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(54) Ventilated sole

(57) Ventilated sole (10) for footwear comprising at least a pump device communicating with the outside by means of at least an aperture (24) and duct means (23) able to connect the inner part of the shoe with the pump device (12), the pump device (12) comprising a first lower component (13) associated with the bottom (10a) of the sole (10) and a second upper component (14) substantially facing the lower component (13) and associated with the high part (21) of the sole (10), the lower (13) and upper (14) components being partly hollow, defining inside an air-tight chamber (33) and being able to be alternately pressed and then released elastically with respect to each other with every step taken by the user, the movement of reciprocal pressure causing the air in the chamber (33) to be compressed and evacuated outside the shoe through the aperture (24), while the movement of release causes the air to be drawn from inside the shoe through the duct (23) and towards the chamber (33).

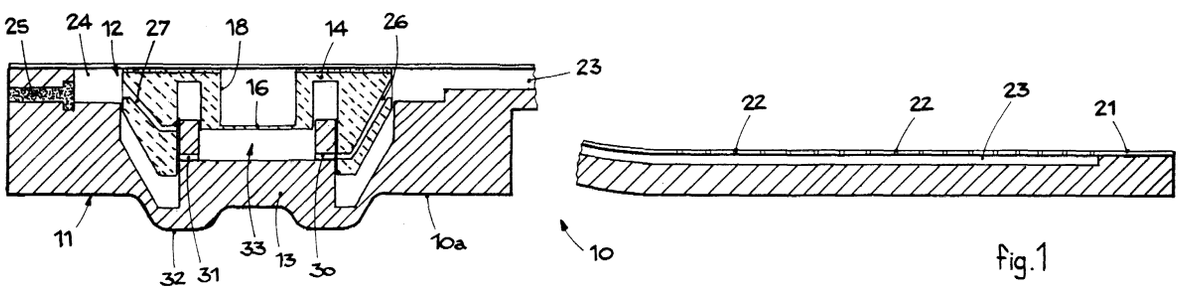

Fig.1

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Description

FIELD OF THE INVENTION

[0001] The invention concerns a ventilated sole able to be applied to footwear of the type with a single-block bottom, either applied or moulded, in order to create a circulation of the air to evacuate the hot damp air inside the shoe, substantially with every step the user takes, and increase the user's comfort.

BACKGROUND OF THE INVENTION

[0002] In the state of the art, the problems connected with using shoes which do not "breathe", or in any case are poorly ventilated, are well-known: they cause the foot to perspire and swell, with a consequent discomfort for the user.

[0003] To solve these problems, various ventilation systems have been proposed for footwear, but in general they have all proved to be not very efficient, or efficient only in certain conditions of use.

[0004] To be more exact, there are two different systems using two different types of ventilated sole: a sole with a membrane and a sole with a pump.

[0005] The sole with a membrane comprises a membrane made of waterproof and breathing material, for example of the type known commercially as "gore-tex", positioned between the arch support and the holed bottom of the shoe.

[0006] In this solution, although the holes made on the bottom of the sole allow the heat and humidity produced by the moving foot to exit, they make the user's foot cold when he is not walking, because the heat insulation of the shoe is very limited due to the presence of said holes.

[0007] The presence of the holes on the bottom is therefore a problem in the winter months, while it is inefficient when the user walks on muddy or snowy routes, where the holes may become blocked and thus prevent any ventilation of the shoe.

[0008] Moreover, if the membrane is not perfectly applied, it compromises the waterproofing of the shoe because of infiltrations between the membrane and the bottom and/or damage to the membrane itself.

[0009] A first type of sole with a pump, for example disclosed by EP-A-0 714 611 or FR-A-2 558 044, comprises apertures for the air to pass through associated with compression means which cause the forced delivery of air inside the shoe when the user is walking. This flow of air, however, reaches the inside of the shoe with difficulty due to the limited pressure of delivery obtained.

[0010] However, should the flow of air reach the user's foot, it would not bring any real benefit, because it would not manage to eliminate the humidity caused by perspiration.

[0011] A second type of sole with a pump, for example disclosed by EP-A-0 624 322 or US-A-5,515,622, provides suction/ compression means connected with the inside of the shoe and able to draw the air inside the shoe to discharge it outside through suitable apertures.

[0012] This type of sole gives an appreciable ventilation to the shoe but has a complex and costly structure comprising a plurality of valves, which are subject to frequent malfunctions and to premature wear, and which end by compromising the effectiveness of the ventilation system.

[0013] The present Applicant has devised and embodied this invention to overcome these shortcomings and to obtain other advantages.

SUMMARY OF THE INVENTION

[0014] The invention is set forth and characterized in the main claim, while the dependent claims describe other characteristics of the main embodiment.

[0015] The purpose of the invention is to achieve a ventilated sole which will allow both to obtain a beneficial circulation of air and also to effectively evacuate the hot, damp air from inside the shoe.

[0016] Another purpose of the invention is to provide a ventilated sole which can be applied substantially to every type of shoe, with a single-block bottom, applied or moulded, which will be simple and economical to achieve and will use a limited number of components.

[0017] The ventilated sole according to the invention comprises a pump device communicating with the outside of the shoe by means of at least an aperture and duct means able to connect the inner part of the shoe with the pump device.

[0018] Preferentially, the pump device is arranged in the heel area of the sole.

[0019] The pump device is made in only two components equipped with a reciprocal movement of compression/release with every step the user takes: a lower component, constrained to the bottom of the sole and possibly integrated therewith, and an upper component associated with the high part of the sole; the two components can be associated due to their same shape and define inside an air-tight chamber alternately connected, by means of appropriate apertures which can be selectively activated, either with the outside, in order to discharge the air from the chamber during the compression movement, or with the duct means of the sole, to draw the air from inside the shoe into the chamber, during the release movement coordinated with the step taken by the user.

