United States Patent

Fedewitz

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[54] HIGH-LIFT SNOW SHOE

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[52] **U.S. Cl.** ....**36/2.5 AB**

[51] **Int. Cl.** **A43b 00/00**

[58] **Field of Search**..................................36/2.5 R, 2.5 AB

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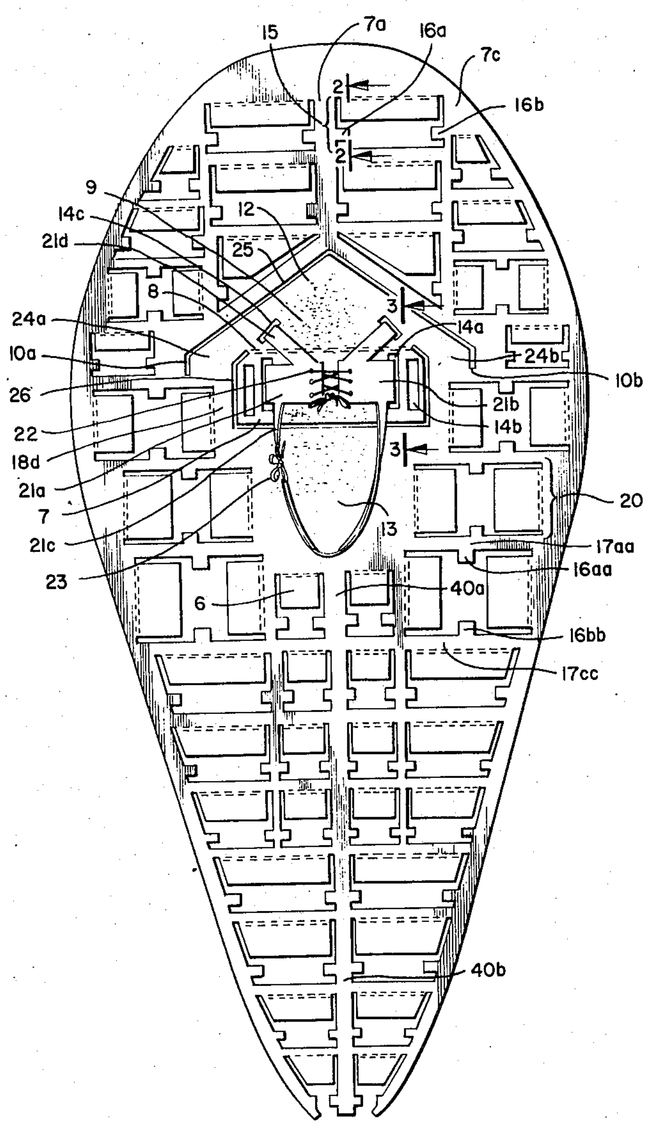
[57] **ABSTRACT**

In a preferred embodiment, a snow shoe of injection-molded polypropylene, the tread of the snow shoe having a plurality of resiliently polypropylene-hinged valve flaps angled downwardly at about 45°, as measured from a horizontal, within a respective open cell space per flap such that as the snow shoe — on the boot of the wearer — is pressed downwardly the snow causes the flap to move upwardly to thereby close-off the open space to substantially prevent large quantities of snow from passing through the open space, to cause the trapped snow pushing upwardly against the under-side face of the flap to contribute to lifting force against the flap which is pressed against a stop "limiting means" thereby supporting the snow shoe tread and snow shoe wearer on top of the snow, but also such that when the snow shoe is lifted the snow collected on the upper face thereof and on the upper face of the flap falls through the open space as the flap returns resiliently to the downwardly angled molded position.

