June 29, 1954 N. T. KNAUF 2,682,416

SAFETY SKI BINDING

Filed Nov. 23, 1951 2 Sheets-Sheet 1

Fig. 1.

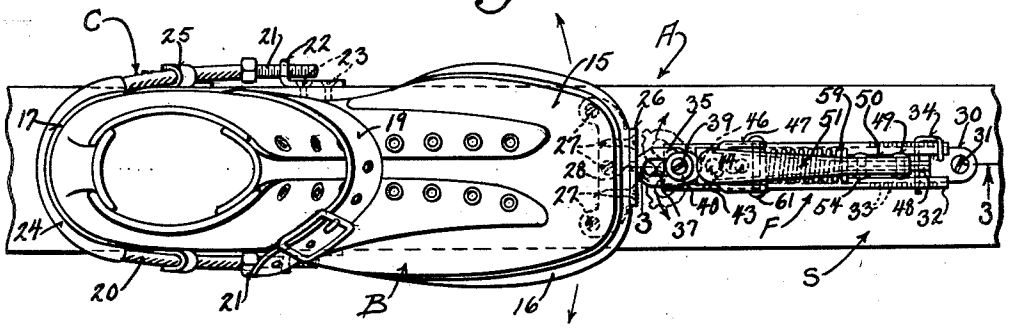


Fig. 2.

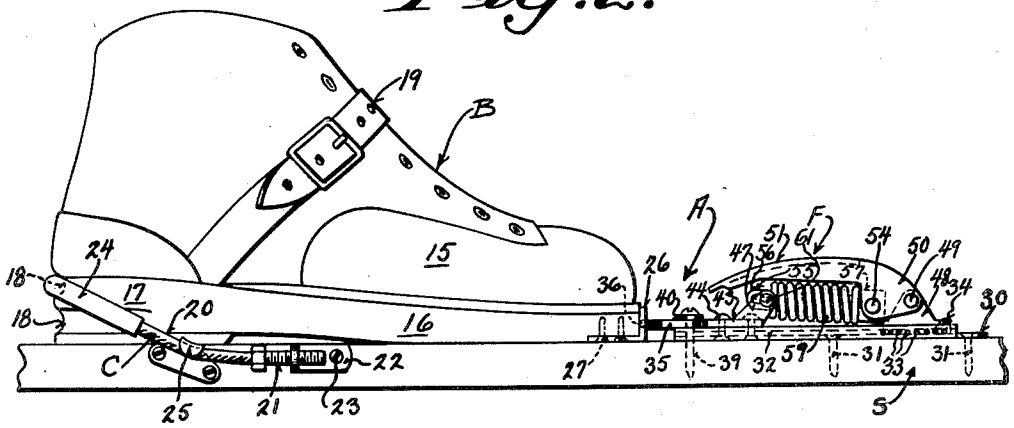
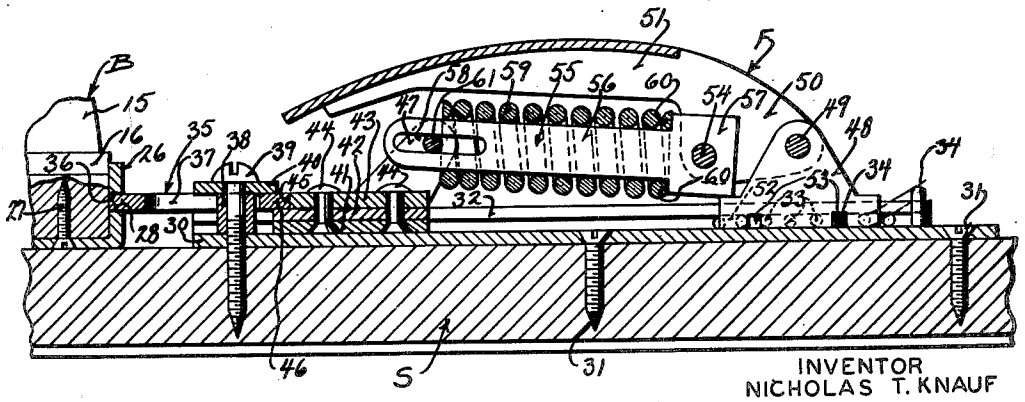


Fig. 3.



