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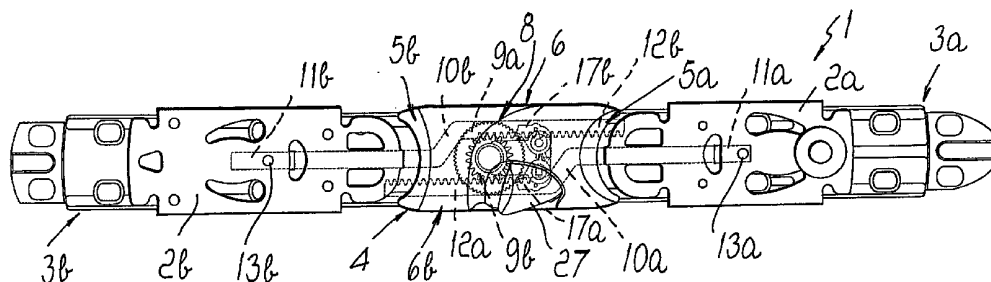
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(54) Title: ADJUSTMENT AND LOCKING DEVICE, PARTICULARLY FOR SKI BINDINGS



(57) Abstract: An adjustment and locking device, particularly for ski bindings, comprising a first front plate and a second rear plate for supporting respectively a toe unit and a heel unit, characterized in that a third plate is interposed between said first and second plates and has means, which can be activated by the user, for temporary locking to a mechanism which is suitable to coordinate the mutually opposite manual axial movement of said first and second plates.

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ADJUSTMENT AND LOCKING DEVICE, PARTICULARLY FOR SKI BINDINGS

Technical Field

The present invention relates to an adjustment and locking device,
5 particularly suitable for use in ski bindings.

Background Art

Known types of ski binding are currently in use which are constituted by
a toe unit and a heel unit which are associated in a downward region, by
virtue of known types of connecting and fixing means such as screws, bolts,
10 brackets and guides, with a ski or with engagement elements which are in
turn associated with said ski.

Said heel unit and toe unit are constituted for example respectively by a
front jaw and a rear jaw which, together with suitable automatic devices,
temporarily lock the tip and heel of the ski boot.

15 These known types of ski binding are adjustable according to shoe size
by allowing to move generally the heel unit longitudinally with respect to the
ski; this can be achieved by virtue of adjustment means of the screw-and-
rack type, as shown for example in US-4,522,422, in which the longitudinal
movement of the heel unit is actuated by means of a screw which is arranged
20 below said heel unit and engages a rack arranged on the surface of the ski. A
continuous adjustment of the size can be achieved with this device.

Another example of device for performing an adjustment, in this case of
the discrete type, is described in DE-A-4,041,402 or in EP-A-0,729,770, in
which adjustment is achieved by disengaging a pawl rigidly coupled to the
25 heel unit from a rack rigidly coupled to the ski, by moving longitudinally the
heel unit along appropriately provided guides, by repositioning it in the new
position and reengaging the pawl with the rack in order to lock said heel unit
in the new selected position.

Since these adjustments entail the movement of the heel unit with respect
30 to the toe unit, which is fixed, they displace the center of gravity of the user

with respect to the position of the ski, consequently varying the balance of the skier during skiing.

All known ski types, and in particular recently designed ones, are built so that they have to be used conveniently with a very specific position of the ski boot with respect to said ski.

Accordingly, the main drawback of these known types of adjustment device is the fact that said adjustment must be performed within small movements of the heel unit toward the tail of the ski, since an excessive movement would cause an equally excessive displacement of the center of gravity of the user, with consequent difficulty in skiing and a reduction in safety conditions.

DE-2,246,668 partially solves the above described drawbacks and discloses a ski binding formed by a toe unit and a heel unit provided with a mechanism for the simultaneous adjustment of the longitudinal position of the toe unit and of the heel unit; said mechanism comprises two connecting elements, one connected to the toe unit and one connected to the heel unit, which are in turn mutually connected by means of an adjustment device which is composed of a rack-and-pinion system.

The user may adjust the position of the toe unit and the heel unit is adjusted by actuating the adjustment device which, by virtue of the pinion, acts simultaneously on the two racks, moving the toe unit and the heel unit in mutually opposite directions.

During adjustment, these mechanisms transmit the longitudinal motion to the toe unit and heel unit according to a given ratio which is substantially constant with respect to a reference plane perpendicular to the longitudinal axis of the ski.

One drawback of the above devices is that the adjustment mechanisms are not universally usable for any type of binding but can be applied only to dedicated bindings interfaced with the adjustment mechanism.

Moreover, the above described adjustment devices comprise devices for

locking the adjustment mechanisms usually constituted, for example, by rotating knobs provided in a lower region with a mechanism for actuating the pinion and therefore the racks.

5 The knob can partially slide axially so as to interact selectively with the pinion.

The partial sliding of the knob along an axial direction is preferably allowed, for example, in contrast with an elastically deformable element such as a spring.

10 The spring is normally suitable to keep the knob in a position in which it does not interact with the pinion, so as to allow to use the sports implement to practice skiing.

If adjustment of the binding is required, one acts by moving the knob axially in contrast with the spring so as to allow connection to the pinion.

15 After turning the knob and therefore completing the adjustment, the spring restores the skiing position, uncoupling the pinion from the mechanism for actuating it.

20 In another manner, the locking and temporary unlocking of the adjustment device can be achieved by virtue of the interaction between first inclined planes, arranged perimetrically to the knob, in a helical pattern, and second inclined planes formed on an element which is rigidly coupled to the adjustment device.

In this manner, a rotation of the knob produces the simultaneous axial movement thereof, thus allowing coupling and uncoupling with respect to the pinion.

25 The main drawback of the above temporary locking devices is that, during sports practice, and therefore when binding adjustment is not allowed, play occurs among the components of the rack-and-pinion system due to the considerable forces generated during skiing.