27 Claims, 6 Drawing Figures



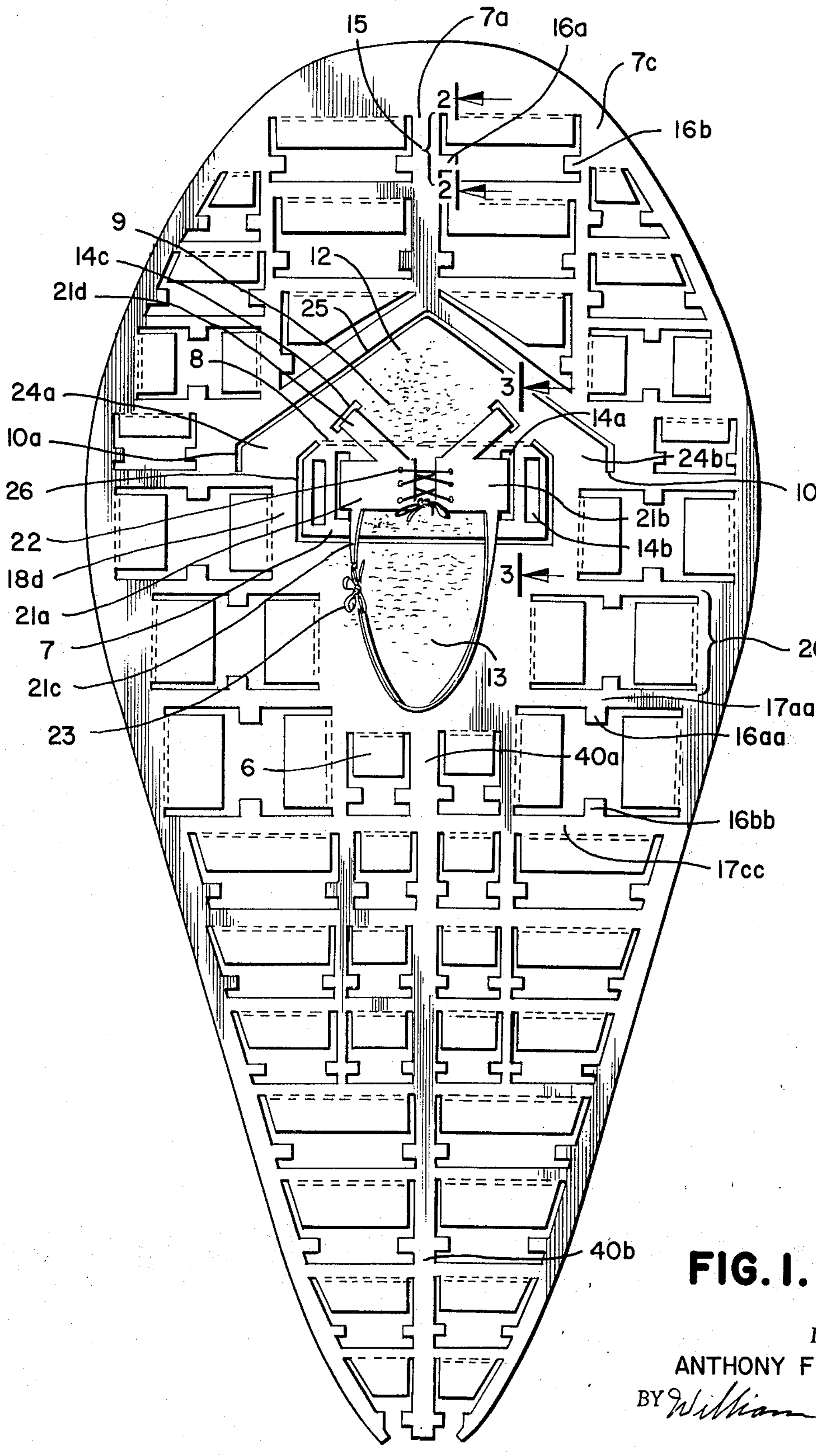


FIG. I.

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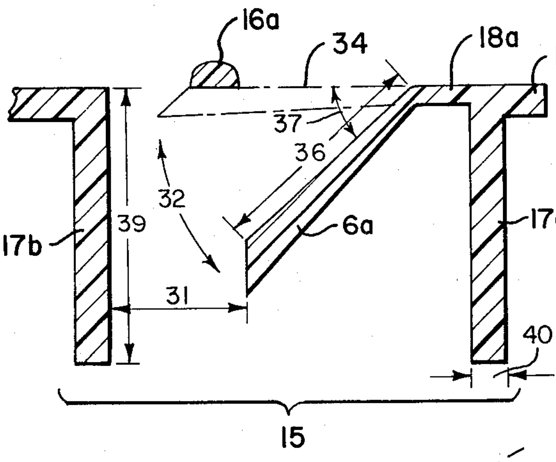
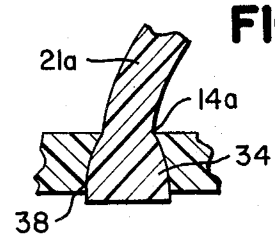


FIG. 2.

FIG. 5.



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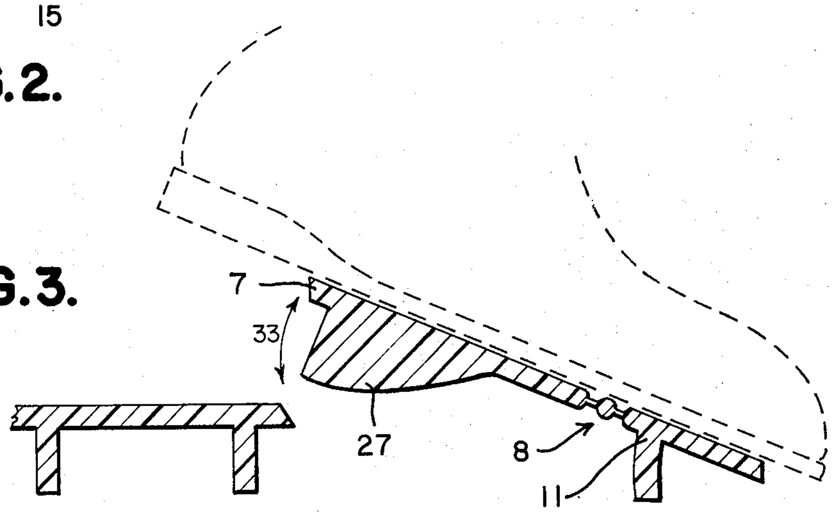
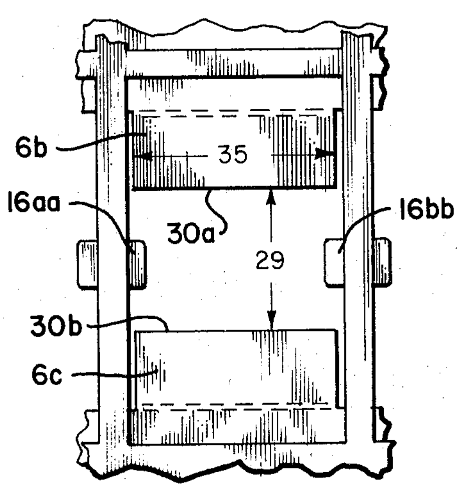


FIG. 4.



