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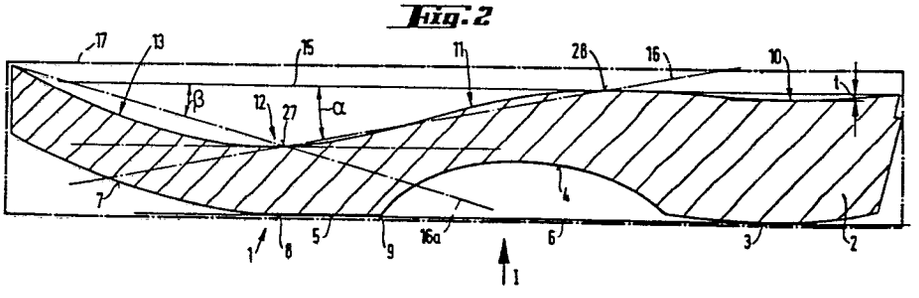
(54) **Sole of rigid material, especially wood, and shoes and boots equipped therewith.**

(57) The sole consists of a rigid material, in particular wood, whose insole is essentially adapted to the shape of the foot and whose toe area (13) rises from a ball area (12). Essentially in each plane of the sole parallel to the middle longitudinal plane, the tangent (15) is parallel to the outsole flat portion (5) in the ball area (12), such flat portion lying in the plane (6) of the outsole of the heel (3), touches the highest point (28) of the sole contour in the region of the longitudinal arch (11) and forms the chord across the shoe rest (10). A line (16) connecting this highest point (28) with the lowest point (27) of the hollow in the ball area (12) forms an angle of about 8-12° with the tangent (15). The front end section of the toe area (13) is higher than the heel rest (10). The outsole in the ball and toe area (12) and (13), respectively, can have a curved roll-off area (7) and optionally a heel area (3) separated from the flat portion (5) by an arch. Furthermore, shoes, sandals and boots equipped with this sole are described (Figure 2).

Fig. 2



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The invention relates to a sole of rigid material, in particular wood, and shoes, sandals or boots equipped therewith.

A contoured sole made of wood is known from US Patent 3 305 947. In this sole the heel rest is considerably lowered with respect to the ridge of the bridge leading to the hollow for the ball of the foot. The ball hollow is formed by a relatively narrow depression from which the toe rest rises, which is contoured in such a way that the toes adopt a gripping position. At the outsole the roll-off curvature is directly delimited by the recess contiguous to the heel tread surface. This known sole provides a backward tilted position, and thus the load is desirably shifted onto the heel. However, with the known sole this is the case only in the upright position. During walking the complete sole executes a rocking movement via the roll-off curvature. Thereby the complete sole is tilted, with the longitudinal arch of the foot forced upwards in the region of the high rising bridge and with the toes in a gripping position. However, the thus produced outer roll-off movement blocks the inner roll-off movement of the foot on the insole. This blockage is further increased by the relatively low level of the heel rest, since the heel can either not rise at all or only too slowly in view of the very low position of the heel rest. However, in consequence of the fact that the foot is deprived of the possibility of rolling off on the insole, the ankle and knee joints are also largely immobilized, which hampers a natural walking motion. Moreover, since the bridge supporting the longi-

tudinal arch of the foot rises high, in the known sole much weight rests on an area which is by nature relatively weak. As a result, fatigue can soon set in and, where the longitudinal arch of the foot is already damaged, pain may increase.

Starting from this basis, the object of the present invention is to provide a sole of the type mentioned above, avoiding the disadvantages of known arrangements and making possible an inner roll-off movement of the foot on the insole but at the same time ensuring that the weight mainly rests on the heel and that thus relatively little weight rests on the longitudinal arch of the foot.

It is true that in the shoes with leather or rubber soles which are at present widely used, there is a roll-off movement via the ball of the foot. However, here the sole must be bent with the aid of the longitudinal arch of the foot in the direction opposite to its inner bias, which experience has shown to result in considerable fatigue and in particular in the case of a damaged longitudinal arch very quickly produces pain.

According to the invention the object set out above is achieved by a sole of rigid material, especially wood, whose insole is essentially adapted to the shape of the foot, wherein the toe area rises from a hollow in the ball area, the tangent essentially lies in each plane of the sole, such plane being parallel to the middle longitudinal plane, is parallel to an outsole flat portion in the ball area or to a flat outsole, touches the highest point of the sole contour in the region of the longitudinal arch and forms the chord across the shoe heel rest, the flat portion lying

in the plane of the outsole heel portion, a line connecting this highest point with the lowest point of the hollow in the ball area forms an angle α of about 8-12° with the tangent, and the front portion of the toe area is higher than the shoe heel rest.

This sole makes possible a natural walk resembling a barefoot walking motion with a natural movement of the ankle and knee joints, which has a positive effect not only on the intervals at which fatigue symptoms appear, but can also advantageously influence the circulation thanks to the resultant pumping action. The insole flat portion is practically a front tread surface which blocks an outer roll-off movement as long as possible via the roll-off curvature and thus induces an inner roll-off movement of the foot on the insole. Nevertheless, in the last phase of an ambulatory movement, the inner roll-off movement can pass into an outer roll-off movement performed via the roll-off curvature. In this phase, however, the weight is already taken off the foot, since the body weight has already been shifted onto the other foot which has been set forward for the next step and which meanwhile can already roll off on the insole. The slight inclination of the bridge and level of the heel rest adapted thereto not only prevent the longitudinal arch of the foot from being forced upwards, but at the same time ensure that main body weight normally rests on the heel. Nevertheless, an inner roll-off movement is not blocked thereby, but rather aided, since the heel can actually easily rise from the upper level of the gently rising bridge.

