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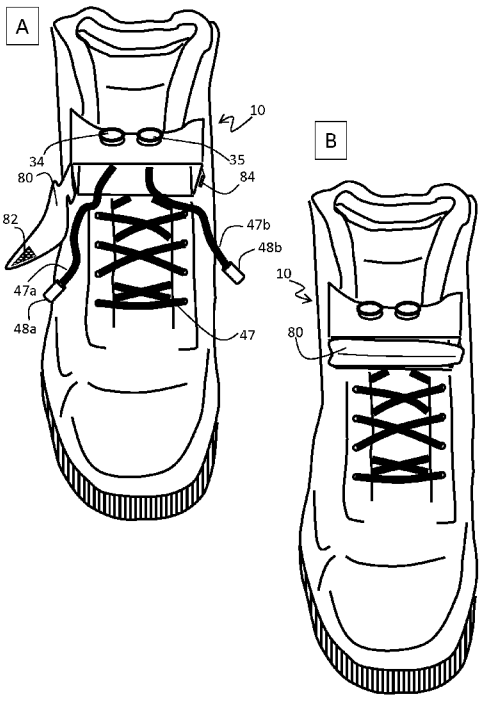
(54) **Title**: LACE TIGHTENING DEVICE

Figure 4



(57) **Abstract**: Described herein is a lace tightening device comprising: a casing comprising an end wall having a generally concave exterior surface and an opposing open end with side walls extending circumferentially between the end wall and the open end defining an interior cavity; at least one aperture formed in the end wall communicating with the interior cavity; and at least one clamp coupled to the interior surface of the casing, the clamp aligned with the at least one aperture. The lace tightening device may be used to threadably receive free lace ends through the at least one apertures, the free lace ends may be manually grasped and pulled through the interior cavity to a tightened position and the at least one clamp in a closed position retains the free lace ends within the interior cavity to maintain the tightened position. The interior cavity is sized to hold the free lace ends in the tightened position. The lace tightening device may be used with any footwear including, for example, running shoes, dress shoes, cleats, clogs, skates or boots.

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LACE TIGHTENING DEVICE

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates generally to laced footwear, and more specifically to a device for tightening footwear laces.

Description of the Related Art

The use of laced footwear is ubiquitous. Footwear can be generically described as comprising a sole portion and an attached upper portion defining an interior cavity for receiving a user's foot. Laces are threaded through or weaved around anchor points such as eyelet holes, sleeves, studs, hooks, hitches and the like typically disposed on an exterior surface of the footwear upper portion. Laces are the predominant mechanism for adjusting the tightness of most types of footwear including running shoes, cleats, dress shoes, boots, clogs, skates and the like with other tightening mechanisms such as Velcro or buckles placing a distant second.

Laced footwear plays a critical part in every major sport including basketball, baseball, hockey, American football, soccer/football, golf, cricket, rugby, track and field, tennis and the like. Unintended removal of footwear or unintended loosening of footwear during the course of play can impact player performance, and therefore defines a risk that needs to be addressed. Similar considerations apply for footwear used in high intensity occupations such as military and law enforcement.

Solutions for shoe lace tightening using clamps have been described in several US Patents including US Patent Nos 1279043 (issued 17 September 1918), 3103725 (issued 17 September 1963), 4967454 (issued 6 November 1990), 6571438 (issued 3 June 2003), and 7409781 (issued 12 August 2008). However, each of these solutions is deficient in that both the clamp and the free lace ends extending from anchor points on a footwear upper and through the clamp remain exposed and susceptible to contact during the course of use to cause unintended loosening or unintended snagging of the lace ends.

Accordingly, there is a continuing need for alternative tightening devices for laced footwear.

SUMMARY OF THE INVENTION

In an aspect there is provided a laced footwear tightening device comprising:

a casing comprising an end wall having a generally concave exterior surface and an opposing open end with side walls extending circumferentially between the end wall and the open end defining an interior cavity;

two apertures formed in the end wall, each aperture communicating with the interior cavity;

two clamps coupled to the interior surface of the casing, each clamp aligned with one of the two apertures.

In another aspect there is provided a laced footwear tightening device comprising:

a casing comprising an end wall having a generally concave exterior surface and an opposing open end with side walls extending circumferentially between the end wall and the open end defining an interior cavity;

at least one aperture formed in the end wall communicating with the interior cavity;

at least one clamp coupled to the interior surface of the casing, the clamp aligned with the at least one aperture.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a side plan view (A), a side perspective view (B), an end wall perspective view (C) and an open end perspective view (D) of a lace tightening device;

Figure 2 shows variants (A), (B), (C), and (D) of lids used to cover the open end of the lace tightening device shown in Figure 1;

Figure 3 shows a perspective view (A) and a cross-section view (B) of a clamp coupled to the interior surface of the lace tightening device shown in Figure 1;

Figure 4 shows a use of the lace tightening device shown in Figure 2D coupled to a shoe with the lid open (A) or closed (B).

