United States Patent [19]

Druss et al.

[11] 3,727,932

[45] Apr. 17, 1973

[54] **SKI BINDING**

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[73] Assignee: **Chimera Research and Development, Inc.,** Holliswood, N.Y.

[22] Filed: **Mar. 30, 1970**

[21] Appl. No.: **23,876**

[52] **U.S. Cl.** ..... **280/11.35 K**

[51] **Int. Cl.** **A63c 9/08**

[58] **Field of Search** ..... 280/11.35 R, 11.35 D, 280/11.35 C, 11.35 K; 36/36, 36 B, 15, 42, 41, 66, 2.5 AL, 2.5 AA; 220/55 Y, 55 K; 292/74

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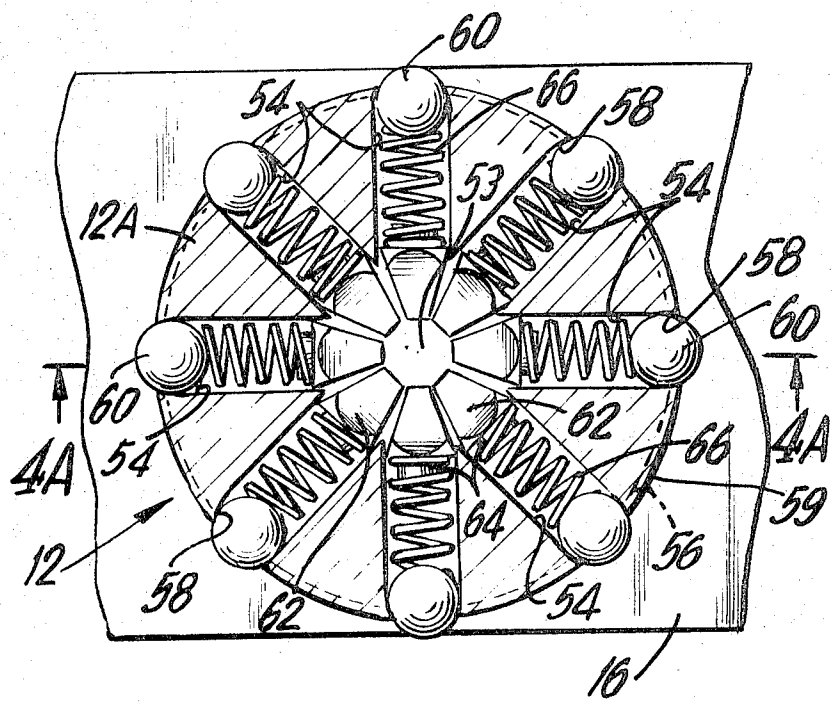
[57] **ABSTRACT**

A ski binding comprising but a single connection between the ski boot and the ski. The essential elements of the binding consist of a plug member and an interengaging socket member, one member being associated with the ski boot and the other with the ski. Optionally, a boot plate may be used to which the respective member may be attached in a conventional manner. In a preferred form, the plug member has simple screw means to adjust the force of loading interengaging spheres or balls, which is the desired release force by which the plug member is allowed to become detached from the socket member. The latter is an annulus of a diameter sufficient to receive the plug member. A plurality of recesses are spaced on the inner wall of the socket member to register with the spheres of the plug member. Any force whether longitudinal of the ski, or as a torque about the skier's body or legs, will develop a reactive force through or about the geometric center of the binding. If the force is sufficient in magnitude and duration an automatic separation of the engaging members is effected in response to the force.

26 Claims, 29 Drawing Figures



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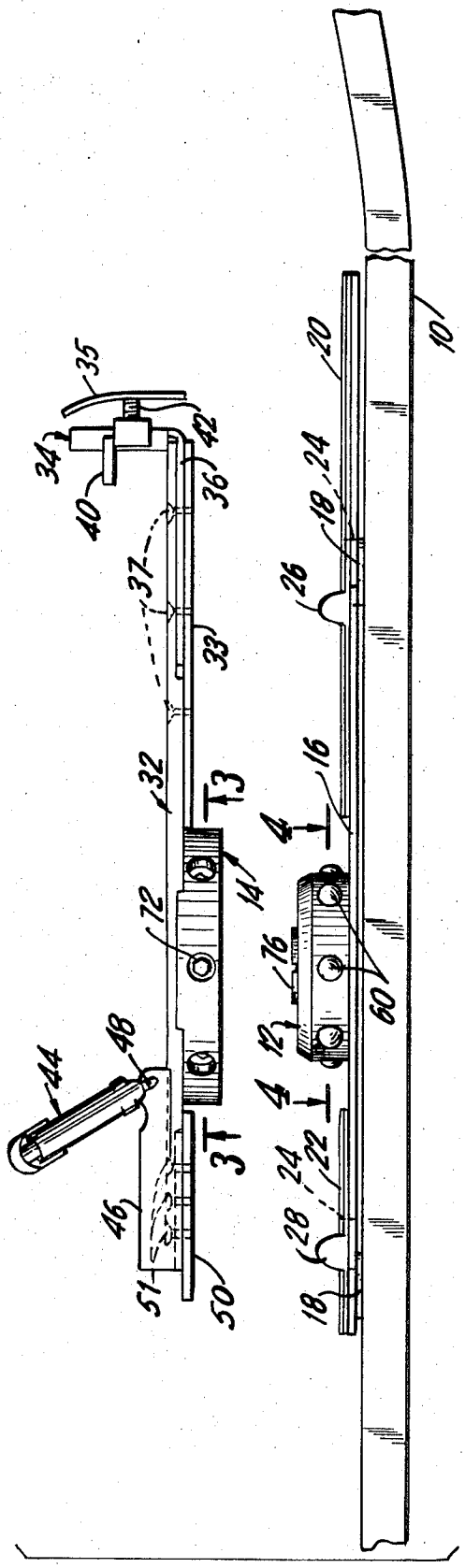

FIG. 1

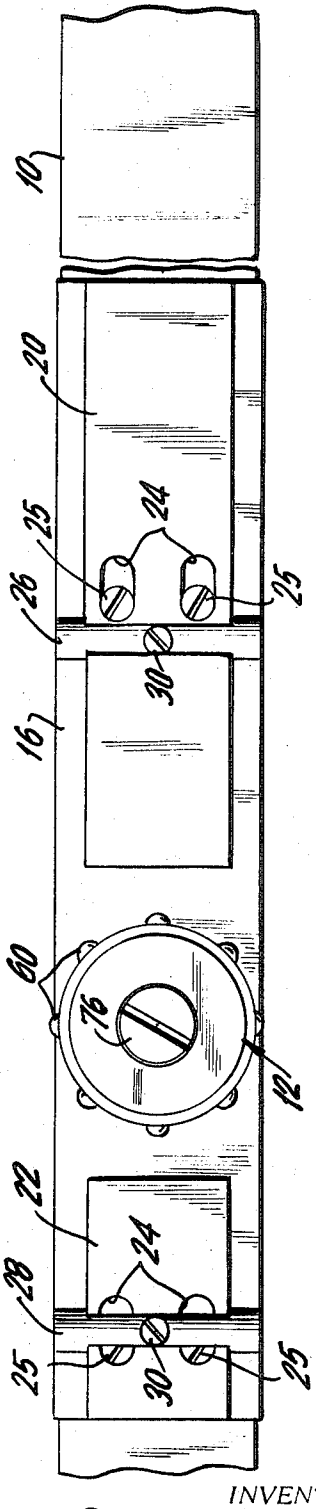

FIG. 2

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ATTORNEY

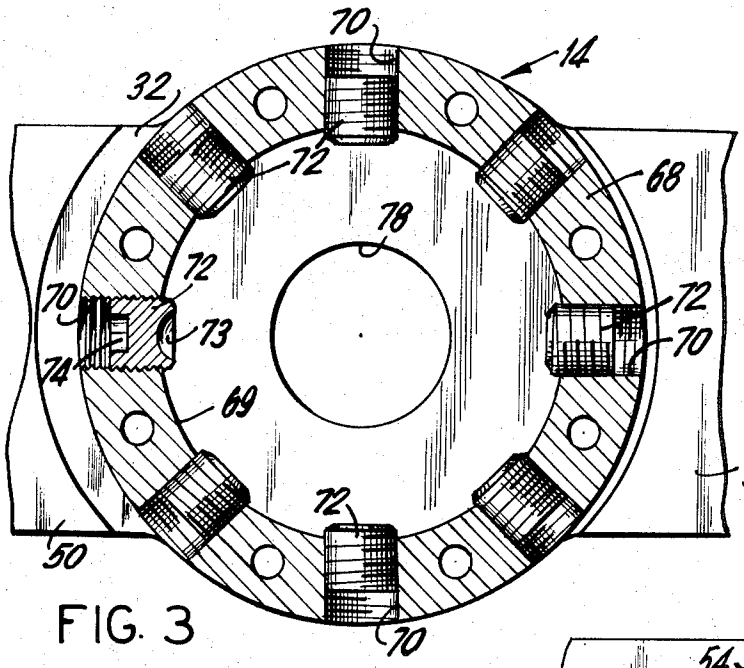

FIG. 3

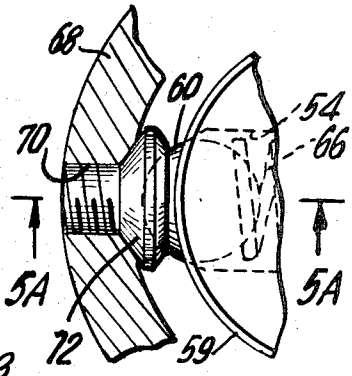

FIG. 5

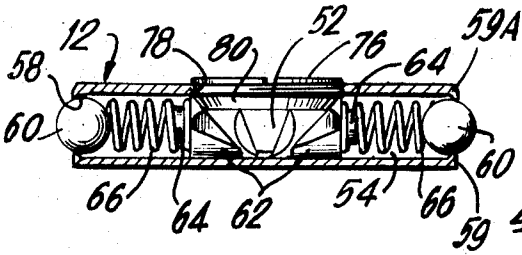

FIG. 4A

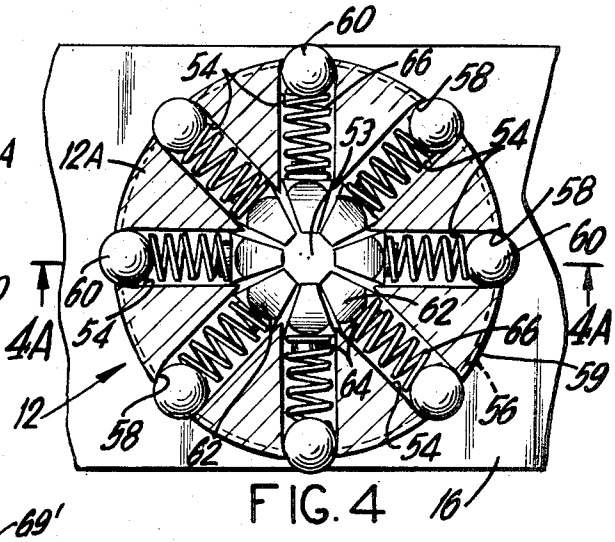

FIG. 4

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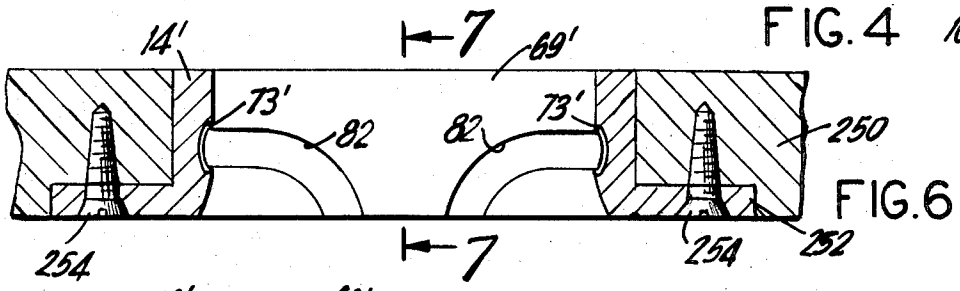


