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(54) Ventilated boot and in-line roller skate with the same
Belüfte Schuh und einspuriger Rollsuh mit derselbe
Chaussure ventilée et patin à roulettes alignées la comportant

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Description

The present invention relates generally to an in-line roller skate and in particular to the boot used on such a skate. The invention further relates to the cooling of the foot of a skater.

An in-line roller skate includes a plurality of wheels rotatable in a common plane and carried by a frame attached to a skate boot. An in-line skate, then, has a lateral support base equal to the width of contact between the wheels and the skating surface, typically on the order of about .5 centimeters. This narrow support base makes balancing on the wheels difficult, especially for the novice skater.

While balancing in the forward/rearward direction is usually only a matter of experience, balancing in the sideward or lateral directions is a matter of sufficient ankle strength and of adequate lateral ankle support from the skate boot. That this difference exists arises from the anatomy of the lower leg and foot, which allows little lateral flexibility and provides little support to an individual’s ankles in the lateral direction. A skater’s ankle therefore has a tendency toward lateral bending. In sum, because an in-line roller skater has to balance on a plurality of wheels rotating in a common plane and having minimal surface contact with the skating surface, the providing of lateral ankle support is an important factor in proper, safe, and enjoyable use of an in-line skate.

When searching for a way to increase lateral ankle support, it was observed that the boots used for downhill snow skiing provide the additional support sought after.

To solve the problem of inadequate ankle support, then, the ski-type boot was adopted for use on in-line roller skates with minimal modification. But in doing so, a boot designed for cold weather has been widely adopted for use in the warm and often very hot weather conditions that in-line skaters encounter. The result has been that the skater’s feet are often hot, damp, and uncomfortable in the tight, nonporous, and stiff ski-type boots.

Ski boots are generally formed of a nonporous, synthetic material such as polyurethane. These boots include a rigid shell that securely supports a skier’s ankle and protects the foot from injury. The rigidity of the shell also provides the skier with better control over the long skis extending forwardly and rearwardly of the boot than would be provided by a boot made of a flexible material such as leather. Because of the nonporous nature of the boot material, they do not breathe and allow no air flow through the walls of the boot. In addition, ski boots are constructed to minimize air exchange between the inside of the boot and the cold skiing environment, striving to retain body generated heat. As a result, extensive heat accumulates in the boot during skate use. Such heat is generated in the boot due to often high ambient temperatures associated with the warm summer days when skating is done, from frictional movement of the foot within the boot, from increased circulation of blood to the feet and lower legs due to vigorous skating activity, from heat transfer from wheels and wheel bearings which heat up during prolonged skating, and from the often very hot asphalt or concrete skating surface. Skating surfaces such as black asphalt, which readily absorb solar and infrared radiation become very hot, and significantly increase temperatures within the boot. Finally many of the boots have a black or dark coloration that readily absorbs solar heat. All these factors contribute to heat build up in the boot.

Besides the problem of heat buildup within the boot, moisture from a skater’s perspiring foot also accumulates in the boot in response to the warm boot and physical activity. As with the heat build-up, the moisture accumulation is due primarily to an inability of air to circulate into and out of the boot and carry such moisture away, but the excessive heat aggravates the moisture accumulation problem because the skater’s foot perspires more with increasing heat levels in an effort to remain cool and to perform its share of dissipating the heat generated by the rest of the body during skating activity. The end result of the heat and moisture problems is that the presently available boots are much less comfortable to use than a skater would desire.

In addition, the synthetic material ski-type boot utilized by in-line skates, while providing excellent lateral stiffness and rigidity for lateral ankle support, provides unnecessary as well as unwanted forward/rearward stiffness and rigidity. This boot characteristic inhibits the performance abilities of the skate because it limits the range of motion of the skater’s legs and feet and therefore the ability of the skater to utilize the full extent of his muscular strength.

A third shortcoming of the ski-type boot is its heavy weight and thick wall which were needed by the skier for downhill skiing. This weight posed little problem for a skier relying generally on gravity for forward downhill motion and where one’s foot need not be lifted from the ground. An in-line skater, by contrast, must generally provide his own forward impetus and is constantly lifting his feet as he strides, moving the foot and skate forward. The heavy boot fatigues a skater, making the use of an in-line skate less enjoyable.

EP-A-0295081 describes an in-line roller skate having a frame to which a plurality of skate wheels are rotatably mounted. A rigid boot is attached to the frame.

EP-A-0260874 describes a ski boot having a number of ventilation openings in suitable portions of the outer sheath. The openings are air-permeable and waterproof.

Thus a need exists for an in-line roller skate boot that is conceived and built with in-line skaters and not snow skiers in mind, that provides skaters with a more comfortable, enjoyable use by cooling and drying their feet; that increases the forward/rearward range of motion available to a skater while preserving the lateral
ankle support desired by in-line skaters, and that weighs less and is less fatiguing to use.

It is a principle object of the present invention to provide new and improved apparatus not subject to the foregoing disadvantages.

It is an object of the present invention to provide an in-line roller skate having a boot made of a synthetic material that is cooler and therefore more comfortable for a skater to use.

It is a further object of the present invention to provide an in-line roller skate having a boot made of a synthetic material that is drier and therefore more comfortable for a skater to use.

It is yet another object of the present invention to provide an in-line roller skate having a boot made of synthetic material that has an increased range of motion in the forward/rearward direction and yet continues to provide lateral support to a skater's ankles.

It is still another object of the present invention to provide an in-line roller skate having a boot made of synthetic material that weighs less than prior art skates.

It is yet another object of the present invention to provide an in-line roller skate having a boot made of a synthetic material that provides improved performance for a skater.

The present invention provides an in-line roller skate comprising a boot formed from a stiff, resilient material, the boot comprising a vamp and a sole which are preferably integral and together define a cavity sized for receiving a skater's foot; roller means comprising a frame and a plurality of in-line wheels, the frame being suitable for attachment to the sole and for rotationally supporting the plurality of wheels; wherein the boot includes a plurality of apertures, the apertures being sized to permit air to circulate freely into and out of the boot cavity, the apertures further being sized and adapted to permit heat and moisture to be more easily expelled from the boot cavity, and the apertures being spaced and positioned for air to be drawn into and forced out of the cavity through the apertures during a skating motion to enable and facilitate dispersed air circulation within the cavity; and wherein a free-floating liner for receiving the foot of a skater is received within the boot so as to permit relative movement of the liner and the boot between a first position, in which part of the liner is spaced from an adjacent part of the boot to permit air to enter the boot through at least one of the said plurality of apertures, and a second position, in which the said part of the liner is in contact with, or nearer to, the said adjacent part of the boot, whereby during said skating motion, the boot, the liner, and the apertures cooperate to create an air-pumping action, such that the skating motion results in relative movement between said liner and the boot thus defining a continuous cycle of the air-pumping action which draws air into and forces air out of the boot cavity through the apertures.

The invention also provides the use of ventilating apertures and an air pumping action between a boot and a liner of an in-line roller skate to cool, and preferably dry, the foot of a skater, the skate comprising: a boot formed from a stiff, resilient material, the boot comprising a vamp and a sole which together define a cavity sized for receiving a skater's foot; and roller means comprising a frame and a plurality of in-line wheels, the frame being attached to the sole and rotationally supporting the plurality of wheels; the boot including a plurality of apertures sized to permit air to circulate freely into and out of the boot cavity and sized and adapted to permit heat and moisture to be more easily expelled from the boot cavity, the apertures being spaced and positioned for air to be drawn into and forced out of the cavity through the apertures during a skating motion to enable and facilitate dispersed air circulation within the cavity; and the liner, which receives the foot of the skater, being received within the boot and being free-floating to permit relative movement of the liner and the boot between a first position, in which part of the liner is spaced from an adjacent part of the boot to permit air to enter the boot through at least one of the said plurality of apertures, and a second position, in which the said part of the liner is in contact with, or nearer to, the said adjacent part of the boot, whereby during said skating motion, the boot, the liner, and the apertures cooperate to create an air-pumping action, such that the skating motion results in relative movement between said liner and the boot thus defining a continuous cycle of the air-pumping action which draws air into and forces air out of the boot cavity through the apertures.

Preferably, the boot is formed of a synthetic material and has a sole to which a roller means is attached, a whole vamp integral with the sole, a cuff pivotally attached to the vamp, a tongue, and means for tightening the boot onto a foot. At selected locations the vamp has a plurality of ventilating apertures to facilitate the movement of air into and out of the boot. The vamp includes a pair of guide rails that each extend upwardly and rearwardly from the top of the vamp near the front of the boot. Each guide rail is supported by a biasing leg extending from the top of the vamp upwardly to join its respective guide rail. Each guide rail together with its biasing leg and the vamp define a guide rail aperture. Each guide rail has a thickness less than the thickness of the walls of the remainder of the boot.

Skater comfort is improved with the present invention by the use of means to cool and to dry the skater's foot and lower leg. Thus, an in-line roller skate of the present invention includes apertures that allow air to circulate in and around the foot more readily than prior art boots. Heat build-up due to the previously mentioned causes can be dissipated more rapidly by air moving past and into and out of the boot through the apertures.

In addition, cooling is increased by a cooperative air pumping action of the skater and the boot. While a more detailed explanation of this phenomena will be provided below, by way of example, as a skater pushes off, the heel and back portion of the foot and liner are raised slightly in relation to the sole of the boot. Strategically
placed ventilating apertures enable air to enter the boot from the outside and to fill the void created by the rising foot. As the foot returns to a position where the heel is once again disposed against the inner sole of the boot, air is forced from the boot through the apertures. In this manner air is pumped into the boot to absorb heat and moisture and is then pumped out carrying the heat and moisture and leaving the foot cooler and drier. Other pumping mechanisms are also included and will be discussed further in the detailed description.