INVENTOR
NICHOLAS T. KNAUF

BY Young & Wright

ATTORNEYS

June 29, 1954 N. T. KNAUF 2,682,416

SAFETY SKI BINDING

Filed Nov. 23, 1951 2 Sheets-Sheet 2

Fig. 4.

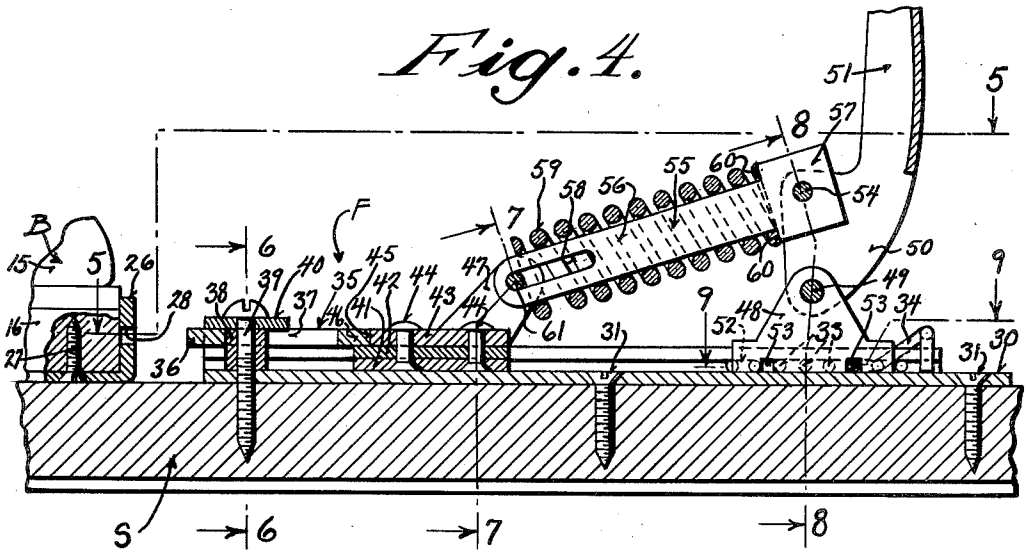


Fig. 5.

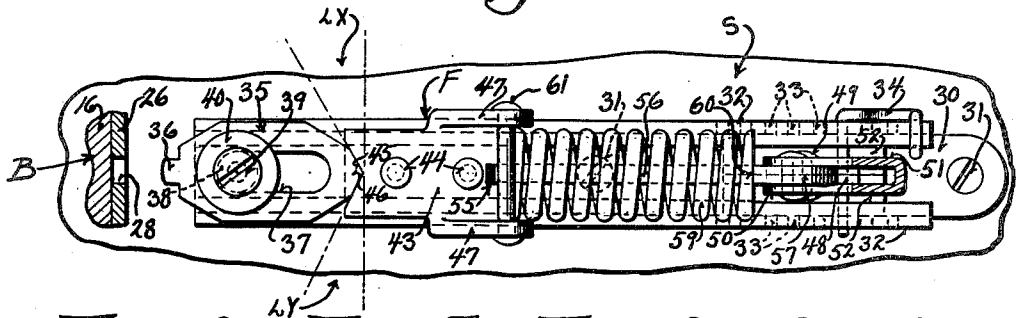


Fig. 6. Fig. 7. Fig. 8. Fig. 9.

