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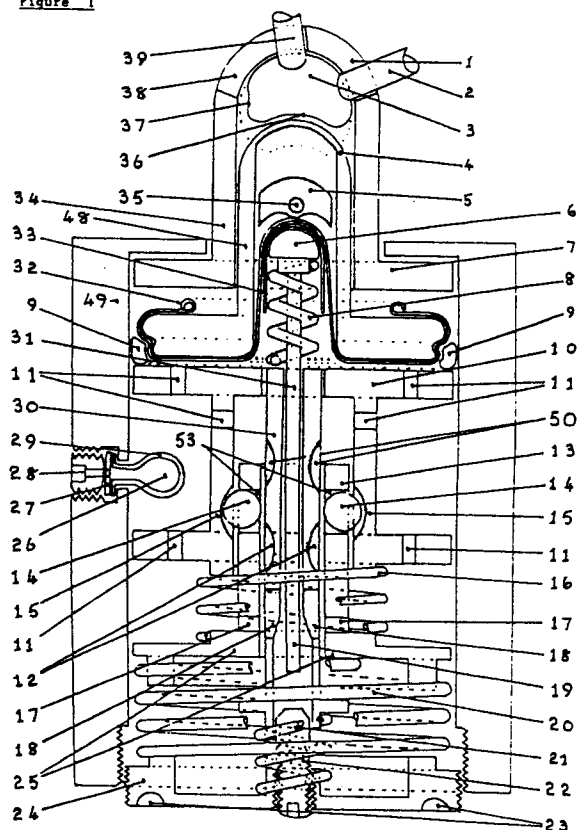
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54 **Safety ski binding.**

57 A ski-boot is secured by its prominent welts to a ski, between arms (39) mounted on two spheroids - (3) each in separate bindings (51) (52). Release is achieved, by the forces acting on the ski-boot, rotating the spheroids against spring-loaded plungers (4), bearing in recesses in the spheroids (36), shaped so as to give a different reaction in different directions, until the plungers are no longer contained. The action of the plungers is controlled by detents (14), which unlock the constraint of the plungers on the spheroid's rotation, when a piston (30) is moved by an anti-freeze fluid, because the rate of flow of the fluid exceeds a by-pass (17) (18) system's capability. As one of the plungers (43) is fixed with respect to its housing (42), the displacement of its spheroid, due to rotation, is transferred through the ski-boot to the other binding, resulting in displacement of its spheroid (3) and container against its spring (20), which thus loads both plungers.

Figure 1



STEP IN SAFETY SKI BINDING FOR DOWNHILL PISTE AND TOURING SKIING

I.

Introduction

I.1. The invention, whose description follows, is the mechanical element of a step in safety ski binding which allows a ski-boot with a prominent welt, to be held securely to a ski and yet release the boot, omnidirectionally, when subjected to the forces experienced in a fall. It is a development of the invention described in British Applications Nos. 8519346 dated 1 August 1985, 8520679 dated 19 August 1985, and 8528932 dated 25 November 1985, and 8601235 dated 20th January, 1986, to which priority is being claimed.

I.2. Mechanical ski-bindings to secure ski-boots are well known, and work on the principle of a spring force being overcome, somehow, in order to affect the release of the ski-boot, before the forces are large enough to cause injury.

I.3 These bindings do not, however, take into account the problem of accurately monitoring the rate at which a force is applied to a binding. It is a well known fact that a force, which can be non-injurious if gradually applied, can cause serious injury if suddenly applied, and that trying to decrease the rate of application of this force, by using springs, produces a compromise, which results, either in loss of "feel" by the skier, or a continuation of the risk of injury, depending on the degree of reluctance offered by the spring. The invention, as claimed in British Application Nos. 8519346, 8520679 and 8528932 overcame this problem by accurately measuring the rate of increase electronically, and initiating release electrically, when the rate of increase was sensed to be potentially injurious. Unfortunately, the electronic components can be expensive, and, should the electronic unit fail, the stand-by mechanical release, although having excellent release properties, is not discriminating as to the rate of increase of the release force.

I.4. This invention as claimed, is intended to overcome these problems. According to the present invention, there is provided, a potentially low-cost, mechanical step-in safety ski-binding, whereby a ski-boot is secured by its prominent welts to a ski, between arms, mounted on two spheroids, each in separate bindings. Release of the ski-boot, is achieved, by the forces acting on the ski-boot, rotating the spheroids against the pressure of spring-loaded plungers, bearing in recesses in the spheroids, shaped, so as to give a different reaction in different directions, until the plungers are no longer contained. The action of the plungers is controlled by detents, which unlock the

constraint of the plungers on the spheroids rotation, when a piston is moved by an anti-freeze fluid, because the rate of flow of the fluid exceeds a bypass system's capability.

I.5. The advantages offered by the invention are:

I.5.1. The invention provides a cheaper, mechanical alternative, to electronically monitoring the rate of increase of release forces and electrically effecting release.

