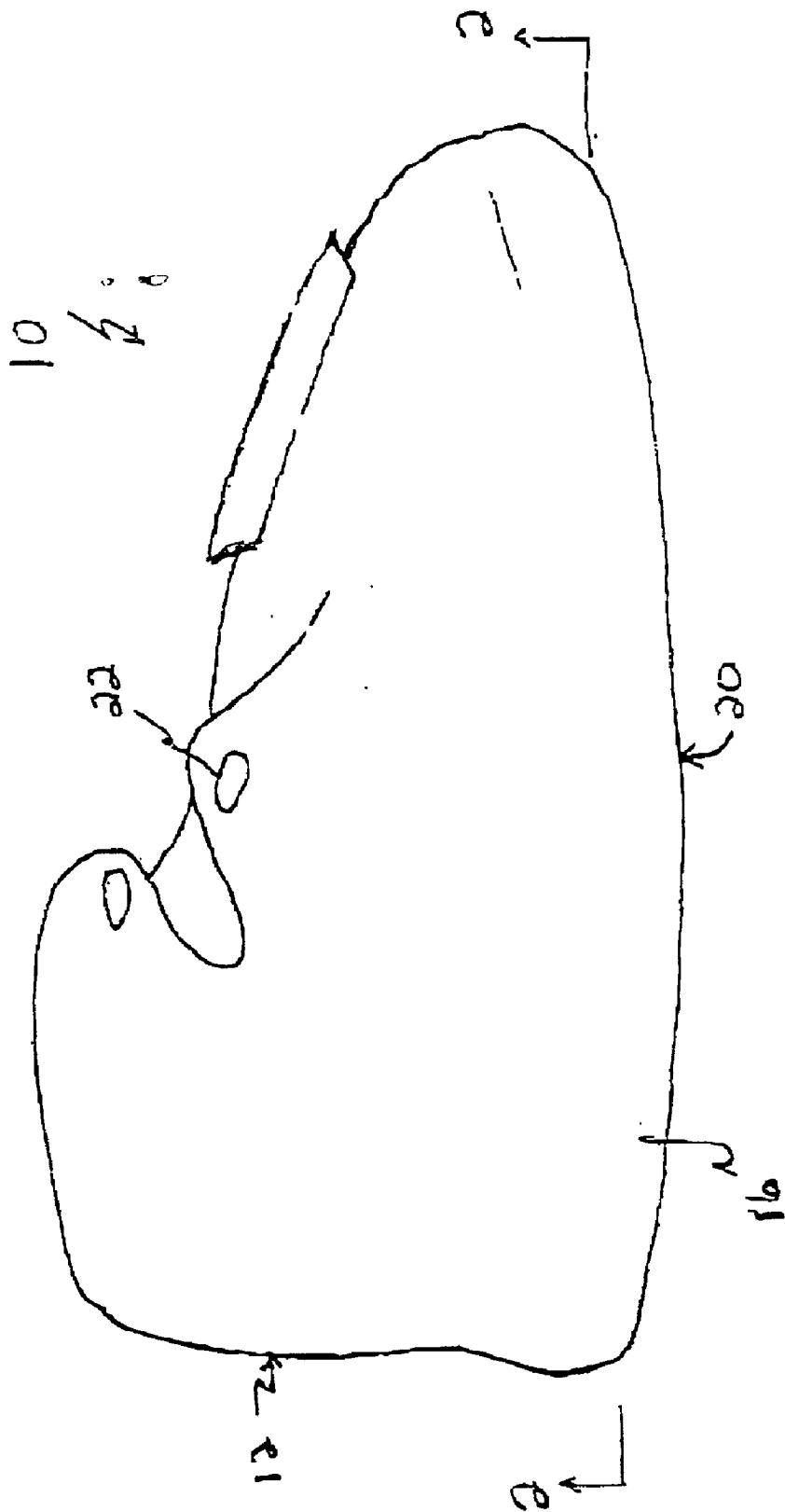


