United States Patent

Wilkes

[15] **3,671,052**

[45] **June 20, 1972**

[54] **SKI BINDINGS**

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[73] Assignee: **Rolamite Incorporated,** San Francisco, Calif.

[22] Filed: **Jan. 16, 1970**

[21] Appl. No.: **3,463**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 717,114, March 29, 1968, Pat. No. 3,543,595.

[52] **U.S. Cl.** ....**280/11.35 T**
[51] **Int. Cl.** **A63c 9/00**
[58] **Field of Search** ....280/11.35 T, 11.35 C

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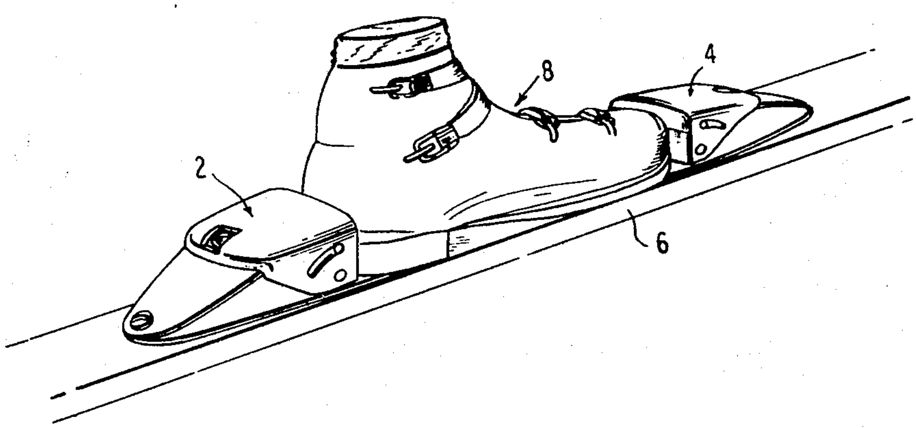
Primary Examiner—Benjamin Hersh
Assistant Examiner—Robert R. Song
Attorney—Burns, Doane, Swecker and Mathis

[57] **ABSTRACT**

Ski bindings for gripping the heel and toe portion of a ski boot. The heel and toe bindings are separate units which release by a snap action in response to the application of a predetermined force through the heel or toe of the boot to the respective bindings. A snap action blade provides the force for resisting lifting movement of the heel of the boot and for resisting swinging movement of the toe of the boot relative to the ski. Both the release force and the degree of movement permitted by the respective bindings is adjustable.

34 Claims, 23 Drawing Figures



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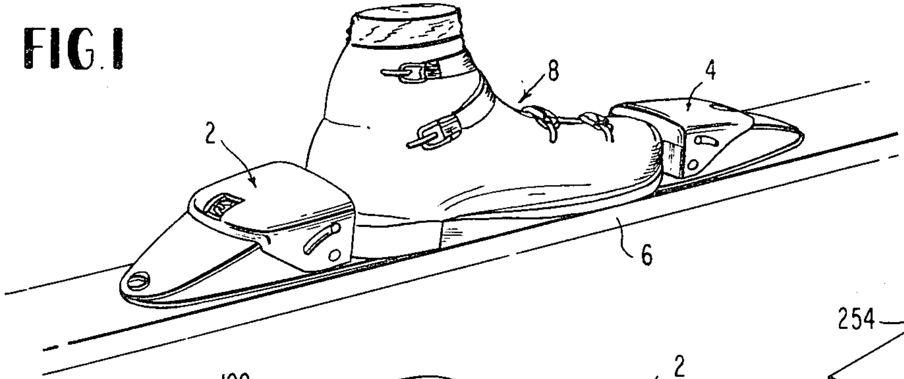
SHEET 01 OF 11