I.5.2. By utilizing the non-compressible property of a flowing fluid, an accurate response, to a potentially injurious increase, in rate of application of release forces, can be achieved.

2. Description

2.1. A specific embodiment of the invention, will now be described, by way of example, with reference to the unscaled accompanying drawings, in which:

2.1.1. Figure 1 illustrates the Mechanical Release Unit.

2.1.2. Figure 2 illustrates the Mechanical Release Unit (Fixed).

2.1.3. Figure 3 illustrates the Manual Release.

2.1.4. Figure 4 illustrates a 3/4-view of a typical housing arrangement for a Mechanical Release Unit.

2.1.5. Figure 5 illustrates 3/4 views of a typical housing arrangement for a Mechanical Release Unit (Fixed).

2.2. The design consists of the following principle components:

2.2.1. Mechanical Release Unit (Fig. 1)

A spheroid (3), into which two retaining arms - (39) and a positioning leg (2) are fixed, and whose rear has a shaped recess (36), is mounted in a cylindrical container (34). The container's closed end is hemispherical. It has a slot (1) and a shaped aperture (38) cut in it, to allow limited movement in any direction of the ski-boot's two retaining arms, and up and down movement of the positioning leg. The arms and leg move, due to forces acting on them, via the welts and sole of the ski-boot. They can only move because the spheroid rotates in its container. A spring-loaded (20) plunger (48), is in three sections, two of which are concentric (10) (13), locked together by inserts (14). The hemispherical head (4) of the third section (48), bears in the shaped recess in the spheroid and acts as a con-

straint on its rotation. The section of the plunger containing the hemispherical head, is separated from the two concentric sections by a compressible fluid seal (9). The seal is forced against the walls of the containing cylinder (49), by the action of the release spring. Rotation of the spheroid can only occur, because of a relative displacement between the spheroid, and the plunger, against the release spring (20). Sufficient rotation will take the plunger outside the constraint of the shaped recess (36). The inserts (14) are locked in place by a shaped piston (30). The rear part of the plunger also forms a piston (25). As it moves, due to movement of the plunger, caused by the spheroid rotating, or moving, anti-freeze fluid will be displaced, by this piston, from the decreasing volume occupied by the release spring (20). This fluid, will either flow through the restrictable by-pass, formed, by the control rod (22), and the ports (18) (17) in the shaped piston (30), and plunger (13), or, if the flow is too great, it will cause displacement of the shaped piston (30), against its return springs (8) - (21). Momentary changes in volume, as the shaped piston (30) moves, is compensated for, by inflation of the compensating bag (29). Due to the shape of the control rod and the by-pass ports (17) (18), in the shaped piston and plunger, movement, of the shaped piston beyond a certain limit, is regenerative. Prior to that, it is degenerative (para 2.2.6. refers). When the middle portion of the plunger - (10) is unlocked from the rear portion (13), the release spring (20) restraint on rotation of the spheroid, will be removed. The spheroid will then be free to move, to the limits imposed by the slot and aperture, in the closed end of the cylindrical spheroid container (34). This movement is against the opposition of the relatively light return springs (8) - (21).

2.2.2. Mechanical Release Unit (Fixed) (Fig. 2)

The Mechanical Release Unit (Fixed), is similar in its action to the Mechanical Release Unit described in para 2.2.1., in that release forces, acting on the retaining arms (39) and positioning leg (2), will cause the spheroid (3) to rotate. Because the plunger (4) is fixed, rotation of the spheroid can now only occur, by the spheroid and its container being displaced away from the plunger, by compressing the relatively light spheroid casing return spring (41). This displacement, will be transmitted through the ski-boot, to the Mechanical Release Unit, against its release spring. It will cause release of the constraint of this spring, either as described

in para 2.2.1., para 2.2.4., or by the rotation of the spheroid, taking the fixed plunger (43) (4), outside the limit of the shaped recess (36).

2.2.3. Controls

There are two controls affecting release:

2.2.3.1. Release Spring Tension Control

The release spring (20) tension is set, by adjusting the retaining cap (24). Displacement of fluid due to adjustment, is taken up, by the compensating bag (29). This control is pre-set, according to the physical properties of the skier.

2.2.3.2. Rate Of Increase In Release Force Control

Control over the rate of increase in release force is set, by controlling the rate at which fluid can be displaced, by the piston part of the plunger (25), through the by-pass ports (17) (18). It is set by adjusting the position of the control rod (22), to set the by-pass dimensions according to the physical properties of the skier.

2.2.4. Manual Release

Manual Release is achieved by sliding the release unit housing (47). The release unit housing is coupled to the piston (30), by the connecting rod (46) acting through the mounting block (5), the spring (8), and fluid seal (32). Sliding the housing will displace the piston (30), until the second shaped portion (50), allows the inserts to unlock the two concentric portions of the plunger from each other, and thus remove the release spring's influence on the spheroid's rotation. The spheroid can thus move the plunger, against the relatively light return spring (16), so that the retaining arms no longer retain the ski-boot.