Moreover, the inventive inclination in the region of the bridge results in a relatively wide ball hollow, which permits an inner roll-off movement on the ball

of the foot. The subsequent rise of the toe rest makes it possible on the other hand to shift the weight even more onto the heel, and on the other, the foot is given so much support in the toe area that it cannot slip off while the heel can easily rise. Thus, the advantages achievable with the invention are to be seen in particular in the facilitation of a natural walking motion in that the main weight is shifted onto the heel while the longitudinal arch carries relatively little weight in conformity with natural conditions. The advantages are thus to be seen in that even feet or legs which otherwise quickly show fatigue symptoms or aches can be exposed to stress over long periods. Thanks to the height of the heel rest the ball of the foot through which the inner roll-off movement is effected is secured in its position which can facilitate the inner roll-off movement and have a positive effect on the weight shift onto the heel. At the same time it is thereby ensured that the sole is almost permanently in contact with the foot during walking.

The roll-off movement is further advantageously influenced in the above-mentioned sense if a roll-off area is provided in the ball and toe area on the outsole. This roll-off area passes into the outsole flat portion.

In particular, the flat portion extends with its front rim to the region below the ball hollow, while the front rim of the flat portion can run approximately parallel to the groove lying perpendicular to the middle longitudinal plane and appearing in the region of the ball hollow. Preferably, the flat portion meets the roll-off curvature tangentially.

This ensures that an outer roll-off movement is reliably blocked until the inner roll-off movement of the foot on the insole is definitely underway. However, in the

last phase of this inner roll-off movement a jerk-free and continuous transition into an outer roll-off movement is ensured before the foot from which the weight is already removed is set forward for the next step.

If the depth of the concave heel rest is smaller than the natural heel contour, the weight is as desired shifted onto the heel which can by nature support great weights and at the same time the weight is as likewise desired removed from the longitudinal arch of the foot.

When a shoe wherein the sole is formed in the usual manner is exchanged fro a shoe equipped with the inventive sole or such a sandal with instep/toe band and/or heel cap, difficulties can arise initially, since the shoe forces the ankle and knee joints to move so that muscles frequently not used are trained. To gradually train the foot for the inventive sole shape, the outsole heel block can be temporarily equipped with detachable pieces of different thicknesses. If the intermediate piece or spacer is shaped as a shock absorber, an excellent shock-absorbing effect is produced resulting in a bouncy walk, which protects the bones and joints.

On the one hand, the back sloping heel cap prevents a shoe or sandal provided with the inventive sole from falling off or slipping away from the foot while being worn, even if the ground slopes up, and on the other hand nevertheless ensures surefootedness in the walking motion and standing position. Thanks to the fact that the heel cap slopes back slightly over its entire height, it is at the same time ensured that the inner roll-off movement is not hampered. Rather the heel is thereby given sufficient room when the sole of the foot performs the roll-off movement on the insole.

In order not to block the inner roll-off movement of the sole of the foot on the insole and to reliably avoid pressure points while still ensuring stability and good support, at least one instep band delimiting the opening and having at least a portion of elastic flexible material can be arranged according to the invention between the heel cap and the front cap. Thanks to its flexibility, the inventive instep band adapts itself to the foot performing the roll-off movement on the insole, and does not block or hamper this roll-off movement. Once the roll-off movement is finished, the instep band shrinks to its original dimension, whereby the sole is advantageously and automatically drawn to the foot and secured to it in a fixed position, which results not only in surefootedness and support, but also in that at the same time the weight is largely taken off the toes, which can contribute to a considerable relaxation in the toe area. At the same time it is thus ensured that the front cap in the region of the opening can be so wide that there is enough room for the inner roll-off movement and pressure points are sure to be avoided, so that the intervals at which fatigue symptoms appear are advantageously lengthened. The advantages achievable thereby are thus to be seen in increased safety and comfort.

An advantageous embodiment of the invention can consist in the instep band exhibiting ends fitted externally. This measure ensures that the instep band cannot slip down inside and obstruct the opening. Rather, it is thus ensured that the instep band always delimits a clear opening and so makes it easier to put on a shoe according to the invention.

Another advantageous embodiment can consist in that the instep band is provided with elastic strips in the region of its ends and is preferably fitted with these

strips at the sole. This ensures that the flexible ends are relatively long and thus relatively high elasticity and flexibility. At the same time the rigid sole used herein makes possible a simple but nevertheless reliable fastening. The use of elastic strips for forming flexible sections in the instep band advantageously results in an especially simple and therefore cost-saving manufacture.

In an advantageous embodiment of the invention, the instep band can have at least two sections joinable by a strap buckle. In this manner it is ensured that the instep band can be adjusted to any foot, providing in each case reliable support and excellent surefootedness.

At the side facing the opening, the front cap can advantageously have an expanding slit to ensure proper fastening on the one hand and sufficient room on the other hand.

The inventive sole can also be used for boot legs fastenable with the aid of fastening means such as buckles or laces, and can be mounted onto a sliding or rolling base part. Examples of such boots are ski boots or skating boots.

In the known boots, especially ski boots of this type, the insole is essentially flat in shape. The boot leg enclosing the ankle is inclined forwards with respect to the flat outsole. Experience has shown that the front area of the foot, which compared to the heel is relatively weak, is thus placed under relatively heavy strain, while the heel which is by nature more capable of supporting heavy weights is strained relatively little. Owing to the slanted position of the boot leg, the ankle joint is permanently

bent, which virtually immobilizes the foot. As a result, the region of the foot which is only intended to be strained slightly, is strained virtually the whole time, which can show up in that the foot gets tired quickly, or cramped or cold. Frequently the foot aches very much or at any rate the muscles get very stiff, which is considered a disadvantage. Moreover, since the known arrangements do not offer a roll-off possibility it is very difficult to walk with them without a rolling or sliding base part, even if the leg part is unfastened and such walking motion requires considerable effort.

The boot with the inventive sole does not have this drawback, since not only is the weight shifted to a high degree from the longitudinal arch and the ball of the foot to the heel, but the boot also permits a relatively easy walking motion when the boot leg is unfastened. In the region of the shoe heel rest the leg of this boot connected to the sole forms a shoe heel cap running at least perpendicular to the plane outsole at least to the height of the heel.