[0020] In one embodiment of the invention, the lower component, or part of it, is able to move elastically with respect to the stationary upper element, when the user is walking, from a lowered position to a raised position, said positions being assumed respectively when the bottom of the sole is raised and when it rests on the ground.

[0021] In the position when it is distanced from the upper component, the lower component creates a depres-

sion inside the air-tight chamber, and draws the air from inside the shoe through the duct means, whereas, in the raised position, when it approaches and is coupled with the upper component, it compresses the air inside the chamber and causes it to be discharged to the outside through the apertures provided for this purpose.

[0022] It comes within the field of the invention, according to the application and the type of shoe, that it is the upper component or part of it which moves alternately towards the lower component which, on the contrary, remains stationary while the user is walking.

[0023] In this way, on the one hand we create a continuous circulation of fresh air taken from the outside environment and made to pass through the duct means, and on the other hand the hot, damp air is removed from inside the shoe and discharged into the outside environment with every step the user takes, considerably improving the user's comfort.

[0024] In a preferential embodiment, at least the lower component is made in a single piece with the bottom of the sole.

[0025] According to a variant, the lower component is an applied element, preferably made of rubber, associated with a sole made of a different material, for example, leather.

[0026] According to a variant, the sole comprises or is associated with a holed arch support, positioned between the duct means and the inside of the shoe. According to another variant, the ventilated sole comprises filter means associated with the apertures to discharge the air.

[0027] According to a further variant, there are removable closing means which, when applied, inhibit the functioning of the pump device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] These and other characteristics of the invention will become clear from the following description of some preferential forms of embodiment, given as a non-restrictive example, with reference to the attached drawings wherein:

Fig. 1	is a longitudinal section of the ventilated sole according to the invention;
Fig. 2	is a view from above of the ventilated sole according to the invention;
Fig. 3	is a view from above of the upper component of the pump device of the ventilated sole shown in Fig. 1;
Fig. 4	shows a section of a preferential embodiment of the two components of the pump device of the ventilated sole according to the invention;
Figs.	5a-5c show schematically the functioning steps of the pump device of the ventilated sole in Fig. 1;
Fig. 6	shows a variant of Fig. 2;
Fig. 7a	shows a detail of Fig. 6;
Fig. 7b	is a front view of Fig. 7a;
Fig. 8	shows a variant of Fig. 6;
Fig. 9a	shows a detail of Fig. 8;
Fig. 9b	is a front view of Fig. 9a;
Fig.10a	is an exploded longitudinal section of a constructional variant of the pump device of the ventilated sole according to the invention;
Figs.10b and 10c	show the pump device of Fig. 10a in its assembled condition in two different functioning steps.

DETAILED DESCRIPTION OF SOME PREFERENTIAL EMBODIMENTS

[0029] With reference to the attached drawings, a ventilated sole 10 according to the invention is provided with a pump device 12 in correspondence with the heel portion 11 and is associated at the upper part with a holed arch support 21. Below the arch support 21, the sole 10 is provided with a duct 23, in this case reticular, and has a conduit 24 in its rear part, associated with a filter 25 with sintered spheres communicating with the outside.

[0030] In the case of a moulded bottom, the duct 23 will have the most suitable geometry to ensure the sole can be removed from the mould.

[0031] The filter 25 allows the air to pass freely, but prevents the water and damp from penetrating inside the sole 10.

[0032] The system of holes on the arch support 21 consists of a plurality of holes 22 distributed in the front portion and able to put the inside of the shoe into communication with the duct 23.

[0033] The pump device 12 is made of two components: a lower component 13 associated with the portion of the heel 11, for example in a single body therewith or applied, and an upper component 14 arranged below the arch support 21 and mating in shape with that of the lower component 13.

[0034] The two components 13 and 14 are made of partly elastic material, for example rubber or similar, so that they can be temporarily deformed, if subjected to external stresses, to activate the pump device 12 as will be explained hereafter.

[0035] The upper component 14 is substantially cylindrical in shape and is provided at the center with two cavities, upper 15 and lower 17, concentric with respect to the axis of the component 14. The upper cavity 15 is laterally closed by a circular wall 18 and at the bottom by a thin membrane 16.

[0036] In the embodiment shown in Fig. 4, the upper

cavity 15 is closed at the top by a cover 42 which prevents dirt or dust from entering, which could alter the correct functioning of the membrane 16.

[0037] The lower cavity 17 is defined laterally by the lateral wall 19 of the upper component 14 and has a toric portion 17a at the top which develops around the circular wall 18.

[0038] In the embodiment shown in Figs. 1-5c, the upper component 14 is also provided with two fins, a first 20a and a second 20b, made externally and in a diametrically opposite position on the lateral wall 19.

[0039] On the first fin 20a there is a through inlet channel 26 connected with the duct 23, whereas on the second fin 20b there is a through outlet channel 27 connected with the conduit 24 and offset in height with respect to the inlet channel 26. Both channels 26 and 27 communicate with the lower cavity 17.

[0040] The lower component 13 shown in Figs. 1-5c consists of a central body 29 and of a shaping 32, both constrained elastically to the sole 10 in correspondence with its bottom 10a. The shaping 32 extends below the central body 29, protruding beyond the bottom 10a.

[0041] The central body 29 is mating in shape with the lower cavity 17 and is able to cooperate therewith to partly close it, defining an air-tight chamber 33.

[0042] The central body 29 comprises at the upper part an annular portion 29a, able to be inserted inside the toric portion 17a of the lower cavity 17, and defines with the sole 10 a housing seating 28 inside which the upper component 14 is partly housed.

[0043] There are two through holes, a first 30 and a second 31, on the same horizontal plane on the annular portion 29a, able to be aligned respectively with the inlet channel 26 and the outlet channel 27.