FIG. 6

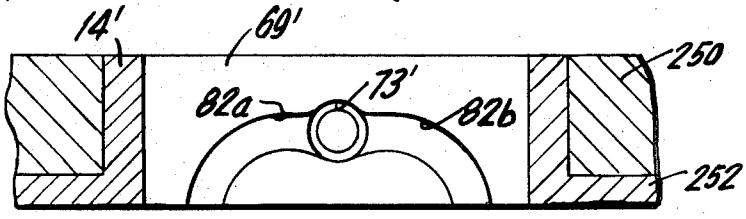


FIG. 7

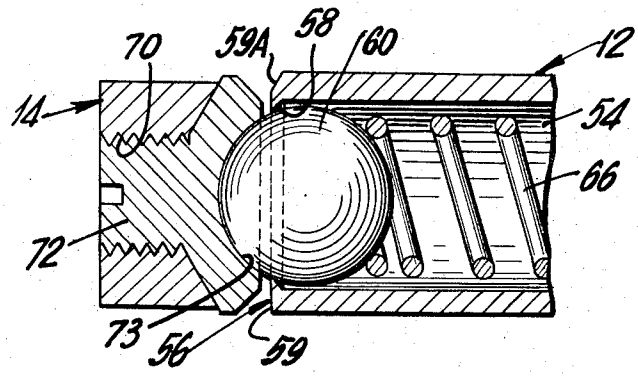


FIG.5A

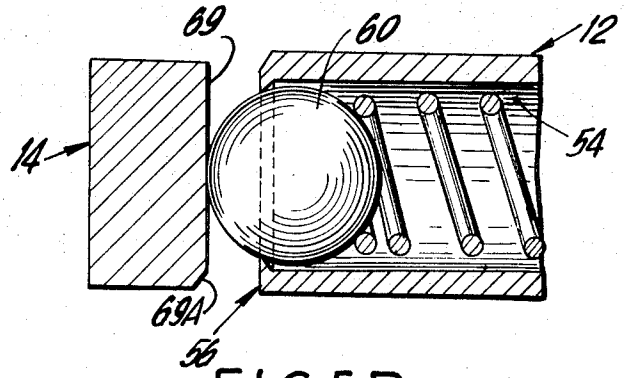


FIG.5B

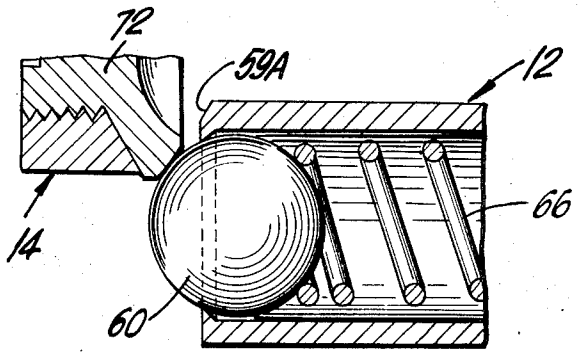


FIG.5C

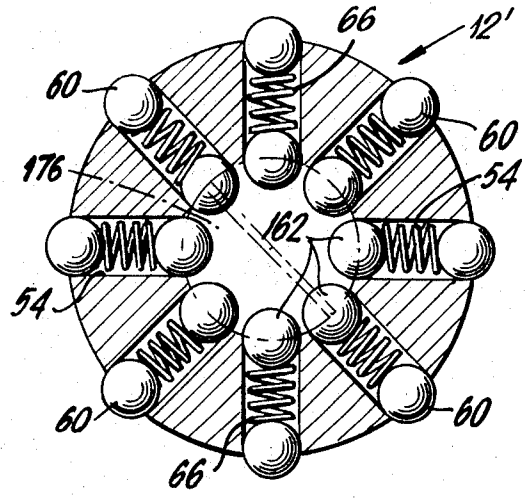


FIG.8

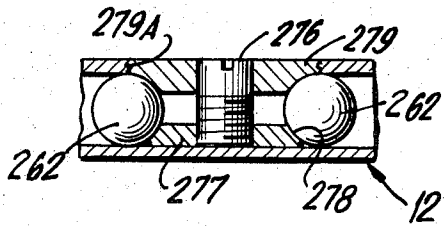


FIG.9A

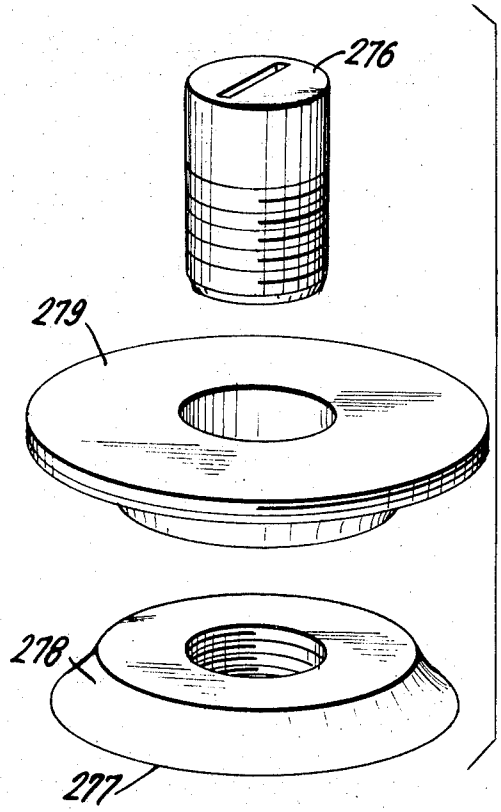


FIG.9

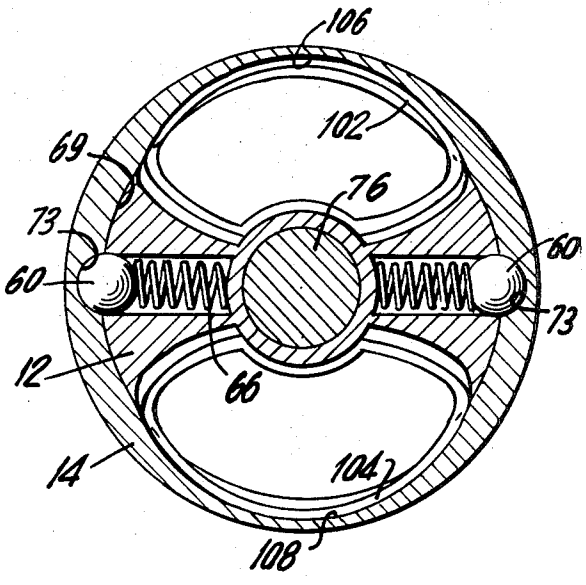


FIG.10

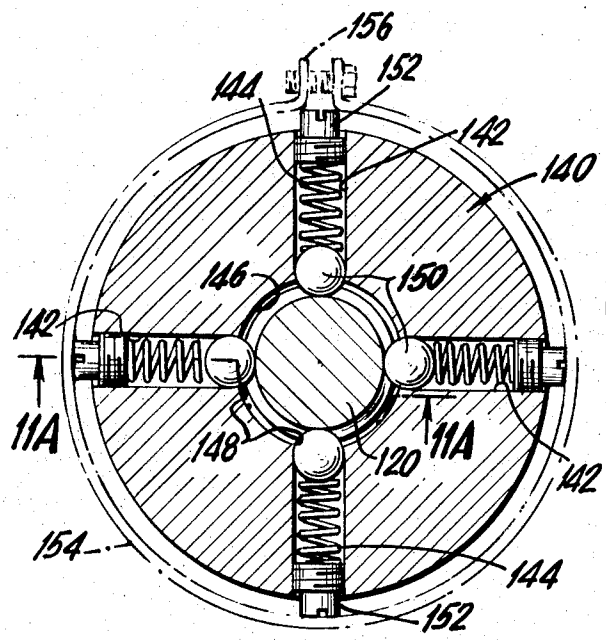


FIG.11

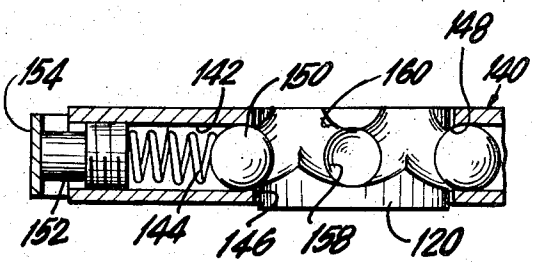


FIG.11A

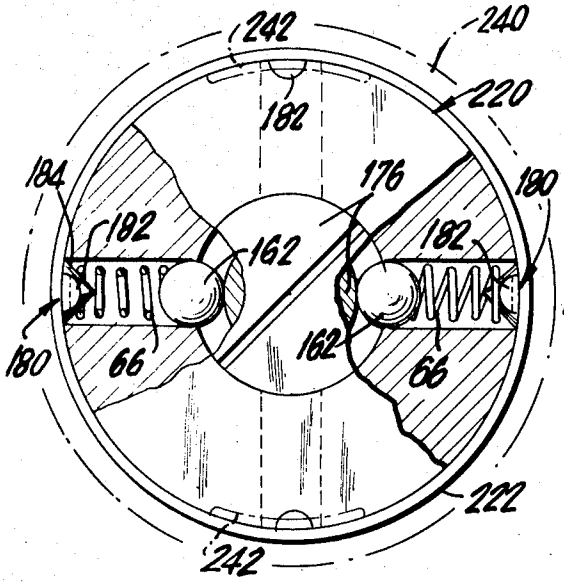


FIG.12

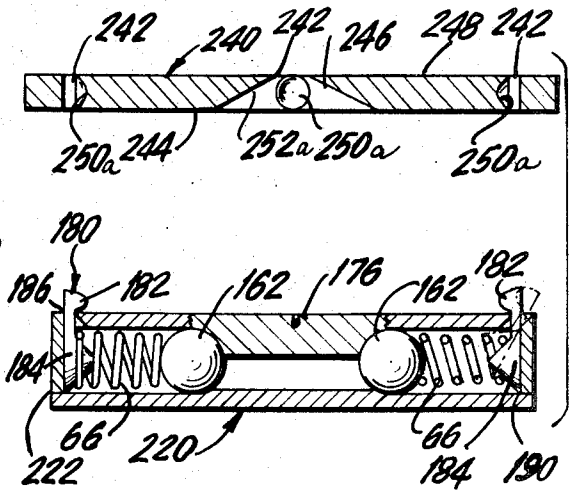


FIG.12A

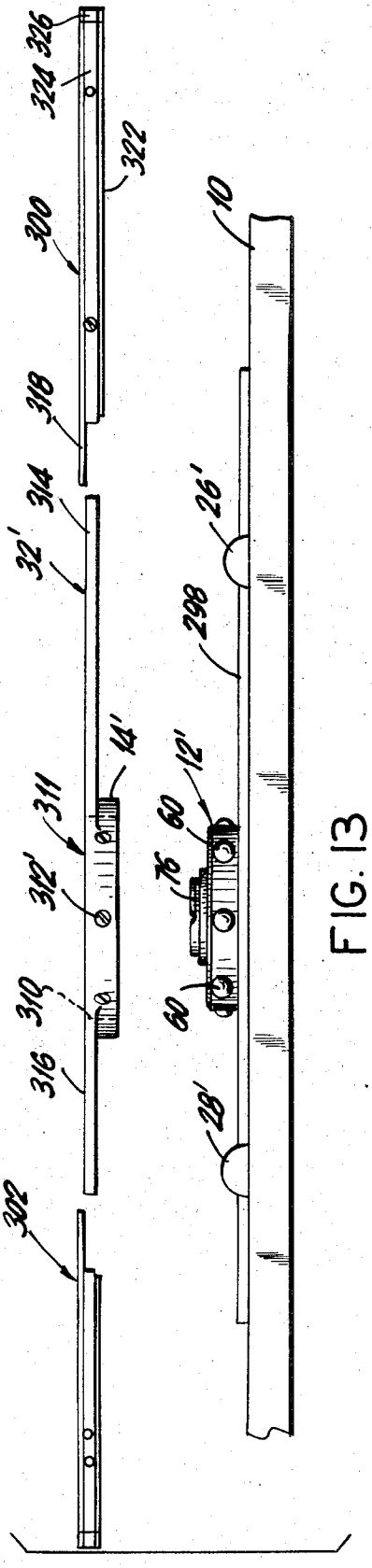


FIG. 13

