Dec. 1, 1970 F. D. WERNER ET AL 3,544,123

ANTI-FRICTION DEVICE FOR SKI BOOTS AND SKIS

Filed March 29, 1968 2 Sheets-Sheet 1

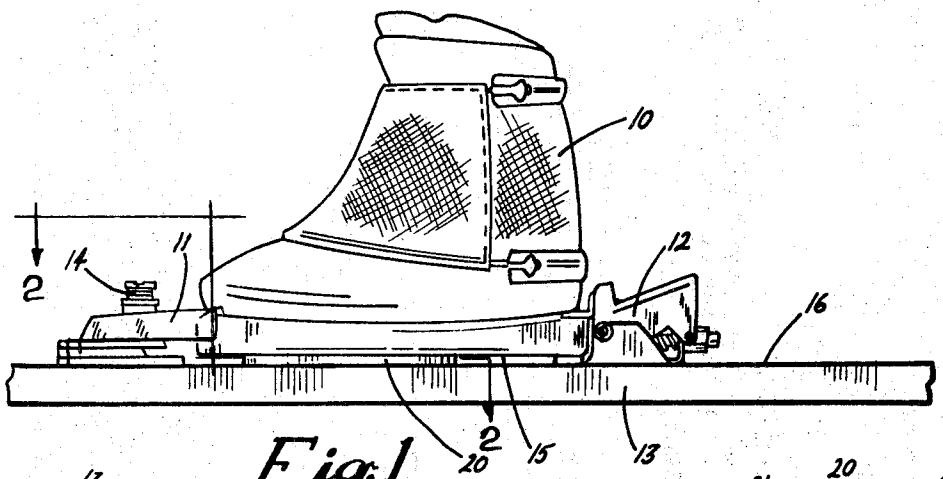

Fig. 1

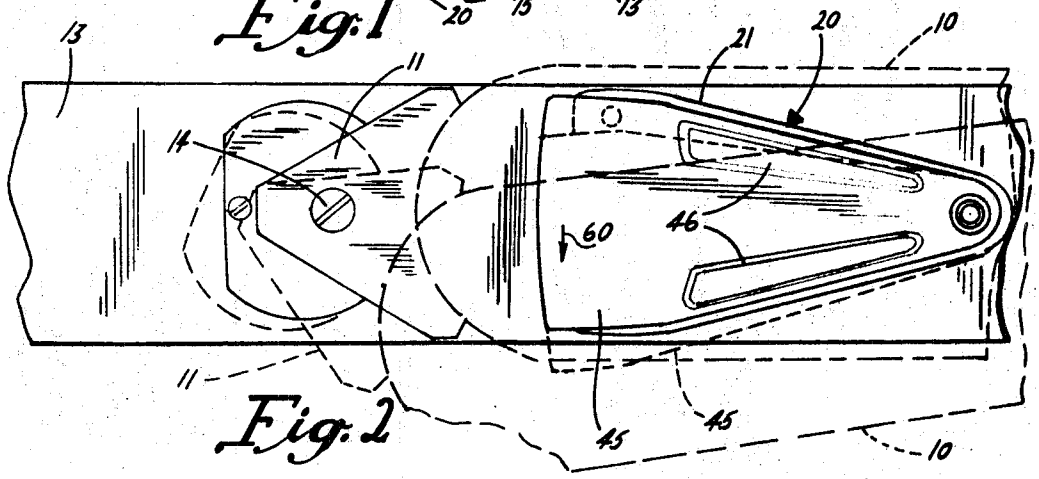

Fig. 2

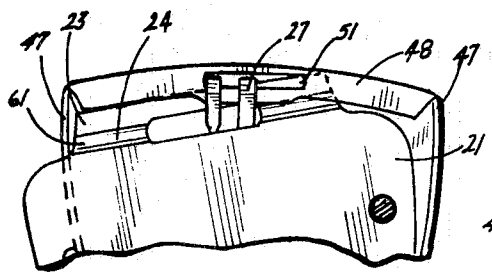

Fig. 5

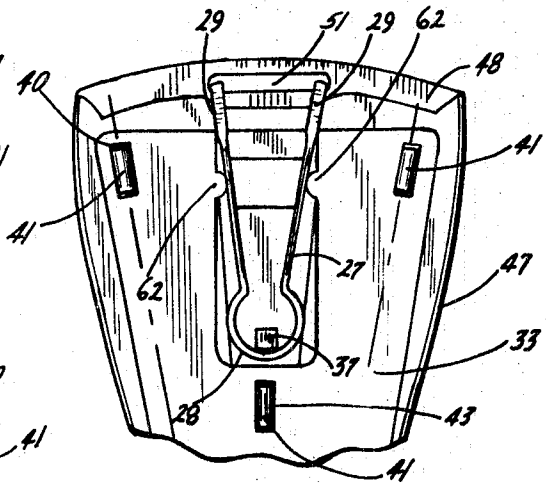

Fig. 7

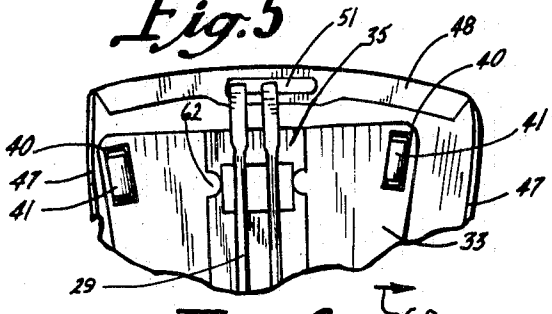

Fig. 6

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ANTI-FRICTION DEVICE FOR SKI BOOTS AND SKIS

Filed March 29, 1968 2 Sheets-Sheet 2

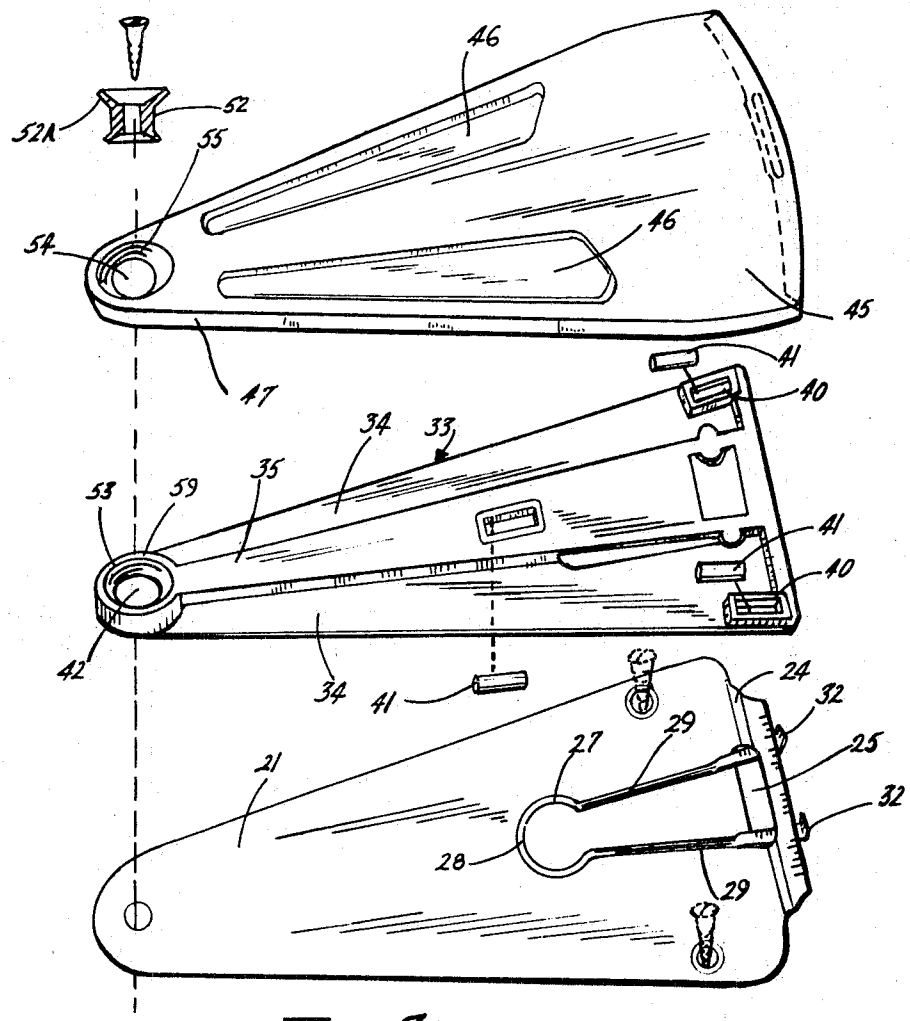

Fig. 3

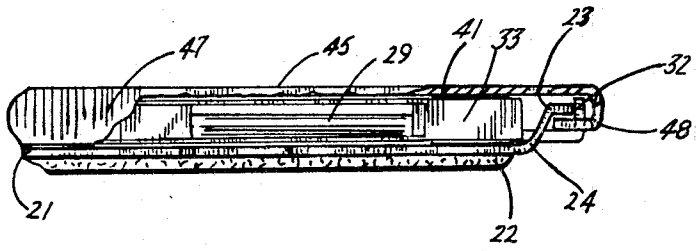

Fig. 4

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ANTI-FRICTION DEVICE FOR SKI BOOTS AND SKIS

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Int. Cl. A63c 9/00
U.S. Cl. 280—11.35 13 Claims

ABSTRACT OF THE DISCLOSURE

An anti-friction unit to be mounted on the top of a ski and positioned underneath a ski boot so that when the ski boot is held in lateral release bindings, the anti-friction device will permit the boot to move laterally within acceptable force variations regardless of the load distribution on the boot, and made to be substantially unaffected by dirt, rust, ice or other foreign materials.

BACKGROUND OF THE INVENTION

Field of the invention