FIG 1

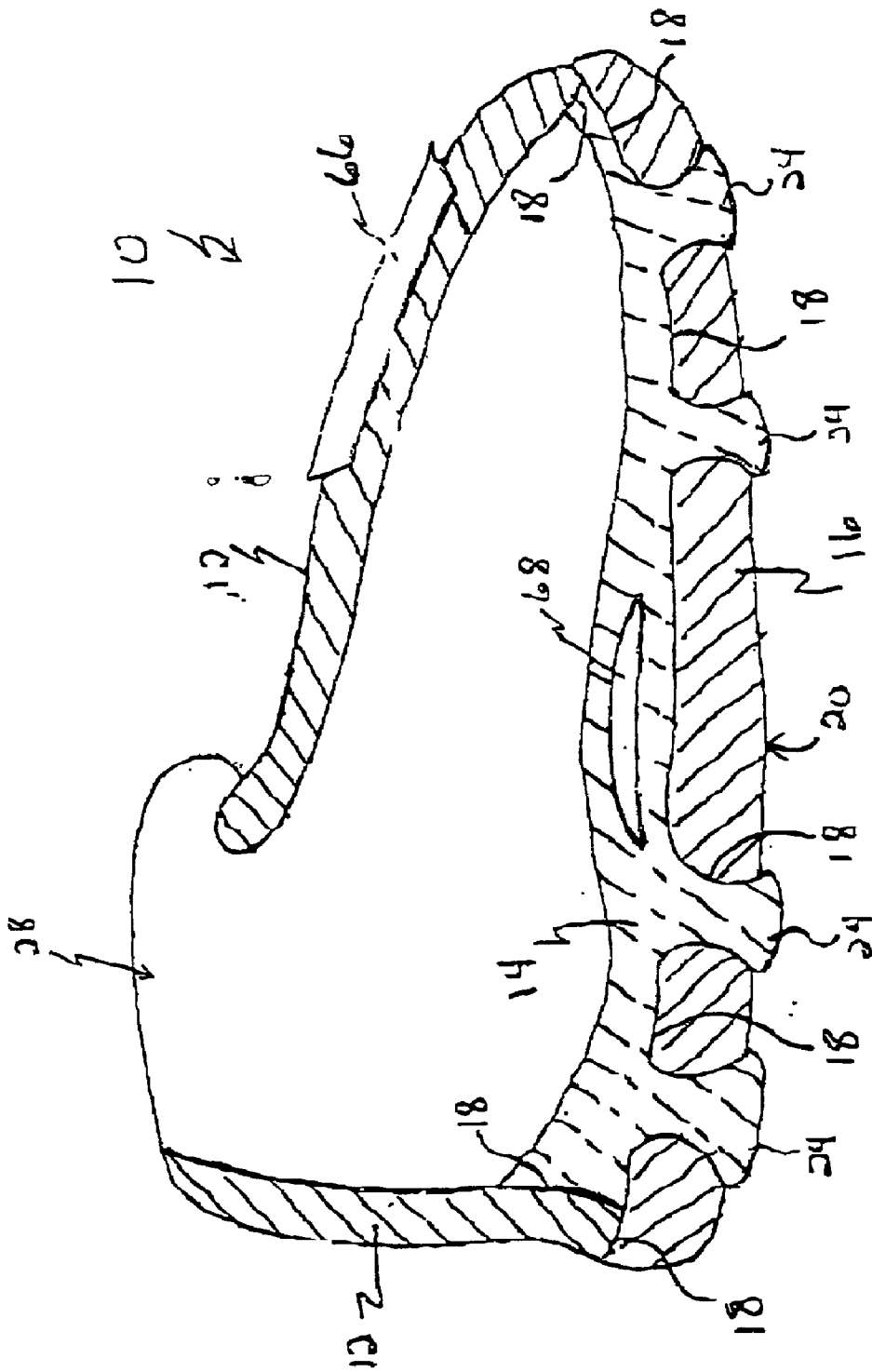