These measures permit the main weight to be carried by the heel in accordance with the natural structure of the body, and the front part of the foot to be freed from strain, with the result that the boot of this invention can be worn without producing fatigue. Advantageously, after-effects in the form of stiff muscles or pains are not to be feared. On the contrary, this is the first boot which surprisingly does not produce pains, even when worn by persons with foot, leg or joint complaints. Since the main strain is placed on the heel, the front region of the foot is practically free and can therefore rest, which ensures that the shoe can be worn over long periods without causing cramps or impeding the circulation. As soon

as the leg of the boot is unfastened, i.e. as the buckles are loosened, the inventive contour of the insole together with the free movement in the heel area provided by the heel cap permits an inner roll-off movement of the foot sole on the insole, thus facilitating ambulation. The toe rest which steadily rises forwards ensures that the toes can easily press against the sole, whereby the ball of the foot performing the inner roll-off movement is maintained in the right position in the ball hollow, and whereby the rising of the heel is facilitated. The slight inclination of the bridge and the level of the heel rest adapted thereto also have an advantageous effect on this. However, at the same time the longitudinal arch of the foot is not only prevented from being forced upward, but the main body weight is also shifted onto the heel. If the leg of the boot is fastened, the heel taking the main weight is conveniently accommodated in the room provided by the heel cap, which results in a confortable, tension and cramp-free fitting of the boot.

In an advantageous further embodiment the sole can be a wooden blank providing an excellent insulation against cold. Such a sole can be simply prepared from an approximately square blank.

The invention is explained in detail as follows with the aid of the drawing.

Figure 1 is a plan view of the sole according to the invention seen from below;

Figure 2 is a middle longitudinal section running parallel to the toes along the line II - II in Figure 1;

Figure 3 is a cross section along the line III - III in Figure 1;

Figure 4 is a cross section along the line IV - IV in Figure 1;

Figure 5 is a side view of a sandal having a sole according to the invention;

Figure 6 is a perspective view of a sandal having a sole according to the invention and an instep band; and

Figure 7 is a middle longitudinal section through a ski boot according to the invention, the section running parallel to the toes.

The sole depicted in Figures 1 to 4 is a one-piece, rigid wooden sole which has been simply worked from a square blank, as described further on, whereby the lower surface of the blank is tangential to those points of the outsole which are in contact with the ground when a person wearing such a sole treads on level ground and the upper surface of the blank is tangential to the insole. As can best be seen from Figures 1 and 2, the sole designated in its entirety as 1 is provided with a heel 2, the tread surface in the heel area 3 which comes into contact with the ground being separated by a downward opening recess 4

from a front tread surface formed by a flat portion 5. When set down on level ground, this front tread surface likewise comes into contact with the ground. The flat portion 5 lies in a plane tangential to the heel area 3, which is here depicted as being slightly curved, the plane being shown in Figure 2 by the line 6. In simple embodiments the heel area 3 can lie completely in a plane with the front flat portion 5. The front tread surface passes into a convex roll-off area 7. At the interface the front flat portion 5 runs practically tangentially into the roll-off area 7, so that the transition is uniform. The border line 8 between the front flat portion 5 and the roll-off area 7 runs roughly perpendicular to the middle longitudinal axis and parallel to the front heel rim. The rear delimitation line 9, however, can be slightly slanted or curved so that at its longitudinal sides the sole is rather broader. The function of the front flat portion 5 is explained in more detail below. In the example on which the drawings are based the outsole is not covered. In practice, however, a rubber covering is provided in the region of the front flat portion 5 and the roll-off area 7 into which it passes, the lower profile of this rubber covering running virtually parallel to the depicted profile of the outsole.

In the region of the insole is provided in a per se known manner a heel rest 10 above the heel 2. From this heel rest 10 there runs a longitudinal arch 11 or bridge, contoured to the longitudinal arch of the foot, to a ball hollow 12 which is contoured to the ball of the foot and ends in a toe area 13, as can best be seen from Figure 2. The insole is approximately contoured to the profile of the human foot, i.e. the sole 1 is provided with a gradient which rises up to the edge. This is especially

apparent in the region of the heel rest 10 and the bridge and, approximately as in Figures 3 and 4, serves to form a trough 14 in the region of the heel rest 10. In the region of the hollow for the ball of the foot, the foot and thus also the sole 1 are at their widest. Accordingly, in this region the gradient of the edge is comparatively slight. The same goes for the toe area 13. The heel rest 10 is contoured approximately symmetrical to the middle longitudinal plane. In the region of the bridge the inner sole edge is somewhat raised in relation to the outer sole edge, in conformity with the natural contour of the foot. This can best be seen from Figure 4.

The longitudinal arch 11 falls off in a slight curve down to the lower lying ball area 12 from the heel rest 10 which is approximately tangential to it, in such a manner that the longitudinal arch of the foot which is held from below is supported but not forced upwards, so that it rests under virtually no strain at all. Accordingly, the major part of the body weight on the sole 1 is transmitted via the heel, which is intended by nature to bear heavy loads, to the heel rest 10 which, apart from its contouring in conformity with the sole of the human foot, is roughly horizontal, i.e. parallel to the plane 6, and the level of which is approximately at the height of the upper bridge region, as can be seen in Figure 2 from the tangent 15 parallel to the tread surface and constructed to the longitudinal arch 11. In the longitudinal section parallel to the toes as shown in Figure 2 the lowest point of the longitudinal arch 11 (bridge) lies in the ball area 12 and the highest point in the region of the transition to the heel rest 10. The desired unburdening of the longitudinal arch and loading of the heel is achieved if the line 16 connecting the lowest point 27 of the hollow in the ball area 12 to the associated highest point 28 of the longitudinal