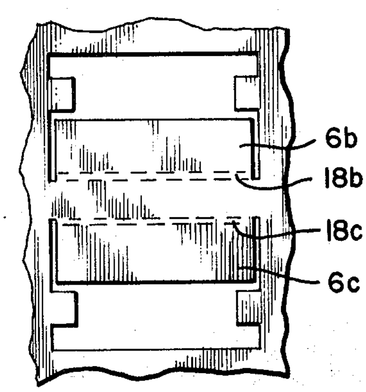


FIG. 6.

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HIGH-LIFT SNOW SHOE

This invention relates to an improved snow shoe which is capable of supporting greater weights in soft snow or holding the wearer higher in the soft snow with concurrently reduced snow shoe size, as compared to prior art snow shoes heretofore available.

BACKGROUND

Although it has long been recognized that maximum lift of a snow shoe would be obtainable if there were no holes or perforations in the snow shoe tread, it also has been recognized that heretofore such a tread would not be useable nor practical because soft snow rapidly collects on top of such a tread. This collected snow makes it increasingly difficult if not impossible to lift the snow shoe or to walk with the snow shoe attached. Accordingly, the controlling feature of any practical snow shoe has been the provision of providing an effective structure for making sure that the snow tending to accumulate on top falls through the tread. Providing such necessary escape spaces for accumulated snow has however required that the snow shoe width and length be proportionately greater than a hole-less shoe, in order that an equivalent amount of surface area be available for pressing downwardly into the snow. However, because a snow shoe having such an equivalent surface area — and thereby an equivalent amount of lift, would be of too great a width and/or too great of length to be conveniently or practically maneuverable or controllable, "lift" has been heretofore sacrificed by compromising to a snow shoe of reduced size but with snow-escape spaces or holes extending through the tread. For example, long years ago and still in some areas of the world, snow shoes are made from a bowed strip of wood with the opposite ends thereof pointed in a common direction and bound together side-by-side, with rawhide webbing strung across and laced to provide supporting surface area with openings provided in the webbing to prevent the accumulation of snow on top of the tread. In addition to the problems already noted above for such a snow shoe, the treated or varnished rawhide quickly wears-off the protective coating and the raw hide deteriorates, as well as absorbing moisture. Similarly the varnish or other wood coating or treatment becomes worn and thereafter the wood is subject to becoming water-logged. Moreover in extreme depths of soft snow, extreme sizes of snow shoes are essential conventionally for a pack-carrying wearer.

In addition to problems of the type discussed above, both extreme sizes as well as less than optimally desireable means for attaching the tread to the boot of the wearer have added to the problems of control, maneuverability, ease of walking, speed of movement and/or walking and the like. For example, a common problem is the shifting of the boot to an out-of-alignment position and/or the boot shifting to one side or the other as slopes or mounds of snow or ice are encountered or during an attempted change of direction, for example.

Some prior snow shoes weigh two pounds or more, thereby causing great weariness to a wearer on an extended trek or journey.

More recently there have been produced plastic snow shoes which at least are light weight. However, not all plastics are suitable for cold exposure, becoming very brittle and easily broken. Alternatively, flexible plastic heretofore has been subject to the disadvantage of the bending of the snow shoe responsive to the weight of the wearer such that balance and control become difficult as well as the wearer sinking further into the snow because the outer portions of the tread flex upwardly when the central portion of the tread sinks downwardly as the tread bends beneath the wearer's weight; sinking further into the snow requires the wearer to lift higher his snow shoe for the next step. Also such plastic shoes continue to require the large size because of the still-needed snow-escape spaces or perforations throughout the face of the tread of each snow shoe.

In order for the snow-shoe wearer's heel to arch forward, normally there has been a hinge action provided for. For some years flexible plastics such as polypropylene have been known to be suitable for bending and/or hinge-pivotable action. Although a plastic snow shoe has been desireable to obtain an advantage of light weight as well as the convenience and reduced cost of an injection molded tread and hinge, such a plastic tread has typically encountered the problem of too great flexibility, i.e. the snow shoe tread of insufficient rigidity bending under the wearer's weight, as discussed above.

In snow shoes prior to this invention, partially as a result of the cumbrous shoes necessary for obtaining a practical amount of lift, but additionally because of the method, mechanism, and/or location of attaching the snow shoes to the boot of the wearer, forward, rearward and/or angular movement of the boot relative to the respective tread has(have) resulted in a frustrating lack of maneuverability of and control in walking with the snow shoes.

A part of the difficulty in obtaining a securing snow shoe mechanism absent of boot movement forward, rearward, and/or angularly has arisen from the need of freedom of the boot heel to rise from the surface of the tread as the foot of the wearer is arched forward during the normal course of walking with the snow shoe attached.

Other typical factors involved in the producing of snow shoes, as well as in any constructive attempts to overcome one or more of the above type problems, include the employment of waterproof and/or non-warping materials, high-level strength and durability, reasonableness of manufacture, adaptability to mass production, resistance to wear and weather conditions, adaptability to different types of boots or other foot-wear, adaptability to different sizes of foot-wear, simplicity of design, together with the major factors of lift and control already discussed at length above.