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, Figures 1A-1D show various views of a lace tightening device 10. The lace tightening device comprises a box shaped casing having an end wall 12,

and side walls 20, 21, 23, 24 together defining an interior cavity. The dimensions of the end wall and side walls are sized to form an interior cavity that can hold a predetermined length of lace ends that extend from anchor points of a footwear upper. The combined perimeter of the side walls defines opening 26 which is communicative with the interior cavity.

End wall 12 has a generally concave exterior surface that is sized to accommodate and engage a generally convex curvature of a footwear upper at a location where lace ends extend from their anchor points, such as a location defined by opposing eyelet anchor points that overlie a tongue on a conventional running shoe upper.

End wall 12 is bound by four edges, a pair of substantially parallel generally concave edges 14, 15 and a pair of substantially parallel curvilinear edges 17, 18. The length of the generally concave edges 14, 15 is typically greater than the length of the curvilinear edges 17, 18 by at least 300%.

Side walls 20, 21, 23, 24 can be subcategorized as a pair of substantially parallel major side walls 20, 21 and a pair of substantially parallel minor side walls 23, 24. The surface area of the major side walls 20, 21 is greater than the surface area of the minor side walls 23, 24. Major side walls 20, 21 join end wall 12 continuously along generally concave edges 14 and 15, respectively. Minor side walls 23, 24 join end wall 12 continuously along curvilinear edges 17 and 18, respectively.

Apertures 30 and 31 are formed at a central portion of end wall 12. Apertures 30 and 31 are communicative with the interior cavity and are sized to receive lace ends and to have lace ends threaded through them. Clamps 34 and 35 are coupled to the interior surface of at least major side wall 20 and may also be coupled to the interior surface of end wall 12 and/or major side wall 21. Clamps 34 and 35 are aligned along the interior surface of the central portion of end wall 12, and more specifically provide openings 38 and 39, respectively that are aligned with apertures 30 and 31, respectively. Clamps 34 and 35 also provide openings 38a and 39a that are opposed to openings 38 and 39, respectively. A lace end may be threaded through aperture 30, and opposing openings 38, 38a with a spring biased clamp block disposed between openings 38, 38a and restricting motion of the lace end between openings 38, 38a. Similarly, a lace end may be threaded through aperture 31, and opposing

openings 39, 39a with a spring biased clamp block disposed between openings 39, 39a and restricting motion of the lace end between openings 39, 39a.

Clamps 34 and 35 are spring biased to a clamped position and are moveable from a clamped position to a release position by manual manipulation. An actuating surface for each of clamps 34 and 35 extends through major side wall 20 to allow for manual manipulation of the clamps to move the clamp from a clamped position to a release position.

Figures 2A-2D show various examples of lids that can be used to cover open end 26. Figure 2A shows lid 50 pivotally attached to a free edge of major side wall 21 by hinge 52. Lid 50 is moveable from an open position to a closed position by rotation along the axis of hinge 52. Latch 54 is coupled to lid 50 in order to retain lid 50 in a closed position.

Figure 2B shows a lid 60 that slides from an open position to a closed position along a groove 61 formed in the interior surface of major end wall 21.

Figure 2C shows a lid 70 comprising an elastic band with opposing ends attached to minor side walls 23 and 24, respectively. In a relaxed state the elastic band corresponds to a closed position, while a tensioned stretched state achieved by manual manipulation results in an open position.

Figure 2D shows a lid 80 comprising a strap having one end attached to minor side wall 23 and an opposing free end. A hook portion 82 of a hook and loop fastener such as Velcro is provided at the free end of the strap. The hook portion 82 can reversibly attach to a loop portion 84 disposed on the exterior surface of minor side wall 24. The dimensions of the strap are sized such that attachment of hook portion 82 to loop portion 84 results in the strap being held taut and covering open end 26.

Figures 3A and 3B show an example of a spring biased clamp 34. Spring biased clamp 34 comprises a tubular base having a substantially cylindrical and elongate side wall 40 and a substantially closed end wall 41 opposing a substantially open end 42 forming a hollow interior cavity. Diametrically opposed openings 38 and 38a are formed in the side wall 40 proximal to the open end 42. Substantially cylindrical piston clamp block 43 is sized to be slidably received through open end 42 and within the interior cavity defined by the tubular base of clamp 34. Piston clamp block 43 has a bore formed along a diameter. Coiled spring 45 located within the interior cavity of the tubular base provides two opposing

terminal coils with a first terminal coil abutting the interior surface of the closed end 41 and the second terminal coil abutting an end wall of the piston clamp block 43 that is received within the tubular base. The tubular base, the coiled spring and the piston clamp block are substantially coaxial. The end wall of piston clamp block 43 may be tapered or grooved for snap fit with the second terminal coil to prevent unintended removal of piston clamp block from tubular base. Alternatively, a flange extending radially inwards at the open end 42 of the tubular base can engage an annular collar extending radially outward from piston clamp block 43 to prevent unintended removal.