arch 11 is inclined at an angle α of 10° to the tangent 15. As tests have shown, the desired result is however still achieved in the range between 8 and 12° to a satisfactory degree. The same essentially applies to all longitudinal sections parallel to the toes. In some cases there is at most a slight deviation in an upward direction in the sole region contoured to the inner region of the foot. In the example which forms the basis for the figures the heel rest 10 is also slightly concave longitudinally from the upper region of the longitudinal arch 11, as can be seen from Figure 2. The resulting depression (depth t) in respect to the level of the tangent 15 should, however, be smaller than the natural contour of the human heel accommodated in this region, which can have a positive effect on the desired load uptake in the heel region. In a simple embodiment the depression can be dispensed with altogether with the result that the heel rest 10 lies virtually entirely on the level of the upper region of the bridge or longitudinal arch 11. The toe area 13 rises from the hollow of the ball area 12 in such a way that the result is a gentle concavity in the region of the ball area 12. On the other hand, however, the bent of the toes is intended to support a body posture by which the load is borne by the heel and also to ensure that the foot maintains its position relative to the insole, in other words that it is not shifted forward, which prevents tensions in the instep area and allows correct positioning of the ball of the foot during the roll-off movement. The front edge of the toe area 13 projects past the tangent 15. Advantageously the toe area 13 is therefore elevated to the point at which the line 16a connecting the front section of the toe area 13 and the lowest point 27 of the ball area 12 forms an angle ß in the range of 15 - 20°, preferably 17.5°, with the tangent 15.

The measures described above on the one hand ensure the desired loading of the heel and unburdening of the longitudinal arch, but on the other hand they also make it possible for the sole of the foot to perform a roll-off movement on the insole. This inner roll-off movement is induced by the front tread surface situated in the region under the ball area 12, the tread surface virtually completely blocking the sole 1 from a roll-off movement via the roll-off area 7. The inner roll-off movement takes place via the balls of the feet, which are accommodated in the ball area 12, the latter offering adequate roll-off clearance thanks to the fact that it is slightly convex. The toe area 13 provides adequate support to hold the ball of the foot on the ball area contoured to it, on the one hand, and, on the other, to permit it to rise back with the heel. This last motion is in turn facilitated by the fact that the bridge or longitudinal arch 11 rises gently and that the heel rest 10 is not or not appreciably sunk in relation to the upper region of the bridge; this, as already explained above, also has a positive effect on the unburdening of the arch of the foot and the desired loading of the heel. At the same time the support ensured in the region of the toes means that when the wearer takes a step the sole cannot tip downwards with the heel. Thus the measures of the present invention virtually make it possible to simulate a barefoot walking motion. The front flat portion 5 by which means an external roll-off movement is prevented can be so dimensioned that the front delimitation lies more or less below the lowest point 27 of the ball area 12. Even if the front flat portion 5 is made narrower as in the illustrated embodiment, however, excellent results can still be achieved. Tests have shown that the front flat portion 5 should nevertheless not be narrower than about 2 cm.

As already intimated above, the sole 1 can be shaped from a blank of the type with outlines shown in Figure 2 at 17. The height of the blank is approximately equal to the greatest sole height, so that the front flat portion 5 and the heel area 3 are practically tangential to the lower surface of the blank and the front tip of the toe area stretches to the upper surface of the blank, apart from a machining allowance which is necessary in practice and not depicted in Figure 2. As a result of the gentle rise of the longitudinal arch 11 and the comparatively low height of the heel there is the advantage that relatively little material is required. Since, on the other hand, the level of the heel rest 10 does not appreciably deviate from the blank upper surface, it is also comparatively simple to work.

The sandal upon which Figure 5 is based consists of a sole also designated here by 1 of the type described above, onto which are affixed an instep/toe band 18 and a heel cap 19 externally enclosing the heel rest 10. The sole 1 can additionally be provided in its upper region with a peripheral recess 20, as can be seen from Figures 3 and 4. This recess takes up the securing edge of the instep/toe band 18 and the heel cap 19. In the embodiment illustrated the instep/toe band 18 and the heel cap 19 are simply fastened to the sole 1 by pins 21. It would,however, also be possible to construct the sole 1 and the heel cap and/or the instep/toe band as one piece. Such a construction could, for example, be manufactured from a plastic blank. The rear height of the heel cap 19 corresponds roughly to normal heel height, resulting on the one hand in excellent stability, and on the other serves to prevent the sandal from falling off the foot of its wearer or the wearer's foot from slipping out. Through its entire height the rear

region of the heel cap 19 is inclined back slightly, which gives the heel the necessary freedom when performing the desired inner roll-off movement. Thanks to the unburdening of the longitudinal arch of the foot, the opening in the instep/toe band 18 is subjected to only comparatively little strain. It is therefore possible to achieve full freedom from tension in the region of the opening 22 of the instep/toe band 18 by manufacturing the latter from relatively soft material. In the illustrated embodiment two lateral slits 23 are made in the region of the opening 22 to ensure especially high flexibility of the instep/toe band 18. These slits can be bridged by a rubber strip not detailed here.

In the illustrated embodiment the heel 2 is formed by a heel piece 24 containing the heel area 3. This heel piece can be detachable affixed to a heel block 25. If the heel area 3 wears down in time the heel piece 24 is simply removed and replaced by a new heel piece. In order to detachably affix the heel piece 24 a notched or screw connection can simply be provided. In the simplest case such a connection can be made using wooden screws which can be screwed in from the heel area 3; the screw heads can be sunk in the heel piece 24. In an embodiment such as this a spacing piece 26 can be laid between the heel piece 24 and the heel block 25, this spacing piece having shock-absorbing properties, which advantageously results in a dulling of the impacts upon the heel and thus a bouncy walk and excellent protection for the bones and joints.

Changing from a shoe with a sole of conventional design, where the heel tread surface is considerably lower than in the embodiment depicted in Figure 2, to a shoe

incorporating the sole of the invention can present initial difficulties. In order to avoid or mitigate these difficulties the sole 1 can simply be equipped with a set comprising several heel pieces 24 of different thicknesses which are used one after the other. Since the heel pieces are detachably affixed they can be changed easily, with the result that advantageously one sole is sufficient. In order to ensure the same degree of sure-footedness with each heel height it may be expedient to provide corresponding heel pieces in the region of the front flat portion 5 also.