The present invention relates to friction control devices for reducing the effective friction between two surfaces, in particular for controlling the friction between the top of a ski and the sole of a boot held in bindings on the ski.

The prior art

It has long been a problem with so-called "safety bindings" in skis to have a binding which will hold the boot snuggly when normal skiing is encountered and yet will positively and reliably laterally release the boot at the same time high downward loads on the boot are encountered.

U. S. Pat. No. 3,079,163 shows a safety binding including a movable plate on the top of the ski which is used in an attempt to reduce friction. This device is not adaptable to general use with other bindings. Further, the mounting and construtcion of the device makes it susceptible to foreign material or ice. The unit does not embody features that minimize friction in all situations, nor does it provide for automatic re-set.

The use of plates of so-called low friction materials fixed to the ski is not particularly helpful because the reduction in friction is not sufficient. For example, an average load setting for lateral release toe bindings is about fifty pounds lateral force. When a skier is leaning forward, it is possible to have a three or four hundred pound downward load on the ball of the foot. Even so-called low friction materials have a static coefficient of friction of .14 to 0.4. The increased lateral force necessary to slide the boot resulting from the friction of the boot sole on a fixed plate makes variations in the lateral release loads outside of tolerable limits necessary for safe binding operation. The presence of sand, mud, rust or ice will cause drastic changes in release load. Release force is different for wet boot soles or dry boot soles.

SUMMARY OF THE INVENTION

The present invention relates to an anti-friction device which reduces the coefficient of friction between two devices which are subjected to changing loads and which must release laterally with respect to each other within acceptable variations from a preset load regardless of the forces applied between the two members. The primary usage is for positive releasing of a ski boot from lateral release ski bindings. The unit is not adversely affected by load on the boot or foreign materials.

It is an object of the present invention to present a

reliable anti-friction device so that the ski bindings normally used with ski boots will operate satisfactorily and eliminate the problems caused by greatly varying friction between the sole of the boot and the ski itself.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of the boot shown in place in a typical safety release binding;

FIG. 2 is a top plan view taken as on line 2—2 in FIG. 1;

FIG. 3 is an exploded view of the device made according to the present invention to show the interior details detail.

