Oct. 31, 1967 G. P. J. SALOMON 3,350,110

SAFETY SKI BINDING

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Fig. 1

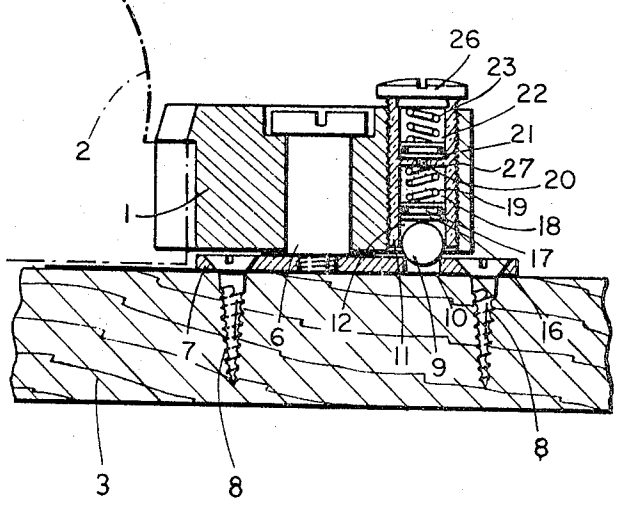
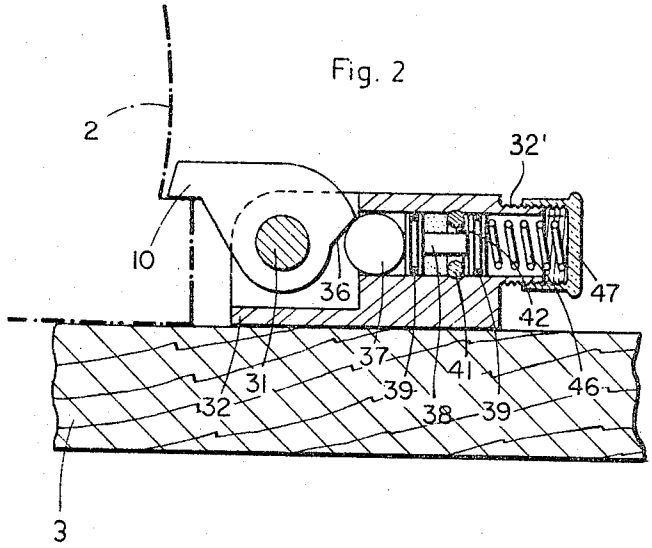