30 This play can lead to a locking of the toe unit and heel unit which is not effective and therefore dangerously unstable, with a substantial reduction in

level of safety during skiing.

DE-2,001,929 discloses a ski binding which comprises a front supporting element, arranged so that it can be adjusted lengthwise on a first base element fixed to the ski, and a rear supporting element, arranged so that it can be adjusted lengthwise on an additional base element which is fixed to the ski, and also comprises an adjustment device in the form of a rack-and-pinion mechanism for the simultaneous adjustment of both supporting elements. Between the supporting elements there are two racks respectively connected to a supporting element and a pinion which meshes with both racks, the racks can be activated manually and can be locked.

This solution is characterized in that the pinion has a fixed locking position on the ski and in that the racks are arranged so that they can be orientated about an axis which lies transversely to the ski in the region where meshing with the pinion occurs.

The above system still has drawbacks, such as a large number of components, whose mutual interaction requires very limited plays and, accordingly, owing to the considerable stresses applied to the ski, can lead to possible malfunctions.

Moreover, the pinion has a position, which is raised vertically with respect to the upper part of the ski and allows its rotation, and a locking position, which is compressed against the upper part of the ski. This requires, together with the presence of a pinion activation lever located on a plane which is approximately parallel to the plane of arrangement of said pinion, a considerable overall thickness of the device.

Finally, the complexity of the individual components and the particular shape of the lever, which interacts with the racks along an axis which is inclined with respect to them, and at the opposite ends, makes the mechanism prone to jamming or sticking during temporary coupling to the racks.

Disclosure of the Invention

The aim of the present invention is therefore to solve the above noted technical problems, eliminating the drawbacks of the cited prior art, by providing a device that allows to modify easily, quickly and continuously
5 the position of the toe unit and heel unit of a ski binding, without altering the position of the foot and body of the user with respect to the center of gravity of the ski.

An important object is to provide a device that is compatible with any commercially available type of ski binding.

10 Another important object is to provide a device that keeps the shoe size adjustment device independent of, and isolated from, any function of the toe unit and heel unit.

Another important object is to provide a device that ensures high rigidity of the adjustment and locking device, having negligible oscillations or plays
15 of the toe unit and heel unit during skiing.

Another object is to provide a device that does not limit the flexural freedom of the ski during use or in any case can have a limited effect on the flexural characteristic of the ski.

Another object is to provide a device that is structurally simple, is
20 composed of a small number of components and has a limited thickness.

Another object is to provide a device that is free from deformations and has low manufacturing costs.

This aim and these and other objects which will become better apparent hereinafter are achieved by an adjustment and locking device, particularly
25 for ski bindings, comprising a first front plate and a second rear plate for supporting respectively a toe unit and a heel unit, characterized in that a third plate is interposed between said first and second plates and has means, which can be activated by the user, for temporary locking to a mechanism which is suitable to coordinate the mutually opposite manual axial
30 movement of said first and second plates.

Brief Description of the Drawings

Further characteristics and advantages of the invention will become apparent from the detailed description of a particular embodiment, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figures 1 and 2 are respectively a bottom view and a plan view of the device according to the invention, shown without the lower covering panel;

Figure 3 is an exploded perspective view of the device;

Figures 4 and 5 are bottom views of the locking means and of the mechanism with which it interacts, arranged in two different positions, respectively for adjustment and for skiing;

Figure 6 is a perspective view of the locking means arranged in the skiing position;

Figure 7 is a bottom perspective view of the pair of pinions;

Figure 8 is a perspective view of the second pivot;

Figure 9 is a sectional front view of the locking means.

Ways of carrying out the Invention

With reference to the above cited figures, the numeral 1 designates an adjustment and locking device, particularly usable for ski bindings, comprising a first front plate and a second rear plate, 2a and 2b respectively. The plates have a transverse cross-section shaped like an inverted C and are respectively and slidably associable at two underlying and complementarily shaped first and second ends, 3a and 3b, of a third plate 4.

In order to ensure the guided connection between the first and second plates and the first and second ends 3a and 3b of the third plate 4, there is a pair of wings, not shown in the drawings, protruding inward below the first and second plates 2a and 2b.

The first and second ends 3a and 3b have a plurality of holes 50 for detachable connection, by means of a plurality of respective screws 51, to the underlying top surface of a ski, not shown in the figures.

The first and second plates 2a and 2b act as a support respectively for a toe unit and a heel unit of a per se known type, which are not shown in the figures and are suitable to temporarily lock respectively the tip and heel of a ski boot.

5 The stroke of the first and second plates 2a and 2b along the first and second ends 3a and 3b of the third plate 4 is delimited respectively by a first abutment surface 5a and a second abutment surface 5b, provided, for example, by tapering the first and second ends 3a and 3b with respect to a central body 6 of the third plate 4.

10 A compartment 7 is formed in the central body 6 and is adapted to contain a mechanism 8 suitable to coordinate the mutually opposite axial movement of the first and second plates 2a and 2b. The compartment can be closed by means of a lower covering panel 6a and an upper covering panel 6b.

15 In this particular embodiment of the invention, the first and second abutment surfaces 5a and 5b are provided, as shown in Figure 3, at the free ends of the upper covering panel 6b.

Figures 4 to 6 show how the mechanism 8, suitable to coordinate the mutually opposite axial movement of the first and second plates 2a and 2b, comprises an upper pinion 9a and a lower pinion 9b which is smaller than the upper one. The pinions are superimposed and rigidly associated, or monolithic, with respect to each other and are centrally provided with a first hole 14 which engages a first pivot 15 allowing a rotation of the pinions.

20 The first pivot 15 has a vertical axis and is arranged centrally in the central body 6, preferably by means of the connection of a third lower end thereof 15a, in a complementarily shaped first seat 16 formed in said central body 6.

30 The first pivot 15 is provided, in an upper region, with a first head 15b, which prevents any extraction of the pair of pinions 9a and 9b, because the upper covering panel 6b rests on the head.