3,671,052

FIG. I



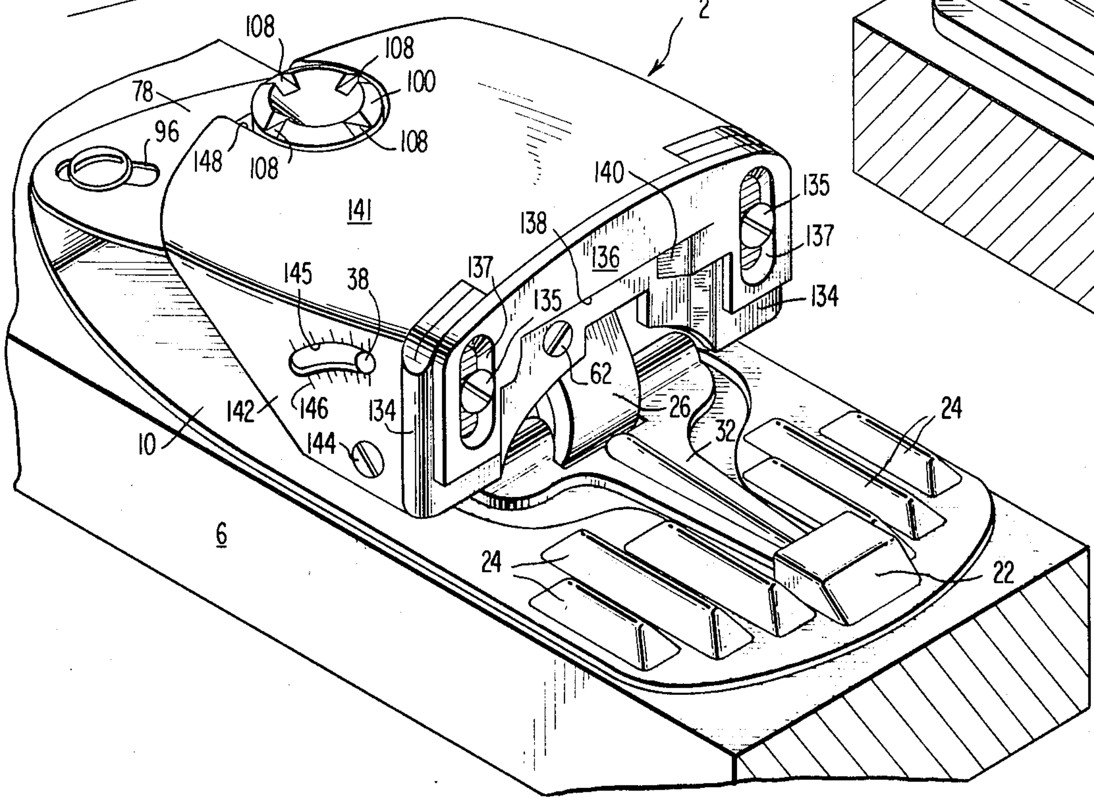


FIG. 2

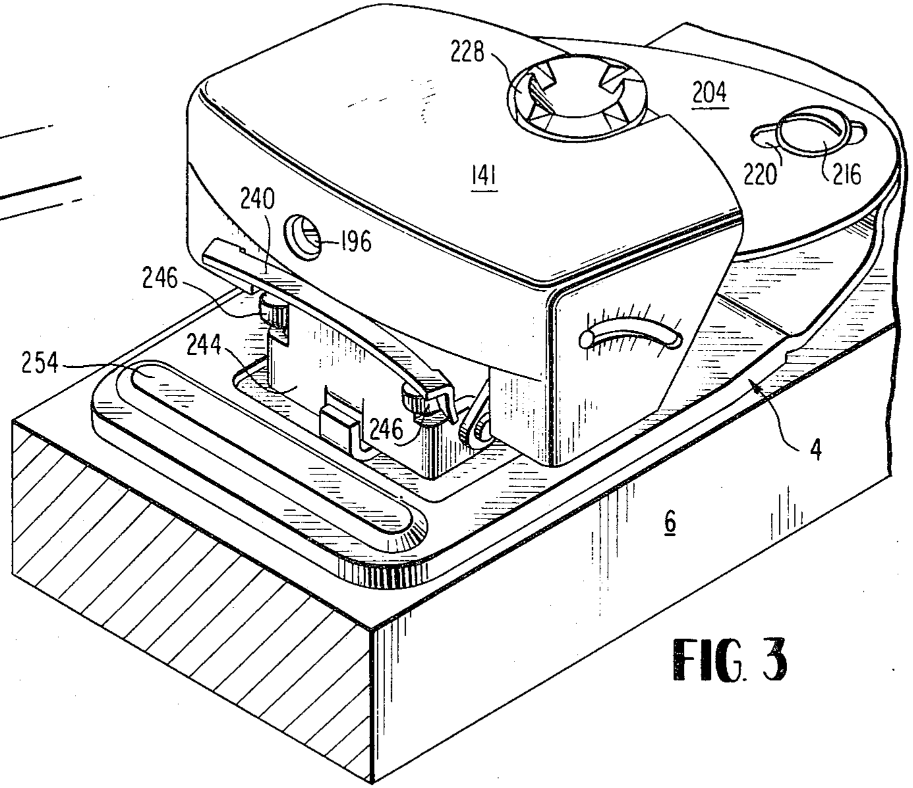


FIG. 3

FIG. 5

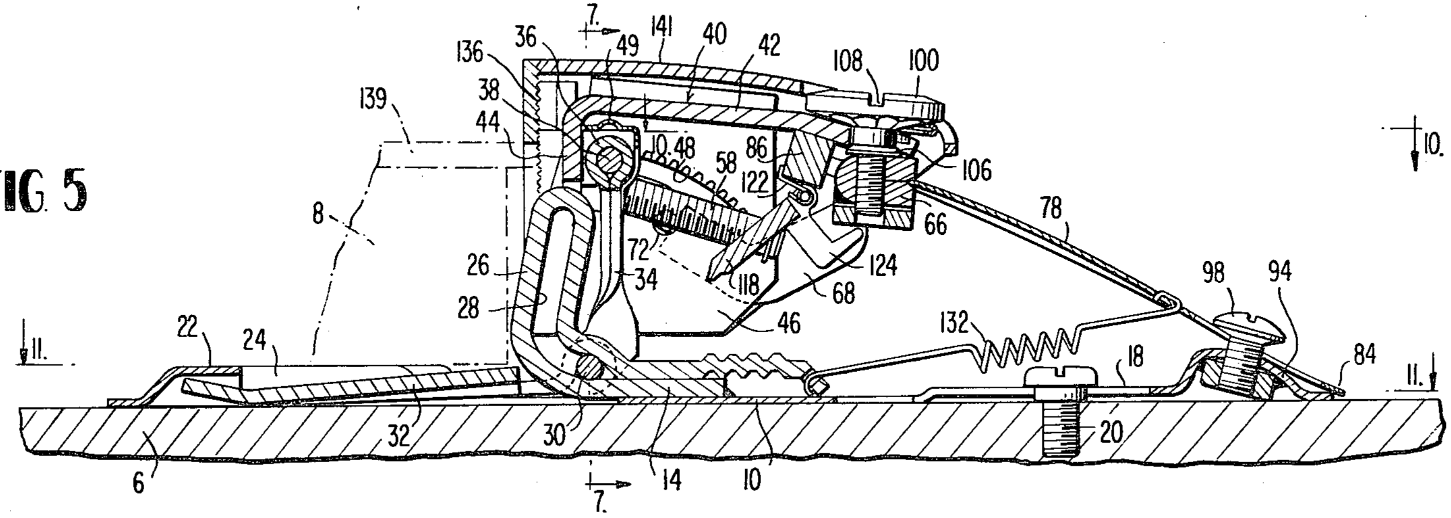

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FIG. 4

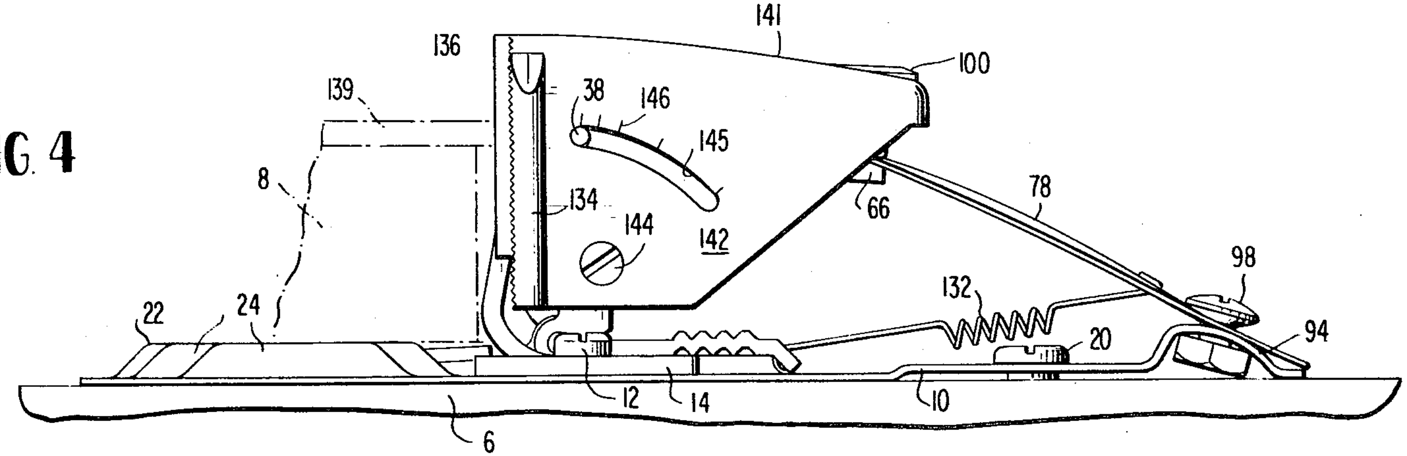
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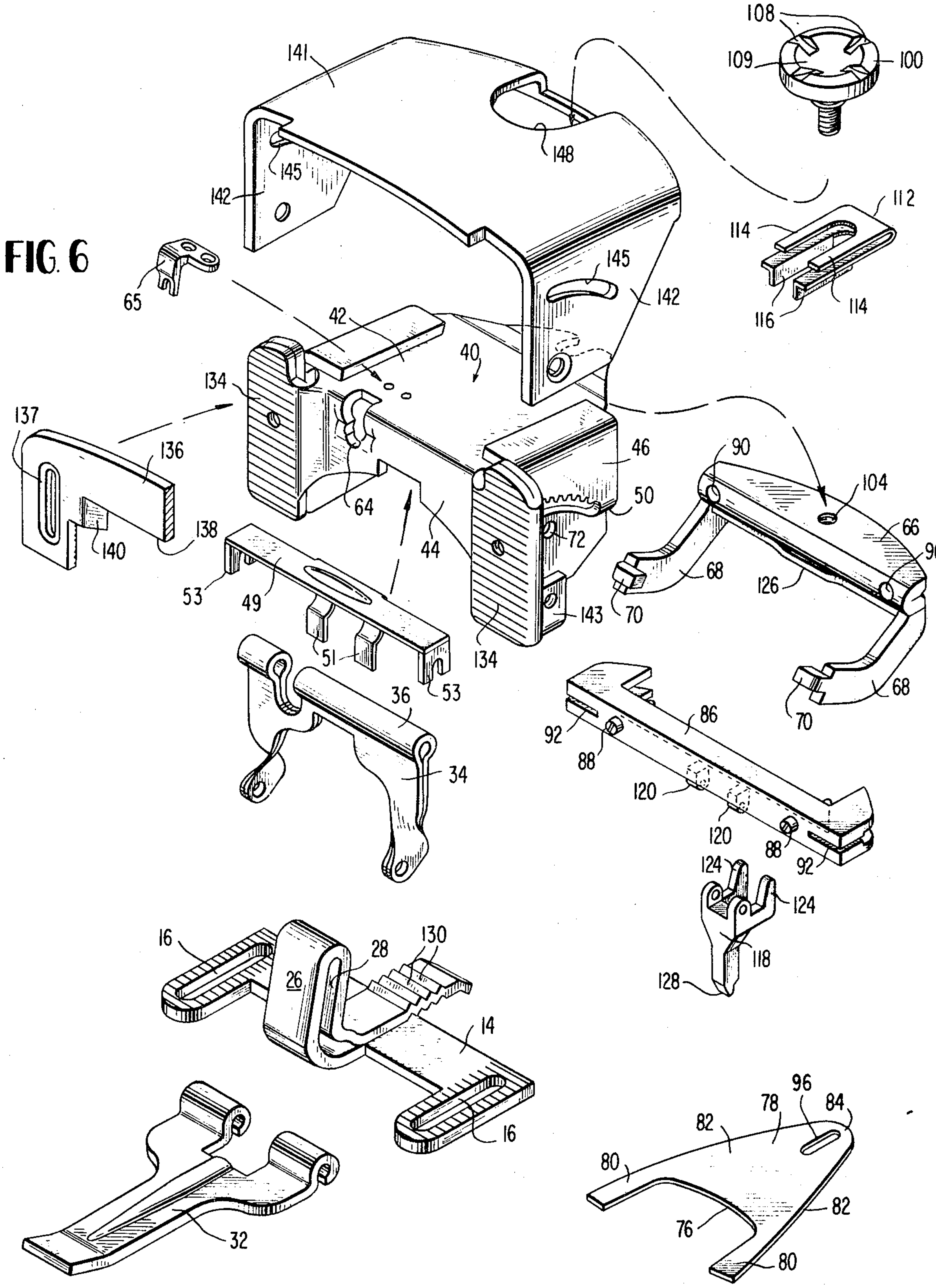
FIG. 6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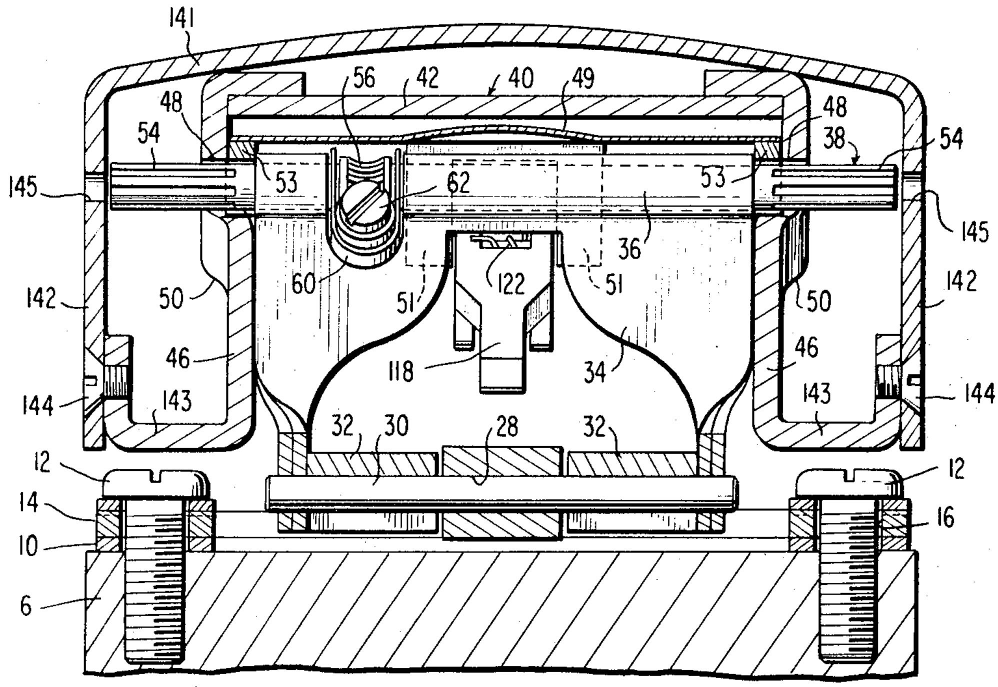
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FIG. 7

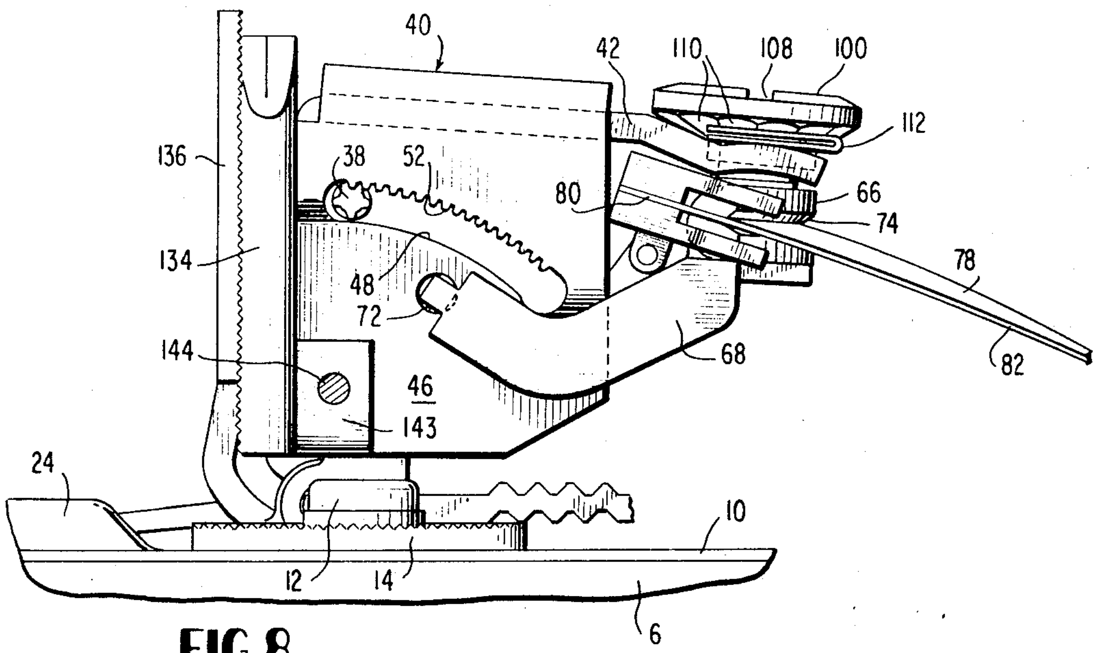
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FIG. 8

FIG. 9

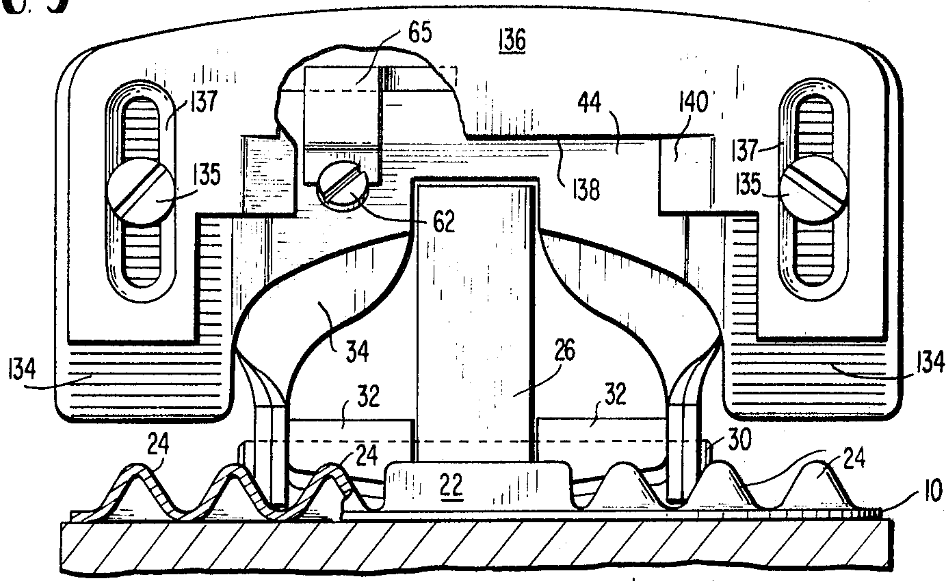
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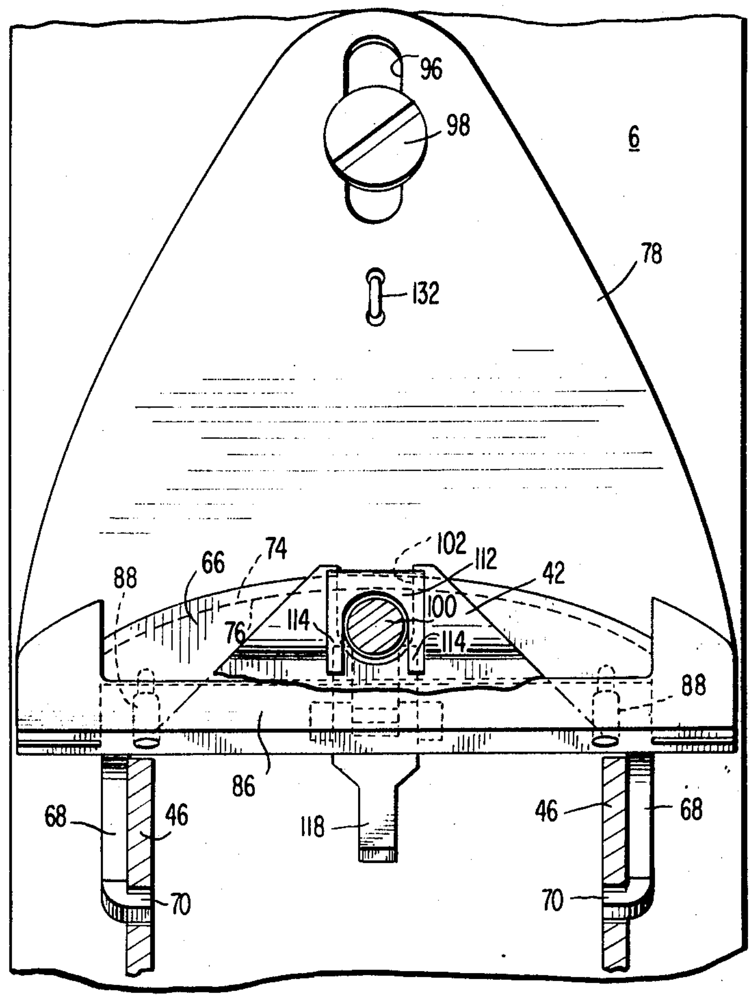
FIG. 10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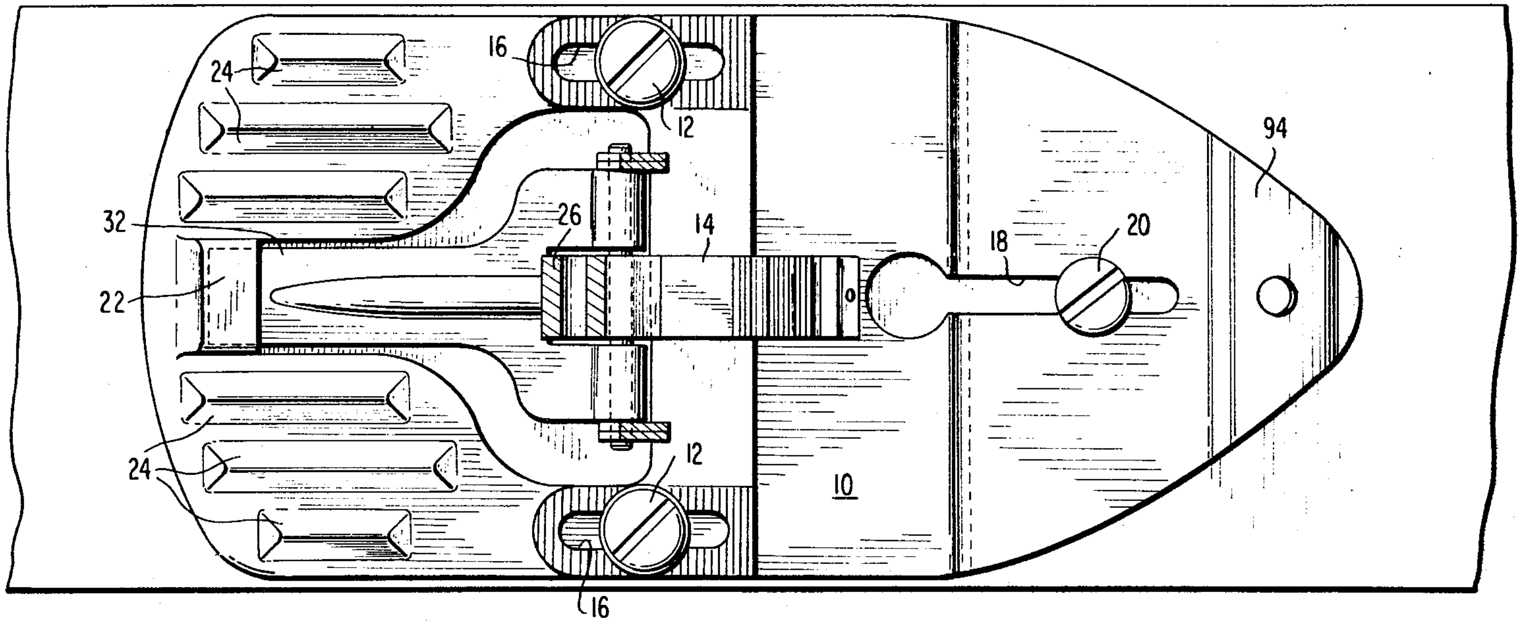
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FIG. 11