Fig. 2



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SAFETY SKI BINDING

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Fig. 3

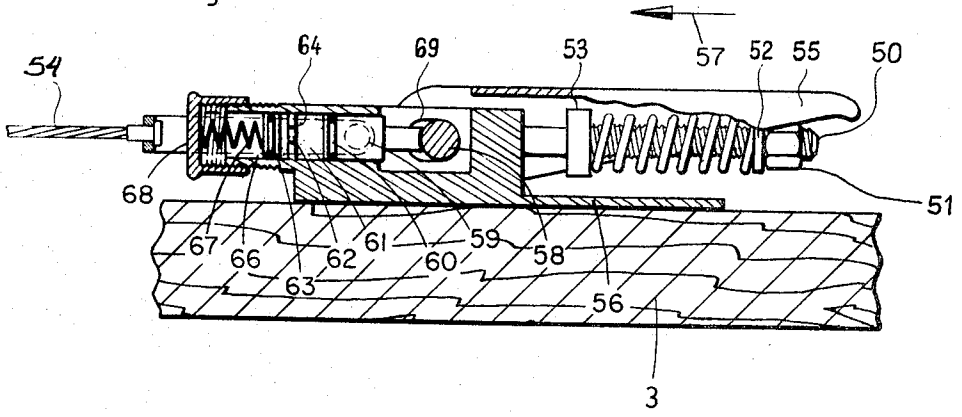


Fig. 4

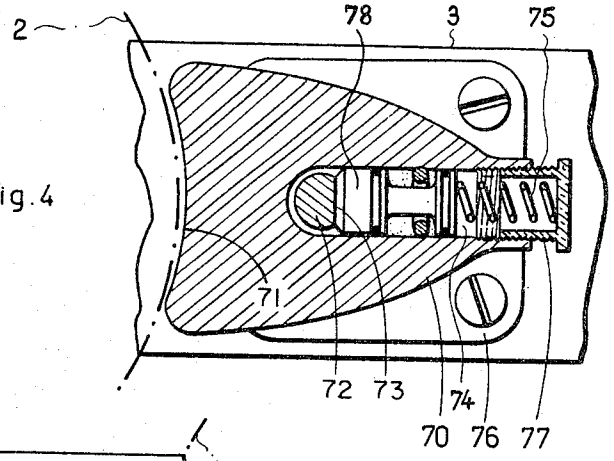
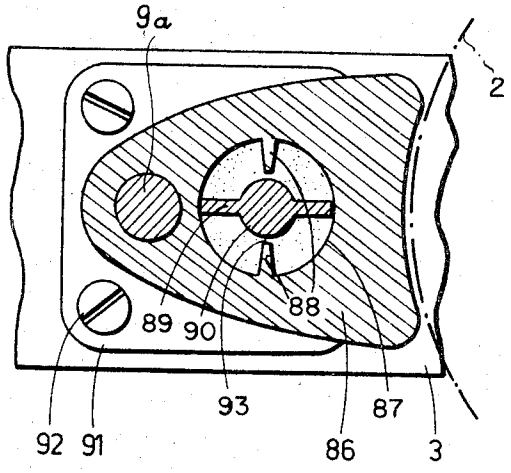


Fig. 5



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SAFETY SKI BINDING

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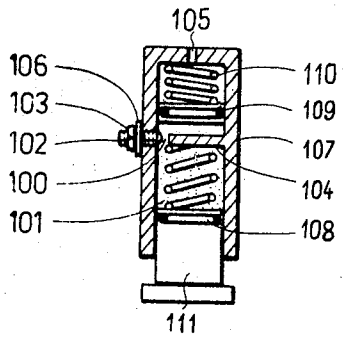
Fig. 6



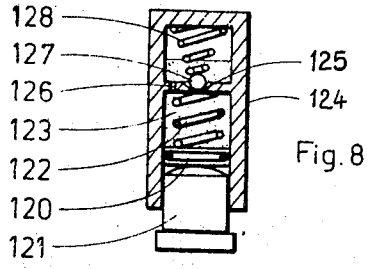


Fig. 8

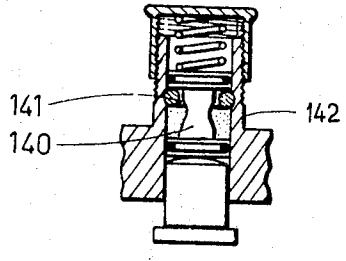
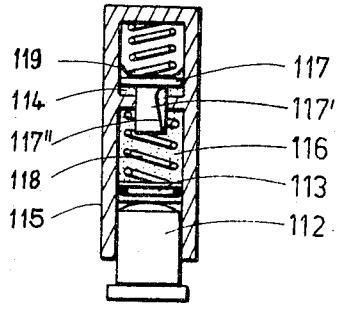