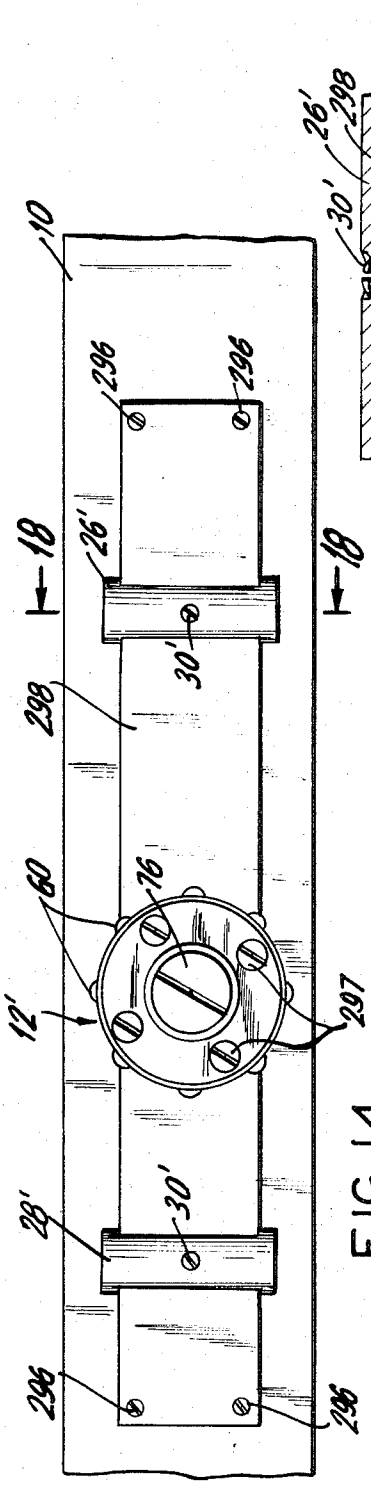


FIG. 14

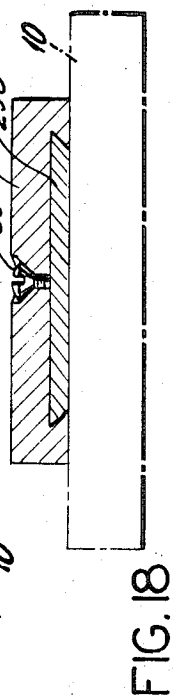


FIG. 18

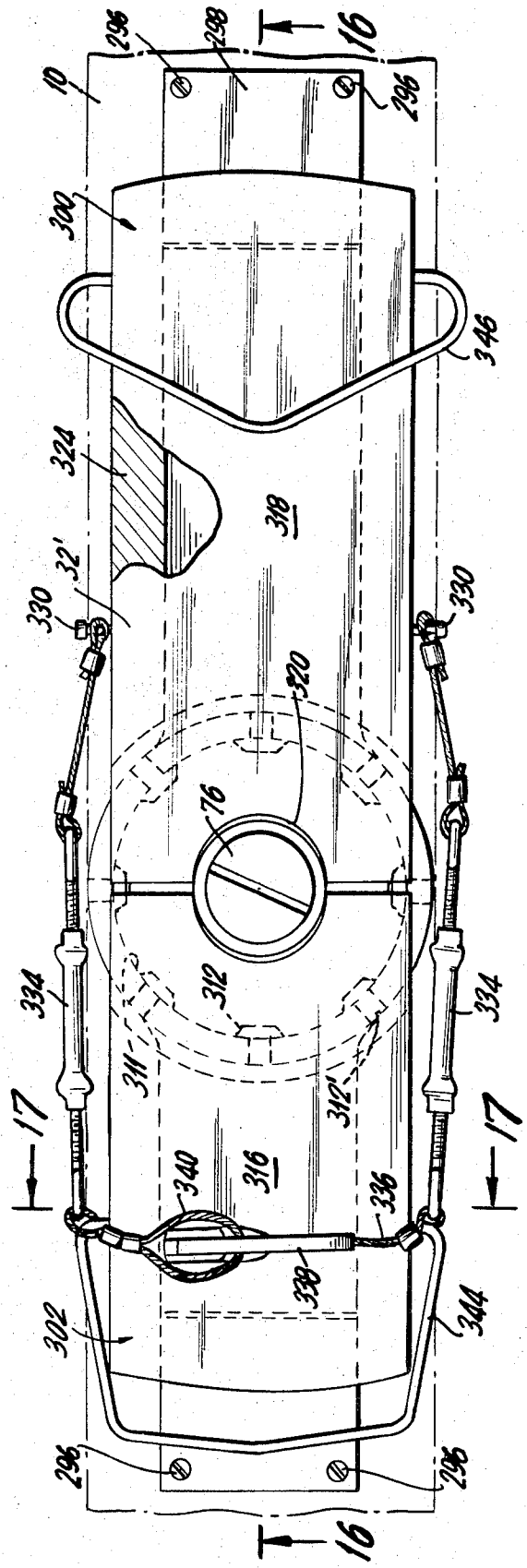


FIG.15

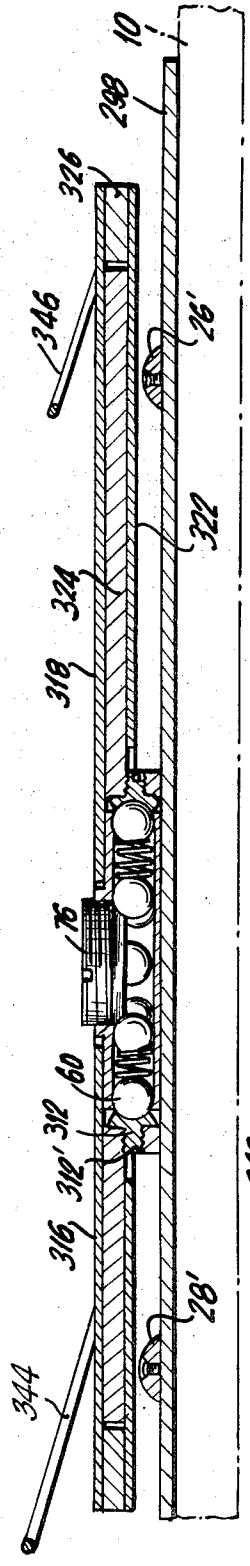


FIG.16

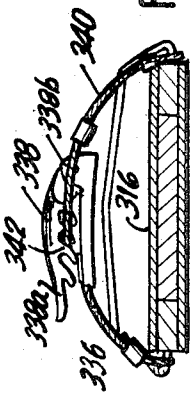


FIG.17

FIG. 19A

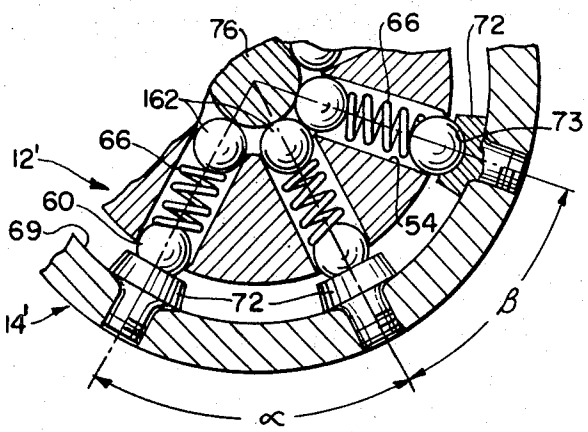
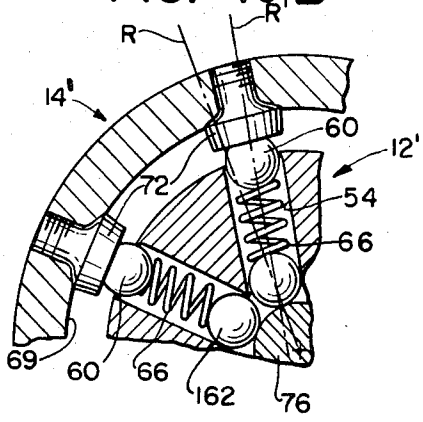


FIG. 19B



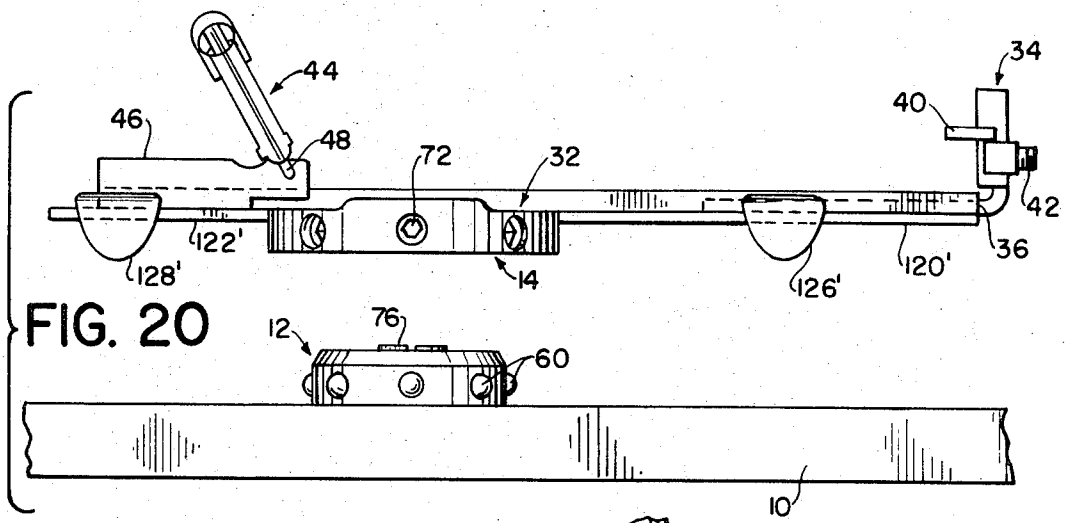
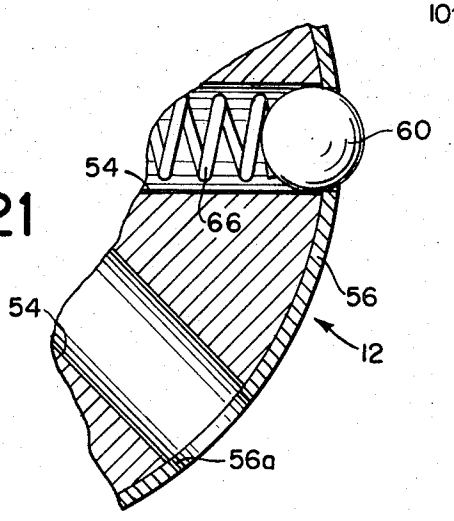


FIG. 20

FIG. 21



SKI BINDING

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to ski bindings and more particularly to ski bindings adapted to release automatically upon being subjected to a force of predetermined magnitude and duration.