2.2.4.1. The limit of movement of the Connecting Rod Mounting Block (5) is set by the dimensions of the slot (40) in the Fixed Base Unit (45) through which the connecting rod passes. The slot dimensions are such that there is sufficient clearance to prevent fouling when the plunger is displaced by the spheroid.

2.2.4.2. The second shaped recess (37) in the spheroids, is so that, after release, the spheroids can remain in a position, suitable for reinserting a ski-boot.

2.2.4.3. The return springs (16) (21) (8), ensure that when a ski-boot is not in the binding, then the plunger and piston will adopt a position, which allows the two parts of the plunger to be locked together by the inserts (14).

2.2.4.4. After release in an upward direction, as when stepping out of the binding, the spheroid container return spring (41), by forcing the spheroid against the fixed plunger, will cause the second shaped recess to rotate the spheroid, to a position, suitable for reinsertion of the skiboot.

2.2.4.5. To minimize fluid loss, those moving parts in contact with the fluid, are isolated by seals (9) (32), which are compressed by the release and return springs.

2.2.5. Summary of Components

The Binding consists of a front and rear unit, at least one of which is a Mechanical Release Unit. The second unit is either a Mechanical Release Unit (Fixed), or another Mechanical Release Unit, depending on the experience of the skier.

2.2.5.1. Either the Mechanical Release Unit, or the Mechanical Release Unit (Fixed), can be in the Front or Rear position.

2.2.5.2. Compensating Bag

The Compensating Bag is a non-permeable, elastic bag (29), filled with a permeable, sponge-like material (26), which will allow changes in pressure and volume inside the fluid container, to balance against atmospheric pressure. It is secured to the casing (49) by a grub screw (28) and washer - (27) which are drilled to allow atmospheric compensation.

2.2.5.3. Compensating Ports

Compensating Ports (11) are drilled through applicable moving components to facilitate a free flow of fluid when these components move and to prevent seepage having a detrimental effect.

2.2.6. Response of Shaped Piston

2.2.6.1. Degenerative Response

For combined positions of the control rod (22) and the shaped piston (30), where the dimensions of the by-pass are accumulatively increasing, the resulting increase in fluid flow, will tend to reduce the amount of movement of the shaped piston. This is a degenerative response.

2.2.6.2. Regenerative Response

For combined positions of the control rod (22) and the shaped piston (30), where the dimensions of the by-pass are accumulatively decreasing, the resulting decrease in fluid flow, will tend to increase the amount of movement of the shaped piston. This is a regenerative response.

2.2.7. Adjustments

2.2.7.1. The release spring tension control - (para. 2.2.3.1. refers) is adjusted for a given depth of the retaining cap (24) in the housing (49), and is set according to physical properties of the skier, by using the adjusting sockets (23).

2.2.7.2. The rate of increase in release force control (para. 2.2.3.2. refers) sets the reluctance of the binding to release. It is adjusted by:

2.2.7.2.1. Applying pressure to the release spring and operating the manual release, by sliding the binding housing against the return springs until the resistance of the release spring is felt, and holding it there until the operation described in para. 2.2.7.2.2. is completed. This sets the extended rod (31) to a known reference position to facilitate setting the control rod (22) to give the required reluctance.

2.2.7.2.2. Screwing the control rod (22) in until it fouls the end of the extended rod (19). This sets the position at which the response is fully regenerative (para. 2.2.6.2. refers).

2.2.7.2.3. Unscrewing the control rod (22) from this position covers the complete range of response from fully regenerative to fully degenerative (para. 2.2.6.1. refers).

2.2.7.4. The control rod (22) is set according to the properties of the skier, and is set for a number of turns of the control rod from the fully regenerative position.

3. Identification and Location of Item Numbers

<u>Item No.</u>	<u>Identification / Comments</u>	<u>Located In Fig. No.</u>
1	Positioning Leg Slot (cut in hemispherical end of spheroid container).	1, 2, 3
2	Positioning Leg	1, 2
3	Spheroid	1, 2
4	Hemispherical Plunger Head	1, 2
5	Manual Release Connecting Rod Mounting Block. (This is shaped so as not to foul the fluid seal (32)).	1
6	Hemispherical Head To Extended Rod (31). (This bears on the seal guard and transfers motion of the connecting rod block (5) to the piston (30) through the return spring (8)).	1
7	Spheroid Container Retaining Flange.	1, 2
8	Piston Return Spring. (This acts together with item 21 to position the piston).	1
9	Compressible Fluid Seal.	1
10	Centre Section of Plunger. (This is concentric with item 13 and can be locked to it by the inserts (14)).	1

