United States Patent [19]

Wilkes

[11] **3,731,943**

[45] **May 8, 1973**

[54] SAFETY SKI BINDING SYSTEM

[76] Inventor: **John D. Wilkes,** 1024 Wisconsin Avenue, Washington, D.C. 20007

[22] Filed: **Oct. 18, 1971**

[21] Appl. No.: **189,910**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 838,873, July 3, 1969, Pat. No. 3,614,119.

[52] **U.S. Cl.** .....**280/11.35 D**
[51] **Int. Cl.**.....**A63c 9/08**
[58] **Field of Search** .....280/11.35 K, 11.35 A, 280/11.35 C, 11.35 D, 11.35 E, 11.35 R, 11.35 B, 11.35 G

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Primary Examiner—Leo Friaglia
Assistant Examiner—Milton L. Smith
Attorney—Karl A. Limbach et al.

[57] **ABSTRACT**

A safety ski binding system wherein a binding assembly is provided for rigid attachment to a ski boot and includes a pair of jaws rotatable on axes parallel to the length of the ski between a released position where the jaws are above the top surface of the ski and a locked position where the jaws engage a ski attachment means connected to the ski. The attachment means are in the form of a rigid or hinged plate or longitudinal strips. The hinge is provided at the forward end of the plate, and the hinged plate includes latch means for releasably latching the rear end of the plate. The binding assembly includes means for moving the jaws from released to locking position and provision for stored energy release for movement of the jaws from locked to unlocked position when forces on the jaws exceed an adjustable force threshold.

41 Claims, 30 Drawing Figures

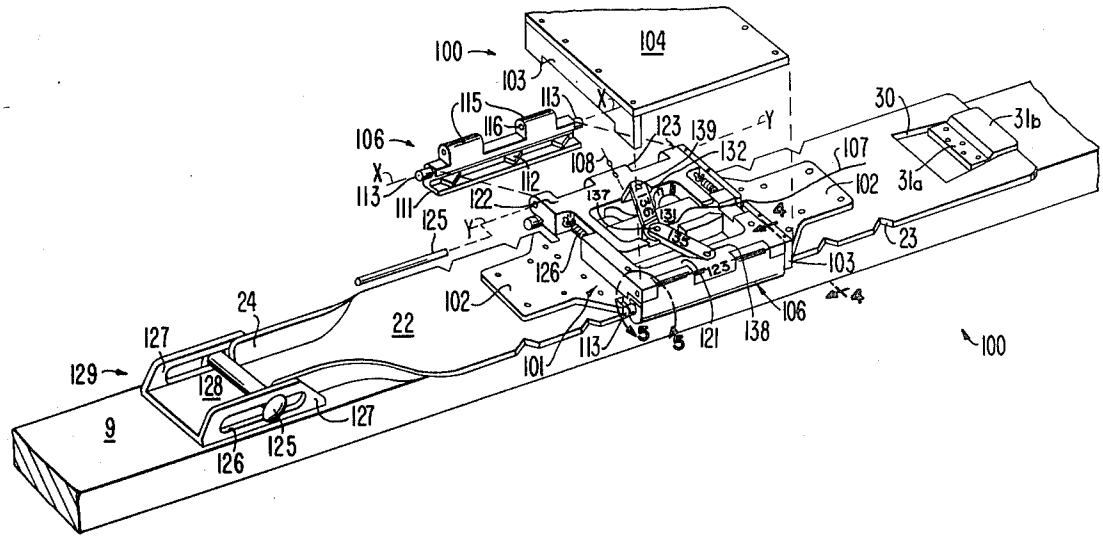
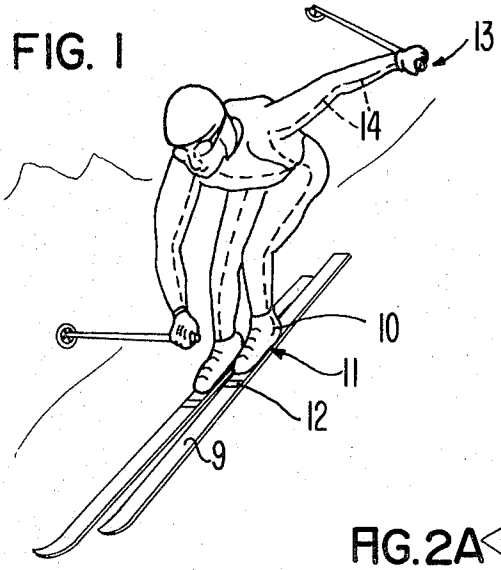


FIG. 1



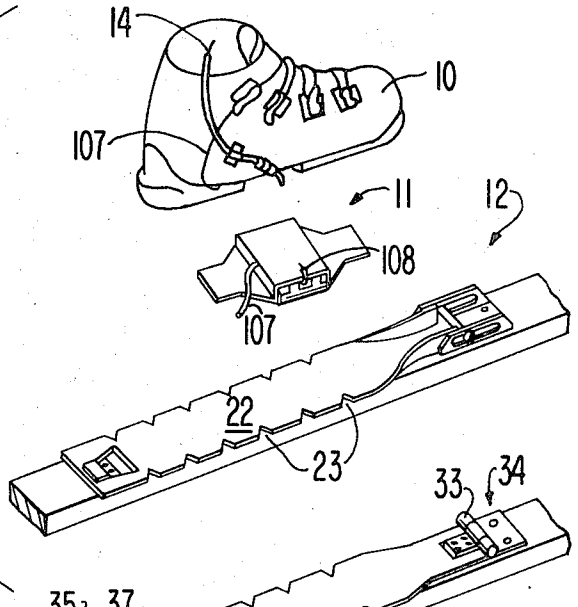


FIG. 2A

FIG. 2C

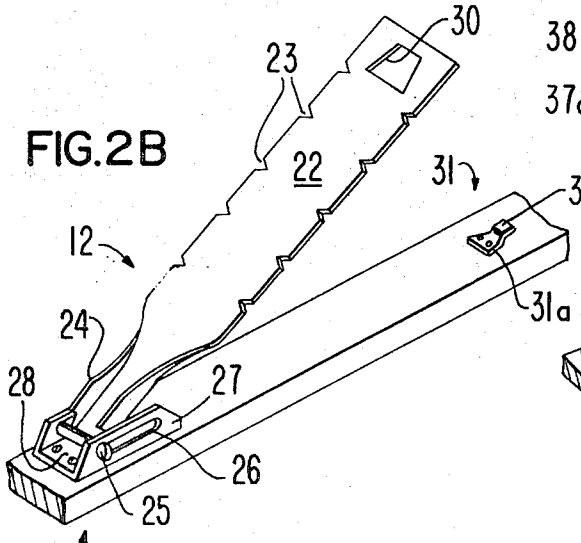


FIG. 2B

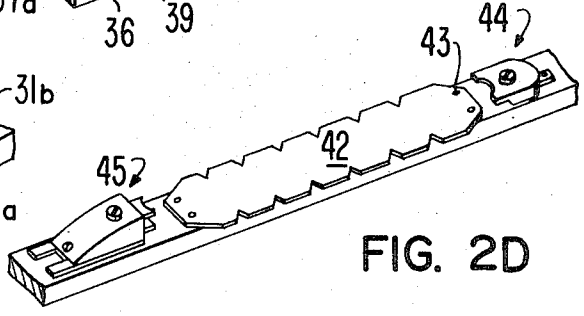


FIG. 2D

FIG. 4A

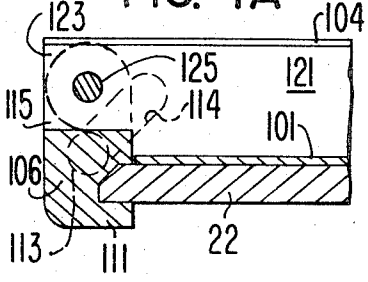


FIG. 4B

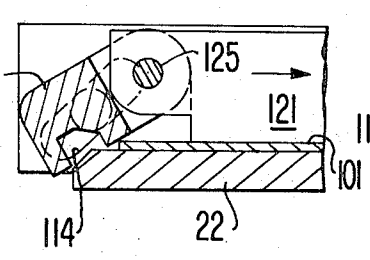
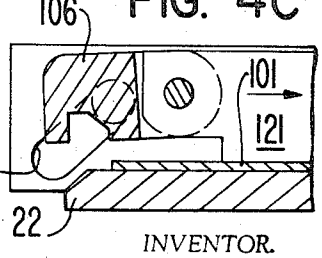