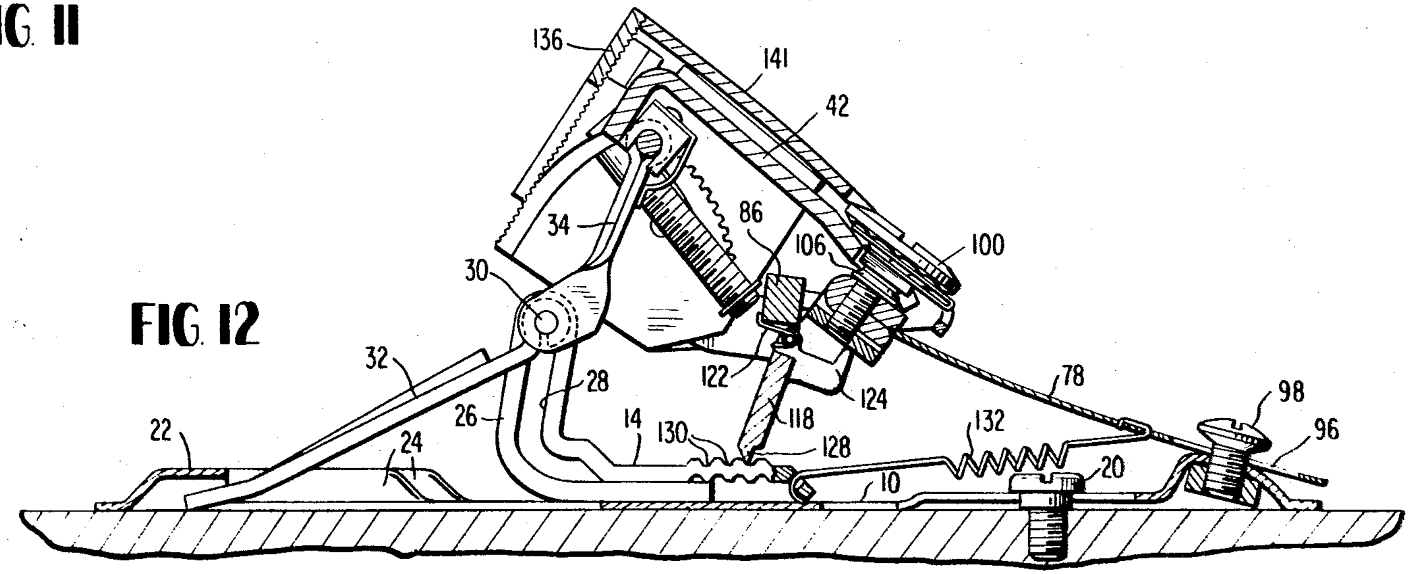
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FIG. 12

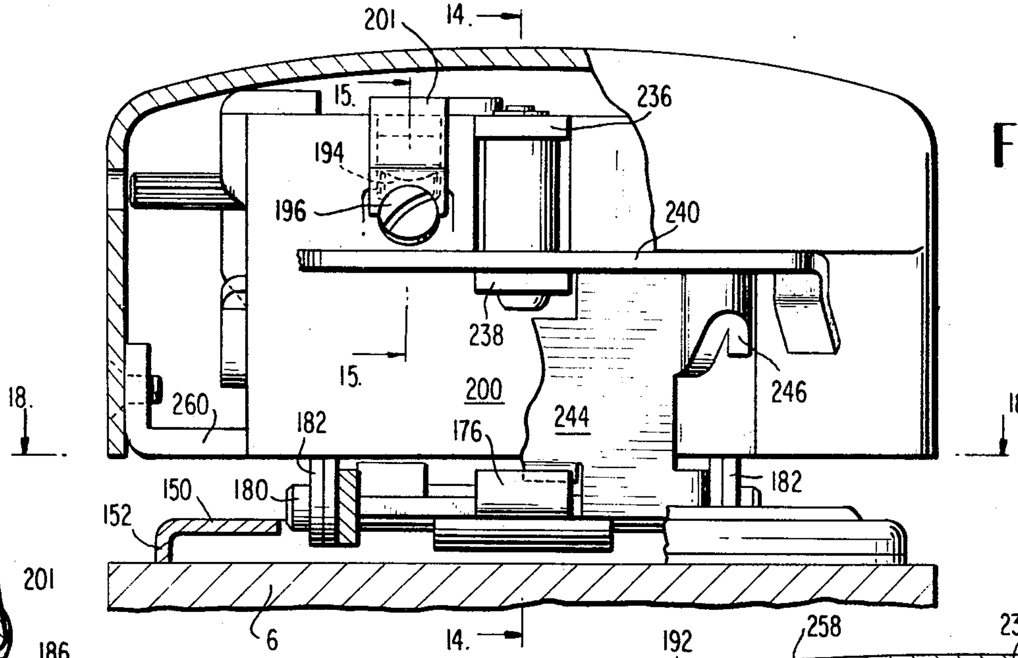


FIG.13

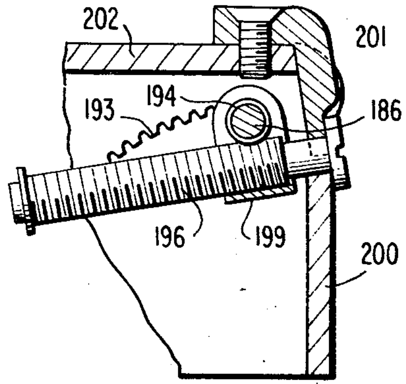


FIG.15

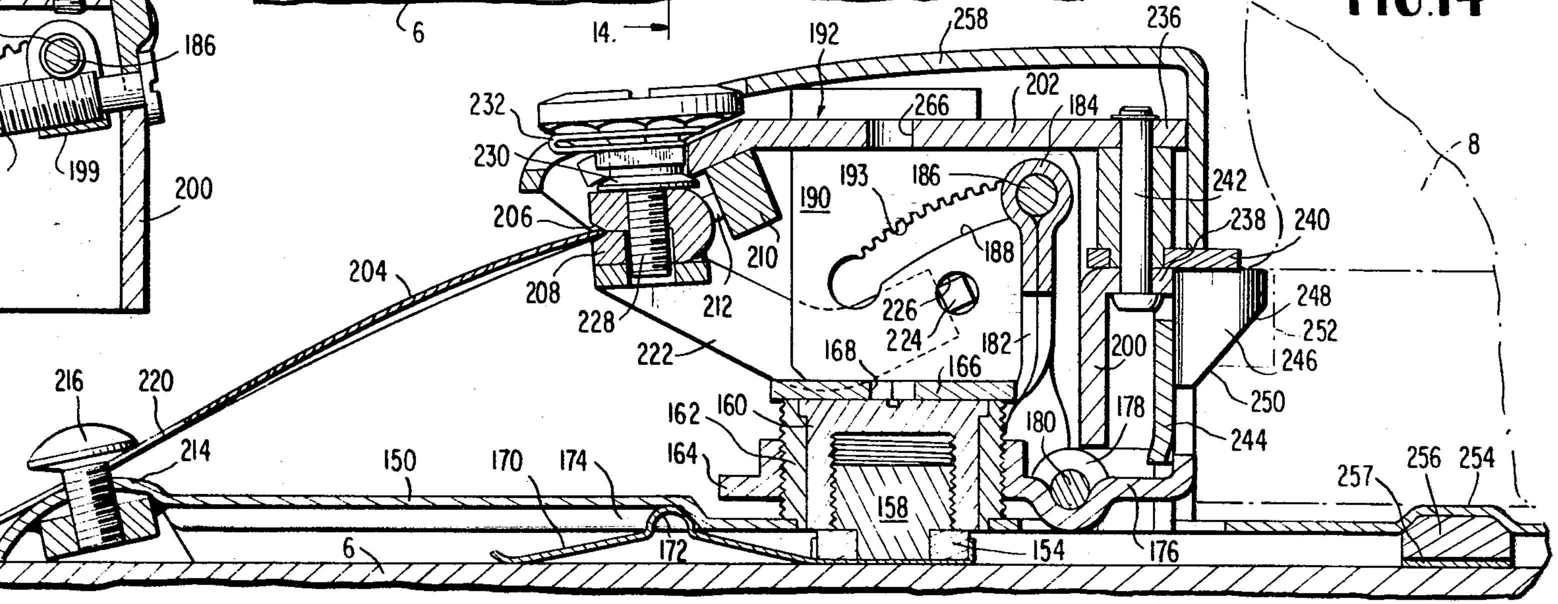
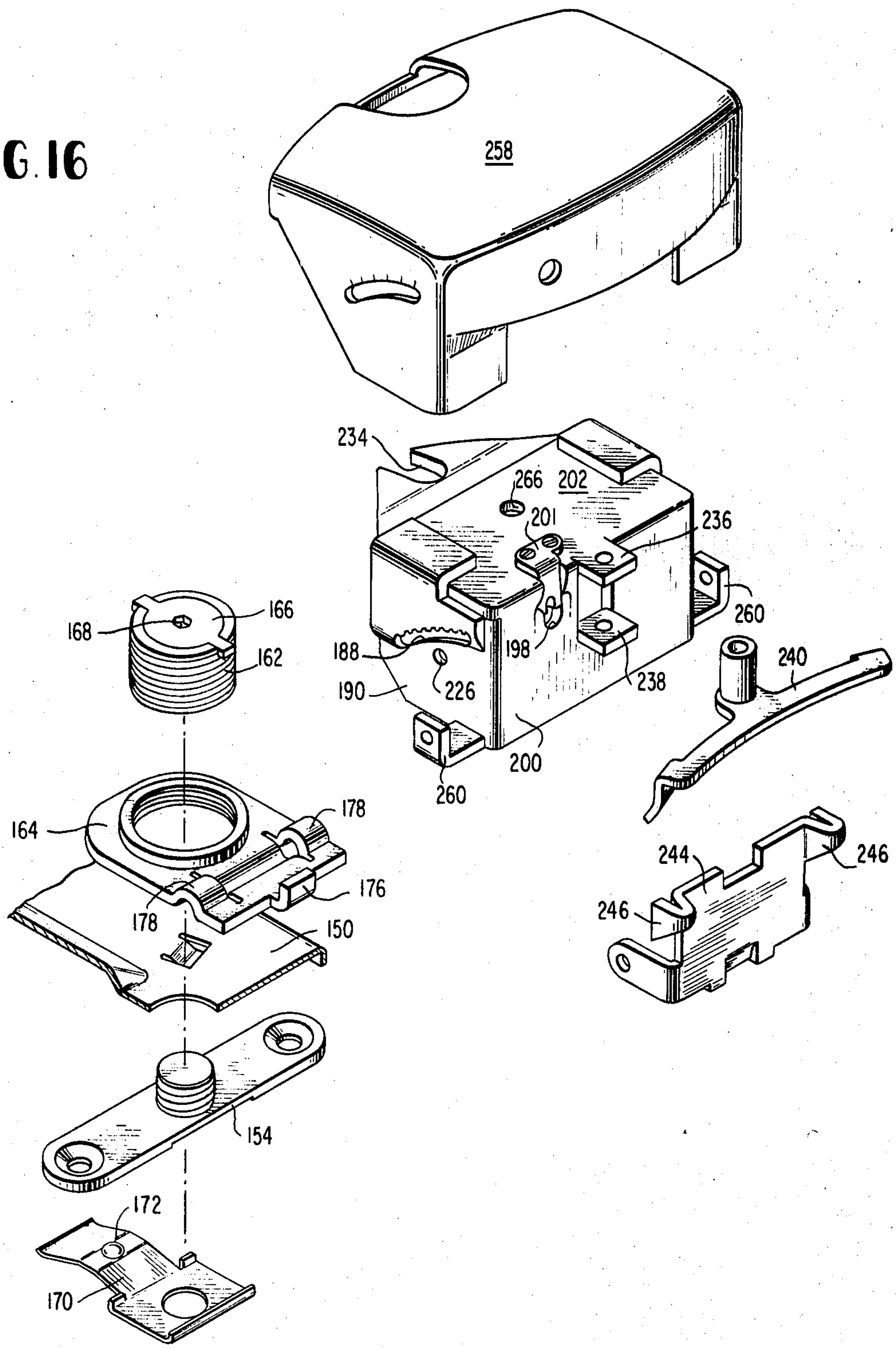


