

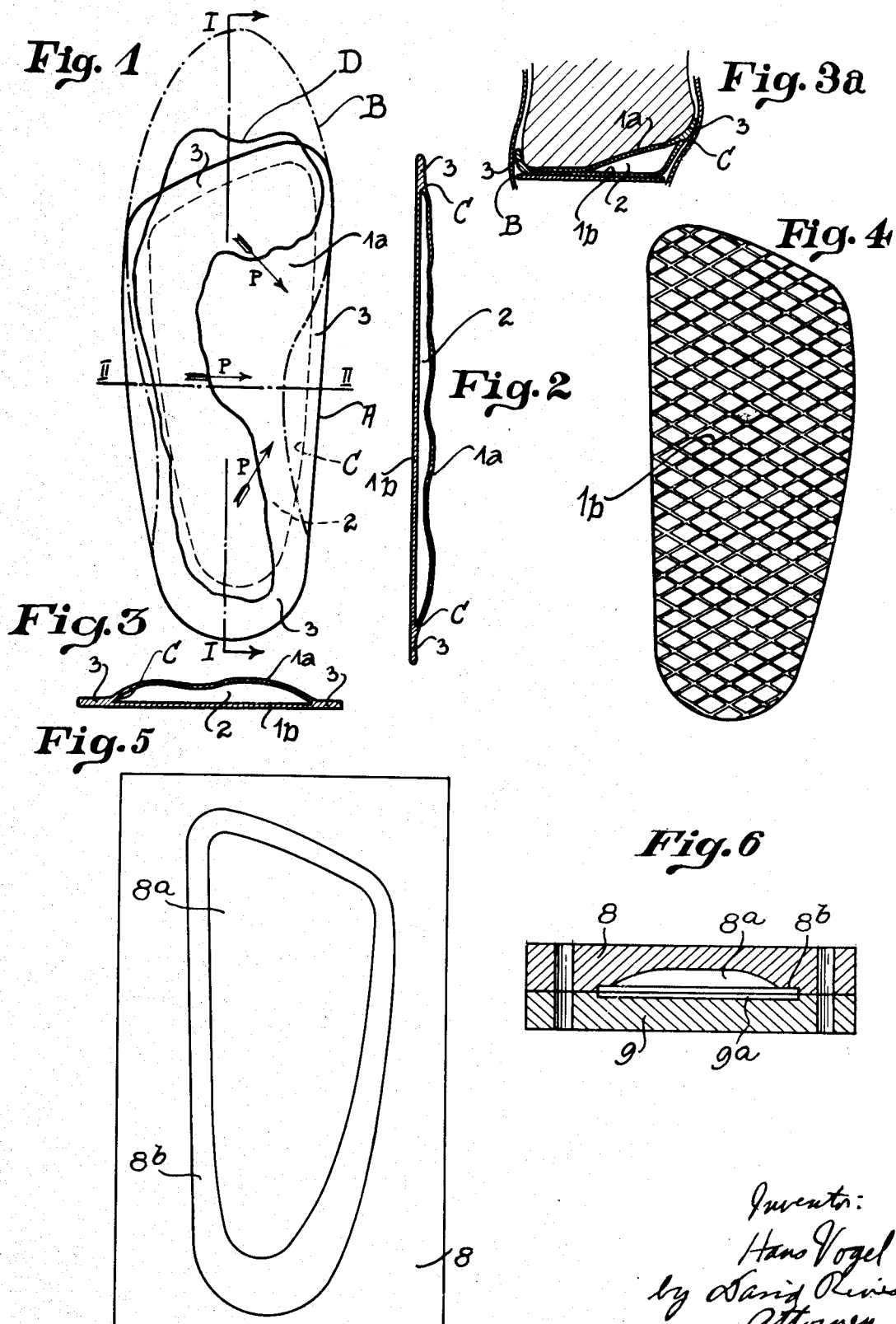
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PNEUMATIC INSERT FOR SHOES

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PNEUMATIC INSERT FOR SHOES

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This invention relates to a pneumatic shoe insert or arch support of the low-pressure type. Numerous pneumatic shoe inserts or arch supports have already become known but have all proved unsatisfactory. The invention solves for the first time the problem of producing a pneumatic shoe insert or arch support which really satisfies all the requirements.