FIG. 4C



INVENTOR.
JOHN D. WILKES

BY Limbach, Limbach and Sutton

ATTORNEYS

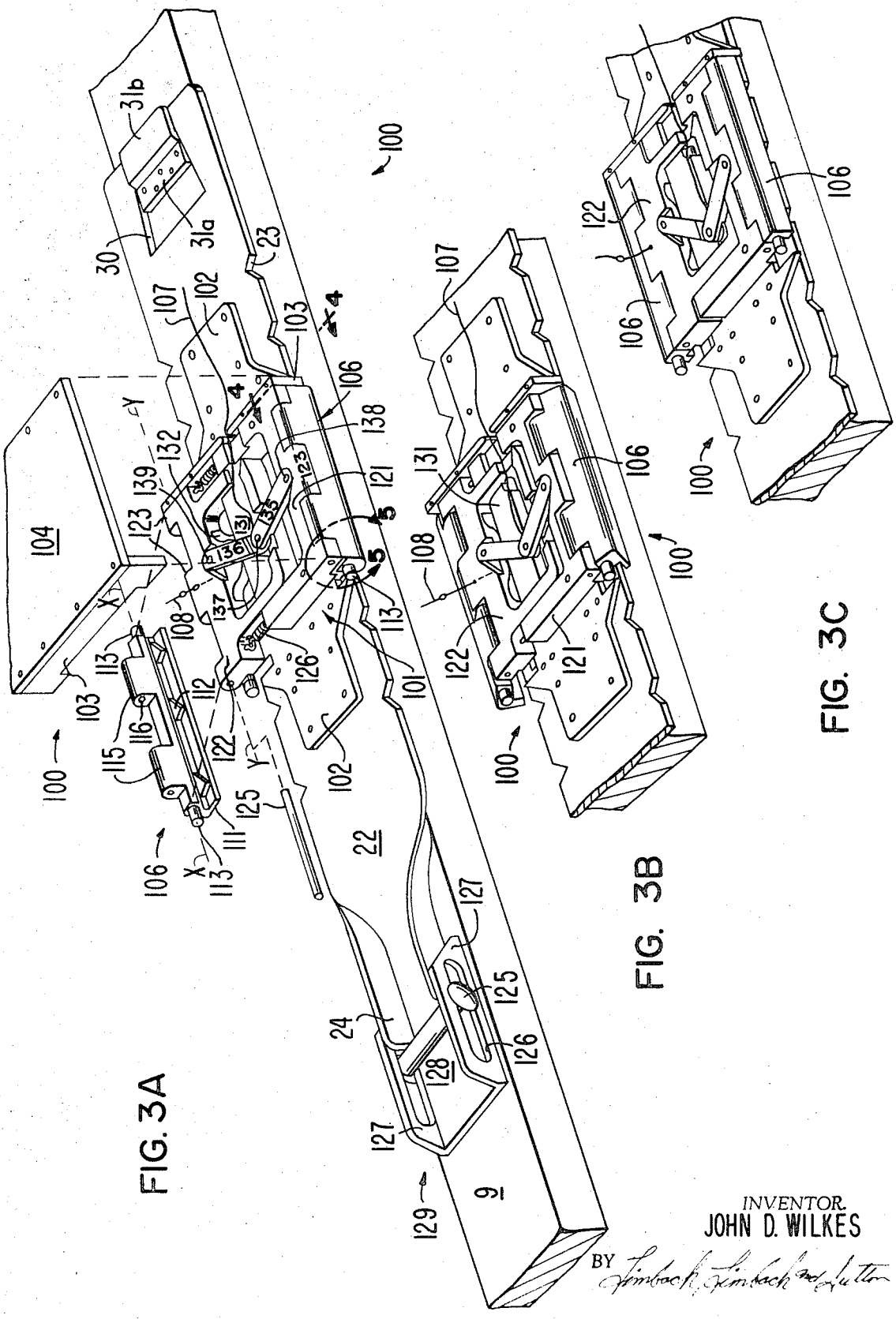


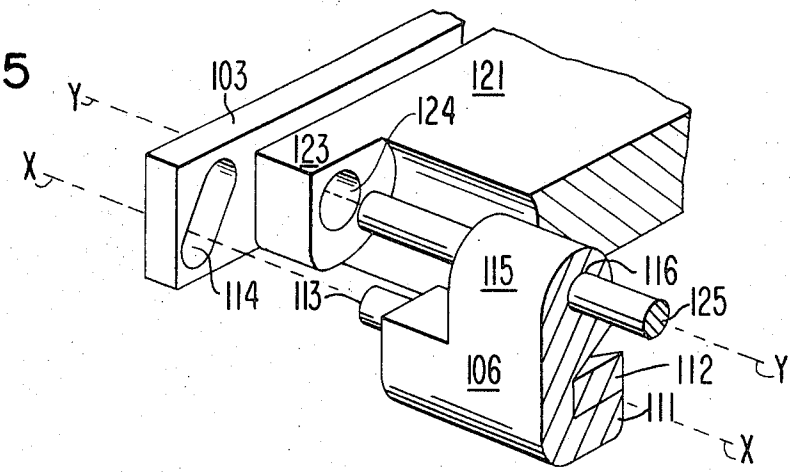
FIG. 3A

FIG. 3B

FIG. 3C

INVENTOR.
JOHN D. WILKES
BY Fimbach, Fimbach and Sutton
ATTORNEYS

FIG. 5



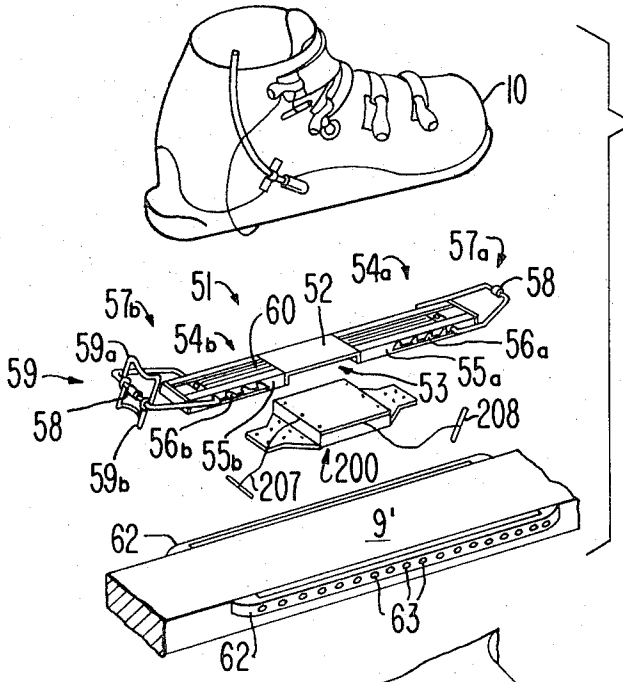


FIG. 8

FIG. 10

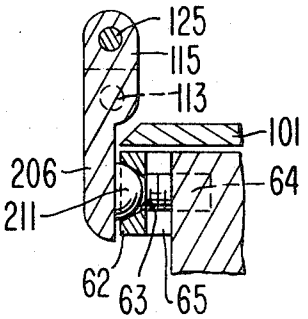
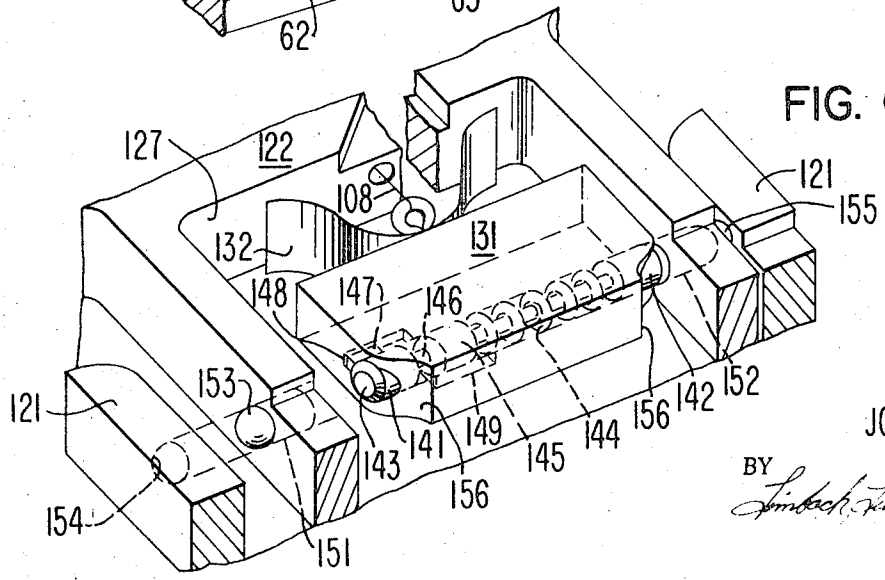