FIG.14

FIG. 16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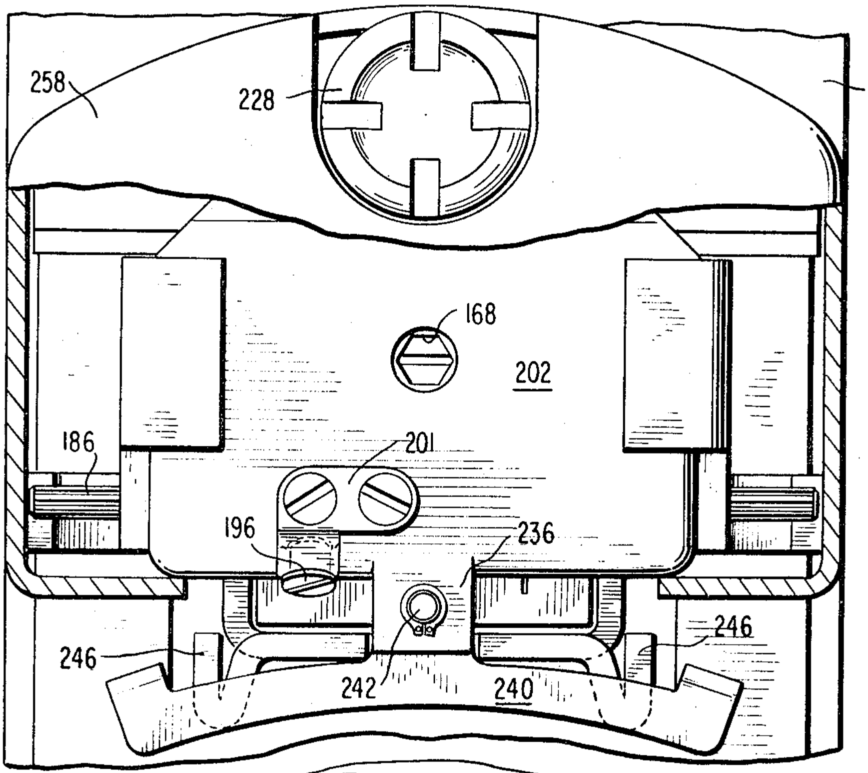
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FIG.17

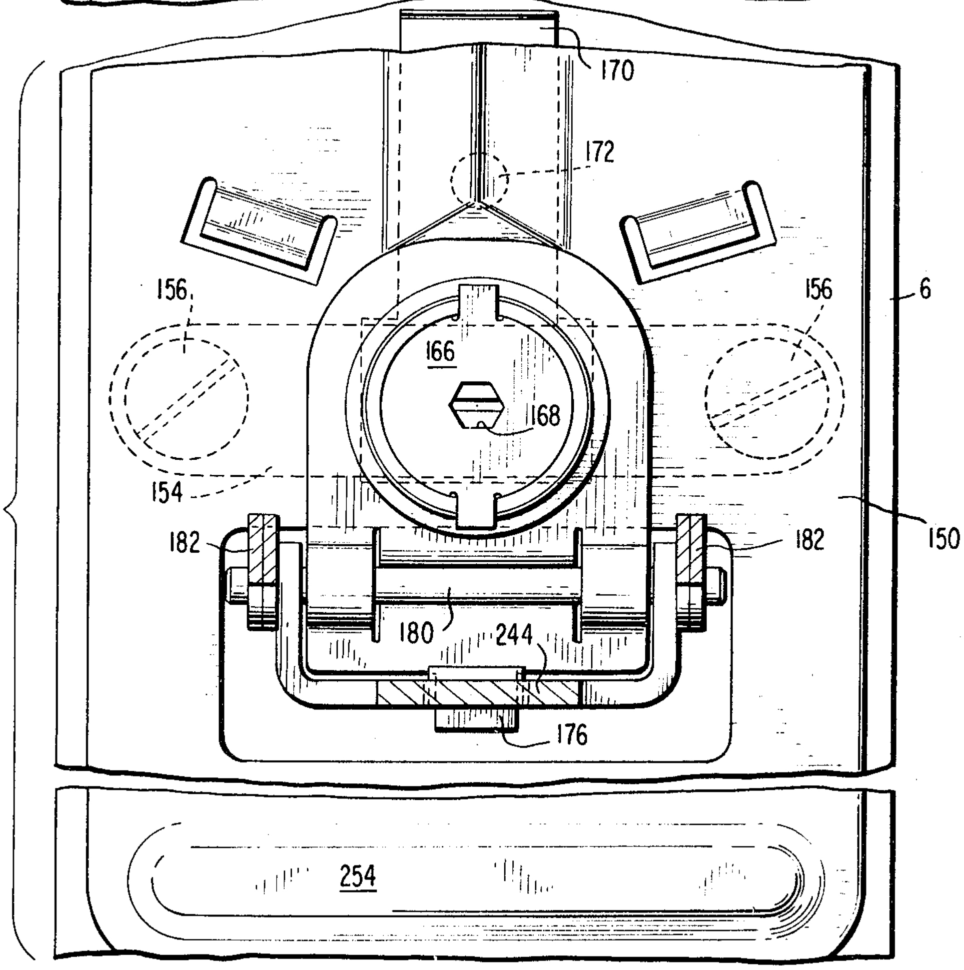
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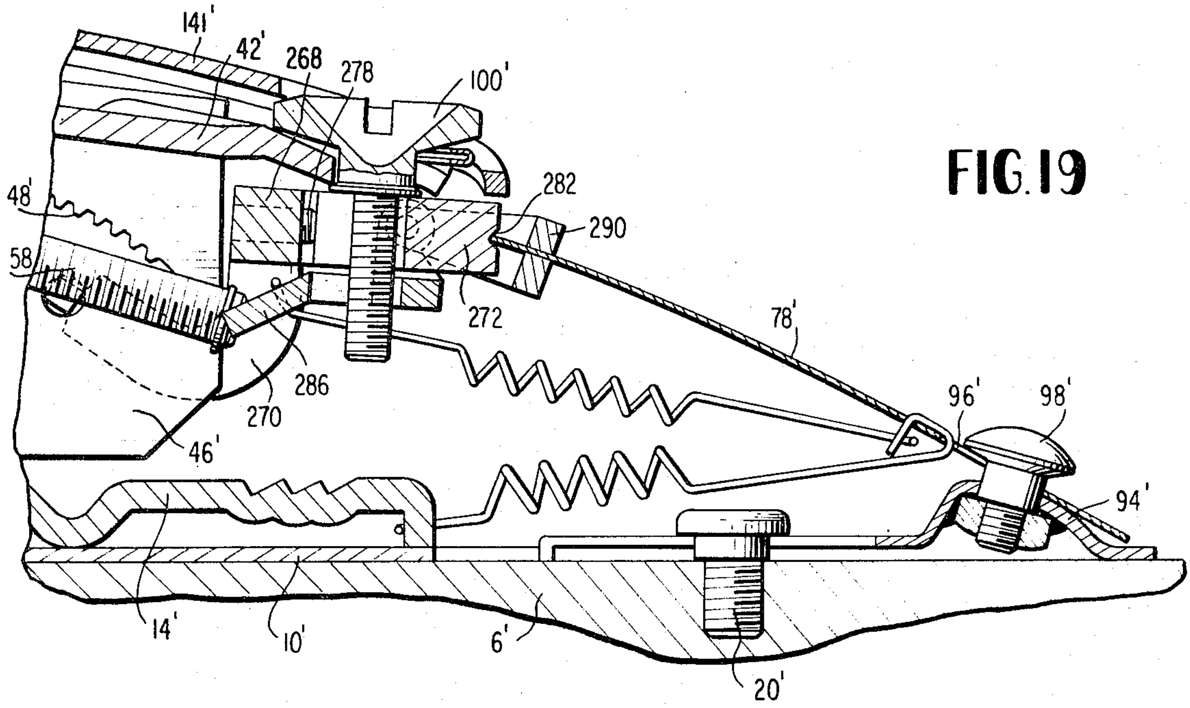
FIG.18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14'
10'
6'
20'

FIG. 19

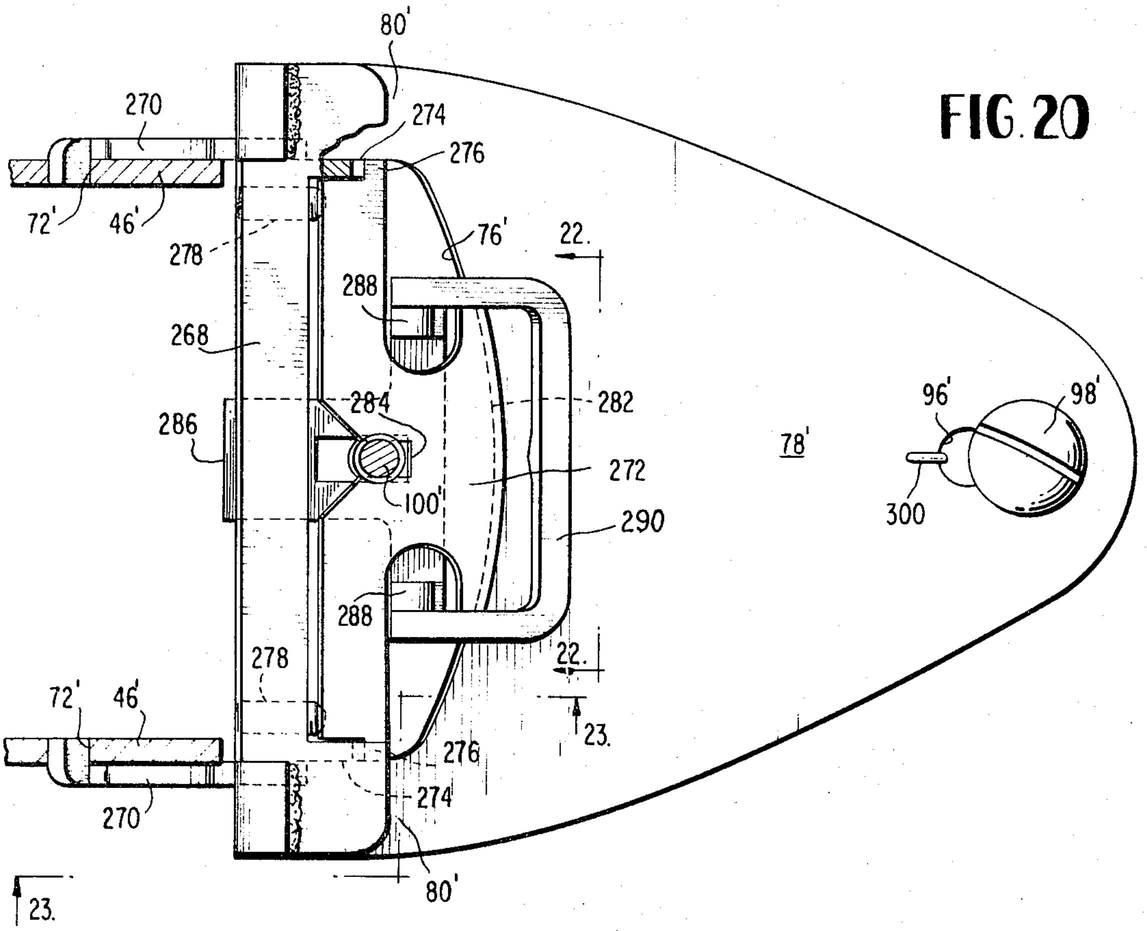
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FIG. 20