Figures 4A and 4B show an example of the lace tightening device 10 in use. A lace 47 is threaded in a conventional criss-cross fashion through two opposing arrays of eyelet anchor points disposed on tabs covering a tongue on a boot upper. Two free lace end portions 47a, 47b extend from the eyelet anchor points. A first free lace end portion 47a is threaded through aperture 30 formed in the central portion of end wall 12, and opposing openings 38, 38a of clamp 34 with the spring biased piston clamp block 43 disposed between openings 38, 38a forcefully held to an open position by manual manipulation to align bore 44 with openings 38, 38a to allow free passage of the first lace end 47a between openings 38, 38a. Similarly, a second free lace end portion 47b is threaded through aperture 31 in the central portion of end wall 12, and opposing openings 39, 39a of clamp 35 with the spring biased piston clamp block disposed between openings 39, 39a held to an open position by applying manual force to align the bore of the piston clamp block with openings 39, 39a to allow free passage of the second lace end portion between openings 39, 39a. The first and second lace ends 47a, 47b can then be manually grasped with one hand and pulled through open end 26 while with the other hand maintaining an abutment of end wall 12 against a generally convex surface of the boot upper at the point of extension of each free lace end from its respective eyelet anchor point. Once the free lace ends 47a, 47b are pulled to a desired tightness, the free lace ends can be folded into the interior cavity of the lace tightening device 10. The lace tightening device may be enclosed with a lid, such as lid 80 strapped across open end 26 as shown in Figure 4B. With or without the lid the lace tightening device 10 shelters both the clamps and the lace ends from exposure to prevent unintended movement, loosening, or snagging of lace ends as well as to provide an aesthetically uniform finish. In order to loosen

the lacing of the boot the piston clamp block of each of clamps 34 and 35 are manually manipulated to an open position and the lace tightening device 10 is pulled away from the generally concave surface of the boot upper to a distance that corresponds to a desired loosening of the laces. The termini of the free lace ends 47a, 47b may each be fitted with a block 48a and 48b, respectively to prevent the lace ends from being pulled entirely from the lace tightening device 10. Many alternatives exist for ensuring that the free lace ends are not pulled entirely from the lace tightening device including tying a knot at the termini of each free lace ends or tying the termini together.

Several variants of the lace tightening device have been described above. Further variants and modification will now be described. Still further variants, modifications and combinations thereof will be recognized by the person of skill in the art.

The lace tightening device may be made of any material including metals, plastics, wood products, polymers, or any combination thereof. Typically, the casing will be made of semi-rigid and rigid materials. Typically, the hardness of the casing will be greater than 40 on the Shore A durometer scale.

The dimensions of the lace tightening device may be varied according to each footwear application. The interior cavity of the lace tightening device will be of sufficient volume to house first and second free lace ends and a mechanism such as clamp(s), retractable spool(s), motorized rollers and the like for retaining the lace ends within the interior cavity.

The shape of the lace tightening device may be varied, but will typically have an end wall 12 with a generally concave exterior surface shaped to engage the generally convex surface of a footwear upper at a location where the free lace ends extend from a pair of spaced opposing anchor points. End wall 12 is shown in Figure 1 as bound by two opposing substantially parallel generally concave edges 14, 15 and two opposing substantially parallel curvilinear edges 17, 18. As shown, the ratio of the length of the curvilinear edges to the generally concave edges is about 1:5. This ratio may be varied to be larger or smaller as desired. The curvilinear edges may even be absent if the generally concave edges conjoin at a point such as in a diamond or ellipsoid shape. Typically, the ratio of the cumulative length of

the curvilinear edges to the cumulative length of the generally concave edges will be less than 4:5, 3:5, 2:5, 1:5 or less than any ratio therebetween.

The end wall 12 may be of any shape that provides a generally concave exterior surface including partial-cylinder shapes, trapezoid shapes, partial-tube shapes, partial-cone shapes and the like. The terms "generally concave" and "concave-like" are used interchangeably and include smooth concave curves and line segment combinations that approximate concave curves, for example a plurality of straight line segments that combine to approximate a concave curve. A generally concave exterior surface will be a surface that is bounded by a best-fit concave curve from the choices of a best-fit concave curve, a best-fit straight line, and a best-fit convex curve. Thus, the generally concave exterior surface need not be a smooth concave curve as shown in Figure 1A, and includes concave curves defined by two or more straight sides. For example, the generally concave exterior surface may be a concave curve defined by two, three, four, five, six, seven, eight, nine, ten or more sides. Furthermore, the generally concave exterior surface may be a concave curve defined by a combination of one or more straight sides and one or more arcuate segments.

As shown in Figure 4 the lace tightening device 10 is coupled to footwear by threadably receiving free lace ends through apertures 30 and 31. Optionally, lace tightening device 10 may be coupled directly to an upper of the footwear by a band or strap extending from one or more of the end wall, major side walls and minor side walls of the casing.

The lace tightening device may be used with any laced footwear including running shoes, dress shoes, cleats, clogs, skates and the like. Typically, the footwear will comprise a sole portion and an upper portion. The upper portion will comprise at least one pair of spaced opposing anchor points such as eyelets, studs, sleeves, hooks, hitches and the like from which first and second free lace end portions will extend and be threadably received through one or two aperture(s) formed in the central portion of end wall 12 having a generally concave shaped exterior surface shaped to engage the generally convex surface of the upper portion at the location of the at least one pair of spaced opposing anchor points from which free lace end portions are extending. When a double aperture arrangement is used the spacing of the two apertures may approximate the spacing of the at least one pair of spaced opposing anchor points in a tightened position. The spacing of the two apertures may range from about 60% to

about 140% compared to the spacing of the at least one pair of spaced opposing anchor points in a tightened position. The spacing of the two apertures may be 60%, 70%, 80%, 90%, 100%, 110%, 120%, 130%, 140% or any percentage therebetween compared to the spacing of the at least one pair of spaced opposing anchor points in a tightened position. Typically, the spacing of the two apertures may range from about 70% to about 100% compared to the spacing of the at least one pair of spaced opposing anchor points in a tightened position.