[0044] With reference to Figs. 5a-5c, the ventilated sole 10 as described heretofore functions as follows, while the user is walking.

[0045] When the heel portion 11 is not in contact with the ground, the shaping 32 remains protruding under the bottom 10a and the central body 29 is lowered and only partly inserted inside the lower cavity 17.

[0046] In this position the first through hole 30 is aligned with the inlet channel 26, while the second through hole 31 is closed by the lateral wall 19 of the upper component 14 (Fig. 5a).

[0047] When the central body 29 is in its lowered position, a depression is created inside the chamber 33 which draws fresh air from the high part, partly open, of the shoe, and also hot damp air from inside the shoe. To be more exact, the air drawn through the holes 22 of the arch support 21 flows through the duct 23 and goes inside the chamber 33 through the inlet channel 26 and the first through hole 30.

[0048] When the heel portion 11 begins to rest on the ground, the shaping 32 is pressed and the central body 29 is thrust upwards and penetrates inside the lower cavity 17; in this condition the air inside the chamber 33 is compressed, since it is unable to exit due to the simultaneous closure of the through holes 30 and 31 by the lateral wall 19, and deforms the membrane 16 which expands towards the upper cavity 15 (Fig. 5b).

[0049] Subsequently, with the heel portion 11 completely resting on the ground, the shaping 32 is totally compressed, is deformed and moves into alignment with the bottom 10a of the sole 10.

[0050] The central body 29 penetrates totally inside the lower cavity 17, taking the second through hole 31 into alignment with the outlet channel 27, while the first through hole 30 is closed by the lateral wall 19 (Fig. 5c).

[0051] In this condition, the air inside the chamber 33 exits through the hole 31 and the outlet channel 27, then passes through the conduit 24 and the filter 25 to be expelled outside.

[0052] When the heel portion 11 is subsequently lifted from the ground, the elastic compression is released and therefore the central body 29 is progressively lowered and the depression is formed inside the chamber 33 which initially deforms the membrane 16 as shown by a line of dashes in Fig. 5b.

[0053] When the heel portion 11 is then completely raised, the central body 29 is again in a lowered position and again causes the depression which draws the air from inside the shoe into the chamber 33 through the passages 26 and 30 which are once again aligned (Fig. 5a).

[0054] Figs. 10a-10c show a constructional variant of the pump device 12 of the ventilated sole 10 according to the invention.

[0055] In this embodiment, the two components 13 and 14 have substantially the same structure as that already described, but with some differences: the elements which have a structure and/or function the same as or similar to those previously cited shall retain the same reference number and will not be described in any further detail.

[0056] The lower component 13, substantially cylindrical in shape, has two vertical slits, a first 43 and a second 44, on the periphery; they are diametrically opposite, and extend downwards from the upper edge.

[0057] The first slit 43 is arranged in communication with the duct 23, while the second slit 44, which is longer than the first 43, is connected to the conduit 24.

[0058] In one embodiment of the invention, the slits 43 and 44 also allow a partial, lateral deformation of the body of the lower component 13 during the compression which is exerted thereon with every step the user takes.

[0059] At the base of the annular portion 29a of the central body 29, and in correspondence with the second slit 44, there is the second through hole 31, while on the upper perimeter of the annular portion 29a, and in correspondence with the first slit 43, there is a lower portion, or hole open at the top 45, which is also through in the thickness of the annular portion 29a.

[0060] The lower portion, or hole open at the top 45, is aligned both on the vertical and on the horizontal plane with the first slit 43 and functions as the first

through hole 30 in the embodiment described previously.

[0061] The upper component 14 does not have the fins 20a and 20b, but, starting from the top, the lateral wall 19 has a short thicker part 46 able to be partly inserted inside the second slit 44; below the thicker portion 46 there is the outlet channel 27, while the inlet channel 26 is arranged in a position diametrically opposite and aligned therewith on the same horizontal plane.

[0062] The thicker portion 46 also functions as a reciprocal centering element between the components 13 and 14 to ensure the axial alignment of the channels 26 and 27 and the holes 45 and 31 in the two limit positions assumed by the pump device 12 when the user is walking.

[0063] In the assembled configuration of the pump device 12, the inlet channel 26 communicates with the first slit 43 and the outlet channel 27 faces onto the second slit 44.

[0064] While the user is walking, and when the heel portion 11 is not resting on the ground, the lower component 13 is in the lowered position, or in any case partly distanced from the upper component 14, and the inlet channel 26 communicates with the lower portion 45, and hence with the chamber 33, while the second through hole 31 is closed by the lateral wall 19 (Fig. 10b).

[0065] In this condition, the air drawn from inside the shoe, due to the effect of the depression inside the chamber 33, is taken into said chamber 33 passing in sequence through the first slit 43, the inlet channel 26 and the lower portion 45.

[0066] When the heel portion 11 begins to rest on the ground, the air inside the chamber 33 is compressed which leads to the membrane 16 being deformed (shown by a line of dashes in Fig. 10b).

[0067] Subsequently, with the heel portion 11 completely resting on the ground and the central body 29 totally inside the lower cavity 17, the inlet channel 26 is closed by the annular portion 29a, while the second through hole 31 moves into alignment with the outlet channel 27 (Fig. 10c).

[0068] In this condition, the air inside the chamber 33 is compressed and expelled through the outlet channel 27, the second through hole 31 and the second slit 44, and then flows into the conduit 24 to be discharged outside.

[0069] Figs. 6-7b show a movable filter element 34 which can be used in association with the conduit 24 instead of the filter 25.

[0070] The movable filter element 34 comprises a platelet 35 with one half full and the other half provided with a mesh insert 36.