There are several kinds of pneumatic shoe inserts or arch supports, such as those having a pneumatic pad adapted to the shape of the arch of the foot and those comprising a rubber bag the hollow space of which extends over the heel and the ball. The shoe inserts of the first-mentioned type are generally high-pressure shoe inserts, i. e. inserts in which the pressure is so high that the pneumatic pad cannot be compressed considerably under the influence of the weight resting upon the same, and therefore supports the arch of the foot. The operation of such shoe inserts or arch supports is substantially the same as that of rigid shoe inserts, as the foot is supported both during walking and when at rest.

In pneumatic shoe inserts or arch supports of the second type, i. e. inserts comprising a rubber bag extending over the heel and the ball, the middle portion of the inner side of the foot is lifted owing to the displacement of gas in the bag caused by the compression of the other portions of the insert by the ball, the outer foot edge and the heel. This action takes place independently of the value of the fluid-pressure existing in the rubber bag. If the gas or other fluid pressure is relatively great, the pressure exerted by the ball, the outer foot edge and the heel is not sufficient to press the opposite wall parts of the rubber bag against each other. In such shoe inserts a gas layer is therefore always present between the standing surface of the foot and the sole of the shoe. If, however, the gas pressure is relatively small, the rubber bag, when a person is standing on the same, will always be completely compressed at the portions in touch with the ball, the outer foot edge and the heel, and a gas cushion exists only on the middle portion of the inner side of the foot, i. e. in the region of the longitudinal arch. Such an insert is an insert of the low-pressure type. By properly dimensioning the volume of the gas space or gas chamber in the rubber bag, and using a small gas liquid, or other fluid filling, as well as thin walls a pneumatic or hydraulic shoe insert can be obtained that shall have substantially the shape of a vertical projection of the foot and that, when not compressed by the weight of the foot, is flat like an insole, thus

taking up substantially no more room in the shoe than an ordinary insole. The support for the foot provided by these prior-art insoles is quite defective. Among other defects, for example, undesirable gas cushions are formed, when compression occurs, at the heel portion of the foot, along the outer edge of the foot, and at the regions of the toes, particularly the ball of the big toe.

An object of the present invention is to provide a new and improved insert or arch support of the low-pressure type.

A further object is to provide an insert of the above-described character in which the internal gas pressure is initially or normally so low that normally, when not subjected to the pressure of the foot, the insert occupies substantially no more space than an ordinary insole, so as not to support the foot when at rest, but the gas or other fluid contained in which is entirely displaceable by the external pressure of the foot, bearing at the heel portion, the ball portion, and the outer edge, of the foot, so as to cause the insert to become warped out of shape, resulting in the gas pressure being exerted upwards against, so as to support, the arch of the foot.

Another object is to provide an arch support of the above-described character having a continuous gas or other fluid-containing chamber that shall provide uniform pressure, widely distributed over the foot, not only upon the middle portion of the longitudinal arch of the foot, but also upon the inner portion of the arch, along the side. The external pressure of the heel portion, the ball portion and the outer edge of the foot compresses the gas contained in the rubber bag. As a consequence, the gas gives way by displacement at desired points only, and there is no displacement at undesired points, with the result that no undesired gas cushions, as above described, can occur.

Several embodiments of the invention are illustrated in the accompanying drawing in which:—

Fig. 1 is a top plan view of one embodiment adapted for the left foot,

Fig. 2 is a section on I—I and

Fig. 3 a section on II—II of Fig. 1.

Fig. 3a is a cross section on a line parallel to line II—II of Fig. 1, the rubber bag being inserted in a shoe and compressed by the weight of the foot resting upon same.