FIG. 6



INVENTOR.
JOHN D. WILKES

BY Limbach, Limbach & Sutton

ATTORNEYS

FIG. 7A

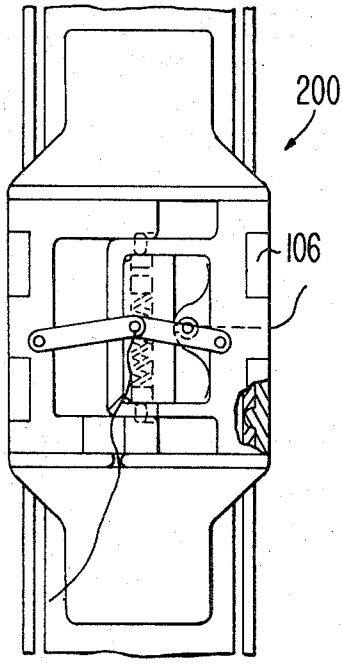


FIG. 7B

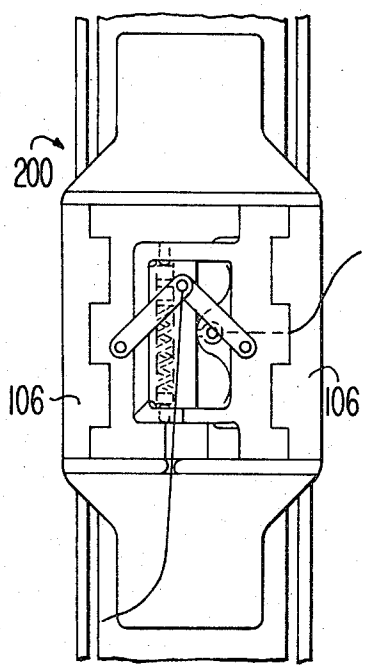


FIG. 7C

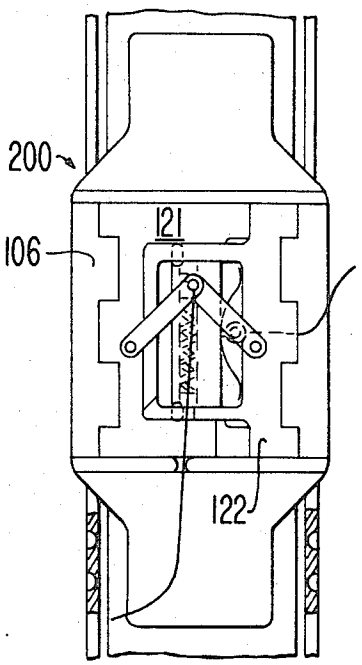


FIG. 9A

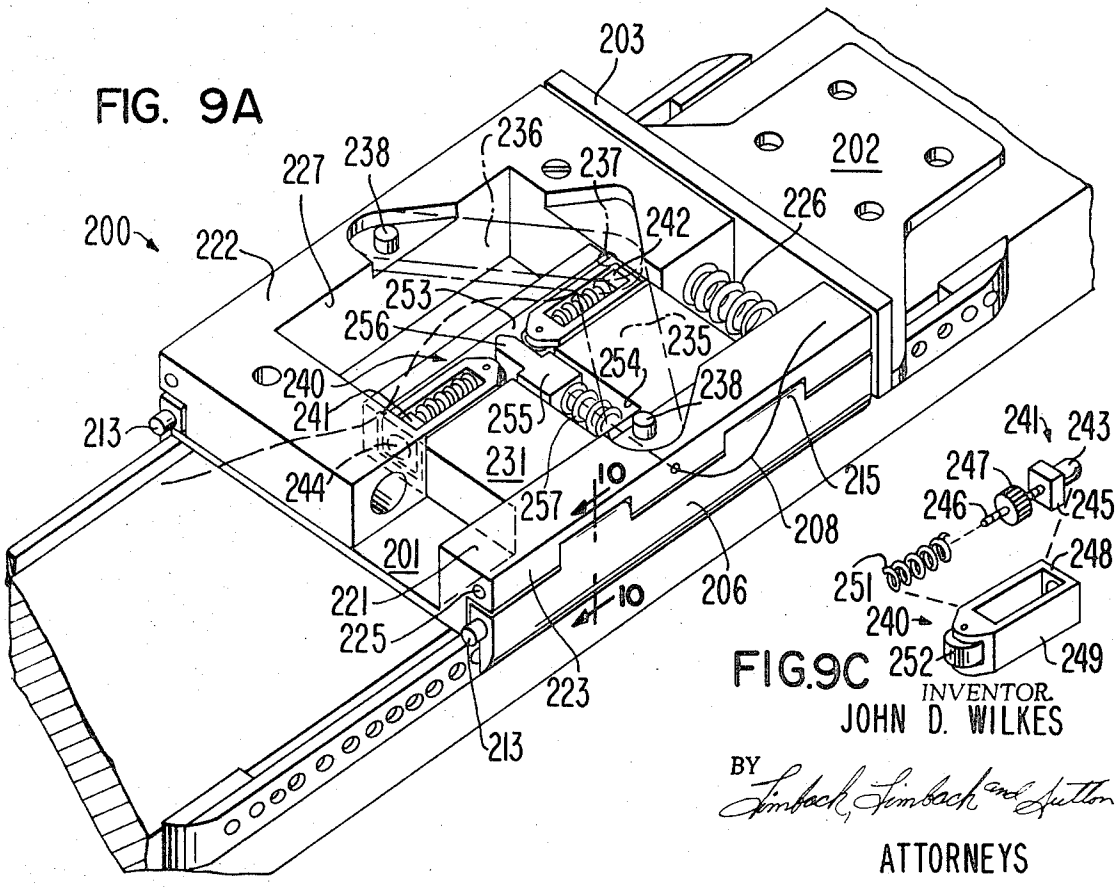


FIG.9C

INVENTOR.
JOHN D. WILKES

BY Limbach, Limbach and Sutton

ATTORNEYS

FIG. 9B

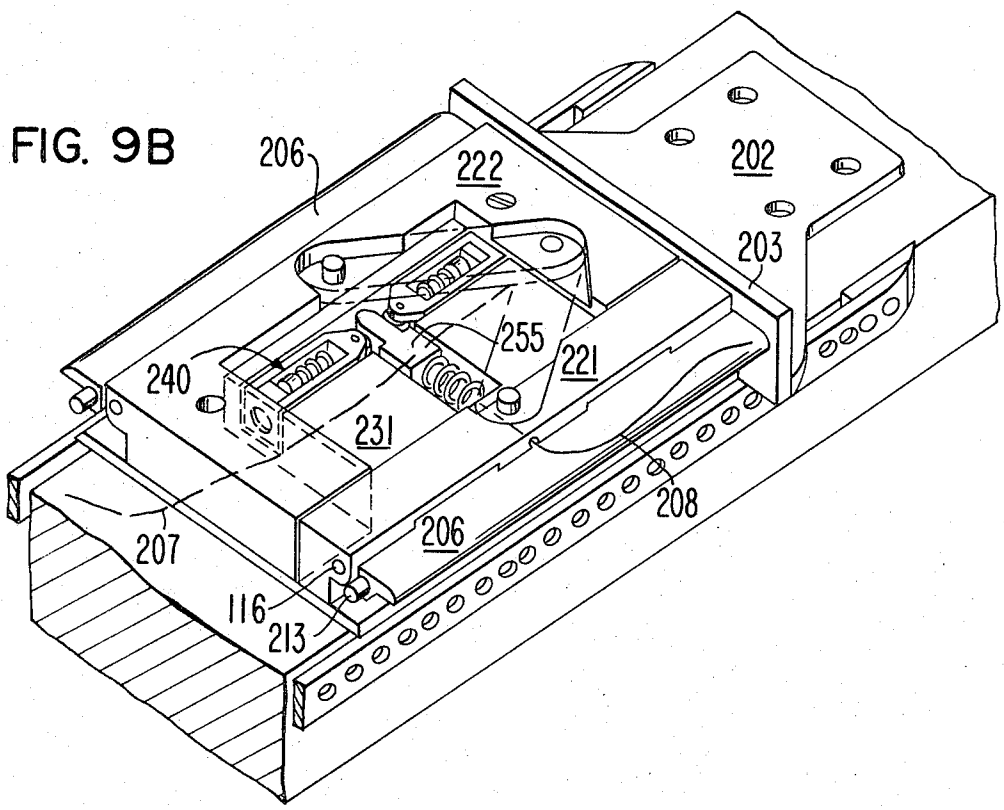
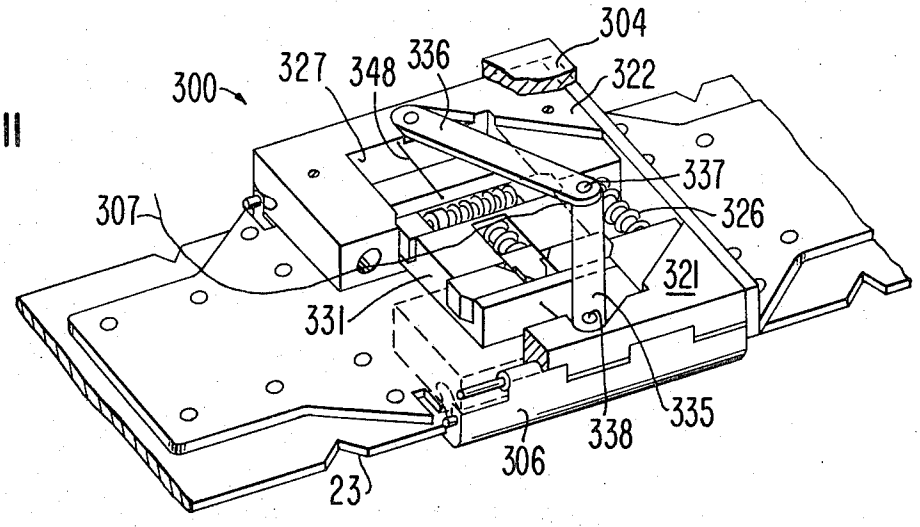


FIG. 11



INVENTOR.
JOHN D. WILKES

BY Limbach, Limbach and Sutton

ATTORNEYS

FIG. 12A

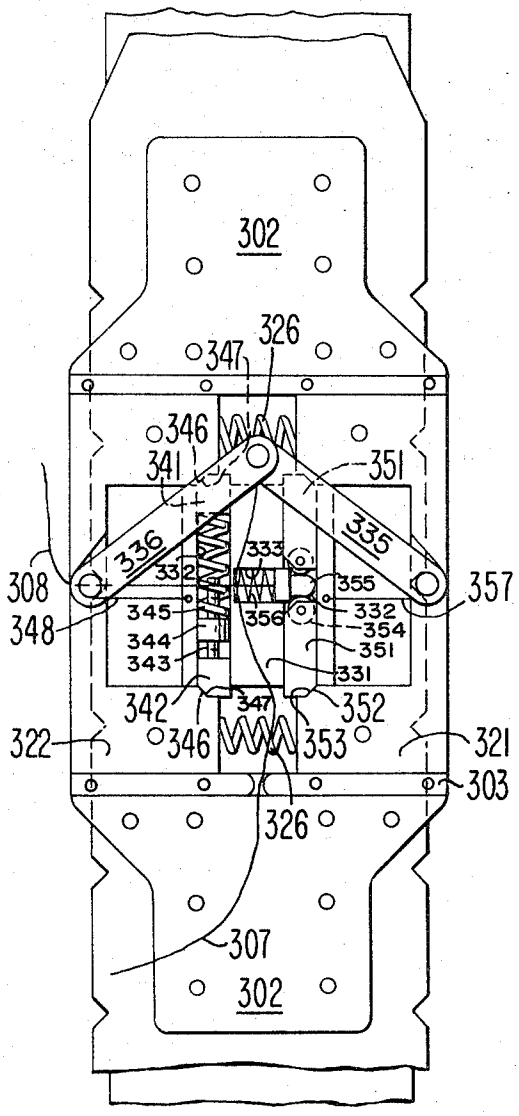
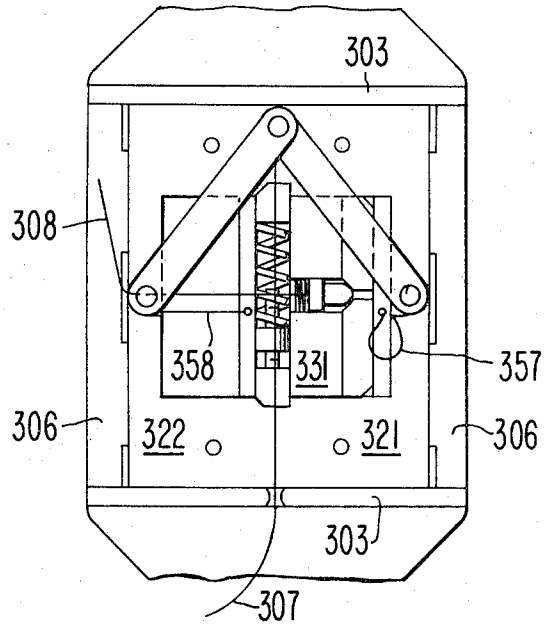


FIG. 12B



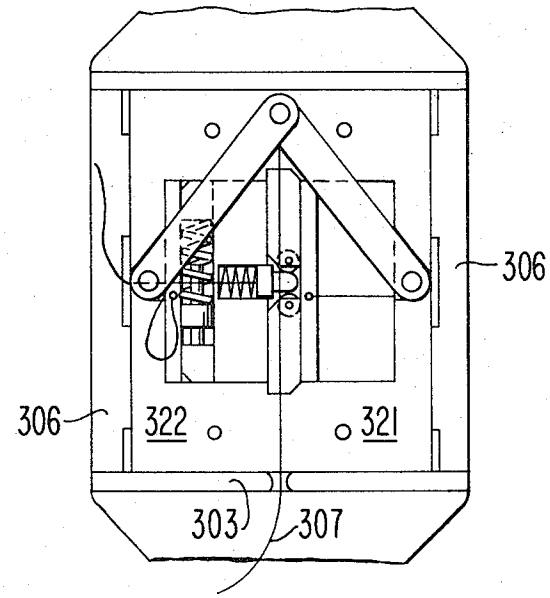
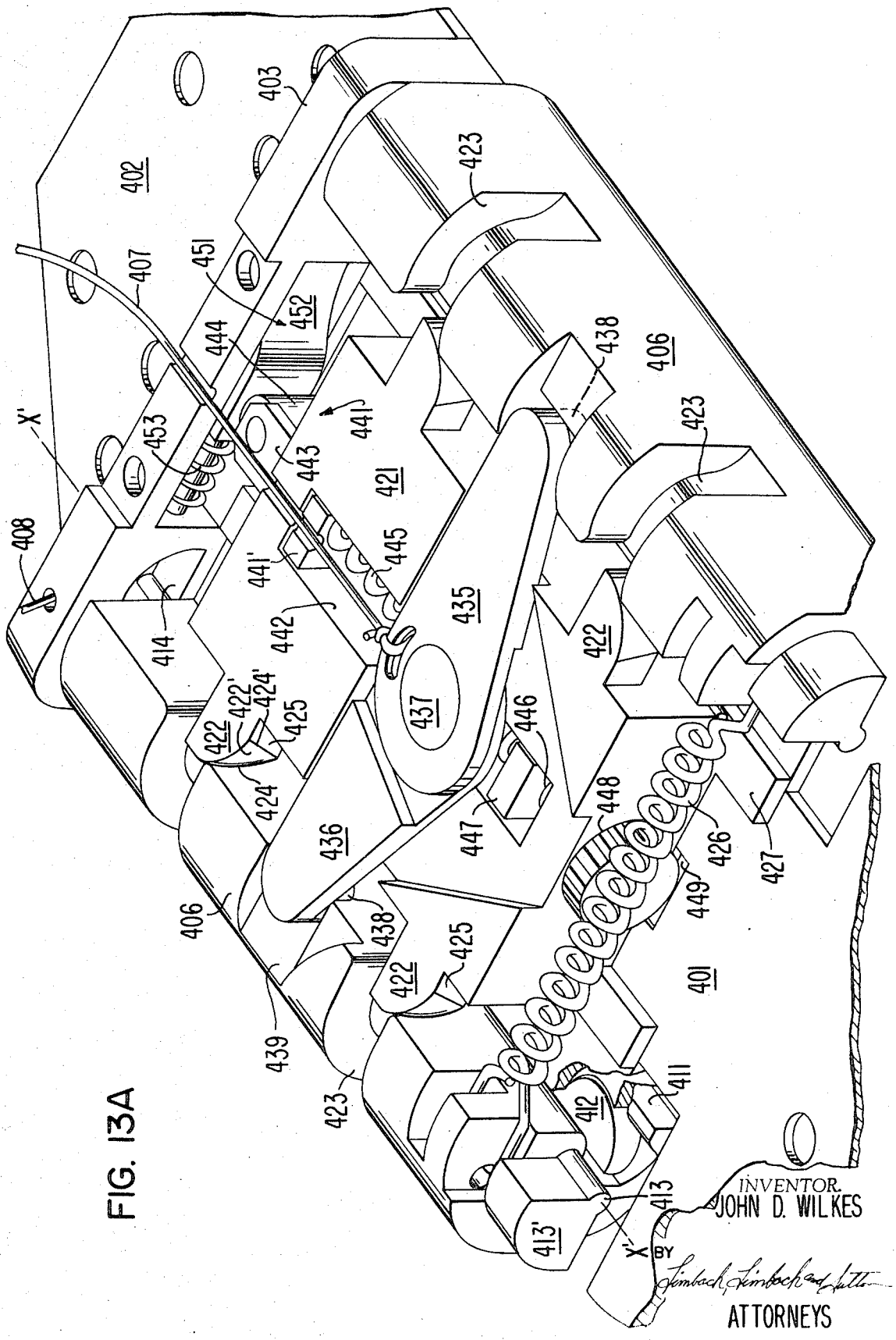


FIG. 12C

INVENTOR.
JOHN D. WILKES
BY Limbach, Limbach and Sutton
ATTORNEYS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INVENTOR.
JOHN D. WILKES
BY
Kimbach, Kimbach and Sutter
ATTORNEYS