The lower pinion 9b engages first and second elements 10a and 10b, for connection to the first and second plates 2a and 2b.

Each of said first and second connecting elements 10a and 10b is constituted by a blade which is approximately S-shaped. The blades are connected, at a first free end 11a and 11b, respectively to the first and second plates 2a and 2b, and the connection is obtained, in this particular embodiment, by means of a first rivet and a second rivet, designated by the reference numerals 13a and 13b.

At their second free ends 12a and 12b, the first and second connecting elements 10a and 10b have a lateral rack suitable to interact with the teeth of said lower pinion 9b.

By virtue of said mutual connections, a motion of one or both of the first and second plates 2a and 2b (or of the toe unit and heel unit connected thereto) performed by the user, leads to a motion of the second free ends 12a and 12b, which are laterally rack-shaped, and therefore to a rotation of the lower pinion 9b.

The presence of the lower pinion 9b, which interacts between the second free ends 12a and 12b, forces the first and second plates 2a and 2b to perform an identical and opposite sliding along the respective first and second ends 3a and 3b of the third plate 4.

Once the intended adjustment has been performed, the toe unit and heel unit may be locked into position by locking the upper pinion 9a, which is rigidly associated with the lower pinion 9b.

Said locking is performed by temporary locking means, constituted by a first pawl 17a and a second pawl 17b, having an approximately triangular or teardrop-like or cam-like plan shape and centrally provided respectively with a second hole 18a and with a third hole 18b, for connection to a second pivot 19a and a third pivot 19b.

The first and second pawls 17a and 17b are arranged on a horizontal plane, preferably in mutually mirror-symmetrical positions, and can rotate in

opposite directions about the second and third pivots 19a and 19b.

The mutual rotation of the two pawls is coordinated by the presence of two or more teeth, generally designated by the reference numeral 20, which protrude radially from each one of the first and second pawls 17a and 17b and are arranged mutually side by side in the locking condition.

The teeth 20, by interacting with each other, coordinate and render symmetrical, with respect to a vertical longitudinal plane, the rotary motion imparted to one of the pawls.

The third pivot 19b is preferably cylindrical and is shaped complementarily to the third hole 18b, which is circular, so as to allow a rotation of the second pawl 17b about the third pivot.

Said third pivot 19b can be accommodated, at a fourth lower end 21a, in a complementarily shaped second seat 22 formed in the central body 6. The third pivot 19b is also provided, in an upper region, with a second head 21b which prevents the extraction of the second pawl 17b from the third pivot.

The second pivot 19a has a shape, shown in Figure 8, which features a fifth lower end 23a which is cylindrical so that it is rotatably associable in a complementarily shaped third seat 24 formed in the central body 6.

Above the fifth end 23a, the second pivot 17a has a prism-shaped region 25 for a non-rotating connection to the first pawl 17a. The second hole 18a of the pawl is in fact shaped complementarily to said prism-shaped region 25.

The second pivot 19a has a sixth upper end 23b which is also preferably prism-shaped so that it can engage in a non-rotating fashion a complementarily shaped fourth seat 26 formed in the lower surface of a lever 27.

The lever 27 can be accommodated in an opening 28 which is formed in the upper covering panel 6b. The shape of said opening 28 is such that when the adjustment and locking device 1 is assembled, the lever 27 cannot be directly disconnected from the second pivot 19a.

A tab 29 protrudes laterally from the lever 27 and allows the user to turn the lever 27. In such manner, by acting on the tab 29, the second pivot 19a is made to turn and therefore the first pawl 17a also is made to turn by virtue of the nonrotating connection in the prism-shaped region 25.

5 The rotation of the first pawl 17a is accompanied, by means of the teeth 20, by an equal and opposite rotation of the second pawl 17b.

The coordinated motion of the pawls is affected by the presence of an elastically deformable element 30, such as for example a wire spring, which is associated, at its free ends, with a fourth hole 31a and a fifth hole 31b,
10 which are shaped complementarily and are formed proximate to the second and third holes 18a and 18b.

Figures 4 and 5 show how the first and second pawls 17a and 17b, arranged proximate to the upper pinion 9a, can interact radially with said pinion, locking it by virtue of respective first and second sets of teeth 32a
15 and 32b protruding laterally proximate to a free end.

The locking device, constituted by the first and second pawls 17a and 17b, is opened by acting on the lever 27 in contrast with the elastically deformable element 30 and by then turning the pawls into the position of Figure 4, so as to uncouple the first and second sets of teeth 32a and 32b
20 from the upper pinion 9a.

At the same time, the elastically deformable element 30 is loaded so that when the tab 29 is pressed, the first and second pawls 17a and 17b close and clamp their respective sets of teeth onto the upper pinion 9a.

Since the elastically deformable element 30 is preloaded, in this position,
25 shown in Figure 5, an elastic force is generated which is suitable to maintain the locking of the pair of pinions, avoiding accidental openings of the device.

Figure 9 illustrates the wire spring 30 which cooperates with the first and second pawls 17a and 17b, above which it is possible to arrange a protective
30 element, not shown, which is optionally associable with the central body 6

so as to stiffen the entire structure and better protect it against any damage.

The operation of the device is therefore as follows: with reference to the above cited figures, the user can adjust the distance between the toe unit and the heel unit by turning the lever 27 in the position shown in Figure 4, thus
5 activating the adjustment and locking device 1.

As a consequence of the rotation of the lever 27, the first and second pawls 17a and 17b are turned outward and thus disengage from the upper pinion 9a, releasing the mechanism 8.

Accordingly, the toe unit and the heel unit, coupled in a lower region to
10 the first and second plates 2a and 2b, are free to move in opposite directions along the longitudinal axis of the ski.

The sliding of the toe unit and of the heel unit along the first and second ends of the third plate 4 is performed manually by the user by virtue of a simple pressure, in the appropriate direction, on either the toe and heel units.