User comfort is further increased when the liner is a wicking liner that syphons moisture from the foot outwardly through the liner to the liner exterior where it is vented to the atmosphere or evaporates. Because evaporation is a cooling process, the skater's foot is kept drier and the skater is more comfortable.

Additionally, the boot may include a detachable tongue that has a smoothly finished outer surface layer and a cushioned inner surface layer where it contacts a skater's foot. The tongue may be attached to the boot by means of a projecting member that is matingly received by an aperture in the vamp of the boot. The tongue's outer surface layer may be a stiff but yieldable synthetic material that retains a memory of its shape. As a skater's leg rotates forwardly about the ankle, such as during a push-off, and then backswayed following completion of the push, a restoring force in the outer surface layer of the tongue acts against the leg to return the leg to a proper position for the next push-off. The detachable nature of the tongue allows a user to custom tailor the boot to a desired comfort and performance level.

The boot cuff, which provides ankle support to the user, may be pivotally attached to the boot at a pair of pivot points located below and rearward of the ankle. The cuff may have a generally crescent shaped configuration and include means for tightening the cuff around the ankle and lower leg. This tightening means is disposed on the cuff such that the cuff is tightened by drawing the cuff around the front of the leg.

The cuff may be capable of pivoting approximately forty-five degrees forwardly from its rest position to allow a range of leg motion not found in other in-line boots. As the cuff pivots forwardly, it slides on the smooth surfaces of the guide rails and the outer layer of the tongue. The increased forward pivoting range of the cuff is achieved in part by the smooth sliding surface presented by the guide rails and in part by the reduced sliding area presented by the guide rail aperture in the region where the cuff slides on the boot when it is pivoted forward in response to leg movement. Additionally, because the cuff tightening means slides on the outer surface layer of the tongue during pivoting, the smooth sliding surface thereof facilitates a sliding motion thereon and provides the tightening means with an unobstructed path on which to move, thereby also contributing to the increased pivoting range of a cuff of the present invention. The increased range improves a skater's performance by allowing stronger push-offs and improves a skater's comfort by increasing the freedom experienced by the leg in a front/rear direction. The increased range of motion further enhances the pumping mechanism noted previously.

The foregoing objects and summary provide only a brief introduction to the present invention. To fully appreciate these and other objects of the present invention as well as the invention itself, all of which will become apparent to those skilled in the art, the following detailed description of the invention and the claims should be read in conjunction with the accompanying drawings. Throughout the specification and drawings identical reference numerals refer to identical or similar parts.

By way of example, an embodiment of the invention will now be described with reference to the accompanying drawing, of which:

Figure 1 is a side elevation view of an in-line roller skate according to the present invention, Figure 2 is an exploded perspective view of the skate boot shown in Figure 1, Figure 3 shows in cross section the in-line skate of Figure 1 with a skater's foot and leg therein, Figure 4 shows in cross-section the in-line skate of Figure 1 and the air flow in the boot during the intake phase of a skating stride, and Figure 5 illustrates in cross-section the air flow out of a boot during the exhaust phase of a skating stride.

Figures 1 and 2 illustrate an embodiment of an in-line roller skate 10 in accordance with the present invention. Skate 10 includes a boot 12 and a roller means 14 attached thereto. Roller means 14 comprises a frame 16 that is attached to a boot sole 18 of boot 12 at a rear sole attachment 20 and a fore sole attachment 22. Frame 16 rotationally supports a plurality of individual wheels 24. While four wheels are shown in the Figures, it is known in the art to use three, four or more wheels attached to a frame and also to skate on as few as two wheels. The present invention is equally useful with other frames and with any number of wheels attached to such frames and all such variations are within the scope of the claims. A brake assembly 25, shown depending from frame 16, may be utilized on boot 12, also.

Boot 12 may be manufactured of a synthetic material such as nylon PEBAX 7033®, a polyether block amide material manufactured by Atochem. This material has a good strength to weight ratio and allows boot 12 to be manufactured with thinner walls than found in prior art boots which are commonly made of polyurethane. Because the walls are thinner, the overall weight of the boot is less than would be found in prior art in-line roller skate boots. Additionally, the reduced thickness of the boot walls increases boot flexibility, which allows the boot to more easily conform to a skater's foot during use, thereby providing a better fit as well as reduced weight for the skater.
Also depicted in Figures 1 and 2 is a free-floating boot liner 26. Liner 26 is not attached to boot 12 and is therefore able to float or move freely within the boot in response to foot and leg movements. Liner 26 protects the foot from harmful rubbing against the interior of boot 12 thereby reducing the likelihood of blisters and other abrasions during use. Liner 26 includes a foot insertion aperture 37 that extends from the top of liner 26, which, in the embodiment shown, reaches above a skater’s ankle to the lower mid-leg region, down the front thereof to the toe region. Liner 26 is formed of an inner mesh material 27a that provides a wicking effect to absorb and draw foot moisture generated by foot and leg perspiration outwardly through the liner and away from the foot to an outer liner 27b. From the outer liner surface the moisture may be vented or evaporated into the atmosphere by increasing air flow as will be more fully explained below. The outer liner material, which may be a vinyl material, allows moisture to escape all over or in selected locations only. It may include a nonporous material that is perforated at certain specific locations such as those directly in line with the ventilating apertures to be discussed below.

Boot 12 has a cuff 30 that is pivotally attached thereto using a pivot 31 or other fastening apparatus known to the art. Cuff 30 is a pair of cooperating cuff extensions 32 between which a buckle 28a or other known tightening means is disposed. Cuff 30 further includes a plurality of ventilators 33, 33a disposed on the rear portion of the cuff to aid in cooling the skater’s foot as described hereafter. Ventilators 33, 33a are shown as being vertically defined and as having a substantially elongated parallelogram configuration though other shapes would be effective and are within the scope of the invention. The vertical orientation of these ventilators takes advantage of leg movements and the consequent action of the rising and falling liner 26 to cool and dry the skater as will be clearly set out below.

Boot 12 further includes tightening means 28b and 28c in addition to tightening means 28a by which boot 12 may be tightened onto a skater’s foot. As shown in the Figures, boot 12 has three buckle-type tightening means. Boot 12 could have additional or fewer tightening means as desired and could utilize eyelets and lacing or a hooks and loops attachment mechanism such as Velcro®, all such variations being within the scope of the invention.

For ease of understanding of the invention, boot 12 will be discussed in terms of its various regions. Thus, boot 12 includes an upper vamp section 36 to which cuff 30 is pivotally attached and a lower vamp section 58 separated generally from upper vamp section 36 by an imaginary or working line 59, which extends around boot 12, beginning at the front end thereof at approximately the height of the skater’s toe in the boot and extending rearwardly to a point slightly below the skaters ankle. Line 59 indicates only a general area of demarcation between the upper and lower sections 36 and 58 respectively. Lower section 58 extends generally perpendicularly upwardly from sole 18 and provides lateral support in the lower foot area. The lower section, then, can be defined generally as that area of the boot extending upwardly from the sole to the height of the lower foot lateral support area of the boot. The area of demarcation provided by imaginary line 59 provides a single, solid ring of boot material surrounding a skater’s foot. That is, while it is desirable to provide a selected level of cooling and drying, it is necessary to preserve the structural integrity of boot 12. This area does so by providing the uninterrupted ring of material extending horizontally around the skater’s foot.

The upper section 36 includes a foot insertion aperture 37a by which a skater may put his foot into the liner 26 of boot 12. Upper section 36 further includes a cap segment 38 that extends from the front of the boot rearwardly to about where a skater’s toes join his foot. A mid-foot section 46 extends rearwardly from the cap segment to an area generally in front of the ankle. Upper section 36 also has an ankle segment 50 that extends rearwardly from the front of the ankle to the back of the foot. Lower section 58 includes a toe box 60, an arch segment 65, and a heel segment 69 corresponding respectively with cap segment 38, mid-foot section 46 and ankle segment 50 of upper section 36 in a forward to rearward progression.

Lower section 58 includes a plurality of ventilating apertures that allow air to circulate into and out of the boot 12 to cool and to dry a skater’s foot. As shown in Figure 2 boot 12 has a total of eight pairs of symmetrically disposed ventilators in lower section 58. Proceeding rearwardly from the front of the boot, a first pair of ventilators 61, 61a, has an elongated parallelogram configuration oriented with its long axis substantially parallel to the riding surface. Ventilators 61, 61a are separated by a toe protection bar 35 that protects a skater’s toes from injury caused by impact and provides forward/rearward structural integrity to boot 12 in the front area thereof. Toe bar 35 extends from sole 18 upwardly and rearwardly over the toes of the skater. Each ventilator 61, 61a allows air to be forced into and circulate boot 12 as a skater skates forward. While other configurations for ventilators 61, 61a will also suffice, the elongated configuration in combination with toe bar 35 provides a greatly increased cooling and drying air flow into boot 12 while substantially retaining the protection provided by a solid, rigid ski-type boot.

Disposed rearwardly of ventilators 61, 61a are a plurality of ventilator pairs 62, 62a; 63, 63a; and 64, 64a. Each of these ventilators has a substantially parallelogram configuration. Each ventilator allows air to flow into and out of boot 12 to cool and dry a skater’s foot, principally in the toe and front foot areas. Additionally, each of the ventilators 61, 61a; 62, 62a; 63, 63a; and 64, 64a serves as an exhaust vent or port by which heat may be radiated to the environment and moisture evaporated into the air exterior to the boot.
As shown in the figures, the four pairs of ventilators, 61-64a inclusive, are depicted in toe box 60. While other numbers of ventilator pairs or individual, non-symmetrically disposed ventilators are also within the scope of the claims, it is desirable that a boot have ventilators disposed near the front of the boot in the lower portion thereof to provide an ingress into the boot for the air rushing by during forward skating.