FIG. 4 is a fragmentary enlarged side elevational view of the forward portion of the anti-friction device made according to the present invention with parts in section and parts broken away;

FIG. 5 is a fragmentary bottom plan view of the device of the present invention showing the unit when it is in its released position in a first direction;

FIG. 6 is a fragmentary bottom view showing the device in its released position of FIG. 5, with the bottom plate removed to show the positioning of the center member; and

FIG. 7 is a fragmentary bottom view of the device taken with the bottom plate of the unit removed to show the position of the internal members carrier in its normal centered position.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the figures, a ski boot **10** is fastened to a lateral release toe piece **11** and a life release heel binding **12**, both mounted onto a ski **13** and holding the ski boot firmly in place on the ski. The binding toe piece **11** is made so that it can be adjusted in the amount of lateral release force which is necessary for it to release the boot, and it will pivot with respect to its mounting plate to release laterally as shown in dotted lines in FIG. 2. The amount of force necessary for the lateral release varies and can be set with an adjusting screw **14** in the usual manner. Many different toe pieces of this general configuration are available commercially and are in wide use. The heel on each binding **12** generally is a vertical release so that when the heel is lifted under sufficient force as in a forward fall, the heel will release, and when the leg is twisted, theoretically the toe piece is released. This will free the skier's leg from the ski. The heel binding is also a commercially available unit of usual or preferred design.

What many times happens in skiing is that the friction between the sole of the boot, the bottom surface of which is shown at **15** and the top surface **16** of the ski, will increase to a point where the force transmitted by the leg will be so great that the leg bones will break. This is largely due to varying loads on the boot sole from forward leaning but also can be from rust, gravel, ice or other foreign material between the boot and the ski. In order to make the amount of friction between the sole of the boot and the top of the ski uniform and control the amount of lateral transverse force necessary to release the toe binding **11** to its dotted position within acceptable limits, an anti-friction or friction control device generally designated **20** is placed between the toe portion of the boot and the top of the ski.

In the exploded view, FIG. 3, it can be seen that the friction control device comprises a base plate **21** which is to be fixed to the top of the ski. As shown, the device can be fastened to the ski with suitable screws, or a suitable adhesive material having adhesive on both sides thereof can be used for affixing the base plate to the top of the ski. This adhesive material is illustrated at **22** in FIG. 4.

The base plate comprises a flat plate-like member of hardened steel, preferably stainless steel, which is triangular shaped as shown. The plate is hard enough to prevent roller indentation. The leading edge area of the base plate **21** includes a guide lip **23** which is integral with the base portion, and is offset therefrom through the use of a transition section **24** which extends upwardly from the base plate itself to the guide lip. The guide lip extends forwardly slightly from the main part of the base plate and there is an opening **25** provided through the transition section. This opening is centrally located on the transition section and is made so that it will permit a hairpin type spring **27** to pass therethrough, as shown in FIG. 3. The hairpin spring **27** has a closed end **28**, and a pair of legs **29, 29** which extend through the opening **25**. The legs **29, 29** are flattened at their outer ends, as shown, and have upwardly extending prongs or ears **32, 32**. The ears, as perhaps best seen in FIG. 4, extend upwardly from the legs themselves and when the spring is in place, the ears extend upwardly above the top of the lip **23**.

A roller cage and bearing member **33** is provided to be positioned on top of the base plate **21**. The roller cage **33** comprises a member having flat plate-like sections **34** adjacent the outer sides thereof and a center raised section **35**. The center raised section forms a pocket (shown in FIG. 7) into which the hairpin spring **27** is fitted. The pocket has openings **36** along the edges thereof in the area where the closed end or rounded end of the hairpin spring rides. The closed end of the hairpin spring can be retained in place with a suitable small fastening lug **37** if desired. This will retain the hairpin spring from exaggerated sideways movement during actuation.

The bearing case **33** also is used to form a plurality of roller pockets. There are two forward pockets **40, 40** which are formed so that the axes of rollers **41** therein will intersect the centerline of a pivot or mounting hole **42** at the rear portions of the bearing cage. A third bearing pocket **43** is formed in the raised member **35** just to the rear of the spring pocket and a roller **41** also fits inside this pocket **43**. The axis of the roller in pocket **43** also intersects the pivot point at the pivot opening **42**.