2. Prior Art

Heretofore ski bindings provided means attaching a skier's boot to a ski by mechanisms of varying degrees of complexity and reliability, with a common purpose of holding the boot to the ski during skiing maneuvers and to effect a release of the boot from the ski when the skier falls forwardly, backwardly or sidewardly or twists. Because of the basic design principle of substantially all of the prior ski bindings, the problem of effecting an accurate, reliable and substantially instantaneous release of the boot from the ski in response to forces which could cause injury to the skier has not been satisfactorily solved.

Previous ski bindings had to have means for attaching both the heel and the toe portion of the ski boot to the ski. Many different design forms provide in one way or another means to release either the heel portion or the toe portion so that with either released the other portion will be also disengaged. In some designs attempts are made to disengage both portions substantially simulataneously.

According to the present invention the connection between the ski boot and the ski is effected by but a single means disposed intermediate the toe and heel portions but preferably in line with the axis of twist or rotation of the skier's leg. According to this principle of the ski binding the unitary connection is arranged to react to all forces that can possibly develop through a single point, geometrically centered relative to the skier and the ski equipment used by him while skiing.

It is a general object of this invention to overcome the shortcomings of prior-art ski bindings by a new principle.

It is a particular object of this invention to provide a ski binding wherein there is but a single effective connection between the ski boot and the ski.

It is still a further object of this invention to provide a reliable release when the skier falls, twists or is otherwise subjected to forces which would cause injury to him.

SUMMARY OF THE INVENTION

According to the invention a plug member and a socket member, constituting interengaging means, coact to hold the ski boot to the ski during normal use, and become disengaged when subjected to abnormal forces, the magnitude of which is predetermined and adjustably preset. One of the members, preferably the plug member, is connected directly to the ski, or an intermediate member such as an adjustable plate is first attached to the ski, and the plug member is attached to the plate.

The plug member is, in a preferred exemplary embodiment, of annular form provided with a plurality of channels extending radially through its body. A compression spring is constrained in each channel between a ball protruding partially through the periphery of the plug member on the outer end of the spring and an adjustment device on the inner end of the spring for effecting a compression adjustment of each spring.

The socket member is connected directly to the boot or to an intermediate boot plate to which the boot may be attached by conventional means.

The socket member is preferably provided with a plurality of recesses along the inner wall for registered engagement with the protruding balls of the plug member. The latter is adapted to be received in the opening of the socket member during normal skiing use and to be retained therein by the balls which are resiliently urged outwardly in the seated position within the respective recesses of the socket member. The spring force exerted on the balls is adjusted to a desired value by a single screw arranged on rotation to displace the springs disposed in the channels of the plug member. When a force exceeding the adjusted release force of the plug member is developed through the binding the spring force is overcome, allowing the balls to become unseated from the recesses whereby the plug member is disengaged automatically and substantially instantaneously from the socket member, allowing the boot to be separated completely from the ski.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a side elevation of an assembly of the ski binding according to the invention the, two engaging members being shown in separated or exploded relation;

FIG. 2 is a plan view of a portion of FIG. 1, showing the ski with a base plate carrying one of the engaging members, in the form of a plug member;

FIG. 3 is a sectional view of a second engaging member, namely a socket member, taken along viewing line 3—3 of FIG. 1;

FIG. 4 is a sectional view of the plug member, taken along viewing line 4—4 of FIG. 1;

FIG. 4A is a sectional view of the plug member, taken along viewing line 4A—4A of FIG. 4;

FIG. 5 is a top fragmentary view of the interengaging plug and socket members, partly in section;

FIGS. 5A, 5B and 5C are enlarged fragmentary views of the members in various relative positions;

FIG. 6 is a sectional view of a modified form of a socket member having grooves for channeling the balls from the seated position during release;

FIG. 7 is the sectional view of a modified socket member, taken along viewing line 7—7 of FIG. 6;

FIG. 8 is a sectional view, similar to FIG. 4, showing a modification of a ball-spring casing using spheres in the interior instead of sectors;

FIG. 9 is an enlarged fragmentary portion of a plug member showing the exploded parts of a modified form of tension adjustment means;

FIG. 9A is a fragmentary sectional view showing the elements of FIG. 9 in assembled relation within the inner portion of the plug member;

FIG. 10 is a plan view in section, similar to FIG. 8, showing a modification of the socket member wherein several of the ball-spring elements are replaced by leaf springs;

FIG. 11 is a plan view in section showing a modification wherein the socket member is provided with resilient loaded ball connectors;

FIG. 11A is a sectional view taken along line 11A—11A of FIG. 11;

FIG. 12 is a top plan view, partly in section, of a modified form of the engaging plug and socket members;

FIG. 12A is a sectional view of the members of FIG. 12 in an exploded view;

FIG. 13 is a side elevation view of a ski carrying a base plate and a plug member in a separated or exploded view, showing a modified form of boot connection members with boot attachment means omitted;

FIG. 14 is a top plan view of the plug member and ski of FIG. 13;

FIG. 15 is a top plan view of the elements of FIG. 13 in an assembled relationship, including boot attachment means;

FIG. 16 is a sectional view of FIG. 15 as seen along viewing line 16—16;

FIG. 17 is a sectional view of FIG. 15 as seen along viewing line 17—17; and

FIG. 18 is a sectional view of FIG. 14 as seen along viewing line 18—18;

FIG. 19A shows a modification of the engaging mechanism, in a partial, sectional view similar to that of FIG. 8 (but supplemented with a portion of the socket member), wherein the spacing between adjoining detent elements is unequal;

FIG. 19B is a partial view similar to that of FIG. 19A, wherein passages of the plug member slope away, within the plane of the engaging mechanism, at a slight angle from a radial direction toward the inner portion of the plug member;

FIG. 20 is again a modified arrangement, similar in its side-elevational presentation to that of FIG. 13, wherein an intermediate plate (rather than the ski) carries at least one rest or couple element for the engaging member, the latter being provided on the ski; and

FIG. 21 is a partial sectional view, similar to FIG. 4, illustrating an annular restraining member encircling the plug member about the outer ends of its passages.

DESCRIPTION OF PREFERRED EMBODIMENTS

Referring now to the drawings there is shown in FIG. 1 a ski **10** carrying a plug member **12** which is adapted to be received in and engaged by a socket member **14**. As a matter of example, the plug member **12** is mounted to the ski **10** by being first mounted on or integrally formed with a base plate **16** which in turn is mounted to the ski at four connections **18**, two of which are at the end of the base plate on the lateral edges thereof. A rubber or other resilient gasket may be interposed between the ski **10** and the base plate **16** if desired.

A long forward track **20** and a relatively shorter rearward track **22** are attached to the upper face of the base plate **16** and suitably provided with slotted screw guides **24**, with tightening screws **25** allowing for adjustment whereby the base plate **16** is longitudinally positioned relative to the ski **10**.

Suitably secured by a dove-tail slot on the respective tracks **20**, **22** are front and rear fulcrums **26**, **28** of generally semi-cylindrical form, and each is provided with a set or lock screw **30** for securing each fulcrum in position over the tracks at desired locations. The ends of each fulcrum extend over the edges of the tracks **20**, **22** in dove-tail relation restrained to allow for sliding of each fulcrum over its track.

The socket member **14** is generally annular and is preferably mounted on or integrally formed with a boot plate **32** extending generally the length of a ski boot.

A toe piece **34** is attached to an angle plate **36** which is rendered slidable between boot plate **32** and a forward support plate **33** and clamped into any desired longitudinal position.

Plate **33** is secured in a desired position by a plurality of screws **37** passing through boot plate **32** and into any of a suitable plurality of threaded holes in the plate **33**. The toe piece **34** is provided with a toe guide **40** adjustably fixed in height above the surface of the boot plate **32** as by a bolt **42**. A curved hood or shield **35** is mounted at the front of the toe piece to deflect snow.

A heel piece **44** of any suitable and conventional form is attached to a channel bracket **46** at pivotal connections **48**. Such a heel piece is preferably provided with a quick-action snap-lock and with spring-loaded guide arms of any conventional form. A rearward support plate **50** clamps channel bracket **46** to the boot plate **32** and is arranged to allow for longitudinal adjustment of the heel piece **44** to various size boots as by screws **51** threaded into holes in plate **50**. Thus, the boot plate **32** is provided with means for attaching a ski boot thereto of any size by the provision of the adjustable toe and heel means **34**, **44**.

According to the present invention, in order to effect a substantially firm if not rigid connection between the boot and the ski which is maintained through all the skiing maneuvers that are normally expected to be encountered and yet to cause or allow to occur a separation of the ski from the boot for accidental or unexpected maneuvers which would otherwise cause a fracture or break of the skier's bones or otherwise cause injury to the body, we have provided an effective single connection between the skier and the ski. The means for achieving this connection is embodied in the interengaging members **12**, **14**.

Referring to FIGS. 4 and 4A, there is shown sectional views of an exemplary form of the plug member **12**. This is generally a short cylinder **12A** having a hollow central portion **52**. A plurality, preferably eight, cylindrical passages **54** extend substantially radially outwardly from the central portion **52** to a peripheral annular portion **56**. Each of the passages **54** is reduced in diameter, as by an annular bevel **58**, between the inner diameter of the peripheral portion **56** and an outer face **59** of the plug member housing **12A**, one such passage being shown in enlarged form in FIG. 5A. The purpose of the bevel **58** is to keep a spherical member such as a ball **60** from escaping from the respective passage **54**.

For manufacturing purposes the bevel **58** can be effectively duplicated by an annular ring shown dotted and having dimensions corresponding to the annular portion **56** and provided with non-beveled holes of smaller diameter than the passages **54**.

The use of the annular portion **56** for restraining the balls **60** in their outward movement will be described somewhat later with reference to a detail view given in FIG. 21, similar to an outer segment of the plug member **12** shown in FIG. 4.

The ball **60** is positioned at the end of each passage **54**, each ball having a diameter sufficiently large to clear the passage **54** and yet be retained within the reduced diameter portion defined for example by the

annular bevel 58. At the inner end of each passage 54 is seated an inner spring retainer segment 62 having a boss 64 over which one end of a coil spring 66 is seated. The retainer segment 62 is shaped in plan view (FIG. 4) to taper towards the center of the housing 52 in sector form so that the plurality of such adjacent retainers 62 form a closely spaced tight-fitting array. The elevation or side profile of each retainer segment (FIG. 4A) is tapered toward the center 53 of the mechanism for adjustment of the force release desired, as will be explained.

A spring 66 is seated in each passage 54, one end of each, as already indicated, being seated over the boss 64 of an associated retainer 62, and the other end pressing against the surface of the associated ball 60. The plug member 12 is thus provided with a plurality of balls 60 urged resiliently outwardly, towards the inside face of the socket member 14 when in engaged position therein.

Referring now to FIG. 3, there is shown a view of an exemplary form of the socket member 14 as seen along viewing line 3-3 of FIG. 1. The socket member 14 is formed generally of a shallow annular housing 68 provided with, say, eight radially oriented passages 70, conveniently threaded into each of which is nested a cupped-recessed insert 72 the outer end of which is provided with a tool slot or socket 74 for installation and adjustment of the inserts 72 within the passages 70.

The cupped-inserts 72 can be, if desired, integrally formed with the socket member 14. The inserts 72 are equally spaced about the housing 68 and each is so aligned as to register exactly with a respective ball 60 of the plug member 12. The recess 73 of the insert 72 is preferably slightly less than hemispherical, that is, the depth of the recess with respect to an inner surface 69 of the socket member 14 is slightly less than the radius of the balls 60.