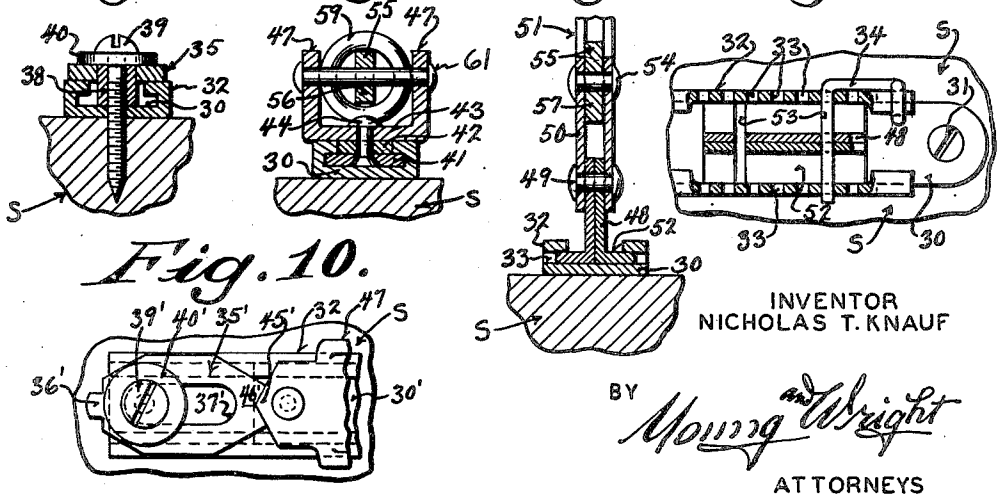


Fig. 10.

INVENTOR
NICHOLAS T. KNAUF

BY Young and Wright

ATTORNEYS

Patented June 29, 1954

2,682,416

UNITED STATES PATENT OFFICE

2,682,416

SAFETY SKI BINDING

Nicholas T. Knauf, Chilton, Wis.

Application November 23, 1951, Serial No. 257,837

5 Claims. (Cl. 280—11.35)

1

My invention appertains to ski bindings and more particularly to a safety ski binding that will hold the boot firmly to the ski but will automatically release upon strains or stresses which are greater than those which can be safely borne by the skier.

In participating in the sport of skiing, it is desirable, particularly in the downhill run or slalom where the skier is constantly required to execute quick turns, jumps, etc., to have the boot fixed firmly and securely to the ski in such a manner that the boot and ski move as one. This is an essential requisite in order to have available to the skier the fine control so necessary to properly execute these various maneuvers.

There are now on the market a number of fine ski bindings of the "fixed" type which have incorporated in them most of the characteristics needed for successfully completing a slalom or downhill run. However, while it is true that these fixed type bindings do give the desired control to the skier, they also provide a source of constant danger and worry to him. In making downhill runs, there are times when the skier is travelling at great speeds, and should an accident or spill occur, it is quite often important that the skier be able to free himself from the skis in order to avoid serious injury. The realization of this danger may present a mental hazard, especially to the beginner, making it difficult for him to gain the confidence needed to become a good skier.

In an effort to overcome the above defects, various attempts have been made in the past to provide safety bindings which may be either manually or automatically released when an accident occurs.

These prior safety bindings have proven unsatisfactory in that almost invariably they do not firmly hold the boot to the ski to give the skier the secure feeling and fine control found in the fixed type of bindings. Moreover, most prior safety bindings either fail to properly release under certain circumstances, or they release too easily when subjected to forces and pressures necessary to properly execute sudden maneuvers, with the result that unnecessary falls and spills invariably occur.

There has long been a need, therefore, for a safety binding which will lend comfort to the skier by firmly holding the boot to the ski, and will not release under the usual forces encountered during normal skiing procedure or even from the relatively heavy forces resulting from minor spills and mishaps, but will immediately

2

and automatically release when stresses and strains are encountered of sufficient force to seriously injure the skier.

It is, therefore, a primary object of my invention to provide a safety binding which will firmly and securely hold the boot to the ski and will not release or become loose during ordinary maneuvers or minor spills, but will release when such strains and stresses are encountered which are sufficient to break or sprain the ankles and legs of the skier.