Fig. 4 is a bottom plan view of the insert according to Fig. 1.

Fig. 5 shows in section a mould for the production of an insert according to the invention and

Fig. 6 in bottom plan view the top part of the mould.

As shown in Figs. 1 to 3, a rubber bag, constituted of an upper layer 1a and a lower layer 1b of plane sheets of rubber, forms a hollow pad the continuous or uniform gas-containing chamber 2 of which extends substantially under the whole heel portion, substantially under the whole ball portion, and under the outer edge, of the foot. Owing to the large size of the gas chamber 2 of the rubber bag, the small amount of its gas filling and the thin walls provided for by the rubber sheets 1a, 1b, the rubber bag, in its uncompressed state, is not substantially bulkier than an insole. It will not, therefore, support the foot when at rest.

Although the shoe insert or arch support is shown in Figs. 1 to 3 in reduced scale, the insert is shown in Figs. 2 and 3, for clearness sake, in approximately its natural thickness. Owing to the small amount of gas pressure in the insert it may be that, if the upper layer consists of an exceedingly thin rubber sheet 1a, shallow undulations will form on the surface of the insert when not subjected to the pressure of the foot. The function of the insert, however, is evidently not impaired thereby. The plan contours of the upper and lower layers 1a and 1b correspond substantially to the perpendicular projection of the human foot, as illustrated more particularly in the drawing by A. It differs considerably from the shape of an insole of the boot or shoe, indicated in Fig. 1 by B. This contour B is strongly concave at the inner or right hand side, whereas the contour A extends at the inner or right hand side approximately in a straight line. If the ball, the outer foot edge and the heel press downward upon the rubber bag 1a, 1b, the compressed gas is displaced from the complementary portions of the pad, in the direction of the arrows P, to the right and a portion of the same as a gas cushion, then occupies the area or region under the arch of the foot, at the right of the contour line B, where the highest point of the foot arch is situated. The volume of the gas or other fluid in the chamber is substantially the same as and, in any event, not substantially greater than, the space under the arch of the foot. In the case of gas fillings, the volume of the gas is, when compressed, substantially the same as the space under the arch of the foot. In arch supports having a greater pressure or volume of gas, the heel portion, the ball portion and the outer edge of the foot cannot displace all the gas from the complementary portions of the pad to the region of the arch, so that there is always present a layer of gas under other edge portions of the sole and under the heel portion and the ball portion of the foot. As liquids, however, are substantially incompressible, the volume of the liquid is substantially the same as the space under the arch of the foot.

The compressed gas cushion thus formed is situated to the left of the contour B the same distance as the foot arch is so situated. That portion of the insert, which is on the outer side of the contour of the insole B rests evidently upon the upper of the shoe as may be seen from Fig. 3a. The upper layer 1a and the lower layer 1b are connected together along their edges to form a solid marginal zone or border 3 that extends throughout the whole periphery of the arch support, the shape and the dimensions of the arch support being such, and the marginal zone being

of such width that, under the pressure of the foot, the gas or other filling becomes displaced in one direction only, towards the space below the arch, in such a manner as to cause the bag to press in an upward direction only towards the foot arch. The gas filling cannot, therefore, form, by displacement, undesirable secondary gas cushions along the circumference of the insert, or under the toes. The inner contour C of the solid marginal zone or border 3 lies outside the contour B of the insole of the boot or shoe in the area or region only of the arch of the foot. The outline D of the standing surface of the foot is situated within the contour B of the insole. The inner contour C of the marginal zone or border 3 is disposed inside the outline D of the standing surface of the foot in the region of the heel, the outer foot edge and the ball, and also outside of said standing surface in the region of the longitudinal arch of the foot. As clearly shown in Fig. 1, the heel portion of the border 3 is preferably of relatively great width, its width being shown greater than the width of the side portions of the border 3. This feature is important in order to prevent an undesired cushion of compressed fluid to be formed behind the heel of the foot when the rubber bag is compressed by the weight of the foot.

