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3,537,719

SKI BINDINGS

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FIG. 1

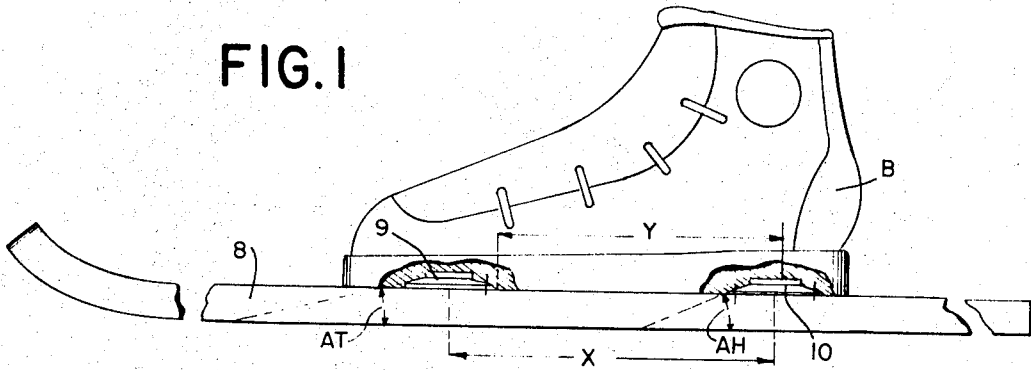


FIG. 3

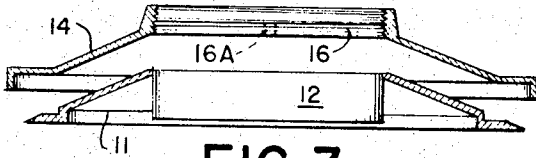


FIG. 4

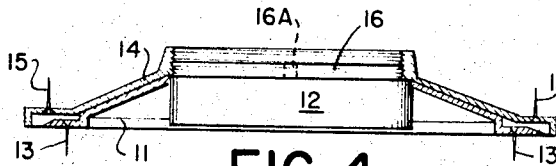


FIG. 2

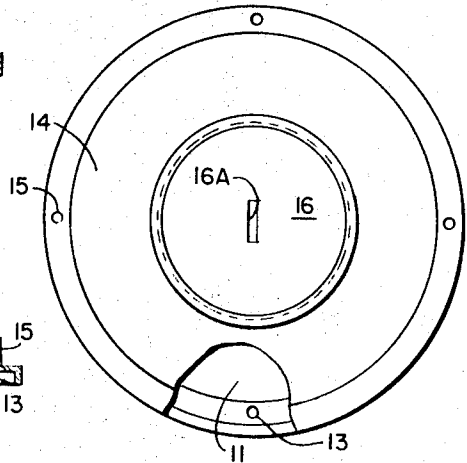


FIG. 5

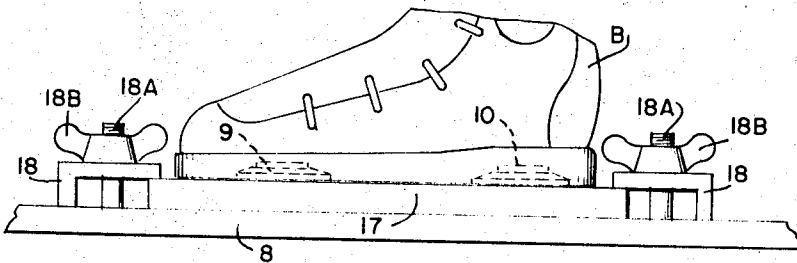
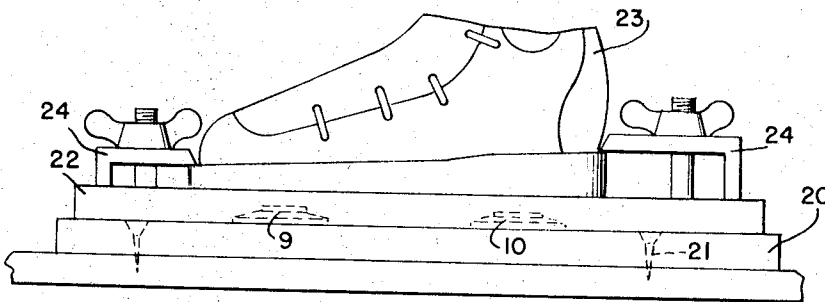


FIG. 6



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SKI BINDINGS

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13 Claims

ABSTRACT OF THE DISCLOSURE

A releasable ski boot binding in which a pair of nesting frusto-conical cooperating parts are releasably secured together by a magnet in one part and an armature in the other part with one attaching unit adjacent the toe and another attaching unit adjacent to heel. The slopes of the frustums and the adjustable magnetic attractions determine the force required to separate the boot from the ski when twisting or lateral force is applied, while the magnetic attractions retain the boot and the ski together against normal vertical separation.