Another object of my invention is to provide a safety ski binding which eliminates the necessity of bringing the cable or heel hold-down assembly along the sides of the boot and ski to the forward portion thereof.

Another important object of my invention is to provide a novel front assembly secured to the ski adjacent the toe portion of the boot for firmly engaging a novel toe plate rigidly fastened to the boot, but which will automatically disengage when a dangerous situation is encountered of sufficient force to cause the boot and toe plate to move laterally or forwardly on the ski.

A further object of my invention is to provide novel means for adjusting my safety ski binding so that a very fine adjustment may be had whereby the boot may be released from the ski when a selected predetermined pressure is transmitted from the ski to the leg of the skier.

A more specific object of the invention is to provide my front assembly with a longitudinally extending track positioned centrally on the top surface of the ski upon which is slidably and pivotally mounted a toe engaging trip-out piece, the front assembly being so constructed and arranged as to move the trip-out piece from its inoperative position to its automatically releasing operative toe plate engaging position under spring tension by the actuation of an adjustably secured clamping lever.

A still further object of my invention is to provide a simple, practical and reliable construction that is economical to manufacture, easy to assemble and positive in its operation.

With the above and other objects in view, which will more readily appear as the nature of the invention is better understood, the same consists in the novel construction, combination and arrangement of parts hereinafter more fully described, illustrated and claimed.

A preferred and practical embodiment of my invention is shown in the accompanying drawings, in which:

Figure 1 is a top plan view of my safety ski

binding and showing the skit boot firmly but releasably held to the ski, with the trip-out piece engaging the toe of the boot in its operative position with the clamping lever closed;

Figure 2 is a side elevational view of the safety ski binding illustrated in Figure 1 of the drawings and showing further details of the front and rear assemblies;

Figure 3 is an enlarged fragmentary side elevational view in section of the front assembly of my safety binding shown in the closed operative position, the section being taken on the line 3—3 of Figure 1 and looking in the direction of the arrows;

Figure 4 is a side elevational view similar to Figure 3 of the drawings but showing the front assembly of my binding in the open inoperative position with the trip-out piece retracted from engagement with the toe plate and boot;

Figure 5 is a top plan view partly in section of the front assembly of my safety binding, the section being taken on the line 5—5 of Figure 4, looking in the direction of the arrows;

Figure 6 is a fragmentary transverse sectional view through the ski and front assembly of my binding, the section being taken on the line 6—6 of Figure 4 and looking in the direction of the arrows;

Figure 7 is a fragmentary transverse sectional view of my front assembly taken on the line 7—7 of Figure 4, and looking in the direction of the arrows;

Figure 8 is a fragmentary transverse sectional view taken on the line 8—8 of Figure 4 and looking in the direction of the arrows;

Figure 9 is a fragmentary top plan view partly in section of my front assembly, the section being taken on the line 9—9 of Figure 4 and looking in the direction of the arrows;

Figure 10 is a fragmentary top plan view illustrating a modified form of the trip-out piece and releasing means for the front assembly shown in Figure 5.

Referring to the drawings in detail wherein similar reference characters designate corresponding parts throughout the several views, the letter A generally indicates one type of my improved safety binding and the same includes a cable assembly C for holding the heel of the boot B firmly to the ski S, and a front assembly F for detachably and releasably securing the toe portion of the boot B to the ski.

The ski boot B is of a standard construction and includes the usual upper 15, enlarged thick outer sole 16, heavy heel 17, and the usual heel grooves 18. The boot B may also include an ankle bracing strap 19.