Disposed on arch segment 65 further rearward of the previously mentioned ventilators are three additional pairs of ventilators 66, 66a; 67, 67a; and 68, 68a; one ventilator of each pair being symmetrically disposed on opposite sides of boot 12. Each of these ventilators has a substantially parallelogram configuration and functions as an inlet port for dry, cool air and an exhaust port for heat and moisture. These ventilators aid in keeping the arch region of a skater’s foot cool and dry.

Heel segment 69 includes a pair of ventilators 70, 70a to aid in cooling the heel and ankle region, each of these ventilators having a substantially elongated parallelogram configuration. Unlike ventilators 61, 61a, however, ventilators 70, 70a have a longitudinal axis oriented substantially perpendicularly to the riding surface. These ventilators 70, 70a are oriented to take advantage of the upward/downward movement of the heel of a skater within boot 12 during skating. As will be further explained, during a skating stride a skater’s foot moves within boot 12 in several complex motions, including a more vertical movement of the heel and ankle region and a more horizontal movement of the toes. Thus forward ventilators 61, 61a have an elongated, horizontal orientation to utilize the wide horizontal cross section of the boot and to receive and expel air therein as the toes move rearwardly and forwardly while ventilators 70, 70a have an elongated vertical orientation to more readily allow inward and outward air flow under and around the heel as the heel and ankle move upwardly and downwardly to draw and expel air from the boot.

Referring now to upper section 36, cap segment 38 includes a pair of ventilators 44, 44a also separated by toe bar 35. Each of these ventilators has a substantially three sided, pie shaped configuration wherein two of the sides are formed by substantially straight lines that join at one end thereof and that are connected at the other along an arcuate edge. Each of these ventilators allows air to enter the boot during skating, and permit heat and moisture to escape by convection. During forward motion of a skater, air is forced into boot 12 through these apertures due to the skater’s forward velocity.

Referring still to upper section 36, a pair of ventilators 48, 48a is disposed in midfoot section 46. As best seen in Figure 2, each of these ventilators has an open sided configuration that is partially closed by tongue 90 as seen in Figure 1. Like ventilators 44 and 44a, ventilators 48 and 48a allow air to enter and exit the boot during skating and heat and moisture to escape by convection. Air may also be forced into boot 12 through these ventilators during forward motion due to the skater’s velocity.

Ankle segment 50 of upper section 36 includes a pair of ventilators 57, 57a that also allow air to enter and exit the boot during skating and heat and moisture to escape by convection. Each of these ventilators has a triangular configuration and will be discussed further below.

Each of the ventilators just described, then, can function as an intake and an exhaust port for air within particular regions of boot 12. Additionally the ventilators contribute to the establishment of cross ventilating air currents within the boot. Thus, ventilators disposed on opposite sides of the boot, such as ventilators 61 and 61a or 64 and 64a, for example, aid in the circulation of air laterally across the foot. Ventilators disposed on the front and rear portions of the boot, such as ventilators 61 and 70 or 70a, for example, facilitate the movement of air between the toe and heel regions of the boot. Finally, the ventilators disposed in the upper section 36 and those disposed in the lower section 58 such as ventilators 44 and 66 or 68a, for example, help to establish an air flow between the upper and lower reaches of boot 12. The cross ventilation that is established in the boot smooths out the heat and moisture distribution in the boot, thereby aiding in the prevention of localized hot or damp areas while at the same time cooling and drying the foot generally.

Referring now to Figure 2, ankle segment 50 includes a pair of guide rails 51, 51a extending upwardly and rearwardly therefrom. Each guide rail is made of the same material as boot 12, but has a reduced thickness equal to about seventy-five percent that of the walls of the boot. The guide rails extend from the interior side 13 of boot 12, thereby presenting a comparatively lower surface to cuff 30, which engages the guide rails, than cuff 30 would experience if the guide rails were of a uniform thickness with the rest of the boot walls. Each of the guide rails 51, 51a is supported by a biasing leg 52, 52a, respectively. Each leg 52, 52a has a first end 53, 53a respectively, attached to ankle segment 50 of boot 12. Each guide rail 51, 51a has a first end 55, 55a respectively attached to ankle segment 50 forwardly of where first end 53 is attached. Guide rails 51, 51a and biasing legs 52, 52a respectively extend upwardly from ankle segment 50 and converge at an apex 56, 56a respectively. Guide rails 51 and 51a extend substantially from the front portion of ankle segment 50 whereas biasing legs 52 and 52a extend substantially from the sides of ankle segment 50. Biasing legs 52, 52a prevent guide rails 51, 51a respectively from collapsing and help bias them respectively outwardly from a skater’s foot and leg. Ventilating apertures 57, 57a discussed previously are defined by ankle segment 50 and by guide rails 51, 51a and biasing legs 52, 52a, respectively.

In operation, cooling and drying of a skater’s foot is accomplished through the use of the strategically placed ventilating apertures and a cooperative air-pumping action between the boot and the liner 26 which
is actuated by normal movements of the skater's foot and leg.

More specifically, cooling and drying of the skater's foot is accomplished in several ways. First, the use and strategic placement of the ventilators allows and encourages an active interchange of the atmospheric air exterior to the boot with that interior of the boot, as well as air circulation per se within boot 12. This interchange and circulation carries heat and moisture away from a skater's foot and makes the temperature and moisture distribution in the boot more uniform, thereby substantially preventing the establishment of localized hot, damp spots. Second, the ventilators allow heat to escape by a more efficient convective process since heat does not have to pass a nonporous boot in those locations. Third, the action of wicking liner 26 draws moisture from the foot to the areas of the ventilators where it may be expelled from the boot or evaporated. The increased air flow expedites evaporation and the cooling effect of such evaporation further reduces the operating temperature of the boot. In addition, it dries the skater's foot and therefore provides a more comfortable skating experience. Fourth, an in-line skate in accordance with the present invention provides cooling through a cooperative pumping action between the boot and the skater's leg and foot.

Several of these cooling, drying processes are shown in Figure 3. In discussing this Figure, it will be assumed that the skater is moving in the direction of arrow 114 and, as a result, the skater will encounter a relative airflow moving in the direction of arrow 116. Of course, the actual air flow into and out of boot 12 will depend in part on the ambient air conditions, including wind direction and speed, and the skater's velocity.

Figure 3 illustrates in cross section a skater's foot 100 and leg 102 disposed within liner 26, which in turn is positioned within boot 12, wherein the skate and foot are shown substantially as they would appear during coasting. The skater's foot 100 lies substantially flush with the inner sole of boot 12 and the leg 102 is in a substantially upright position with cuff 30 also being in an upright position. As shown in these figures, skate 10 is configured such that the skater is skating only on center wheels 110 on skating surface 112 when coasting.

Generally, an air flow will enter boot 12 as indicated by arrows 131 through ventilators disposed in the front portion of boot 12. Thus, as shown in Figure 3, air will enter through apertures 44, 44a; 48, 48a; 57, 57a; 61, 61a; 62, 62a; 63, 63a; and 64, 64a. Air entering boot 12 at these locations will act to dissipate the heat and moisture accumulating within the boot and provide a desirable level of cooling in the toe and upper foot regions. Furthermore, as indicated by dotted line arrows 133, a front to rear circulation within the boot will be established. Thus, air flowing into boot 12 as indicated by arrows 131 will flow rearwardly as indicated by dotted line arrows 133 and ultimately exit the boot as indicated by arrows 137 through ventilators 33, 33a; 48, 48a; 57, 57a; 66, 66a; 67, 67a; 68, 68a; and 70, 70a. Additionally, air will circulate upwardly along leg 102 and exit through foot insertion aperture 37a as indicated.

It is recognized, of course, that due to the atomic nature of the gaseous atmosphere, that air will in fact be exiting and entering boot 12 through each of the ventilators previously described. Further, it should be recognized that due to the positioning and size of various ventilating apertures, air may enter predominantly in one portion thereof while another portion thereof may have a primary outflow of air. Thus, for example, ventilator 48 may, as shown, have a general inflow of air at a rearward most position as indicated by arrow 131 and an outflow from a relatively forward location as shown by arrow 137. The outflow is a result primarily of air previously entering boot 12 from a position forward thereof. Thus, as shown, a general front to rear circulatory pattern is established within boot 12. In addition, an up and down circulation pattern will be established between the ventilators in the upper section of boot 12 and those in the lower section thereof, as generally indicated by arrows 140, 141, respectively. In addition, a convective and radiative heat loss to the environment as indicated by arrows 143 will occur through the ventilators, such as 44 and 44a. This type of heat transfer will exceed that of prior art boots because of the presence of the ventilators, which makes the heat transfer easier by the removal of obstructing boot material.

Figures 4 and 5 illustrate the air pumping process and the cooperation of the various components of boot 12 that successfully cool and dry a skater's foot. Again, in Figures 4 and 5 it is assumed that the skater has a generally left to right direction of travel as indicated by arrow 114 and that a relative motion of air thereto is indicated by arrow 116. It will be understood that the relative motion of foot 100 and leg 102 described hereafter are exaggerated to illustrate more graphically the pumping action to be described. The pumping of air into and out of boot 12 begins as an intake stroke. Thus, as a skater begins a stride, he will lean forward and move one leg forward while pushing on the skating surface with the other leg, such as leg 102. As this pushing action occurs, the skate 10 is rotated forwardly such that only the forward most wheels are touching the skating surface 112. The heel 104 of the pushing foot will be lifted slightly off the inner-sole 151 of the boot, carrying free-floating liner 26 upwardly also, and creating a small gap 152 between the liner 26 and inner sole 151 into which air is drawn. This air may enter boot 12 through any of the ventilators shown but will do so primarily through ventilators 68, 68a and 70, 70a. Ventilators 70 and 70a are configured to take particular advantage of the intake stroke since they are oriented with the longitudinal axis of their substantially parallelogram configuration lying substantially parallel with the direction of motion of heel 104 within boot 12. Thus, by orienting ventilators 70, 70a such that their longitudinal axis is up and down, a larger, unobstructed access into heel segment 69 is had than would be obtained if their axis lay perpendicular to the direction of heel motion. This larger
access makes it easier for air to flow into boot 12 during this intake stroke wherein heel 104 is raised upwardly during a push.