FIG. 13A

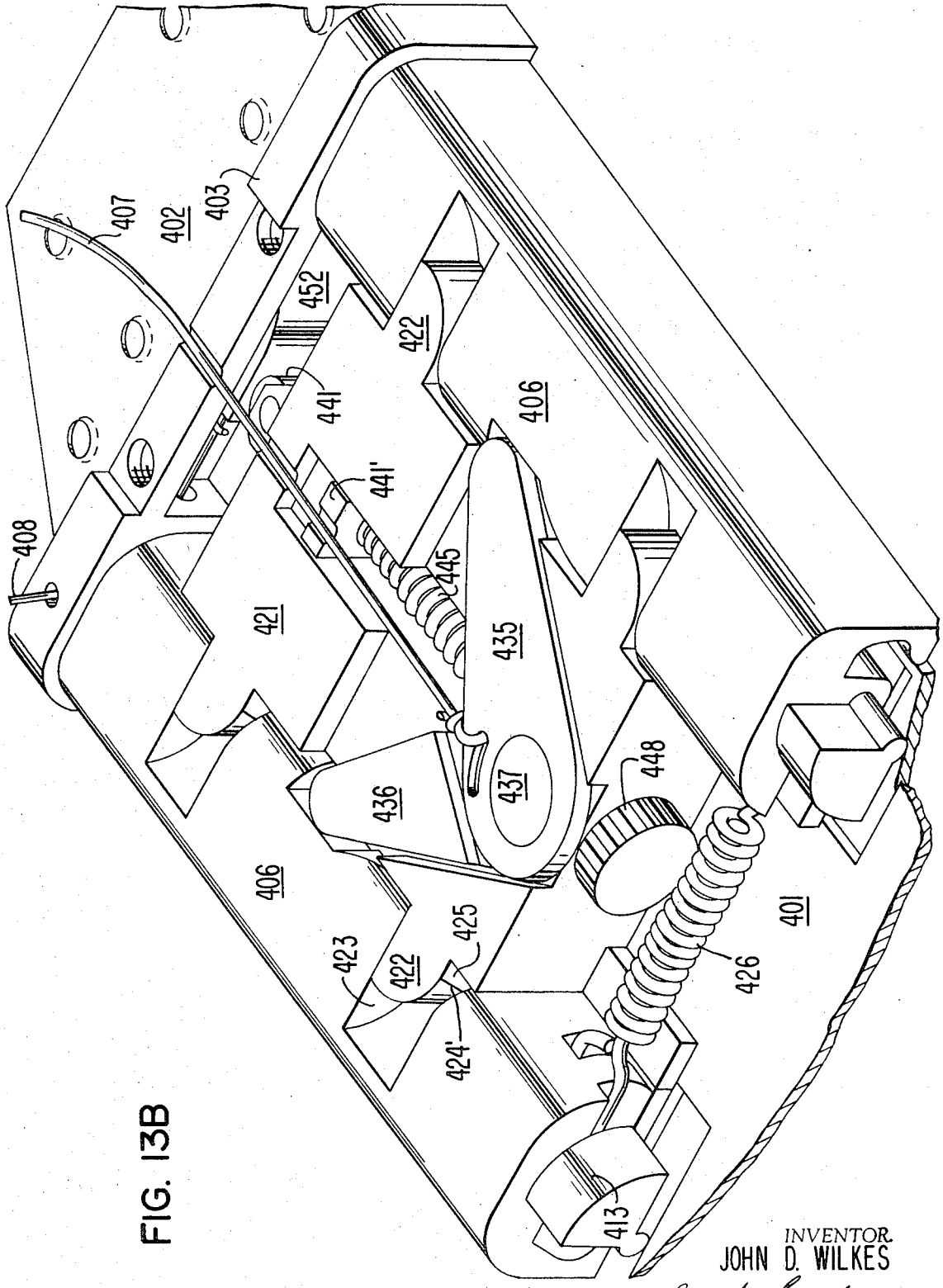

FIG. 13B

INVENTOR.
JOHN D. WILKES
BY Limbach, Limbach and Sutton
ATTORNEYS

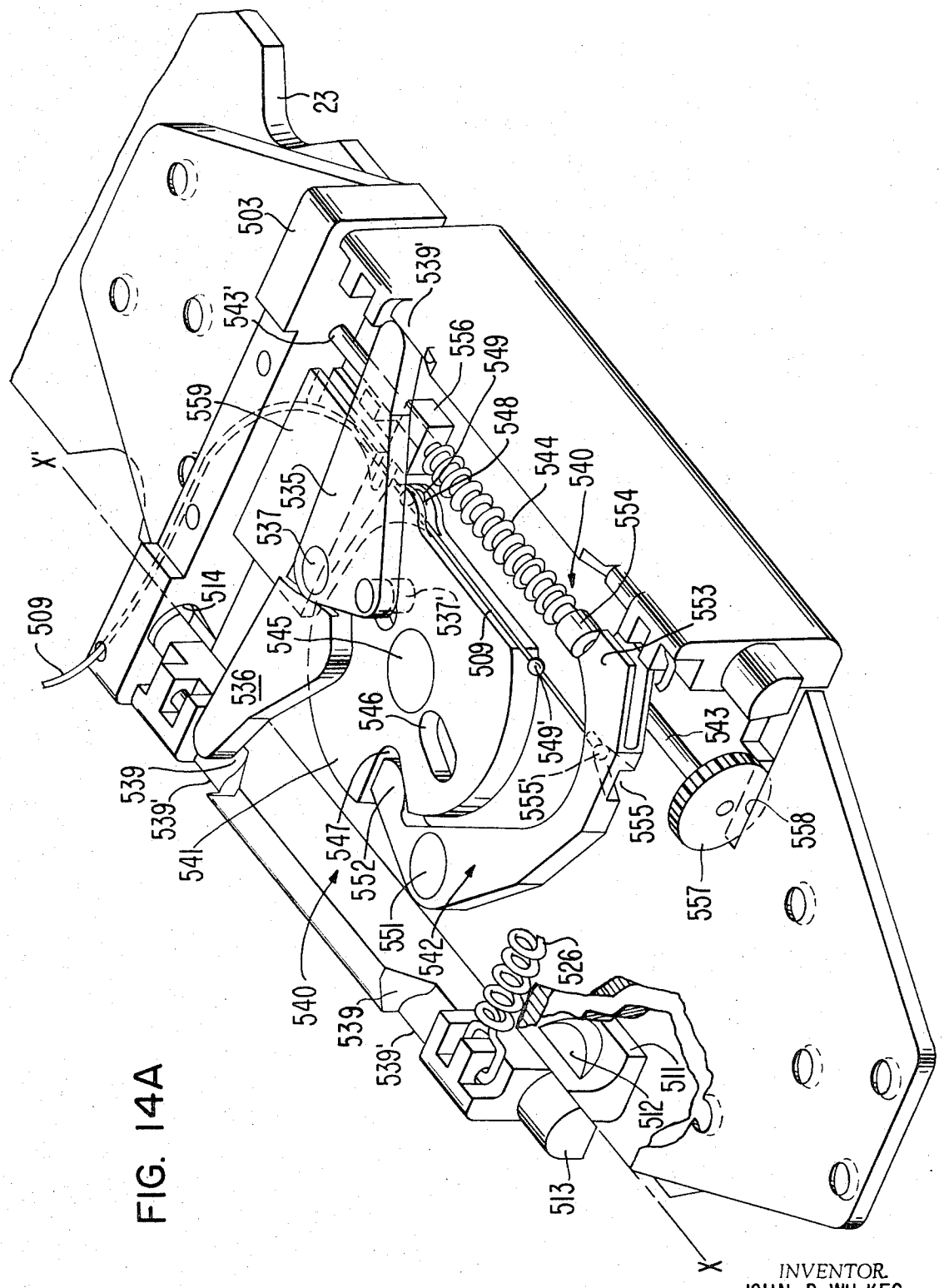

FIG. 14A

INVENTOR.
JOHN D. WILKES

BY
Limbach, Limbach & Sutton
ATTORNEYS

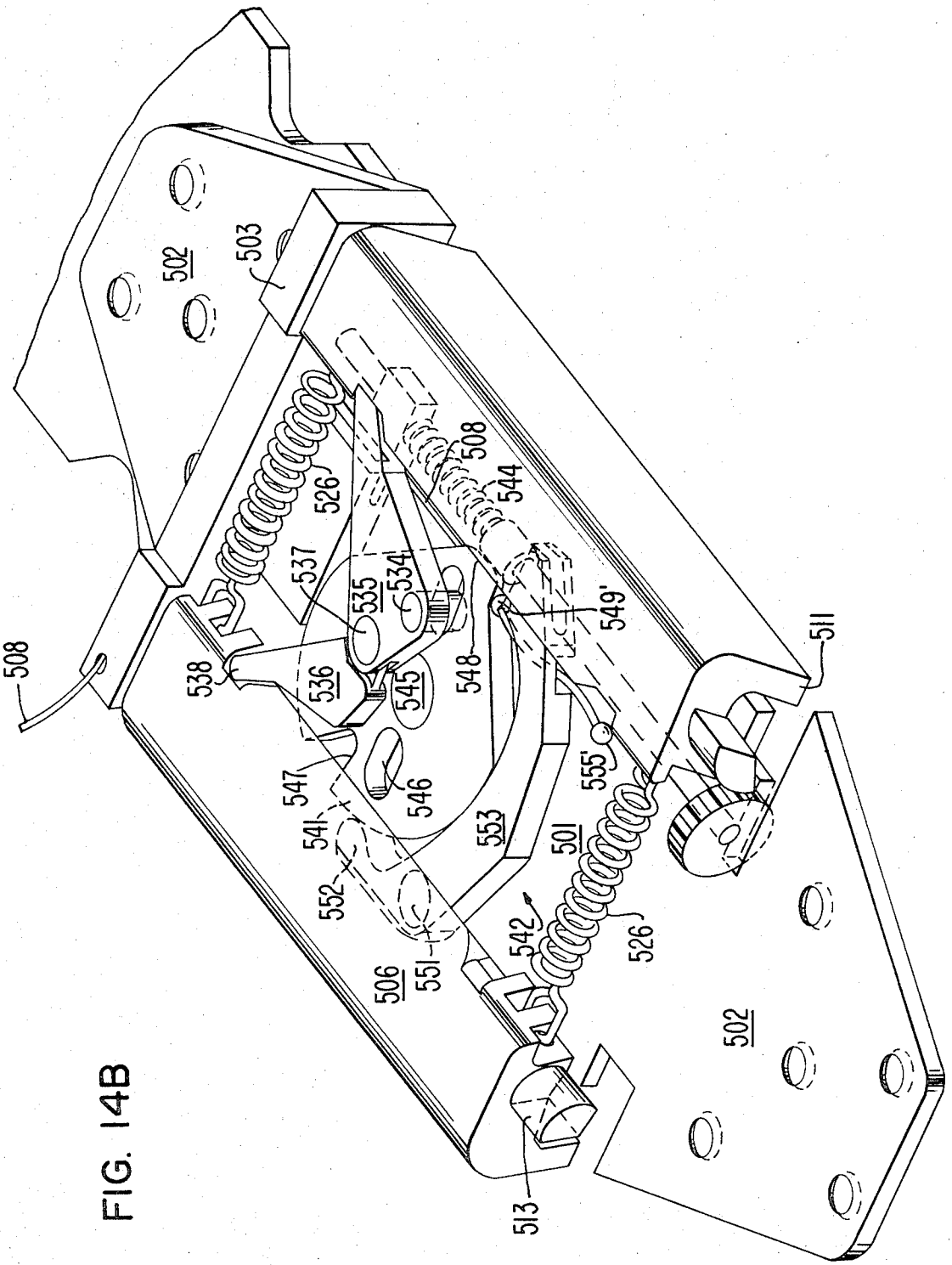

FIG. 14B

INVENTOR.
JOHN D. WILKES
BY Limbach, Limbach & Sutton
ATTORNEYS

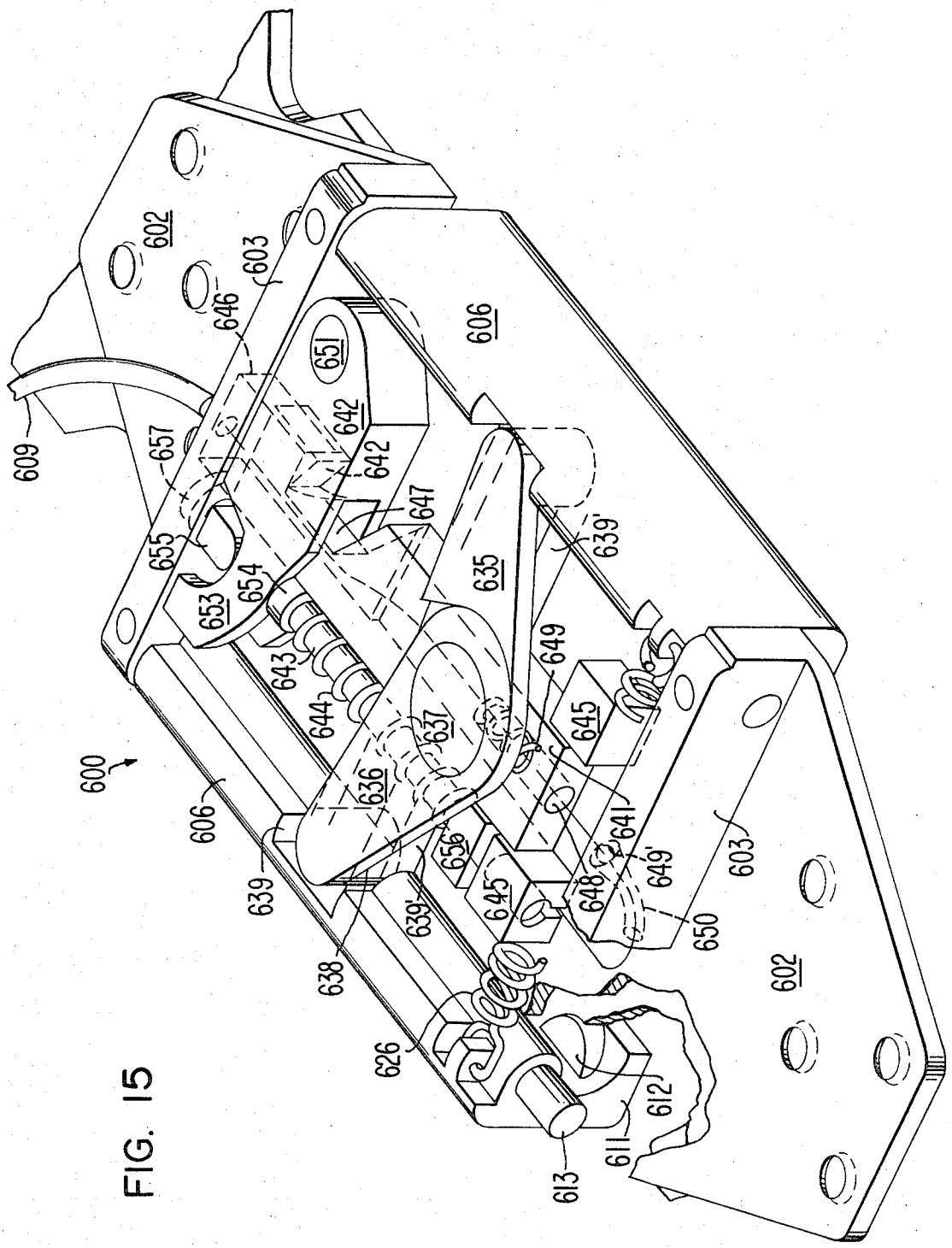

FIG. 15

INVENTOR.
JOHN D. WILKES

BY
Limbach, Limbach and Sutton

ATTORNEYS

SAFETY SKI BINDING SYSTEM

This application is a continuation-in-part of my copending application "Releasable Ski Bindings and Accessories" Ser. No. 838,873, filed July 3, 1969, now U. S. Pat. No. 3,614,119 issued Oct. 19, 1971.

BACKGROUND OF INVENTION

This invention is directed to a safety ski binding system and particularly to such a binding system which can be universally utilized on skis of different manufacture and which provide free unobstructed movement of the ski boot with respect to the ski when the binding is in released position.

The increased popularity of skiing has generated the development of a vast number of different ski bindings. At the same time the sport has generated a demand for rental skis which can be utilized both with rental ski boots or with ski boots owned personally by the skier since skiers are more apt to own only their own boots rather than only their own skis. The fit of a ski boot is more critical to the individual, and ski boots are more easily carried to the ski area than are skis.

To date ski bindings have not been adapted to the special requirement of ski rentals. Being permanently mounted on the skis, previous ski bindings have required readjustment with each rental. Such adjustments are not only time consuming but also add burdens of cost and potential liability of ski rental operators. Elimination of these drawbacks in ski bindings without detriment to desirable releasing characteristics of bindings are an important objective of this invention.

By creating a ski binding that is integral with the ski boot or attached to it and releasing from the ski rather than from the boot, this invention fulfills the requirement of the growing population of skiers who own ski boots but rent skis and at the same time both reduces the adjustment requirements and liability exposure of the ski rental operator. At the same time this system benefits all skiers by the added safety, convenience of use and interchangeability, and ready adaptability to different skiing requirements.

Broadly stated, the present invention to be described in greater detail below is directed to a ski binding mounted or fastened to the ski boot and the binding is provided with a pair of side jaws movable from a released position within the binding mechanism to a locked position wherein the jaws extend downwardly from the binding and laterally grip attachment elements on the ski. This construction permits the use of a universal sized attachment plate for use on all skis and utilizable without readjustment on skis equipped with the appropriate attachment elements. With retraction of the jaws the binding provides multidirectional releasability, that is, release along all axes of rotation and along all but the downward axis of translation. Additionally, other toe and heel types of bindings can be used with boots equipped with the binding in accordance with this system as well as skis equipped with the binding attachment of this system. When other bindings are not utilized on the skis, the ski boot is free for unobstructed separation therefrom once the binding of this system is moved to release position.

The attachment elements on the ski can consist of either a fixed or hinged flat plate attached on top of each ski and projecting beyond the sides thereof or rigid strips mounted on the side walls of each ski. Except for a separate junior size, the attachment elements described herein are of fixed size, regardless of boot or ski size. Therefore, adjustment of the binding affects only the threshold of force required to produce the automatic release. This adjustment is particular for the individual, and once this adjustment is made to the binding in the boot, it need not be readjusted regardless of the skis used by the skier.

As used herein, the terms "lock" and "release" applied to the binding mean respectively a stable state of attachment of the boot to the ski by the binding and loss of attachment of the boot to the ski by the binding. Three types of binding releases are envisioned. The first type of release is automatic or autorelease which occurs when opposing forces between the boot and the ski exceed values pre-set in the binding and referred to as an adjustable force threshold. A second command type release is triggered when the skier, voluntarily or by fall induced reflex action of his hands, lets go of the optional hand release levers mounted on the handles of his ski poles. This command release is described in my copending application, now U. S. Pat. No. 3,614,119. As a third type of release, a hand release can occur by manual action of the skier, typically while at a standstill. Where the skier is equipped with the command release device as set forth in my patent referred to above, the command release can be used as the hand release.

In accordance with another aspect of the present invention the ski binding system can include both automatic and command or hand release capabilities by inclusion of a pair of movable transmission members movable relative to each other during movement of said jaws and spring biased means for holding the members against relative movement until force on said jaws exceeds an adjusted force threshold. When such adjusted force threshold is exceeded the binding will automatically release and where either a command action or hand release force is applied to said transmission members command release or hand release is achieved.

By full retraction of the clamping jaws as release occurs the boot with its attached binding is free to move unobstructed off the ski in any direction. Additionally, with this construction, this ski binding does not interfere with the use of other heel and toe binding.

In accordance with still another aspect of the present invention, the ski attachment means to which the binding assembly is clamped includes means for hingedly connecting the forward portion of the attachment means to the ski and means for releasably latching the opposite end of the ski attaching means to the ski. With this construction the binding is useful for downhill and slalom skiing when the latch is secured, and when the latch is unsecured the attachment means is free to rotate upwardly about the hinge for ski touring.

In accordance with still another embodiment of the present invention the ski attachment plate includes a plurality of notches for cooperating with a fewer number of mating teeth on the jaws of the binding so that the skier can position his boot at one of several locations on the attachment plate thereby providing the skier with a choice of boot positions appropriate to the snow conditions, skiing style and particular type of skiing such as downhill or slalom skiing.