For the purpose of simplicity and clarity, I have shown and described my safety binding applied to the right ski and right boot only. However, it is to be understood that the binding for the left ski and boot is exactly the same except for certain features in the front assembly trip-out piece and its keeper slide which will be more fully understood as the description proceeds. However, the rear cable assembly C is exactly the same for both the left and right bindings and each includes a cable 20, each end of which terminates in a cable adjusting screw 21. The cable adjusting screws 21 are received in suitable anchor brackets 22 which are rigidly fastened in proper alignment to the sides of the ski S by means of counter-sunk screws 23. Cable 20 fits around the rear of the heel 17 and is received in one of the grooves 18. That portion of the cable 20 which comes in contact with the heel groove 18 is provided with a length of rubber covered tubing 24. If desired, I also provide the rear assembly with a pair of cable choker hooks 25 which are secured at a convenient angle to the rear of the anchor brackets 22. It is to be noted that the position of the anchor brackets 22 and the provision of a separate rear cable assembly eliminates the necessity of extending the cable 20 to the forward portion of the ski.

However, the most important features of my safety binding lie in the arrangement and construction of the front toe holding assembly F, and in accordance with the present invention I provide the toe end of the boot B with a toe plate 26 which is rigidly secured by means of counter-sunk screws 27 to the sole 16. The forward wall of the toe plate 26 is provided with a detent or keeper aperture 28, as more clearly shown in Figures 4 and 5 of the drawings.

In constructing the forward assembly F of my safety binding A, a longitudinally extending track 30 is first rigidly secured centrally on the top surface of the ski S by means of the counter-sunk screws 31. The forward ends of the side edges 32 of the track 30 are provided with a series of equally spaced aligned holes 33, through any two of which a frangible adjusting pin 34 is adapted to pass for the purpose of adjustably securing the movable parts of the front assembly F to the track 30. Slidably and pivotally mounted on the top surface of the side edges 32 at the rear portion of the track 30 adjacent the toe end of the boot, is a trip-out piece 35. Trip-out piece 35 has formed on one end thereof a projection or keeper lug 36 of a size and configuration to snugly engage the keeper aperture 28 in the forward wall of the toe plate 26. Trip-out piece 35 has formed therethrough a central longitudinally extending slot 37 which receives a collar 38. Collar 38 is firmly held in position by means of a pivot screw 39 which passes through the track 30 and is firmly embedded in the ski S. If desired a washer 40 may be interposed between the head of the screw 39 and the top surface of the trip-out piece 35. The forward portion 46 of the trip-out piece 35 terminates at a predetermined angle, the purpose of which will be more fully understood as the description proceeds.

Positioned forwardly of the trip-out piece 35 and slidably mounted in the track 30 by means of a guide strip 41, spacer strip 42, is a keeper slide 43. The rear end of the keeper slide 43 has formed therein a V-notch 45, the angle of which coincides with the angle of the point on the forward portion 46 of the trip-out piece 35. Extending vertically on the forward portion of the keeper slide 43 are a pair of upstanding ears 47. Guide strip 41, spacer strip 42, and the keeper slide 43 are rigidly secured together by means of the rivets 44. However, it is obvious that the various pieces may be cast as one, but for economy and ease in manufacturing, wherever possible all of the parts are stamped from sheet metal and riveted or otherwise secured together.

Slidably mounted in the forward portion of the track 30 is an adjustable pivot member 48. As illustrated, pivot member 48 is formed by joining two similar stampings and rigidly securing them together by means of a rivet 49. Rivet 49 also serves as a supporting pivot for the lower end 50 of the clamping lever 51. Referring particularly to Figure 9 of the drawings, it can be seen that the under track engaging portion 52 of the adjustable pivot member 48 is provided with a

pair of spaced transversely extending slots 53, and as clearly shown, when one of the spaced slots is aligned with any two of the apertures 33 formed in the side edges 32 of the track 30 and the adjusting pin 34 received therein, the pivot member 48 is firmly held against sliding movement. It is to be here noted that the distance between the transverse slots 53 of the pivot member 48 is such that when one slot is aligned with a pair of apertures 33 that the other slot is positioned midway between the respective pairs of adjacent apertures. In this manner, if eight aligned apertures 33 are provided in the sides 32 of the track 30, there may be had 16 adjustments of the pivot member 48. While the dimensions and spacing of the apertures 33 and slots 53 are a matter of choice and design, it has been found that better results are had where the distance between the centers of the apertures 33 is $\frac{3}{16}$'' and the distance between the centers of the two transverse slots 53 of the pivot member 48 is $\frac{21}{32}$ of an inch. While this adjustment feature is quite apparent in Figures 3 and 4 of the drawings, it is better shown in Figure 9.