SUMMARY OF THE INVENTION

The overcoming of the above problems are among the objects of this invention, as well as other objects apparent from the preceding and following disclosure, and one or more of these objects are obtained by one or more embodiments of this invention. The invention includes a high-lift valve which imparts a high degree of lifting capacity to a snow shoe embodying a plurality of the lift valves, while concurrently providing a mechanism whereby soft snow tending to accumulate on the upper face of the snow shoe tread escapes through spaces opening in the tread as weight is taken off-of the snow shoe and the snow shoe lifted in the normal course of walking of the wearer of the snow shoe. The snow shoe tread is substantially in its entirety molded (by normally injection molding) from a resilient polymeric material, hereafter referred to as "plastic," such as well-known conventional (or other desirable) semi-flexible polymer selected from the group consisting of polyolefin, unfilled nylon, and polyvinyl polymers, preferably polypropylene or polyethylene, provided that the particular one(s) of such polymers are characterized by flexibility of a nature adaptable to this invention; for example, a completely elastic composition would not be adaptable because of the lack of resistance to bending under the weight of the wearer, whereas a composition without any significant resiliency would be subject to either breaking and/or providing a plastic valve which would not function properly, as described hereafter. However, as is well known in the polymer art, elastic polymeric compositions may be modified in their characteristics to provide increased rigidity — i.e. to become a little less elastic — by the incorporation of filler and/or by other known and/or desired methods. The plastic, such as for example any of those noted above, is suitable for the snow-shoe tread in having the desired flexibility and resiliency for the high-lift valve while concurrently (particularly when in the inventive cellular form of the preferred valve cells) providing rigidity for the snow-shoe support structure.

Thus, the tread and the high-lift valve are both of the plastic material, molded concurrently as a single, unitary injection (for example) molded product preferably in a cellular form with one or more valveflaps per cell. The cellular form serves to protect the valve(s) as well as providing a structure less susceptable to bending under the weight of the snow shoe wearer. The high-lift valve is in effect a substantially one-way valve substantially preventing snow from rising completely through the snow shoe onto the top of the tread, providing for the trapping of snow beneath the lower surface of the tread, and providing for the escape through the tread of soft snow accumulated on the upper face of the snow shoe tread. The high-lift valve is a plastic flap hinged by a thin (normally thinner) plastic hinge to a plastic part of the tread structure, the valve flap, hinge and tread structure being integral and unitary, with the valve flap molded in a position angled obliquely downwardly (i.e. slanted downwardly), relative to a horizontal (the typical tread faces normally being parallel to a horizontal), at an angle ranging from about 20° to about 70°, with the tread support structure being shaped to provide a structure-free space extending from above to below the snow shoe tread such that the flap is pivotably flexible upwardly on the hinge through an arc of at least part of the angle and such that as the article is pressed downwardly onto a substantially flowable particulate composition such as soft snow, the flap is thereby pressed upwardly through the arc by the composition trapped under and also such that portions of the particulate composition on top of the flap is flowable downwardly past the flap when the flap resiliently returns to its fixed (molded) angle (downwardly slanted).

THE FIGURES

FIG. 1 illustrates a typical and preferred embodiment of the invention, disclosing an elevation plan view of an upper surface of a snow shoe embodying the high-lift one-way valves.

FIG. 2 is a cross-section taken along lines 2—2 of FIG. 1.

FIG. 3 is a cross-section taken along lines 3—3 of FIG. 1 as such a cross-section would appear when strapped to a wearer's boot during an arching forward of the boot heel as occurs after a step and preparatory to lifting the snow shoe in a next step.

FIG. 4 illustrates an elevation plan view of a portion of a lower face of a snow shoe tread such as the snow shoe of FIG. 1, the illustrated portion disclosing a typical cell structure having two high-lift valve flaps within the single cell, one hinge and flap being mounted in one end and the other hinge and flap being mounted in the opposite end of the cell.

FIG. 5 illustrates a typical cross-sectional side view of a portion of the boot-mounting plate and strap attaching means, disclosing a preferred wedge-securing device for firmly but simply securing the strap to the plate.

FIG. 6 illustrates two back-to-back cells with back-to-back hinges from a common support structure portion.

DETAILED DESCRIPTION OF THE INVENTION

The primary function of the inventive lift valve is to provide for resistance to flow in one direction — upward through the snow shoe tread — and utilizing that resistance to provide weight-carrying capacity or lift, and to provide for reduced and little resistance to snow flow downwardly through the snow shoe tread. The weight carrying capacity of any given snow shoe is a function of its projected surface contact area on the lower face of the snow shoe tread. Because of the many snow-escape holes extending through the surface of heretofore snow shoe treads, lower tread face contact area constituted only a small percentage of the total area encompassed by the periphery of the snow shoe. By virtue of the snow shoe including a plurality of the inventive high-lift valves, the inventive snow shoe approaches the efficiency of a flat plane and yet is self-purging of soft snow tending to accumulate on the upper surface of the tread. The cellular structure provides protection of the flap 6 while concurrently providing both strength and rigidity to thereby dispense with the requirements of both separate frame and conventional webb construction thereby also reducing the need for the additional weight of such parts.

As illustrated in FIG. 2, the greater minimum valve-flap 6a thickness at the outer edge which engages the stop in the closed position is necessary to prevent the flap under pressure from flexing at that point and sliding (when flexed) past the stop *16a;* flexing at the hinge area — sufficiently for the flap to slip past the stop — is a less likely possibility because of reduced leverage against the flap at that point, and therefore the flap near the hinge 18a and the hinge itself may be thinner for optimal pivoting action of the flap; also the thinner flap toward the hinge 18a allows snow-shoe weight reduction by virtue of reduced total mass.