[0071] The platelet 35 is inserted sliding into a seating 38 communicating with the conduit 24 and with the outside and is provided with a ridge 37; by acting on the ridge 37 it is possible to selectively displace the filter element 34 from a closed position, wherein the full half closes the conduit 24, to an open position wherein the mesh insert 36 is arranged in front of the conduit 24 in order to allow the air to be discharged from the chamber 33 and hence the pump device 12 to function.

[0072] Figs. 8-9a show a variant of the sole 10 which uses a fixed filter element 39 positioned between the conduit 24 and the outside and comprising a mesh insert 36 associated with a frame 40.

[0073] In the preferential embodiment shown in Fig. 4, on the outside of the lower component 13 there are notches 41 which allow the component 13 to deform towards the outside during the steps wherein it is subject to compression; in this way we prevent the component 13 from deforming towards the inside and hence, over time, from becoming an obstacle to the correct movement during the pumping cycle.

[0074] It is obvious however that modifications and/or additions can be made to the ventilated sole 10 as described heretofore, without departing from the spirit and scope of the invention.

[0075] For example the sole 10 can also be made of leather and have only the pump device 12, or only the lower component 13, made of rubber.

[0076] Or the conduit 24 and/or the filter 25 can be sloping downwards from the inside to the outside of the sole 10, in order to prevent water rising towards the pump device 12.

[0077] Furthermore, the duct 23 can comprise a single main conduit, connected to the inlet channel 26, and a plurality of branches communicating with the inside of the shoe.

[0078] Moreover, as shown by a line of dashes in Fig. 10a, an auxiliary elastic element 47 can be provided, in this case a spring, positioned between the lower component 13 and the upper component 14; the function of the auxiliary elastic element 47 is to facilitate the return of lower component 13 to the lowered position when the heel portion 11 is not resting on the ground.

[0079] It is also obvious that, although the invention has been described with reference to specific examples, a skilled person shall certainly be able to achieve many other equivalent forms of ventilated sole, all of which shall come within the field and scope of this invention.

Claims

1. Ventilated sole for footwear comprising at least a pump device communicating with the outside by means of at least an aperture (24) and duct means (23) able to connect the inner part of the shoe with said pump device, the sole being characterized in that said pump device (12) comprises a first lower component (13) associated with the bottom (10a) of said sole (10) and a second upper component (14) substantially facing said lower component (13) and associated with the high part (21) of said sole (10), said lower (13) and upper (14) components being partly hollow and defining inside an air-tight

chamber (33), said components (13, 14), or at least part of them, being able to be alternately pressed and then released elastically with respect to each other with every step taken by the user, the movement of reciprocal pressure causing the air in the chamber (33) to be compressed and evacuated outside the shoe through said aperture (24), while the movement of release causes the air to be drawn from inside the shoe through said duct (23) and towards said chamber (33).

2. Ventilated sole as in Claim 1, characterized in that said chamber (33) is able to be positioned alternately and selectively in communication, in relation to the pressing or release of said components (13, 14), or with said duct means (23) or with said aperture (24) by means of respective passages (30, 45 and 31) made on said lower component (13), said passages (30, 45 and 31) being able to be alternately closed by said upper component (14) according to the position which it assumes with respect to said lower component (13).

3. Ventilated sole as in Claim 2, characterized in that said upper component (14) comprises on its periphery an inlet channel (26) and an outlet channel (27) communicating respectively with said duct means (23) and said aperture (24), said inlet channel (26) being able to align with a first (30, 45) of said passages in the release condition of said components (13, 14) to put said chamber (33) into communication with said duct means (23), said outlet channel (27) being able to align with a second of said passages (31) in the pressing condition of said components (13, 14) to put said chamber (33) into communication with said aperture (24).

4. Ventilated sole as in Claim 1, characterized in that said lower component (13) has two diametrically opposite vertical slits (43, 44) on its periphery, a first slit (43) being able to be connected to said duct (23) and a second slit (44) being able to be connected to said aperture (24).

5. Ventilated sole as in Claim 4, characterized in that said slits (43, 44) are able to allow a partial lateral deformation of said lower component (13) in the pressing condition of said components (13, 14).

6. Ventilated sole as in Claims 2 and 4, characterized in that said lower component (13) has a first passage (30, 45) in correspondence with said first slit (43) and a second passage (31) in correspondence with said second slit (44).

7. Ventilated sole as in any claim from 4 to 6 inclusive, characterized in that said upper component (14) has a thicker portion (46) able to be inserted in said second slit (44) to reciprocally center said components (13, 14).

8. Ventilated sole as in Claim 1, characterized in that said chamber (33) comprises at least a membrane (16) able to be deformed according to the air pressure conditions inside.

9. Ventilated sole as in Claim 1, characterized in that said pump device (12) is located in correspondence with the heel portion (11) of said sole (10).

10. Ventilated sole as in Claim 1, characterized in that said lower component (13) comprises a shaping (32) protruding below said bottom (10a) in said release condition and able to be deformed to take said lower component (13) into proximity with said upper component (14).

11. Ventilated sole as in Claim 1, characterized in that at least said lower component (13) is made of rubber.

12. Ventilated sole as in Claim 1, characterized in that said aperture (24) is associated with filter means (25, 34, 39).

13. Ventilated sole as in Claim 12, characterized in that said filter means comprise at least an element (25) made with sintered spheres.

14. Ventilated sole as in Claim 12, characterized in that said filter means comprise an element (34, 39) with a mesh insert (36).

15. Ventilated sole as in Claim 14, characterized in that said element (34) is selectively movable from a position wherein it closes said aperture (24) to a position wherein it arranges said mesh insert (36) in cooperation with said aperture (24).

16. Ventilated sole as in Claim 1, characterized in that it comprises, or is associated with, an arch support (21) provided with holes (22) able to put the inside of the shoe into communication with said duct means (23).