Fig. 10

Fig. 7



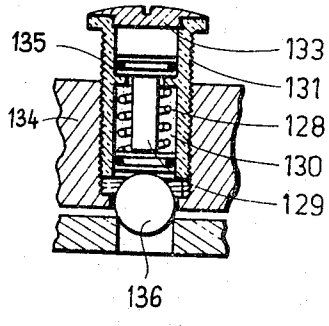


Fig. 9

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Fig. 11

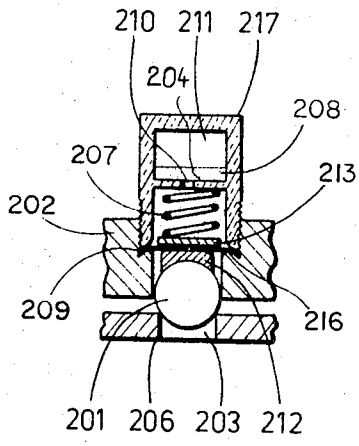
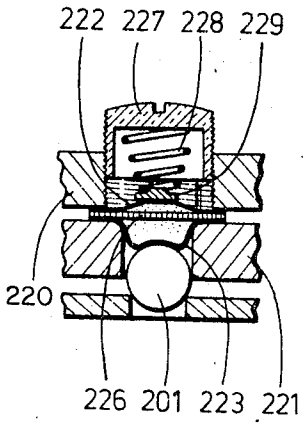


Fig. 12



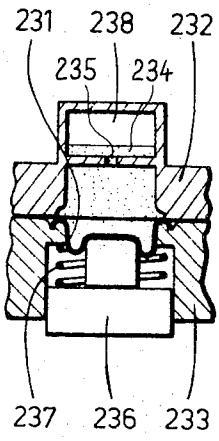


Fig. 13

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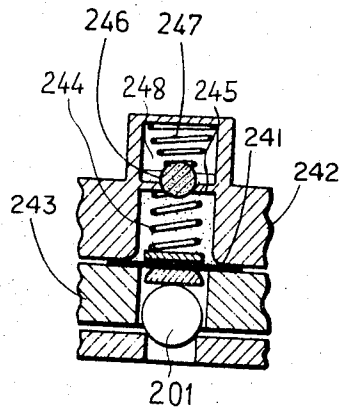
Fig.14



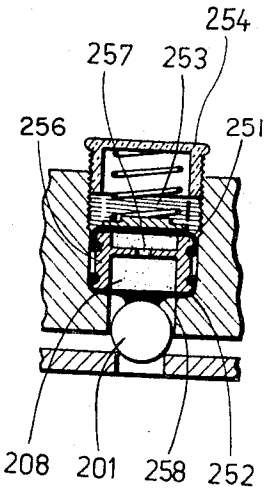


Fig.15

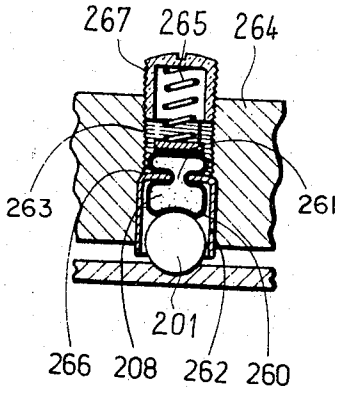


Fig.16

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United States Patent Office 3,350,110
Patented Oct. 31, 1967

3,350,110

SAFETY SKI BINDING

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Filed Aug. 24, 1966, Ser. No. 574,759
Claims priority, application France, Aug. 25, 1965, 29,465; Jan. 29, 1966, 47,738
15 Claims. (Cl. 280—11.35)

My present invention relates to a safety ski binding wherein two relatively movable elements, one of them fixed to a runner and the other in direct or indirect engagement with a boot, are normally held in a predetermined operative position from which they can be released in response to several abnormal stresses.

Various means are known for normally retaining the movable element of such ski binding, e.g., a heel or toe clamp, in a predetermined operative position with reference to the fixed element, such as a base plate attached to the upper runner surface. In U.S. Patent 2,698,757 (Berlenbach), for example, a spring-loaded ball check is used for the yieldable immobilization of a rotatable toe-clamp carrier with reference to the runner; a similar system is disclosed in U.S. Patent No. 2,867,446 (Rehacek). In these known devices, the ball-shaped detent member partly engages in a complementary recess of the opposite element under the sole pressure of its biasing spring so that any impact, however short, will dislodge it if its magnitude is sufficient to overcome the biasing force. There exists, however, a certain tolerance level below which the body of a skier can readily absorb short stresses of a magnitude which, if sustained over long periods (e.g., as a result of a fall), would become extremely uncomfortable. A spring-loaded detent, on the other hand, cannot discriminate between stresses effective over shorter and longer periods and will therefore release as soon as the stress reaches the threshold for which it has been set.