Air is also brought into boot 12 through ventilators 33, 33a and insertion openings 37 and 37a. As the leg 102 is pivoted forwardly and heel 104 is elevated within boot 12, leg 102 is also pivoted forwardly with respect to cuff 30, carrying liner 26 therewith, and thereby opening a small gap between the top of cuff 30 and liner 26. The creation of this small gap facilitates the entry of air into boot 12 through ventilators 33 and 33a and at the top of the boot through insertion openings 37 and 37a.

Thus, with the intake stroke, air is brought into boot 12 at rearward and bottom locations, where it is otherwise difficult for air to circulate. As shown in Figure 3, air circulation in these regions is principally one of a forced out flow due to air moving front to rear within the boot. To any extent that this circulation is not established, cooling and drying of the heel and arch areas will suffer in comparison to the toe and top foot areas, which receive a forced air flow into the boot as noted previously. Thus, the pumping mechanism admirably brings air into the boot at a region that may otherwise experience localized heating.

Additionally, pumping occurs at the front of the boot. Thus, as a skater pushes off (Fig. 4), his leg 102 pivots forwardly around his ankle. At the same time, the heel rises and weight is transferred to the ball 154 of the foot, causing the toes 156 to slide rearwardly from the front of the boot. This enlarges the gap 158 between the liner and the front of the boot into which air may more readily flow. Air may easily enter the boot through ventilators 44, 44a and 61, 61a as shown by intake arrows 131 during this intake stroke, providing circulation within boot 12 and bringing in cooling, drying air to the front of the boot. Additionally, as weight is removed from the sole portion 155 of wicking liner 26, it inhales incoming air and expands.

A further form of pumping action also occurs with the skate in accordance with the present invention. Thus as previously referred to, as a skater pushes off, his leg is pivoted forwardly (Fig. 4) with respect to the ankle such that cuff 30 pivots forwardly and buckle 28a slides downwardly on tongue outer-liner 91 in the direction of tightening means 28b as indicated by arrow 165. The skater's leg compresses the front part of liner 26 and, in a manner similar to a sponge, squeezes air and moisture therefrom, which can then exit the boot via the ventilators such as ventilators 44, 44a, 48, 48a, 57, 57a in particular. The intake stroke, then, also exhausts some air from the boot and liner, principally along the top of the foot and the front of the leg, thereby forcibly expelling heat and moisture from the boot and cooling and drying the foot.

Referring now to Figure 5, as the skater completes the push he will bring the pushing leg forward whereby the heel 104 will return to its position flat against the inner-sole 151 of the boot and consequently expel air through the ventilators. Thus with a boot in accord with the present invention, an interchange of air is accomplished through a pumping action of the foot within the boot. Prior art boots, because of their solid construction did not allow the ready interchange of air found in the present boot.

More particularly, upon the exhaust stroke, as the leg is pulled forward, the toes 156 move forward to position 168, shrinking gap 158 and thereby expelling air from ventilators 44 and 44a and 61 and 61a. In a full cycle, then, as seen in Figures 4 and 5, air is pumped into boot 12 through these ventilators and then exhausted. A supply of cooling and drying air is thus constantly provided to the front of the boot during skating.

Furthermore, as shown in Figure 5, during the exhaust stroke, heel 104 returns to rest against inner sole 151 of boot 12. As it does so, free floating liner 26 will be carried downward therewith and the material of the liner lying against inner sole 151 will be compressed and air carrying heat and moisture will be expelled therefrom. This air, along with the air in gap 158, which is filled by liner 26 and foot 100 during the exhaust stroke, will be expelled from boot 12 through the ventilators, such as ventilators 33, 33a; 66, 66a; 67, 67a; 68, 68a; and 70, 70a. In a full cycle as seen in Figures 4 and 5, air is forcibly circulated into and out of boot 12 through the boot ventilators, such as ventilators 70 and 70a, for example, and consequently provides a continuous supply of cooling and drying air to the boot. As the skate is returned to a near horizontal position by the completion of the push and the forward movement of the pushing leg, liner 26 re-expands in the top and front foot areas and absorbs air from the atmosphere. Ventilators 48 and 48a and 57 and 57a experience an intake of air, then, as shown by arrow 131, part of which will be expelled during the next pushing stride, as discussed with reference to Figure 4.

Continuing to describe the exhaust stroke as shown in Figure 5, as the pushing leg 102 is brought forward in preparation for the next stride, the leg 102 pivots rearwardly at ankle 153, pushing against the rear portion of liner 26 to compresses the linear, thereby expelling air therefrom through ventilators 33 and 33a and through the rear portions of insertion openings 37, and 37a. Thus, the forward and rearward portions of liner 26 are alternately being compressed and expanded, and consequently air is being alternately expelled and drawn in, respectively. Liner 26 thus aids in generating a constant interchange of air between the interior of the boot and the external atmosphere. In addition, it should be recalled that liner 26 is preferably a wicking liner and actually draws moisture from the foot outward to where it may be vented or evaporated. Further, the free-floating nature of the liner 26 further facilitates cooling and drying of a skater's foot since it helps create gap 152 in boot 12. That is, if liner 26 were affixed to the boot, no gap would be created and the cooling and drying functions would be inhibited.
The ventilators of boot 12 thereby provide a general front to rear flow of air into and out of boot 12 during skating activity. In addition, however, by strategically placing ventilators in both the upper and lower sections of boot 12, an up and down ventilation is achieved, and by disposing ventilators on both sides of the boot, various forms of cross ventilation also occur. All of this ventilation aids in the removal of heat and air from the boot and thereby keeps the skater's foot drier, cooler and more comfortable, thus making in-line skating a more enjoyable sport.

It is important to note that placement of each of the ventilators is intended to provide a desired level of cooling and drying while retaining the necessary structural strength of boot 12. In this regard, it should be noted that as best seen in Figure 1, tightening means 28b and 28c each exert a tightening force that defines a line of tightening stress in boot 12 as indicated by double headed arrows 76 and 78 respectively. Since each tightening means exerts a tightening force across the width thereof, a pair of zones 74 and 78 as indicated by the dotted lines on Figure 1, are created in association with stress lines 76 and 80 respectively wherein it is preferable that no ventilating or fitting apertures should be placed. These zones preserve the structural integrity of the boot. It should also be noted that none of the ventilators extend across imaginary line 59, which, as previously noted, assures that the boot has needed structural support. Finally, a column of boot material is provided from sole 18 to the top of ankle segment 50 in the heel region, helping to maintain appropriate lateral ankle support. Thus, even after placing the described apertures in boot 12, the structural integrity of the boot is maintained, thereby preserving lateral ankle support and the desired protective features of a hard, rigid skioskype boot.

It should be noted that cuff ventilators 33 are disposed such that they would be within an area directly in line with the closure stress exerted by tightening means 28a. These ventilators however are disposed on the rear portion of cuff 30 where resistance to bending is not as important. Where strength is important, such as the lateral portions of cuff 30 that provide lateral support for the skater's ankles, the side portions of cuff 30 are preferably more solid material.

Ventilators disposed as shown retain needed lateral stiffness in the lower vamp section where lateral support to a skater's foot is important. In addition, while fewer or greater numbers of ventilators and various other configurations of ventilators can be utilized with the present invention, the shown arrangement and number represent a preferred embodiment.

Guide rails 51 and 51a along with apertures 57 and 57a further aid in the ventilation of boot 12. As previously noted, prior art boots had a substantially thick walled construction were resistant to lateral flexing of any kind. Additionally, some prior art boots included a pair of cuff supports extending upwardly from the rear portion of ankle segment 50 interiorly of cuff 30 that were resistant to forward bending, thereby further restricting the pivoting range of prior art boots. As a result of these pivoting restrictions, prior art boot cuffs were resistant to any forward pivoting of the cuff greater than about five to ten degrees with a foot in the boot. By contrast, the cuff attached to a boot of the present invention is capable of pivoting forwardly from a first upright position 170 to a second forwardly inclined position 175 through an arc of approximately 45 degrees, and back again rearwardly to the upright position and ankle movement is thus limited only by the physical dexterity of the skater's ankle. With a foot in boot 12, a cuff pivoting range of up to twenty-five degrees is available.

This extreme range of pivoting provided by cuff 30, which far exceeds that available in prior art boots, helps boot 12 to provide a unique cooling ability that is unknown in the art. The great pivoting range facilitates the pumping actions just discussed in that it allows greater swinging motion of leg 102 about ankle 153 than was available in prior art boots and therefore creates greater opportunity for the exchange of air. This occurs because the greater the range through which the leg can pivot about the ankle in a stride, the higher the heel is likely to be raised within the boot and the greater gap 152 will become. Similarly, the greater the magnitude of the pivoting arc, the greater is the back and forth range of motion of the toes within the boot and the greater gap 158 will become. As gap size increases, so does circulation and, accordingly, so does the cooling and drying of the skater's foot.

When a skater's leg pivots around the skater's ankle, such as during a push-off or stride, cuff 30 will pivot forwardly about axis 34 of cuff pivot 31, cuff extensions 32 slide downwardly toward buckle 28, and cuff 30 will slidingly rotate downwardly on guide rails 51. The pivoting of cuff 30 is aided by and is a function of several factors. Some of these are the guide rails 51, 51a upon which cuff 30 slides; the smooth finished tongue outerlayer 91 to be discussed below, upon which the cuff extensions 32 slide; the ventilators 57, 57a, which provide an unobstructed reduced friction sliding path for cuff 30, and the use of a thinner more flexible material for cuff 30 and boot 12. Guide rails 51 and 51a in combination with apertures 57 and 57a provide a smooth, reduced sliding surface area that minimizes pivoting friction with cuff 30. Thus, cuff 30 will more easily pivot and will do so with a greater degree of motion than will cuffs found in prior art boots. Pivoting is further aided by a smooth inner surface on cuff 30.