The radially outward force of the balls 60, in register with the recesses 73 in the socket member 14, will depend upon the force of springs 66 and the adjusted pressure of the segments 62 bearing against those springs. The adjustment of each of segment 62 is effected by a screw 76 threadably guided within a bore 78 of the plug member 12. The inner or bottom portion 80 of the screw 76 is provided with a taper having an angle complementary to the slope of the segments 62 as seen in FIG. 4A.

Thus the adjustment of the screw 76, inwardly or outwardly of the bore 78, provides for means for adjusting by a single screw the radial position of all segments 62 simultaneously and thereby change the effective force of each spring 66 on its associated ball 60. The greater the depth of the screw 76 rotated into the bore 78 the greater will be the force exerted on each ball 60 and thus the greater the force that will be necessary to cause the ball 60 to be depressed out of detent or engagement with the respective recess 73 in the socket member 14 (FIG. 3).

When the plug member 12 is seated within the socket member 14 each of the balls 60 will be in register with the respective recess 73 and the ski body 10 will be in substantially firm if not rigid connection with the boot plate 32. This operative relation should be understood to be effected by the socket member 14 of FIG. 1 being guided over the plug member 12 and to be snapped into detented relation therewith.

Although the base plate 16 may be mounted at any desired location along the longitudinal axis of the ski 10, we have found that more effective control of the skiing maneuvers or manipulations can be effected if the axis of the adjustment screw 76 (FIG. 4A) and the torque axis of the skier's leg coincide or are substantially co-linear.

It will be appreciated by those skilled in the art that the flexure center of the ski need not be, and most likely is not, the geometric center of the ski which is, at the middle thereof. With the base plate 16 mounted generally so that the axis of the screw 76 and thus the center 53 of the connection means coincides, adjustment of the plate 16 by means of the slots 24 will provide adjustable means for positioning the user's boot relative to the flexure center of the ski whereby the ideal relation of the skier's leg can be established co-axially with the center of the single connection means of the present invention.

In use, the screw 76 (FIGS. 1 and 4A) is rotated to adjust the compression on the springs 66 (FIGS. 4 and 4A) to the desired value. Known testing devices may be used to determine the precise force desired at which a release will occur. For certain skiing operations, it is desirable to have a larger release force than for others. Thus, a skillful skier in a racing situation will adjust for a larger release force than a neophyte. Until the skier knows the critical release condition for his style of skiing, it is preferable that the release force be adjusted to a relatively low value which can, of course, be readjusted to higher values with increased experience.

After the adjustment of the spring forces, the socket member 14 is then placed over the plug member 12 so that the longitudinal axis of the boot plate 32 is in line with the longitudinal axis of the ski 10 (FIG. 1). The two components are interengaged so that the balls 60 are received in detented position within the recesses 73 (FIG. 3). The skier then places his boot over the boot plate 32 with the boot toe facing into the toe guide 40 and attaches the heel piece 44 around the heel of the boot. The skier is now ready for skiing.

If the skier is involved with a falling situation wherein a lateral force is applied to his ski there will be developed a torque or couple about the axis of the screw 76 (center 53) which in turn will develop a torque about the skier's leg. The torque on the leg will continue as long as the original force is sustained. If the force is sufficiently great and the duration is sufficiently long the leg will be injured by sprains or fractures, particularly a serious type known as a spiral fracture. These types of injuries occur from conventional ski bindings owing to their failure of automatic automatically and timely disengaging the ski from the skier's boot.

According to the present invention this type of accident or injury is significantly reduced by the operation of the ski binding to separate automatically in response to the applied torque or moment before the injury can occur.

According to this invention the action of separating the ski binding, so that the boot carrying the socket member 14 is safely disengaged from the ski carrying the plug member 12, becomes effective when a predetermined force is reached as follows.

A torque caused by a force striking the ski 10 will cause or tend to cause the plug member 12 to rotate

relative to the socket member **14** about the center **53** of the release mechanism in the direction of the applied torque. Each of the balls **60** will be subjected to a force having a tangential component relative to the plug member **12**, which in turn develops a component force radially inward of the plug member **12**, since the annular bevel **58** and the walls of the passages **54** containing the balls prevent any tangential or lateral movement thereof. The radial inward displacement of the balls **60** thus tends to disengage or, in fact, disengages at least one ball from the respective cup **73** of the socket member **14**.

The amount of inward displacement of the ball **60** depends on, first, the adjusted compression of the spring **66** which defines its linear displacement that is produced by the applied force, and, second, the duration of the force causing the torque. If such force is adequate and continued the plug member **12** will be rotated sufficiently to completely disengage the ball **60** in question from its cup **73**. When such a disengagement occurs the ball **60** will ride on or clear the inner face **69** of the annular portion of the socket member **14** (FIG. 3) and will allow the plug member **12** to separate the ski **10** from the ski boot.

If the force is not sustained long enough to effect a complete disengagement of the ball or balls **60** from its or their recess **73**, the ball will reseat itself in operative position so that the skier may continue. This action thus allows the skier to absorb non-injuring jolts or forces without disruption of skiing.

Referring now to FIGS. 5A, 5B, and 5C there is shown sectional enlarged fragmentary elevative portions of the plug member **12** in several possible positions. FIG. 5A shows the ball **60** of socket member **12** seated in recess **73** of the socket member **14**. The top edge of outer face **59** is preferably beveled as shown at **59A** to provide clearance between the top of the plug member and the bottom corner of the socket member.

A recessed insert **72** is illustrated in FIG. 5A (a fragmentary modification of FIG. 3) with shoulders and reduced shanks. FIG. 5A is a section taken along line 5A—5A of FIG. 5.

FIG. 5B shows the ball **60** disengaged from the recess **73** and riding the surface **69** of the socket member **14**, at a portion intermediate the recesses **73** of two adjoining inserts **72** (see FIG. 3). The bottom edge of surface **69** also may be beveled as at **69A** to provide better clearance with the plug member **12**. FIG. 5C shows the latter **12** just disengaged from the recess of the socket member **14** and having been displaced vertically.

The ski binding responds to forces, blows, or impacts exceeding the pre-set adjustment to effect a complete and substantially instantaneous separation of the interengaging members. The direction of the force effectively acting on the members will determine which ball or balls **60** are in contact with the inner surface of the socket member. Thus, for certain actions some detented balls will be in contact with the socket member wall and some balls diametrically opposite therefrom will be clear of the socket member.

It should be noted that the clear space between the inner wall **69** of the socket member **14** and the outer face **59** of the plug member is determined in part by the sizes of the balls **60** and the recesses **73**.

In order to provide positive disengagement of the socket member **14** from the plug member **12**, the spacing between their peripheral portions may be such as to allow for the balls **60** to be clear of any contact with the inner face **69** of the socket member **14**.

For certain requirements it may be desirable to have the spacing reduced such that the balls **60** actually make contact with the inner wall **69** after they have been disengaged from the cups **73**, as illustrated in FIG. 5B. For either design, spacing is critically related to the relative heights of the socket and plug members, particularly the relative spacing of the balls **60** and the recesses **73**. Too large a distance from the recess **73** to the bottom edge of the socket member can cause binding of the plug member **12** within the socket member **14** for separation movements causing relative canting of the two parts.

The shorter the edge-to-recess distance, the less will be the binding effect due to canting. It will be understood thus that the chosen design of the several components will determine the relative spacing and dimension so that positive separation occurs when the selected force of separation has been developed.

For certain designs it may be desirable to slant the channels **54** of the plug member **12** upwardly from the central portion **52** to the outer peripheral portion **56**. The slant of each channel may be the same or one group may be inclined at a smaller angle than another group of channels to effect a release pattern as desired, or channels **54** may slant upwardly.

It will be noted that many types of forces to which a skier is subjected can cause or can tend to cause unexpected injuries to the skier. A simple fall can cause an injury. It will be understood that any force or action to which the skier is subjected that may cause the skier to lose his balance or otherwise cause injury to him are contemplated by the binding mechanism of the invention.

Thus a force that would tend to cause a longitudinal pivot of the boot relative to the ski **10** if of sufficient magnitude and duration will cause a separation of the boot from the ski. Thus, one or more balls **60** in line with such a separating pivotal force will be detented out of the respective sockets **73** and allow the plug member **12** to be separated from the socket member **14**. This type of movement would correspond to a forward and backward fall of the skier.

It should be noted in these movements that the fulcrums **26**, **28** serve as either forward or rearward fulcrums about which the pivoting action of the boot makes relative to the ski to effect the separation of the plug member **12** from the socket member **14**. The fulcrums **26**, **28** are each independently adjustable relative to the central axis **53** of the assembly.

The closer each of the fulcrums is to the central axis, the lower amount of force will be necessary to effect separation. Conversely, the greater distance the fulcrums are positioned from the central axis **53** of the assembly, the greater will be the force necessary to effect separation.

It will now be appreciated that the ski binding assembly of the invention provides for a wide range of release adjustment both for the neophyte as well as the highly skilled skier.

As indicated above, the screw **76** in the plug member **12** provides for very simple adjustment by rotating it and establishing thereby various values of effective forces of the several springs **66** acting on the balls **60**.

It will be further appreciated that the several release force adjustments as provided according to this invention are adjustable independent of each other. By these independent adjustments a skier can adjust for a relatively easy separation owing to torques which would thereby allow for quick, reliable and automatic separation for lateral forces, and at the same time the fulcrums **26, 28** can be adjusted for relatively large forces of separation along the longitudinal direction of the skis as for example caused by forward and backward falls. Thus the three members, namely the forward and rearward fulcrums **26, 28** and the screw member **76**, can be adjusted to cover all release requirements that any skier desires. It will be especially noted that heretofore conventional ski binding mechanisms were incapable of providing for such a wide range of seemingly contradictory release requirements.

If the force causing the original torque is momentary the ski will not be separated from the boot by the following action of the mechanism which serves as a shock absorber. According to the invention we have arranged an automatic detaching mechanism to have a play or override to prevent an instantaneous separation of the boot from the ski. This operation is in accordance with the expected mode of operation of conventional ski binding devices.

According to conventional ski bindings a possible total displacement of about one inch is provided in the toe binding portion. Such shock absorbing play is needed, as just explained, to allow forces of short duration not to cause disengagement of the binding from the ski. Conventional ski bindings provide for such lost motion by mechanisms of various designs providing in general a pivoting mechanism directly on the toe portion of the boot. Similar devices have been provided for allowing a play of the heel portion of the boot.

According to the present invention, the lost motion or play of the toe portion is effected by a proportionately smaller play in the cooperative action of the engaging plug and socket members **12, 14**, respectively.

In a preferred form of the invention the balls **60** are three-sixteenths inch in radius. The depth of the recesses **73** in the socket member **14** is slightly less than three-sixteenths inch. Thus a relative rotation of three-sixteenths inch can occur between the engaging members before there is a disengagement of the balls **60** from their respective recesses **73**. Any force of a magnitude and duration that is insufficient to cause any ball **60** from being fully unseated from its recess **73** but effects partial unseating thereof allows that ball **60** to be fully re-seated in the recess **73** by the action of the respective spring **66** after the force has ceased.

The mechanical advantage of the movement of the toe of the boot relative to the maximum movement of the ball **60** without unseating from the socket **73** is such as to cause a rotating deflection of the toe of generally of about one inch, the length of the boot affecting this deflection, since the deflection is proportional to the boot length.

Thus, according to the invention the skier can experience a toe movement of about 1 inch before his boot will be disengaged from the ski as a result of momentary forces of insufficient magnitude and duration that otherwise would tend to cause an injury.

Various possible modifications of the invention will be understood by those skilled in the art in view of the embodiment just described. In particular it should be apparent that the balls **60** need not be strictly spherical in form but may have an oblate spheroid shape, the recesses **73** being suitably shaped to accommodate such shapes.