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| 11 | Compensating Ports (drilled through item 9 to prevent fluid seepage having a detrimental effect). | 1 |
| 12 | Unlocking Recess. (These are shaped recesses in the shaped piston (30) to allow the inserts unlocking movement when aligned with them. They are shaped to encourage movement of the inserts). | 1 |
| 13 | Rear Section Of Plunger. (This is concentric with item 10 to which it can be locked by the inserts (14)). | 1 |
| 14 | Locking Inserts. (These are shaped to facilitate transfer into the unlocking recesses (12) and (50)). | 1 |
| 15 | Locking Recess. (This is shaped to encourage movement of the locking inserts (14)). | 1 |
| 16 | Plunger Return Spring. (This is a lightly tensioned spring which repositions the plunger after release of a ski-boot to align the concentric components for the locking inserts to relock them). | 1 |
| 17 | Rear Section Of Plunger Fluid By-pass Port. | 1 |
| 18 | Shaped Piston By-pass Port. (This is wide enough to allow fluid, displaced by movement of the shaped piston when operating the manual release, to flow). | 1 |

19	Fixed Reference End Of Extended Rod (used for setting the reluctance of the binding).	1
20	Release Spring	1
21	Piston Return Spring. (This acts with item 8 to position the piston (30)).	1
22	Control Rod	1
23	Retaining Cap Adjusting Sockets	1
24	Retaining Cap	1
25	Piston Formed By Rear Portion Of Plunger.	1
26	Permeable Sponge-like Material. (This is in the elastic compensating bag (29) and allows it to change volume either side of a norm set by atmospheric pressure).	1
27	Washer	1
28	Grub-screw (pierced to allow a change in volume of the compensating bag).	1
29	Elastic Compensating Bag	1
30	Shaped Piston	1
31	Extended Rod	1

32	Fluid Seal	1
33	Fluid Seal Guard. (This prevents chaffing of the seal by the return spring (8)).	1
34	Cylindrical Spheroid Container. (The closed end is hemispherical and has a slot (1) and an aperture (38) in it.	1
35	Connecting Rod Securing Socket	1
36	Shaped Recess In Spheroid. (This is shaped to give different release characteristics in different directions).	1, 2
37	Second Shaped Recess In Spheroid. (This is a shallow recess to hold the spheroid oriented for reinsertion of a ski-boot after release).	1, 2
38	Aperture. (This controls the limit of the movement of the securing arms (39)).	1, 2
39	Securing Arms. (These are two arms which protrude from the spheroid and secure a ski-boot by bearing on its welts either side of the toe. They are shaped to facilitate movement of the ski-boot, without jamming it).	1, 2
40	Connecting Rod Clearance Slot In Fixed Base (its dimensions set the limit of the mounting block's (5) movement).	3

41	Spheroid Container Return Spring	2
42	Housing	2
43	Fixed Plunger	2
44	Raised End Of Mechanical Release Unit Housing. (It is indented to ease moving it with a ski-stick)..	3
45	Fixed Base Unit	3
46	Connecting Rod. (This transfers movement of the sliding housing, through a slot in the fixed base unit, to the shaped piston (30) via the socket (35) in the mounting block (5), in order to effect manual release).	3
47	Sliding Housing	3
48	Forward End Of Plunger. (This is slotted to allow movement of the connecting rod (46) as the housing (47) is slid for manual release).	1
49	Containing Cylinder	1
50	Unlocking Recesses (for manual release).	1
51	Mechanical Release Unit Housing	4
52	Mechanical Release Unit (Fixed) Housing	5
53	Insert Socket. (This socket contains the insert and allows it to move either into a recess in the shaped piston (12) (50) or the centre section of the plunger (10)).	1

Claims

1. A safety ski binding comprising front and rear binding units having retaining elements adapted to engage the prominent welt of a ski-boot, at least one of said binding units having a release mechanism adapted to release said retaining elements in response to the occurrence of injurious forces acting on the ski-boot, characterized in that

a) said retaining elements (39) are coupled - (37, 36, 4, 48) to a piston arrangement (10, 13) in a manner so as to translate any movement of said retaining elements into an axial displacement of said piston arrangement against a restraining spring (20),

b) said piston arrangement (10, 13) is contained within a liquid-filled cylinder (49) and has a piston element (25) subdividing the interior of said cylinder into two compartments,

c) said two compartments are in flow communication with each other through a flow restrictor (22) of limited flow capacity,

d) said piston arrangement has two telescopic sections (10, 13) and a detent mechanism (14, 30, 8) associated thereto, said detent mechanism locking said two sections together and being hydraulically operable to unlock said two sections when a displacement of said piston arrangement - (10, 13) causes the liquid pressure in the compartment behind said piston element (25) to exceed a predetermined value.

2. A safety ski binding as claimed in claim 1, characterized in that said detent mechanism comprises a number of detent elements (14) for locking said two sections (10, 13) together and a locking member (30), said locking member being spring-biased (8) into a locking position retaining said detent elements in their locking engagement, and being hydraulically displaceable against its bias spring (8) into a position allowing said detent elements to move out of their locking engagement.