The comparative ease with which cuff 30 pivots as well as its pivoting range not only facilitates the cooling and drying functions of boot 12 but also increases the performance ability of the skater. As is well known, increasing the flexibility and the range of motion through which a muscle can move results in a corresponding increase in the muscle's efficiency and strength output. Thus, by increasing the pivoting arc of the cuff, the leg and foot of a skater can achieve a greater range of motion relative to the other. Consequently, the strength
of the skater's leg is increased and the skater is able to skate faster and more efficiently, incur less fatigue, and if capable, is more able to perform acrobatic maneuvers such as jumping.

Boot 12 may also include a detachable tongue 90. This feature of the present invention will be described with reference to Figure 2, and one means of attaching it to boot 12 will be illustrated. Thus as shown in Figure 2 tongue 90 includes a tongue outer-layer 91 that is attached to a tongue inner-layer 92 by means of stitching 93. Other means of attaching the tongue outer-layer 91 to the tongue inner-layer 92 are known and are within the purview of the present invention. Tongue 90 is defined by an upper tongue portion 94 and a lower tongue portion 95 upon which a tongue button 96 is disposed. Tongue button 96 includes a button shaft 97 having a substantially rectangular cross-sectional configuration extending upwardly therefrom though other configurations would serve equally well. Tongue button 96 further includes a button plate 98 that is integral with button shaft 97 and that has a pair of button lips 99 extending longitudinally forward and rearwardly therefrom.

The tongue attachment means further includes a cap segment extension 40 extending rearwardly from cap segment 38 as best seen in Figure 2. Cap extension 40 includes a cap segment extension aperture 42 that is configured to receive button 96 and together therewith to removably attach tongue 90 to boot 12. Cap segment extension aperture 42 will closely receive shaft 97 of button 96 when tongue 90 is attached to boot 12. Lips 99 will extend forwardly and rearwardly of extension aperture 42 and will function to retain shaft 97 within extension aperture 42.

Tongue outer-layer 91 is preferably a synthetic material having a smooth surface finish to facilitate the sliding of buckle 28a as cuff 30 pivots forwardly with a skater's leg. Layer 91 is preferably made of a material having a shape retaining memory. That is, following its manufacture, tongue outer-layer 91 has a rest shape to which it will seek to return when it is flexed therefrom. Preferably this rest shape will conform to a skater's foot and leg position prior to beginning a stride. Thus, as a skater pivots his leg forward around the ankle, such as during a push off, upper tongue portion 94 is pivoted forwardly with respect to lower tongue portion 95. As the skater moves his leg forward to complete the stride, tongue 90 acting through tongue outer-layer 91 will exert a restoring force on the skater's foot and leg to return tongue 90 to its rest position. Because the rest position conforms to the proper position for beginning a subsequent stride, tongue 90 will aid the skater in returning skate 10 to its proper position for such a subsequent stride. The detachable nature of tongue 90 allows a skater to custom fit a particular skate according to comfort and performance level. A skater can thereby rely in part on the restoring force exhibited by tongue 90 rather than solely on muscle memory and strength to return skate 10 to a proper position for a subsequent stride. The skater's performance level will accordingly increase.

Thus, a novel in-line skating boot, built and constructed with the specific demands of in-line skating in mind has been set forth.

Having thus described the present invention, numerous substitutions, modifications and alterations thereof, which fall within the scope of the appended claims, will now suggest themselves to those skilled in the art.

Claims

1. An in-line roller skate comprising:

a boot (12) formed from a stiff, resilient material, the boot comprising a vamp and a sole (18) which together define a cavity sized for receiving a skater's foot;

roller means (14) comprising a frame (16) and a plurality of in-line wheels (24), the frame (16) being suitable for attachment to the sole (18) and for rotationally supporting the plurality of wheels (24);

characterised in that the boot (12) includes a plurality of apertures (33, 33a, 44, 44a, 48, 48a, 57, 57a, 61-64, 61a-64a, 66-68, 66a-68a, 70, 70a), the apertures being sized to permit air to circulate freely into and out of the boot cavity, the apertures further being sized and adapted to permit heat and moisture to be more easily expelled from the boot cavity, and the apertures being spaced and positioned for air to be drawn into and forced out of the cavity through the apertures during a skating motion to enable and facilitate dispersed air circulation within the cavity;

and in that a free-floating liner (26) for receiving the foot of a skater is received within the boot (12) so as to permit relative movement of the liner (26) and the boot (12) between a first position, in which part of the liner (26) is spaced from an adjacent part of the boot (12) to permit air to enter the boot (12) through at least one of the said plurality of apertures, and a second position, in which the said part of the liner (26) is in contact with, or nearer to, the said adjacent part of the boot (12), whereby during said skating motion, the boot (12), the liner (26), the foot and the apertures cooperate to create an air-pumping action, such that the skating motion results in relative movement between said liner (28) and the boot (12) thus defining a continuous cycle of the air-pumping action which draws air into and forces air out of the boot cavity through the apertures.

2. A skate as claimed in claim 1, wherein the liner (26) is at least semi-permeable to air and moisture at positions in general alignment with the apertures.
3. A skate as claimed in claim 1, wherein the liner (26) is a wicking liner for drawing moisture away from a skater's foot outwardly through the liner (26).

4. A skate as claimed in any one of claims 1 to 3, wherein the boot (12) includes a lower vamp portion (58), and said plurality of apertures are positioned along the lower vamp portion (58).

5. A skate as claimed in any one of claims 1 to 3, wherein the plurality of apertures comprises at least a forward aperture and a rearward aperture, the forward and rearward apertures being positioned along a side of the boot (12).

6. A skate as claimed in any one of claims 1 to 3, wherein the boot (12) includes a mid-foot portion (46) comprising a lower arch portion and an upper mid-foot segment, and wherein the plurality of apertures comprises at least two apertures positioned within the mid-foot portion (46).

7. A skate as claimed in any one of claims 1 to 3, wherein the boot (12) includes a mid-foot portion (46) comprising a lower arch segment and an upper mid-foot segment; and an ankle portion (50); the plurality of apertures comprising an aperture positioned in the mid-foot portion (46) and an aperture positioned in the ankle portion (50).

8. A skate as claimed in any one of claims 1 to 3, wherein the boot (12) includes a toe box segment (60) including at least two apertures disposed on opposite sides of the boot (12), and wherein the liner (26) includes a toe portion capable in use of sliding forwardly and rearwardly between an intake position and an exhaust position in response to the skater striding while skating, thereby causing the intake and exhaust of air through the toe box apertures.

9. A skate as claimed in any one of claims 1 to 3, wherein the boot (12) further includes a pivotally attached cuff (30), the plurality of apertures comprising a pair of apertures positioned on the cuff (30).

10. A skate as claimed in any one of claims 1 to 3, wherein the boot (12) further includes a pivotally attached cuff (30) which includes at least one of the apertures, and wherein the boot comprises a toe portion, comprising a lower toe box segment (60) and an upper cap segment (38), the toe portion (60) including at least one of the apertures; a mid-foot portion (46) comprising a lower arch segment and an upper mid-foot segment, the mid-foot portion including at least one of the apertures; and a heel portion (69), the heel portion (69) including at least one of the apertures.

11. A skate as claimed in any one of claims 1 to 10, wherein the boot (12) includes an upper boot section (36) and has an inner surface (13), and wherein the boot (12) further includes:

   a cuff (30) pivotally attached to the boot upper vamp section (36), the cuff (30) comprising a stiff material, being swingable through a predetermined arc between a first upright position and a second position forwardly inclined from the first position, and including a means (28) for tightening the cuff (30) around the lower leg of a skater; and

   a pair of low friction guide rails (51, 51a) disposed on the boot upper section (36) underlying and contacting the cuff, the guide rails (51, 51a) providing low friction contact with the cuff (30) as the cuff (30) swings through the predetermined arc between the first upright position and the second position, each of the guide rails (51, 51a) comprising a member extending from the inner surface (13) of the boot (12), each said member having an elongate configuration and having a thickness less than the thickness of the boot (12) in the area from which it extends.

12. A skate as claimed in claim 11, wherein the boot upper section (36) includes an ankle segment (50) and wherein each of said guide rails (51, 51a) extends upwardly and rearwardly from the ankle segment (50), each of said guide rails (51, 51a) being supported by a biasing leg (52, 52a) for preventing the guide rail (51, 51a) from collapsing by biasing it outwardly, each of the biasing legs (52, 52a) extending upwardly and forwardly from the ankle segment (50) to join the guide rail (51, 51a), each of the guide rails (51, 51a) and its respective biasing leg (52, 52a) together with the ankle segment (50) cooperating to define a guide rail aperture therebetween, and wherein the cuff (30) includes a smooth inner surface that slides on said guide rails (51, 51a) as the cuff (30) pivots.

13. A skate as claimed in claim 11 or claim 12, wherein the boot upper section (36) includes a tongue (90), and the cuff (30) is partly defined by a pair of cuff extensions (32) that extend forwardly and overlie the boot tongue (90), the cuff extensions (32) sliding on the tongue (90) as the cuff (30) pivots.

14. A skate as claimed in any one of claims 11 to 13, wherein the cuff (30) is pivotable through an arc of about forty-five degrees about a substantially horizontal axis between the first upright position and the second inclined position.