The snow shoe tread may optionally omit a toe hole in the tread of this invention, thereby (when omitted) further reducing the open-space normally in a snow shoe tread; in a tread of this invention omitting the toe hole, the boot-support plate 7 is of longer length (as measured from anterior to posterior ends of the snow shoe tread) with the entire boot-toe end remaining on the plate, preferably abutting a stop projecting upward from the forward end of the plate to prevent the toe of the boot from extending forward beyond the plate hinge 8. However, in an illustrated preferred embodiment of FIGS. 1 and 3, the forward toe flap 9 extends beyond (or at least as far as) the boot toe and the body of the tread is either molded such that, or the body of the tread is slit (cut) such that, the slit-space substantially circumscribes the boot-toe portion with the slit on each side of the boot-toe portion 9 to slit-termination points *10a* and *10b* about adjacent opposite ends of the hinge 8 but preferably angled away from the hinge ends so that substantially high strengths exists between the slit-termination points and the hinge ends, whereby there is hinge action provided for the boot-toe portion 9 when the wearer's boot is arched forward as illustrated in FIG. 3 but whereby normally in the stepping position and weight-carrying position the boot-toe portion 9 is in its normally fixed (where molded) position in the same horizontal plane as the upper and lower faces of the snow shoe tread, thereby the lower face of the boot-toe portion 9 providing additional lift as compared to a snow shoe tread having an open-toe hole extending through the tread. Also, in this FIG. 3 illustrated embodiment, the plate 7 and hinge 8 are not required to carry alone the wearer's weight because a substantial portion of the wearer's weight is carried by the support structure portion 11. On the anterior portion of the upper face of the boot-toe portion 9 is illustrated an optional boot-toe stop 12, in FIG. 1.

In FIG. 1, typically illustrated are: boot-heel support portion 13; plate hinge area of hinge 8; through-aperture or through-slit such as *14b*, and *14c;* cell flap 6a of single cell 15 having stop *16a* and *16b* at opposite ends of the cell projecting from the support structure forming the periphery of the cell; normally the edges of the cell from which the stops 16 (*a* and *b*) extend constitute the tops of the respective walls such as stop *16aa* (as viewed from the bottom of the double cell — i.e. two hinges and two flaps, opposing each other from opposite ends of the cell — of FIG. 4) extending from the top of wall *17aa* and stop *16bb* extending from the top of wall *17cc*, whereas in FIG. 2 flap *6a* extends from the hinge 18a of thinner cross-section than support structure portion 19 and thinner than the flap 6a; in the FIG. 2 it may be seen that the hinge 18 *a* in this embodiment extends directly from the top of the cell wall *17d* which is opposite (across the cell from) cell wall *17b*. It should be noted however that the cellular walls need not necessarily be adjacent the opening which the flap 6 serves to close and open; however, in a preferred embodiment, the cell walls define the opening typically as illustrated in FIGS. 2 and 4. FIG. 1 additionally illustrates double cells such as double cell 20, straps *21a*, *21b*, lace 22, strap *21c*, knoted bow 23, previously listed toe flap 9, hinge-action portion *24a* and hinge-action portion *24b*, previously mentioned boot-toe stop 12, slit (or molded space) 25 extending between slit-termination points *10a* and *10b*, slit (or space) 26 (between the circumscribing support-structure edges **28***a*, *b*, and *c*) defining the boot-support plate **7**, guide **27** for serving to guide the plate downwardly into the space defined by the slit **26** (when the plate **7** is pivoted upwardly) as well as for serving to facilitate the prevention of any sideward shifting movement of the plate **7** when the plate is in its downward weight-supporting position. Preferably the edges of the plate are cut after molding and cut at an inward angle such that when in the down position the upper edge of the plate **7** presses downwardly on the lower angular edge of the support structure portions **28***a* and **28***b* and **28***c*. The boot-toe portion **9** may be additionally optionally hinged from (by a hinge section such as hinge **8** — of the same type, that is) the portions **24**a and **24**b with the additional hinge extending across the width of the boot-toe portion **9**.

Although solely single and double cells are illustrated in FIGS. **1**, **2**, and **3**, it is possible to have varying arrangements of the flaps and/or to have three, four, or more flaps per cell. However, a particular advantage of the double cell illustrated in FIG. **4**, for example, is that valve flap support surface area is approximately twice the single cell valve flap support surface area, while the upper tread face-opening nevertheless has typical space **29** between opposing outer edges **30***a* and **30***b* of flaps **6***b* and **6***c*; this space **29** is of about the same area across as space **31** of cell **15**, whereby when closed upwardly the flaps **6***b* and **6***c* substantially close the upper tread face opening of the double cell. It should be noted that such a closed opening is not so easily accomplished with a single cell, because — as a limitation imposed by an injection mold method of making the cell-containing snow shoe — the flap **6***a* as molded at the fixed angle (typically as illustrated in FIG. **2**) must be sufficiently short so as not to extend beneath the projecting flap stop **16***a* in order that after the injection molding operation — a mass production method to reduce cost and thereby make practical the making of such a plastic shoe — the cell (or snow shoe of which the cell is a part) may be lifted from the mold; if the flap as molded extended beneath or beyond the stop **16***a*, the hardened plastic cell could not be removed from its mold. Also, if the flap is molded angled (slanted) downwardly to too great an extent, the downward movement of the cell into soft snow (for example) will not result in enough leverage and/or enough snow pressing against the underside face of the flap to cause the flap to move upwardly, as well as causing the edge **30***c* of the flap to dig into the snow, the snow thereby jamming the closing action of the valve, and the valve generally being inoperative. Alternatively, if space **31** becomes too narrow, snow cannot escape therethrough. Accordingly, there is a substantive limit to the operable downward angle as well as a practical and substantive limit (if injection molding is to be employed) to the length of the flap so as not to extend under nor beyond the stop **16***a*. Thus both the larger upper tread cell face space as well as the mechanism to substantially totally close that space is a real advantage, obtaining a complete plane without opening therein and thereby maximum lift in a double cell.