Once the intended adjustment has been achieved, in order to lock the
15 adjustment device it is sufficient to act on the tab 29, returning the lever 27 to the original position (Figure 5) and thus restoring the connection between the first and second sets of teeth 32a and 32b of the pawls 17a and 17b on the upper pinion 9a.

It has thus been found that the invention has achieved the intended aim
20 and objects, an adjustment and locking device having been provided which allows to modify easily, rapidly and continuously the position of the toe unit and heel unit of a ski binding without altering the position of the foot and body of the user with respect to the center of gravity of the ski.

The device according to the invention is compatible with any kind of
25 commercially available ski binding, since it is independent of the shape of the toe unit and heel unit. Moreover, the adjustment and locking device is highly rigid, by virtue of its very shape, having negligible oscillations or plays of the toe unit and heel unit during skiing.

Moreover, the fact that the device according to the invention, composed
30

of a fixed plate and sliding plates, has been entrusted with the function of adjusting the shoe size of the binding, in addition to the traditional function of supporting the binding, allows to keep the flexural capabilities of the ski substantially unchanged, because the binding and all its adjustments are transferred from the central region of the ski to the plates.

The device according to the invention is susceptible of numerous modifications and variations within the scope of the appended claims.

Thus, for example, it is possible to provide a device in which the connecting elements 10a and 10b are arranged above the pawls 17a and 17b and, accordingly, the upper pinion 9a has a smaller diameter than the lower pinion.

Also, the shape of the second pivot 19a may be different from the described one, particularly in the region between the sixth end 23b and the prism-shaped region 25, so long as the free rotation of the second pivot with respect to the central body 6 is allowed and the rotation of said pivot with respect to the lever 27 and the first pawl 17a is prevented.

The materials used, as well as the dimensions that constitute the individual components of the invention, may of course be the most pertinent according to specific requirements.

The disclosures in Italian Patent Application No. TV2000A000147 from which this application claims priority are incorporated herein by reference.

CLAIMS

1. An adjustment and locking device, particularly for ski bindings, comprising a first front plate and a second rear plate for supporting respectively a toe unit and a heel unit, characterized in that a third plate is
5 interposed between said first and second plates and has means, which can be activated by the user, for temporary locking to a mechanism which is suitable to coordinate the mutually opposite manual axial movement of said first and second plates.
2. The device according to claim 1, characterized in that said first and
10 second plates have a transverse cross-section shaped like an inverted C, and are slidably associable at two underlying and complementarily shaped first and second ends of said third plate.
3. The device according to claim 2, characterized in that two wings are provided for the guided mutual connection of said first and second plates and
15 said first and second ends of said third plate, said wings protruding inward and downward with respect to said first and second plates.
4. The device according to one or more of the preceding claims, characterized in that said third plate has a central box-shaped body interposed between said first and second ends and that can be closed at the
20 top and bottom by means of an upper covering panel and a lower covering panel.
5. The device according to claim 4, characterized in that said mechanism suitable to coordinate the opposite axial movement of said first and second plates is arranged in a compartment formed between said upper covering
25 panel and said lower covering panel.
6. The device according to one or more of the preceding claims, characterized in that said mechanism suitable to coordinate the opposite axial movement of said first and second plates comprises an upper pinion and a lower pinion that are superimposed and rigidly associated or
30 monolithic with respect to each other.

7. The device according to claim 6, wherein said upper and lower pinions have a rotating connection with respect to a first pivot which passes through a first hole arranged vertically in said central body, characterized in that a third lower end of said first pivot is connected in a complementarily shaped first seat formed in said central body.

8. The device according to claim 6, wherein said lower pinion is suitable to engage first and second elements for connection to said first and second plates, by virtue of a connection between two respective free ends which are laterally rack-shaped, face each other and interact with the teeth of said lower pinion, characterized in that said lower pinion is smaller than said upper pinion.

9. The device according to one or more of the preceding claims, characterized in that said temporary locking means which can be activated by the user is constituted by a first pawl and a second pawl that are rotatably associated with said central body proximate to said upper pinion.

10. The device according to claim 9, characterized in that said first and second pawls interact, with a combined vise-like movement, with said upper pinion.

11. The device according to claim 10, characterized in that said first and second pawls have a flat shape which is symmetrical with respect to a vertical plane which is arranged longitudinally.

12. The device according to claim 11, characterized in that said first and second pawls are advantageously approximately triangular or teardrop-shaped or cam-shaped.

13. The device according to claim 9, characterized in that said first and second pawls are rotatably associated with said central body by virtue of a second pivot and a third pivot, that are arranged vertically and pass respectively through second and third holes formed approximately centrally in said first and second pawls.

14. The device according to claims 10 and 13, characterized in that said

first and second pawls are arranged on a horizontal plane, in a mutually mirror-symmetrical position, and can rotate in opposite directions about said second and third pivots.

15 15. The device according to claim 14, characterized in that the mutual rotation of said first and second pawls is coordinated by the presence of one or more teeth, which protrude radially from each one of said first and second pawls and are arranged side by side in the locking condition.

10 16. The device according to one or more of the preceding claims, characterized in that said teeth, by interacting with each other, coordinate and render symmetrical, with respect to a vertical longitudinal plane, the rotary motion imparted to one of said first and second pawls.

15 17. The device according to one or more of the preceding claims, characterized in that said third pivot is cylindrical and is shaped complementarily to said third circular hole so as to allow said second pawl to rotate about said third pivot.

18. The device according to claim 17, characterized in that a fourth lower end of said third pivot can be accommodated in a complementarily shaped second seat formed in said central body.

20 19. The device according to one or more of the preceding claims, characterized in that a fifth lower end of said second pivot is cylindrical so that it is rotatably associable in a complementarily shaped third seat formed in said central body.

25 20. The device according to claim 19, characterized in that above said fifth end said second pivot has a prism-shaped region which is suitable to provide a nonrotating connection to said second hole of said first pawl, said second hole being shaped complementarily.