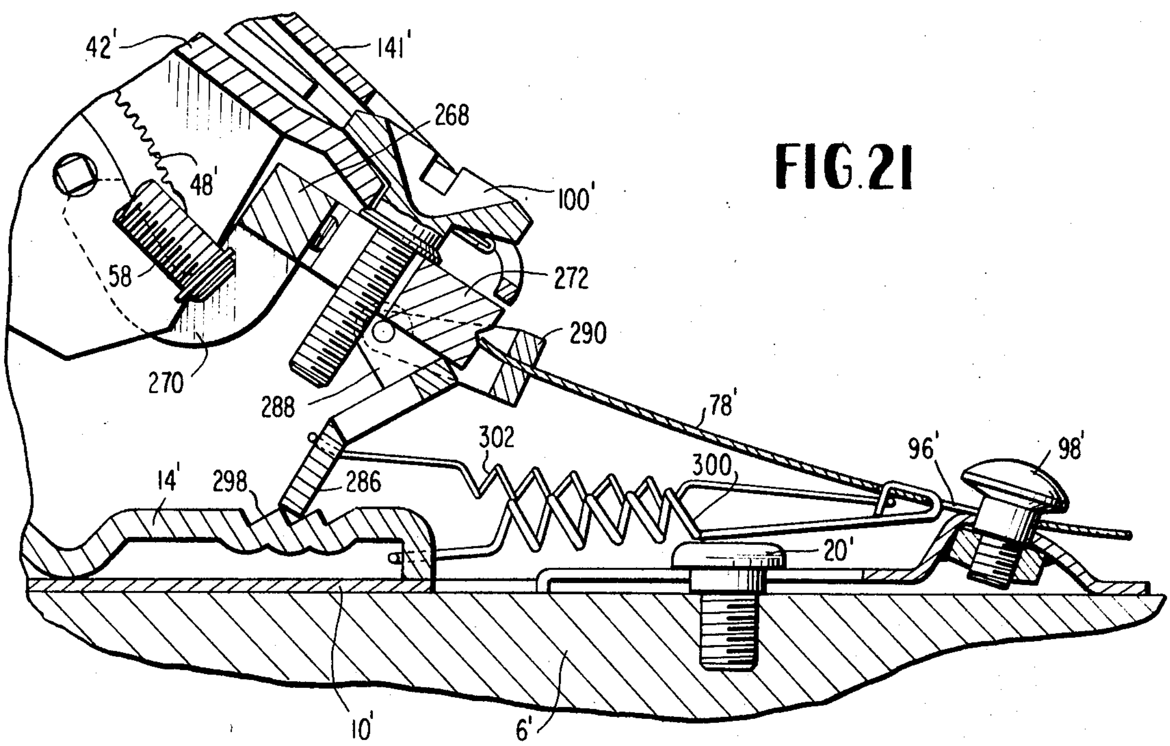


FIG.21

FIG.22

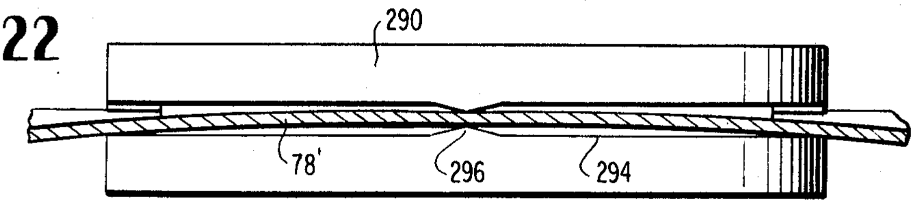
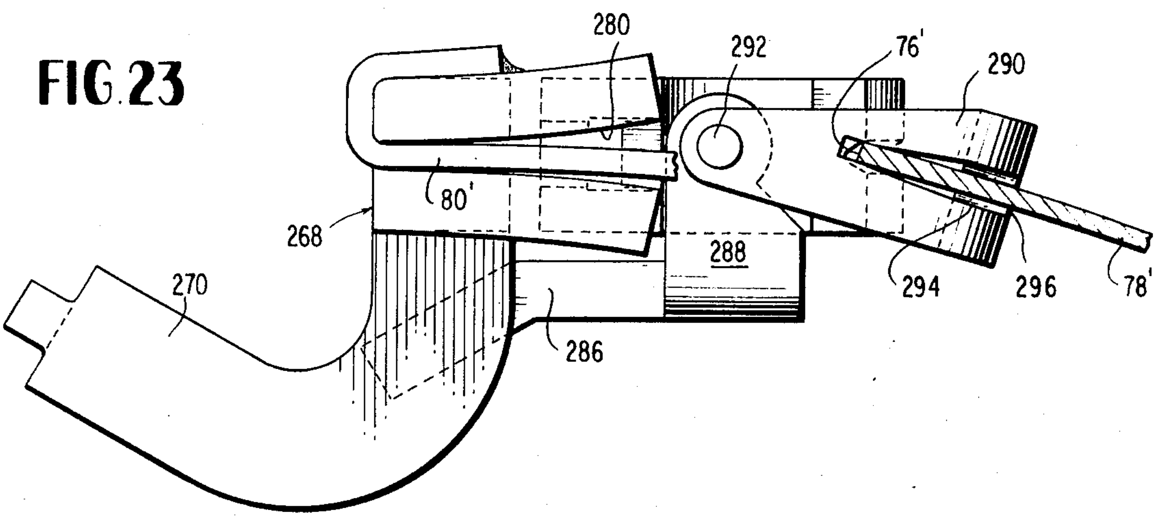


FIG.23



SKI BINDINGS

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of my copending application Ser. No. 717,114 entitled "Snap Action Apparatus," filed Mar. 29, 1968 now U.S. Pat. No. 3,543,595, issued Dec. 1, 1970.

BACKGROUND OF THE INVENTION

This invention relates to ski bindings, and more particularly to devices for temporarily securing the heel and toe of a ski boot on a ski.

A typical heel binding grips the heel of the boot in such a way that it allows lifting of the heel off the surface of the ski to a limited extent without releasing, but when sufficient upward force is applied to the binding, such as when the forward motion of the ski suddenly stops or is abruptly reduced, the binding releases the heel and the boot is free to separate from the ski. This is the primary mode of release for the heel. It is also desirable for the binding to release the heel when the force is applied laterally to the heel of the boot, such as by catching the ski on a chair lift or under a partially buried root or limb.

In releasing the heel of the boot by applying a force upwardly, there are two factors to be considered. First, the heel binding should allow limited lifting movement of the heel without releasing the binding and second the force required to release should be adjustable. In cross-country skiing, for example, large heel lift without release is desirable. Racers, on the other hand, want the bindings to allow very little heel lift.

Bindings also should release at a force that corresponds to the particular skiing conditions that are encountered. A low release force is desirable for beginning and novice skiers, while a high release force is required for slolam and downhill skiers. The heel binding, therefore, must be adjustable to accommodate the particular requirements of heel lift and release force under a wide range of skiing ability and conditions.

Prior heel bindings typically do not allow independent adjustment of heel lift and release force. For example, it is common to use a tension spring for resisting heel lift and a toggle linkage for release when a preset displacement of the heel occurs. Usually, only adjustment of the spring tension is possible, and when the tension of the spring is changed, there is a corresponding change in the degree of lift permitted. As a result, different heel bindings are used depending upon the skill of the skier and the skiing conditions that are to be encountered.

A typical binding for the toe of the boot provides lateral release to either side of the ski. The toe binding is primarily intended to prevent torsional leg fractures, and twisted and sprained ankles and knees. A certain amount of lateral movement may be desirable, according to the skill of the skier and the ski conditions. The force at which the toe binding releases the toe of the boot should also be adjustable and the toe binding should continually urge the toe of the boot to return to a centered position with respect to the ski. The front or toe binding should also be capable of releasing the toe of the boot directly upward when sufficient force is applied. When the skier is riding on a chair lift, it is possible for the tip of the ski to be caught, so that the tail of the ski is thrown against the back of the chair. Also, certain types of falls make it desirable for the front binding to release directly upward.

Most prior toe bindings either do not provide for lateral release, or utilize spring loaded cam actions that are ineffective when the toe is only slightly offset from the center of the ski. Also, many prior bindings are unable to provide for a wide range of lateral movement of the toe.

In addition to the ability to adjust the heel and toe bindings for various conditions, another important feature that is desirable is the uniformity with which a binding releases. The binding should repeatedly release at substantially the same force at a given force setting on the binding. If the binding releases over a wide range of forces for the same setting, then there is a danger that the binding will release with either too little or too great a force and the uncertainty may be disconcerting to the skier. A common disadvantage of conventional bindings is the lack of sensitivity of adjustment and the inability to release at the same force for a given setting.

A desirable feature of ski bindings is that the bindings can be easily clamped to the boot. The skier should be able to secure his boot in the bindings by inserting the toe of his boot into the toe binding and by placing the heel on the ski and applying his weight to the heel into the binding and have the heel binding positively grip the heel. This step-in feature should operate regardless of whether snow has packed under the heel of the boot and the presence of snow under the heel should not affect adversely the accuracy of the release force or the amount of lift that is permitted before release.

Another desirable feature of ski bindings is that they be easily releasable manually by the skier when he wishes to remove the skies. Also, in the event of a fall, the skier should be able to release the bindings easily, even if he is in a position where it is difficult to reach the bindings. The bindings also should be capable of being adjusted to the proper release force and relative release motion without disassembling the binding, so that adjustments can be made while the skier is on the slope to correct for terrain or snow conditions that he is about to encounter.

Conventional bindings often are difficult to fasten to the boot and to get out of in the event of an accident. For example, some bindings require the skier to swing a lever by hand against the heel of the boot, while overcoming the force of the release spring, which may be impossible when the skier is not on firm ground. Similarly, release may require the skier to apply the preset release force to overcome the spring. Such arrangements may prevent the skier from removing his skies readily after a fall.

SUMMARY OF THE INVENTION

Accordingly, it is an object of this invention to provide improved heel and toe ski bindings.

A further object of this invention is to provide ski bindings in which the release force is accurately and conveniently adjustable.

A still further object of this invention is to provide ski bindings in which the extent of motion of the heel and toe of the boot prior to release is adjustable independently of the release force adjustment.

Another object of this invention is to provide ski bindings which allow the boot to be readily fastened in the bindings and released manually by the skier.

It is also an object of this invention to provide ski bindings in which the release force and deflection prior to release are adjustable over a wide range.

These objects are accomplished in accordance with preferred embodiments of the invention by heel and toe bindings which incorporate a conical snapper for yieldably urging the heel of the boot toward the ski surface and urging the toe of the boot toward the center of the ski. The conical snapper includes a thin, resiliently flexible blade. The inner end of the blade is mounted in such a way that it is stressed to assume a transversely curved configuration, with the transverse curvature progressively decreasing toward the outer end of the blade. The blade is bistable and the blade is mounted in the binding so that in one stable position the outer end of the blade bears against the base plate of the binding when the boot is fastened on the ski. This arrangement causes the blade to buckle progressively from the outer end toward the inner end as an increasing force is applied to the blade, until the blade snaps over to the other stable position.

A lever connects the boot with the blade to press the outer end of the blade against the base plate as the boot applies a force to the binding in the direction of release. In the heel unit, the lifting force applied by the boot is applied directly to the lever, while in the toe binding, a transfer linkage is used to transmit lateral displacement of the toe of the boot to the vertically movable lever that is connected with the blade. As the force of the blade increases, the outer end of the blade progressively deflects until the blade ultimately snaps over to the opposite stable position. Both the front and the rear bindings provide for adjustment of the release force by changing the pivot point of the lever. The displacement permitted by the binding before release is adjustable by preloading the blade to cause the outer end of the blade to be deflected when the heel is against the ski, or for the front binding when the toe is centered. Both the front and the rear bindings continually and uniformly urge the heel and toe toward their respective initial positions until the force applied through the lever system to the blade exceeds maximum resisting force provided by the blade. When this occurs, the blade snaps over and the heel or toe of the boot is released.

DESCRIPTION OF THE DRAWINGS

These preferred embodiments are illustrated in the accompanying drawings in which:

FIG. **1** is a perspective view of the ski bindings of this invention as secured on a ski and showing a boot fastened therein;

FIG. **2** is a perspective view of the heel unit of this invention;

FIG. **3** is a perspective view of the toe unit of this invention;

FIG. **4** is a side elevational view of the heel unit;

FIG. **5** is a longitudinal cross sectional view of the heel unit;

FIG. **6** is an exploded view showing the components of the heel unit;

FIG. **7** is a cross sectional view of the heel unit along the line **7—7** in FIG. **5**;

FIG. **8** is a side elevational view of the heel unit with the cover removed;

FIG. **9** is a front elevational view of the heel unit;

FIG. **10** is a cross sectional view of the heel unit along the line **10—10** in FIG. **5**;

FIG. **11** is a cross sectional view of the heel unit along the line **11—11** in FIG. **5**;

FIG. **12** is a longitudinal cross sectional view of the heel unit showing the unit in its released position;

FIG. **13** is a rear elevational view, partially in cross section, of the toe unit;

FIG. **14** is a cross sectional view of the toe unit along the line **14—14** in FIG. **13**;

FIG. **15** is a detail cross sectional view of the toe unit along the line **15—15** in FIG. **13**;

FIG. **16** is an exploded view of the components in the toe unit;

FIG. **17** is a top plan view, partially in cross section, of the toe unit;

FIG. **18** is a cross sectional view of the toe unit along the line **18—18** in FIG. **13**;

FIG. **19** is a longitudinal cross sectional view of a modified form of the heel unit;

FIG. **20** is a top plan view, partially in cross section of the modified heel unit;

FIG. **21** is a longitudinal cross sectional view of the modified heel unit showing the unit in its released position;

FIG. **22** is a cross sectional view of the modified heel unit along the line **22—22** in FIG. **20**; and

FIG. **23** is a cross sectional view of the modified heel unit along the line **23—23** in FIG. **20**.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

In FIG. **1**, a heel binding unit **2** and a toe binding unit **4** in accordance with this invention are shown as mounted on a conventional ski **6**. The units **2** and **4** engage the heel and toe of a ski boot **8** to hold the boot on the upper surface of the ski **6**, while allowing limited movement of the heel and toe relative to the ski. The heel unit **2** is shown in greater detail in FIG. **2**, while the toe unit is illustrated in FIG. **3**.

HEEL UNIT

The heel unit **2** includes a base plate **10** which is secured to the upper surface of the ski **6** by a pair of screws **12**, as shown in FIGS. **7** and **11**. A stop bracket **14** is superimposed on the base plate **10** and secured to the plate by welding or other suitable means. The bracket **14** has a pair of slots **16** which are aligned with corresponding slots in the base plate **10**. The screws **12** extend through the bracket slots **16** and through the slots in the base plate **10** to hold the base plate firmly against the surface of the ski **6**. The base plate **10** also has a key slot **18**. A screw **20** extends through the slot **18** and is secured in the ski **6**. The screw **20** has an enlarged shank portion between the screw threads and the head which allows the plate to slide freely along the length of the slot **18**. The slots **16** and **18** permit the base plate **10** to be adjusted longitudinally of the ski to accommodate boots of different lengths, or to allow accurate positioning of the binding along the length of ski **6**.

At the forward end, the base plate **10** has a raised platform **22** and ridges **24** for supporting the heel of the ski boot **8**, as shown in FIGS. **2** and **9**. The inclined sides of the ridges **24** are coated with a material having a low coefficient of friction, such as polytetrafluorethylene. The peaks of the ridges **24** tend to bite into snow that may be caked on the bottom of the boot heel, and since the snow or ice on the heel is not frictionally supported by the inclined sides of the ridges, the ridges form effective wedges which easily break off accumulations of snow or ice from the heel. Furthermore, the snow or ice cannot pack in the bottom of the ridges because of the presence of the low friction material. Thus, the ridges in the platform effectively remove snow or ice from the bottom of the boot heel and allow the heel to rest firmly on the ridges **24** and the platform **22**.

The stop bracket **14** includes an upwardly inclined portion **26** and the front surface of the portion **26** serves as a stop for positioning the heel of the boot **8** when it is placed on the ridges and the platform **22**, as shown in FIG. **5**. The boot stop **26** has an internal guide slot **28** with an upwardly inclined leg portion and a horizontal leg portion adjacent the base plate **10**. A rod **30** extends through the slot **28** and is movable along the slot. A step lever **32** has a tubular portion adjacent one end and the rod **30** extends through the tubular portion for hingedly mounting the step lever **32** on the boot stop **26**. The lever **32** extends forwardly from the boot stop **26** and the outer end of the lever extends under the platform **22** as shown in FIGS. **2** and **5**. The outer end of the lever rests on the surface of the ski **6**.