Typically, the two apertures will be symmetrically spaced from the anchor points when in a tightened position. When the two apertures are formed in a central portion of the end wall the apertures will both be located in between the anchor points in a tightened position as the central portion of the end wall will not extend beyond the anchor points when in a tightened position.

The drawings show two apertures 30 and 31 for threadably receiving lace ends. A lace tightening device with a single aperture formed in the central portion of the end wall 12 is also contemplated. A single clamp is aligned with the single aperture and the aperture and clamp openings are sized to simultaneously receive both lace ends. It will be recognized that the use of a single aperture requires a greater average distance between the aperture and the anchor point compared to the use of a double aperture. When two apertures are used the apertures may be spaced a predetermined distance so that when the end wall 12 engages the footwear upper in a tightened position each aperture is proximal to an anchor point from which a free lace end extends. Thus, the double aperture arrangement results in greater stability of the engagement of the generally concave surface of the end wall 12 with the generally convex surface of the footwear upper as compared to a single aperture arrangement.

The tightening of the lace ends may be automated. For example, a spring biased spool may be disposed in the interior cavity of the lace tightening device. Lace ends may be coupled to the spool using adhesive tape, interference fit with notches in the spool wall, or any other conventional mechanism of attachment. The spool is spring biased to wind the attached lace ends into a tight wound position. Manual force applied to the lace tightening device to pull the device away from the footwear upper to unwind the lace ends and place the spool in a loose unwound position. The spool may be equipped with a lock to lock the spool in a wound position, unwound position or any position therebetween. Retractable

mechanisms using spools such as retractable leashes and retractable measuring tapes are well known may be adapted to automate tightening of lace ends.

Any conventional retraction mechanism may be used to control retraction and/or extension to effect tightening of lace ends. The spool is rotatably supported within the casing, the free lace ends being wound around the spool and casing. A brake located within the casing can engage a plurality of evenly spaced surfaces, such as teeth, to stop rotation of the spool. An actuator extends from the casing, the actuator operationally coupled to the brake. The actuator has a first default position which does not activate the brake, and a second position that activates the brake. the A biasing mechanism such as a coiled leaf spring may be connected to the spool to bias winding of the lace ends. The casing provides one or two apertures at a central portion of end wall 12 for communication of the lace ends into and out of the casing. For a double aperture arrangement a spool may be aligned with each aperture.

Another mechanism for automation is to couple the spool to a motorized shaft. A motor with a drive shaft coupled to the spool may be included within the casing of the lace tightening device. A power source may also be coupled to the casing. A switch actuator controlling electrical communication of the power source and the motor can be provided on the exterior surface of the casing.

A motorized variant of the lace tightening device without a spool is also contemplated. The spool can be replaced with a pair of engaging pulleys or rollers that trap the lace ends by friction and roll the lace ends into or out of the interior cavity depending on the direction of rotation of the motor and drive shaft.

Clamps aligned with apertures formed in end wall 12 are not needed in the automated variants of the lace tightening device, but may be included for added robustness of maintaining the lace ends within the interior cavity in the tightened position. Typically, when included with the automated variants of the lace tightening device clamps will not be spring biased to a closed position.

For automated variants a removable lid may be unnecessary. For automated variants the casing may be fully enclosed except for the aperture(s) in the central portion of the end wall 12 communicating with the interior cavity defined by the casing.

The lace tightening device may be used with or without a lid. When a lid is not used typically a fastening mechanism such as a clip, a clasp or a hook may be used to secure the lace ends within the interior cavity of the casing. When a lid is used, the lid may be of any shape, size, rigidity or hardness as desired. For example, the lid may be characterized as dome-shaped or flat, larger or smaller than the open end, flexible or rigid, or soft or hard. As shown in Figure 2 the lid may be coupled to the casing using any conventional mechanism.

Any conventional clamp may be housed within the lace tightening device. Typically, for variants of the lace tightening device requiring manual grasping and pulling of lace ends into the interior cavity a clamp spring biased to a closed position will be aligned with an aperture in end wall 12 communicating with the interior cavity.

Still further variants, modifications and combinations thereof will be recognized by the person of skill in the art.

WHAT IS CLAIMED IS:

1. A laced footwear tightening device comprising:

a casing comprising an end wall having a generally concave exterior surface and an opposing open end with side walls extending circumferentially between the end wall and the open end defining an interior cavity;

two apertures formed in the end wall, each aperture communicating with the interior cavity;

two clamps coupled to the interior surface of the casing, each clamp aligned with one of the two apertures.