In accordance with another aspect of the present invention the binding system includes a single adjustment screw to set the force threshold for releasing the binding from the attachment plate.

These and other features and advantages will become more apparent upon a perusal of the following specification taken in conjunction with the accompanying drawings wherein similar characters of reference refer to similar structures in each of the several views.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view schematically illustrating a skier equipped with this invention and optional command trigger devices.

FIG. 2A is an enlarged exploded perspective view showing a portion of the structure shown in FIG. 1.

FIG. 2B is an enlarged perspective view showing the ski attaching plate of FIG. 2A in detached elevated position.

FIGS. 2C and 2D are perspective views showing alternative structures to a portion of the structure shown in FIG. 2A.

FIG. 3A is an enlarged, partially exploded, perspective view of the ski binding illustrated in FIG. 2A in locked position prior to release. FIGS. 3B and 3C are views similar to FIG. 3A respectively showing the binding during and after release.

FIGS. 4A, 4B, and 4C show a portion of a structure shown in FIG. 3A taken along line 44 in the direction of the arrows respectively showing the positions of that portion of the structure for the positions shown in FIGS. 3A, 3B, and 3C respectively.

FIG. 5 is an enlarged perspective view of a portion of the structure shown in FIG. 3A delineated by line 5—5 including the end plate 103.

FIG. 6 is an enlarged perspective view of a portion of the structure shown in FIG. 3A with the transmission blocks broken away and exploded in the foreground direction.

FIGS. 7A, 7B, and 7C are top views illustrating the structures shown in FIGS. 3A, 3B, and 3C, respectively.

FIG. 8 is a perspective view, partially exploded, of another embodiment of the present invention.

FIGS. 9A and 9B are enlarged perspective views of a portion of the structure shown in FIG. 8 with the cover removed and respectively showing the binding in locked and released position.

FIG. 9C is an enlarged perspective view, partially exploded of a portion of the structure shown in FIG. 9A and 9B.

FIG. 10 is an enlarged elevational sectional view of a portion of the structure shown in FIG. 9A taken along line 10—10 in the direction of the arrows.

FIG. 11 is a perspective view of still another binding embodiment of the present invention.

FIGS. 12A, 12B, and 12C are top views of the structure shown in FIG. 11 respectively showing the locked position, the position after command release, and the position after automatic release.

FIGS. 13A and 13B are enlarged perspective views of still another embodiment of the present invention respectively showing the binding in locked and released positions.

FIGS. 14A and 14B are enlarged views of still another embodiment of the present invention respectively showing the binding in locked and released positions.

FIG. 15 is an enlarged perspective view of still another embodiment of the present invention showing the binding in locked position.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings there are disclosed preferred embodiments showing different features of my present invention.

With particular reference to FIG. 1 there is shown a skier whose ski boots 10 are connected through a releasable binding 11 to a ski attachment plate 12 mounted on the top surface centrally of each of his skis 9. The skier is provided with my optional command release trigger, actuated by a hand release mechanism 13 in the handle of his ski pole and acting through sheathed release cables 14 and a two-way switch 15 as generally described in my patent referred to above. One setting position of the switch 15 assures release if triggering action comes from either hand, the other setting causing release when triggering issues from both hands. Even if the skier should forget to actuate one or both triggers by releasing his grip on his ski poles as he starts to fall, natural reflex action of the openings of a person's hand to break one's fall serves as an extra safety backup for this command release mode.

The invention of the present application includes the merger of the command release binding with the ski boot so that the releasable interface lies between the binding and the ski. The only element of the system permanently secured to the ski is the ski attachment element or plate 12 which serves as the lock-on surface for the releasable binding 11.

The binding system is also characterized by a lateral mode of attachment to the ski by a pair of deployable and retractable jaws that lock onto the ski-mounted attachment plate 12 of fixed, universal width. The universality of this system is applicable since most alpine skis Nordic event or cross-country skis and jumping skis excluded are approximately the same width at the boot location, regardless of the ski length. Children's, cross country and jumping skis can utilize different sized bindings and attachment plates.

With particular reference to FIGS. 2A and 2B a preferred construction for the attachment plate 12 includes the provision of a flat plate member 22 of slightly greater width than the width of the ski and provided with a series of spaced-apart recesses or notches 23 along each side thereof. The forward end of the plate 22 is bent upwardly to form a pair of guide vanes 24 and wrapped around a hinge pin 25 for articulation of the plate 22. The hinge pin 25 is slidably supported in longitudinal slots 26 in the upturned sidewalls 27 of a base plate 28 which is secured, such as by screws, to the ski and forming a forward mounting bracket 29 for the plate 22. The opposite, rear end of plate 22 is provided with a trapezoidal shaped aperture or cut-out 30 which fits over a rear bracket 31 secured to the ski and including a trapezoidal plate portion 31*a* and a hook portion 31*b* spaced above the top surface of the ski by the thickness of plate 22.

The construction of this plate 22 articulated about forward bracket 29 and latchable to the ski with rear bracket 31 serves to prevent yaw of plate 22 about the ski center line, to provide separate plate settings for downhill/slalom and ski touring, and to permit hands-off switching between these two settings. Plate yaw is prevented by the restraining actions of the guide vanes 24 positioned between sidewalls 27, and when in latched position engagement of the trapezoidal plate portion 31a with the trapezoidal cut-out 30.

The downhill/slalom setting of plate 22 as shown in FIG. 2A is held flat against the ski by the hook portion 31b as long as the motion of the skier remains positive in the two forward directional quadrants, characteristic of this mode of skiing. The ski touring setting as illustrated in FIG. 2B allows lifting of the heel in a rotational motion hinged forward of the toe line, thus permitting an easier and longer stride.