It is, therefore, the general object of my present invention to provide means in a ski binding for releasably interconnecting two relatively movable elements, such as a base plate and a toe or heel clamp, in a manner insuring that the normal operating position of these elements will be retained in the absence of severe abnormal stresses whose intensity, integrated over a period of time, exceeds a predetermined limit so that brief shocks of moderate intensity will be ineffectual.

This object is realized, pursuant to my present invention, by the provision of a dash-pot assembly as part of the means for retaining the two relatively movable elements in their operative position, the assembly forming a fluid chamber containing a hydraulic liquid such as oil which, under the action of one or more pistons, is displaceable through a restricted passage when the piston or pistons are set in motion by an incipient relative movement of the two elements.

The invention is applicable to ski bindings provided with the aforedescribed detents of the ball-check type, with the piston of the dash-pot assembly either bearing upon the ball check or acting independently thereof; it can also be used with bindings lacking such detents, e.g., those wherein a cable of other boot-engaging means is simply stressed against a boot by the operation of a toggle lever or similar latching device.

My invention will be described in greater detail with reference to the accompanying drawing in which:

FIG. 1 is a sectional elevational view of a heel clamp forming part of a ski binding according to the invention;

FIG. 2 is a view similar to FIG. 1, showing a different embodiment;

FIG. 3 is another view similar to FIG. 1, illustrating the application of the invention to a cable tightener of a ski binding;

FIG. 4 is a sectional plan view showing a toe clamp embodying the invention;

FIG. 5 is a view similar to FIG. 4, showing another modification of the clamp; and

FIGS. 6–16 are cross-sectional views of a variety of dash-pot assemblies adapted to be interchangeably used in the embodiments of FIGS. 1–4.

FIG. 1 shows a toe clamp wherein, as generally disclosed in the aforementioned Berlenbach patent, a clamp element **1** is rotatably mounted on a base plate **7** by means of a stud **6**, the plate **7** being fixed to a runner **3** by wood screws **8**. The front of the clamp is designed as a jaw laterally engaging the heel of a boot **2** (indicated in dot-dash lines), the boot being urged rearwardly by a conventional spring-loaded toe clamp not shown. In response to severe lateral stresses, the boot is free to swing out sideways with rotation of element **1** about the axis of stud **6**, such rotation being normally prevented by a ball check **9** partly received in a circular hole **10** of base plate **7**.

The retaining ball **9** is under downward pressure from a flat piston **16** which is slidably mounted with the aid of a packing ring **17** in a fluid chamber **12** defined by an externally threaded sleeve **11**; this sleeve is screwed into a vertical bore of element **1**, offset from the stud **6**, and is fixedly provided with a slitted top **26** by which it may be rotated with the aid of a screw driver.

A transverse partition **27** within the sleeve **11** is formed with a narrow aperture **20** for the passage of a hydraulic liquid **18** occupying the chamber **12**. This liquid is confined by piston **16** below the partition and a counterpiston **21** above the partition, this counterpiston being similar to piston **16** and being overlain by an air space **22** which may be vented to the atmosphere, e.g., as shown in FIG. 6, or closed so that the air cushion therein elastically resists the upward movement of that piston. Each of the pistons **16**, **21** is provided with an individual biasing spring **19** and **28** bearing upon the partition **27** and the top **26**, respectively.