Furthermore, it will be appreciated that the boot itself may be provided with a socket member integrally formed in its sole portion. It is understood that it would be somewhat impractical, if not undesirable, for the skier to have his ski boot designed to incorporate a mechanism that is suitable only for a particular form of ski binding. But it is nevertheless within the purview of the present invention that a boot may be so provided with means for making a single and direct connection between the skier's boot and the ski.

Furthermore, it will be apparent, as has been mentioned before, that the plug member **12** may be mounted on the boot plate **32** and in turn the socket member **14** on the base plate **16**. In other words, the operation of the mechanism can be effected by the interchange of the socket and plug members without affecting the operation of the automatic separation principle of the invention.

Further, the fulcrums **26, 28** may be mounted on the boot plate **32** instead of the base plate **16**.

In a modified form of the invention the spacing of the balls **60** within the plug member **12** may be unequal, the spacing being chosen according to a particular mode of operation desired. Thus, a greater separation force may be developed with respect to certain torques by spacing the balls, for example, more closely in the portion nearer the toe of the boot. Such spacing of the balls may be an angular separation of about 30°, the balls on the heelward portion being spaced 45° to 60°.

A modified form of the invention is illustrated in FIGS. **6** and **7** showing a fragmentary portion in sectional elevation of the inner wall of the socket member **14**. FIG. **7** illustrates a track or groove **82***a* and **82***b* extending in curved or helical path in opposite directions from a recess **73**; in the section of FIG. **6** the grooves are generally designated by numeral **82**. (The primed numbers are used to indicate modified but otherwise similar parts.) The recess **73'** is formed in an inner surface or wall **69'** of a socket member **14'**. A plug member (not shown) which operates with the socket member **14'**, illustrated in FIGS. **6** and **7**, may have only diametrically opposed balls (similar to **60**). The balls are seated in the recesses **73'** when the socket member **14'** receives the plug member as previously described.

The grooves **82***a* and **82***b* are shallower than the recess holes **73'**. The relative depth of the grooves to the recess holes is chosen according to the operating characteristics desired as explained above with respect to the embodiment illustrated in FIGS. **3** and **4**, and particularly to FIGS. **5A–5C**.

In operation the balls **60** when exposed long enough to a sufficient force will detent from the recesses **73'**

and be guided downwardly along the groove path **82***a*, **82***b* depending on the direction of the force causing the detent action, until the balls are cleared from the grooves, allowing thereby complete physical separation of the plug and socket members and, thereby, complete separation of the ski from the skier.

It will be appreciated that this embodiment (FIGS. **6** and **7**) is distinguished from the previous embodiment (FIGS. **1** to **4**) in that the balls **60** when detented from the recesses are constrained to be guided along a path to force separation of the socket and plug members. The grooves thereby obviate the possibility of the balls skipping from one recess to another as could occur for certain torque forces that effect a relative rotational motion of the components without axial movements.

It should be appreciated, however, that the embodiment with the helical grooves tends to bind for longitudinal forces such as cause forward and backward falling. This shortcoming, however, can be minimized by shaping the grooves **82** in a relatively shallow angular direction.

The socket member **14'** of FIGS. **6** and **7** may be integrally formed into the sole of a boot **250** by attaching a mounting flange **252** to the body of the sole **250**, such as by screws **254**.

Referring now to FIG. **8**, there is shown another modifed form of the invention wherein spherical members, such as balls, are substituted for the spring-retainer sector segments **62**, as described with respect to FIG. **4**. This view is similar except for the modification that will be described. It will be understood that the various parts carrying identical reference numerals are similar to those described in FIG. **4**.

In the embodiment of FIG. **8**, showing a plug member **12'**, inner balls **162** are substituted for the retainer segments **62**. The springs **66** included in the passages **54** are thereby constrained between the respective surfaces defined by the outer balls **60** and the inner balls **162**.

A screw **176** similar to screw **76** serves to provide an adjustment of spring-compression force on the respective balls by forcing the balls **162** outwardly into the radial passages **54** and thereby compress the springs **66** to effect a resulting greater outward force by the balls **60** into the respective recesses **73** when seated. Otherwise, this modification operates substantially as described above and is advantageous because spherical balls **162** are more economical than retainer sector segments **62**. FIG. **8** is thus a preferred form of the invention.

A still further modified form of the invention is shown in FIG. **9A** the components thereof being shown in exploded view in FIG. **9**. According to this form the adjustable screw member **176** of FIG. **8** is replaced by a screw **276** adapted for a slip collar fit. The screw **276** is seated in the housing of plug member **12** for rotation within a slip collar **279** which is threadably attached to the housing as at **279A**. Attached to the screw **276** is a circular disc member **277** having a contoured side face **278** to be displaced vertically along the axis of the screw **276** and to thereby cause balls **262** to be displaced relative to the vertical position of the disc **277**.

Referring now to FIG. **10**, there is shown a further modifed form of the invention wherein similar components as those described in FIG. **4** are shown, similar the same reference numerals referring to identical parts.

Here only one pair of diametrically opposed balls **60** is used preferably oriented along the longitudinal axis of the ski **10**. A pair of leaf springs **102**, **104** are disposed in a recess formed within plug member **12** and suitably retained therein. The inner face of the socket member **14** is provided with a pair of diametrically opposed recesses **73**, as previously described, for receiving the balls **60**. In addition an elongated recess **106**, **108** is provided within the adjacent portions of the inner wall **69** of the socket member **14**.

The recesses **106** and **108** are adapted to receive generally the outer surfaces of the springs **102**, **104**. Release force adjustment on the balls **60** is accomplished simultaneously with a similar force release adjustment on the springs **102**, **104** by screw **76**, similar to that previously described. A tapered surface of the screw **76** allows for displacing the respective springs **66** to thereby effect a force-release adjustment.

Referring now to FIG. **11**, there is shown still another modified form of the invention wherein a socket member **140**, being a modification of the socket member **14** previously described, is provided with spring loaded members placed therein instead of in the plug member. A plug member **120**, being a modification of the member **12** heretofore described, is passive insofar that no spring members are provided therein.

Referring now particularly to FIG. **11**, the socket member **140** is provided with a plurality of radial cylindrical passages **142**, each provided with a spring **144**. The inner wall **146** of the socket member **140** is provided with a plurality of reduced-diameter apertures **148** into which are seated balls **150**. The outer ends of the springs **144** are seated in a member **152** which may be provided with a slot for threadably adjusting the pressure on the springs **144**.

In an alternative, a band **154** may be applied around the circumference of the socket member **140** with a tightening means **156** (slidable rather than threaded) to effect desirable tensional force on the band **154** which in turn acts simultaneously on the member **152** thereby adjusting the force on the springs **144**.

The plug member **120** as seen in FIG. **11A** is provided with a series of detent recesses **158** for receiving the respective balls **150**. Curved channels or grooves **160** are provided in the outer periphery of the plug **120**, curving symmetrically on either side of the recesses **158** towards the upper edge of the plug member **120**. In operation the latter when engaging socket member **140** causes a seating of the balls **150** in the recesses **158**. The separation of the two members is effected in a similar manner as previously described.

Referring now to FIGS. **12** and **12A**, there is shown a further modified form of the invention wherein a plug member **220** is arranged to engage a socket member **240**.

The structure of the plug member **220** is similar to the member **12'** previously described with respect to FIG. **8**. The earlier-mentioned balls **162** act from the inner portion of the member on springs **66**, the screw **176** providing means for adjusting the compression force on the springs by displacing the balls **162**. On the extreme outer end of each spring **66** is disposed a lever **180** having an extension or head **182** protruding above

the surface of the plug member **220**. Shank portions **184** of the levers **180** extend into the body portion and are kept in place by the pressure of the ends of springs **66**, pressing against them with the action of the outer peripheral wall portion **222** of the plug member which holds them in place.

The socket member **240** is generally a circular disc provided with four apertures **242** corresponding in number to that of lever **180**, of a size sufficient to clear the head **182** of the lever **180**. The bottom surface **244** of the socket member **240** is provided with an elongated aperture tapering towards the small aperture portion **246**. In operation the socket member **240** engages the plug member **220** by the levers **180** being respectively inserted into the apertures **242**. The catch or head portions **182** extend into recesses **250***a* formed on the radially inner surfaces of the apertures **242**. The socket member **240** may be formed integrally with a rectangular boot plate, the apertures being arranged in generally circular array.

In operation any force to cause a harmful torque on the skier as previously described will pivot at least one lever **180** against the force of its spring **66**.

The fulcrum of each lever **180** is effective at a portion **186** as shown in FIG. 12A. If the force is sufficient in magnitude and duration the lever **180** will be detented from the respective recess **250***a* of the aperture **242**, allowing the lever **180** to be guided along a contour portion **252***a* of the small aperture portion **246** to the bottom surface **244** to cause a separation of the socket member **240** from the plug member **220**.

If the head **182** of the lever **180** is disposed to face radially outward with respect to the plug member **220**, a recess such as **250***a* in socket member **240** would be adapted to be included in the radially outward portion of the aperture **242**. Also, the fulcrum of pivot action of the lever **180** in response to separation forces will occur at a portion **190** as shown in FIG. 12A.

It will be appreciated that this form of the invention does not involve a reception of the complete plug member **220** into a recess of the socket member **240**. It does, however, cause a portion of the former to be received in a recess portion of the latter. In other respects the operation of this form of the invention is similar and of course within the scope of the invention as previously described.

Referring now to FIGS. **13** through **18** there will now be described a complete assembly of a preferred ski binding embodying the features of the invention, including an improved means for attaching the ski boot to a quick attach and quick release boot plate. The latter is arranged to automatically adjust for any size of boot length in cooperation with improved heel and toe pieces.

FIG. **13** illustrates in side elevation the ski **10** carrying the plug member **12'**, preferably of the form illustrated in FIG. **8**, attached to a base plate **298** (similar to **16**, FIG. **1**), which in turn is attached to the ski **10** as by screws **296**. Forward and rearward fulcrums **26'** and **28'** are dovetailed to the edges of the base plate as seen in FIG. **18**, and locked in place as desired by set or lock screws **30'**.

In exploded relation to the ski **10** is a boot plate **32'** integrally formed with the earlier-mentioned socket member **14'** (see FIGS. **6**, **7**), preferably of a form similar to that illustrated in FIG. **3**. The boot plate **32'** is formed with a circular inner aperture **310** provided with a plurality of threaded holes to receive ball recesses **312** threadably inserted as by slots **312'** to receive spring loaded balls **60** of the plug member **12'**. See the sectional view of these elements in FIGS. **16** and **15**.

A generally elongated forward extension plate portion **314** extends integrally from a ring portion **311** in diametric opposite relationship; a rear extension plate portion is shown at **316**. Forward and rearward bootplate sheats **300**, **302** are arranged to slidably telescope with the extension portions **314** **316**, respectively. Sheath **300** is formed with a top wall **318** having a circular cutout **320** to provide access to the adjustment screw **76** on the plug member **12'**, see FIG. **15**.

Forward sheath, **300** further is formed with a bottom wall **322** and side walls **324** of substantial thickness sufficient to define a snug fit and path for the forward portion **314** of the boot plate **32'**. An end wall **326** provides a closure and limit for the end of the plate **314**. Screws **297** attaching the plug member **12'** to the base plate **298** may serve to be the principal attachment to the ski **10**.

Rearward sheath **302** is similarly formed although it is somewhat shorter since it serves to support the heel portion of the boot. See FIG. **15** where it is apparent that the assembly is arranged for the plug and socket member portions to be disposed towards the heel portion so that the geometric center thereof is substantially colinear with the skier's leg.