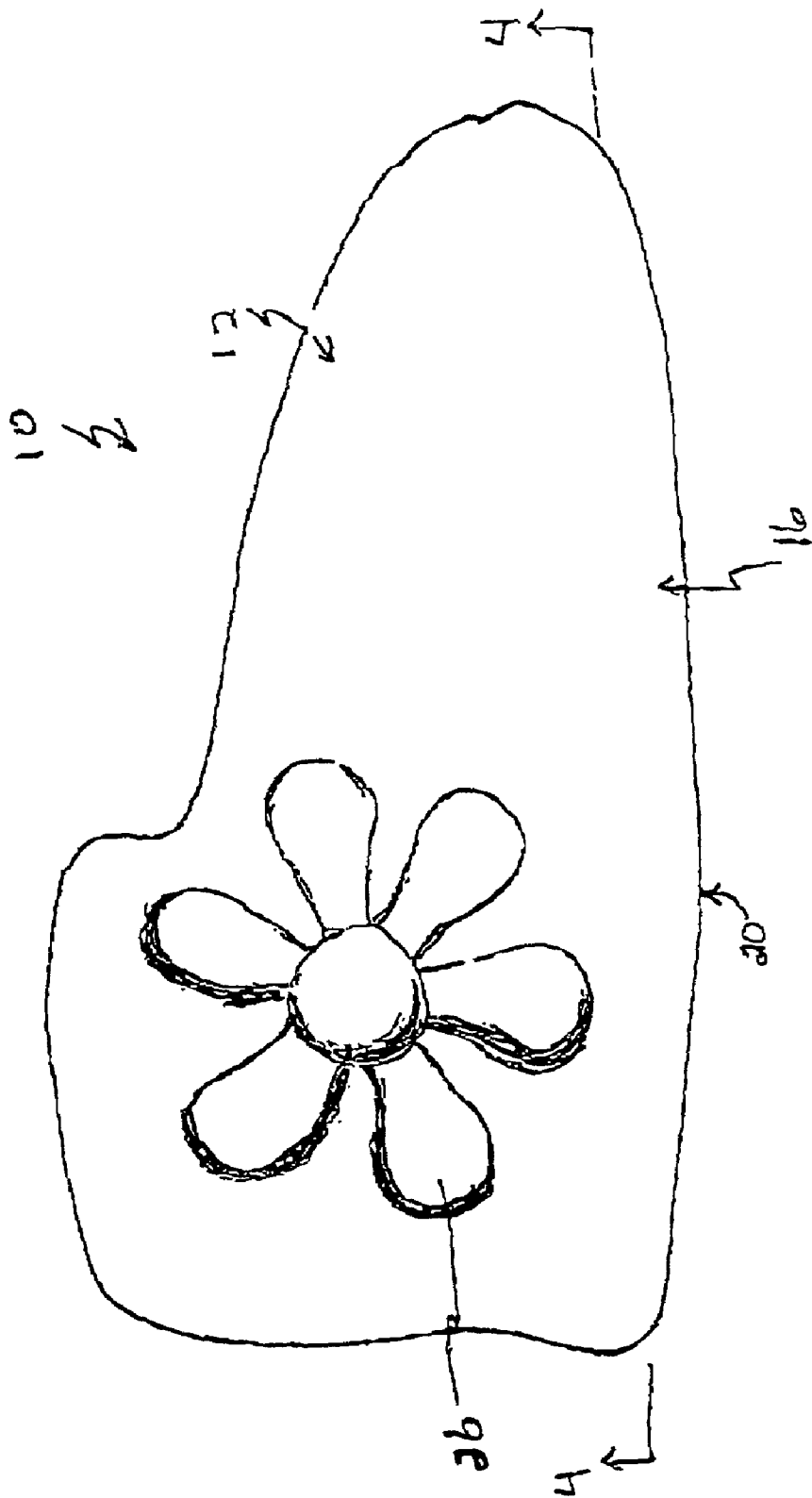