The lower layer 1b is substantially plane, whereas the portion of the upper layer 1a between the marginal edges 3, as seen in Figs. 2 and 3, is domed convexly over the lower layer 1b and makes an acute angle with the lower layer 1b at its points of attachment thereto. The convex shape is caused by the internal gas pressure, not by previous molding, for the sheets 1a and 1b, as before stated, are plane.

As shown in Fig. 4, the underside surface of the lower layer facing the insole of the shoe is provided with an anti-slip surface, which may be produced by vulcanization, similarly to the surface of the outer sole of rubber shoes. As this anti-slip surface prevents the insert from slipping in the shoe, the insert may be made shorter than the length of the insole, i. e. the toe portion may be dispensed with.

The described inserts are suitable for weak and medium heavy cases of flat foot or spread foot.

The upper layer 1a of the described inserts has preferably a covering which is porous and, therefore, sweat absorbent, to promote ventilation. If constituted, for example, of a suitable fabric, it may, together with the body of the insert, be easily washed.

The insert is purposely unprovided with a sealed gas orifice, a valve or the like, as it is desired that the gas be prevented from escaping, when under pressure.

The gas is introduced into the bag of the insert by means of a gas-developing substance accommodated between two mould halves 8 and 9 shown in Fig. 5, and the gas chamber of the insert is sealed.

The mould half 8 has a cup-shaped cavity 8a which merges into a step 8b as shown also in Fig. 6. This step serves to produce the above-mentioned marginal zone 3 of the insert. The lower half 9 of the mould has a cavity 9a which, however, is not cup-shaped, like the cavity 8a, but is plane. For manufacturing on a larger scale multiple moulds are employed, with the aid of which a great number of inserts can be produced at the same time.

An important feature of the arch support according to the invention consists in that any stiff members which might affect the natural walking-movement of the foot are dispensed with.

It will be apparent that the arch support, as described and illustrated is extremely simple in construction and can be manufactured at a comparatively low cost.

While I have shown and described the preferred embodiments of my invention, it will be obvious that various changes in details of construction and in the proportions may be resorted to for successfully carrying my invention into practice without sacrificing any of the novel features or departing from the scope of the appended claims.

What I claim is:—

1. A pneumatic shoe insert of the low-pressure type comprising a rubber bag constituted of an upper layer and a lower layer each having substantially the shape of a vertical projection of the foot and providing a continuous fluid-containing chamber extending substantially under the whole heel portion, substantially under the whole ball portion, and under the outer edge, of the foot, the layers being integrally connected together along their edges to form a solid marginal zone that extends throughout the whole periphery of the insert, the pressure of the fluid in the chamber being normally so low that the rubber bag is substantially flat when uncompressed so as to exert substantially no pressure upon the foot when at rest, the volume of the fluid in the chamber being when compressed substantially the same as the space under the arch of the foot, and the shape and the dimensions of the insert being such, and the marginal zone being of such width, that, under the pressure of the foot, bearing at the heel portion, the ball portion and the outer edge, of the foot, all the fluid in the chamber becomes displaced into a single fluid cushion in the said space under the arch of the foot, thereby preventing the formation of fluid cushions elsewhere than in the said space under the arch of the foot, whereby the said single fluid cushion exerts pressure in an upward direction only towards the arch of the foot.

2. A pneumatic shoe insert of the low-pressure type comprising a rubber bag constituted of an upper layer and a lower layer each having substantially the shape of a vertical projection of the foot and providing a continuous fluid-containing chamber extending substantially under the whole heel portion, substantially under the whole ball portion, and under the outer edge, of the foot, the layers being integrally connected together along their edges to form a solid marginal zone that extends throughout the whole periphery of the insert, the lower layer being substantially plane, the upper layer making an acute angle with the lower layer at its connection thereto along the inner edge of the marginal zone and being convexly curved above the lower layer, the pressure of the fluid in the chamber being normally so low that the rubber bag is substantially flat when uncompressed so as to exert substantially no pressure upon the foot when at rest, the volume of the fluid in the chamber being when compressed substantially the same as the space under the arch of the foot, and the shape and the dimensions of the insert being such, and the marginal zone being of such width, that, under the pressure of the foot, bearing at the heel portion, the ball portion and the outer edge, of the foot, all the fluid in the chamber