The bearing cage is made of a low friction material which has high strength, such as nylon, and the rollers **41** are of size so that they will protrude just above and below the edges of the surfaces defining the pockets **40** and **43**. The rollers **41** ride against the top surface of the base plate **21** and the bottom surface of a cover plate **45** rides on top of the rollers.

The cover plate **45** has a top member which is provided with two stiffening indentations **46, 46** and has turned down flanges **47** along the longitudinal edges of the plate. The flanges **47** are of size so that when the unit is assembled as shown in FIG. 4 the flange closely clears the top of the base plate **21**. At the forward edge of the cover plate **45** the cover plate has a turned over guide member **48** which forms a U-shape in cross section as shown in FIG. 4 and is made to fit below and retain the lip **23**. The guide member **48** does not extend all the way out to the peripheral edges of plate **45**, for ease of manufacture, but does go substantially to each of the sides of the cover plate. The lip **23** fits inside the U-shape of the guide member and extends above the lower edges of flanges **47** as shown.

Referring specifically to FIGS. 5, 6 and 7, it can be seen that the guide member **48** is provided with an opening **51** on the bottom side thereof. This opening is positioned to align with the upright ears **32, 32** of the spring, and is of size so that the spring ears fit inside the opening when it is under slight compression. The opening **51** is forwardly of the outer edge of the lip **23** and the ears also clear the outer edge of this lip.

Thus, in assembly, the spring legs **29, 29** extend through the opening **25** in the transition section **24** of the lip **23** so that the prongs extend into the opening **51**. The unit is retained in assembled position with a rivet **52** that is

shouldered. The rivet is fastened to hold the bottom plate, the roller cage, and the top cover **45** together for relative movement about a single pivotal axis adjacent the rear of the unit. The bearing cage opening **42** has a cone shaped surface **53**, and the cover plate also has a pivot opening **54** having an interior cone shaped surface **55**. When the rivet **52** is in place, holding the unit together, the flange portion **52A** of the rivet bears against the conical portion **55** surrounding the opening **54**. The rivet holds the bottom surface of the cover plate in contact with a boss **59** on the roller cage surrounding opening **42** so that there is a bearing surface for relative movement between the two parts, namely the bearing cage and the cover plate. The bearing cage is of low friction material so the pivot moves easily. The bearing cage also bears on the bottom plate **21** to carry load at the rear portions of the unit from the cover to the bottom plate.

If screws are used to mount the unit, there is a shoulder on the interior of the rivet **52** which carries the load from the screw. The screw does not bear against the flange portion **52A**. Thus, the screw at the rear of the anti-friction unit can be tightened down securely without causing binding between the pivoting plates.

When the unit is used, the base plate is fastened to the ski in a suitable manner such as with adhesive material **22** or with screws as desired. The rivet will hold the pivoting plates **45, 33** and **21** together for pivoting about its central rear axis. At the forward edge, the guide member **48** will hold the cover plate and the base plate from separating because the guide member **48** will engage the underside of the lip **23**.

The unit is placed substantially under the ball of the foot or slightly forwardly therefrom so that the three rollers are in position to carry most of the weight of the foot from the ski boot when the skier leans forwardly. Because the unit has some thickness, a small block can be placed under the heel portion of the boot to keep the boot level.

When the foot is to be released, the anti-friction device will do it under rolling friction. The movement of the top plate, which will move with the boot, relative to the bottom plate which stays with the ski is supported by free rollers.

Assuming that a transverse force is encountered which is sufficient to permit the release binding **11** of the toe to release, the force will cause the cover plate **45** to tend to pivot about the axis of opening **54** on rivet **52**. The cover plate will bear against the rollers **41**, and the rollers **41** will thus roll against the top of the bottom plate **21** and be carried by the cage **33** in this rolling motion. The rolling motion results in a maximum reduction of friction because the rollers are not pinned, but roll freely within the cage. Also, the axis of the rollers coincide back at the axis of pivot of the cover so that there is very little tendency for the rollers to slide rather than roll. When the cover plate pivots, one end of the opening **51**, depending on the direction of pivoting of the cover plate, will engage one of the ears **32** of the spring **27** and will move that ear to compress the hairpin spring **27** by tending to move the two legs **29** together. This is shown in FIG. 5, wherein the cover plate (looking at it from the bottom of the unit) has pivoted in direction as indicated by the arrow **60** and has caused the two legs **29** of the spring **27** to move together. This spring force is not great enough to substantially affect the releasing force for the binding, but is sufficient to return the bearing cage and cover plate to center when the boot is released.