For either single or double cells, the closing action — i.e. the extent to which the opening is more completely closed — is further improved by virtue of the increased thickness of edge **30***c* as illustrated — i.e. the greater thickness together with the angled edge (relative to the faces of the flap) maximizes the reach of the flap for closing purposes, while adding strength and durability to the flap.

The movement indication arrow **32** illustrates the path of movement of the flap **6***a* to the closed position when pressured upwardly by snow (for example) when the cell is pressured downwardly.

The movement indication arrow **33** illustrates the path of movement of the hinged plate **7** between the open and closed positions.

In FIG. **3**, although the illustrated hinge **8** is a double hinge, a single hinge may be employed. However, the advantage of a double hinge is that because of the double hinge action, there is less bending of the plastic hinge required and accordingly a thicker hinge may be employed in view of the double hinge limiting the maximum stress that would probably ever (normally) be placed on either of the single hinges making up the double hinge. The thicker hinge naturally has greater strength and durability, and not only is less apt to break or tear but also is less flexible in shifting sideward movement as compared to the situation that would exist with a thinner hinge. Yet there is ample upwardly and downwardly flexibility as needed.

The FIG. **5** serves to illustrate how the strap **21***a* (for example) is removably anchored into a molded slot **38** designed for a wedge-lock mechanism, whereby the wedge **34** — the terminal end of strap **21***a* — is easily inserted into the locking position but is removable if and when desired, such as to adjust for the width of wearer's boot or to replace a worn or severed strap **21***a*.

Although a particular typical harness means is illustrated as straps such as **21***a*, **21***b*, **21***c*, lace **22**, and lace bow **23**, any suitable, conventional, and/or desirable harness may be employed preferably employing the strap attaching mechanism of FIG. **5**, and the through-slits or other attaching means may be located on any one or more support portions such as **7**, **9**, or **18***d*, for example.

Although a preferred attaching means for the strap is illustrated in FIG. **5**, any desirable, suitable, and/or conventional attaching means and mechanism may be employed.

Similarly, although a preferred boot-securing means is illustrated and described, any desired, suitable, and/or conventional boot-securing means and mechanism may be employed.

In the illustrated embodiment of FIG. **1**, there are provided a plurality of through-slits such as **14***a*, **14***b*, and **14***c*, either molded as through-slit **34***a* (see FIG. **5**) or cut thereinto subsequent to (i.e., after) the molding operation on opposite sides of the boot-securing position, providing optional slits for different width boots; however, part or all of the through-slits may be through the support structure (other than the plate) adjacent or anterior to the plate, and/or on the boot-toe portion for example, as might be desired. This is a preferred embodiment, incorporating the plurality of optionally alternative through-slits, the result being that with the strap snugly fitting the almost exact width of boot of the wearer, there is reduced or eliminated any remaining substantial possibility of shifting of the boot sidewardly in the strap harness. It should further be noted, however, that such through slits are also appropriate for the employment of a belt-like strap downwardly into a slit on one side of the boot and upwardly through another slit on the opposite side of the boot. In the illustration of FIG. **1**, extending from boot-toe portion **9** straps such as **21***d* extend from through-slits such as **14***c* to join straps **21***a* and **21***b*.

For purposes of this disclosure, the width of the flap **6** refers to a measurement along imaginary axis **36**, whereas the length of the flap **6** refers to a measurement along imaginary axis **35**. The angle **37** is the angle of the downwardly angled flap **6**, the angle at which the flap is fixedly molded.

As stated above, the angle **37** may range from about 20° to about 70°, but preferably ranges from about 40° to about 50°. The flap **6** (**6***a*, **6***b*, etc.) thickness may range from about 0.011 inches to about 0.15, but preferably ranges from about 0.02 inches to about 0.11 inches. The flap hinge **18***a* ranges normally from about 0.002 inches to about 0.015 inches, but preferably ranges from about 0.006 inches to about 0.011 inches. The cell depth as measured along imaginary axis **39** normally ranges from about ⅜ inch to about 1½ inches, but preferably from about one-half inch to about five-eighths inch. The flap width normally ranges from about ⅜ inch to about 1½ inches, but preferably from about one-half inch to about three-quarters inch, and the length ranges normally from about ½ inch to about 6 inches, preferably from about **1** inch to about 4 inches. The space **31** normally ranges from about ¼ inch to about 2 inches, but preferably from about ⅜ inch to about 1¼ inch. The overall snow shoe tread length normally ranges from about 20 inches to 36 inches, but preferably ranges from about 25 inches to about 30 inches, and normally has a width ranging from about 9 inches to about 16 inches but preferably from about 11 inches to about 14 inches. The boot plate length normally ranges from about 3 inches to about 9 inches, preferably from about 4 inches to about 6 inches, and in width normally from about 4 inches to about 7 inches, preferably from about 4.5 inches to about 6 inches.