FIG 2



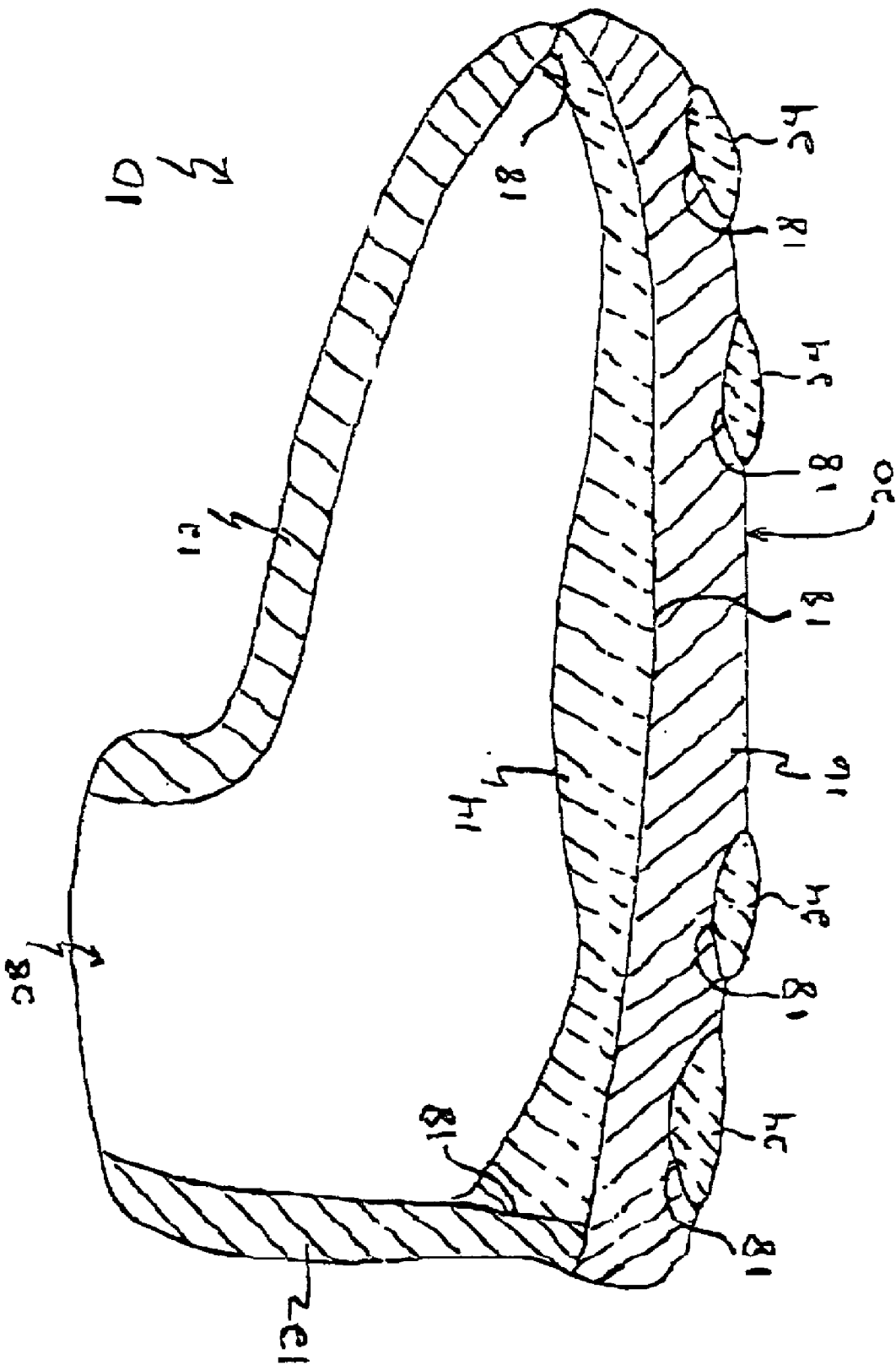
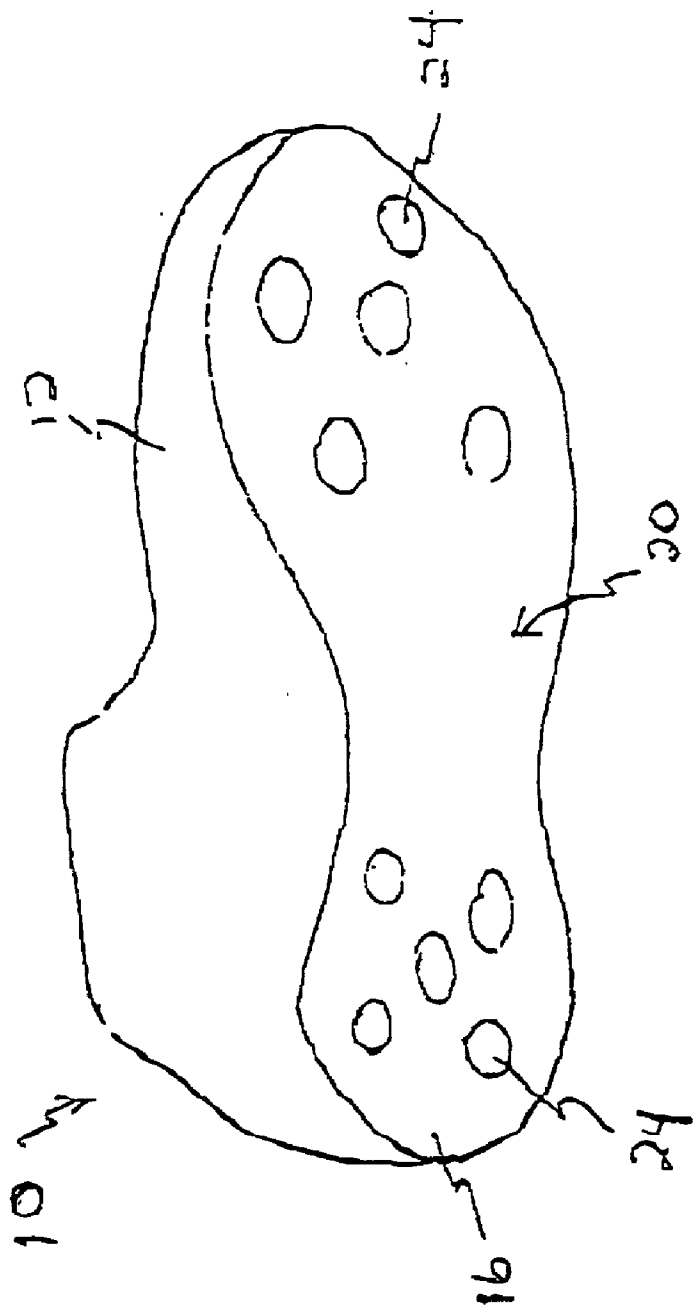