15. A skate as claimed in any one of claims 1 to 14, wherein the boot (12) further includes a removable
tongue (90), the tongue (90) including an outer layer (91) having upper (94) and lower (95) portions and attachment means for removably attaching the tongue (90) to the boot (12).

16. A skate as claimed in claim 15, wherein the boot has an upper section (36) which includes a cap segment (38) and wherein the attachment means includes a cap segment extension (40) projecting rearwardly from the cap segment, the cap segment extension having an attachment aperture (42) and a top and a bottom and wherein the means further includes an attachment member (96) attached to the tongue lower portion (95) for removable insertion into the aperture (42) from the bottom side thereof.

17. A skate as claimed in claim 15 or claim 16, wherein the tongue (90) is relatively flexible between a rear rest position and a forward flexed position in response to a strike by a skater, and wherein the tongue outer layer (91) is formed of a material having a shape memory such that as the tongue (90) is flexed forward the tongue (90) exerts a restoring force against the skater's leg to return the skate to the rest position in preparation for a succeeding stride.

18. The use of ventilating apertures and an air pumping action between a boot and a liner of an in-line roller skate to cool, and preferably dry, the foot of a skater, the skate comprising:

- a boot (12) formed from a stiff, resilient material, the boot comprising a vamp and a sole (18) which together define a cavity sized for receiving a skater's foot; and
- roller means (14) comprising a frame (16) and a plurality of in-line wheels (24), the frame (16) being attached to the sole (18) and rotationally supporting the plurality of wheels (24);
- the boot (12) including a plurality of apertures (33, 33a, 44, 44a, 48, 48a, 57, 57a, 61-64, 61a-64a, 66-68, 66a-68a, 70, 70a) sized to permit air to circulate freely into and out of the boot cavity and sized and adapted to permit heat and moisture to be more easily expelled from the boot cavity, the apertures being spaced and positioned for air to be drawn into and forced out of the cavity through the apertures during a skating motion to enable and facilitate dispersed air circulation within the cavity; and
- the liner (25), which receives the foot of the skater, being received within the boot (12) and being free-floating to permit relative movement of the liner (26) and the boot (12) between a first position, in which part of the liner (26) is spaced from an adjacent part of the boot (12) to permit air to enter the boot (12) through at least one of the said plurality of apertures, and a second position, in which the said part of the liner (26) is in contact with, or nearer to, the said adjacent part of the boot (12), whereby during said skating motion, the boot (12), the liner (26), the foot and the apertures cooperate to create an air-pumping action, such that the skating motion results in relative movement between said liner (26) and the boot (12) thus defining a continuous cycle of the air-pumping action which draws air into and forces air out of the boot cavity through the apertures.

19. The use as claimed in claim 18, wherein the skate has one or more of the features specified in claims 2 to 17.

Patentansprüche

1. Einspuriger Rollschuh, umfassend:

- einen Stiefel (12) aus einem steifen, elastischen Material, wobei der Stiefel ein Vorderblatt und eine Sohle (18) umfaßt, die zusammen einen zur Aufnahme eines Rollschuhläuferfußes bemessenen Hohlräum definieren;
- Laufrollenmittel (14), umfassend einen Rahmen (16) und eine Mehrzahl von in-line-Rädern (24), wobei der Rahmen (16) zur Befestigung an der Sohle (18) und zum drehbaren Lagern der Mehrzahl von Rädern (24) geeignet ist;
- dadurch gekennzeichnet, daß der Stiefel (12) eine Mehrzahl von Ausschnitten (33, 33a, 44, 44a, 48, 48a, 57, 57a, 61-64, 61a-64a, 66-68, 66a-68a, 70, 70a) umfaßt, wobei die Ausschnitte so bemessen sind, daß ein freies Zirkulieren von Luft in und aus dem Stiefelhohlräum erlaubt wird, und die Ausschnitte ferner bemessen und angepaßt sind, um ein leichteres Abgeben von Wärme und Feuchtigkeit aus dem Stiefelhohlräum zu erlauben, und
- die Ausschnitte unterteilt und positioniert sind, damit Luft während der Rollschuhlaufbewegung durch die Ausschnitte in den Hohlräum eingezogen und hinausgedrückt wird, um verstreute Luftzirkulation in dem Hohlräum zu ermöglichen oder zu erleichtern;
- und daß ein freischwimmernder Einsatz (26) zur Aufnahme des Fußes eines Läufers in dem Stiefel (12) aufgenommen ist, so daß eine relative Bewegung des Einsatzes (26) und des Stiefels (12) erlaubt wird zwischen einer ersten Stellung, bei der ein Teil des Einsatzes (26) befestigt ist von einem benachbarten Teil des Stiefels (12), um Luft den Eintritt in den Stiefel (12) durch mindestens einen der Mehrzahl von Ausschnitten zu erlauben,
und einer zweiten Stellung, bei der der genannte Teil des Einsatzes (26) in Berührung mit, oder näher zu, dem genannten benachbarten Teil des Stiefels (12) ist, wodurch während der Rollschuhlaufbewegung der Stiefel (12), der Einsatz (26), der Fuß und die Ausschnitte zusammenwirken zum Erzeugen einer Luftpumptätigkeit, derart, daß die Rollschuhlaufbewegung zu einer relativen Bewegung zwischen dem Einsatz (26) und dem Stiefel (12) führt, infolgedessen ein kontinuierlicher Zyklus der Luftpumptätigkeit festgelegt wird, die Luft durch die Ausschnitte in den Stiefelhohlraum einzieht und hinausdrängt.

2. Rollschuh wie in Anspruch 1 beansprucht, wobei der Einsatz (26) zumindest halbdurchlässig ist für Luft und Feuchtigkeit in Stellungen in allgemeiner Ausrichtung mit den Ausschnitten.

3. Rollschuh wie in Anspruch 1 beansprucht, wobei der Einsatz (26) ein dochwirkender Einsatz ist zum Wegziehen von Feuchtigkeit von einem Rollschuhläuferfuß nach außen durch den Einsatz (26).

4. Rollschuh wie in einem Anspruch 1 bis 3 beansprucht, wobei der Stiefel (12) einen unteren Vorderblattabschnitt (58) umfaßt, und die Mehrzahl von Ausschnitten entlang des unteren Vorderblattabschnitts (58) positioniert sind.

5. Rollschuh wie in einem der Ansprüche 1 bis 3 beansprucht, wobei die Mehrzahl von Ausschnitten mindestens einen vorderen Ausschnitt und einen hinteren Ausschnitt umfaßt, wobei der vordere und der hintere Ausschnitt entlang einer Seite des Stiefels (12) positioniert sind.

6. Rollschuh wie in einem der Ansprüche 1 bis 3 beansprucht, wobei der Stiefel (12) einen Mittelfußabschnitt (46) umfaßt, der einen unteren Bogenabschnitt und ein oberes Mittelfüßsegment umfaßt, und wobei die Mehrzahl von Ausschnitten mindestens zwei Ausschnitte enthält, die in dem Mittelfüßabschnitt (46) positioniert sind.

7. Rollschuh wie in einem der Ansprüche 1 bis 3 beansprucht, wobei der Stiefel (12) umfaßt einen Mittelfüßabschnitt (46), der einen unteren Bogensegment und ein oberes Mittelfüßsegment umfaßt; und einen Fußknochelabschnitt (50); die Mehrzahl von Ausschnitten in einem Mittelfüßabschnitt (46) positionierten Ausschnitt und einen in dem Fußknochelabschnitt (50) positionierten Ausschnitt umfaßt.

8. Rollschuh wie in einem der Ansprüche 1 bis 3 beansprucht, wobei der Stiefel (12) einen Zehenkastensegment (60) umfaßt, mindestens zwei an gegenüberliegenden Seiten des Stiefels (12) angeordnete Ausschnitte umfaßt, und wobei der Einsatz (26) einen Zehenabschnitt umfaßt, der im Gebrauch vorwärts und rückwärts verschiebbar ist zwischen einer Einströmstellung und einer Ausströmstellung als Antwort auf den Rollschuhläuferabschnitt beim Rollschuhlauf, wodurch das Einströmen und Ausströmen von Luft durch die Zehenkastenausschnitte verursacht wird.

9. Rollschuh wie in einem der Ansprüche 1 bis 3 beansprucht, wobei der Stiefel (12) ferner eine schwenkbar befestigte Manschette (30) umfaßt, und die Mehrzahl von Ausschnitten ein Paar an der Manschette (30) positionierte Ausschnitte umfaßt.

10. Rollschuh wie in einem der Ansprüche 1 bis 3 beansprucht, wobei der Stiefel (12) ferner umfaßt eine schwenkbar befestigte Manschette (30), die mindestens einen der Ausschnitte enthält, und wobei der Stiefel einen Zehenabschnitt umfaßt, der ein unteres Zehenkastensegment (60) und ein oberes Kappensegment (38) umfaßt, wobei der Zehenabschnitt (60) mindestens einen der Ausschnitte enthält; einen Mittelfüßabschnitt (46), der ein unteres Bogensegment und ein oberes Mittelfüßsegment umfaßt, wobei der Mittelfüßabschnitt mindestens einen der Ausschnitte enthält; und einen Versenabschnitt (59), wobei der Versenabschnitt (59) mindestens einen der Ausschnitte enthält.