The invention relates to releasable attaching means and particularly releasable bindings for attaching boots to skis to provide for separation of the boots worn by a skier from the ski in the event of excessive forces which might injure the skier.

Heretofore known types of release bindings have been uncertain in the operation and sometimes the release bindings would release with such a small force that the skier could not maintain proper control and at other times the release bindings would require such excessive forces for separation of the ski from the boot that the skiers would be injured before the ski would separate from the boot.

An object of the present invention is to provide a releasable attaching means particularly useful for skiers which overcomes the difficulties of the prior art structures.

Another object of the invention is to provide a releasable attaching structure using magnets and avoiding complicated linkages heretofore employed.

A further object is to provide a releasable attaching means for boots and skis in which the force required for separation at the toe is less than the force required at the heel.

Other and further objects will be apparent upon references to the drawing wherein:

FIG. 1 is an elevation of a boot secured to a ski by means of a toe unit having cooperating nested frusto-conical parts with the inner part secured to the ski and carrying a magnet and the outer part secured in a recess at the ball portion of the sole of the boot and carrying an adjustable armature with the heel having a similar unit with the angle of the cone of the heel unit being steeper;

FIG. 2 is a plan view of the assembled heel unit;

FIG. 3 is a vertical section on an enlarged scale of the heel unit with the frusto-conical parts separated and showing the magnet in the inner cone and the adjustable armature in the outer cone;

FIG. 4 is a similar section with the parts together.

FIG. 5 is a modification in which one part of the attachment units are mounted on the boot and the other parts of the attaching unit are mounted on an intermediate base or intermediate boot sole adapted to be secured to a ski by any type of conventional fastening means such as the clamps illustrated.

FIG. 6 is a further modification in which the conventional ski boot is detachably fixed to an intermediate member by the attachment units and the intermediate

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member is detachably secured to an intermediate base which is secured to the ski in any suitable manner.

Briefly a ski boot is secured to the ski by a toe unit having hollow frusto-conical nesting parts with a magnet in the lower inner part and an armature in the upper outer part with the armature adjustable to vary the magnetic force: the bottom part is secured to the ski by suitable means and the top part is secured in a recess in the sole of the boot adjacent the toe. A similar unit with a steeper angle of inclination is mounted in the heel and two or more units may be mounted in either the toe portion or heel portion, the boot being retained on the ski by the magnetic attraction which requires a vertical force for separation or a lateral force causing the outer frusto-conical part to cam along the inner frusto-conical part and thereby separate.

Referring more specifically to the drawing, a fragment of a conventional ski 8 is provided with one attaching unit 9 for the toe and another attaching unit 10 for the heel with the parts of the toe and heel units identified by similar reference numerals followed by T for toe and H for heel, where it becomes necessary to distinguish.

On the base or ski 8 is mounted a hollow frustum 11 in which a magnet 12 is secured by any suitable means and the frustum 11 is attached to the ski by suitable screws 13 suitably countersunk to provide a smooth exterior surface to the inner frustum 11. A cooperating outer hollow frustum part 14 has its recess receiving the projecting frustum 11 and such part 14 is secured to the boot by suitable fastenings such as screws or rivets 15 in a cooperating recess in the boot to provide for effective surface contact between the inner surface of part 14 and the outer surface of part 11. A ferromagnetic armature 16 is adjustably mounted in the part 14 by suitable means such as screw threads on its periphery cooperating with female screw threads on the part 14 whereby the air gap between the adjacent surface of the magnet 12 and the armature 16 can be adjusted by a tool such as a screw driver received in slot 16A to obtain the desired retention force in an axial or vertical direction with respect to the parts 11 and 14. It will be apparent that a second permanent magnet may be substituted for the ferromagnetic armature 16.