As shown in FIGS. **5** and **7**, a yoke **34** is pivotally mounted on opposite ends of the rod **30** for swinging movement relative to the base **10** and relative to the step lever **32**. The yoke **34** has a sleeve **36** formed along the upper edge through which a shaft **38** extends. The shaft **38** supports a housing **40**. The housing **40** includes a top wall **42**, a front wall **44** and opposite sidewalls **46**. Each sidewall **46** has an arcuate slot **48** through which the shaft **38** extends (FIGS. **7** and **8**). A perpendicularizing spring **49** is positioned over the sleeve **36** and has fingers **51** which bear against the rear side of the yoke **34**. The ends of the spring **49** have blocks **53** through which the shaft **38** extends. The lower end of each block **53** bears against the lower side of the slot **48** to maintain the yoke in a radial position, as it is adjusted along the slot **48**. Each sidewall **46** also has an arcuate step **50** which is aligned with the slot **48** so that the upper edge of the slot **48** is offset outwardly from the lower edge of the slot, as shown in FIG. **7**. The upper edge of the slot has gear teeth **52** which mesh with the splines **54** at each outer end of the shaft **38**. The lower edge of the slot **48** forms a bearing surface for supporting the shaft and the blocks **53**.

The position of the shaft **38** along the slots **48** is controlled by rotation of the shaft. As the shaft rotates, the splines **54** progressively engage the gear teeth **52** and displace the shaft along the slot. Rotation of the shaft **38** is accomplished by a worm and gear arrangement. A gear **56** (FIG. **7**) is formed on the shaft **38** and a worm **58** drives the gear **56**. The worm **58** is mounted in driving relation with the gear **56** by a saddle **60** which is suspended from the shaft **38** on opposite sides of the gear **56** and passes around the worm to hold the worm in engagement with the gear **56**. The saddle **60** is preferably formed of resilient sheet metal and a portion of the saddle is resiliently biased into engagement with the worm. This saddle portion resists accidental rotation of the worm **58** caused, for example, by vibration of the skiis while being transported.

The worm shaft includes a cylindrical portion of reduced diameter and a slotted head **62**. The cylindrical portion is received in a socket **64** (FIG. **6**) formed in the front wall **44** of the housing. A retainer **65** (FIGS. **6** and **9**) has a socket at one end which cooperates with the socket **64** for engaging the cylindrical portion on the worm shaft. The retainer **65** is preferably formed of wear resistant metal since it bears the axial thrust of the worm shaft. The portion of the front wall adjacent the socket **64** is inclined rearwardly to conform to the average slope of the worm **58** (FIG. **5**). Since the shaft **38** moves along an arcuate path, the socket for the worm shaft allows slight pivoting movement of the worm about the socket. The helix angle of the worm **58** is such that the shaft **38** is friction locked in position along the slot **48** by the worm, but its position can be changed by rotation of the worm.

A reactor **66** extends across the rear of the housing **40** (FIGS. **5** and **10**). The reactor **66** has a pair of arms **68** which project forwardly along the outer surface of the sidewalls **46**. The ends of the arms **68** have lateral projections **70** which are received in holes **72** in the sidewalls **46**. The reactor **66** is provided with an arcuate groove **74** for receiving the inner edge **76** of a thin, resilient, snapper blade **78**. The blade **78** is shown in its unstressed condition in FIG. **6**. The inner edge **76** has a radius of curvature that is greater than the radius of curvature of the bottom of the groove **74**. The blade **78** also has a pair of tab portions **80** which project forwardly at opposite ends of the curved edge **76**. The lateral edges **82** of the blade **78** converge progressively toward the outer end **84** of the blade.

A tension bar **86** is positioned on the forward side of the reactor **66**. A pair of screws **88** extend through threaded holes in the tension bar **86** and are received in sockets **90** on the forward side of the reactor **66**. The tabs **80** of the blade are received in slots **92** at the opposite ends of the tension bar **86**. During assembly, the blade **78** is aligned with the groove **74**, so that the edge **76** bears against the bottom of the groove. The tabs are then secured in slots **92** by braising, welding or other suitable means. Tension is then applied to the tabs **80** by means of the screws **88** to draw the lateral edges of the blade rearwardly, thereby imposing compressive stresses in the blade along the arcuate edge **76** and tensile stresses along the tabs **80** to cause the blade to assume a transverse curvature and to be stable at either of two positions on opposite sides of a neutral plane.

The blade **78** has a front face which corresponds to the upper surface of the blade and a rear face which faces toward the upper surface of the ski **6**. When the unit is in position for actively holding the heel of a boot on the surface of the platform **22** and on the corrugations **24**, the blade **78** is in the bistable position in which the front face of the blade has a convex, substantially frustoconical shape. The tabs **80** cause the tension bar **86** to pivot about the ends of the screws **88** and to become substantially aligned with the lateral edges **82** of the blade, as shown in FIG. **8**.

The outer end of the blade **78** bears against a lateral ridge **94** on the base plate **10**. The blade has a longitudinal slot **96** (FIG. **10**) and a retaining screw **98** extends through the slot and is received in a threaded socket in the base **10** to prevent the outer end of the blade from being displaced away from the ridge **94** when the blade is snapped over to the release position. The slot **96** allows the blade to move longitudinally relative to the retaining screw **98**.

The shape of the blade and the manner in which the blade is stressed causes the blade to assume a transverse curvature and in which the curvature of successive transverse cross sections of the blade decreases from the inner edge **76** progressively toward the outer edge **84**. As a result, the blade buckles progressively from the outer end **84** toward the curved edge **76** as a force applied to the reactor **66** is transmitted through the blade **78** to the ridge **94**. The resistance to deflection of the outer end of the blade **84** by such a force progressively increases as the outer end of the blade deflects, until the blade ultimately snaps over to the other bistable position. A more complete explanation of this phenomenon is contained in my copending application Ser. No. 717,114, entitled "Snap Action Apparatus," filed Mar. 29, 1968, now U.S. Pat. No. 3,543,595, issued Dec. 1, 1970.

If the blade **78** were naturally flat it would require the same force for snapping over in either direction from one bistable position to the other. A large force for resisting deflection of the outer end of the blade, however, is desirable when the front face of the blade is in a convex configuration for actively holding the heel of a boot on the platform, but when the front face of the blade is concave and the unit is released, the force of the blade resists cocking the unit. Therefore, the blade **78** preferably has a slight preformed transverse curvature which gives the front face a convex curvature independently of the compressive and tensile stresses imposed by the reactor and tension bar assembly. As a result of the preformed curvature in the blade, a greater force is required to snap the blade **78** from a holding position with the front face convex than is required to snap the blade from a released position with the front face of the blade concave.

Referring to FIG. **5**, the position of the reactor **66** relative to the top **42** of the housing is controlled by an adjusting screw **100**. The screw extends through a slot **102** in the top **42**, as shown in FIGS. **5**, **8** and **10**. The reactor **66** has a threaded hole **104** for receiving the screw **100**. The shank of the screw, as shown in FIG. **5**, has a shoulder **106** which bears against the lower surface of the top **42**. The head of the screw **100** has slots **108** for turning the screw. The slots **108** preferably have the proper size and spacing to receive the edge of a coin, which serves as a driver for turning the screw **100**. The head of the screw **100** also has a conical socket **109** for receiving and supporting the tip of a ski pole. When the skier inserts his ski pole in the socket **109** and presses downwardly, the blade **78** snaps over and the heel of the boot is released.

The shoulder under the head has a plurality of flats **110** and a spring clip **112** (FIG. **8**) is inserted between the top **42** and the head of the screw. The clip **112** has a pair of cantilever arms **114** which engage the flats **110**. Tabs **116** on the clip **112** are secured along the sides of the slot **102** and resist rotation of the clip relative to the top **42**, so that the clip temporarily holds the screw in its adjusted position. The sides of the tabs **116** serve as bearing surfaces for the screw **100**. The central slot in the clip allows the screw to move along the housing slot **102** as the reactor position is being adjusted by turning the screw. The arms **114** remain in engagement with the flats **110** to resist turning of the screw **100**, regardless of the position of the screw along the slot **102**.

A prop **118** is used to facilitate snap over of the blade when the blade is in the released position. This action is referred to as "cocking" the unit. The prop **118** is mounted for swinging movement on a pair of brackets **120** projecting from the lower side of the tension bar **86**. A hinge spring **122** urges the prop **118** to swing counterclockwise as viewed in FIG. **12**. Rotation of the prop **118**, however, is restricted by a pair of cams **124** which engage the cam surface **126** on the reactor **66**. The cams **124** cause the prop **118** to swing rearwardly to the position shown in FIG. **12**, when the blade **78** has snapped over to the release position. When the unit is cocked so that the blade **78** is in the opposite stable position, the cams **124** engage the surface **126** on the reactor **66** (FIG. **6**) and hold the prop in its raised position. The lower end of the prop **118** is in the shape of a cog **128** in order to engage one of a series of transverse grooves **130** in the bracket **14**.

A spring **132** is connected between the bracket **14** and the blade **78**, as shown in FIG. **12**, to displace the blade **78** forwardly when the blade snaps over to the release position until the retaining screw **98** engages the outer end of the slot **96**. The hinge spring **122** swings the prop **118** downwardly when the blade snaps over and the spring **132** insures that the housing is sufficiently forward to permit the spring loaded prop **118** to support the tension bar **86** when the skier presses the heel of his boot downwardly on the lever **32**.

The front wall **44** of the housing also includes a pair of flanges **134**. The front face of each flange **134** has transverse serrations (FIG **6**), and a heel clamp **136** is secured to the serrated faces of the flanges **134** by screws **135**. The heel clamp **136** has slotted openings **137** to permit vertical adjustment of the heel clamp **136** relative to the housing **40** to accommodate boot heels of various heights. The clamp **136** has a transverse shoulder **138** for engaging a plate **139** on the upper edge of the boot heel, as shown schematically in FIG. **5**. The heel clamp **136** also includes a pair of cam surfaces **140** (FIG. **9**) which are in position to be engaged by the boot heel plate **139** to resist lateral movement of the heel.

The housing **40** is enclosed by a cover **141**. The cover includes opposite sidewalls **142**. The cover **141** is mounted on brackets **143** projecting outwardly from the sidewalls **46** of the housing and is secured to the housing by screws **144**. The sidewalls are provided with arcuate slots **145** which are aligned with the ends of the shaft **38**, as shown in FIG. **7**. An appropriate scale **146** is marked along the slot **145** to indicate the force required for release of the unit. The cover has an opening **148** (FIG. **2**) through which the head of the screw **100** extends. The opening **148** allows access to the screw **100** for adjusting preload on the blade **78**. The cover does not extend across the front of the housing **40** and the head **62** of the worm shaft for adjusting the leverage is accessible.

OPERATION OF THE HEEL UNIT

In order to cock the unit from the release position as shown in FIG. **12**, the heel of the boot is applied against the lever **32** with the edge of the heel resting against the boot stop **26**. As the skier applies his weight to the boot heel, the bar **30** which is connected with the lever **32** moves downwardly along the inclined portion of the slot **28**. The motion of the bar **30** is transmitted through the yoke **34** and through the shaft **38** to the housing **40**, thereby exerting a downward force on the housing. Movement of the housing is resisted by the prop **118** which engages one of the grooves **130**. The reaction force transmitted through the prop **118** is applied to the tension bar **86**, thereby causing the housing **40** to rotate about the screws **88** which connect the tension bar **86** with the reactor **66**. The relative motion between the reactor **66** and the tension bar **86** ultimately causes the blade **78** to snap over to its opposite stable position.

The linkages are designed such that the bar **30** is in the horizontal leg of the slot **28** when snapover occurs. When the blade snaps over, the projection **126** on the reactor **66** immediately swings the prop **118** out of the grooves **130** and the housing moves suddenly to the position shown in FIG. **5**. The bias of the blade **78** urges the clamp **136** toward the surface of the ski **6** and the shoulder **138** in the clamp engages the plate **139** projecting rearwardly from the heel of the boot **8**.

If the heel of the boot attempts to lift from the platform **22**, the force of the heel is transmitted through the clamp **136** to the housing **40**. The housing **40** is prevented from moving upwardly by the shaft **38** which is held in position by the yoke **34**. The housing, however, can accommodate upward movement at the heel by rotating clockwise, as viewed in FIG. **5**, around the shaft **38**. This motion of the housing **40** is transmitted through the top **42** of the housing to the reactor **66**. Downward movement of the reactor **66**, however, is resisted by the blade **78**, which at its outer end bears against the transverse ridge **94** on the base plate. As the force exerted upwardly by the heel **8** increases, the blade **78** deflects at the outer end by progressively buckling along the transverse cross sections from the outer end toward the inner edge **76** that is supported on the reactor **66**. The deflection at the outer end of the blade **78** allows limited upward movement of the heel clamp **136** without causing the blade **78** to snap over.

However, when sufficient force is applied through the heel to the heel clamp **139**, the blade **78** snaps over to the opposite stable configuration. The snapping of the blade **78** causes the reactor **66** to rotate clockwise, as viewed in FIG. **5**, about the ends of the screws **88** projecting rearwardly from the tension bar **86**. The motion of the reactor **66** is transmitted to the housing **40** through the arms **68**, thereby causing the housing to rotate clockwise to the position shown in FIG. **12**. At the same time, the prop **118** swings downwardly into position for engaging the transverse grooves **130** and the housing remains in the position shown in FIG. **12**. The snap action of the blade **78** occurs suddenly and the motion of the housing immediately moves the heel clamp **136** away from the heel of the boot so that the boot is free to separate from the ski.

The heel unit also releases when sufficient force is applied laterally. The cam surfaces **140** on the clamp **136** are engaged by the heel plate **139** and when a lateral force is applied, there is a component of force tending to rotate the housing **40** about the shaft **38**. When the lateral force is sufficiently large, the blade **78** snaps over, releasing the heel.