In the illustrated example the roll-off area 7 runs approximately parallel to the surface of the ball area 12 and the toe area 13. This ensures that the sole thickness is the same in this region. It would, however, be directly possible to round off the roll-off area 7 more sharply if individual circumstances require in order to have a positive effect on the external roll-off movement taking place in the last phase of the stride.

Despite the fact that the heel rest is essentially parallel to the tread surface, the sole according to the present invention results altogether in a backward inclination between the front end section of the toe area and the heel rest.

In the sandal shown in Figure 6 the outsole of the rigid sole 1 is provided with an elastic heel piece 24, 24'. The hollow in the ball area is spanned by a front cap 29 which is closed to the front in the region of the toe rest. The rear edge of the front cap 29 here delimits an opening 30 the size of which is best so selected as to give a surplus over the foot resting on the insole which at least corresponds to the profile of the foot in this region during the roll-off movement. To further shift the weight off this area one or more expanding slits 31 can be provided at the rear edge of the front cap 29. This ensures that the roll-off movement taking place on the insole is not blocked and that pressure points on the foot are definitely prevented. In the embodiment illustrated the front cap 29 is completely separate from the heel cap 19. It would, however, be readily possible to construct these two caps in such a way that they are connected by laterally running strips or alternatively made in one piece.

In order to ensure optimal support by the sandal despite the roominess of the front cap 29 and thus to ensure sufficient stability, an instep band is provided in the region between the heel cap 19 and the front cap 29. This instep band is designated in its entirety by 32 and in part consists of elastically expandable material. Thus this instep band 32 can fit snugly around the foot resting on the sole 1 without blocking the rise of the heel and thereby the roll-off movement by the sole of the foot on the insole. In the embodiment illustrated the instep band 32 is provided with an elastic strip 33 at each end so as to ensure a high degree of elasticity. The middle section 34 can be of leather. The lower ends of the elastic strips 33 are affixed to the sole 1. If the sole is of wood, nails, pins, staples or similar can also be used.

In the embodiment illustrated these connecting elements are covered by a decorative strip 35 which at the same time prevents them from being torn out.

The elastic strips 33 can be disguised by being arranged inside the front extensions of the heel cap 19 or else inside lateral strips running between the heel cap and the front cap. In the embodiment shown, the elastic strips 33 which form the ends of the instep band 32 are arranged outside the front extensions of the heel cap 19. This ensures that when the wearer puts on such a footwear the instep band 32 is easily accessible. Above all this is an advantage when the sole is not free in the region between the heel cap and the front cap, but is provided with lateral strips or bands.

The elastic strips 33 can be sewn or glued to the middle section 34 or firmly affixed by other means. In the embodiment shown fittings are provided for this purpose in the form of an eyelet 36 and a strap buckle 37, to which the elastic strips 33 are affixed in the form of loops. The middle section 34 is likewise affixed by a loop to the eyelet 36 and at its opposite end can be engaged with the buckle 37. In the embodiment shown a row of holes 38 is provided for this purpose, which allows the width of the instep band 32 to be adjusted and thus individual fitting.

The ski boot partly and in section depicted in Figure 7 consists of a rigid sole 1 to which is connected a boot leg 39 which is to be fastenable by buckles or the like (not depicted). The sole and the leg can be formed as an integral plastic blank. In the depicted embodiment the sole 1 is to consist for instance of wood, which provides excellent insulation against cold. The boot leg 39 joined to the sole can consist of leather or plastic and its inner surface can be completely or partly

lined. In the embodiment shown, the sole 1 is provided with a peripheral recess in the area of its upper rim and the fastening rim of the boot leg 39 engages in said recess.

The sole 1 has a plane outsole 3' contacting the tread metal of the corresponding ski. In the area of the front and rear sole rims, there are provided bar-like projections 40 and 41, respectively, with which the clamp elements of the binding attached to the ski can be engaged. The insole has a contour adapted to the human foot sole as described above in connection with figure 2.

In the depicted embodiment the boot leg 39 is formed in the region of the heel rest 10 as heel cap 42 sloping back slightly to the height of the heel. This measure provides sufficient room for the heel when the boot leg is unfastened, i.e. unbuckled. Therefore, the foot can roll off on the insole when the boot leg is unfastened, which facilitates ambulation without skis or in ski touring. This inner roll-off movement is effected via the ball of the foot resting in the hollow of the ball area 12. The gentle concavity of the ball area 12, the slight rise of the longtitudinal arch 11 along the inclined connecting line 16, as well as the horizontal orientation of the heel rest 10 in the area of the upper bridge level facilitate this inner roll-off movement. The bent toes in the toe area 13 provides sufficient support so that on the one hand the heel can easily rise and on the other hand the ball of the foot is maintained in the right position in the hollow. In the toe area 13 the instep height of the interior can be greater than the normal toe thickness so that the toes permanently have sufficient room to move. Since the heel cap 42 is positioned at least perpendicular to the outsole 3'

and is preferably sloped back slightly, there is not only sufficient room to perform an inner roll-off movement but at the same time an immobilization and inclination of the ankle joint is prevented. As soon as the buckles are closed the heel comfortably seats itself practically automatically in the room provided so ensuring that the boot fits properly. For this purpose, the clearance of the boot leg between heel and instep is expediently so dimensioned that in the closed position it snugly encloses the foot.

A ski boot of the type described above advantageously ensures that the body weight mainly rests on the heel and that the longitudinal arch of the foot and the ball of the foot are largely free from strain, so that those zones of the foot which are by nature weak are strained little, with the result that even in cases of foot, leg or joint complaints the boots can be worn for long periods. This at the same time facilitates an inner roll-off movement and thus easy ambulation without skis. Above the invention is illustrated by means of a ski boot. However, skating boots or roller skating boots and the like can be improved in the same manner.