The modification in FIG. 5 shows the ski 8 having an intermediate base 17 secured thereon by any suitable means such as L-shaped clamp members 18 which engage the toe and heel ends of the intermediate base 17. The intermediate base may be shaped to correspond to the sole, though provided with projections for clamping, and may be made substantially of materials suitable for boot soles, so that the wearer may walk in normal fashion when the base is detached from the ski, and the base is secured to the boot by attaching units 9 and 10. The L-shaped clamp member 18 may be held in clamping relation by a threaded stud 18A fixed to the ski 8 and freely passing through an aperture in the horizontal arm of the clamp member 18 and a thumb nut 18B mounted on the stud and reacting on the horizontal arm.

The frusto-conical parts 11 secured to the base 17 cooperates with the frusto-conical parts 14 carried by the boot B. With this construction, the skier may rent conventional skis and wear or carry his own boots with base 17 and when he reaches a ski slope can rent the skis 8 and attach the intermediate bases 17 by the clamps 18 and then have the advantages of his own well-fitted boots without having to carry the long awkward skis.

In FIG. 6, the ski 8 is shown as having an intermediate base member 20 suitably fixed to the ski by permanent attachments such as screws 21 or the like or by suitable clamps such as clamps 18 shown in FIG. 4 and such intermediate base carries the frusto-conical parts 11 while an upper member 22 carries the cooperat-

ing recessed frusto-conical part 14 of the units 9 and 10 and such intermediate member is secured to a conventional ski boot 23 by means of clamps 24 of any suitable type which may be similar to clamps 18 whereby the boot 23 is fixed to the intermediate member 22 and the intermediate member is detachably attached to the intermediate base 20 by the separable magnetic units previously described. This makes it possible for a person having conventional boots to use such conventional boots with the attaching means of the present invention without requiring modification of the boot.

The cooperating slant surfaces of the parts 11 and 14 are arranged to be smooth and preferably relatively frictionless such as being coated by a plastic product sold under the trademark Teflon. Other friction reducing means such as lubrication or oilite bearing surfaces may be used. The retaining force of the magnets in a vertical or axial direction is substantially equal to the magnetic attraction force of the magnet 12 to the armature 16 of the units 9 and 10. However, a twisting or lateral force between the boot and the ski will cause the outer parts 14 to move relative to the inner parts 11 producing a camming action and the resultant vertical force caused by the lateral force is proportional to the tangent of the angle AT or AH between the outer slant surface of the inner frusto-conical part 11 and the mating inner slant surface of the outer frusto-conical part 14.

In skiing, axial forces along the axis of the heel unit and along the axis of the toe unit are referred to as vertical forces and the weight of the skier is normally applied in such direction by gravity. Forces perpendicular thereto, such as horizontally along the length of the ski or laterally of the ski in a plane parallel to the plane of the ski are referred to as lateral forces. Both forces occur simultaneously and when such forces become excessive, there is danger of injury to the skier. For the purpose of illustration, the mathematical relation is discussed in accordance with the following definitions:

Weight of skier= W ; weight of ski= S

Distance between axes of heel and toe units= X

Effective distance between ball and heel of foot= Y

Base angle of heel unit= AH

Base angle of toe unit= AT

Vertical force at heel unit for release= MH

Vertical force at toe unit for release= MT

Lateral force at heel unit for release= LH

Lateral force at toe unit for release= LT

Assuming that the toe unit is directly under the ball of the foot and the forces required for release are not greater than $MT=.2W$, $MH=.4W$, $LT=.25W$, and $LH=.75W$, the required magnetic force MT in the toe unit then must be $.2W$, and that in the heel unit must be $.4(Y/X)W$. The maximum lateral forces for release, occurs when all of the skier's weight is applied at a single unit. The minimum force for release occurs when the weight of the ski is fully supported by the unit such as when the skier is on a chair lift with the skis unsupported. These relations may be expressed:

LH (maximum) $= [.4(Y/X)W + W]$ (tangent angle AH)

LT (maximum) $= [.2W + W]$ (tangent angle AT)

LH (minimum) $= [.4(Y/X)W - S]$ (tangent angle AH)

LT (minimum) $= (.2W - S)$ tangent angle AT .

The maximum release force then will be met if angle AT is approximately equal to 12° and angle AH approximately equal to 24.5° ; the forces at minimum will be adjusted in accordance with the weights of the skier and the ski.

For illustration assuming a skier to weight 250 lbs., the magnetic forces at the toe and heel are adjusted to be 50 and 100 lbs., respectively, and such forces can be readily obtained with permanent magnetic materials in the limited space provided. The magnets may be received in recesses in the ski or intermediate base to increase the available volume for the magnet and the

frusto-conical part 11 may be an integral part of the magnet 12.