FIG. 4

FIG 5



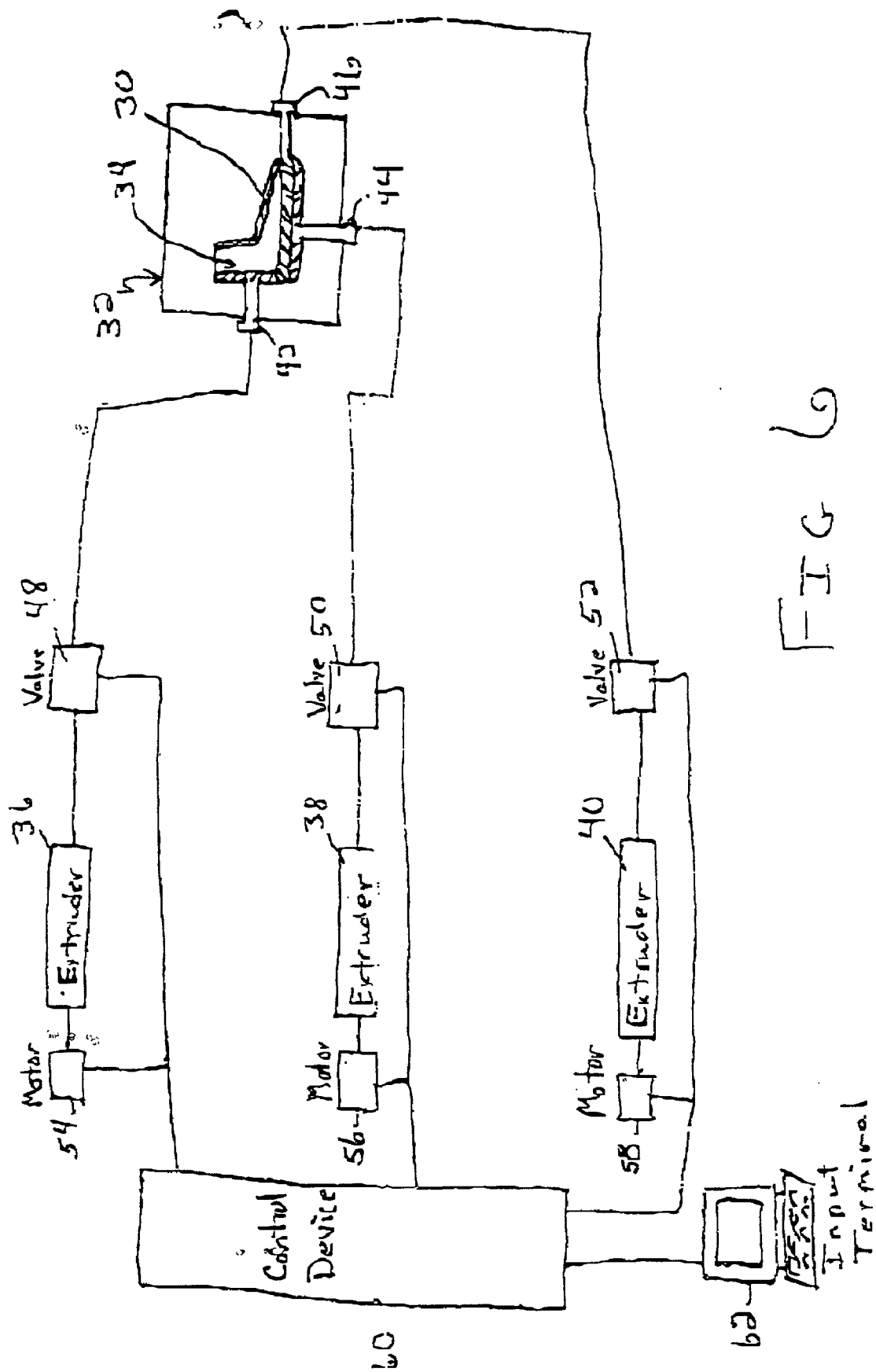


FIG 6

INJECTION MOLDED ARTICLE OF FOOTWEAR AND METHOD OF MANUFACTURING

CROSS REFERENCES TO RELATED APPLICATIONS

[0001] This application takes priority from United States Provisional Patent Application Serial No. 60/160,282 filed on Oct. 19, 1999.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] This invention relates to an injection molded shoe and a method for producing a unitary footwear formed of two or more silicone materials using an injection molding apparatus without the need of further assembly steps.

[0004] 2. Description of the Related Art

[0005] Numerous articles of footwear and methods of manufacturing the footwear are known in the prior art. Typically, footwear and methods of manufacturing footwear consists of assembling numerous parts such as the upper covering, the insole and the outsole and joining these parts together by stitching, using an adhesive or bonding the parts using an injection molded polymer.

[0006] The simplest of these methods of construction include stitching together overlapping layers of leather or cloth to form an upper covering for the foot and then using an adhesive to attach a preformed outsole. Other construction methods include forming an injection molded outsole and/or insole and integrally joining the upper during the molding process of the sole unit such as, for example, joining an upper and a preformed rubber outsole with a foamed poly-urethane, injection molded insole.

[0007] Although articles of footwear have been manufactured wherein portions of the footwear are formed by injection molding polymers, the prior methods still have required the preforming of certain portions of the shoe and joining the portions together using adhesives or other polymers which present other disadvantages such as the adhesive or joining materials passing into other portions of the shoe and providing an complex and lengthy manufacturing and assembling process.

SUMMARY OF THE INVENTION

[0008] It is an object of this invention to provide an injection molded integrally formed article of footwear shoe which does not require the assembling and joining of numerous parts. The article of footwear according to the present invention includes an upper having an opening for receiving a wearer's foot, a insole for supporting the wearer's foot, and an outsole. The upper, the insole and the outsole are comprised of at least two different forms of injection molded polymer materials permanently bonded at interfaces between the different forms of polymer materials to provide an integrally formed and unitary article of footwear. The article of footwear preferably includes a plurality of injection molded points on the bottom of the outsole. The at least two different forms of polymer materials are, preferably, different forms of silicone such as for example, a limb silicone material and silicone foam and gel material. For example, the upper is formed of a limb silicone material,