becomes displaced into a single fluid cushion in the said space under the arch of the foot, thereby preventing the formation of fluid cushions elsewhere than in the said space under the arch of the foot, whereby the said single fluid cushion exerts pressure in an upward direction only towards the arch of the foot.

3. Shoe insert as claimed in claim 1 characterized in that the face of the lower layer facing the shoe has an anti-slipping profile.

4. Shoe insert as claimed in claim 1 characterized in that the upper layer is covered with a porous, absorbent material, said cover engaging with pocket-like extensions over the lower layer to permit an easy exchange of the porous, absorbent material.

5. A pneumatic shoe insert of the low-pressure type comprising a rubber bag having substantially the shape of a vertical projection of the foot and providing a continuous fluid-containing chamber extending substantially under the whole heel portion, substantially under the whole ball portion, and under the outer edge, of the foot, the bag having a solid marginal zone that extends throughout its whole periphery, the inner contour of the zone lying outside of the contour of the insole only in the region of the longitudinal arch of the foot, the pressure of the fluid in the chamber being normally so low that the rubber bag is substantially flat when uncompressed so as to exert substantially no pressure upon the foot when at rest, the volume of the compressed fluid in the chamber being substantially the same as the space under the arch of the foot, and the shape and the dimensions of the insert being such, and the marginal zone being of such width, that, under the pressure of the foot, bearing at the heel portion, the ball portion and the outer edge, of the foot, all the fluid in the chamber becomes displaced into a single fluid cushion in the said space under the arch of the foot, thereby preventing the formation of fluid cushions elsewhere than in the said space under the arch of the foot, and whereby the said single fluid cushion exerts pressure in an upward direction only towards the arch of the foot.

6. A pneumatic shoe insert of the low-pressure type comprising a rubber bag constituted of an upper layer and a lower layer each having substantially the shape of a vertical projection of the foot and providing a continuous fluid-containing chamber extending substantially under the whole heel portion, substantially under the whole ball portion, and under the outer edge, of the foot, the layers being integrally connected together along their edges to form a solid marginal zone that extends throughout the whole periphery of the insert, the edge of the marginal zone adjacent to the longitudinal arch of the foot being substantially rectilinear, the inner edge of the zone being disposed inside the contour of the under side of the foot in the region of the heel, the edge of the outer foot and the ball and outside of the contour of the insole in the region of the longitudinal arch of the foot, the layers being shorter than the foot so as not to include a toe portion, the pressure of the fluid in the chamber being normally so low that the rubber bag is substantially flat when uncompressed so as to exert substantially no pressure upon the foot when at rest, the volume of the compressed fluid in the chamber being substantially the same as the space under the arch of the foot, and the shape and the dimensions of the insert being such, and the marginal zone being of such width, that, under the pressure of the foot, 75

bearing at the heel portion, the ball portion and the outer edge, of the foot, substantially all the fluid in the chamber becomes displaced into a single fluid cushion in the said space under the arch of the foot, thereby preventing the formation of fluid cushions elsewhere than in the said space under the arch of the foot, whereby the said single fluid cushion exerts pressure in an upward direction only towards the arch of the foot, the upper layer being provided with a cover of porous absorbent material, and the lower layer being provided with an anti-slip surface.