As previously stated, clamping lever 51 is pivotally mounted on the upper end of pivot member 48 by means of the rivet 49. Clamping lever 51 is U-shaped in cross section and the lower end 50 also receives a pin 54 which pivotally holds a spring guide strip 55 to the lever 51. Spring guide strip 55 is stamped from a single length of metal and includes an elongated relatively narrow body 56 provided at one end with an enlarged rectangular head 57, through which the pin 54 passes to secure the guide strip between the side edges of the clamping lever 51. The other end of the narrow body 56 is provided with an elongated longitudinal slot 58. Received on the elongated body 56 of the spring guide strip 55 is a compression spring 59, one end of which rests against the shoulders 60 formed by the enlarged head 57. The other end presses against a cross pin 61 which is firmly secured to the upper ends of the upstanding keeper slide ears 47, and which also passes through the slot 58 of the spring guide strip 55. The compression spring 59 is placed on the guide strip under a slight compression or preload so that no looseness will develop during the operation of the clamping lever 51. In order to avoid the buckling of the spring when compressed, it is to be noted that the width of the body 56 is approximately of the same dimension as the inside diameter of the spring 50.

In utilizing my novel safety ski binding, the boot B is first placed on the surface of the ski S between the front and rear assemblies, and the heel cable assembly C is adjusted so that the toe of the boot is in close proximity to the trip-out piece 35 when the trip-out piece is in a selected position. The pivot member 48 is then adjusted in the track 30 until the end 46 of trip-out piece 35 is received in the V-notch 45 of the keeper slide 43 with the clamping lever 51 in its open position (Figure 4). The frangible adjusting pin 34 is then placed through the slot 53 in pivot member 48 which is in alignment with a pair of holes 33. This locks pivot member 48 against sliding movement in the track 30. Clamping lever 51 is then moved to its closed position as illustrated more particularly in Figure 3 of the drawings. This movement compresses spring 59 and moves the keeper slide into tight engagement with the trip-out piece 35, and securely holds the keeper lug 36 in the keeper aperture 28 provided in the forward wall of the toe plate 26. In this position the boot B is firmly locked to the ski S as shown in Figures 1, 2 and 3.

An important feature of my invention resides in the fact that the pivot member 48 may be adjusted to a number of positions whereby the compressive load under which the trip-out piece 35 is placed may be finely controlled. Another important adjusting feature lies in the flexibility of the trip-out piece 35 whereby the position of the fulcrum point may be varied as desired. For example, Figures 3 and 4 illustrate the two extreme positions of the fulcrum point of trip-out piece 35, it being obvious that a greater lateral force would be required to pivot trip-out piece 35 in its position shown in Figure 4 than in the position illustrated in Figure 3 of the drawings. However, by adjusting the rear cable assembly to move the toe plate 26 toward or away from trip-out piece 35, a number of intermediate positions may be had and, as stated above, by changing the position of the pivot member 48, the compressive load under which trip-out piece may be placed is also varied.

When the boot B is firmly secured to the ski S with the trip-out piece 35 in the selected position and under the desired spring load, normal pressures and strains resulting from minor falls or the execution of various maneuvers will not be sufficient to dislodge or free the boot from the ski. However, when such stresses and strains occur which are greater than those which can be safely borne by the skier, the boot will be moved transversely of the ski as illustrated by the arrows in Figure 1 of the drawings, and trip-out piece 35 will likewise pivot in the same direction as indicated by the dotted line position, and the keeper lug 36 will be disengaged from the keeper aperture 28 thereby freeing the boot B from the binding A. In extreme forward pressures resulting from a sudden abrupt halt of the forward motion of the skis, the line of force will be transmitted in a straight line from the boot through trip-out piece 35 and keeper slide 43 to the pivot member 48 compressing the spring 59 and causing the frangible adjusting pin 34 to shear, whereby the whole assembly will move forward on the ski to free the boot therefrom.