11. Rollschuh wie in einem der Ansprüche 1 bis 10 beansprucht, wobei der Stiefel (12) ein Stiefeloberteil (36) umfaßt und einen inneren Rand (13) besitzt, und wobei der Stiefel (12) ferner umfaßt:

   eine an dem Stiefelvorderblattoberteil (36) schwenkbar befestigte Manschette (30), wobei die Manschette (30) aus einem steifen Material besteht, das schwenkbar ist über einen vorgeformten Bogen zwischen einer ersten aufrechten Stellung und einer zweiten gegenüber der ersten Stellung vorwärts geneigten Stellung, und ein Mittel (28) zum Festziehen der Manschette (30) um ein Unterbinde eines Rollschuhläufers umfaßt; und ein Paar Niedrigreibungsführungsschienen (51, 51a), die unter der Manschette liegend und diese kontaktierend an dem Stiefeloberteil (36) angeordnet sind, wobei die Führungsschienen (51, 51a) niedrigen Reibungskontakt mit der Manschette (30) liefern, wenn die Manschette (30) über den vorgeformten Bogen zwischen der ersten aufrechten Stellung und der zweiten Stellung schwingt, und jede der Führungsschienen (51, 51a) umfaßt ein von dem inneren Rand (13) des Stiefels (12) sich erstreckendes Glied, wobei jedes Glied eine längliche Gestaltung und eine Stärke besitzt,
12. Rollschuh wie in Anspruch 11 beansprucht, wobei das Stiefelnoberteil (36) ein Fußknöchelsegment (50) umfaßt, und wobei jede der Führungsschienen (51, 51a) sich von dem Fußknöchelsegment (50) nach oben und hinten erstreckt, jede der Führungsschienen (51, 51a) getragen wird von einem Vorspannbein (52, 52a) zum Abhalten der Führungsschiene (51, 51a) von einem Zusammenfallen durch Vorspannen derselben nach außen, jedes Vorspannbein (52, 52a) sich von dem Fußknöchelsegment (50) nach oben und vorn erstreckt, um sich an die Führungsschiene (51, 51a) anzuschließen, jede der Führungsschienen (51, 51a) und ihr jeweiliges Vorspannbein (52, 52a) wirken zusammen mit dem Fußknöchelsegment (50), um dazwischen einen Führungsschienenausschnitt zu definieren, und wobei die Manschette (30) eine glatte innere Oberfläche enthält, die auf den Führungsschienen (51, 51a) gleitet, wenn die Manschette (30) schwenkt.

13. Rollschuh wie in Anspruch 11 oder 12 beansprucht, wobei das Stiefelnoberteil (36) eine Zunge (90) umfaßt, und die Manschette (30) teilweise bestimmt ist durch ein Paar Manschetteneinleger (32), die sich vorwärts erstrecken und die Stiefelzunge (90) überlagern, und die Manschetteneinleger (32) auf der Zunge (90) gleiten, wenn die Manschette (30) schwenkt.

14. Rollschuh wie in einem der Ansprüche 11 bis 13 beansprucht, wobei die Manschette (30) schwenkbar ist um eine im wesentlichen horizontal Achse über einen Bogen von etwa fünfundvierzig Grad zwischen der ersten aufrechten Stellung und der zweiten geneigten Stellung.

15. Rollschuh wie in einem der Ansprüche 1 bis 14 beansprucht, wobei der Stiefel (12) ferner eine herausnehmbare Zunge (90) umfaßt, wobei die Zunge (90) eine äußere Lage (91) mit Ober-(94) und Unter-(95)teil und ein Befestigungsmittel zum herausnehmbaren Befestigen der Zunge (90) an dem Stiefel (12) umfaßt.

16. Rollschuh wie in Anspruch 15 beansprucht, wobei der Stiefel ein Oberteil (36) besitzt, das ein Kappensegment (38) umfaßt, und wobei das Befestigungsmittel eine Kappensegmentausdehnung (40) umfaßt, die von dem Kappensegment nach hinten sich erstrecken, und die Kappensegmentausdehnung einen Befestigungsausschnitt (42) und einen Kopf und einen Boden umfaßt, und wobei das Mittel ferner umfaßt ein Befestigungsglied (96), das an das Unterteil (95) der Zunge befestigt ist zum herausnehmbaren Einsetzen in den Ausschnitt (42) von der Bodenseite davon.

17. Rollschuh wie in Anspruch 15 oder 16 beansprucht, wobei die Zunge (90) relativ flexibel ist zwischen einer hinteren Ruhestellung und einer vorderen gebogenen Stellung als Antwort auf einen Schritt eines Rollschuhläufers, und wobei die Zungenauflage (91) aus einem Material gebildet ist, das ein Formgedächtnis besitzt, derart, daß wenn die Zunge (90) nach vorn gebogen ist, die Zunge (90) eine Rückstellkraft gegen das Rollschuhläuferbein ausübt, um den Rollschuh in Vorbereitung für einen nachfolgenden Schritt in die Ruhestellung zurückzustellen.

18. Verwendung von Belüftungsausschnitten und einer Luftpumpentätigkeit zwischen einem Stiefel und einem Einsatz eines einspurigen Rollschuhs zum Kühlen, und vorzugsweise Trocknen, des Fußes eines Rollschuhläufers, und der Rollschuh umfaßt: einen Stiefel (12) aus einem steifen, elastischen Material, wobei der Stiefel ein Vorderblatt und eine Sohle (18) umfaßt, die zusammen einen zur Aufnahme eines Rollschuhläuferfußes bemessenen Hohlräum definieren; und Laufrollenmittel (14), umfassend einen Rahmen (16) und eine Mehrzahl von Inline-Rädern (24) wobei der Rahmen (16) an der Sohle (18) befestigt ist und die Mehrzahl von Rädern (24) drehbar lagert; der Stiefel (12) eine Mehrzahl von Ausschnitten (33, 33a, 44, 44a, 48, 48a, 57, 57a, 61-64, 61a-64a, 66-68, 68a-68a, 70, 70a) umfaßt, die so bemessen sind, daß ein freies Zirkulieren von Luft in und aus dem Stiefelhoheraum erlaubt wird, und bemessen und angepaßt sind, um ein leichteres Abgeben von Wärme und Feuchtigkeit aus dem Stiefelhoheraum zu erlauben, die Ausschnitte unterteilt und positioniert sind, damit Luft während der Rollschuhlaufbewegung durch die Ausschnitte in den Hohlräum eingezogen und hinausgedrängt wird, um verstreute Luftzirkulation in dem Hohlräum zu ermöglichen und zu erleichtern; und der Einsatz (26), der den Fuß des Rollschuhläufers aufnimmt, ist im Schuh (12) aufgenommen und ist freischwimmend, um eine relative Bewegung des Einsatzes (26) und des Stiefels (12) zu erlauben zwischen einer ersten Stellung, bei der ein Teil des Einsatzes (26) beabstandet ist von einem benachbarten Teil des Stiefels (12), um Luft den Eintritt in den Stiefel (12) durch mindestens einen der Mehrzahl von Ausschnitten zu erlauben, und einer zweiten Stellung, bei der der genannte Teil des Einsatzes (26) in Berührung mit, oder näher zu, dem genannten benachbarten Teil des Stiefels
(12) ist, wodurch während der Rollschuhlauf-
bewegung der Stiefel (12), der Einsatz (26), der 
Fuß und die Ausschnitte zusammenwirken 
zum Erzeugen einer Luftpumptätigkeit, der-
art, daß die Rollschuhlaufbewegung zu einer 
relativen Bewegung zwischen dem Einsatz 
(26) und dem Stiefel (12) führt, infolgedessen 
ein kontinuierlicher Zyklus der Luftpumptä-
tigkeit festgelegt wird, die Luft durch die Aus-
schnitte in den Stiefelholiraum einzieht und 
hinausdrängt.

19. Die Verwendung wie in Anspruch 18 beansprucht, 
wobei der Rollschuh ein oder mehrere der in den 
Ansprüchen 2 bis 17 spezifizierten Merkmale 
besitzt.

Reivenditions

1. Patin à roulette alignées comprenant :

- une chaussure (12) en matériau rigide élasti-
que, la chaussure comprenant une empeigne 
e une semelle (18) qui ensemble définissent 
e une cavité dimensionnée pour recevoir un pied 
de patineur ;
- des moyens de roulement (14) comprenant un 
cadre (16) et plusieurs roulettes alignées (24), 
le cadre (16) étant adapté pour être fixé à la 
semelle (18) et étant adapté pour supporter en 
rotation la pluralité des roulettes (24) ;
- caractérisé en ce que la chaussure (12) com-
prend plusieurs ouvertures (33, 33a, 44, 44a, 
48, 48a, 57, 57a, 61-64, 61a-64a, 66-68, 66a-
68a, 70, 70a), les ouvertures étant dimension-
nées pour permettre à l’air de circuler librement 
dans et à l’extérieur de la cavité de la chaus-
sure, les ouvertures étant par ailleurs dimen-
sionnées et adaptées pour permettre à la 
chaleur et à l’humidité de s’évacuer plus facile-
ment de la cavité de la chaussure, et

les ouvertures étant espacées et positionnées de 
telle sorte que l’air puisse pénétrer à l’intérieur de la 
cavité et s’en évacuer à travers les ouvertures 
pendant un mouvement de patinage pour permettre 
et faciliter la circulation de l’air dispersé à l’intérieur de 
de la cavité ;

- et en ce qu’une doublure non adhérente (26) 
destinée à recevoir le pied d’un patineur est insérée 
dans la chaussure (12) afin de permettre le mouve-
ment relatif de la doublure (26) et de la chaussure 
(12) entre une première position, dans laquelle une 
partie de la doublure (26) est séparée d’une partie 
adjacente de la chaussure (12) pour permettre à 
air de pénétrer dans la chaussure (12) à travers au 
moins l’une desdites multiples ouvertures et une 
seconde position, dans laquelle une partie de la 
doublure (26) est en contact avec ladite partie adja-

cente de la chaussure (12) ou à proximité de celle-
-ci, si bien que pendant le mouvement de patinage, 
la chaussure (12), la doublure (26), le pied et les 
ouvertures coopèrent pour créer une action de 
pompage de l’air, de telle sorte que le mouvement 
de patinage résulte en un mouvement relatif entre 
ladite doublure (26) et la chaussure (12), définiti-
sant ainsi un cycle continu de l’action de pompage 
de l’air qui aspire l’air dans la cavité de la chaussure 
et l’évacue à travers les ouvertures.