30 21. The device according to claim 20, characterized in that a sixth upper end of said second pivot is prism-shaped, so that it can engage in a nonrotating manner in a complementarily shaped fourth seat formed in the lower surface of a lever arranged in an upward region.

22. The device according to claim 21, characterized in that said lever can be accommodated in an opening formed in said upper covering panel, the shape of said opening being suitable, when said adjustment and locking device is assembled, to prevent direct disconnection of said lever from said
5 second pivot.

23. The device according to one or more of the preceding claims, characterized in that a tab protrudes laterally from said lever and allows the user to turn said lever, accordingly forcing a rotation of said second pivot and therefore also of said first pawl by means of said nonrotating connection
10 in said prism-shaped region.

24. The device according to one or more of the preceding claims, characterized in that said one or more teeth that protrude radially from said first and second pawls force said second pawl to perform a rotation which is identical and opposite with respect to the rotation of said first pawl.

25. The device according to one or more of the preceding claims, characterized in that it has, between said first and second pawls, an elastically deformable element, which is preloaded and is suitable to coordinate the action of said first and second pawls.
15

26. The device according to claim 25, characterized in that said elastically deformable element is constituted by a wire spring which is associated, at its
20 free ends, with a fourth hole and a fifth hole which are shaped complementarily and are respectively formed in said first and second pawls proximate to said second and third holes.

27. The device according to claim 26, characterized in that a rotation of
25 said first and second pawls away from said upper pinion applies an additional load to said elastically deformable element, which is already preloaded.

28. The device according to one or more of the preceding claims, characterized in that a first set of teeth and a second set of teeth protrude
30 laterally from said first and second pawls, that are arranged proximate to

said upper pinion.

29. The device according to claim 27, characterized in that said first and second sets of teeth, that protrude proximate to a free end of said first and second pawls, are shaped complementarily to the teeth of said upper pinion, so as to be able to interact radially therewith, locking said adjustment device.

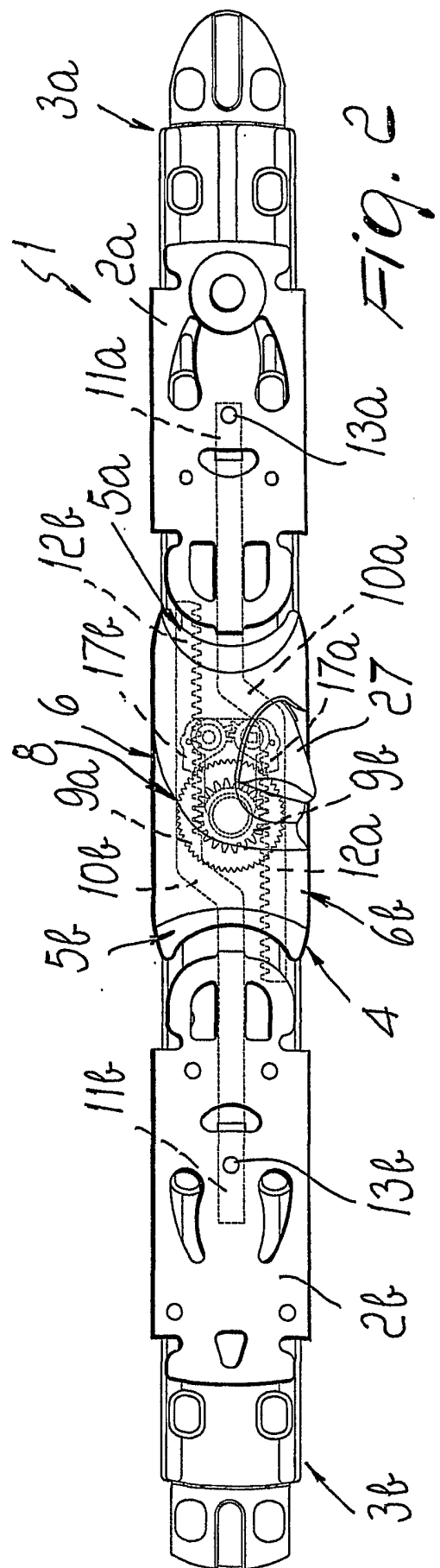
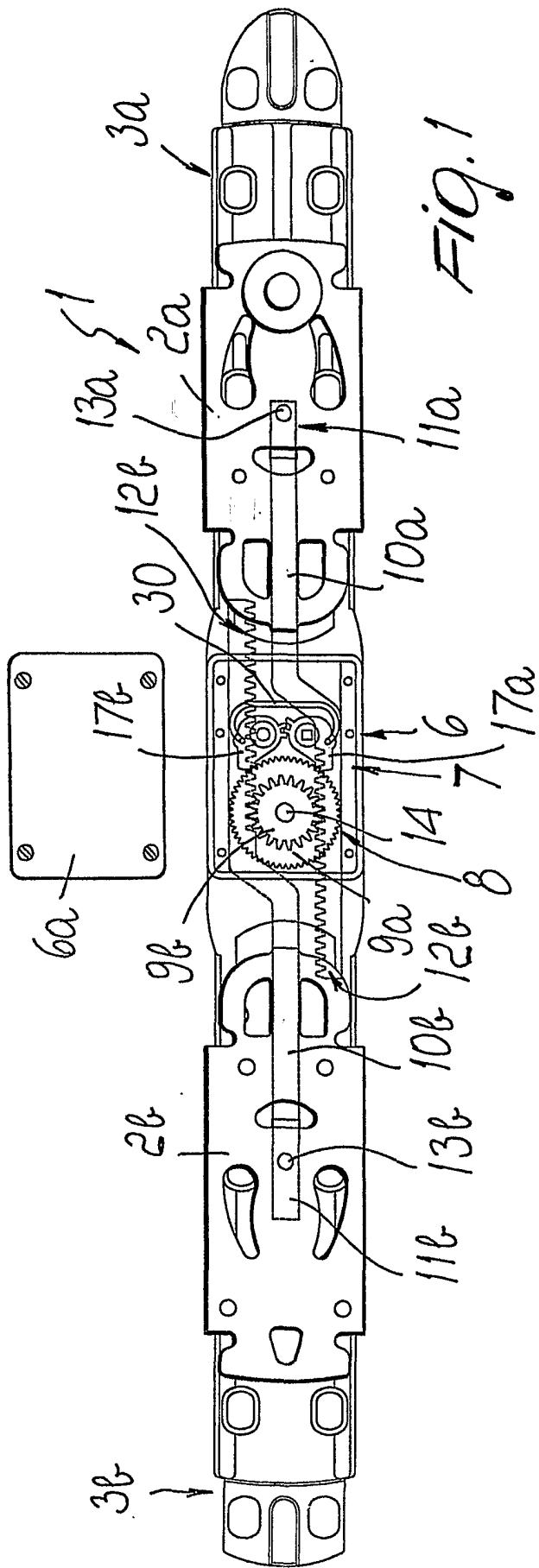
30. The device according to claim 28, characterized in that the locking force of said first and second sets of teeth on said upper pinion is constituted by the elastic force produced by the preloading of said elastically deformable element.