the insole is formed of a silicone gel material, and the outsole is formed of a silicone foam material.

[0009] A method for manufacturing the integrally formed injection molded article of footwear according to the present invention includes providing a mold having at least one cavity for forming the article of footwear and providing the at least two different forms of polymer materials. A controlled amount of each of said at least two different forms of polymer materials are injected into the mold cavity at a predetermined temperature and a predetermined pressure for each of the different forms of polymer materials. The different forms of polymer materials bond to each other at interfaces between the different forms of polymer materials. The polymer materials are cured to provide the integrally formed article of footwear and the article of footwear is removed from the mold.

[0010] The step of injecting into the mold cavity a controlled amount of each of the polymer materials, further includes, for example, coupling at least one distributor valve to a supply of each of the different forms of polymer materials and coupling a plurality of sprues to the mold leading to the mold cavity and to the distributor valves. Each of the different forms of polymer materials are distributed in the controlled amounts from the distributor valves and are injected into the mold cavity through the plurality of sprues.

[0011] A control device including a microprocessor is connected, for example, to each distributor valve and to each of the supplies of the different forms of polymer materials for controlling the distribution of the polymer materials. The temperature and pressure of the supplies of the different forms of polymer materials are also controlled.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The present invention may be better understood, and its numerous objects, features, and advantages made apparent to those skilled in the art by referencing the accompanying drawings.

[0013] FIG. 1 is a side elevational view of an article of footwear according to a first embodiment of the present invention;

[0014] FIG. 2 is a cross-sectional view of the article of footwear taken generally along line 2-2 of FIG. 1;

[0015] FIG. 3 is a side elevational view of an article of footwear according to a second embodiment of the present invention;

[0016] FIG. 4 is a cross-sectional view of the article of footwear taken generally along line 4-4 of FIG. 3;

[0017] FIG. 5 is a bottom elevational view of the article of footwear according to the present invention, and

[0018] FIG. 6 is a schematic diagram illustrating the manufacture of the shoe article according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0019] The following sets forth a detailed description of the best-contemplated mode and embodiments for carrying out the invention. The description is intended to be illustrative of the invention and should not be taken to be limiting.