17. Ventilated sole as in Claim 1, characterized in that said lower component (13) has notches (41) of preferential deformation on the outside.

18. Ventilated sole as in Claim 1, characterized in that said lower component (13) is made in a single piece with said sole (10).

19. Ventilated sole as in Claim 1, characterized in that said lower component (13) is an autonomous component applied to said sole (10).

20. Ventilated sole as in Claim 1, characterized in that said pump device (12) is associated with elastic means (47) positioned between said upper component (14) and said lower component (13) to assist the latter to remain in the lowered position when said bottom (10a) is not resting on the ground.

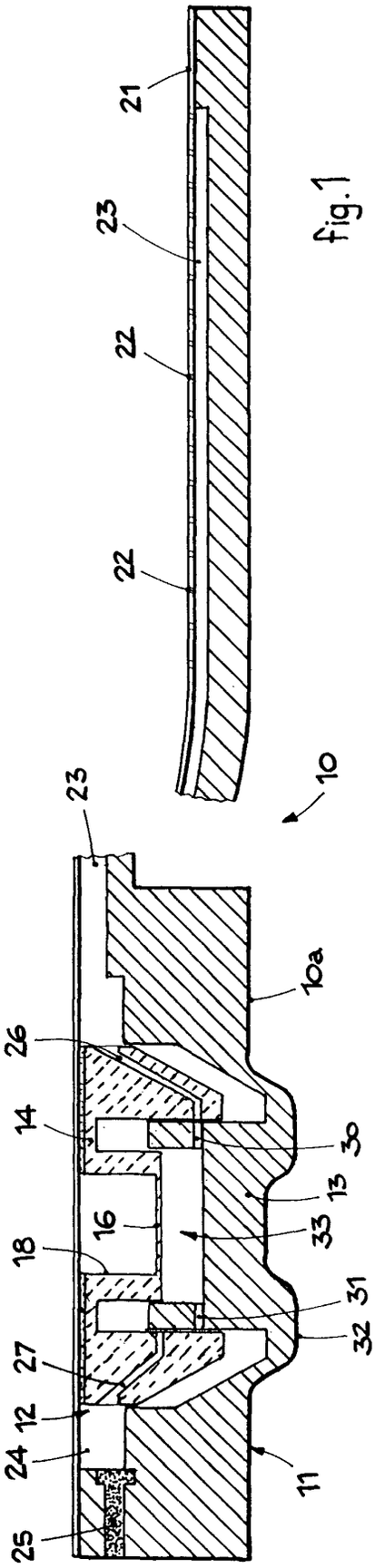
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fig. 1

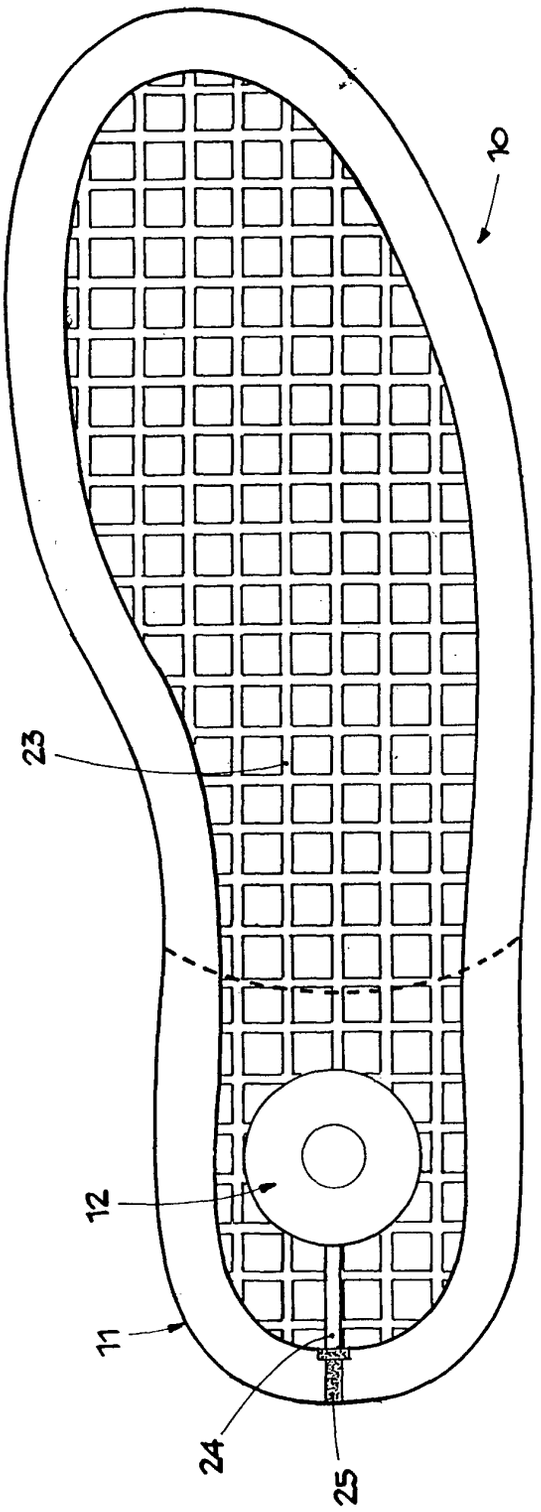
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fig. 2