As can be seen, one flange **47** will engage an edge portion **61** of the transition section **24** on the base plate, and this will act as a stop to prevent the cover plate from pivoting too far. Likewise, in the opposite direction the transition portion **24** and the flange **47** on the opposite side of the cover plate will act as stops to limit movement of the cover plate in the opposite direction.

When the boot has been released from the ski, the spring

27 will drive the cover plate back to its normal position. The hairpin spring will act to cause this centering.

When the rollers 41 roll, the bearing cage moves substantially half the angular distance of the cover plate. Thus, at the same time that the cover plate shifts, the bearing cage shifts slightly, and the compression of the spring takes place largely between one end surface of the opening 25 and one end surface of opening 51. There are small lugs 62 provided in the edges of the pocket for the spring 27 to hold the spring properly positioned and initially compress it slightly when first positioned.

It should be also noted that in order to install the forward screws in the bottom plate to the ski, the unit merely has to be moved so that the cover plate is in its full sideways position, and the screw holes at the forward end of the base plate 21 will be uncovered and thus the screws can be installed. The cover plate movement is sufficient to permit this installation as shown in FIG. 1.

The spring 27 also acts not only to center the cover plate with respect to the base plate, but also to center the roller cage each time. Because the basic action on the spring takes place between the edges of the opening 25 and the edges of the opening 51, the rear portions of the spring react against the lugs 62 to center the roller cage each time it's returned to center. Sometimes, if the rollers slide rather than roll the cage could become misplaced and then the unit would not operate as well. However, this centering action of the spring acts to keep the roller cage centered after each time it has been pivoted as well as recentering the cover plate with respect to the base plate. The ears or prongs 32 on the spring 27 are constrained in opening 51 so they prevent the spring from slipping out of place. The ears are made long enough to insure this.

The turned down flanges 47 act as stiffeners for the cover plate, as well, and also acts as a scraper for ice and foreign material to make sure that when the cover plate pivots it will scrape away any ice that might have built up along the edges of the base plate or on the ski, and keep this foreign material out of the way of the rollers. It can be seen that the clearance between the edges 47 and the base plate 21 is quite small and this will insure that no foreign material gets into the roller cage to adversely affect operation.

What is claimed is:

1. A friction control unit positioned between an upper surface of a ski and a lower surface of the sole of a ski boot, wherein lateral release binding means for releasably securing the boot to the ski are provided, comprising an assembly of a first plate, a center bearing cage member, and a second cover plate pivotally mounted together about a common axis adjacent the rear of the assembly, means to mount said first plate to the top surface of said ski with said common axis substantially perpendicular to the upper surface of said ski and substantially centered transversely on the ski, the forward portions of said assembly lying under a ski boot fastened in the binding means adjacent the front of the boot and roller means, said bearing cage member having pockets defined therethrough, said roller means being positioned within said pockets in said center bearing cage member for transferring force from said cover plate to said first plate in the forward portions of said assembly.

2. The friction control unit of claim 1 wherein said second cover plate and said first plate having interlocking guide and lip means at the forward portions thereof, said guide and lip means preventing vertical separation of said cover plate and said first plate in the forward portions of said assembly but permitting movement of the cover plate relative the ski about the common axis.

3. The combination as specified in claim 2 wherein said rolling means comprise substantially cylindrical rollers having rolling axes intersecting the common axis of said assembly.

4. The combination as specified in claim 3 wherein said center bearing cage for retaining said rollers includes low friction means for transferring force from said second plate to said first plate in the area adjacent to the pivot between said second plate and said first plate.