[0020] Referring to FIGS. 1-5, the article of footwear or shoe 10 according to the present invention includes a first portion or upper 12, a second portion or insole 14, and a third portion or outsole 16. As discussed below in greater detail, the entire shoe 10 is manufactured using different forms of polymers without the need for preforming, assembling and joining separate parts of the shoe. The upper 12 includes an opening 28 for receiving a wearer's foot and the insole 14 supports the wearer's foot. The upper 12, the insole 14 and the outsole 16 are comprised of at least two different forms of injection molded polymer materials permanently bonded at interfaces between the different forms of polymer materials to provide an integrally formed and unitary shoe 10.

[0021] For example, the upper 12, the insole 14, and the outsole 16 are injection molded into an integrally formed shoe 10 using at least two different types or forms of polymers in a single mold wherein the different forms of polymers used for the different portions of the shoe 10 mesh at interfaces 18 and permanently bond the upper 12, the insole 14, and the outsole 16 of the shoe 10 together providing an integrally formed article of footwear.

[0022] The method of manufacturing the integrally formed injection molded article of footwear according to the present invention is illustrated in FIG. 6. As shown the shoe 30 is manufactured in mold 32 having a mold cavity 34. At least two different forms of polymer materials, preferably, different forms of silicone such as, for example, silicone foams and silicone gels, are provided in extruders 36, 38 and 40. Nozzles or sprues 42, 44 and 46 are connected to extruders 36, 38 and 40 and lead into the mold cavity 34 for providing the different polymer materials such that the polymer materials are injected into the mold cavity 34 in a viscous condition. Distributor valves 48, 50 and 52 are positioned in conduits leading from the outputs of the extruders 36, 38 and 40 to sprues 42, 44 and 46 for distributing the viscous polymer materials into the mold cavity 34 in pre-selected and controlled amounts.

[0023] Extruders 36, 38 and 40 are driven by motors 54, 56 and 58. The operation of the motor 54, 56 and 59 is controlled by control device 60 which includes, for example, timers, adjustment devices and 2. microprocessor included, for example, with input terminal 62. The control device 60 including the input terminal 62 allow the motors 54, 56 and 52 to be programmed such that the motors 54, 56 and 58 are actuated for a selected, predetermined length of time or at a selected, predetermined pressure for each of the extruders 36, 38 and 40. The distributor valves 48, 50 and 52 are also connected to the control device 60. Correspondingly, the distributor valves 48, 50 and 52 provide the different forms of polymer materials at predetermined time intervals and at predetermined portions of the mold cavity 34 causing the shoe 30 portions to be formed in the mold cavity 34.

[0024] The shoe 30 portions mesh at the interfaces 18 between adjacent portions (see FIGS. 2 and 4) and permanently bond to each other to provide a single part or unitary shoe 30. The polymer materials are cured providing a single part, integrally formed shoe 30 which requires no additional manufacturing steps such as assembling or joining separate portions of a shoe. After curing, the shoe 30 is removed from the mold cavity 34. The curing time varies depending on the selection and type of polymer materials. Although a preferred method of manufacturing the integrally formed injection molded shoe of the present invention is illustrated in FIG. 6, other known processes used for injection molding polymer materials can be incorporated in to the manufacturing method illustrated.

[0025] A number of variations the injection molded shoe are conceivable, such as, for example, the shoe 10 can be manufactured having a variety of closure elements such as, for example, the lace loops 22 illustrated in FIG. 1 or the shoe can be simply pulled onto the foot such as the "bootie" illustrated in FIG. 3. The shoe 10 can be manufactured and molded including any type of decorative ornamentation formed within the molded shoe or any three-dimensional (3D) design such as the 3D design 26 illustrated in FIG. 3. The shoe 10 can also be manufactured and molded including other molded parts such as, for example, heel pull straps and similar external additions, as well as including reinforcements and/or stiffeners embedded into the molded shoe 10 such as the ornamental element 66 and the functional element 68 for insole support illustrated in FIG. 2.