To change settings from the downhill/slalom position to the ski touring position, plate 22 is first disengaged from bracket 31 by a backward kick of the boot. The heel is then raised to clear the hook portion 31*b* as the boot is moved forward causing the hinge pin 25 to slide forward until it comes to rest against the forward ends of the longitudinal slot 26. In this position as long as the skier's motion remains positive in the two forward quadrants, attachment plate 22 is free to rotate upwardly about pin 25.

An alternative articulated attachment plate construction is illustrated in FIG. 2C wherein the plate 32 is hinged at its forward end via a hinge 33 to a forward bracket 34 secured to the ski. A rear bracket 35 is movable between two positions to latch and unlatch the rear end of plate 32. This bracket 35 includes a central portion 36 having a plurality of diagonal slots 37 each provided with a rearward lateral projecting slot portion 37*a*. Screws 38 pass through the slots into the ski, and the bracket 35 includes a forward overlapping portion 39 which extends over the rear end of plate 32 when the bracket is positioned with the screws in the rearward lateral slot portions 37a. By shifting the rear bracket 35 to move the screws along slots 37 the forward overlapping portion 39 is drawn rearwardly from the end of the plate 32 permitting the plate to lift up and permitting articulation of the attachment plate.

Still another embodiment of the invention is shown in FIG. 2D wherein a non-articulated attachment plate 42 is illustrated secured to the ski by screws 43. It will be appreciated with a further understanding of the locking and release mechanism in accordance with the present invention that conventional toe bindings 44 and heel bindings 45 can be used on the same ski as the binding in accordance with the present invention.

In the embodiment of the invention illustrated in FIG. 2A the releasable binding 11 is provided for rigid attachment, such as by screws, to the sole of the ski boot 10 with the release mechanism positioned within a cut-out of the sole of the boot. The base plate of the binding 11 and the sole of the boot then provide a smooth flat surface for engagement with the attachment plate 22. In order to prevent snow accumulation and a smooth resistance-free surface for separation of the binding and attachment plate during binding release, the bottom surface of the binding can be coated with anti-ice, nonstick hybrid material combination such as Teflon S - Teflon FEP.

Other attachment means differing from those illustrated in FIGS. 2A–D can be utilized with this invention, and one such attachment means is described below with reference to another embodiment of this invention.

Referring now to FIGS. 3–7 there is shown releasable binding 100 having a base plate 101 and forward and backward extending boot attachment plate portions 102. The releasable mechanism is housed above the base plate 101 between forward and rear walls 103 and a cover plate 104. The mechanism includes side clamping or locking jaws 106 movable outwardly and downwardly from the binding assembly 100 to clamp onto the plate 22.

The binding assembly includes mechanisms, as will be described in greater detail below, for first locking the binding 100 to the attachment plate 102 and operable by binding locking cable 107 and subsequent hand or command release operable by release cable 108. The automatic release feature operates in response to an adjustable force threshold without any cable actuation.

Each of the clamping or locking jaws 106 includes a bottom flange portion 111 projecting normally thereto and included with a plurality of spaced-apart teeth 112 meeting with the notches 23 on attachment plate 22. External pins 113 project from the forward and backward ends of each jaw 106 and are slidably supported in pin guidance grooves 114 in the end walls 103 for rotation of the jaws about a first longitudinal axis X—X parallel with the length of the ski.

On the opposite side of axis X—X from the flange portions 111 the jaws are provided with interdigital projections 115 having axial bores 116 therein for rotational connection about an axis Y—Y with one of two transmission blocks 121 and 122 each provided with interdigital projections 123 having axial bores 124 for receiving hinge pins 125 on the axes Y—Y.

The transmission blocks 121 and 122 provide the transmission of motion between the jaws 106 and the other operative elements of the binding 100 for performing the locking and automatic or command release functions of the binding. The main body of transmission block 122 is smaller than the main body of transmission block 121 to telescope thereinto and a pair of tension springs 126 are connected between blocks 121 and 122 to urge such telescopic action.

Transmission block 122 is provided with an internal opening 127 for receiving a lock and release block 131 (see FIG. 6) serving to provide a spring bias for holding the transmission members or blocks 121 and 122 against relative movement until force on the jaws 106 exceeds an adjustable force threshold. In the internal opening 127 a return leaf spring 132 is provided for urging the lock and release block 131 against one side of this opening 127 at which location the spring bias is applied in the manner set forth in greater detail below.

A pair of articulated locking arms 135 and 136 are provided, rotatably connected together at their one ends by a pin 137 and each rotatably connected at its other end to one of the jaws 106 by a rotational pin 138. These locking arms are provided for originally moving the locking jaws 106 into locking position or to return the jaws to locking position after command or automatic release.

The release mechanism 140 operable with the lock and release block 131 includes a pair of cylindrical plungers 141 and 142 slidable in a bore within block 131 and each provided with a bevel to a flat surface 143 on the outwardly projecting end thereof. These plungers 141 and 142 are spring biased outwardly by a spring 144 the compression of which is controlled by a knurled knob 145 screw-threaded on a shaft 147 connected to one plunger 142 and slidable within the other plunger 144. The one plunger 143 is prevented against rotation by means of a key tab 147 slidable in a key way 148 so that rotation of the knurled knob 145 through a window 149 in the base plate 101 of the binding extends the distance between the plunger 141 and the knob 145 to compress the spring 144.

The spring bias established by the plungers 141 and 142 and spring 144 is applied to the transmission blocks 121 and 122 by means of shafts 151 and 152 captured in block 122 and applying the spring pressure from the plungers to spherical ends 153 which engage in spherical cavities 154 and 155 in the arms of transmission block 121 which telescope around the reduced portion of transmission block 122. The corners of lock and release block 131 adjacent the plungers 141 and 142 are inwardly curved with a surface 156 to permit the plungers to ride up onto the shafts 151 and 152 as the lock and release block 131 is returned against one side of the opening 127 in transmission block 122 by reason of spring pressure from leaf spring 132.

The command release cable 108 is connected to the lock and release block 131 so that actuation of the cable urges block 131 against the spring 132, and binding locking cable 107 is connected to the pin 137 rotatably connecting the articulated locking arms 135 to pull the arms toward but never reaching alignment with one another for forcing the jaws outwardly toward locking position as described in detail below.

FIGS. 3A, 3B and 3C show the release sequence in locking position or before release, during release, and after release respectively. The corresponding views of FIGS. 4 and 7 show this same sequence. The locking sequence is the same but in reverse order.

Jaw motion is a combination of rotation of the jaws 106 about axis X—X, inward translation of axis Y—Y, and inward and upward translation of axis X—X.

For automatic release the triggering impulse is provided by forces exerted on or by the ski or skier on the clamp connection of the jaws 106 and attachment plate 22 which is transmitted by the jaws 106 and the transmission blocks 121 and 122 to the lock and release block 131. This block 131 restrains inward telescoping movement of blocks 121 and 122 as long as the total inward force applied to the blocks remains below the preset limit or force threshold set principally for the age and size of the particular skier by means of the knurled knob 145. Release of block 131 additionally enables boosting inward movement of the transmission bocks 121 and 122 due to springs 126 as soon as the spring bias of plungers 141 and 142 is removed from shafts 151 and 152.

It will be appreciated that force of the skier in any direction relative to the ski other than directly down onto the ski will produce a force on the jaws 106 that is transmitted to block 131 thus providing an improved release binding over prior art toe and heel clamping units which have principally been designed for response to lifting or lateral movement of the heel or lateral movement of the toe but inefficient response to all of the other forces that can be subjected to the binding. With my invention any translational force in the plane of the boot sole, i.e. parallel to the plate 22 and any torque about an axis normal to that plane produces a separation component on the jaws. Furthermore any force between the boot and ski with a vertical component also produces a jaw separation affect.

As an illustration of the force effect on the binding reference is made to FIGS. 3A, 4A, and 7A wherein automatic release is seen to be proceeded by an initial rotation of the jaw 106 about axis X—X with pins 113 rotating in place in grooves 114. When the adjusted force threshold is passed permitting telescopic movement of transmission blocks 121 and 122, this rotation about axis X—X causes an inward translation and telescoping of these transmission blocks which is boosted inwardly by retraction springs 126 pulling hinge Y—Y laterally inward, drawing pins 113 along slot 114 (see FIG. 4B) until full retraction of the jaw is achieved (see FIG. 4C).

For command release or hand release the motion is essentially the same, but the release impulse is provided by tension on cable 108 against return leaf spring 132.

The binding 100 is relocked onto the ski attachment plate 102 by positioning the boot and binding on the plate and hand pulling the locking cable 107 which moves the jaws outwardly and downwardly. When the jaws 106 and transmission blocks 121 and 122 reach the locking position, return spring 132 automatically pushes block 131 to the locked position and the binding is relocked.

The width of attachment plate 22 is selected to provide clearance of the jaws 106 from the side walls of the ski so that only interaction between the jaws 106 and plate 22 with the mating teeth 112 and notches 23 effect lock before threshold. The entire series of notches 23 along the plate 22 provide the skier a choice of boot positions for his boot along the plate 23 as appropriate to the snow conditions, skiing style and particular type of skiing such as downhill or slalom skiing.

The other views of the drawing as described below illustrate other embodiments of the present invention operable generally in the same manner as the embodiment just described with minor variations due to the differences in specific construction.

Referring now to FIG. 8 there is shown another embodiment of the present invention wherein the binding 200 is rigidly attached to a boot and binding attachment frame 51 for releasable attachment to the ski boot 10' and wherein the boot with its attachment frame 51 is then secured to the ski 9' with a different jaw clamping configuration.

The binding attachment frame 51 is formed of a plate member 52 flat in the central portion of the frame and bent downwardly to form a binding receiving opening 53 between a forward portion 54*a* and a rearward portion 54*b*. At each of the sides of the forward and rear portions 54*a* and 54*b*, respectively, the plate member is folded upwardly to define side portions and folded over at the top to form with the central flat portion of plate member 52 a flat surface from the front of the frame to the back for engagement with the sole of the boot. The

forward and rear side portions 55*a* and 55*b* respectively are provided with forward angled and rearward angled slots 56*a* and 56*b*, respectively, for receiving a forward or toe bracket 57*a* and a rear or heel bracket 57*b*. These brackets 57*a* and 57*b* are formed from two pieces of rod stock held together by linking nuts 58 whereby the width of the bracket can be adjusted to accommodate different width boots or larger rods can be utilized for larger boots. A latch bracket 59 is provided at the rear end of the frame including a handle portion 59*a* and a heel clamping portion 59*b*, both of rod stock, with the bracket 59 rotatable on the rear bracket 57 to engage the heel clamping portion 59*b* against the heel of the boot to clamp the boot to the frame 51. A leaf spring extends longitudinally within the forward and rear portion 54*a* and 54b to prevent the brackets 57*a* and 57*b* from dropping out of the respective slots 56*a* and 56*b* selected for the particular size ski boot.

The ski attachment means secured to the ski includes a pair of rails or binding bars 62 secured, such as by screws, on the sides of the ski adjacent the upper surface of the ski. These rails or bars include a series of spaced-apart, truncated hemispherical or conical perforations or recesses 63 extending from the exterior surface inwardly to an opening 65 extending longitudinally of the bars. These recesses 63 receive hemispherical or conical pegs or protrusions 211 (see FIG. 10) on the clamping jaws 206 of the binding 200. With the opening 65 behind the perforations or recesses 63 accumulation of snow in the recesses 63 is prevented.

Referring now to FIGS. 9A and 9B the binding 200 is similar to binding 100 and includes a base plate 201, boot attachment plate 202 and forward and rear walls 203 cooperating with a cover plate (not shown) to enclose the release mechanism which actuates the side clamping jaws 206. This binding 200 includes binding locking cable 207 and command release cable 208 operable similar to the cables for binding 100.

The side clamping jaws are removable with external pins 213 and are interdigitally connected to telescoping transmission blocks 221 and 222 urged into telescoped relationship by springs 226.

A lock and release block portion 231 of transmission block 221 projects into an internal opening 227 of the other transmission block 222 for the telescopic movement and articulated locking arms 235 and 236 rotatably connected by the pin 237 are rotatably connected to the transmission blocks by pins 238 for moving the blocks and the jaws 206 into locked position.