2. Patin selon la revendication 1, dans lequel la dou-
blure (26) est au moins semi-perméable à l’air et à 
l’humidité au niveau d’un alignement général avec 
les ouvertures.

3. Patin selon la revendication 1, dans lequel la dou-
blure (26) est une doublure à effet de mèche pour 
elonger l’humidité du pied du patineur en la faisant 
sortir à travers la doublure (26).

4. Patin selon l’une quelconque des revendications 1 
à 3, dans lequel la chaussure (12) comprend une 
partie d’empeigne inférieure (58) et lesdites multi-
plies ouvertures sont positionnées le long de la par-
tie d’empeigne inférieure (58).

5. Patin selon l’une quelconque des revendications 1 
à 3, dans lequel les multiples ouvertures compren-
ment au moins une ouverture avant et une ouver-
ture arrière, les ouvertures avant et arrière étant 
positionnées le long d’un côté de la chaussure (12).

6. Patin selon l’une quelconque des revendications 1 
à 3, dans lequel la chaussure (12) comprend une 
partie à mi-hauteur de pied (46) comprenant une 
partie arquée inférieure et un segment supérieur à 
mi-hauteur de pied et dans lequel les multiples 
ouvertures comprennent au moins deux ouvertures 
positionnées dans la partie à mi-hauteur de pied 
(46).

7. Patin selon l’une des revendications 1 à 3 dans 
de laquelle la chaussure (12) comprend une partie à mi-
haut de pied (46) comprenant un segment arqué 
inférieur et un segment supérieur à mi-hauteur de 
pied ; et une partie formant cheville (50) ; les multi-
ples ouvertures comprenant une ouverture posi-
tionnée dans la partie à mi-hauteur du pied (46) et 
e une ouverture positionnée dans la partie formant 
cheville (50).

8. Patin selon l’une quelconque des revendications 1 
à 3, dans lequel la chaussure (12) comprend une 
partie avant pour le logement des orteils (60) com-
prénant au moins deux ouvertures disposées sur 
ses côtés opposés de la chaussure (12) et dans 
de laquelle la doublure (26) comprend une partie pour 
les orteils pouvant glisser vers l’avant ou vers
l’arrière entre une position d’entrée et une position de sortie lorsque le patineur patine à grands pas, engendrant ainsi l’entrée et la sortie de l’air à travers les ouvertures de la partie avant pour le logement des orteils.

9. Patin selon l’une quelconque des revendications 1 à 3, dans lequel la chaussure (12) comprend également un parement fixé de manière pivotante (30), les multiples ouvertures comprenant une paire d’ouvertures positionnées dans le parement (30).

10. Patin selon l’une quelconque des revendications 1 à 3, dans lequel la chaussure (12) comprend également un parement fixé de manière pivotante (30) qui comprend au moins une des ouvertures et dans lequel la chaussure comprend une butée comprenant une partie avant pour le logement des orteils (60) et une partie de recouvrement supérieure (38), la partie avant pour le logement des orteils (60) comprenant au moins une des ouvertures ; une partie à mi-hauteur de pied (46) comprenant un segment arqué inférieur et un segment supérieur à mi-hauteur de pied, la partie à mi-hauteur de pied comprenant au moins l’une des ouvertures ; une partie de talon (69), la partie de talon (69) comprenant au moins l’une des ouvertures.

11. Patin selon l’une quelconque des revendications 1 à 10, dans lequel la chaussure (12) comprend une partie de chaussure supérieure (36) et une surface interne (13) et dans lequel la chaussure (12) comprend également :

un parement (30) fixé de manière pivotante sur l’empeigne supérieure de la chaussure (36), le parement (30) comprenant un matériau rigide, pouvant osciller dans un arc prédéterminé entre une première position verticale et une seconde position inclinée vers l’avant à partir de la première position et comprenant des moyens (28) de serrage du parement (30) autour de la partie inférieure de la jambe d’un patineur ; et une paire de rails de guidage à faible frottement (51, 51a) disposées sur la partie supérieure de la chaussure (36) disposées sous le parement et en contact avec celui-ci, les rails de guidage (51, 51a) formant un contact à faible frottement avec le parement (30) lorsque le parement (30) oscille dans l’arc prédéterminé entre la première position verticale et la seconde position, chacun des rails de guidage (51, 51a) comprenant un élément se prolongeant depuis la surface intérieure (13) de la chaussure (12), chaque élément ayant une configuration allongée et ayant une épaisseur inférieure à l’épaisseur de la chaussure (12) dans la zone à partir de laquelle il se prolonge.

12. Patin selon la revendication 11, dans lequel la partie supérieure de la chaussure (36) comprend une partie formant cheville (50) et dans lequel chacun desdits rails de guidage (51, 51a) se prolonge vers le haut et vers l’arrière à partir de la partie formant cheville (50), chacun desdits rails de guidage (51, 51a) étant soutenu par un bras de déviation (52, 52a) pour empêcher le rail de guidage (51, 51a) de s’effondrer en le déviant vers l’extérieur, chacun des bras de déviation (52, 52a) se prolongeant vers le haut et vers l’avant à partir de la partie formant cheville (50) pour rejoindre le rail de guidage (51, 51a), chacun des rails de guidage (51, 51a) et son bras de déviation respectif (52, 52a) conjointement avec la partie formant cheville (50) coopérant pour définir une ouverture dans le rail de guidage entre ceux-ci et dans lequel le parement (30) comprend une surface intérieure lisse qui glisse sur lesdits rails de guidage (51, 51a) lorsque le parement (30) pivote.

13. Patin selon la revendication 11 ou la revendication 12, dans lequel la partie supérieure de la chaussure (36) comprend une languette (90) et le parement (30) est partiellement défini par une paire d’extensions de parement (32) qui se prolongent vers l’avant et recouvrent la languette de la chaussure (90), les extensions de parement (32) glissant sur la languette (90) lorsque le parement (30) pivote.

14. Patin selon l’une quelconque des revendications 11 à 13, dans lequel le parement (30) peut pivoter autour d’un arc d’environ quarante-cinq degrés autour d’un axe substantiellement horizontal entre la première position verticale et la seconde position inclinée.

15. Patin selon l’une quelconque des revendications 1 à 14, dans lequel la chaussure (12) comprend également une languette amovible (90), la languette (90) comprenant une couche externe (91) ayant des parties supérieure (94) et inférieure (95) et des moyens de fixation pour fixer la languette (90) à la chaussure (12).

16. Patin selon la revendication 15, dans lequel la chaussure a une partie supérieure (36) qui comprend un segment de recouvrement (38) et dans lequel les moyens de fixation comprennent une extension du segment de recouvrement (40) faisant saillie vers l’arrière du segment de recouvrement, l’extension du segment de recouvrement ayant une ouverture de fixation (42), une partie supérieure et une partie inférieure et dans lequel les moyens comprennent également un élément de fixation (96) fixé à la partie inférieure de la languette (95) permettant une insertion amovible dans l’ouverture (42) à partir de la partie inférieure.
17. Patin selon la revendication 15 ou la revendication 16, dans lequel la languette (90) est relativement souple entre une position de repos arrière et une position fléchie vers l'avant lorsque le patineur fait un grand pas et dans lequel la couche externe de la languette (91) est constituée d'un matériau ayant une mémoire de forme, de telle sorte que lorsque la languette (90) fléchit vers l'avant, la languette (90) exerce une force de restauration contre la jambe du patineur pour faire revenir le patin à la position de repos en préparation du prochain grand pas.

18. Utilisation d'ouvertures d'aération et d'une action de pompage de l'air entre une chaussure et une doublure d'un patin à roulettes alignées pour refroidir et, de préférence sécher, le pied d'un patineur, le patin comprenant :

une chaussure (12) en matériau rigide élastique, la chaussure comprenant une empeigne et une semelle (18) qui ensemble définissent une cavité dimensionnée pour recevoir un pied de patineur ; et des moyens de roulement (14) comprenant un cadre (16) et plusieurs rotules alignées (24), le cadre (16) étant fixé à la semelle (18) et supportant en rotation les multiples rotules (24) ;
la chaussure (12) comprenant de multiples ouvertures (33, 33a, 44, 44a, 48, 48a, 57, 57a, 61 à 64, 61a à 64a, 66 à 68, 66a à 68a, 70, 70a), dimensionnées pour permettre à l'air de circuler librement dans et à l'extérieur de la cavité de la chaussure, et dimensionnées et adaptées pour permettre à la chaleur et à l'humidité de s'évacuer plus facilement de la cavité de la chaussure, les ouvertures étant espacées et positionnées de telle sorte que l'air puisse pénétrer à l'intérieur de la cavité et s'en échapper à travers les ouvertures pendant un mouvement de patinage pour permettre et faciliter la circulation de l'air dispersé à l'intérieur de la cavité ;
et la doublure (26) qui reçoit le pied du patineur étant logée dans la chaussure (12) et étant non adhérente pour permettre le mouvement relatif de la doublure (26) et de la chaussure (12) entre une première position, dans laquelle une partie de la doublure (26) est séparée d'une partie adjacente de la chaussure (12) pour permettre à l'air de pénétrer dans la chaussure (12) à travers au moins l'une desdites multiples ouvertures et une seconde position, dans laquelle ladite partie de la doublure (26) est en contact avec ladite partie adjacente de la chaussure (12) ou à proximité de celle-ci, si bien que pendant le mouvement de patinage, la chaussure (12), la doublure (26), le pied et les ouvertures coopèrent pour créer une action de pompage de l'air, de telle sorte que le mou-

19. Utilisation selon la revendication 18, dans lequel le patin a une ou plusieurs des caractéristiques spécifiées dans les revendications 2 à 17.