2. The laced footwear tightening device of claim 1, wherein the generally concave exterior surface of the end wall is bound by two opposing generally concave edges and two opposing curvilinear edges.

3. The laced footwear tightening device of claim 2, wherein the ratio of the cumulative length of the curvilinear edges to the cumulative length of the generally concave edges is less than 3:5.

4. The laced footwear tightening device of claim 1, wherein the generally concave exterior surface is sized to engage a generally convex exterior surface of an upper portion of the footwear at a location where free lace ends extend from a pair of opposing spaced anchor points attached to the upper portion of the footwear.

5. The laced footwear tightening device of claim 4, wherein the two apertures are located at a central portion of the end wall and the spacing between the two apertures is from 70% to 100% of the spacing of the pair of opposing spaced anchor points when the laced footwear is in a tightened position.

6. The laced footwear tightening device of claim 1, wherein each clamp is spring biased to a closed position.

7. The laced footwear tightening device of claim 1, wherein an actuator for moving each clamp to an open position is located at an exterior surface of the side wall of the casing proximal to the end wall.

8. The laced footwear tightening device of claim 1, further comprising a reversible fastener coupled the interior surface of the casing to hold lace ends within the interior cavity.

9. The laced footwear tightening device of claim 1, further comprising a lid coupled to the casing to reversibly cover the open end.

10. The laced footwear tightening device of claim 9, wherein the lid is hingedly coupled to the casing at or proximal to the open end and the lid is pivotable between an open position and a closed position.

11. A laced footwear tightening device comprising:

a casing comprising an end wall having a generally concave exterior surface and an opposing open end with side walls extending circumferentially between the end wall and the open end defining an interior cavity;

at least one aperture formed in the end wall communicating with the interior cavity;

at least one clamp coupled to the interior surface of the casing, the clamp aligned with the at least one aperture.

12. The laced footwear tightening device of claim 11, wherein the generally concave exterior surface of the end wall is bound by two opposing generally concave edges and two opposing curvilinear edges.

13. The laced footwear tightening device of claim 12, wherein the ratio of the cumulative length of the curvilinear edges to the cumulative length of the generally concave edges is less than 3:5.

14. The laced footwear tightening device of claim 11, wherein the generally concave exterior surface is sized to engage a generally convex exterior surface of an upper portion of the footwear at a location where free lace ends extend from a pair of opposing spaced anchor points attached to the upper portion of the footwear.

15. The laced footwear tightening device of claim 11, wherein the at least one aperture is located at a central portion of the end wall.

16. The laced footwear tightening device of claim 11, wherein the clamp is spring biased to a closed position.

17. The laced footwear tightening device of claim 11, wherein an actuator for moving the clamp to an open position is located at an exterior surface of the side wall of the casing proximal to the end wall.

18. The laced footwear tightening device of claim 11, further comprising a reversible fastener coupled the interior surface of the casing to hold lace ends within the interior cavity.

19. The laced footwear tightening device of claim 11, further comprising a lid coupled to the casing to reversibly cover the open end.

20. The laced footwear tightening device of claim 19, wherein the lid is hingedly coupled to the casing at or proximal to the open end and the lid is pivotable between an open position and a closed position.

21. The laced footwear tightening device of any one of claims 1 to 20 coupled to a footwear selected from the group consisting of running shoes, dress shoes, cleats, clogs, skates and boots.