7. A pneumatic shoe insert of the low-pressure type comprising a rubber bag having substantially the shape of a vertical projection of the foot and providing a continuous fluid-containing chamber extending substantially under the whole heel portion, substantially under the whole ball portion, and under the outer edge, of the foot, the bag having a solid marginal zone that extends throughout its whole periphery, the inner contour of the zone lying outside of the contour of the insole only in the region of the longitudinal arch of the foot, the heel portion of the zone being of greater width than the side portions thereof, the pressure of the fluid in the chamber being normally so low that the rubber bag is substantially flat when uncompressed so as to exert substantially no pressure upon the foot when at rest, the volume of the compressed fluid in the chamber being substantially the same as the space under the arch of the foot, and the shape and the dimensions of the insert being such that, under the pressure of the foot, bearing at the heel portion, the ball portion and the outer edge, of the foot, substantially all the fluid in the chamber becomes displaced into a single fluid cushion in the said space under the arch of the foot, thereby preventing the formation of fluid cushions elsewhere than in the said space under the arch of the foot, and whereby the said single fluid cushion exerts pressure in an upward direction only towards the arch of the foot.

8. A pneumatic shoe insert of the low-pressure type comprising a rubber bag constituted of an upper layer and a lower layer each having substantially the shape of a vertical projection of the foot and providing a continuous fluid-containing chamber extending substantially under the whole heel portion, substantially under the whole ball portion, and under the outer edge, of the foot, the layers being integrally connected together along their edges to form a solid marginal zone that extends throughout the whole periphery of the insert, the said periphery being disposed outside of the contour of the insole in the region where the longitudinal arch of the foot is situated, the layers being shorter than the foot so as not to include a toe portion, the heel portion of the zone being of greater width than the side portions thereof, the inner edge of the zone being disposed outside of the contour of the insole in the region of the longitudinal arch of the foot, the upper layer being provided with a cover of porous absorbent material, and the lower layer being provided with an anti-slip surface.

9. A pneumatic shoe insert of the low-pressure type comprising a rubber bag constituted of an upper layer and a lower layer each having substantially the shape of a vertical projection of the foot and providing a continuous gas-containing chamber extending substantially under the whole heel portion, substantially under the whole ball portion, and under the outer edge, of the foot, the layers being integrally connected together along their edges to form a solid marginal zone that extends throughout the whole periphery of the insert, the pressure of the gas in the chamber being normally so low that the rubber bag is substantially flat when uncompressed so as to exert substantially no pressure upon the foot when at rest, the volume of the gas in the chamber when compressed being substantially the same as the space under the arch of the foot, and the shape and the dimensions of the insert being such, and the marginal zone being of such width, that, under the pressure of the foot, bearing at the heel portion, the ball portion and the outer edge, of the foot, all the gas in the chamber becomes displaced into a single gas cushion in the said space under the arch of the foot, thereby preventing the formation of gas cushions elsewhere than in the said space under the arch of the foot, whereby the said single gas cushion exerts pressure in an upward direction only towards the arch of the foot, the bag being unprovided with an orifice, and the gas being introduced into the chamber through the medium of a gas-developing substance introduced between the layers prior to connecting them together.

10. A pneumatic arch-supporting insert comprising a rubber bag constituted of an upper layer and a lower layer each having substantially the shape of a vertical projection of a human foot and providing a uniform gas-containing chamber extending under the heel and ball portion and under the outer edge of the foot, the pressure of the gas in the chamber being normally so low that the rubber bag is substantially flat when uncompressed so as to exert substantially no pressure upon the foot when at rest, the volume of the uncompressed gas being so small that when the rubber bag is compressed by the foot the inner surfaces of the layers are pressed against each other at the heel and ball portion and under the outer edge of the foot and the volume of the compressed gas being so great that the arch of the foot is supported when the pressure of the foot is applied to the heel and ball portion and the outer edge of the foot, the layers being integrally connected together along their circumference to form a solid marginal zone that extends throughout the whole circumference of the insert, the inner edge of said solid marginal zone lying within the outline of the insole in the heel and ball portion and along the outer edge of the foot and lying outside the outline of the insole in the region of the longitudinal arch only, the upper layer being provided with a cover of porous absorbent material, and the lower layer being provided with a friction profile on the shoe-contacting surface.

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