The lock and release mechanism 240 includes a pair of plungers 241 and 242 each provided with a hemispherical end 243 supported on a substantially square base 245 and engaging a corresponding hemispherical recess 244 on the transmission block 222. A threaded shaft 246 (see FIG. 9C) is provided in each plunger 241 with a knurled adjustment screw 247 thereon. The hemispherical end 243 projects through an aperture 248 at one end of a box-like frame 249 adapted to hold the plunger with a compression spring 251 therein against the knurled screw 247. Adjustment of the screw 247 through a window in the bottom of the plate (not shown) is used to adjust the force threshold for the automatic release.

A roller 252 is rotatably mounted on the opposite end of the box-like frame 249 so that both frames can be slidably supported in a channel 253 extending transversely of the lock and release block portion 231 to align the hemispherical ends 243 with the hemispherical recesses 244 when the transmission blocks are in locked position. A second channel 254 orthogonal to and bisecting channel 253 is provided to slidably support a trigger piston 255 having a tapered end 256 spring biased by a coil spring 257 between the two rollers 252 in channel 253. The command release cable 208 is connected to the trigger piston 255 so that action of the cable by command or for hand release withdraws the trigger piston from between the rollers thereby relieving the pressure on the hemispherical ends 243 thereby permitting the transmission blocks 221 and 222 to telescope together.

FIG. 9B shows the transmission blocks 221 and 222 telescoped together in response to a force on the jaws exceeding the force threshold.

Referring now to FIGS. 11 and 12 there is shown still another embodiment of the present invention where the binding 300 having a base plate 301, boot attachment plate 302 portion, forward and rear walls 303 and cover plate 304 is provided with side clamping jaws 306 movable into binding locking position by locking cable 307 and released by release cable 308. In this embodiment the transmission blocks 321 and 322 do not telescope within one another, but their movement toward one another urged by the spring 326 is prevented by the lock and release block 331 positioned therebetween and movable into internal openings 327 of both blocks 321 and 322 in the manner set forth below. Block 331 includes a pair of parallel spaced-apart elongate channels 332 and an orthogonal channel 333.

A pair of articulated locking arms 335 and 336 rotatably connected by pin 337 are rotatably connected to the transmission blocks 321 and 322 by pins 338 for movement of the blocks and thus of the clamping jaws 306 into locking position in response to pressure applied to the locking cables 307 connected to pin 337.

The release mechanism 340 includes a pair of opposed plungers 341 and 342 slidably mounted in one channel 332 at one side of the lock 331 with a threaded shaft 343 provided with a knurled knob 344 screwed into plunger 342 for adjusting the compression of a coil spring 345 bearing against the knob 344 and the other plunger 341. Each of the plungers 341 and 342 includes a beveled shoulder 346 mating with a corresponding beveled shoulder portion 347 on the respective transmission block. A flexible cable segment 348 extends from the transmission block to the release block 331 preventing movement of the block 331 outwardly from the transmission block 322 beyond the point of contact between the beveled shoulder surfaces 346 and 347. Force on the clamping jaws 306 exceeding the force threshold set by knurled knob 344 through a window (not shown) causes the plungers 341 and 342 to ride over the beveled shoulder 347 and the block 331 to translate into transmission block 322 permitting relative movement of the transmission blocks 321 and 322 and retraction of the clamping jaws 306 from locked to released position.

For hand release or command release a pair of plungers are slidably supported in the other channel 332 on

the other side of block 331 and each provided with a beveled surface 352 at the end thereof projecting out of the channel for engagement with a corresponding beveled surface 353 on the transmission block 321. A roller 354 is provided on the opposite end of each plunger 351 from the beveled surface 352 for engagement with the rounded end of a trigger piston 355 slidably supported in orthogonal channel 333 and spring biased by a coil spring 356 into position between the two rollers 354.

Command or hand release cable 308 is connected to trigger piston 355 so that actuation of cable 308 against the spring bias of coil spring 356 withdraws trigger piston 355 from between the rollers 354 on plungers 351 permitting the beveled surfaces 352 to ride up on the beveled surfaces 353 of the transmission block for translation of the release block into the internal opening 327 of transmission block 321. This translation then permits movement of the two transmission blocks toward one another for movement of the clamping jaws from locked to released position. A flexible cable segment 357 is connected between transmission block 321 and release block 331 preventing movement of these blocks away from one another beyond the point of contact between the beveled surfaces 352 and 353 as shown in FIG. 12A.

FIG. 12B shows the binding 300 in released position responsive to hand or command release, and FIG. 12C shows the binding 300 in released position in response to automatic release. Referring now to FIG. 13 there is shown another binding 400 embodiment of the present invention utilizing a single transmission block. As with the previous bindings, binding 400 includes a base plate 401 having boot attachment portion 402, forward and rear walls 403 cooperating with a cover (not shown) for covering the mechanism. A binding locking cable 407 is provided for locking the binding, and hand or command release cable 408 is provided for release of the binding.

The engaging flange 411 of the jaws 406 includes semi-circular teeth 412 mating with similarly shaped recesses or notches in the attachment plate.

In this embodiment jaw movement is purely rotational rather than rotational and translational and consists of a 90° turn about an axis X'—X' by means of a peg 413 projecting from the end of the jaw and provided with a semi-circular keeper 413' rotatable in a semi-circular keeper recess 414 a full quadrant or 90° larger than the keeper 413 to permit the 90° rotation.

Like the other bindings of this invention, the release sequence of this binding includes two phases; first a release phase in which the jaws oppose release of the ski attachment plate followed by a retraction phase in which the jaws are forceably withdrawn by energy stored in the bindings retraction springs after the adjusted force threshold has been exceeded. Binding adjustment affects only this force threshold to complete the release phase. And, although binding release is triggered at the completion of the release phase, actual release of the ski attachment plate occurs only during the retraction phase.

In this embodiment of the present invention, a single transmission and release block serves the function of the transmission blocks for transmitting the force on the clamping jaws to the release mechanism and the release block for establishing the frictional engagement where spring bias is applied preventing relative motion until the force threshold has been exceeded.

The transmission block 421 movable longitudinally of the ski between the clamping jaws 406 includes a plurality of outwardly projecting teeth 422 projecting into channels or slots 423 in the top peripheral portion of the jaws 406. These teeth 422 include a curved surface 422' establishing a line of contact 424 at the corner of the channel 423, surface 422 extending to a diagonal line 424' where the tooth surface becomes a flat facet 425 perpendicular to the axis X'—X'. Surface 422' is such that as the jaw 406 rotates inwardly the corner of the slot 423 sweeps surface 422' and in so doing imparts a forward translation to the transmission and release block 421 (the direction to the upper right in FIG. 13). Once the line of contact 424 reaches the diagonal line 424' the jaw is free to continue to rotate inwardly along facet 425 and is positively urged inwardly by tension coil spring 426 connected between the two clamping jaws 406.

The transmission and release block 421 is slidable along rails 427 mounted on the base plate 401, and the binding cover (not shown) includes depressions which extend down into the channel 423 to prevent ingestion of snow into the binding mechanism.

A pair of articulated locking arms 435 and 436 are provided as in the other embodiments rotatably connected at their one end by a pin 437 and each provided at the opposite end with a cylindrical knob or pin 438 projecting into a cavity in the jaw to force the jaw to rotate to locked position upon movement of the articulated arms 435 and 436 near alignment with one another by actuation of the binding locking cable 407. The mechanism for establishing the threshold force for automatic release includes a plunger 441 having a substantially square base 441' slidable within a substantially square channel 442 and having a roller block 443 projecting through a reduced opening at the end of channel 442 and with a roller 444 rotatably mounted in roller block 443. A compression spring 445 for adjusting the force threshold bears up against the plunger base 441 and is positioned on a shaft threaded adjacent the opposite end for movement of a compression block 447 thereon in response to rotation of the shaft 446 by a knurled knob 448 projecting through a window 449 in the base plate 401.

A command release block 451 is slidably supported in a transverse channel in wall 403 and is provided with a tapered surface 452 engaged by the roller 444. A compression spring 453 urges the command release block to the right (as shown in FIGS. 13) with the outwardly projecting portion of surface 452 then in contact with roller 444. Movement of the block 452 in response to the hand or command release cable 408 rolls roller 444 down the tapered surface 452 reducing the compression on the spring 445 and permitting the jaws to release and withdraw to the released position. FIG. 13B shows the binding 400 in released position responsive to automatic release.

Referring now to FIGS. 14A and 14B there is shown still another embodiment of present invention wherein an alternative release mechanism is used and jaw motion combines both translation with rotation during retraction. This binding 500 includes the base plate

501, and forward and rearward walls 503 combining with the cover (not shown) to cover the actuating and release mechanism for side clamping jaws 506. In this embodiment a common locking and command release cable 509 is utilized. Also, as shown, the jaws 106 include the clamping flange 511 with semi-circular teeth 512 and a semi-circular keeper peg 513 rotatable in a semi-circular keeper recess 514 provided with a near full quadrant more rotation.

Linkage of the jaws with the release mechanism is provided by two pairs of transmission and articulated locking arms 535 and 536 (only the forward pair being shown) which are articulated together at their one end by a pin 537 and with their outward end 538 engaging jaw recesses 539 in the jaws 506 and with lateral contact of each arm with the recess along a curved recess ridge 539' which provides continuing internally directed pressure on the arms 535 and 536 as the jaws 106 are retracted or extended. One arm in each pair is provided with a cylindrical pin 537' extending downwardly almost to the base plate 501 and engaging the release mechanism to be described.

The release mechanism 540 includes a transmission disc 541, a release lever 542, a release adjustment screw 543, and a release spring 544. Transmission disc 541 is rotatably supported on an axial pin 545 secured to the base plate 501. Additionally, the transmission disc 541 includes a pair of elongate slots 546 for receiving the connection pin 537' of the articulated locking and transmission arm and a peripheral notch 547 for release interconnection with release lever 542.

The release lever 542 is rotatably supported on a pin 548 secured to the base plate 501 and includes a short end 549 which engages the peripheral notch 547 of disc 541. Substantially diametrically opposed to the notch 547 disc 541 is provided with a bifurcated projecting peripheral portion adapted to pass the locking and command release cable 509 therethrough and including a spherical or ball recess socket 549 engagable by a binding locking ball 549' fixedly secured to the cable 509.

The release lever 542 is rotatably supported on a pin 551 fixedly secured to the base plate 501 and includes a short end 552 engaging peripheral 547 and a bifurcated long end engaging a plunger 554 slidably mounted on adjustment screw 543 and spring biased against the long end of lever arm 542 by the release spring 544. This lever 542 is also provided with a spherical or ball receiving socket 555 in the long end 553 thereof adapted to receive a command or hand release ball 555' fixedly secured to cable 509 a given distance from ball 549'.

The end of release adjustment screw 543 remote from the bifurcated long end 553 of the lever 542 is rotatably supported in a bore 543' in the forward end wall 503, and the shaft 543 is threaded adjacent this end for carrying a release spring block 556, the position of which can be changed to change the compression on spring 544 by a knurled knob 557 positioned on the opposite end of shaft 543 and projecting through a window 558 in base plate 501.

The dual purpose cable 509 passes around a guide block 559 through the bifurcated peripheral portion 548 on disc 541 to the ball or connection member 555 for movement of the lever 542.

From the position shown in FIG. 14A, automatic release of the binding 500 occurs in the following manner. As the jaws 106 rotate inward about axes X'—X' the transmission arms 535 move from the position closest to alignment and actuation pins 537' impart a rotational motion to disc 541 with resultant counter-rotation of the release lever 542 and compression of the release spring 544. If sufficient force is applied to the jaw to exceed the force threshold, the short lever arm 552 eventually egresses from notch 547 permitting rapid rotation of disc 541 in response to stored spring tension of the jaw retration spring 526.

During this automatic release cable 509 remains free of any "pull" forces. With the binding 500 in released position shown in FIG. 14B, the locking ball 549' engages ball socket 549 and pulling action on cable 509 causes rotation of the transmission disc 541 for articulation of arms 535 and return of the clamping jaws 506 to locked position.

In the locked position of binding 500 as shown in drawing 14A, application of a pulling force to command and hand release cable 509 causes release ball 555' in socket 555 to pull the long lever arm 553 thereby causing the releasing sequence of steps described above.