In operation the forward and rear sheaths **300**,**302** are slipped over the ends of the plate **32'** and closed towards each other, limited by the end wall **326**, and the abutment of the inner ends including the cutout **320** as shown in FIG. **15**.

A novel feature of this preferred form of ski binding is shown particularly in FIGS. **15** through **18**. A pair of flexible cable attachments for the heel portion of the boot are attached to screws **330** connected to the side walls **324** of forward sheath **300**. A piece of flexible wire (suitably covered with plastic or rubber) is provided on each side with loops for connection to the screws **330** and a turnbuckle **334**. The opposite looped ends of the turnbuckles are attached to another piece of flexible wire which in turn is looped conjointly from both sides through a pivot catch **338** having a handle portion **338a** for moving about a pivot **338b**. A wire loop **340** is adapted to be snagged in teeth **342** of the catch **338** as needed for the particular boot size. The wire loop **340** and another wire **336**, on the opposite side, are also looped about a generally C-or U-shaped bracket **344** suitably connected for pivoted movement on the side walls of sheath **302**. The forward end of the sheath **300** carries another generally C-shaped bracket **346** also arranged for pivotal movement by attachment to the side walls **324** of the forward sheath **300**.

In use the skier inserts the toe of his boot under the bracket **346** and places the heel portion down to cover the opening defined by the cutout **320**. The heel will extend rearward thereof. The catch **338** is arranged to engage loop **340** and is pivoted to hold the latter in tight position against the rear of the boot, substantially as shown in FIG. **17**. The boot itself is not shown but its position in the binding will be apparent. The bracket

344 is then pivoted rearward and downward, substantially as shown in FIG. 16 to thereby firmly tighten the heel bracket assembly.

When it is desired to release the boot from the boot plate, the handle 338*a* is pivoted thereby releasing the loop 340 so that the boot is free from the connection. The binding itself in respect of the adjustment of the fulcrums 26', 28', and the adjustment and operation of the plug and socket member assembly, should be readily apparent in view of the previous descriptions.

FIGS. 19A and 19B show modifications (in sectional illustrations similar to FIG. 8 but partly cut away and partly supplemented). For the sake of better correlation with the previous figures, identical reference numerals have been used, such as 12' and 14', respectively, for the plug and the socket members, 54 for radial passages which accommodate springs 66, and respective outer and inner detent elements in the form of balls 60, 162.

The inner surface of the described annular housing is identified by 69. The modifications may include recessed inserts 72 against which the balls 60 are urged by the springs 66, with inner, profiled recesses 73 for said balls. The central screw 76 (of FIGS. 1, 2, 4*a*) is also shown in FIGS. 19A and 19B.

The modification of FIG. 19A has an engaging mechanism wherein the spacing between adjoining detent elements is unequal. This can be provided between the detent elements, such as balls 60 and the recesses 73 provided therefor. It will be noted that the angle α between the dot-dashed center lines of the two lowermost balls 60 is larger than the angle β between the pair of balls following in the counterclockwise direction. Balls and recesses on opposite sides of the plug and socket members are not necessarily within the same diametral lines.

The modification of FIG. 19B, in turn, shows passages in the plug member which slope away, within the plane of the engaging mechanism, at a slight angle from a radial direction toward the inner portion of the plug member. The passages 54 are shown to slope away with their respective dot-dash center lines, identified by R', from the radial direction denoted by R; this is considered to be an important and useful alternative feature of the invention.

FIG. 20 illustrates a possible reversal of the arrangement of FIG. 1 (or FIGS. 13 to 18), wherein the rest or fulcrum members (26, 28; 26', 28'), constituting one or more couples, are respectively provided on the ski for the skier's boot. FIG. 20 shows such elements at 126', 128', as well as cooperating track portions 120', 122', in the intermediate plate 32, for cooperation in a reversed sense with the ski 10.

Here again already described parts and reference numerals have been used, namely 12, 14, 34, 36, 40, 42, 44, 46, 48, 60, 72 and 76, substantially as shown and described for FIG. 1, except for the reversal of the arrangement of the rest or couple elements.

Finally, reference has been made earlier to the modification of FIG. 21 wherein the annular member 56 of FIG. 4 is used to restrain the outward movement of the balls 60. Numerals 12, 54, 66 denote the same parts as in FIG. 4, while 56a denotes holes or apertures in the annular member 56, somewhat smaller in diameter than those of the passages 54 (or of the respective balls 60). It will be understood that the socket member 14 and other details have been omitted from the showing of this figure, and also some other less important parts from the modified embodiments of FIGS. 19A, 19B and 20.

It should also be understood that the just described modifications are fully compatible with other, optional features and arrangements of the inventive ski binding and intermediate plate, as described hereinbefore.

It should now be understood that we have provided a ski binding having essentially but a single connection between the skier's boot and the ski. According to the principle of the invention a substantially instantaneous separation of the boot from the ski is automatically effected upon the impact of a force predetermined in magnitude by the skier's chosen release value. Furthermore the action of the forward and rearward fulcrums provides means to adjust for a release of the binding for substantially longitudinally directed impacts, independent of the adjustment made for the release of the plug and socket members laterally. Thus seemingly contradictory release requirements can be independently selected whereby a wide range of adjustments can be made for releasing the ski binding for many different skiing conditions.

Various alternative, modified and combined forms of the invention other than those specifically illustrated and described will be readily understood by those skilled in this art.

What is claimed is:

1. A ski binding for removably attaching a skier's boot to a ski, comprising an interengaging mechanism (FIGS. 1, 13, 16) between the boot (250) and the ski (10), said mechanism having substantially planar engaging portions (12/14, 12'/14', 120/140, 220/240) forward of the heel portion of the boot and rearward of the toe portion of the boot, operatively associated with the boot and the ski, respectively, detent means (60/73, 60/73', 60/176, 60/276, 150/158, 162) forming part of said engaging portions for positive indexing therebetween in the respective planes of said engaging portions as well as in angular directions with respect to the longitudinal axes of the boot and the ski, said engaging portions being adapted to react by relative rotational movement, movement out of said planes of the engaging portions, and a combination of said movements, upon occurrence of a force of predetermined magnitude and duration, thereby allowing release of said engaging portions from each other and of the boot from the ski when the skier encounters a major obstacle which results in said force, further comprising means (20, 22, 30; 76, 176, 276; 120', 122') for adjusting the force by which said engaging portions are allowed to release from each other, wherein said engaging portions are respectively secured to coextensive but opposing portions (10, 16; 32, 32') of said interengaging mechanism, further comprising at least one fulcrum means (26, 28; 26', 28'; 126', 128') slidably secured to one of said mechanism portions, in a location selectively spaced apart from said engaging portions in forward and rearward directions along the extension of the ski, said fulcrum means allowing pivotal movement of the boot with respect to the ski to provide at least one couple with respect to one of said engaging portions, and wherein said force adjusting means includes means (20,

22, 30, 120', 122') for adjusting the relative position of said at least one couple with respect to the other of said mechanism portions.

2. A ski binding for removably attaching a skier's boot to a ski, comprising an interengaging mechanism (FIGS. 1, 13, 16) between the boot (250) and the ski (10), said mechanism having substantially planar engaging portions (12/14, 12'/14', 120/140, 220/240) forward of the heel portion of the boot and rearward of the toe portion of the boot, operatively associated with the boot and the ski, respectively, detent means (60/73, 60//73', 60/176, 60/276, 150/158, 162) forming part of said engaging portions for positive indexing therebetween in the respective planes of said engaging portions as well as in angular directions with respect to the longitudinal axes of the boot and the ski, said engaging portions being adapted to react by relative rotational movement, movement out of said planes of the engaging portions, and a combination of said movements, upon occurrence of a force of predetermined magnitude and duration, thereby allowing release of said engaging portions from each other and of the boot from the ski when the skier encounters a major obstacle which results in said force, wherein said engaging portions include a socket member (14, 14', 140, 240) and a plug member (12, 12', 120, 220), said members being adapted to be resiliently, detachably interconnected, and resilient means (66, 144) for maintaining said members in connected relation, further comprising means (32', 314, 316, 300, 302, 330, 334 to 346) for attaching one (14') of said socket and said plug members at least indirectly to the boot, including an elongated plate (32') having forward (314) and rearward (316) extensions, said plate being arranged to be oriented generally lengthwise of the ski, said one member being attached to said plate at an intermediate portion thereof, first and second slidable sheaths (300, 302) adapted for respective engagement with said extensions, a toe bracket (346) on said first sheath for holding the toe portion of the boot, and cable means (330, 334 to 342) for detachably fastening the heel portion of the boot to said second sheath, said cable means including a cable connection (330) to said first sheath and to a pivotal bracket (344) on said second sheath, said bracket being adapted to be pivoted so as to fasten said cable means in a secured tight position about the heel portion of the boot.

3. The ski binding as defined in claim 2, wherein one of said socket and said plug members (12, 14, . . .) is attached to said elongated plate (32') while the other of said members is attached to the ski (10).

4. A ski binding for removably attaching a skier's boot to a ski, comprising an interengaging mechanism (FIGS. 1, 13, 16) between the boot (250) and the ski (10), said mechanism having substantially planar engaging portions (12/14, 12'/14', 120/140, 220/240) forward of the heel portion of the boot and rearward of the toe portion of the boot, operatively associated with the boot and the ski, respectively, detent means (60/73, 60/73', 60/176, 60/276, 150/158, 162) forming part of said engaging portions for positive indexing therebetween in the respective planes of said engaging portions as well as in angular directions with respect to the longitudinal axes of the boot and the ski, said engaging portions being adapted to react by relative rotational movement, movement out of said planes of the engaging portions, and a combination of said movements, upon occurrence of a force of predetermined magnitude and duration, thereby allowing release of said engaging portions from each other and of the boot from the ski when the skier encounters a major obstacle which results in said force, wherein said engaging portions include a socket member (14, 14', 140, 240) and a plug member (12, 12', 120, 220), said members being adapted to be resiliently, detachably connected, and resilient means (66, 144) for maintaining said members in connected relation, further comprising at least one rest (26, 28; 26', 28'; 126', 128') secured at a distance from said engaging portions, in the direction of the longitudinal extension of the ski, to provide at least one couple for the boot and the ski, respectively, with respect to said engaging portions.

5. A ski binding for removably attaching a skier's boot to a ski, comprising an interengaging mechanism (FIGS. 1, 13, 16) between the boot (250) and the ski (10), said mechanism having substantially planar engaging portions (12/14, 12'/14', 120//140, 220/240) forward of the heel portion of the boot and rearward of the toe portion of the boot, operatively associated with the boot and the ski, respectively, detent means (60/73, 60/73', 60/176, 60/276, 150/158, 162) forming part of said engaging portions for positive indexing therebetween in the respective planes of said engaging portions as well as in angular directions with respect to the longitudinal axes of the boot and the ski, said engaging portions being adapted to react by relative rotational movement, movement out of said planes of the engaging portions, and a combination of said movements, upon occurrence of a force of predetermined magnitude and duration, thereby allowing release of said engaging portions from each other and of the boot from the ski when the skier encounters a major obstacle which results in said force, wherein said engaging portions include a socket member (14, 14', 140, 240) and a plug member (12, 12', 120, 220), said members being adapted to be resiliently, detachably interconnected, and resilient means (66, 144) for maintaining said members in connected relation, further comprising at least one rest (26, 28; 26', 28'; 126', 128') secured at a distance from one of said plug and said socket members, in the direction of the longitudinal extension of the ski, to provide at least one fulcrum for the boot and the ski, respectively, with respect to said one member.