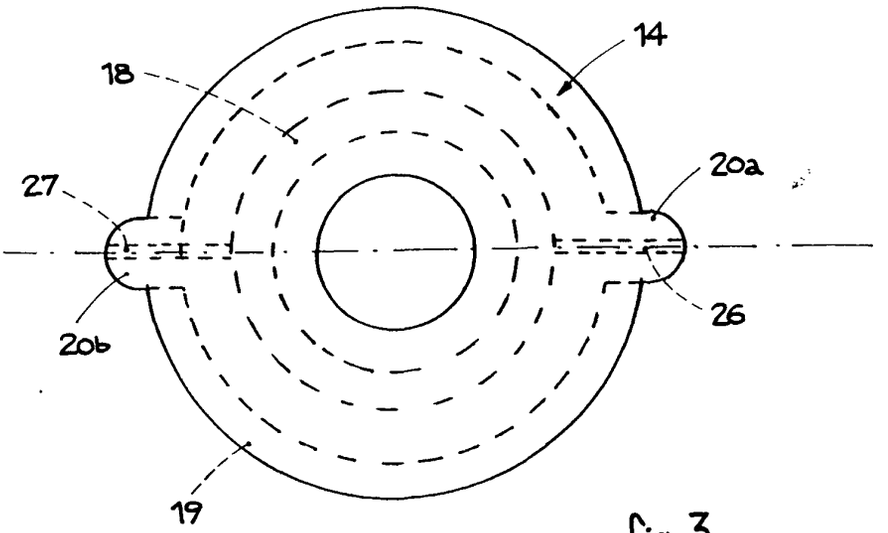
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Fig.3

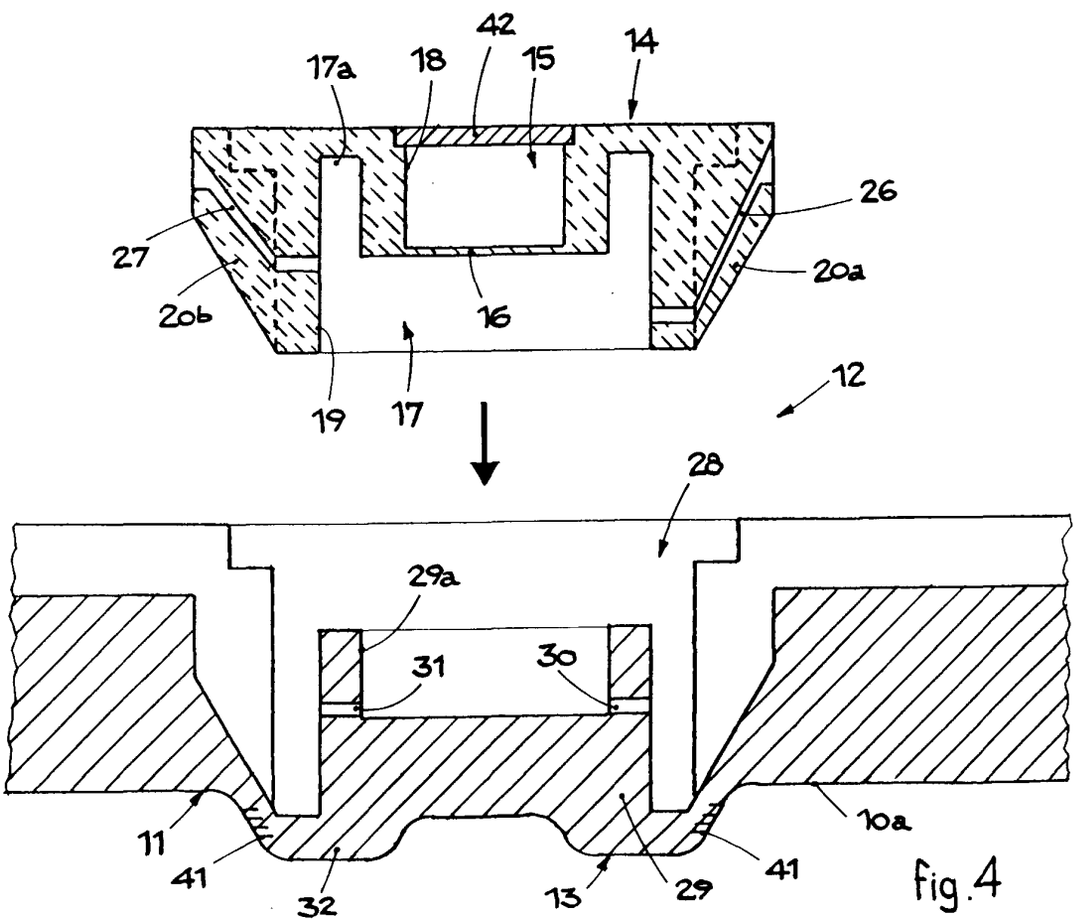
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Fig.4