It will be apparent that the magnet 12 may be on the part 14 and the armatures may be on the part 11. The part 11 may be mounted in the boot member or intermediate member and the cooperating part 14 may be mounted on the ski or the intermediate base and still obtain some of the advantages of the present invention.

To prevent water, ice and snow from getting into contact with the mating surfaces of the parts 11 and 14, a resilient gasket-like material may be provided adjacent the bottom of the part 14 and the periphery of part 11 or a complete gasket layer extending along the surface of the ski may be provided for this purpose.

It will be apparent that changes may be made within the spirit of the invention as defined by the valid scope of the claims.

What is claimed is:

1. An attachment structure for removably attaching a member to a base and to provide for removal by direct separation forces or by lateral forces between the member and the base comprising at least a pair of units for arrangement in spaced relation, for securing the member to the base, each unit having a pair of separable parts with one part adapted for securement to the base and the other part adapted for securement to the member, one part having a generally tapering projecting portion and other part having a cooperating generally flaring recess for reception of the generally tapering projecting portion, a magnet in one of said parts and a cooperating armature or another magnet in the other of said parts whereby the parts of the unit are magnetically maintained together and the member and the base to which the parts may be secured are removably attached together, the magnet being on the part having the tapering projection, the armature being on the part having the flaring recess, the armature being adjustable toward and away from the magnet.

2. The invention according to claim 1 in which the magnet is on the part having the recess and the armature is on the part having the projection.

3. A ski binding for removable attachment of a ski boot to a ski to provide for separation of the boot from the ski by direct separation forces or by lateral forces or combinations thereof between the boot and the ski comprising at least a pair of units for mounting in spaced relation for securing the boot to the ski, at least one unit of each pair having a pair of separable parts with one part adapted for attachment to the ski and the other part adapted for attachment to the boot, the one part of the one unit having a generally conically shaped tapering projection with means on said one part for securement to one of the ski or boot, the other part of said one unit having a generally conically shaped recess for intimate cooperation with the tapering projection of the one part to provide a snug nesting relation, means to attach the other part of the said one unit to the other of the ski or boot, a magnet on one of said parts and a cooperating armature on the other of said parts whereby when the parts of the one unit are in nesting relation the magnet and the armature cooperate to prevent separation for small forces and adapted to permit separation when damaging twisting or direct separation forces are applied, the cooperating tapers of the parts of the one unit permitting releasing movement of the boot relative to the ski in forward, rearward or lateral directions, another of the units spaced from said one unit and having means to releasably retain the boot on the ski.

4. The invention according to claim 3 in which the said another of the units is substantially the same as said one unit.

5. The invention according to claim 4 in which one of said units has a different taper from the said another of said units.

6. The invention according to claim 4 in which a plate is adapted for clamping mounting on one of said ski or boot and the units are adapted to have their parts mounted on the other of said ski or boot.

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7. The invention according to claim 4 in which the part having the projection is on the ski and the part having the recess is on the boot.

8. The invention according to claim 4 in which the part having the projection is on the boot and the part having the recess is on the ski.

9. The invention according to claim 4 in which the units lie within the outline of the sole and heel of a boot.

10. The invention according to claim 3 in which the units are free of untapered abutments.

11. The invention according to claim 3 in which there are no non-tapered surfaces engaging the parts.

12. A ski binding for removable attachment of a ski boot to a ski to provide for separation of the boot from the ski by direct separation forces or by lateral forces or combinations thereof between the boot and the ski comprising a pair of units for mounting in spaced relation for securing the boot to the ski, each unit having a pair of separable parts with one part adapted for attachment to the ski and the other part adapted for attachment to the boot, the one part of each unit having a generally conically shaped tapering projection with means on said first part for securement to a ski, the other part of each unit having a generally conically shaped recess for intimate cooperation with the tapering projection of the one part to provide a snug nesting relation, a magnet on one of said parts and a cooperating armature on the other of said parts whereby when the parts of each unit are in nesting relation the magnet and the armature cooperate to pre-

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vent separation for small forces and adapted to permit separation when damaging twisting or direct separation forces are applied, the cooperating tapers of the parts of each unit permitting movement of the boot relative to the ski in forward, rearward or lateral directions.

13. The invention according to claim 12 in which the one part having a generally conically shaped tapering projection is secured to the ski and the cooperating generally conical recess is secured to the boot.

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248—206; 292—251.5; 335—219, 295