Figure 1

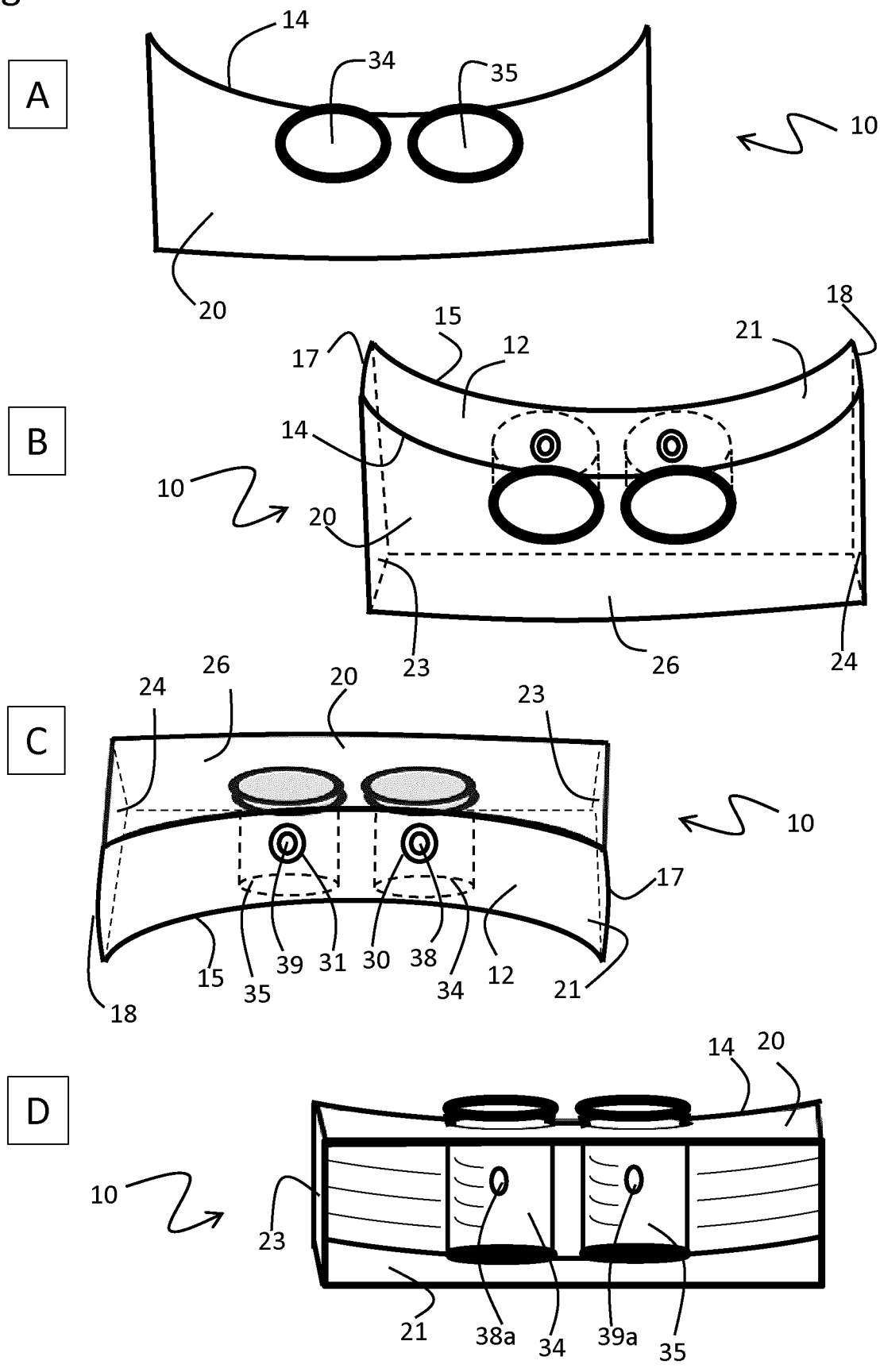
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Figure 2

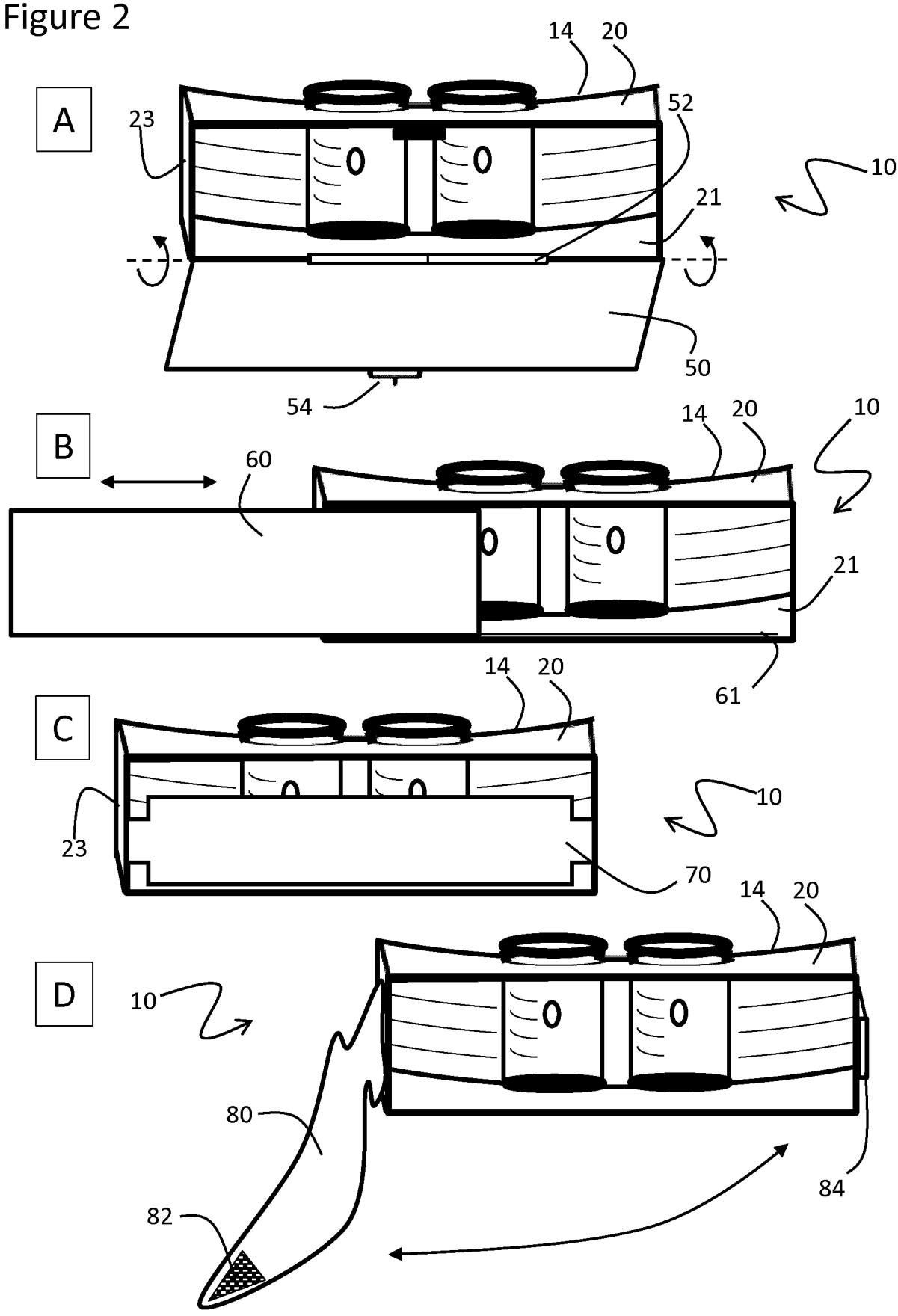
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Figure 3