To maintain proper grip on ice crusted snow surfaces, the lower edge portions of the high-lift snow shoe may have off-set edges, and/or serrated or toothed edges, and/or may include molded holes, indentations, or slots for the insertion of typically metal ice-cleats, for example.

Instead of the wedge-lock strap terminal illustrated in FIG. **5**, the terminal portion may be T-shaped or any other shape suitable for providing a locked-in strap terminal; with the T-shaped terminal, the hole molded into the shoe therefor would be molded a fraction of an inch smaller than the T-terminal so as to provide for a wedging snug and locked fit.

The heel plate on the upper surface of the tread is preferably a rough finish and/or a serrated surface, in order that any tendency for the boot heel to slip sideward will be reduced. Similarly also preferably the plate **7** surface and the boot-toe portion **9** surface have a rough finish and/or a serrated surface to further reduce any tendency for the boot sole to slip forwardly, backwardly, and/or sidewardly.

Although in the preceding disclosure there has been discussed solely a snow-shoe embodiment of the inventive high-lift valve of this invention, the valve and structure may be equally well employed to any flowable particulate composition other than soft snow discussed above, other typical compositions being for example a grain within a grain bin or the like, where it is desirable that the worker not sink-down beneath the surface thereof.

FIG. **6** illustrates back-to-back valve flaps **6*b*** and **6*c*** hinged by hinges **18*b*** and **18*c*** from a common support portion, where two single cells are back-to-back if and when desired. Also a single cell can be back to a double cell, or two double cells back-to-back.

It should also be noted that if desired, single-flap containing cells may circumscribe (for example) the snow shoe periphery and be facing outwardly from the boot at each cell's respective location and concurrently be absent an outer wall — i.e. absent the wall **17*b*** — whereby the space beyond the flap edge **30** (space normally designated **30c**) may be infinite — the flap edges **30** in such an embodiment having no protective snow shoe outside-frame structure, i.e. such cells being three-walled cells, such as the trailing cells of FIG. **1**.

The cellular walls such as **17*a*, *b*, *c***, and ***d*** are preferably thicker along imaginary axis **40** at points nearer the central portions of the snow shoe and tapered to thinner cross-section at points distant from the central portions, since the outer portions are not required to be as strong and sturdy. The thicker wall portions prevent flexing action of the central portions of the tread structure and the transmital of snow shoe wearer's weight to the outer portions; for example the support structure between cells is thicker at **40a** than at **40b**. The thinner outer portions thereby are not any larger nor heavier than necessary, resulting in a lighter-weight snow shoe.

Although cellular structure typically having walls **17*a*, *b*, *c***, and ***d*** are preferred, the tread may alternatively be a substantially plane surface having the valved surface as illustrated in FIG. **1**, but with sturdy (preferably tapered) struts in any desired underside supporting and/or reinforcing structure as a separate or unitary constructed or molded part of the planar tread surface.

There are modifications which to the ordinary artisan in this art would be obvious, although all possible variations and equivalents have not been discussed in this disclosure. Accordingly, it is within the scope of this invention to employ such modifications and use such equivalents which fall within the spirit of this invention.

I claim:

1. An article comprising, in combination: at least one plastic one-way valve means comprising a support structure; continuous with an upper portion of said support structure at least one unitary resilient first hinge means extending from said upper portion along said longitudinal axis; a valve flap continuous and unitary with said hinge means, said valve flap having an outer edge opposite an edge adjoining said first hinge, said valve flap relative to a horizontal plane, extending from said longitudinal axis at a substantially fixed angle ranging from about 20° to about 70°; said support structure being shaped to provide a structure-free space extending from above to below said article such that said valve flap is pivotably flexible upwardly on said hinge means through an arc of at least part of said angle and such that as said article is pressed downwardly onto a substantially flowable particulate composition, said valve flap is pressed upwardly through said arc by said composition and also such that portions of said particulate composition on top of said valve flap is flowable downwardly past said valve flap when said valve flap resiliently returns to said substantially fixed angle, said structure-free space extending from said flap's said outer edge at least about one-fourth inch as measured along a horizontal imaginary axis extending outwardly from said outer edge, said valve flap ranging from about 0.015 inch to about 0.15 inch in thickness and between said first hinge means and said outer edge a width ranging from about ⅜ to about 1¼ inches, said plastic valve means consisting essentially of semi-flexible polymer, said support including stop means to limit said flap's upward pivotable flexure to a predetermined maximum number of degrees, and said hinge means ranging in thickness from about 0.002 inch to about 0.015 inch.

2. An article according to claim **1**, further including a plurality of said one-way valve means continuous and unitary with one-another.

3. An article according to claim **2**, in which said flexible polymer is polyolefin.

4. An article according to claim **2**, in which said flexible polymer is unfilled nylon.

5. An article according to claim **2**, in which said flexible polymer is polyvinyl polymers.

6. An article according to claim **2**, shaped to form a snow shoe tread ranging from about 20 inches to about 36 inches in length and from about 9 inches to about 16 inches in width.

7. An article according to claim **6**, including means for attaching said snow shoe tread to a boot sole.

8. An article according to claim **7**, in which said attaching means includes, continuous and unitary with said tread, resilient second hinge means and boot sole-support structure attached pivotably to said second hinge means.