Referring now to FIG. 15, there is shown still another embodiment of the present invention wherein the rotational release mechanism of the binding 500 in FIG. 14 is replaced by a linear mechanism and the rotation and translation of the jaws during retraction is replaced by rotational motion alone. The binding 600 includes the same base plate 601, base attachment plate 602, end walls, and side clamping jaws 606. This binding also includes the combined binding, locking and command release cable 609 and the stored energy for the automatic release is provided by tension coil spring 626 connected between the jaws.

The binding 600 also includes articulated locking and transmission arms 635 and 636 rotatably connected at the binding longitudinal center line to a large pin 637 mounted on top of the binding transmission block 641. Each arm 635 and 636 includes an outward downwardly projecting pin 638 which engages jaw recesses 639 and also slides along a pin guide slot 639' in the base plate 601. As the jaws rotate during release of the binding, the downwardly directed pins 638 slide along slots 639' causing the arms to move out of alignment and the V therebetween to narrow and the transmission block 641 to move in the direction of the arrow.

The binding release mechanism 640 consists of the transmission block 641, a release lever 642, a release adjustment screw 643 and a release spring 644. Transmission block 641 is confined between a pair of guide blocks 645 and 645' at the rear end of the binding and the block slides within a channel 646 at the forward end of the binding. At the forward end of the binding the block includes a notch 647, and at the rear end of the binding a ball receiving bore therewithin is provided with a spring 649 to receive a binding locking ball 649' connected to the combined locking and command release cable 609 which extends from the forward end of the binding longitudinally through the block 641 around a channel 650 in the rear end wall 603 and back up to the other end of the binding 600 as described in greater detail below.

The release lever **642** is rotatably supported near the forward end of the binding on a pin **651** and includes a notch engaging portion **652** between bifurcated arms **653** which extend around the block **641** and engage a plunger **654** slidably supported on the release adjustment screw **643**. One end of the release adjustment screw **643** is rotatably supported in guide blocks **645'** and threads near that one end engage a release spring block **656** engaged by one end of compression spring **644**. A knurled knob **657** at the other end of the screw **643** and projecting below the base plate **601** enables rotation of the shaft to move release spring lock **656** for varying the spring compression on the plunger **654**.

On the opposite side of the bifurcated lever arm **653** from the plunger **654** a command release slide **655** is freely rotatable on the release adjustment screw and is connected to the end of the combined locking and command release cable.

During automatic release of binding **600** force applied to the clamping jaws **606** causes forward motion of pin **637** connected to block **641** inhibited from motion by engagement of the notch engagement lever portion **652** in notch **647** and the compression force of spring **644**. When the force on the jaws exceeds the adjusted force threshold notch engaging portion **652** clears notch **647** allowing retraction springs **626** to complete the release.

For command release cable **609** is pulled causing command release slide **655** to pull on the bifurcated lever arm until the notch engaging portion clears the notch.

When the binding is in release position it is moved to locking position by pulling on the combined locking and command release cable **609** causing the ball **649'** to engage weak spring **649** in block **641** and move the block **641** forward until the notch engaging portion **562** again engages notches **647**. As the pulling force on cable **609** is suddenly released, three impulses act on the system: the strong impulse of release spring **644** tending to force the release lever arm **642** to locked position, the weaker impulse of retract spring **626** tending to release the jaws **606** and move the bolt **637** rearward, and the weak impulse of spring **649** tending to move the ball **649'** and block **641** in opposite directions. The net effect is to retard the forward motion of block **641** sufficiently for notch engaging portion **652** to engage the notch **647** whereupon the release spring **644** prevails over the retract spring **626**. It should be noted that the effects of the springs **626** and **644** are conditioned by the mechanical demultiplication factors involved in the design of the mechanism; the specific intent of demultiplication is to reduce the force of pull on cable **609** required to lock or release the binding.

It will be appreciated that various release mechanism, locking mechanisms and locking elements can be interchanged among the various embodiments described above.

Shock absorbing characteristics of the binding may be modified by using a non-linear release spring **644** and/or modifying the profile of portion **652** of release lever **642**. Similarly, since the elasticity of the binding is a function of the length of the jaws and the amount of overhang, the binding can be varied to provide the skier with the desired characteristics.

It is to be understood that the invention is not limited to the particular embodiments and features described and shown, but that it comprises any modifications and equivalents within the scope of the appended claims.

What is claimed is:

1. A ski binding assembly comprising

a releasable ski boot binding assembly for rigid attachment to a ski boot and releasable attachment to a ski attachment means, and

a ski attachment means for rigid attachment to a ski and to be releasably clamped by said binding assembly;

said binding assembly including at least a pair of jaws movably rotatable on axes parallel to the length of the ski between a locked position engaged with said attachment means and a released position disengaged from said attachment means,

means for moving and adjustably releasably locking portions of said jaws outwardly of said assembly to said locked position and

force responsive means for urging portions of said jaws centrally of said assembly and the ski and moving said jaws to said released position when the adjusted releasing forces on said moving and locking means are exceeded.

2. The assembly of claim **1** wherein:

said moving and locking means includes spring biased means for holding said jaws in locked position, and

means for adjusting the spring bias on said spring biased means.

3. The apparatus of claim **2** wherein

said moving and locking means includes a pair of movable transmission members movable relative to each other during movement of said jaws and

said spring biased means includes means for holding said members against relative movement until force on said jaws exceeds an adjusted force threshold.

4. The apparatus in accordance with claim **3** wherein each of said transmission members is connected to one of said jaws and

a lock and release block means for holding said transmission members apart until said force threshold is exceeded.

5. The apparatus in accordance with claim **4** wherein

said transmission members are constructed to telescope together and

said spring biased means holding said transmission members from telescoped position until said force threshold is exceeded.

6. The apparatus in accordance with claim **3** wherein said transmission members include

a transmission block provided with a notch and

a transmission lever having a portion engagable in said notch when said transmission members are in locked position.

7. The apparatus in accordance with claim **6** wherein said transmission block is substantially circular and

a means for rotatably mounting said transmission block between said jaws for rotation about an axis substantially perpendicular to the rotatable axes of said jaws.

8. The apparatus in accordance with claim 6 including means limiting movement of said transmission block to movement longitudinal of the ski and parallel to the rotatable axes of said jaws.

9. The apparatus in accordance with claim 1 including

a pair of articulated locking arms and rotatably connected together at their one ends and each engaging at the other end one of said jaws, and

means for moving the rotatable connection between said locking arms to move said jaws to locked position.

10. The apparatus in accordance with claim 1 including a command release cable connected to said moving and locking means to move said jaws from locked position to said released position.

11. The apparatus in accordance with claim 10 wherein said command release cable includes means for moving said moving and locking means from released to locked position.

12. The apparatus of claim 1 wherein said ski attachment means includes:

means for hingedly connecting said attachment means at one end thereof to the ski and

means for releasably latching the opposite end of said ski attaching means to the ski.

13. The assembly of claim 1 including means for fixedly securing said binding assembly on the bottom of a ski boot.

14. The assembly of claim 1 including

means for fixedly connecting said binding assembly to an attachment frame and

means for releasably connecting said attachment frame to the bottom of a ski boot.

15. The apparatus of claim 1 wherein

said ski attachment means includes a plurality of notches, and

said jaws include a flanged portion engaging said ski attachemnt means and a plurality of teeth engaging at least certain of said notches.

16. The apparatus of claim 1 wherein said ski attachment means includes a plurality of perforations and

each of said jaws includes a flanged portion engagable with said ski attachment means and a plurality of pegged members engagable with at least certain of said perforations.

17. The assembly in accordance with claim 1 wherein said ski attachment means projects outwardly from opposite sides of the ski.

18. The apparatus of claim 2 wherein

said moving and locking means includes at least one transmission member movable relative to said jaws, and

said spring biased means includes means for holding said transmission member against relative movement with said jaws until force on said jaws exceeds an adjusted force threshold.

19. A ski binding assembly comprising:

ski attachment means along a portion of the ski and projecting outwardly from opposite sides thereof, and

a releasable ski boot binding assembly for attachment to a ski boot to releasably clamp the ski boot to said attachment means and including:

a pair of angled jaws having a normally projecting flange portion and rotatable between a locked position wherein said flange projects below the bottom of said binding assembly and engages the outwardly projecting portion of said attachment means and a released position wherein the flange is retracted above the bottom of the binding assembly,

means for moving said jaws to locked position, and

stored energy transmission means for moving said jaws from locked position to released position responsive to forces on said jaws exceeding an adjustable force threshold.

20. The assembly of claim 19 including

spring biased means for holding said jaws in locked position, and

means for adjusting the spring bias on said spring biased means.

21. The apparatus of claim 20 wherein

said transmission means includes a pair of movable transmission members movable relative to each other during movement of said jaws and

said spring biased means includes means for holding said members against relative movement until force on said jaws exceeds an adjusted force threshold.

22. The apparatus in accordance with claim 21 wherein

each of said transmission members is connected to one of said jaws and including

a lock and release block means for holding said transmission members apart until said force threshold is exceeded.

23. The apparatus in accordance with claim 22 wherein

said transmission members are constructed to telescope together.

24. The apparatus in accordance with claim 21 wherein said transmission members include

a transmission block provided with a notch and

a transmission lever having a portion engagable in said notch when said transmission members are in locked position.

25. The apparatus in accordance with claim 24 wherein said transmission block is substantially circular and

means for rotatably mounting said transmission block between said jaws for rotation about an axis substantially perpendicular to the rotatable axes of said jaws.

26. The apparatus in accordance with claim 24 including means limiting movement of said transmission block to movement longitudinal of the ski and parallel to the rotatable axes of said jaws.

27. The apparatus of claim 20 wherein

said transmission means includes at least one transmission member movable relative to said jaws and

said spring biased means includes means for holding said transmission member against relative movement with said jaws until force on said jaws exceeds an adjusted force threshold.

28. The apparatus in accordance with claim 19 including

a pair of articulated locking arms rotatably connected together at their one ends and each engaging at the other end one of said jaws, and

means for moving the rotatable connection between said locking arms to move said jaws to locked position.

29. The apparatus in accordance with claim 19 including a command release cable means connected to said transmission means for release of the stored energy to move said jaws from locked position to said released position.

30. The apparatus in accordance with claim 29 wherein said command release cable means includes means slidably connected to said means for moving said jaws to locked position.

31. The apparatus of claim 19 wherein said ski attachment means includes

means for hingedly connecting said attachment means at one end thereof to the ski and

means for releasably latching the opposite end of said ski attaching means to the ski.

32. The assembly of claim 19 including means for fixedly securing said binding assembly on the bottom of a ski boot.

33. The assembly of claim 19 including

means for fixedly connecting said binding assembly to an attachment frame and

means for releasably connecting said attachment frame to the bottom of a ski boot.

34. The apparatus of claim 19 wherein

said ski attachment means includes a plurality of notches and

said jaws include a flanged portion engaging said ski attachment means and a plurality of teeth engaging at least certain of said notches.

35. The apparatus of claim 19 wherein said ski attachment means includes a plurality of perforations and

each of said jaws includes a flanged portion engagable with said ski attachment means and a plurality of pegged members engagable with at least certain of said perforations.

36. The assembly in accordance with claim 19 wherein said ski attachment means projects outwardly from opposite sides of the ski adjacent the top surface thereof.

37. A ski binding assembly comprising

a binding plate member,

means for clamping a ski boot to said binding plate member,

means for hingedly connecting the forward end of said plate member to a ski, and

means for releasably latching the rear end of said plate member to said ski.

38. The assembly of claim 1 wherein

said attachment means includes a plurality of recesses equally spaced apart along the length thereof

said binding assembly including a plurality of equally spaced apart recess engaging means on said jaws,

the number of recess engaging means being less than the number of recesses permitting location of the boot binding assembly at a plurality of locations.

39. The apparatus of claim 2 wherein said means for adjusting the spring bias includes a single adjustment screw.

40. The assembly of claim 19 wherein

said attachment means includes a plurality of recesses equally spaced apart along the length thereof

said binding assembly including a plurality of equally spaced apart recess engaging means on said jaws, the number of recess engaging means being less than the number of recesses permitting location of the boot binding assembly at a plurality of locations.

41. The apparatus of claim 20 wherein said means for adjusting the spring bias includes a single adjustment screw.

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