3. A safety ski binding as claimed in claim 2, characterized in that said detent elements are detent balls (14) and said locking member (30) is a piston having radial recesses (12) which are moved

into register with the detent balls (14) when the locking member is displaced from its locking position so as to allow the detent balls to be radially displaced out of their locking engagement.

4. A safety ski binding as claimed in any of claims 1 to 3, characterized in that a compression spring (16) is located between said two sections - (10, 13) so as to bias them into an elongated position.

5. A safety ski binding as claimed in any of claims 1 to 4, characterized in that said retaining elements (39) project from a spheroid (3) mounted for omnidirectional rotation and cooperating with said piston arrangement (10, 13) through a hemispherical piston head (4) bearing against a spherical recess (36) of said spheroid.

6. A safety ski binding as claimed in any of claims 1 to 5, characterized in that said cylinder - (49) has an adjustable cap (24) serving as an adjustable support for said restraining spring (20).

7. A safety ski binding as claimed in any of claims 1 to 7, characterized in that said flow restrictor has an adjustable member (22) for varying its flow resistance.

8. A safety ski binding as claimed in any of claims 1 to 7, characterized in that the cylinder compartment in front of said piston element (25) has associated therewith an elastic compensating member (29) allowing for compensation of liquid volume variations.

9. A safety ski binding as claimed in any of claims 1 to 8, characterized in that said detent mechanism (30) is coupled (5, 35, 6, 8) to a manually operable member for manual release of the retaining means.

10. A safety ski binding as claimed in any of claims 1 to 9, characterized in that only one of said front and rear binding units includes a release mechanism, and that the other binding unit (fig. 2) has its retaining elements (39) coupled to a fixed member (42, 43) in a manner so as to translate any movement of said retaining elements into a displacement of said retaining elements towards said first-mentioned binding unit.