In boots according to the invention it is advantageous to facilitate the bending movement by making the upper leather at the back of and above the heel, i.e. between the heel cap and the leg of the boot, from a relatively soft material, or alternatively to provide a suitable soft insert having a surplus of material.

SOLE OF RIGID MATERIAL, ESPECIALLY WOOD, AND SHOES AND BOOTS EQUIPPED WITH SUCH A SOLE.

Patent Claims

1. Sole of rigid material, especially wood, whose insole is essentially adapted to the shape of the foot, wherein

a) the toe area (13) rises from a hollow in the ball area (12);

b) the tangent (15) essentially lies in each plane of the sole, such plane being parallel to the middle longitudinal plane, is parallel to an outsole flat portion (5) in the ball area (12) or to a flat outsole (3'), touches the highest point (28) of the sole contour in the region of the longitudinal arch (11) and forms the chord across the shoe heel rest (10), the flat portion (5) lying in the plane (6) of the outsole heel portion (3);

c) a line (16) connecting this highest point (28) with the lowest point (27) of the hollow in the ball area (12) forms an angle α of about 8-12° with the tangent (15); and

d) the front portion of the toe area (13) is higher than the shoe heel rest (10).

2. Sole according to claim 1, characterized in that the shoe rest (10) has a concave trough (14) the depth (t) of which is smaller than the natural heel contour.

3. Sole according to claim 1 or 2, characterized in that the line (16a) connecting the front end portion of the toe area (13) with the lowest point (27) in the ball area (12) forms an angle ß ranging from 15° to 20°, preferably 17.5°, with the tangent (15) which is parallel to the outsole.

4. Sole according to one of claims 1 to 3, characterized in that the outsole in the ball and toe area (12) and (13), respectively, has a curved roll-off area (7).

5. Sole according to claim 4, characterized in that the outsole has a heel area (3) separated from the flat portion (5) by an arch.

6. Shoe with a sole according to claim 4 or 5, characterized by a shoe heel cap (19) which terminates the shoe heel rest (10) outwardly, projects over the insole up to the heel height and in its rear part slopes back slightly over its entire height.

7. Shoe according to claim 6 or with a sole according to one of claims 1 to 5, characterized in that the

leg or the instep/toe band (18) encloses the foot tension-free in the upright position.

8. Shoe according to claim 7, characterized in that the leg is flexible in the area of the opening (22).

9. Shoe according to one of claims 6 to 8, characterized by at least one instep band (32) which is arranged between the shoe heel cap (19) and a front cap (29), delimits the opening and exhibits at least one portion consisting of elastic, flexible material (elastic strip) (33).

10. Boot with fastening means, such as buckles, and with a fastenable boot leg and a rigid sole according to one of claims 1 to 5 which is connectable to the boot leg and onto which a sliding or rolling base part can be attached, in particular ski or skating boots, characterized in that in the region of the shoe heel rest (10) the boot leg connected to the sole (1) forms a shoe heel cap (42) running at least perpendicular to the plane outsole (3') at least to the height of the heel.

11. Boot according to claim 10, characterized in that in the region of the shoe heel rest (10) the boot leg slopes back slightly at least to the height of the heel.