In the normal use of the ski, the clamp shown in FIG. 1 occupies the illustrated position in which it is held by the detent **9**. In response to lateral stresses tending to rotate the element **1** on the base plate **7**, ball **9** is cammed upwardly at a rate and to an extent determined by the intensity and duration of the stress. If the shock is of only moderate strength and abates quickly, insufficient liquid will pass through the aperture **20** to enable a complete withdrawal of ball **9** from recess **10**; as soon as the stress has ceased, the lower spring **19** through its piston **16** instantly restores ball **9** to its normal position while the upper spring **23** through its piston **21** gradually returns the displaced liquid **18** to the fluid space underneath partition **27**. The bias of spring **19** alone should be so chosen (through rotation of sleeve **11**) that the ball **9** can rise in response to any lateral stress which, if rapidly recurring or persisting over an extended period, would make the skier uncomfortable.

The heel clamp shown in FIG. 2 comprises a fixed element in the form of a block **32** permanently secured, by screws not shown, to the runner **3**. Pivotally mounted on the block **32**, by means of a horizontal pin **31**, is a movable element **30** which swings in a vertical plane and bears from above upon the heel of boot **2**. Element **30** has a camming surface **36** normally engaged by a ball-shaped detent **37** forming part of a dash-pot assembly similar to that described in connection with FIG. 1. A piston **38**, provided with two heads **39** and **39'**, is under pressure of a spring **46** within a fluid chamber formed by a horizontal bore of block **32**. Spring **46** bears upon a screw cap **47** which threadedly engages a projection **32'** of element **32**; manual rotation of this cap enables adjustment of the spring pressure. A snap ring **41**, fitted into a peripheral recess of the fluid chamber, defines with

the stem of piston **38** a restricted annular passage **42** for the hydraulic fluid.

The operation of the system of FIG. 2 is analogous to that of FIG. 1 except that the clamp is released by severe vertical stresses (tending to raise the heel of boot **2**) rather than lateral horizontal stresses as in the preceding embodiment.

In FIG. 3 I have shown a cable tightener comprising an anchor block **56** which is longitudinally slidable along the runner **3**, as indicated by arrow **57**. A pair of parallel bolts **50** (only one shown) extend rearwardly from the block **56** and carry respective nuts **51** which serve as abutments for coil springs **52**, the latter bearing upon a slider **53** to which a cable **54** is fastened. The cable **54** may be looped in the usual manner around the heel of a boot not shown in this figure. A toggle lever **55** is articulated to the block **56** by a transverse pin **58** and is pivotally mounted on the runner **3** by a linkage which has not been illustrated but may be generally similar to that shown in U.S. Patent No. 2,733,075 (Rehacek). When the lever **55** is depressed as seen in FIG. 3, spring **52** is compressed and cable **54** is tensioned around the boot of the skier. In this position the lever **55** and its associated linkage represent an element which is fixed with reference to the runner **3**.

The pin **58** is in contact with a piston **59** forming part of a dash-pot assembly of the general character heretofore described. Piston **59** is fitted with the aid of a packing ring **60** in a bore **66** of block **56** occupied by a hydraulic liquid **61**. A restricted passage **62** is formed in a transverse partition **64**, beyond which a counterpiston **63** is held under pressure from a coil spring **67** which is adjustably retained by a screw cap **68**.

In response to severe pulls on the cable **54**, not absorbed by the relatively stiff springs **52**, block **56** with its dash-pot assembly moves toward the right to the extent permitted by the hydraulic resistance of its fluid chamber, thereby allowing a sufficient slackening of the cable to release the boot. It should be noted that the pin **58** is lodged in elongated cutouts **69** of block **56** which permit the necessary relative displacement of this block and the stationary lever assembly.

In FIG. 4 I have shown a toe clamp **70** which is horizontally pivotable on its base plate **76** screwed onto the runner **3**, by being journaled on a stud shaft **72** rigid with that plate, the concave rear face **71** of the clamp element **70** bearing upon the toe of the boot **2**. Shaft **72** has a frame **73** upon which bears the head of a piston **78** forming part of a dash-pot assembly generally similar to the one shown in FIG. 2. The assembly is lodged in a bore **74** of element **70** which has a threaded end engaged by a screw cap **77** serving to vary the stress of the biasing spring **75**.