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Figure 1

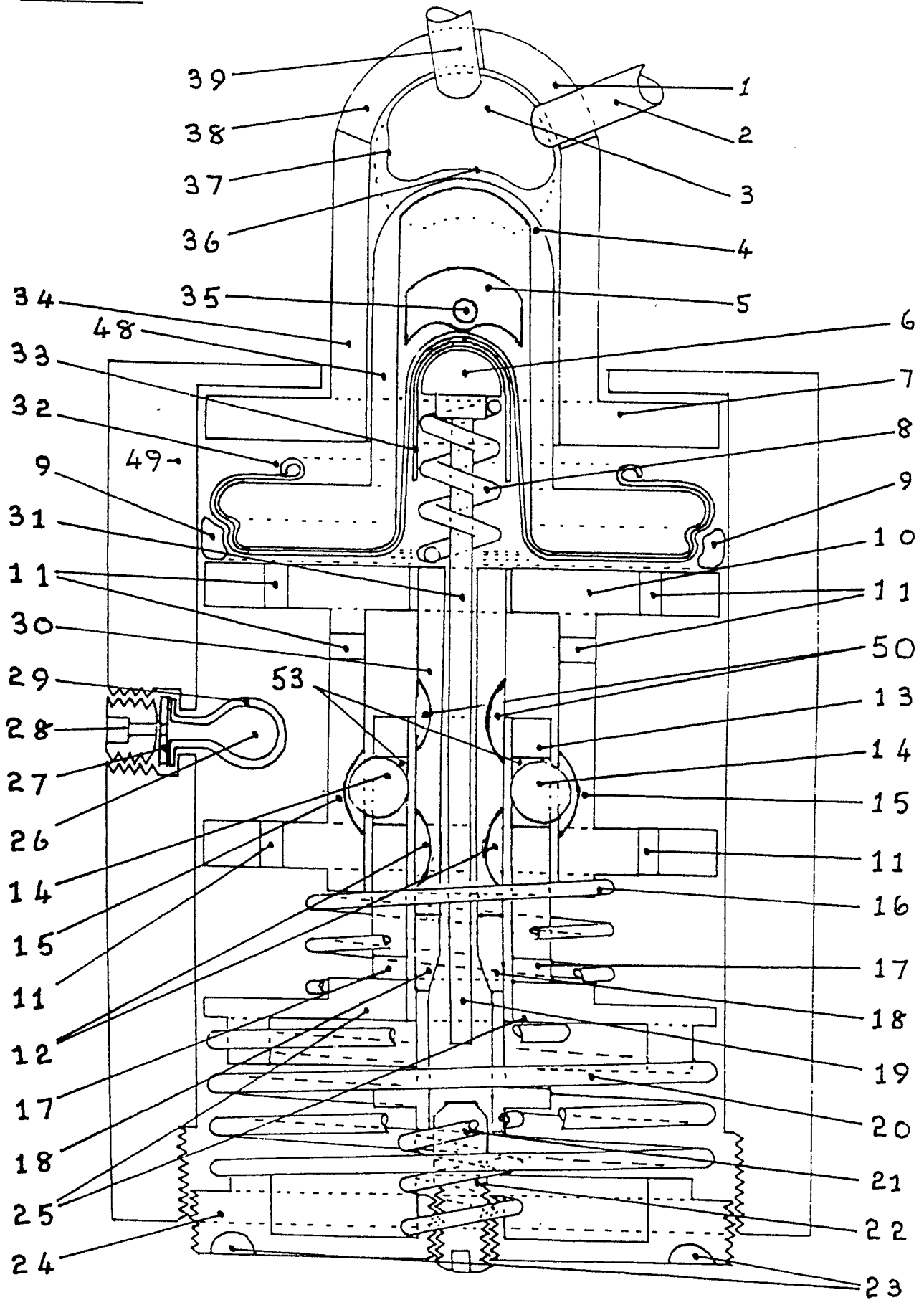


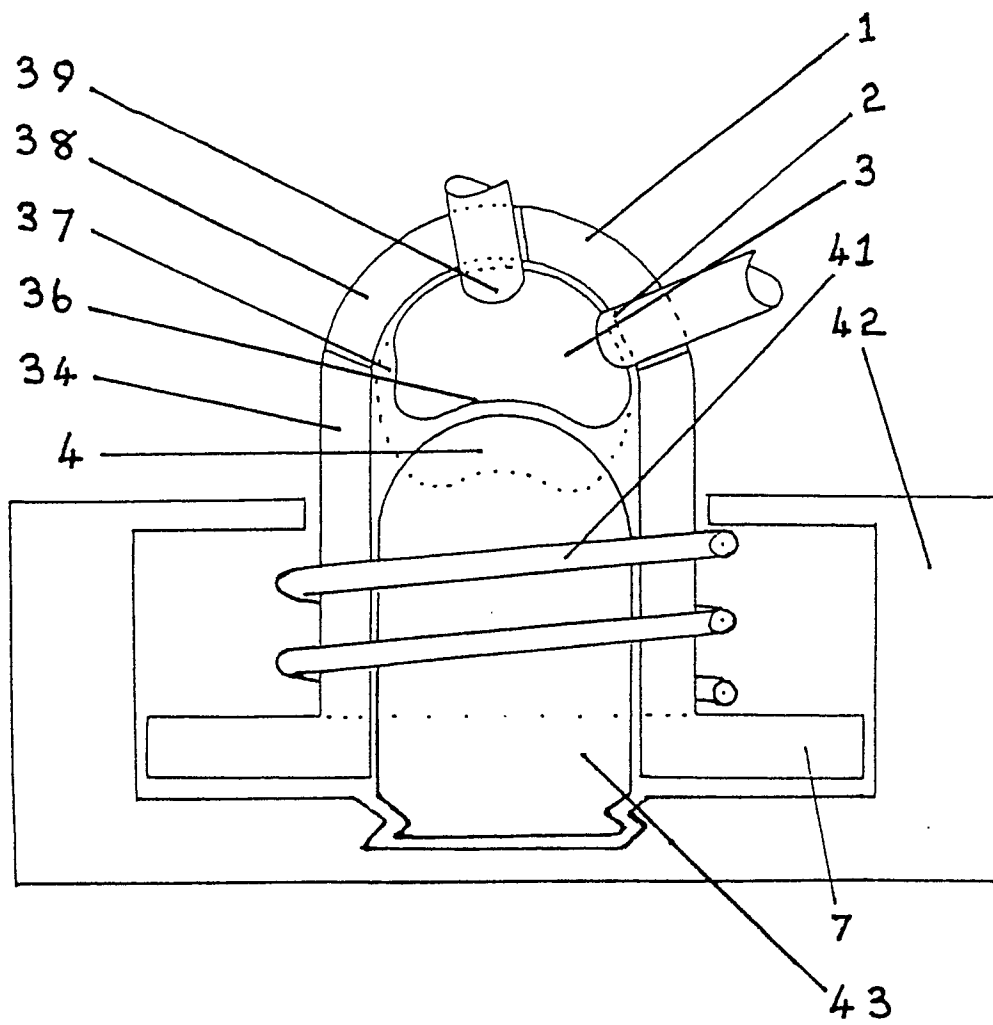
Figure 2

Figure 3

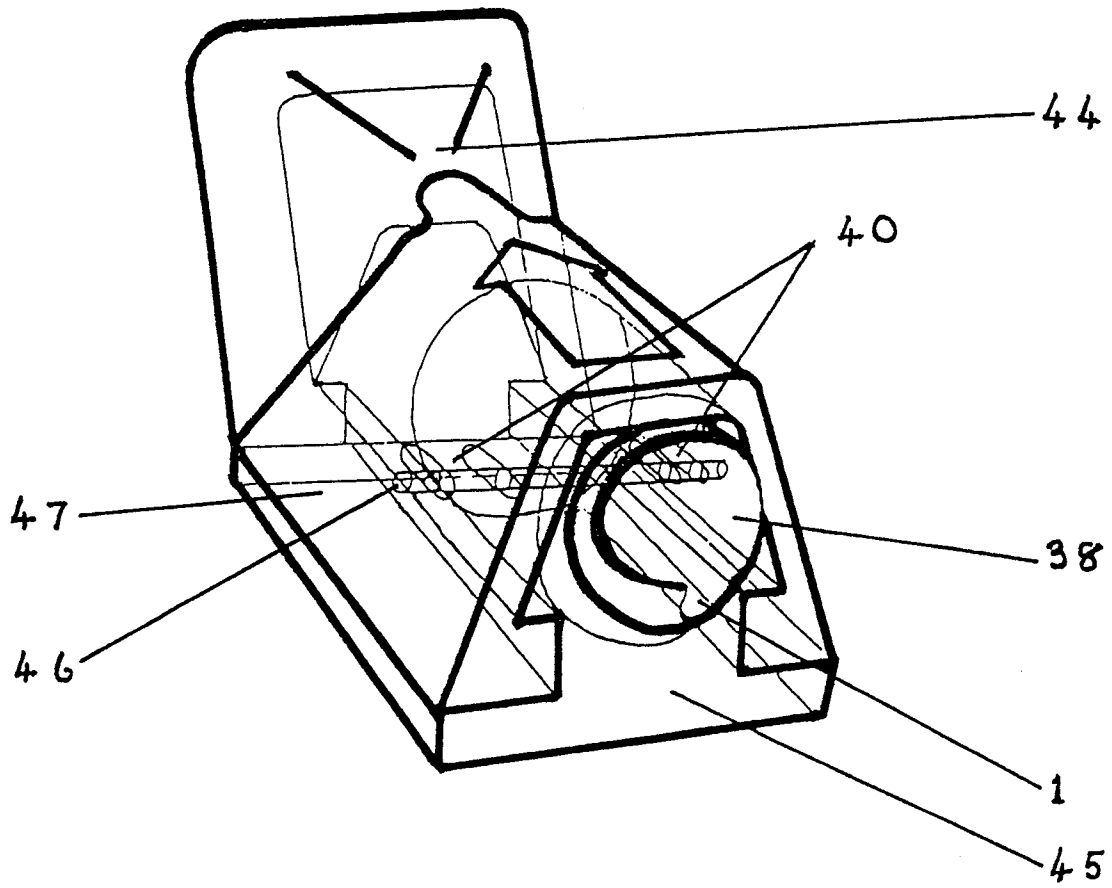


Figure 4

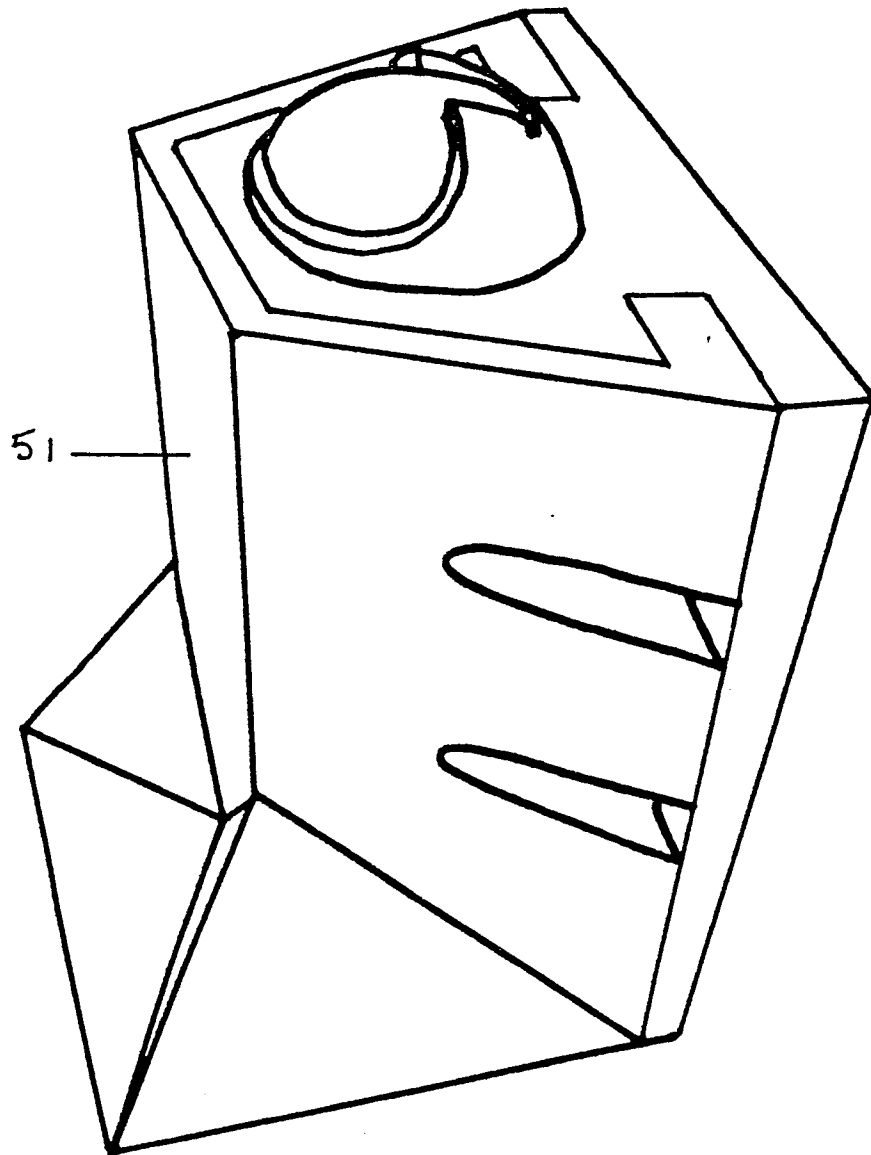