One of the primary advantages of my safety binding lies in the fact that it includes all of the advantages found in a fixed type binding, and that the boot will not be released from the ski unless it is absolutely necessary to avoid serious injury, and while it is obvious that the boot may be released from the ski under equal left or right lateral forces, it has been found that greater torsional stress is required to break or injure the limbs of a skier when the ski is turned inwardly than when turned outwardly. Therefore, in the preferred form, the angles formed by the V-notch 45 in the keeper slide 43 and the pointed end 46 of the trip-out piece 35 are such that the inner angle X is greater than the outer angle Y, and consequently more force must be exerted to release the boot when the ski is turned inwardly than when the same is turned outwardly. While any proportion between the angles may be had, it has been found from actual experience that the desired inner angle X should be 30° and the outer angle Y should be 22° as illustrated in Figure 5 of the drawings. As previously stated, Figure 5 illustrates the front assembly for a right ski binding, and it is obvious that in the left binding the angles of the trip-out piece 35 and V-notch 45 of the keeper slide 43 will be just the opposite

so that when these pieces are applied to a front assembly of a left ski binding, the inner angle will be 30° and the outer angle will be 22°. This fine adjustment is extremely desirable in that the ski and boot will not be unnecessarily separated resulting in obvious and unnecessary inconvenience to the skier.

In Figure 10 of the drawings, I have illustrated a modified form of the trip-out piece **35** and keeper slide **43**, and in this form the keeper slide **43'** is provided with the pointed end **45'**, and the trip-out piece **35'** has formed therein the V-notch **46'**.

While in the preferred embodiment of my invention I form the trip-out piece **35** and keeper slide **43** with matching V ends (of either equal or different angles), I have found that one piece must have a V-notch formed in its end but the other piece may have a rounded or some other type of reduced end portion that will ride in the V-notch. However, with matching V ends, a longer length of engagement is had and a further displacement of the boot will be necessary to pivot the trip-out piece **35** resulting in a firmer and more reliable binding.

From the foregoing, it is believed that the features and advantages of the invention will be readily apparent to those skilled in the art, and it will of course be understood that changes in the form, proportion and minor details of construction may be resorted to without departing from the spirit of the invention or the scope of the appended claims.

I claim:

1. A safety ski binding for detachably and releasably holding a boot to a ski comprising, a rear heel hold-down assembly secured to the ski and a separate front toe engaging assembly, said front assembly including a toe plate rigidly secured to the boot sole and having a forward wall covering a central vertical portion of the toe, said forward wall having a keeper aperture therein, a longitudinally extending track positioned centrally on the ski adjacent the toe plate, a trip-out piece slidably and pivotally mounted on the top surface of said track and having a keeper lug on one end of a size and configuration to snugly fit into the keeper aperture, the other end of said trip-out piece terminating in a V-point, a keeper slide slidably mounted in the track adjacent the pointed end of the trip-out piece and having a V-notch on one end in alignment with and corresponding to the shape of the V-point on the trip-out piece, and means including a clamping lever pivotally and adjustably mounted to the track and adapted to be rotated from an open to a closed position for moving said keeper slide into engagement with the trip-out piece, whereby the keeper lug will move into said keeper aperture to releasably hold the toe of the boot to the ski.