Under the pressure of its spring **75**, piston **78** will tend to maintain its illustrated position relative to the flat face **73** of shaft **72**. Even after the piston **78** has been forced back by the shaft **72** rotating relatively thereto, spring **75** will exert a restoring force which will be effective over a considerable angle of rotation to either side from the normal position illustrated.

FIG. 5 shows another toe clamp whose swingable element **86** is pivotable around a shaft **90** which rises from a base plate **91**, the latter being secured by screws **92** to the runner **3**. A ball **9***a* forms part of a detent which is similar to the one shown in FIG. 1, except that this ball may be merely spring-loaded in the conventional manner instead of being under pressure of a hydraulic fluid. Clamping element **86** has a cylindrical recess **87** which is centered on the axis of shaft **90** and subdivided into two halves by a pair of radial ribs **89** extending in diametrically opposite direction from the shaft **90**. Two stationary ribs **88**, projecting inwardly from the periphery of recess **87**, terminate short of the shaft **90** so as to form therewith two restricted passages **93**.

Upon incipient relative rotation between the clamp **86** and the runner **3** in response to a lateral deflection of the boot **2**, the ribs **89** of shaft **90** act like pistons upon the fluid in the chamber **87**, the displacement of this fluid being impeded by the small clearances **93**. If the deflecting force is relatively weak and of short duration, the ball **9***a* will not be fully dislodged from its recess in the plate **91** and its loading spring will tend to return this ball to that recess, thereby camming the assembly back into the illustrated normal position.

I shall describe, in connection with FIGS. 6–16, a variety of modifications of the dash-pot assemblies shown in FIGS. 1–4. While the embodiments of FIGS. 6–16 are shown in part provided with a ball and in part equipped with a flat piston head, it will be apparent that the shape of the working end of each of these dash-pot assemblies may be modified to fit the bindings of any of FIGS. 1–4 or related structures.

In FIG. 6 I show an assembly comprising a cylinder **107** which forms a fluid chamber and has an open end occupied by a flat piston **108** in contact with a working plunger **111**. The arrangement is otherwise generally similar to that of FIG. 1, except that the constricted passage for the hydraulic fluid **101** is formed by a peripheral gap in a transverse partition **104**. A setscrew **102** in cylinder **107** is adjustable to vary the effective width of that gap and may be locked in position by a nut **103** bearing upon the cylinder wall through a washer **106**. A vent **105** in the closed end of cylinder **107** connects the air space beyond counterpiston **109** with the outer atmosphere so that this piston is biased only by the pressure of its loading spring **110**.

In FIG. 7, in which a cylinder **115** receives a piston **113** engaged by a plunger **112**, the associated counterpiston **117** has a stem **117′** slidably guided in a central aperture of a transverse partition **114**. Stem **117′** is laterally recessed at **117″**, the depth of this recess varying over the length of the stem so that the effective width of the fluid passage through partition **114** will depend on the axial position of this counterpiston. In the specific arrangement illustrated, the recess **117″** becomes progressively shallower toward the free end of stem **117′** so that the hydraulic liquid **116** will pass through the partition **114**, under pressure of piston **113**, at a relatively high initial rate which decreases with further piston displacement. Such a variable fluid passage will be of particular use in a mechanism where, e.g. as shown in FIGS. 2 and 4, the piston co-operates with a camming surface engaging it under a varying angle of attack. Piston **113** is loaded by a spring **118**; a packing disk **119** about the head of counterpiston **117** to provide airtight contact with the walls of cylinder **111**.

In FIG. 8 there is shown a cylinder **124** with a single piston **120** engaged by a working plunger **121**. A biasing spring **122** in fluid chamber **123** bears upon a partition **125** having a bleeding aperture **126** and a central bore accommodating a ball valve **127** which is under pressure of a relatively light spring **128**. Ball **127** will be dislodged in response to strong fluid pressures to permit an increased flow through the partition; upon its return to its seat, aperture **126** allows the displaced hydraulic liquid to flow back slowly under pressure of the air volume in the fluid chamber.