6. The ski binding as defined in claim 5, the ski (10) having a geometric center substantially in the middle thereof, further comprising a base plate (16, 298) extending lengthwise of the ski, one of said engaging portions (12, 14, . . .) being attached to said base plate, and means (20 – 24, 25) for adjusting the relative position of said base plate with respect to the ski, and thus the position of a floating point constituted by the interaction of respective engaging portions on the boot and the ski, thereby allowing the skier's boot (250) to be selectively positioned relative to a flexure center of the ski, said geometric center being optionally noncoincident with said flexure center.

7. The ski binding as defined in claim 5, wherein said detent means (60/73, . . .) each include at least two detent elements (60/73, 60/73', 60/176, 60/276,

150/158, 162//176) adapted to be matingly interengaged when the boot (250) is operatively connected to the ski (10), further comprising means (66/144) for preloading a detent element in one of said engaging portions (12, 14, . . .) with respect to a complementary detent element in the other of said engaging portions, said preloading means including said resilient means (66, 144), and wherein said force adjusting means includes at least one member (76, 176, 276) for selectively presetting the force of said preloading means.

8. The ski binding as defined in claim 5, wherein said socket member (14') is integrally formed with the boot (250) while said plug member (12, 12', . . .) is attached to the ski (10).

9. The ski binding as defined in claim 5, further comprising at least three spaced-apart detent elements (60, 150) on one of said socket and said plug members (12, 14, . . .), and a corresponding number of symmetrically disposed recesses (73, 73', 158) on the other of said members, for receiving said elements in the detented position of said members.

10. The ski binding as defined in claim 9, wherein the spacing between adjoining ones of said detent elements (60, 150) and of said recesses (73, 73', 158) is unequal.

11. The ski binding as defined in claim 5, further comprising an intermediate plate (32, 32') extending lengthwise of the boot (250), said one member (14, 14') being attached to said intermediate plate, and means (34, 44) for removably attaching the boot to said intermediate plate.

12. The ski binding as defined in claim 39, wherein said at least one rest (126', 128') is provided on said intermediate plate (32) in close proximity with the ski (10) to act as a fulcrum therefor with respect to the boot.

13. The ski binding as defined in claim 5, wherein said at least one rest (26, 28; 26', 28') is provided on the ski (10) in close proximity with the skier's boot (250) to act as a fulcrum therefor with respect to the ski.

14. The ski binding as defined in claim 5, wherein said socket member (140) is of generally annular form, having at least two inwardly directed passages (142), an adjustable spring element (144) and a detent element (150) in each passage, said detent elements being lodged more inwardly than said spring elements, and means (148) for restraining said detent elements in said passages to limited movement in a direction inwardly from said socket member, said detent elements being urged inwardly by said spring elements.

15. The ski binding as defined in claim 14, wherein said inwardly directed passages (142) slope away, within the plane of said interengaging mechanism, at a slight angle from a radial direction toward the center portion of said socket member (140).

16. The ski binding as defined in claim 14, wherein said restraining means is constituted by at least two apertures (148) in said socket member (140), adjoining said detent elements (150), said apertures having a diameter less than that of said detent elements.

17. The ski binding as defined in claim 5, wherein said plug member (12, 12', 120, 220) is of generally annular form, having at least two outwardly directed passages (54), a spring element (66), constituting said resilient means and a detent element (60) in each passage, said spring elements being lodged more inwardly than said detent elements, and means (58) for restraining said detent elements in said passages to limited movement in a direction outwardly from said plug member, and means (62, 76, 176, 276 - 279) associated with the inner ends of said passages for adjusting the compressive force of said spring elements.

18. The ski binding as defined in claim 17, wherein said passages (54) slope away, within the plane of said interengaging mechanism, at a slight angle from a radial direction toward the inner portion of said plug member (12, 12').

19. The ski binding as defined in claim 17, wherein said socket member (14, 14', 120, 220) is of generally annular form, the inside diameter of which is large enough to receive said plug member (12, 12', 120, 220), and further comprising at least two recesses (73) about the inner periphery of said socket member for receiving said detent elements (60), thereby to hold said plug member to said socket member.

20. The ski binding as defined in claim 17, wherein said restraining means is in the form of an annular member (56) encircling said plug member (12) about the outer ends of said passages (54), said annular member being provided with holes of somewhat smaller diameters than those of said passages.

21. The ski binding as defined in claim 17, wherein said force adjusting means includes a screw (76, 176, 276) centrally disposed in said plug member (12, 12'), adapted to bear against the inner ends of said spring elements (66) and compress them substantially in proportion to the axial movement of said screw.

22. The ski binding as defined in claim 21, further comprising tapered segment members (62) disposed between said inner ends of the spring elements (66) and said screw (76, 176, 276), the latter having a tapered surface (80) complementary to the tapered surfaces of said segment members.

23. A ski binding for removably attaching a skier's boot to a ski, comprising an interengaging mechanism (FIGS. 1, 13, 16) between the boot (250) and the ski (10), said mechanism having substantially planar engaging portions (120/140) forward of the heel portion of the boot and rearward of the toe portion of the boot, operatively associated with the boot and the ski, respectively, detent means (60/176) forming part of said engaging portions for positive indexing therebetween in the respective planes of said engaging portions as well as in angular directions with respect to the longitudinal axes of the boot and the ski, said engaging portions being adapted to react by relative rotational movement, movement out of said planes of the engaging portions, and a combination of said movements, upon occurrence of a force of predetermined magnitude and duration, thereby allowing release of said engaging portions from each other and of the boot from the ski when the skier encounters a major obstacle which results in said force, wherein said engaging portions include a socket member (140) and a plug member (120), said members being adapted to be resiliently, detachably interconnected, and resilient means (144) for maintaining said members in connected relation, further wherein said socket member is

of generally annular form, having at least two inwardly directed passages (142), an adjustable spring element (144), constituting said resilient means, and a detent element (150) in each passage, said detent elements being lodged more inwardly than said spring elements, and means (148) for restraining said detent elements in said passages to limited movement in a direction inwardly from said socket member, said detent elements being urged inwardly by said spring elements, and wherein said restraining means is constituted by at least two apertures (148) in said socket member (140), adjoining said detent elements (150), said apertures having a diameter less than that of said detent elements, and finally wherein said plug member is in the general form of a disc having at least two detent recesses (158) for receiving said detent elements, and grooves (160) in the side wall of said disc for facilitating movement of said elements between detented and separated positions.

24. A ski binding for removably attaching a skier's boot to a ski, comprising an interengaging mechanism (FIGS. 1, 13, 16) between the boot (250) and the ski (10), said mechanism having substantially planar engaging portions (12/14, 12'/14', 120/140, 220/240) forward of the heel portion of the boot and rearward of the toe portion of the boot, operatively associated with the boot and the ski, respectively, detent means (60/73, 60//73', 60/176, 60/276, 150/158, 162) forming part of said engaging portions for positive indexing therebetween in the respective planes of said engaging portions as well as in angular directions with respect to the longitudinal axes of the boot and the ski, said engaging portions being adapted to react by relative rotational movement, movement out of said planes of the engaging portions, and a combination of said movements, upon occurrence of a force of predetermined magnitude and duration, thereby allowing release of said engaging portions from each other and of the boot from the ski when the skier encounters a major obstacle which results in said force, wherein said engaging portions include a socket member (14, 14', 140, 240) and a plug member (12, 12', 120, 220), said members being adapted to be resiliently, detachably interconnected, and resilient means (66, 144) for maintaining said members in connected relation, and wherein said plug member is of generally annular form, having at least two outwardly directed passages (54), a spring element (66), constituting said resilient means, and a detent element (60) in each passage, said spring elements being lodged more inwardly than said detent elements, and means (58) for restraining said detent elements in said passages to limited movement in a direction outwardly from said plug member, and means (62, 76, 176, 276 to 279) associated with the inner ends of said passages for adjusting the compressive force of said spring elements, and the inner wall of said socket member includes a pair of complementary grooves (82, *a*, *b*) extending to the open from said recesses, for facilitating movement of said spheres between detented and separated positions.

25. A ski binding for removably attaching a skier's boot to a ski, comprising an interengaging mechanism (FIGS. 1, 13, 16) between the boot (250) and the ski (10), said mechanism having substantially planar engaging portions (12/14, 12'/14', 120//140, 220/240) forward of the heel portion of the boot and rearward of the toe portion of the boot, operatively associated with the boot and the ski, respectively, detent means (60/73, 60/73', 60/176, 60/276, 150/158, 162) forming part of said engaging portions for positive indexing therebetween in the respective planes of said engaging portions as well as in angular directions with respect to the longitudinal axes of the boot and the ski, said engaging portions being adapted to react by relative rotational movement, movement out of said planes of the engaging portions, and a combination of said movements, upon occurrence of a force of predetermined magnitude and duration, thereby allowing release of said engaging portions from each other and of the boot from the ski when the skier encounters a major obstacle which results in said force, wherein said engaging portions include a socket member (14, 14', 140, 240) and a plug member (12, 12', 120, 220), said members being adapted to be resiliently, detachably interconnected, and resilient means (66, 144) for maintaining said members in connected relation, and wherein said plug member is of generally annular form, having at least two outwardly directed passages (54), a spring element (66), constituting said resilient means, and a detent element (60) in each passage, said spring elements being lodged more inwardly than said detent elements, and means (58) for restraining said detent elements in said passages to limited movement in a direction outwardly from said plug member, and means (62, 76, 176, 276 to 279) associated with the inner ends of said passages for adjusting the compressive force of said spring elements, and finally wherein said plug member includes at least one pair of levers (180) having terminal detent portions (182) while said socket member includes at least one pair of apertures (242, 250*a*) for receiving said detent portions, and further comprising biasing means (66, 162) in said plug member for urging said detent portions in engagement with said apertures.

26. A ski binding for removably attaching a skier's boot to a ski, comprising an interengaging mechanism (FIGS. 1, 13, 16) between the boot (250) and the ski (10), said mechanism having substantially planar engaging portions (12/14, 12'/14', 120/140, 220/240) forward of the heel portion of the boot and rearward of the toe portion of the boot, operatively associated with the boot and the ski, respectively, detent means (60/73, 60//73', 60/176, 60/276, 150/158, 162) forming part of said engaging portions for positive indexing therebetween in the respective planes of said engaging portions as well as in angular directions with respect to the longitudinal axes of the boot and the ski, said engaging portions being adapted to react by relative rotational movement, movement out of said planes of the engaging portions, and a combination of said movements, upon occurrence of a force of predetermined magnitude and duration, thereby allowing release of said engaging portions from each other and of the boot from the ski when the skier encounters a major obstacle which results in said force, wherein said engaging portions include a socket member (14, 14', 140, 240) and a plug member (12, 12', 120, 220), said members being adapted to be resiliently, detachably interconnected, and resilient means (66, 144) for maintaining

said members in connected relation, and wherein said plug member is of generally annular form, having at least two outwardly directed passages (**54**), a spring element (**66**), constituting said resilient means, and a detent element (**60**) in each passage, said spring elements being lodged more inwardly than said detent elements, and means (**58**) for restraining said detent elements in said passages to limited movement in a direction outwardly from said plug member, and means (**62, 76, 176, 276** to **279**) associated with the inner ends of said passages for adjusting the compressive force of said spring elements, and finally wherein said force adjusting means includes a screw (**76, 176, 276**) centrally disposed in said plug member, adapted to bear against the inner ends of said spring elements and compress them substantially in proportion to the axial movement of said screw, finally comprising a fixed slip collar (**279**) within which said screw is freely rotatable, a disc (**277**) to which said screw is threadedly connected and which is adapted to be displaced along the axis of said screw, proportional to said axial movement of the screw, and spheres (**262**) at said inner ends of the spring elements, the peripheral edges of said collar and said disc being contoured to receive said spheres, whereby said axial movement alters the displacement of said spring elements by the radial displacement of said spheres.

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