[0026] Referring to FIGS. 1-4, the article of footwear or shoe 10 of the present invention is manufactured, preferably, entirely of silicone using different forms of silicone such as, for example, a silicone foam for the outsole 16, and a silicone gel for the insole 14, and limb silicone for the top and sides or upper 12. The different forms of the silicone then work together in a synergetic manner to dissipate energy from the bottom up through the sides of the shoe 10 emulating, for example, an animals paw in energy absorption and dissipation particularly advantageous in the field of athletic shoes or sneakers. The use of the different forms of silicone also provides other advantage including permanently bonding between the different forms of silicone provide a single part or unitary shoe 10. Another advantage provided by the injection molded shoe 10 according to the present invention is that the silicone provides a shoe that is approximately 75% breathable which aids in dissipating heat also particularly useful in athletic shoes.

[0027] As illustrated in FIGS. 2 and 4 and particularly shown in FIG. 5, the bottom 20 of the shoe 10 preferably includes silicone gel "points" 24 which provide improved energy dissipation and improved traction. In the manufacture of the shoe 10, numerous injection sites and sprues (see FIG. 6) can be used on the mold 32 to allow for the silicone gel points 24 to be formed from the silicone gel insole 14 portion (as shown in FIG. 2) or the silicone gel points 24 can be individually injected (as shown in FIG. 4).

[0028] It should be noted that the present invention may be usefully applied not only to athletic shoes, particularly noted by way of example but to all types of shoe and boot designs. A variety of colors and three-dimensional designs as well as various embedded elements, both functional and ornamental, can be easily applied to the article of footwear according to the present invention.

[0029] While preferred embodiments have been shown and described, various modifications and substitutions may be made thereto without departing from the spirit and scope of the invention. Accordingly it is to be understood that the present invention has been described by way of illustrations and not limitations.

What is claimed is:

1. A method for manufacturing an integrally formed injection molded article of footwear, comprising:

- providing a mold having at least one cavity for forming the article of footwear;
- providing at least two different forms of polymer materials; and

injecting into the mold cavity a controlled amount of each of said at least two different forms of polymer materials at a predetermined temperature and a predetermined pressure for each of the different forms of polymer materials;

bonding each of the different forms of polymer materials to the other at an interface between the different forms of polymer materials;

curing said different forms of polymer materials to provide the integrally formed article of footwear; and

removing the article of footwear from the mold.

2. A method, as recited in claim 1, wherein the step of injecting into the mold cavity a controlled amount of each of said at least two different forms of polymer materials, further comprises

coupling at least one distributor valve to a supply of each of said at least two different forms of polymer materials;

coupling a plurality of sprues to the mold leading to the mold cavity and to the distributor valves wherein each of said at least two different forms of polymer materials are distributed in said controlled amounts from the distributor valves and are injected into the mold cavity through the plurality of sprues.

3. A method, as recited in claim 2, further comprising:

connecting a control device including microprocessor to each distributor valve and to each of said supply of the at least two different forms of polymer materials wherein the control device controls the distribution of said at least two different forms of polymer materials; and

controlling the temperature and pressure of said supply of the at least two different forms of polymer materials.

4. A method, as recited in claim 3, wherein the control device controls the temperature and pressure of said supply of the at least two different forms of polymer materials.

5. A method, as recited in claim 1, wherein the at least two different forms of polymer materials are different forms of silicone.

6. A method, as recited in claim 1, further comprising:

embedding a functional element into the article of footwear.

7. A method, as recited in claim 1, further comprising: embedding an ornamental element into the article of footwear.

8. An article of footwear comprising:

an upper having an opening for receiving a wearer's foot;

a insole for supporting the wearer's foot; and

an outsole; and

wherein the upper, the insole and the outsole are comprised of at least two different forms of injection molded polymer materials permanently bonded at interfaces between said different forms of polymer materials to provide an integrally formed and unitary article of footwear having said upper, said insole and said outsole.

9. An article of footwear, as recited in claim 8, further comprising:

a plurality of injection molded points on a bottom of said outsole.

10. An article of footwear, as recited in claim 8, further comprising:

an injection molded three-dimensional ornamental design.

11. An article of footwear, as recited in claim 8, wherein the at least two different forms of polymer materials are different forms of silicone.

12. An article of footwear, as recited in claim 8, wherein said upper is formed of a limb silicone material.

13. An article of footwear, as recited in claim 8, wherein said insole is formed of a silicone gel material.

14. An article of footwear, as recited in claim 8, wherein said outsole is formed of a silicone foam material.

15. An article of footwear, as recited in claim 9, wherein the injection molded points are formed of a silicone gel material.

16. An article of footwear, as recited in claim 8, further comprising:

an embedded functional element.

17. An article of footwear, as recited in claim 8, further comprising:

an embedded ornamental element.

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