9. An article according to claim **8**, in which said boot sole-support structure and said second hinge means are hinge and plate jointly extending about 3 inches to about 9 inches in width as measured along an imaginary axis parallel to said second hinge means, and of about 2 inches to about 7 inches in length as measured along an imaginary axis about perpendicular to said second hinge means and in which said hinge extends into a hole through said support structure.

10. An article according to claim **9**, in which said plate includes at least one through-slit adjacent each of opposite plate edges extending through the plate's upper and lower faces for inserting therethrough a boot-securing strap.

11. An article according to claim **10**, in which said plate includes a plurality of said through-slit ranging consecutively inwardly from each of inner and outer edges of said plate such that optional slit-engaging strap positions are available for variable boot widths, and in which said second hinge means and said plate are defined by a continuous through-space extending through said tread to circumscribe about three sides of said plate and opposite ends of said second hinge means, said plate being pivotable upwardly out of said through-space.

12. An article according to claim **11**, in which said second hinge means extends rearwardly from a forward portion of said tread forward of said through-space such that said hinge plate pivots forwardly when a mounted boot's heel is raised and arched forwardly.

13. An article according to claim 12, in which said support structure is cellular in shape, in which said support structure includes a substantially upright wall extending along an imaginary longitudinal axis with said longitudinal axis during said article's use being employable substantially in a horizontal position, and in which at least two of said flaps are hinged within at least one of a plurality of adjoined cells and said two flaps extend about toward each other defining a narrow space between opposing flaps' said outer edge.

14. An article according to claim 13, in which a lower portion of each said through-slit is enlarged relative to the through-slit's upper channel.

15. An article according to claim 13, in which said one cell's depth ranges from about ⅝ inch to about 1½ inches.

16. An article according to claim 15, in which said angle ranges from about 40° to about 50°, said structure-free space ranges from about ⅝ inch to about 1¼ inches, said flap thickness ranges from about 0.011 inch to about **0.11** inch and in width from about one-half to three-fourths inch, said cell's depth ranges from about one-half inch to about five-eighths inch, said snow ranges in length from about 25 inches to about 30 inches and in width from about 11 inches to about 14 inches, said second hinge means is of thinner thickness than said plate's average thickness, said plate ranges in length from about 4 inches to about 6 inches and in width from about 4½ inches to about 6 inches, said hinge means ranges from about 0.006 inches to about 0.011 inches, and said flexible polymer is polyolefin.

17. An article according to claim 15 wherein said flexible polymer is unfilled nylon.

18. An article according to claim 15 wherein said flexible polymer is polyvinyl polymers.

19. An article according to claim 10, in which said second hinge means and said plate are defined by a continuous through-space comprising said hole extending through said tread to circumscribe about three sides of said plate and opposite ends of said second hinge means, said plate being pivotable upwardly out of said through-space, and in which said hinge means extends rearwardly from a forward portion of said tread forward of said through-space such that said hinge plate is pivotable forwardly when a mounted boot's heel is raised and arched forwardly.

20. An article according to claim 19, in which a lower portion of each said through-slit is enlarged relative to the through-slit's upper portion.

21. An article according to claim 2, in which back-to-back ones of said flap extend in about opposite directions from back-to-back ones of said first hinge means mounted on a common said upright wall.

22. An article according to claim 1, in which said polymer is polypropylene.

23. An article according to claim 1, in which said support structure forms at least one cell in which at least two of said flaps are hinged within said cell with one flap hinged on one side of the cell and the other of the two flaps hinged on an opposite side of the cell such that the two flaps extend about toward each other defining a narrow space between opposing flaps' outer edge.

24. An article according to claim 1, in which said support structure forms at least one cell of which said upright wall is one of the cell's walls, with said flap hinged within the and with said structure-free space between said outer edge and an opposite wall of said cell ranging from said about ¼ inch to about 2 inches.

25. An article according to claim 12, in which said plate includes on its lower face adjacent opposite inner and outer edges downwardly projecting guide means for guiding downward pivotable movement of said plate into said through-space and for limiting sideward shifting of said plate within said free space.

26. An article according to claim 12, in which said snow shoe tread includes a toe hole therethrough in a tread portion anterior to said forward-portion second hinge-support structure, said second hinge-support structure being substantially U-shaped with each U-leg angling rearwardly toward the snow shoe tread's posterior end, angling substantially around opposite ends of said opposite ends of said second hinge whereby said second hinge-support structure has inherent hinge-action flexibility for downward bending.

27. A snow shoe tread comprising an injection-molded plastic tread of a plastic composition selected from the group consisting of polyolefin, unfilled nylon, and polyvinyl polymers, said tread including a continuous and unitary attaching means comprising a hinge means and a boot sole-support structure attached pivotably to said hinge means, in which said hinge means and said boot sole-support structure are defined by a continuous through-space extending through said tread to circumscribe about three sides of said boot sole-support structure and opposite ends of said hinge means, said boot sole-support structure being pivotable upwardly out of said through-space, said hinge means extending rearwardly from a forward portion of said tread forward of said through space such that said hinged boot sole-support structure pivots forwardly when a mounted boot's heel is raised and arched forwardly, and said snow shoe tread including a toe hole therethrough in a tread portion anterior to said through-space, said tread including a hinge-support portion from which said hinge extends, said hinge-support structure extending forwardly into said hole, said hole extending rearwardly on opposite sides of said hinge-support structure such that said hinge-support structure is depressable downwardly when a boot mounted on said sole-support is pivoted forwardly as the boot's heel is raised and the boot arched forwardly.

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