If the skier finds that the upward force required for release is either greater or less than desired, he can change the force setting merely by turning the screw **62** to move the shaft **38** along the slot **48**. In FIG. **5**, the shaft **38** is shown near the left-hand end of the slot **48**, so that a relatively large force is required for release. As the shaft **38** is moved toward the right, the length of the lever arm between the shaft **38** and the heel clamp **136** is increased, so that progressively smaller forces are required for release.

The amount of displacement of the heel off of the platform **22** before release occurs can be adjusted by means of the screw **100**. By turning the screw, the reactor **66** can be moved upwardly or downwardly relative to the tension bar **86**. This displacement of the reactor **66** causes deflection of the outer end **84** of the blade, so that the additional displacement required at the heel clamp **136** for snapover of the blade **78** is correspondingly smaller. This adjustment can easily be made by inserting a coin or other spacer between the heel of the boot and the platform **22** and then tightening the screw **100** until the blade **78** snaps over. The spacer is then removed.

As shown in FIG. **6**, the head of the screw **100** has a conical counterbore to serve as a socket in which the end of a ski pole can be inserted to release the unit easily. This manner of release requires considerably less force than that required at the heel clamp **136** because the lever arm is correspondingly longer. The size and shape of the blade **78** determines the range of forces that can be supported by the blade in its conical configuration. By adjusting the tension exerted by the tension bar **86**, the degree of coning of the blade can be varied. This adjustment is accomplished by turning the screws **88**. Usually this adjustment would be made by the manufacturer and the skier would adjust the force and deflection characteristics by means of the screws **62** and **100**, respectively.

TOE UNIT

The toe binding unit **4** is shown in FIGS. **3** and **13** to **17**. The unit includes a swivel plate **150** which is raised from the surface of the ski **6** and has flanges **152** along the margins of the plate **150**. The swivel plate **150** is secured to the ski **6** by a bracket **154**, which is held in place on the surface of the ski **6** by screws **156**. The bracket **154** includes a threaded center post **158** which is threaded into a sleeve **160**. The sleeve **160** is enclosed within a hollow screw **162** having external threads. The screw **162** is threaded into a ring **164**. A cap **166** is secured on the upper end of the screw **162** to prevent axial movement of the sleeve **160**, while allowing rotation of the sleeve relative to the screw **162**. The cap **166** has a hexagonal opening **168** to receive an Allen wrench for rotating the screw **162** relative to the ring **164**.

A spring biased detent **170** is clamped between the bracket **154** and the surface of the ski **6**. The detent **170** has a spherical projection **172** which is received with a corresponding socket **174** in the swivel plate **150** when the plate is aligned with the longitudinal axis of the ski. When torque is applied tending to rotate the plate **150** about the sleeve **160**, the sides of the socket **174** acts as a cam forcing the projection out of the socket, so that the spring **170** no longer resists swinging movement of the base plate **150**.

A yoke plate **176** is secured to the ring **164** by welding. The plate **176** has an integrally formed bearing portion **178** in which a rod **180** is inserted. A yoke **182** is mounted at the opposite ends of the rod **180** for swinging movement relative to the yoke plate **176**. The upper end of the yoke **182** is formed with a sleeve **184** for supporting a transverse shaft **186**. The yoke **182** is substantially identical to the yoke **34** shown in FIG. **6**.

The shaft **186** extends through arcuate slots **188** in the opposite sidewalls **190** of the housing **192**. The arcuate slots **188** are provided with gear teeth **193** along their respective upper edges, as shown in FIG. **14**, and the outer ends of the shaft **186** are splined to mesh with the gear teeth in the slots. Displacement of the shaft along the slot is accomplished by a worm and gear arrangement corresponding to the worm **58** and gear **56** of the heel unit, as shown in FIGS. **5** and **7**. The gear **194** is shown in FIG. **13**. The worm **196** has a recessed portion under the head which is received in a slot **198** in the front wall **200** of the housing **192**. As shown in FIG. **15**, a retainer **201** similar to the retainer **65** in the heel unit cooperates with the slot **198** for supporting the worm for rotation. A saddle **199** holds the worm **196** in engagement with the gear **194**. The housing also has a top **202**.

A thin blade **204** of resilient material has an inner edge that engages an arcuate notch **206** in a reactor **208**. The inner edge of the blade **204** has a larger radius of curvature than the bottom of the notch **206** and tabs extend rearwardly from the arcuate edge of the blade and are secured in a transverse tension bar **210**. The bar **210** is spaced for pivotal movement relative to the reactor **208** by a pair of screws **212**. The blade **204** and the mounting arrangement for the blade in the reactor **208** and tension bar **210** and their associated components are substantially identical to the corresponding components of the heel unit, as previously described. The outer end of the blade **204** rests against a lateral ridge **214** on the swivel plate **105**. A retaining screw **216** extends through a longitudinal slot **220** in the blade and restricts lateral movement of the outer end of the blade while allowing longitudinal movement along the slot **220**.

The reactor **208** has a pair of arms **222** extending rearwardly. Each arm has a projection **224** which is received in a hole **226** in the wall **190** to allow swinging movement of the reactor relative to the housing **192**. The preload on the blade **204** is applied by a screw **228** which extends through the reactor **208**. The screw has a shoulder **230** which bears against the lower surface of the top **202** and by turning the screw, the position of the reactor **208** relative to the top **202** can be adjusted in the same manner as the reactor **66** of the heel unit. A spring clip **232** under the head of the screw engages flats formed under the screw head to resist rotation of the screw. The screw **228** is received in a slot **234** in the top **202**.

At the rear of the housing **192**, there are a pair of rearwardly projecting flanges **236** and **238**. A toe clamp **240** is mounted between the flanges for limited rotational movement about a hinge pin **242**. A toe guide **244** below the clamp **240** is pivotally mounted on the transverse bar **180**. The guide has rearward projections **246** which bear against the lower surface of the toe clamp **240**. An inclined cam surface **248** is provided on the lower edge of the projections **246** for engaging an abutment **250** in the toe of the boot **8**. As shown in FIG. **14**, the boot **8** has slots **252** which receive the projections **246**. The plate **150** has a raised platform **254** which is spaced rearwardly from the projections **246**, so that the edge of the boot **8** overhangs the platform **254** and can be wedged against the cam surface **248**.

In order to allow the base to swing freely over the surface of the ski **6**, a friction reducing block **256** is positioned between the platform **254** and the surface of the ski. The block **256**, as shown in FIG. **14**, is covered with a layer **257** of low friction material such as polytetrafluorethlyene.

The housing **192** is enclosed by a cover **258** which is mounted on a pair of lateral tabs **260** which project outwardly from the sides **190** of the housing **192**. The cover **258** has an access opening for the reactor adjustment screw **228** and an opening **264** to allow access to the leverage adjustment worm **196**. The housing top **202** also has an opening **266** through which an Allen wrench can be inserted in the socket **168** to adjust the height of the plate **176** relative to the housing **150**.

OPERATION OF THE TOE UNIT

In order to clamp the boot toe in the toe binding unit, it is necessary to cock the unit so that it is in the position shown in FIG. **14**. This can easily be done by pressing down on the toe clamp **240**. The toe of the boot **8** is inserted while the heel of the boot is raised. The boot is moved forwardly until the front edge of the boot engages the toe clamp **240**. The heel of the boot is then moved downwardly to rest on the heel support surface of the heel binding unit. This movement causes the surface **250** of the grooves **252** in the toe of the boot to engage the cam surfaces **248** on the toe guide **244** and to lift up the front unit slightly, thereby introducing a slight deflection at the outer end of the blade **204**.

When a lateral force is applied to the toe of the boot, this force is transmitted through the side of the groove **252** which bears against the projection **246**. When sufficient lateral force is applied to release the detent **170**, the housing and base plate **150** swing together as a unit relative to the bracket **154**. As the toe clamp **240** continues to move laterally toward the right, as viewed in FIG. **16**, for example, the clamp **240** swings clockwise about the pin **242** to maintain its engagement with the toe of the boot on opposite sides of the projections **246**. Gradually, as the surface **250** of the left-hand groove **252** and the left-hand projection **246** swings toward the central axis of the ski, the surface exerts a force forwardly on the cam surface **248**. Since the toe surface **250** is inclined, there is an upward component of force acting on the toe guide **244**, and this motion is transmitted through the toe clamp **240** to the housing **192**. When sufficient force has been applied through the surface **248**, the blade **204** snaps over and immediately releases the toe of the boot. The toe binding also releases, if an upward force is applied through the toe of the boot to the guide **240**, such as occurs when the tip of the ski is caught on a chair lift or exposed root, or some other obstruction. The force and the deflection required for release is adjusted in the same manner as the rear binding by means of the screws **196** and **228**, respectively. The front binding is also adjustable for boots of various thickness. By inserting a wrench into the socket **168** and turning the barrel **164** relative to the plate **176**, the position of the cam surface **248** relative to the platform **250** can be adjusted.

The action of both the front unit and the rear unit in snapping from an operative to a release position permits the units to be easily enclosed to keep out snow. A boot of thin flexible material may be fastened along the edge of the base plate **10** of the heel unit and around the cover **141**. Accordian pleats in the boot would allow relative movement between the cover **141** and the plate **10**. Similarly, a boot may be fastened around the edge of the swivel plate **150** and around the cover **258**. Since the outer end of the blade in both units does not move appreciably relative to the base plate, other than to deflect, the boot may fit closely over the blade, resulting in a neat unitary appearance of the bindings.

MODIFIED HEEL UNIT

A modified form of the heel unit of this invention is illustrated in FIGS. **19** to **23**. The modified heel unit has substantially the same structure as the heel unit illustrated in FIGS. **2** to **12**, except for the arrangement for stressing the blade and for snapping the blade over from a released position to a clamping position. Parts of the heel unit which are substantially the same as is illustrated in FIGS. 2 to 12 are identified with the same reference numeral followed by a prime symbol.

A tension bar **268** is pivotally mounted on the sidewalls **46'** of the housing by a pair of arms **270** having projections which are received in holes **72'** in the sidewalls **46'**. The tension bar **268** supports a reactor **272** by means of a pair of opposed grooves **274** at opposite ends of the tension bar **268**. The grooves **274** have opposed parallel flat surfaces which engage corresponding surfaces on projections **276** at opposite ends of the reactor **272**. The grooves and projections cooperate to resist pivoting movement of the reactor relative to the tension bar **268**. A pair of screws **278** extend through threaded holes in the tension bar **268** and engage the forward edge of the reactor **272**.

The blade **78'** has a curved arcuate edge **76'** and a pair of tab portions **80'** which project forwardly at opposite ends of the arcuate edge **76'**. The tab portions **80'** extend through slots **280** at opposite ends of the tension bar **268**. As shown in FIGS. **20** and **23**, the ends of the tabs **80'** are bent over the forward edge of the tension bar **268** and welded at the top surface of the tension bar. The reactor **272** has an arcuate groove **282** in which the edge **76'** of the blade is received. As shown in FIG. **20**, the length of the reactor groove **282** is substantially less than the length of the arcuate edge **76'** to provide a transition zone for the blade between the connection of the tabs **80'** with the tension bar **268** and the edge **76'** with the reactor **272**. The shape of the reactor **272** allows the center portion where the groove **282** is located to deflect forwardly as the blade snaps over from one stable position to the other. The adjustment screw **100'** extends through a threaded slot **284** in the reactor **272** for adjusting the position of the reactor and the tension bar relative to the top of the housing **42'**.

To assist in snapping over the blade **78** from a released position to a clamping position, a pivoted prop **286** is provided. The prop **286** has a pair of tabs **288**. A U-shaped bracket **290** is supported on the blade **278'** and the legs of the bracket **290** are pivotally connected with the tabs **288** by a pin **292**. The bracket **290** has a central slot **294** with opposed projections **296** for engaging the blade **78'** at a point spaced from the arcuate groove **282** in the reactor **272**. The arcuate edge of the blade **78'** is gripped at the ends of the slot **294**, as shown in FIG. **23**. By mounting the bracket **290** in this way, the bracket swings from the position shown in FIG. **19** to the position shown in FIG. **21** when the blade snaps over to the released position. The stop bracket **14'** has a plurality of V-shaped grooves **298** which are in position for engagement by the lower end of the prop **286**. A spring **300** extends between the end of the bracket **14'** and the blade **78'** for urging the blade forwardly in the slot **96'** (FIG. **20**). Another spring **302** is connected between the blade **78'** and the prop **286** for urging the prop to swing downwardly to the position shown in FIG. **21**.

The operation of the modified heel unit, as shown in FIGS. **19** to **23**, is substantially the same as that of the heel unit shown in FIGS. **2** to **12**. As an upward force is applied to the housing by a ski boot, the top **42'** and sidewalls **46'** swing downwardly imposing additional forces on the blade **78'** and causing the end of the blade to deflect against the transverse ridge **94'** on the base. When the blade **78'** is no longer able to support the force exerted by the ski boot, the blade snaps over to the position shown in FIG. **19** which frees the prop **286** to be pulled downwardly by the spring **302** into engagement with the transverse grooves **298**. In order to clamp the binding on a ski boot again, the heel of the boot is pressed downwardly against the step lever. The prop **286** resists downward movement of the reactor **272**, thereby causing the blade to snap over to the position shown in FIG. **19**. As soon as the blade snaps, the bracket **290** swings to the position shown in FIG. **19** and the prop is pulled against the bottom of the reactor **272** and into the position shown in FIG. **19**. The adjustment of the deflection of the outer end of the blade **78'** is accomplished by turning the screw **100'**. This changes the orientation of the reactor **272** relative to the housing, since the tension bar **268** is pivotally mounted by means of the arms **270** on the sidewalls **46'** of the housing. When the blade snaps to release position, however, the prop **286** is in position to engage one of the grooves **298**, regardless of the adjusted position of the reactor **272** at the time that the blade snaps.

Although the modified structure of the reactor **272** and the tension bar **268** have been described with respect to the heel unit, this structure may also be substituted for the corresponding structure in the toe unit. Of course, the toe unit does not include the prop **286** and so the prop and associated structure is not necessary in the toe unit.