FIG. 9 shows an assembly, similar to that of FIGS. 2 and 4, with a two-headed piston **129** in a fluid space **130** of an externally threaded cylinder **131**; as in FIG. 1, the cylinder is closed opposite its working end by a slitted lid **133** which is soldered or otherwise made rigid with it to enable rotation of the cylinder in its supporting body **134**. A biasing spring **128** bears upon an apertured partition **135** and the head of piston **129** proximal to ball **136**.

FIG. 10 shows another modification of the dash-pot assembly of FIGS. 2 and 4 wherein the piston stem **140**, surrounded with annular clearance by a snap ring **141** in a sleeve **142**, is of noncylindrical shape, its varying diameter serving to change the effective width of the constricted

fluid passage in the manner described with reference to FIG. 7.

In FIG. 11, in which the two relatively movable elements are again a clamp member **202** and a base plate **206**, a spherical detent **201** is held in engagement with a recess **203** of plate **206** by a dash-pot assembly whose piston comprises an elastic membrane **209** and a spacer block **212** bearing upon the ball **201**. Membrane **209** spans the open end **216** of a cylinder **217** having a transverse partition **204** with a central aperture **210**. A biasing spring **207** is compressed between the partition **204** and a protective disk **213** resting against a face of membrane **209**. The hydraulic liquid in fluid chamber **211** has been indicated at **208**.

The system of FIG. 11 operates substantially in the same manner as the dash-pot assemblies heretofore described except that the elasticity of the membrane **209** supplements the biasing force of spring **207** and of the air volume compressed within space **211**.

In FIG. 12 the movable element is divided into two firmly interconnected portions **220** and **221** between which two flexible membranes **222** and **223** are clamped with interposition of a porous disk **226**. This disk forms a liquid-permeable partition in a fluid chamber defined by the two membranes, the interstices of this partition constituting a restricted passage for the liquid therein. This liquid is under pressure from a spring **228**, acting through a shoe **229** which rests against the membrane **222**, the spring pressure being adjustable by a screw cap **227** threaded into clamp portion **220**. Membrane **223** is in direct contact with locking ball **201**. Disk **226** may be peripherally coated or impregnated to prevent any leakage of the hydraulic fluid. Membrane **222** may again be of the elastic type in order to help maintain the ball **201** in its operating position.

FIG. 13 again shows a two-part movable element **232**, **233** between which a flexible membrane **231** is clamped. A spring **237** bears upon a plunger **236** which, in direct contact with membrane **231**, is lodged in a recess of part **233**. A partition **234** in fluid chamber **238**, formed within the other part **232**, again defines a restricted passage **235** for the hydraulic liquid. The restoring force for this liquid is here supplied merely by the air cushion in space **238**.

In FIG. 14, which shows an arrangement generally similar to that of FIG. 11, a membrane **241** clamped between two relatively fixed portions **242**, **243** of a movable element is under pressure from a spring **244** acting against a centrally apertured partition **245**. Seated in the aperture of this partition is a porous ball **246** held in position by an auxiliary spring **247**, generally in the manner described with reference to ball **127** and spring **128** of FIG. 8. Owing to the porosity of the ball **246**, liquid may pass through it even in its illustrated normal position (under the pressure of the compressed air in space **248**) so that the provision of bleeding aperture (as shown at **126** in FIG. 8) becomes unnecessary.

The system of FIG. 15 is generally similar to that of FIG. 12 except that the fluid chamber for the liquid **208** is here formed by a sleeve **256** with a restricted passage **257** spanned on its open ends by a pair of flexible membranes **251** and **252**. Membrane **251** is under pressure from a spring **253**, again held with adjustable pressure by a screw cap **254**, whereas membrane **252** bears directly upon ball **201** to a central reinforcement **258**.