2. A ski binding for detachably and releasably holding a boot to a ski comprising an adjustable rear cable assembly secured to the ski and a separate automatically releasing front assembly, said front assembly including a toe plate rigidly secured to the boot and having a vertically extending centrally positioned forward wall provided with a keeper aperture therein, a longitudinally extending track positioned centrally on the top surface of the ski adjacent the toe plate, a trip-out piece slidably and pivotally mounted on the top surface of the track in close proximity to the toe plate, said trip-out piece having its forward end terminating in a V-point and a keeper lug on the opposite end of a size and configuration to snugly fit into the keeper aperture, a keeper slide slidably mounted in the track and having its rear portion formed with a V-notch corresponding to and in alignment with the V-point of the trip-out piece, an adjustable pivot member mounted in the forward portion of said track and adapted to slide therein, a clamping lever pivotally mounted on said pivot member, a spring guide strip pivotally mounted at one end to said clamping lever and slidably and pivotally secured at its other end to said keeper slide, a compression spring received about said spring guide strip and exerting pressure on said keeper slide, and means for adjustably locking said pivot member against sliding movement in said track, said clamping lever having an open position whereby the trip-out piece is free from engagement with the toe plate and a closed operative position, whereby the keeper lug of the trip-out piece is received in the keeper aperture and the toe end of the boot held to the ski but adapted to be automatically released upon a sufficient lateral force to cause the trip-out piece to pivot free of the keeper slide and toe plate.

3. A safety ski binding as set forth in claim 2 wherein, the means for adjustably locking the pivot member in said track includes a series of equally spaced aligned holes in each side of the track adjacent the forward end thereof, the lower portion of said pivot member having a pair of spaced parallel transversely extending slots, said transverse slots being so spaced that when one of the slots is in alignment with a pair of track holes the other slot lies between adjacent pairs of holes, and a frangible adjusting pin received in a pair of track holes and an aligned pivot member slot.

4. A safety ski binding for detachably and releasably holding a boot to a ski comprising, a rear heel hold-down assembly secured to the ski and a separate front toe engaging assembly, said front assembly including a toe plate rigidly secured to the boot sole and having a forward wall covering a central vertical portion of the toe, said forward wall having a keeper aperture therein, a longitudinally extending track positioned centrally on the ski adjacent the toe plate, a trip-out piece slidably and pivotally mounted on the top surface of said track and having a keeper lug on one end of a size and configuration to snugly fit into the keeper aperture, the other end of said trip-out piece terminating in a reduced portion, a keeper slide slidably mounted in the track adjacent the reduced end of the trip-out piece and having a V-notch on one end in alignment with the reduced end of the trip-out piece, and means including a clamping lever pivotally and adjustably mounted to the track and adapted to be rotated from an open to a closed position for moving said keeper slide into engagement with the trip-out piece, whereby the reduced end portion of the trip-out piece will be received in the V-notch and the keeper lug will move into said keeper aperture to releasably hold the toe of the boot to the ski.

5. A safety ski binding for detachably and releasably holding a boot to a ski comprising, a rear heel hold-down assembly secured to the ski and a separate front toe engaging assembly, said front assembly including a toe plate rigidly secured to the boot sole and having a forward wall covering a central vertical portion of the toe, said forward wall having a keeper aperture therein,

a longitudinally extending track positioned centrally on the ski adjacent the toe plate, a trip-out piece slidably and pivotally mounted on the top surface of said track and having a keeper lug on one end of a size and configuration to snugly fit into the keeper aperture, the other end of said trip-out piece terminating in a V-notch, a keeper slide slidably mounted in the track adjacent the V-notch end of the trip-out piece and having a reduced portion on one end in alignment with the V-notch of the trip-out piece, and means including a clamping lever pivotally and adjustably mounted to the track and adapted to be rotated from an open to a closed position for moving said keeper slide into engagement with the trip-out piece, whereby the reduced end portion of the keeper slide will be received in the V-notch of the trip-out piece and the keeper lug will move into said keeper aperture to releasably hold the toe of the boot to the ski.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,279,519	Davis	Sept. 24, 1918
2,616,714	Cubberley	Nov. 4, 1952

FOREIGN PATENTS

Number	Country	Date
52,792	France (Addition to 868,333)	June 12, 1944
172,459	Great Britain	Dec. 15, 1921
246,020	Switzerland	Aug. 16, 1947
327,523	Italy	July 13, 1935
596,836	Great Britain	Jan. 12, 1948
603,512	Great Britain	June 17, 1948