Fig. 1

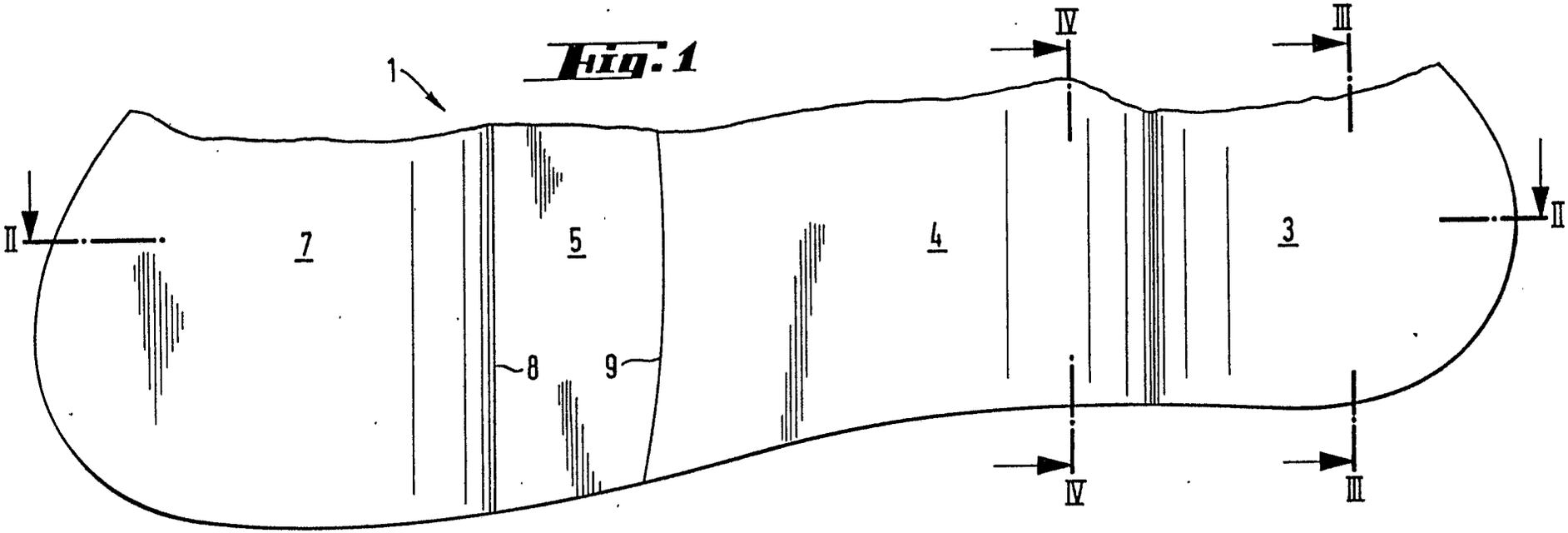

Fig. 2

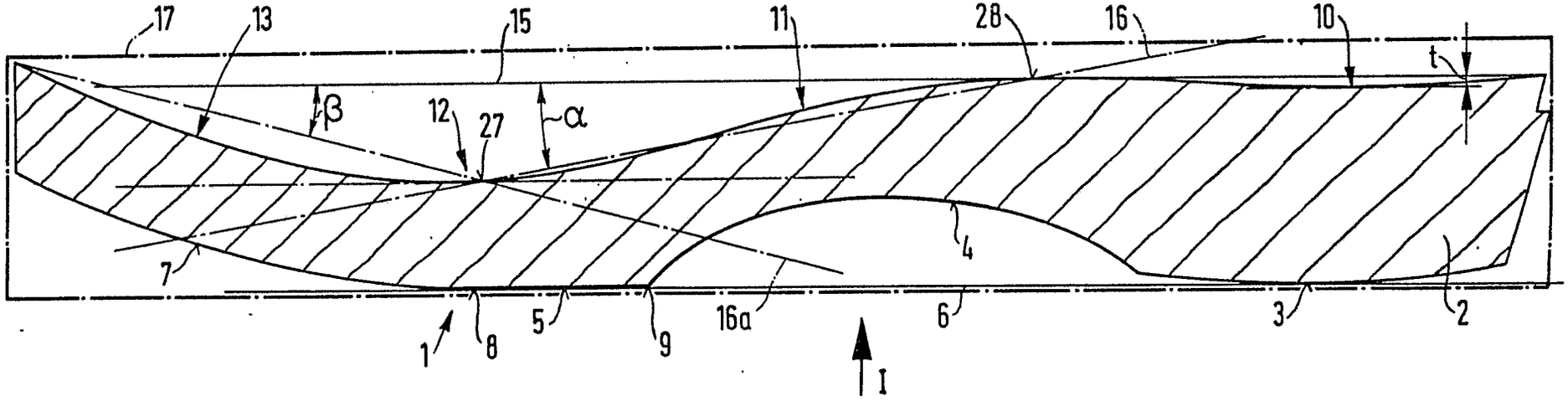

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Fig. 3

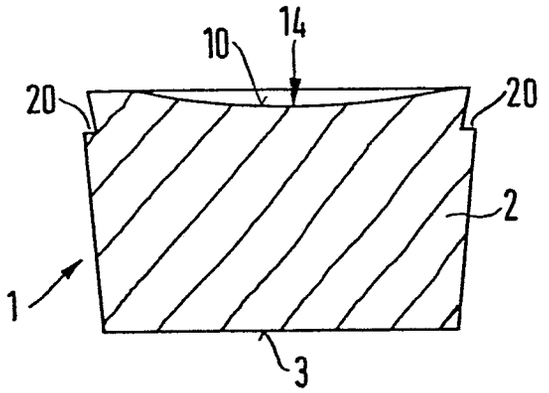


Fig. 4

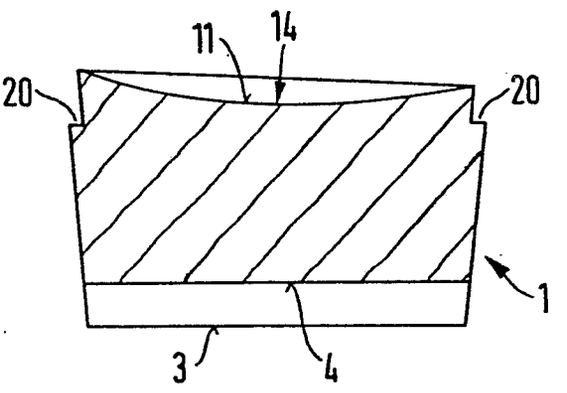
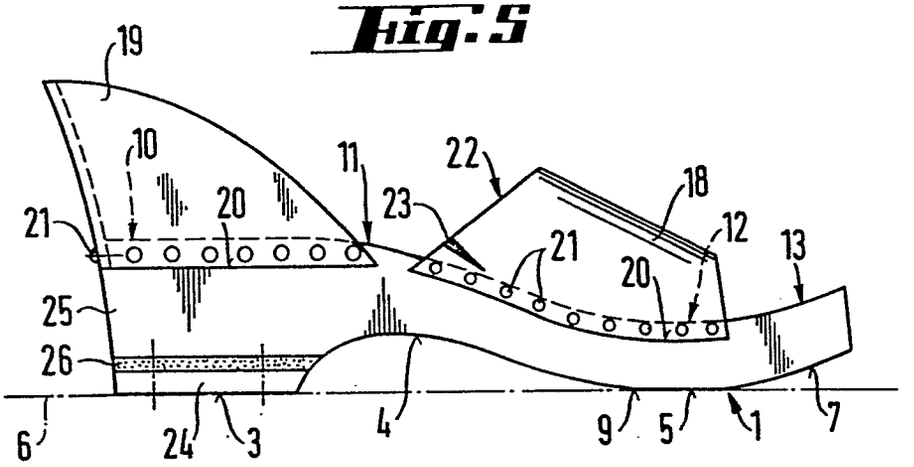