In FIG. 16 the fluid chamber is formed as a completely closed flexible bag **260** containing the liquid **208**. This bag is externally reinforced by a rigid sleeve **262** having a bange **266** which projects inwardly to deform a portion of the bag and define a restricted passage **261**. Sleeve **262** is seated against a shoulder **266** in a bore **263** of the movable binding element **264**. Bag **260** is under pressure from a spring **265** received in a screw cap **267**.

While a variety of constructions embodying my present invention have been particularly described and illustrated, it will be apparent that many more modifications can be devised, e.g., through combinations or interchange of features from the various assemblies separately shown. It should also be borne in mind that the element bearing the dash-pot assembly need not necessarily be the movable clamp body, although this will usually be most convenient, but that the system could readily be reversed by placing this assembly on the fixed base plate for operative engagement of the movable element. These and other variations, readily apparent to persons skilled in the art, are intended to be embraced within the space and scope of my invention as defined in the appended claims.

I claim:

1. In a ski binding having a first element fixed to a runner, boot-engaging means including a second element secured to said first element with at least limited relative mobility, and retaining means normally preventing relative motion of said elements, the improvement wherein said retaining means includes a dash-pot assembly forming a fluid chamber and comprising piston means on one of said elements bearing upon the other of said elements, said fluid chamber having a restricted passage for a hydraulic liquid displaceable by said piston means upon movement thereof from a normal position in response to severe abnormal stresses.

2. The improvement defined in claim **1** wherein said retaining means comprises a detent member yieldably interconnecting said elements, and means including said dash-pot assembly maintaining said detent member operatively positioned in the absence of said abnormal stresses.

3. The improvement defined in claim **2** wherein said detent member comprises a ball check on one of said elements normally engaging in a recess on the other of said elements.

4. The improvement defined in claim **2** wherein said detent member comprises a ball on said first element normally contacting a camming formation of said second element.

5. The improvement defined in claim **2** wherein said detent member comprises a shaft rigid with one of said elements, the other of said elements being rotatably journaled on said shaft, said shaft having a flat normally engaged by said piston means.

6. The improvement defined in claim **2** wherein said detent member is a shaft rigid with one of said elements, said piston means comprising at least one rib projecting laterally from said shaft, said fluid chamber being formed in the other of said elements and being centered on the axis of said shaft while maintaining substantially fluid-tight overall contact with said rib.

7. The improvement defined in claim **1** wherein said dash-pot assembly further comprises resilient means bearing upon said piston means and urging same into contact with said other of said elements.

8. The improvement defined in claim **7** wherein said piston means comprises a first piston proximal to said other of said elements and a second piston remote from said others of said elements, said pistons being separated from each other by the liquid in said fluid chamber, said resilient means bearing upon at least said second piston.

9. The improvement defined in claim **8** wherein said fluid chamber has an internal partition with an aperture constituting said restricted passage, one of said pistons having a stem guided in said aperture and partly obstructing same, said stem being of varying cross-section for changing the effective width of said passage in different positions of said one of said pistons.

10. The improvement defined in claim **1** wherein said dash-pot assembly further comprises a spring-loaded valve body yieldably lodged in said restricted passage.

11. The improvement defined in claim **10** wherein said valve body is porous for permitting some liquid flow

through said passage even in a normal position in which said passage is fully obstructed by said body.

12. The improvement defined in claim 1 wherein said piston means includes part of a flexible membrane confining the hydraulic liquid in said fluid chamber.

13. The improvement defined in claim 12 wherein said membrane forms a closed bag around said hydraulic liquid.

14. The improvement defined in claim 13 wherein said dash-pot assembly further comprises a rigid sleeve surrounding said bag, said sleeve having at least one internal projection deforming a portion of said bag to form said restricted passage.

15. The improvement defined in claim 1 wherein said dash-pot assembly further comprises a porous partition in said fluid chamber forming said restricted passage.

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L. D. MORRIS, *Assistant Examiner.*