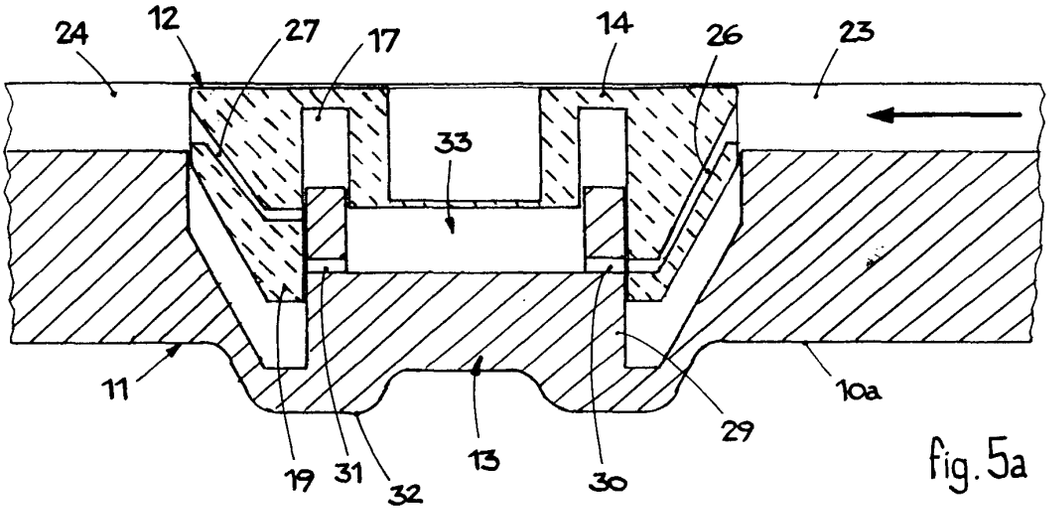

fig. 5a

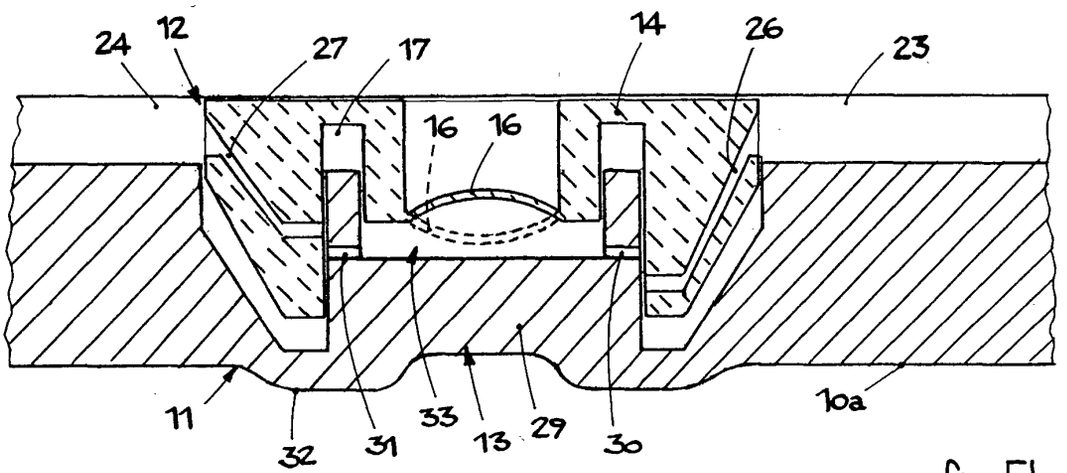

fig. 5b

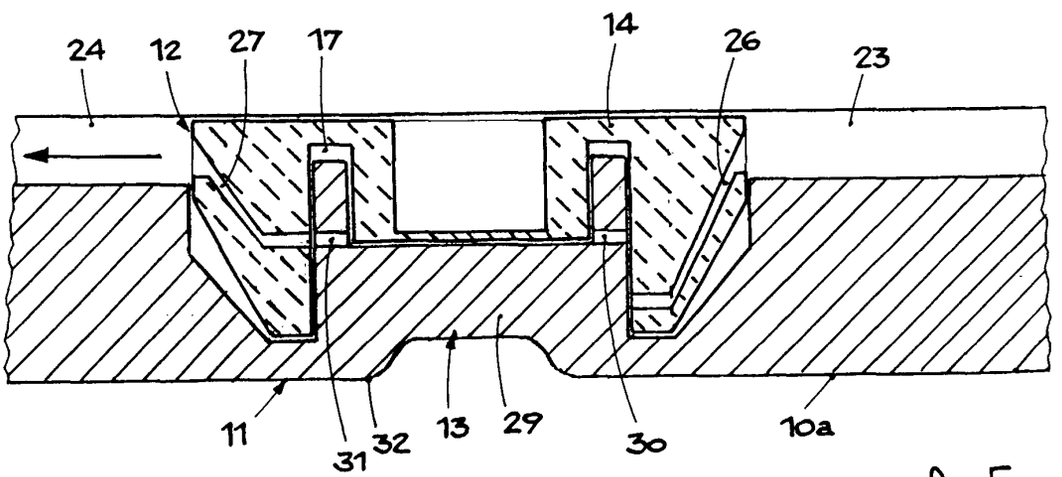

fig. 5c

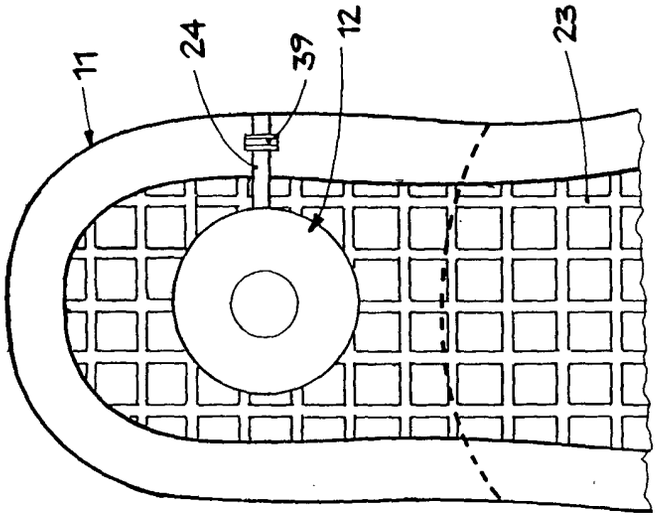

fig 8

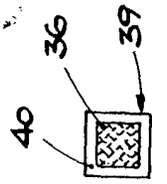

fig. 9b

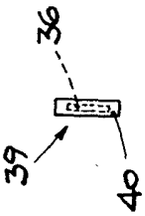

fig. 9a

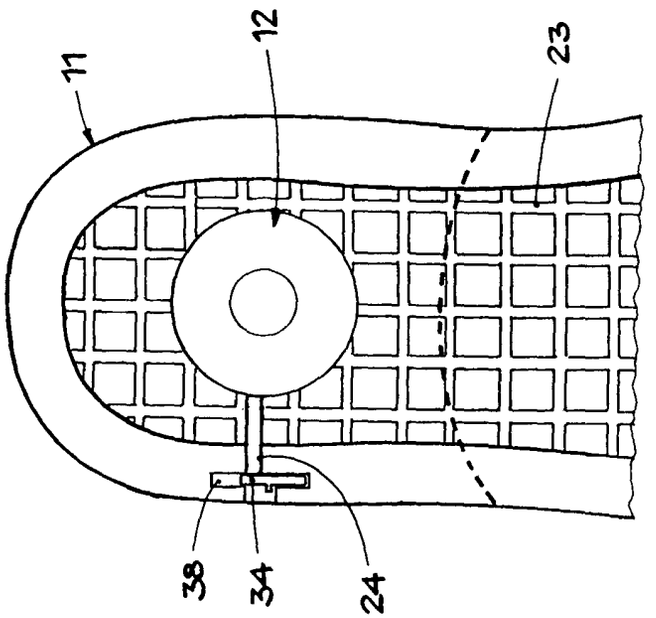

fig.6

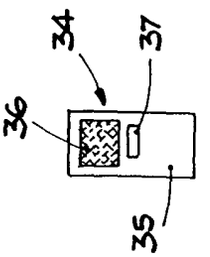

fig. 7b

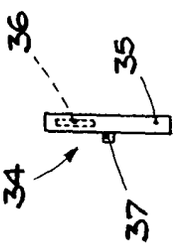