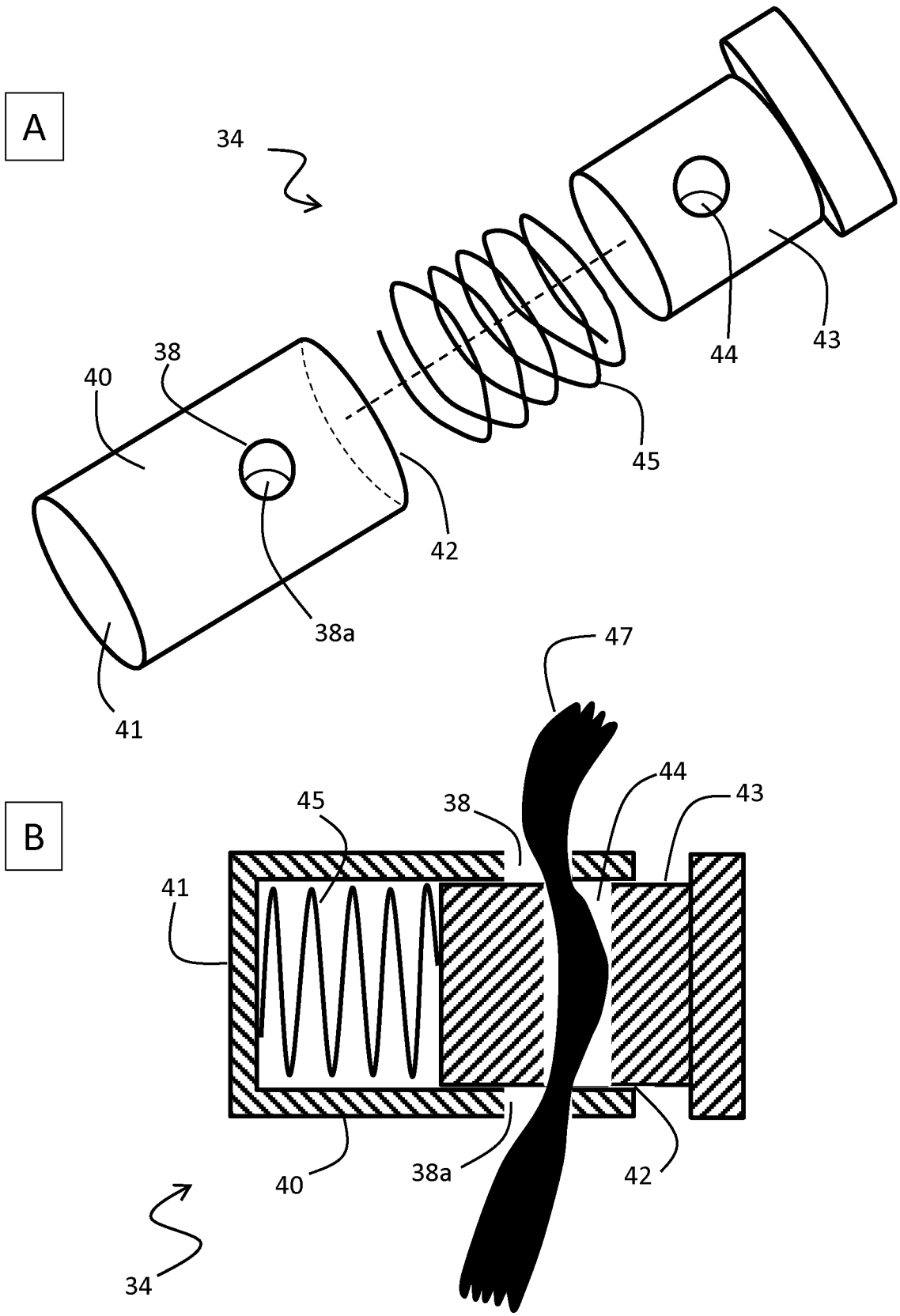
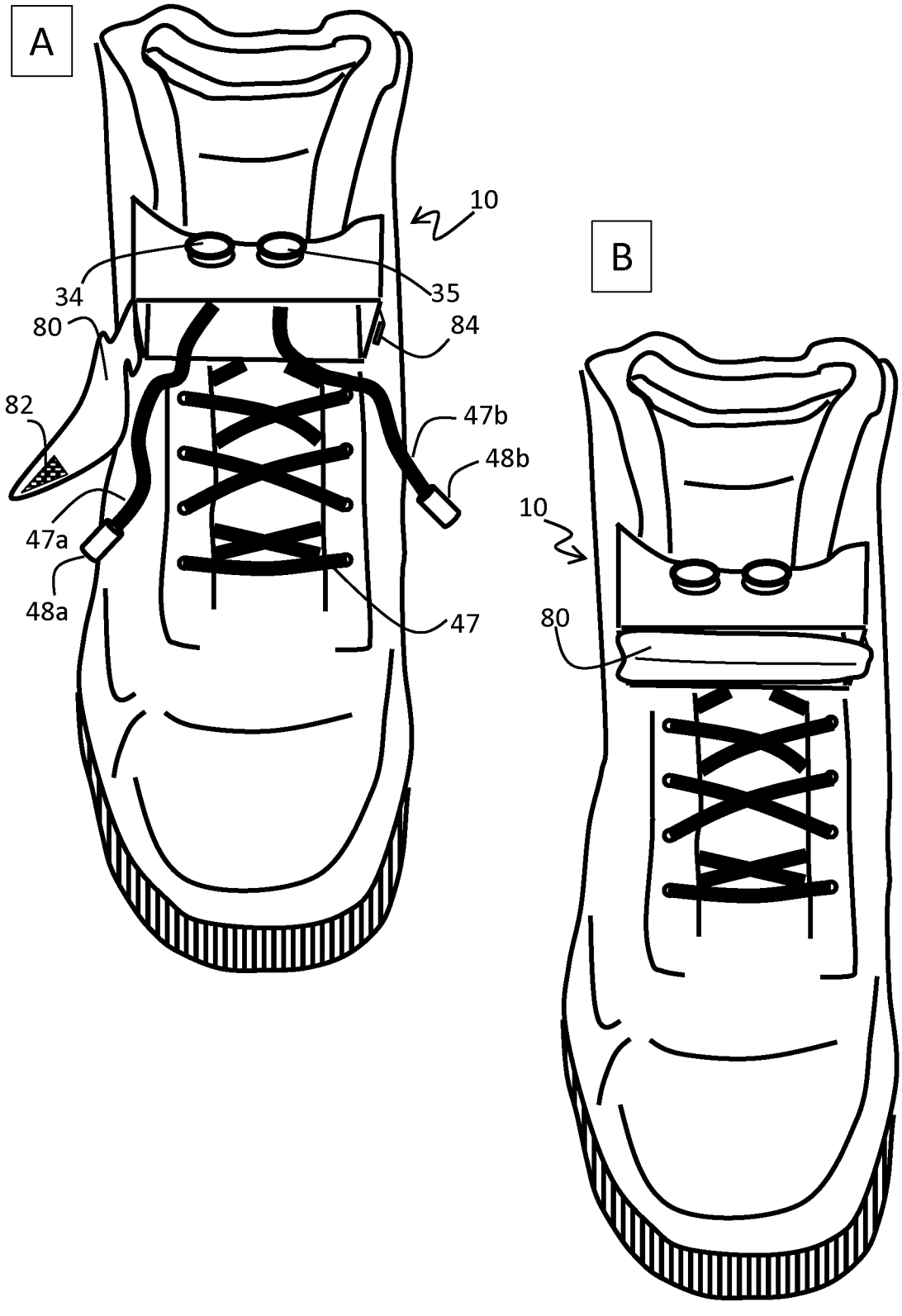