31. The device according to one or more of the preceding claims, characterized in that said locking device, constituted by said first and second pawls, is opened by acting on said lever in contrast with said elastically deformable element, inducing a rotation of said first and second pawls that is suitable to disengage said first and second sets of teeth from said upper pinion.

32. The device according to one or more of the preceding claims, characterized in that it has a first abutment surface and a second abutment surface suitable to delimit the stroke of said first and second plates along said first and second ends of said third plate.

33. The device according to claim 32, characterized in that said first and second abutment surfaces are obtained by tapering said first and second ends with respect to said central body of said third plate.

34. The device according to claim 32, characterized in that said first and second abutment surfaces are formed at the free ends of said upper covering panel.



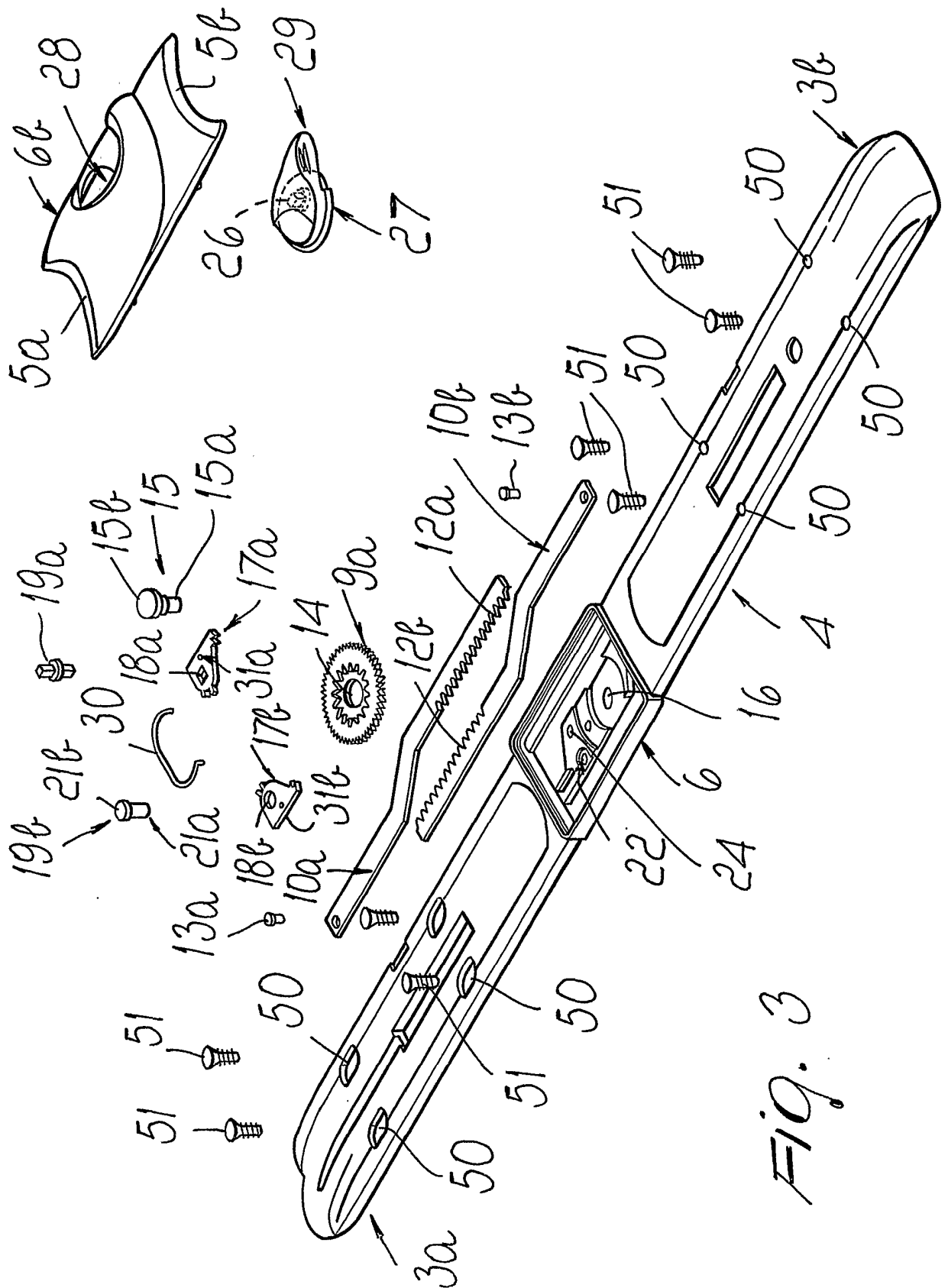


FIG. 3

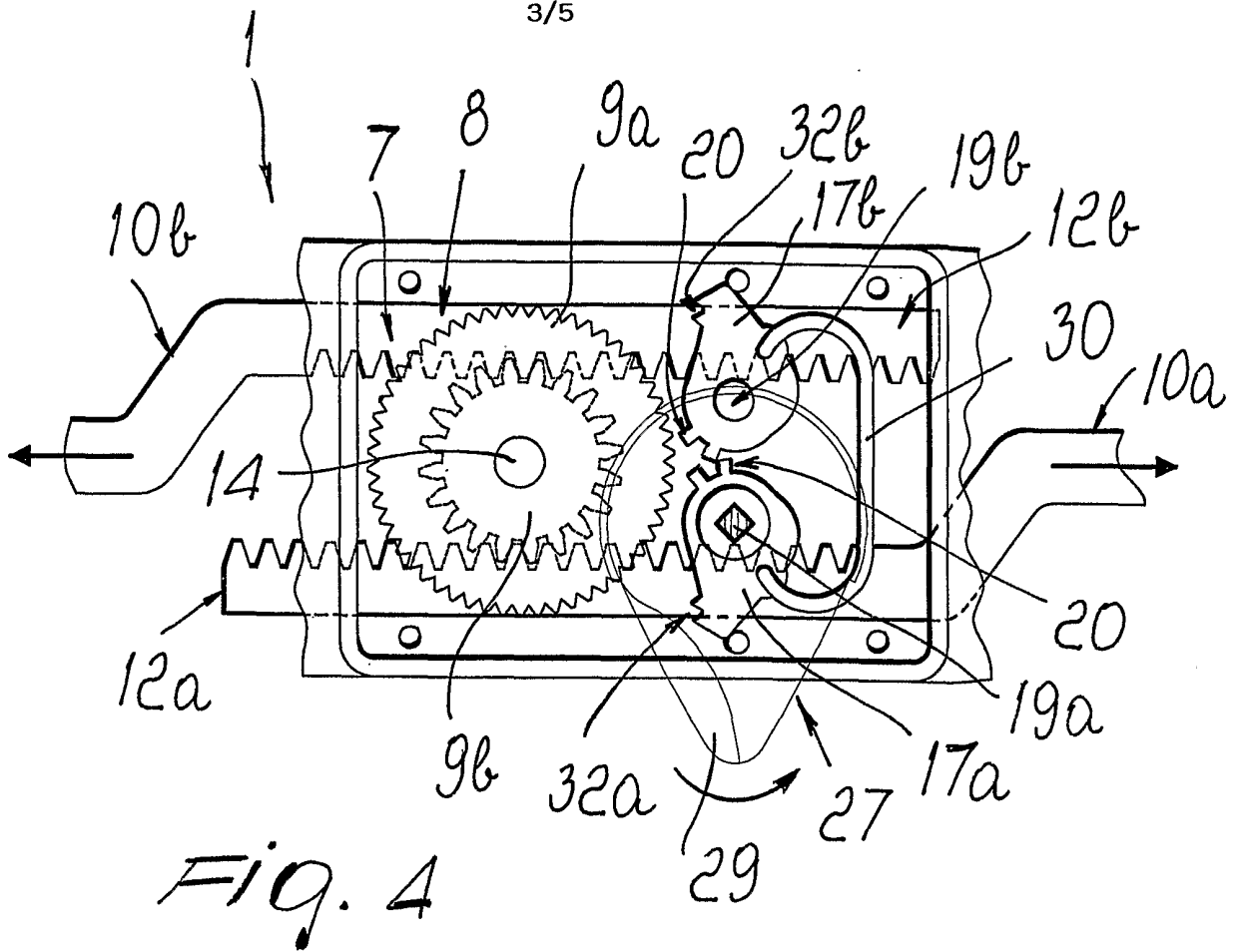


Fig. 4

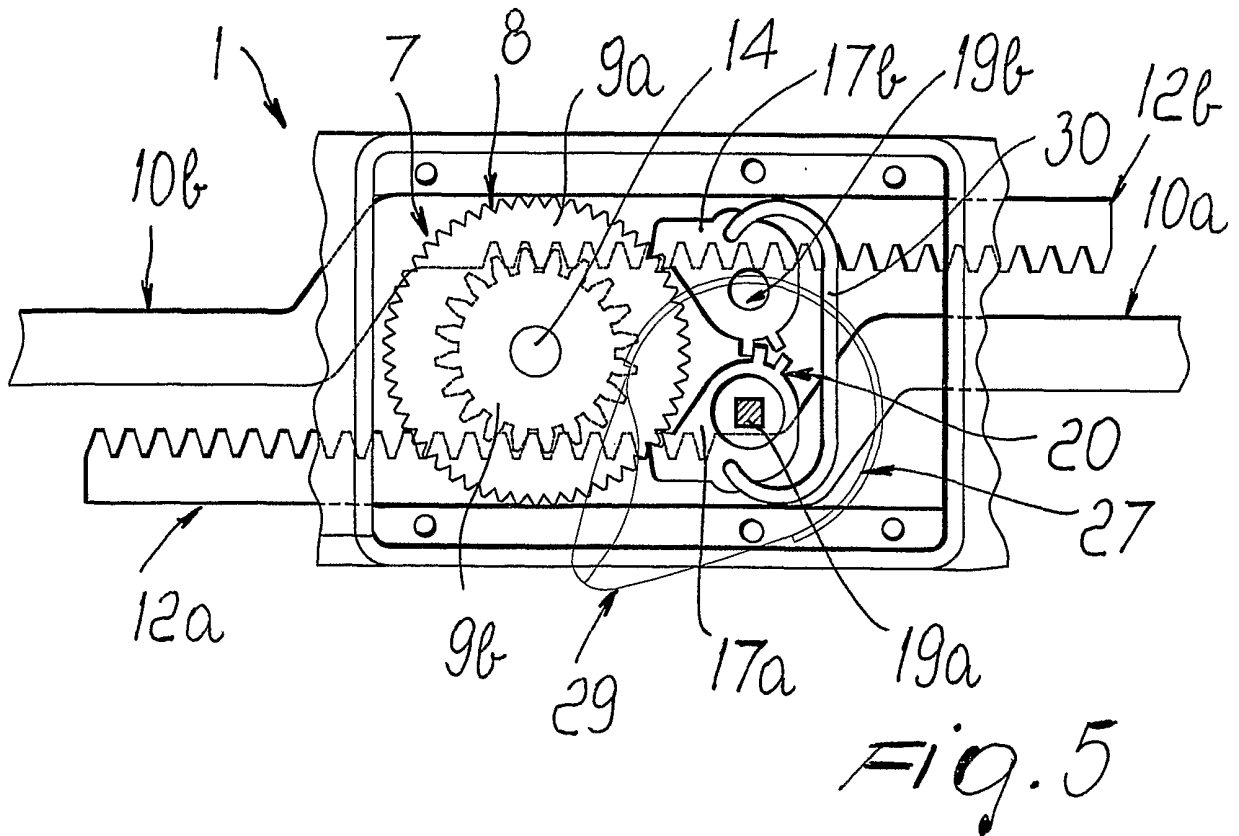


Fig. 5

FIG. 7

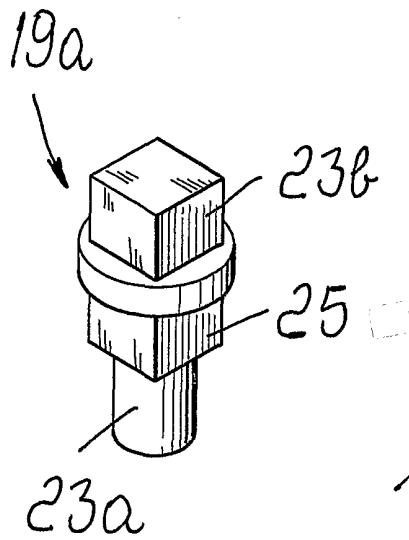
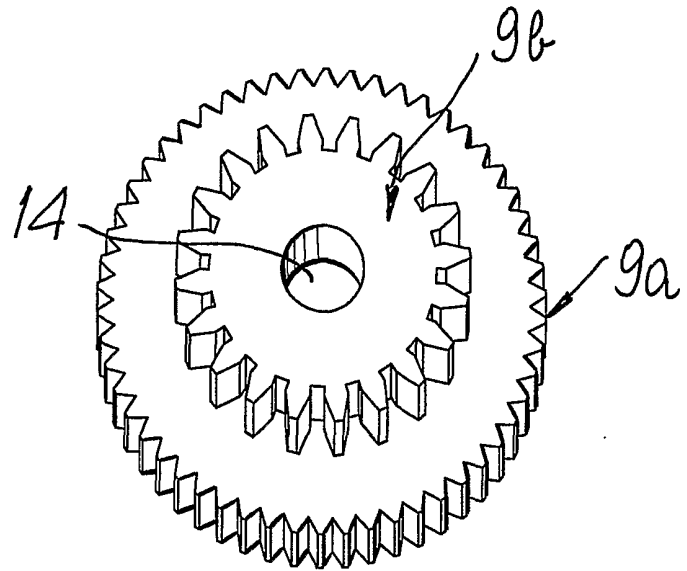


FIG. 8

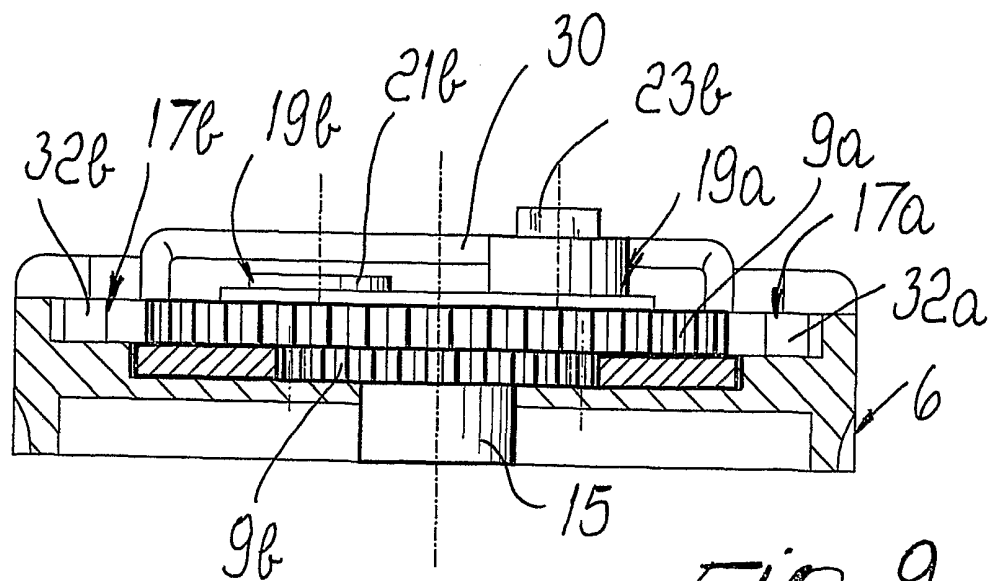


FIG. 9

INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 01/12773

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 A63C9/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A63C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 344 179 A (FRITSCHI ANDREAS ET AL) 6 September 1994 (1994-09-06) the whole document ----	1-3, 23, 28, 30-34
A	DE 91 17 298 U (VARPAT PATENTVERWERTUNGS AG LI) 4 May 2000 (2000-05-04) the whole document ----	1, 5, 6, 8
A	DE 42 30 392 A (VARPAT PATENTVERWERTUNG) 1 April 1993 (1993-04-01) the whole document -----	1, 5, 6, 8

 Further documents are listed in the continuation of box C. Patent family members are listed in annex.

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Date of the actual completion of the international search

3 April 2002

Date of mailing of the international search report

09/04/2002

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
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