fig. 7a

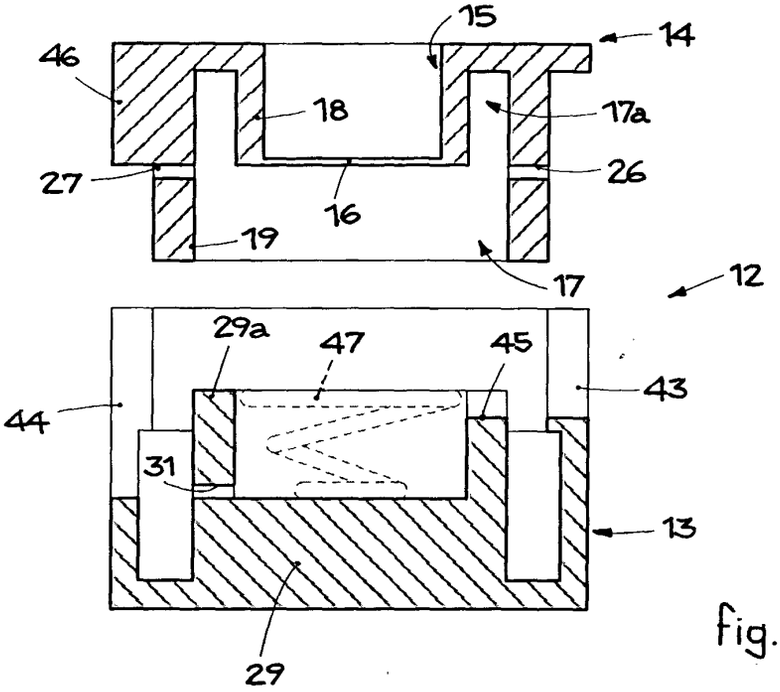

fig. 10a

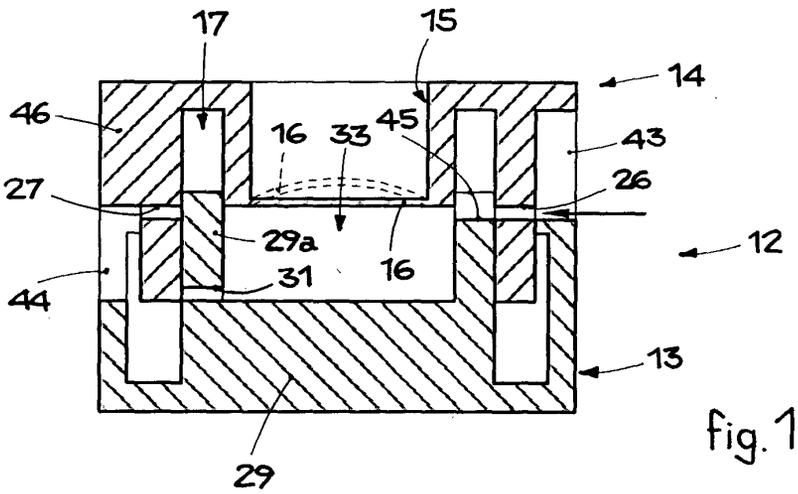

fig. 10b

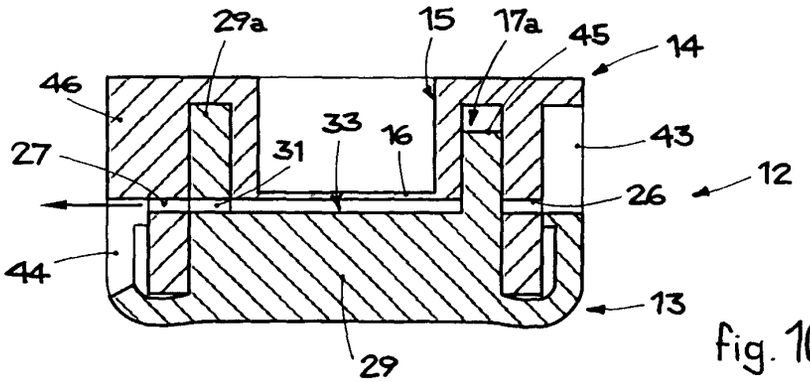

fig. 10c

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Application Number
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Place of search	Date of completion of the search	Examiner
THE HAGUE	9 April 2001	DECLERCK, J

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