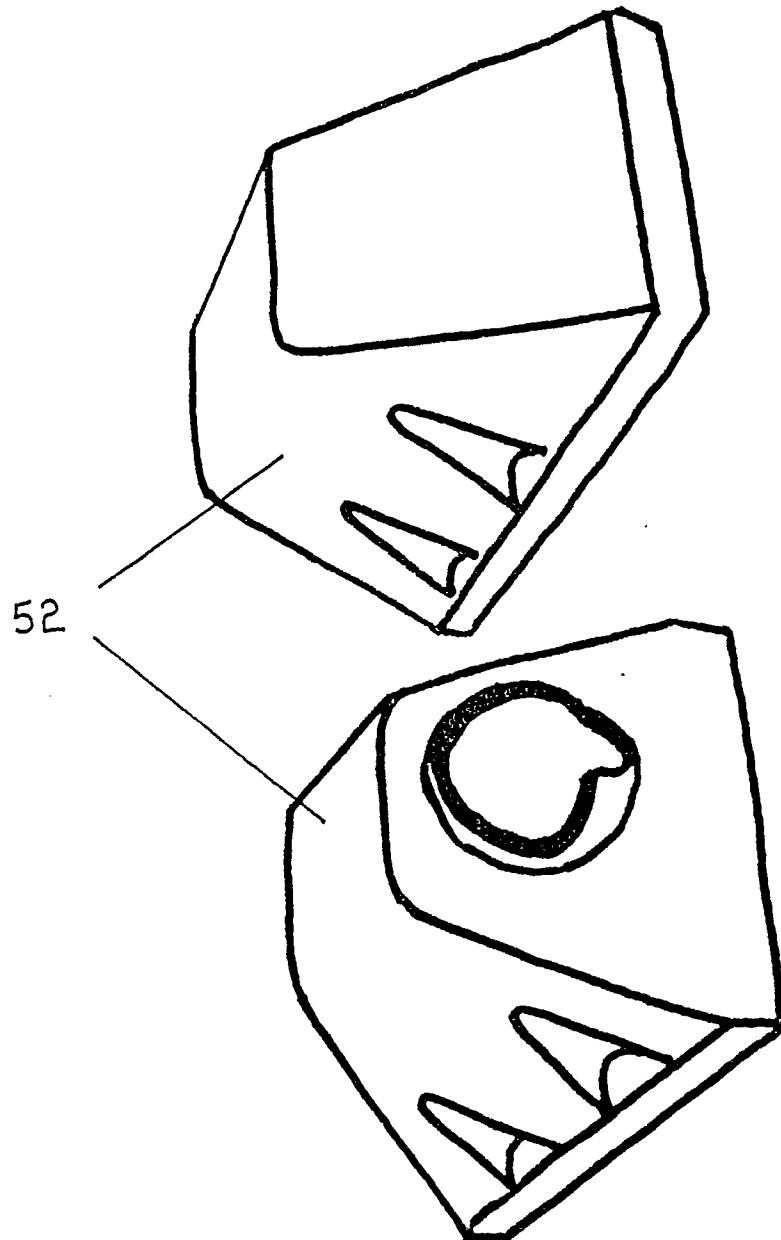


Figure 5





DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A	CH-A- 581 481 (GERTSCH) * Column 1, line 68 - column 3, line 29; figures 1,2 *	1,2,6,9,10	A 63 C 9/08
A	FR-A-2 414 153 (STABILUS GmbH)		
A	FR-A-2 212 159 (GERTSCH)		
A	FR-A-2 522 514 (SALOMON)		
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			A 63 C
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 02-12-1986	Examiner GERMANO A.G.
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	