The toe and heel binding units of this invention have many advantages over prior ski bindings. The release action uses the elastic behavior of a progressively buckling transversely arched, normally flat sheet material to provide a uniform and repeatable release characteristic. The release mechanism is substantially free of friction and is not adversely affected by accumulations of ice and snow in the binding. The force and displacement desired for release can be adjusted precisely without disassembling the binding and without requiring any special tools. The mechanism permits the binding to be set by placing a spacer under the heel and then adjusting the displacement screw until the binding releases. The spacer is then removed. The toe unit is set by turning the boot to the desired release angle and then adjusting the displacement screw until release occurs.

Both the toe unit and heel unit provide positive clamping of the boot to the ski. The blade continually exerts a restoring force on the boot urging it to return to its original position. The toe and heel units promote safety since they release both to the side and upwardly.

While this invention has been illustrated and described in several preferred embodiments, it is recognized that variations and changes may be made therein without departing from the invention, as set forth in the claims.

What is claimed is:

1. A ski binding comprising:

a base,

clamping means on said base, said clamping means including a transverse pivot shaft mounted on said base and including lever means extending longitudinally of said base and pivotally supported on said shaft,

spring means extending between said lever means and said base, said clamping means including a boot clamping abutment, said abutment being on the opposite side of said transverse shaft from said spring means, said spring means yieldably resisting pivoting of said lever means about said shaft in a direction which moves said clamping abutment away from said base, and

release means mounted between said spring means and said lever means for removing the resistance of said spring means in response to pivoting of said lever means about said shaft when said abutment means has moved a predetermined distance away from said base, said release means allowing said lever means to pivot about said shaft to move said abutment away from said base a distance greater than said predetermined distance without interference by said spring means, whereby release of said ski boot occurs substantially instantaneously and without sudden variations in spring resistance prior to release.

2. The ski binding according to claim **1** including a second transverse shaft on said base, link means extending between said second shaft and said pivot shaft, and means for displacing said second shaft relative to said base upon movement of said abutment beyond said predetermined distance, whereby said clamping abutment moves away from said base upon release.

3. The ski binding according to claim **1** wherein said lever means includes means for adjusting the distance separating said clamping abutment and said spring means from said shaft, whereby the spring force transmitted by said spring means to clamping abutment is adjustable.

4. A ski binding comprising: a base, clamping means on said base, said clamping means being movable a predetermined distance relative to said base from a position for clamping a ski boot on said base to a position wherein a ski boot would be released in response to a predetermined force applied to said clamping means in a predetermined direction, said clamping means including a clamping abutment and lever means movable with said abutment about a transverse axis relative to said base, spring means yieldably resisting displacement of said clamping means, said spring means providing progressively increasing resistance in response to displacement of said clamping means in said direction until said predetermined force causes said clamping means to move to said released position, said spring means including a blade having an inner end and an outer end, said blade outer end being in engagement with said base, said blade inner end being connected with said lever means for deflecting said blade upon pivoting said lever means about said axis, said spring means having a greater resistance to deflection adjacent said inner end than adjacent said outer end, and means for adjusting the magnitude of said predetermined distance substantially independently of said predetermined force, whereby said blade deflects progressively from adjacent said outer end toward said inner end.

5. The ski binding according to claim 4 wherein said clamping means includes a transverse shaft supporting said lever means for pivoting movement about said shaft.

6. The ski binding according to claim 5 including a transverse bar, means mounting said bar on said base, and means connecting said shaft with said bar for swinging movement of said shaft along a cylindrical path about said bar, whereby swinging said shaft along said path changes the leverage between said abutment and said blade, and said bar retains said lever means in a predetermined position with respect to said base during movement of said shaft along said path.

7. The ski binding according to claim 6 wherein said lever means includes a housing having a pair of side walls extending longitudinally of said lever means, said side walls having arcuate slots therein, said shaft extending through said slots, and means for temporarily locking said shaft against movement along said slots.

8. A ski binding comprising a base, a housing, means connecting said housing with said base, said connecting means including means for pivoting said housing about a transverse axis relative to said base, means on said housing cooperating with said base for clamping a ski boot, reaction means, said reaction means including a blade of thin resiliently flexible sheet material interconnecting said housing and said base, said blade being stressed to seek to assume a substantially conical bistable configuration and being capable of snapping from a concave configuration on one face of said blade to a concave configuration on the opposite face of said blade upon a predetermined deflection of said blade against said base, said transverse axis being between said blade and said clamping means, said clamping means being rendered ineffective upon snapping of said blade from one configuration to the other, whereby the application of a force against said clamping means is transmitted through said housing to said blade to deflect said blade against said base progressively and ultimately to snap said blade when a predetermined force is applied to said clamping means.

9. A ski binding according to claim 8 wherein said blade has adjacent said housing a bearing edge located intermediate the lateral margins of said blade and having legs extending outwardly therefrom at locations on opposite sides of said bearing edge, said reaction means also including means for pressing against said bearing edge and for pulling on said legs to load said blade so that said sheet material thereof adjacent said bearing edge is in compression and the sheet material thereof spaced from said edge is in tension, whereby said blade is distorted elastically to seek alternately both of said concave configurations.

10. A ski binding according to claim 9 wherein said pressing and pulling means includes a reactor, said reactor having an arcuate groove therein, said bearing edge being arcuate and having a greater radius of curvature than said reactor groove, said bearing edge being received in said reactor groove, and includes means interconnecting said blade legs, said interconnecting means being spaced from said reactor and being movable relative to said reactor.

11. A ski binding according to claim 10 wherein said interconnecting means includes a bar, screw means extending between said bar and said reactor, whereby adjustment of said screw means changes the spacing between said bar and said reactor, thereby changing the stresses induced in said blade by said reactor and said interconnecting means.

12. A ski binding according to claim 8 including means for selectively changing the deflection of said blade against said base when a ski boot of predetermined dimensions is clamped by said clamping means, whereby the amount of additional deflection of said blade necessary to cause snapping of said blade can be adjusted.

13. A ski binding according to claim 12 wherein said deflection changing means includes screw means between said housing and said reaction means, said reaction means being displaced relative to said housing upon operation of said screw means.

14. A ski binding according to claim 8 wherein said connecting means including a tension link, means pivotally fastening one end of said tension link to said base, the other end of said tension link being pivotally fastened to said housing at said transverse axis, said tension link being inclined rearwardly when a boot is clamped in said clamping means, whereby said tension link draws said housing forwardly.

15. A ski binding according to claim 8 including means for adjusting said transverse axis forwardly and rearwardly relative to said housing, whereby the leverage of said clamping means and said reaction means is adjustable.

16. A ski binding according to claim 15 wherein said connecting means includes a tension link mounted at one end for swinging movement relative to said base about an axis parallel to said transverse axis, the other end of said link being pivotally fastened to said housing at said transverse axis, said adjusting means including an arcuate guide on said housing, and means for selectively displacing said link other end along said guide.

17. A ski binding according to claim 10 including a pair of arms on said reactor, said arms projecting forwardly of said reactor groove and being mounted on said housing for swinging movement about an axis parallel to said transverse axis, said arms axis being positioned relative to said transverse axis to swing said housing about said transverse axis in the direction of rendering said engaging means ineffective upon snapping of said blade.

18. A ski binding according to claim 10 wherein said interconnecting means includes a pair of arms, said arms being mounted on said housing for swinging movement about an axis parallel to said transverse axis, said arms axis being positioned relative to said transverse axis to swing said housing about said transverse axis in the direction of rendering said engaging means ineffective upon snapping of said blade.

19. A ski binding according to claim 10 wherein said interconnecting means includes a tension bar having a pair of opposed slots, opposite ends of said reactor being received in said bar slots, means restricting rotation of said reactor relative to said tension bar, means securing said blade legs at opposite ends of said tension bar whereby said tension bar slots allow adjustment of the spacing between said reactor and said tension bar.

20. In a ski binding having a base, lever means for engaging a portion of a ski boot, and means for resisting movement of said lever means in a direction which would allow release of said boot, said resisting means comprising a thin resilient element of sheet material including a longitudinally extending segment having a first end spaced from said base and a second end adjacent said base and front and back faces, said segment having a first stable three dimensional configuration in which

the front face portion extending longitudinally from said first end is concave in a transverse direction and in which the cross buckling modulus of successive transverse cross sections of said segment decreases monotonically from said first end, said lever being connected with said first end of said segment for moving said first end toward said base when said lever means is moving in said boot release direction and elastic buckling of successive transverse cross sections of said segment progresses longitudinally along said segment to said first end thereof and then said segment snaps over and assumes a second three dimensional configuration in which the front face portion extending longitudinally from said first end is convex, whereby said successive elastic buckling of said segment progressively increases resistance to movement of said lever in said release direction until said segment snaps over.

21. In a ski binding according to claim **20** wherein said resisting means includes a reactor adjacent said first end, said segment having an arcuate edge along said first end, said reactor having an arcuate groove therein, said segment edge being received in said reactor groove and having a greater radius of curvature than said reactor groove, said segment extending laterally at opposite ends of said edge, and means for applying tension in said segment along said lateral portions, said tension applying means acting in a direction urging said edge into said groove and thereby stressing said segment in compression adjacent said groove and in tension along said lateral portions.

22. In a ski binding according to claim **21** wherein said resisting means includes means for adjusting the deflection of said segment adjacent said second end due to elastic buckling of successive transverse cross section, whereby additional deflection of said deflecting direction by said lever means necessary to cause snap over of said segment can be adjusted.

23. In a ski binding according to claim **21** wherein said tension applying means includes a tension bar interconnecting said lateral portions, means for pivoting said tension bar about a transverse axis relative to said reactor, a prop, means pivotally mounting said prop on said tension bar for swinging movement about an axis parallel to said tension bar pivot axis, abutment means on said base for supporting said prop, and means for swinging said prop into engagement with said supporting means upon rotation of said reactor about said pivot axis during snapover of said segment, whereby said prop temporarily supports said tension bar to facilitate snapping said segment back to said first three dimensional configuration.

24. In a ski binding according to claim **21**, wherein said tension applying means includes a tension bar interconnecting said lateral portions, a prop, means mounting said prop on said segment adjacent said first end, abutment means on said base for supporting said prop, and means for swinging said prop into engagement with said supporting means upon snapping of said segment in said boot release direction, whereby said prop temporarily supports said reaction and segment to facilitate snapping said segment back to said first three dimensional configuration.

25. A ski binding comprising a base, a housing, said housing having a top and opposite side walls, tension link means connecting said housing with said base for rotation about a transverse axis, a thin resilient segment of sheet material having an inner end and an outer end, said inner end including an arcuate edge, segment stressing means, said stressing means including arms mounted on said side walls for pivoting said housing and stressing means relative to each other about a transverse axis spaced from said tension link axis, said stressing means including a reactor having an arcuate groove with a smaller radius of curvature than said segment edge, said segment having lateral portions at opposite ends of said arcuate edge, said stressing means also including a transverse tension bar secured between said lateral portions at opposite ends of said arcuate edge, said segment being stressed by said tension bar and said reactor to assume a first three dimensional stable configuration in which the front face portion extending longitudinally from said inner end is convex in a transverse direction, and in which the cross buckling modulus of successive transverse cross sections of said segment decreases monotonically from said inner end. The back face of said segment being opposite said base, and means on said housing for engaging a portion of a ski boot and resisting forces applied in a direction away from said base.

26. A ski binding according to claim **25** wherein said housing side walls each include an arcuate slot, a transverse shaft, said link means including a tension link having bearing means for supporting said transverse shaft, said shaft extending through said slots in each side wall, said tension link being pivotally mounted on said base for swinging movement about said transverse axis, and means on said housing for selectively displacing said shaft along said slot.

27. The ski binding according to claim **26** including splines on said shaft at opposite ends thereof, said slots each having gear teeth along the side opposite said base, said gear teeth being in position to engage said splines on said shaft, and including means for rotating said shaft relative to said tension link, whereby said shaft is displaced progressively along said arcuate slot.

28. A ski binding according to claim **27** wherein said rotating means includes a worm and a gear on said shaft in engagement with said worm, means on said housing holding said worm against axial movement, whereby rotation of said worm rotates said gear and shaft for displacing said shaft along said slot, the helix angle of said worm being sufficiently great for friction locking said worm against rotation by said gear.

29. A ski binding according to claim **28** wherein said side walls each include an arcuate step, said step in each side wall being aligned with said arcuate slot, thereby offsetting the side of said slot adjacent said base from said geared side, said splines terminating intermediate said offset side of said geared side, whereby said splines engage only said geared side.

30. A ski binding according to claim **26** wherein said tension link includes bearing means supporting a transverse bar, said base including a bracket extending upwardly from said base, said bracket having a slot therein projecting forwardly and upwardly from said base, said bar being received in said slot and being movable along said slot, a step lever adjacent said base, said step lever being hingedly mounted on said bar, whereby snapping of said segment displaces said bar along said slot, thereby lifting said lever relative to said base and said lever being in position for cocking said unit when said lever is raised.

31. A ski binding according to claim **30** including means for temporarily supporting said stressing means on said base when said segment is snapped over to said second configuration.

32. A ski binding according to claim **30** wherein said bracket includes a guide surface in position for engagement by the heel of a boot and positioning said boot with respect to said base, said housing including a heel clamp, said clamp having a shoulder positioned in opposition to said base when said segment is in said first configuration and means for adjusting said shoulder relative to said base.

33. A ski binding according to claim **32** wherein said heel clamp includes cam surfaces at opposite ends of said shoulder, said cam surfaces being inclined laterally, whereby the lateral force of a heel against said cam is transmitted to said segment tending to snap over said segment from said first configuration to said second configuration.

34. In a ski binding unit of the type having a boot supporting surface, means for dislodging ice and snow from said boot comprising a plurality of corrugations on said support surface, said corrugations including inclined side walls and peaks, said inclined side walls having a surface of a low coefficient of friction, said peaks having a surface of a higher coefficient of friction than said side walls whereby said peaks wedge into accumulations of ice and snow of a boot when said boot is placed on said surface.

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