Fig. 5



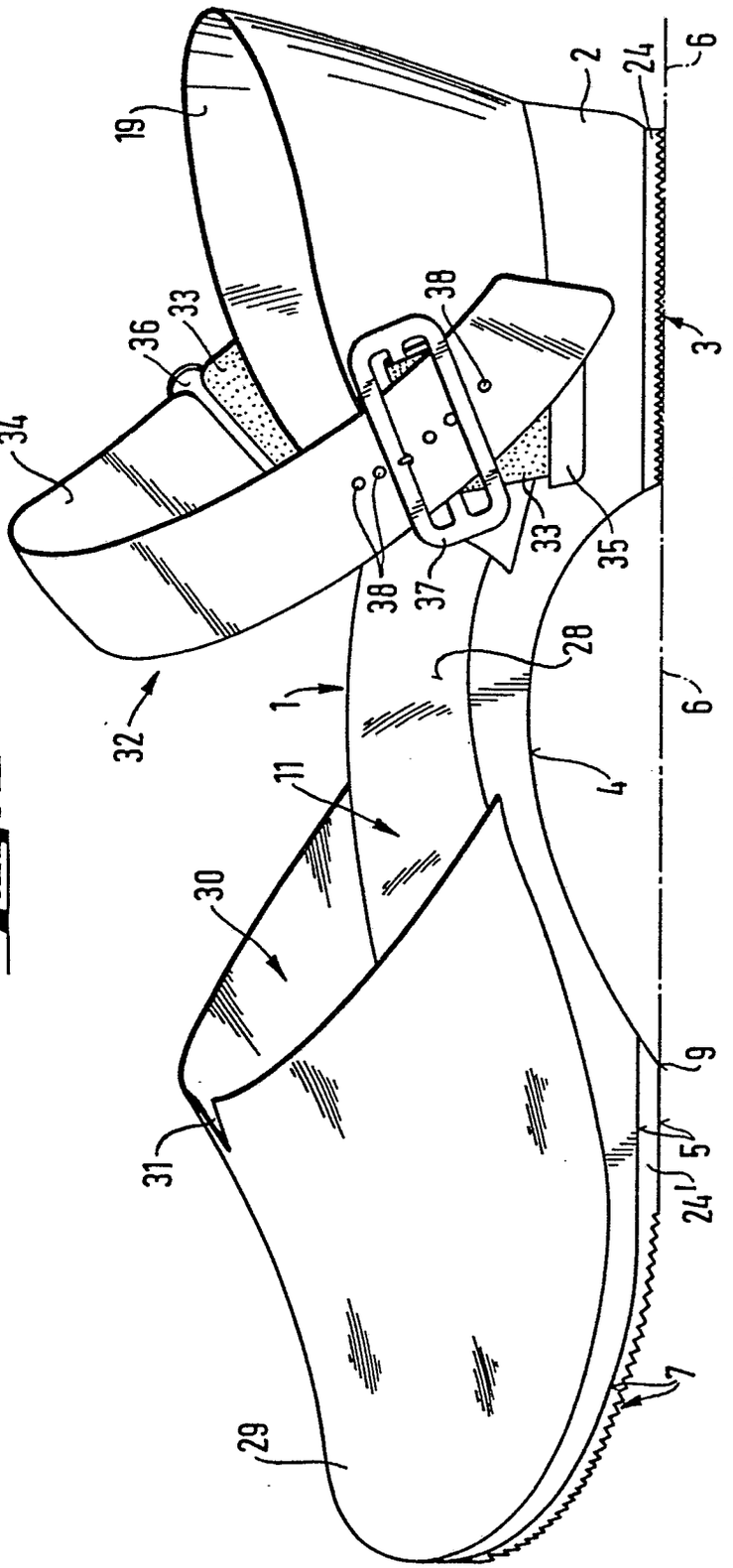


Fig. 6

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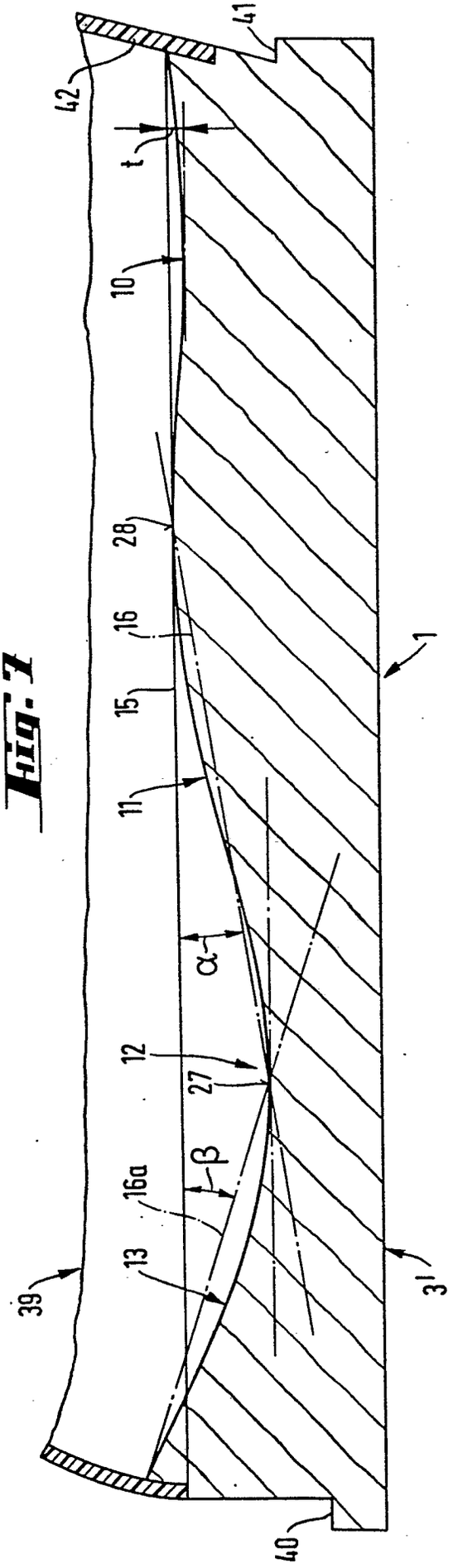

Fig. 1

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European Patent Office

EUROPEAN SEARCH REPORT

Application number
EP 81 10 5576

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
AD	US - A - 3 305 947 (A. KALSOY)	1
A	US - A - 3 729 840 (J. FAMOLARE)	1

CLASSIFICATION OF THE APPLICATION (Int. Cl.³)

A 43 B 13/14
13/08
13/37

TECHNICAL FIELDS SEARCHED (Int. Cl.³)

A 43 B

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	14-10-1981	DECLERCK