Figure 4



INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2013/050582

A. CLASSIFICATION OF SUBJECT MATTER
IPC: ***A43C 11/00*** (2006.01) , ***A43C 1/00*** (2006.01) , ***A43C 7/00*** (2006.01)
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC (2006.01): A43C, A43C 11/00, A43C 1/00, A43C 7/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used)
Canadian Patent Database (CPD), EPOQUE (Epodoc), Google Patents, Google Search Engine
Keywords: foot, footwear, shoes, boot, skate, lace, lacing, clamp, clip, spring, housing, casing, case, contain, space, fasten, tight, clutch, lock

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2004/0221433 A1 (WOLFBERG, D.) 11 November 2004 (11-11-2004) *Whole Document*	11 to 17, and 21
A	US 2004/0163285 A1 (JOHNSON, J. A.) 26 August 2004 (26-08-2004) *Whole Document*	
A	CA 2288477 A1 (SMITH, D. G.) 02 May 2001 (02-05-2001) *Whole Document*	
A	US 7073279 B2 (MIN, D. G.) 11 July 2006 (11-07-2006) *Whole Document*	

[ ] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents :

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Date of the actual completion of the international search	Date of mailing of the international search report
06 November 2013 (06-11-2013)	10 April 2014 (10-04-2014)

Name and mailing address of the ISA/CA	Authorized officer
Canadian Intellectual Property Office Place du Portage I, C114 - 1st Floor, Box PCT 50 Victoria Street Gatineau, Quebec K1A 0C9 Facsimile No.: 001-819-953-2476	Genevieve Scott (819) 953-1627

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/CA2013/050582

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