5. The combination as specified in claim 2 wherein said second cover plate has two longitudinal edges and has flange means extending along both of the longitudinal edges thereof, said flange means being of dimension to very closely clear the upper surface of said first plate when said second cover plate pivots relative to said first plate.

6. A friction reducing unit for mounting between a first surface comprising the upper surface of a ski and a second surface, said ski having a longitudinal direction, comprising a first plate member adapted to be attached to said first surface, a second plate member substantially parallel to said first plate member, means pivotally mounting said first and second plate members together about a pivot axis at substantially right angles to said longitudinal direction so that portions of said second plate member will move transversely relative to said first plate member, said second plate member being adapted to support said second surface, rolling members positioned between said first and said second plate members and effective to transfer force from said second plate member to said first plate member and to roll when said second plate member moves relative to said first plate member, said rolling members being positioned spaced from said pivotal axis in said longitudinal direction, and bearing cage means for retaining said rolling members in a predetermined orientation for rolling motion between said first and said second plate members, said bearing cage means being positioned between said first and second plate members and having low friction means thereon for transferring force from said second plate member to said first plate member adjacent to the pivot axis between said second plate member and said first plate member.

7. A friction reducing unit for mounting between a first surface comprising the upper surface of a ski and a second surface, said ski having a longitudinal direction, comprising a first plate member adapted to be attached to said first surface, a second plate member substantially parallel to said first plate member, means pivotally mounting said first and second plate members together about a pivot axis at substantially right angles to said longitudinal direction so that portions of said second plate member will move transversely relative to said first plate member, said second plate member being adapted to support said second surface, rolling members positioned between said first and said second plate members and effective to transfer force from said second plate member to said first plate member and to roll when said second plate member moves relative to said first plate member, said rolling members being positioned spaced from said pivotal axis in said longitudinal direction, and said second plate member comprising a cover member having a flange extending along the longitudinal edges thereof, said flange being of dimension to very closely clear the upper surface of said first plate member when said second plate member pivots relative to said first plate member.

8. A device for controlling friction load between a ski boot and the top of a ski, said ski boot being retained on said ski with lateral release bindings, comprising an assembly of two spaced apart substantially parallel plates, means pivotally mounting said plates with respect to each other for limited pivotal movement about a pivotal axis adjacent one end thereof, a plurality of rolling members between said plates, and supporting said plates directly, means for constraining said rolling members for rolling contact with both of said plates in a predetermined path as said plates pivot with respect to each other, and means to mount said assembly in position on said ski with said plates and the rolling members substantially under the ball of a foot of a skier wearing said ski boot, and with

the pivot axis positioned rearwardly of the ball of said foot.

9. The combination as specified in claim **8**, wherein said rolling members comprise substantially cylindrical rollers having axes extending generally in longitudinal direction of the ski.

10. The combination as specified in claim **8** and guide means adjacent the ends of said plates opposite from said pivotal axis, said guide means forming complemental interlocking means between said plates to prevent separation of said plates from predetermined planes.

11. The combination as specified in claim **8** and means cooperating between said plates forming stop members which limit relative pivotal movement between said plates.

12. The combination as specified in claim **8** and spring means biasing an upper one of said plates toward a normal position substantially overlying a lower one of said plates.

13. The combination as specified in claim **8** wherein said means for constraining said rolling members for rolling contact with both of said plates comprises a separate bearing cage member, said bearing cage member being pivotally mounted between said plates about said pivotal axis.

References Cited

UNITED STATES PATENTS

2,676,813	4/1954	Beyl	280—11.35(CB)
2,745,672	5/1956	Meier	280—11.35(CB)
2,846,232	8/1958	Schnell	280—11.35(HA)
3,079,163	2/1963	De Beausacq	280—11.35(AA)

FOREIGN PATENTS

1,358,624	3/1964	France.
431,349	8/1967	Switzerland.

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PO-1050
(5/69)

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,544,123 Dated December 1, 1970

Inventor(s) Frank D. Werner and Paul S. Petersen

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 54, "0.4" should be --.04--. Column 2, line 1: delete "detail." and insert --thereof;--. Column 5, line 58, after "boot" insert --,--.

SIGNED AND SEALED
MAR 9 1971

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents