(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 532 885 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
25.05.2005 Bulletin 2005/21

(51) Int Cl.[7]: **A43B 5/04**

(21) Application number: **04025129.0**

(22) Date of filing: **22.10.2004**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LI LU MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL HR LT LV MK

(30) Priority: **19.11.2003 IT MI20032248**

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(54) Inclination adjustment device, particularly for sports shoes such as boots or skates

(57) An inclination adjustment device, particularly for sports shoes such as boots or skates, has a quarter (2) coupled to a shell (15) of a ski boot by a stud (7), which can assume a plurality of positions with respect to the quarter; the positions are determined by the engagement of a first contoured surface formed on the quarter and of a second contoured surface formed on the stud, and the quarter can thus be arranged in a plurality of positions with respect to the shell along a sliding direction. The stud is pivoted so that it can rotate on the shell of the boot by a pivot (14) that can move along its own axis; the stud is free to rotate about the pivoting axis when the pivot is a position known as adjustment position, changing the relative position of the two contoured surfaces.

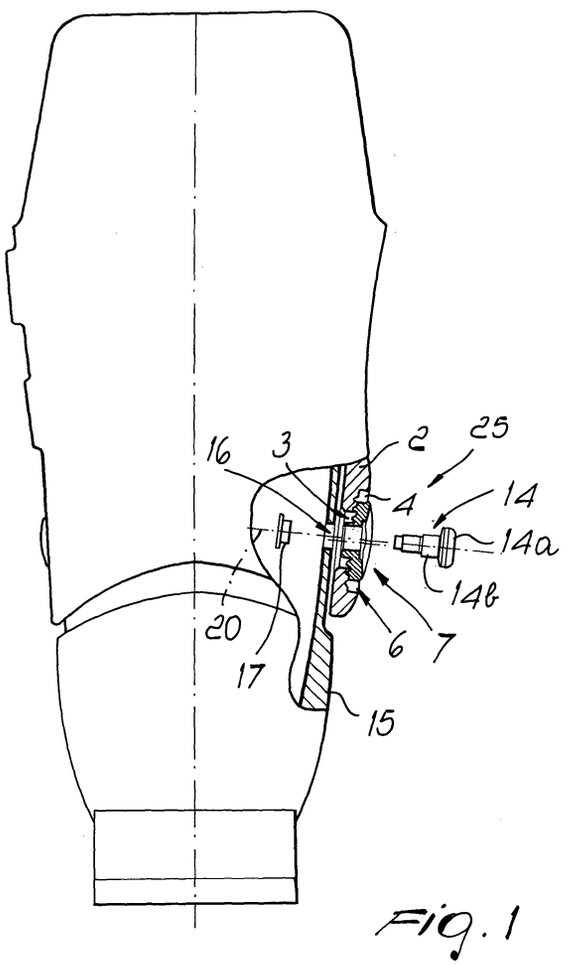

Fig. 1

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Description

[0001] The present invention relates to an inclination adjustment device particularly for sports shoes such as boots or skates.

[0002] The use of ski boots can entail problems for a large number of users, since they have to meet two contrasting requirements.

[0003] On the one hand, it is in fact necessary to use components that are very rigid, so that the skier can transmit his movements to the skis quickly and confidently; on the other hand, it is necessary to be able to adapt the boot to the physical configuration of the user as comfortably as possible, allowing the user to operate in suitable comfort and avoiding the onset of aches and fatigue, which might be a direct or indirect cause of severe lesions.

[0004] In view of the need to provide products that have a high degree of standardization, commonly used known ski boots have a certain number of adjustments, aimed at providing the best adaptation of the sports implement to the physical configuration of the user.

[0005] In this manner, one obtains a component that is sufficiently rigid and at the same time adapted to the measurements of the skier.

[0006] Among the various adjustments that are commonly available in ski boots, a considerable role is played by the possibility to modify the lateral angle of the quarters, commonly known as canting, so as to adapt them to the shape of the user's leg.

[0007] Many devices are currently known which allow to obtain this canting adjustment; among them, French patent no. 2,527,908, filed on 2 June 1982, is known and describes a device for adjusting a ski boot in which the adjustment member is composed of a body, which has a longitudinal opening, and of a cross-member, whose dimensions are smaller than those of the opening and which can move along an axis that is longitudinal with respect to the body and is pivoted freely thereto about an axis that lies transversely to it.

[0008] The cross-member determines the position of a hole along the longitudinal axis of the body of the adjustment member depending on the position assumed inside the opening.

[0009] Although this device allows to vary the lateral inclination of the rear quarter with respect to the shell, it is constituted constructively by a plurality of components, which require particular work at the points of the boot where they are applied.

[0010] The device, therefore, has considerable costs and requires specific components intended for this operation alone.

[0011] US patent application no. 4,570,364 is also known which claims a Swiss priority date of 23 February 1983 and describes two adjustment devices, which are essentially constituted by a body that includes internally two complementarily threaded screws, the ends of which can protrude or retract into the body, which can be turned by the skier.

[0012] The ends of the complementarily threaded screws are respectively associated with the shell at a region that is adjacent to the tip of the foot and at the end of the front quarter that lies above the shell, at the foot instep region.

[0013] Although these devices allow to achieve, by varying the protrusion of the complementarily threaded screws from the body, a deformation of the front quarter that accordingly makes it change its lateral angle, a considerable fatigue of the materials is observed, leading over time to their permanent deformation.

[0014] Secondly, even this embodiment uses specific devices that are suitable to allow this individual adjustment.

[0015] Finally, attention is also drawn to the structural complexity of the devices, which requires the provision of particular receptacles at the shell, whose usual shape is accordingly also changed aesthetically.

[0016] French patent no. 2,570,936, filed on 2 October 1984, is also known and describes a ski boot of the rear-entry type, in which canting can be adjusted by virtue of the presence of a head member provided with a slot that cooperates with a means that is shaped complementarily to the end of the pivoting shaft that affects two parts of the boot, the head member being blocked in a translational motion along an axis that is transverse to the longitudinal axis of the shaft by virtue of the presence of an elastically deformable means.

[0017] This embodiment, too, is scarcely practical, since it still requires devices suitable specifically for canting adjustment.

[0018] A canting adjustment device is also known which has a stud provided with a surface that is profiled so as to mate with a contoured portion that is generally composed of a plurality of teeth and is provided on a front quarter.

[0019] The stud can be disengaged from contact with the contoured portion so that it can be moved and coupled again with it in a different position, since the contoured portion formed on the front quarter is larger than the profiled surface of the stud.

[0020] By virtue of the reaction applied by a connecting screw between the stud and the shell of the boot, a movement of the stud causes the rotation of the quarter, allowing to adjust the canting angle.

[0021] The main drawback of this known type of device is that in order to ensure the structural strength of the teeth that compose the contoured portion, their pitch cannot be reduced below a minimum level.

[0022] As a consequence of the materials and technologies usually used in the production of ski boots, this minimum value is currently equal to approximately 3 millimeters.

[0023] Accordingly, any canting adjustment cannot provide for a relative translational motion of the front quarter by less than the above cited minimum pitch, and this is not entirely satisfactory for users.

[0024] Reducing the pitch below 3 millimeters compromises operation, since the teeth tend to deform and straddle each other if they are not perfectly aligned, with consequent deformation thereof.

[0025] The aim of the present invention is therefore to solve the cited technical problems, eliminating the drawbacks of the cited known art and thus providing an invention that allows to achieve fine adjustment of canting without increasing the complexity of the device with respect to what is provided by the background art.

[0026] Within the scope of this aim, an important object is to provide an invention that can be operated easily by the skier, so as to obtain easily the intended adjustment.

[0027] Another object is to ensure maximum reliability and safety in use, so as to allow the skier at all times to have adequate control over the skis.

[0028] Another object is to provide an invention that is structurally simple and has modest manufacturing costs.

[0029] This aim and these and other objects that will become better apparent hereinafter are achieved by an inclination adjustment device, particularly for sports shoes such as boots or skates, which includes a quarter that is articulated, in the malleolar region, by virtue of a stud, to a shell, characterized in that the stud has a first toothed region that cooperates selectively with a second toothed region, which is formed on the quarter and is orientated approximately transversely thereto and is longitudinally longer than the first region, the stud having a first hole for a pivot for detachable connection to the shell, which is formed in a region that is intermediate between two consecutive teeth and does not coincide with a central axis of the stud.

[0030] Further characteristics and advantages of the invention will become better apparent from the description of a preferred but not exclusive embodiment of the device according to the invention, illustrated by way of non-limiting example in the accompanying drawings, wherein:

Figure 1 is a partially sectional exploded view of the adjustment device applied to a ski boot;

Figure 2 is a plan view of the stud according to the invention;

Figure 3 is a sectional view of the stud, taken along the plane IV-IV of Figure 2;

Figure 4 is a perspective view of the stud;

Figure 5 is a normal view and a longitudinal sectional view of the adjustment device in a first exemplifying operating position;

Figure 6 is a normal view and a longitudinal sectional view of the adjustment device in a second exemplifying operating position;

Figure 7 is a normal view and a longitudinal sectional view of the adjustment device in a third exemplifying operating position;

Figure 8 is a front elevation view of a first series of different configurations that can be obtained by virtue of the adjustment device;

Figure 9 is a front elevation view of a second series of different configurations that can be obtained by virtue of the adjustment device;

Figure 10 is a normal view of a series of positions of the stud that correspond to the adjustments of Figure 10.

[0031] In the examples of embodiment that follow, individual characteristics, given in relation to specific examples, may actually be interchanged with other different characteristics that exist in other examples of embodiment.

[0032] Moreover, it is noted that anything found to be already known during the patenting process is understood not to be claimed and to be the subject of a disclaimer.

[0033] With reference to the figures cited above, the reference numeral 1 designates a ski boot that is composed of a quarter 2 and a shell 15, which are mutually articulated by virtue of an adjustment device according to the invention, designated by the reference numeral 25.

[0034] The quarter 2 is arranged laterally with respect to the shell 15 and can perform a translational motion, with respect to it, in a substantially vertical direction, assuming relative positions defined by the adjustment device 25.

[0035] In this adjustment device, on the lateral surface of the quarter 2, approximately in the malleolar region, there is a through slot 3, which in a particular but not exclusive embodiment is arranged so that the major axis of its cross-section is orientated substantially vertically and is therefore approximately perpendicular to the sole of the boot.

[0036] In a region that surrounds the through slot 3, at the outer lateral surface of the quarter 2 and through part of its thickness, there is an approximately elliptical elongated receptacle 4, which surrounds the through slot.

[0037] A first toothed region 5 is formed on the bottom of the receptacle 4, and its profile is constituted by a plurality of first teeth 6, which are arranged transversely with respect to the major axis of the slot 3 and have a preset pitch.

[0038] The pitch does not decrease, due to mechanical strength reasons, below a chosen minimum threshold.

[0039] The device 1, furthermore, is formed by a stud 7, which is essentially T-shaped and includes an actuation head 12, below which there is a coupling body 9 whose shape duplicates the shape of the receptacle 4 but is smaller at the major axis.

[0040] The coupling body 9 has, on the opposite side with respect to the actuation head 12, a second toothed region 10, whose profile is constituted by a plurality of second teeth 11, whose shape is such that they can

mesh with the first teeth 6, formed in the first toothed region 5, and have the same pitch, so that the stud 7 can be positioned selectively with respect to the quarter 2 along a direction that coincides with the major axis of the through slot 3 and of the receptacle 4.

[0041] The stud 7 furthermore includes a lug 8, which is essentially cylindrical and protrudes at the second toothed region, on the opposite side with respect to the actuation head 12.

[0042] The lug 8 can be positioned so that it can slide within the through slot 3, since its diameter is slightly smaller than the width of the slot 3, so that it can perform a translational motion therein, allowing the stud 7 to be guided during its relative movement with respect to the quarter 2.

[0043] The lug 8 can be rotated while remaining at least partially inside the through slot 3.

[0044] The mutual and selective arrangement of the first and second toothed regions 5 and 10, and the possible corresponding movement of the lug 8 within the through slot 3, allow the stud 7 to assume various positions, in each of which the second teeth 11 of the second toothed region 10 couple with a fraction of first teeth 6 of the first toothed region 5.

[0045] The actuation head 12, which has by way of example a circular cross-section, is meant to constitute a grip member for the actuation of the device 1 by the user and a protection for the first and second toothed regions 5 and 10.

[0046] Furthermore, a cavity 18 is formed on the actuation head 12 of the stud 7, on the opposite side with respect to the first toothed region 5 and through part of its thickness and is open in an upward region and forms, in a downward region, a preferably flat abutment surface 19.

[0047] A first through hole 13 is formed in the stud 7, and its axis coincides with the axis of the lug 8.

[0048] A pivot 14, provided at a first end with a head 14a, can be inserted in the first hole 13, so that the head 14a can abut against the abutment surface 19.

[0049] Advantageously, the stem 14b of the pivot 14 has a slightly smaller diameter than the first hole 13, so as to allow a relative rotation between the pivot and the stud 7 about the axis 20 of the first hole 13.

[0050] A second through hole 16 is formed in the lateral surface of the shell 15, approximately in the malleolar region, and a locking member 17 is accommodated inside it and can be connected, at a second end of the pivot 14 that lies opposite the one where the head 14a is formed, so as to fasten the stud 7, and therefore the quarter 2, to the shell 15.

[0051] The pivot 14 can move axially with respect to the locking member 17, so that it can pass from a first position, termed closure position, in which it retains, by virtue of its head 14a, the stud 7 against the quarter, to a second position, termed adjustment position, in which the head moves away from the stud 7, allowing it to disconnect from the quarter 2, so that the first and first toothed regions 5 and 10 are disengaged and the coupling body 9 is extracted from the receptacle 4, and vice versa.

[0052] This function can be achieved for example by virtue of the presence of a thread, which is formed in the end region of the pivot 14 that lies opposite the end where the head is present and is suitable to engage a corresponding thread provided on the locking member 17, which is constituted by way of example by a nut.

[0053] Advantageously, the second hole 13 has a longitudinal axis 20 that is arranged in an intermediate region between two consecutive teeth of the second toothed region 10 that does not coincide with the central axis 21 of the actuation head 12 of the stud 7.

[0054] In more general terms, the axis 20 is arranged in any position of the profile of the second teeth 11, except for the positions that correspond to a apex or base of the second teeth 11 or are arranged at a distance from any one of the apexes or bases that is equal to a whole multiple of the pitch of the first teeth 6 and of the second teeth 11.

[0055] Conveniently, the distance between the axis 20 and any one of the apexes or bases of the first or second teeth 6 and 11 can be equal to one quarter of the pitch of the first and second teeth; however, equally advantageous results can be achieved with different distances.

[0056] A first series of notches 22 and a second series of notches 23 can be provided conveniently on the outer lateral surface of the quarter 2, proximate to the receptacle 4; these notches indicate, in cooperation with the position indicator 24 provided on the upper surface of the actuation head 12 of the stud 7, the correct position that the stud must assume in order to obtain a given adjustment of the canting angle of the sports shoe.

[0057] The notches of each series are mutually spaced, along the direction of motion of the stud 7 with respect to the quarter 2, by a distance equal to the pitch of the first teeth 6 and of the second teeth 11, while the two series are advantageously mutually staggered, in the same direction, by a distance equal to half of the pitch.

[0058] The operation of the adjustment device according to the invention provides for two operating modes, capable of allowing a respectively more or less significant variation of the angle of the quarter.

[0059] In the first case, adjustment is performed by placing the pivot 14 in the adjustment position and partially extracting the stud 7 from the receptacle 4, so as to mutually separate the first and second toothed regions.

[0060] Once the second teeth 11 have been disengaged from the portion of the first teeth 6 with which they were engaged, the stud 7 can be moved by sliding the lug 8 within the through slot 3 according to the direction in which the adjustment is to be performed, so that the first toothed region 5 is coupled to the second toothed region 10 at a different portion of the first teeth 6.

[0061] Once the intended adjustment has been achieved, the stud 7 is fixed in the position that has been reached by locking the pivot 14.

[0062] In this manner, the stud 7 performs a translational motion with respect to the quarter 2 by a distance that is equal to a whole multiple of the pitch of the first teeth 6 and of the second teeth 11, so that the reaction of the shell 15 applies, by virtue of the pivot 14 and the stud 7, a force to the quarter 2 that acts so as to force it to perform a translational motion that is equal to the translational motion performed by the stud 7 with respect to the through slot 3 and is directed in the opposite direction.

[0063] The stud 7 is thus stationary with respect to the shell 15, and only the quarter 2 moves, for example vertically, adjusting the canting of the boot.

[0064] In the second operating mode, instead, once the pivot 14 has been loosened, the stud 7, after being raised so that the first and second toothed regions 5 and 10 are disconnected and the coupling body 9 is extracted from the receptacle 4, is rotated appropriately through 180° about the axis of the first hole 13 by virtue of the support provided by the pivot 14.

[0065] In this manner, an offset is produced between the first teeth 6 and the second teeth 11 which prevents the shaped surfaces from being able to mate without a relative translational motion in the direction in which the quarter 2 slides with respect to the shell 15, which coincides with the major axis of the slot 3 and of the receptacle 4.

[0066] As shown in the sectional views of Figures 5, 6 and 7, as a consequence of the rotation of the stud 7, the axis 21 of the stud passes from one of the half-planes formed by the axis 20 of the hole 13 to the other half-plane, producing the above mentioned offset.

[0067] In order to reinsert the stud 7 in the quarter 2 so that once the coupling body 9 has been reinserted in the receptacle 4 the second toothed region 10 is coupled to the first toothed region 10 at the same portion of the second teeth 11 with which it was coupled prior to the adjustment, the quarter must undergo a relative translational motion with respect to the shell 15 and the stud 7 in the direction in which the quarter 2 moves with respect to the shell 15.

[0068] This translational motion is equal to twice the distance of the axis 20 of the first hole 13 with respect to the nearest apex or base of the second teeth.

[0069] It is easily understood that by choosing accurately the extent of the above cited distance it is possible to provide more precise adjustments of the canting of the ski boot than allowed by known devices, offering better possibilities to adapt the boot to the physical characteristics of the skier.

[0070] In the particular case in which the axis 20 of the first hole is equidistant from a consecutive apex and base of the second teeth, and is thus spaced from each apex and base by one quarter of the pitch of the first teeth 6 and of the second teeth 11, the fine canting adjustment performed in the manner described above entails a movement of the quarter in the intended direction that is equal to half the pitch of the first teeth 6 and of the second teeth 11.

[0071] It has thus been found that it is possible to provide, in cooperation with the first operating mode, a uniform spacing among the various possibilities of adjustment.

[0072] In particular, in the practical execution of ski boots with the possibility to adjust canting, the minimum dimension of the pitch of the first teeth 6 and of the second teeth 11 allowed by current technologies and materials is equal to approximately three millimeters, since the use of thicknesses of the first and second teeth 6 and 11 that are below this limit would entail a high risk of breakage thereof during use.

[0073] An advantageous but certainly not unique sizing of the device described above can therefore provide conveniently that the distance between the axis 20 of the first hole 13 and an apex or base of the second teeth is equal to 0.75 millimeters, therefore one quarter of the pitch of the first and second teeth 6 and 11.

[0074] In this manner, one obtains the possibility to adjust the canting by virtue of movements of the quarter that are multiples of 1.5 millimeters, a value that corresponds to half the pitch of the first and second teeth 6 and 11.

[0075] It is thus evident that although the device retains the same thickness of the first and second teeth 6 and 11 used by known adjustment systems, the precision of the adjustment performed is exactly doubled.

[0076] By virtue of the arrangement of the first and second series of notches 22 and 23 described above, a movement of the stud 7 that entails the transfer of the position indicator 24 from one notch to the next of the same series, as shown in Figures 5 and 6, indicates a translational motion of the quarter 2 by a distance equal to the pitch of the first and second teeth 6 and 11, while the passage from one notch to the corresponding notch of the opposite series, as shown in Figures 6 and 7, produces a movement equal to half of the pitch.

[0077] Figure 8 illustrates, by way of example, three configurations of the canting of a ski boot, which can be obtained by virtue of the simple translational motion of the quarter 2 with respect to the stud 7.

[0078] Starting from an initial configuration, designated in the figure by the letter A, it is possible to obtain two adjustments, designated by the letters B and C, by virtue of the translational motion of the quarter 2 with respect to the stud 7 and the shell 15 by a distance equal to the pitch of the first and second teeth, respectively upward and downward.

[0079] The configuration D shown in Figure 9 can be obtained, starting from the configuration A, by virtue of a rotation of the stud 7 about the axis of the first hole 13 that is equal to 180°.

[0080] This action entails, as described above, a translational motion of the quarter 2 with respect to the

shell 15 and to the stud 7 by a distance equal to half the pitch of the first and second teeth.

[0081] Starting from the configuration D, it is possible to obtain configurations E and F by virtue of a simple translational motion of the quarter 2 with respect to the shell 15 and the stud 7 by a distance equal to the pitch of the first and second teeth.

[0082] For further clarification, Figure 10 illustrates, in a normal view and in a partially sectional view, the relative arrangements of the quarter 2 and of the stud 7 that correspond to the adjustments shown in Figures 8 and 9.

[0083] Obviously, the adjustment device described here can be present on just one side or on both sides of the ski boot, ensuring in either case the operation described above.

[0084] It has thus been found that the adjustment device according to the invention fully achieves the intended aim, since it allows to obtain an adjustment of the canting of a ski boot more accurately than allowed by known systems without requiring a new sizing of the components or the introduction of additional components, thus ensuring a level of safety in use that is at least equal to that of known devices.

[0085] Another object achieved by the invention is to allow easy adjustment on the part of the user, allowing to obtain directly and safely the configuration that is most suitable for the user's requirements.

[0086] Another object achieved by the adjustment device according to the invention is to allow the user better control over the skis, since the finer adjustment and therefore the high level of adaptation to the physical characteristics of the user allow the user to be more confident in using the skis.

[0087] The adjustment device thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the inventive concept.

[0088] The materials used, as well as the dimensions that constitute the individual components of the invention, may of course be more pertinent according to the specific requirements.

[0089] The various means for performing certain different functions need not certainly coexist only in the illustrated embodiment but can be present per se in many embodiments, including ones that are not illustrated.

[0090] The characteristics described as advantageous, convenient or the like may also be omitted or be replaced by equivalents.

Claims

1. An inclination adjustment device, particularly for sports shoes such as boots or skates, comprising a quarter that is articulated, in the malleolar region, by virtue of a stud, to a shell, **characterized in that** said stud has a first toothed region, which is orientated approximately transversely thereto and is longitudinally longer than a second toothed region formed on said stud, said stud having a first hole for a pivot for detachable connection to said shell, which is formed in a region that is intermediate between two consecutive teeth and does not coincide with a central axis of said stud.

2. The device according to claim 1, wherein a through slot is formed in said quarter in the malleolar region and is preferably arranged so that the major axis of its cross-section is orientated approximately at right angles to a sole of a sports shoe, **characterized in that** an approximately elliptical elongated receptacle is formed at said through slot on the outer lateral surface of said quarter and through part of its thickness and surrounds said through slot.

3. The device according to claims 1 and 2, **characterized in that** said first toothed region protrudes from the bottom of said receptacle.

4. The device according to one or more of the preceding claims, **characterized in that** said first toothed region has a profile that is constituted by a plurality of first teeth, which are arranged transversely with respect to a major axis of said slot with a predefined pitch.

5. The device according to one or more of the preceding claims, **characterized in that** said stud is essentially T-shaped and comprises an actuation head below which there is a coupling body whose shape matches the shape of said receptacle but is smaller at the major axis.

6. The device according to claims 1 and 5, **characterized in that** said second toothed region is formed on said coupling body on the opposite side with respect to said actuation head.

7. The device according to one or more of the preceding claims, **characterized in that** said second toothed region has a profile that is constituted by a plurality of second teeth, which are shaped complementary with respect to said first teeth, are arranged with the same said pitch and can mesh selectively with said first teeth in a plurality of positions along a direction that coincides with said axis of said through slot and of said receptacle.

8. The device according to one or more of the preceding claims, **characterized in that** said stud comprises an essentially cylindrical lug, which protrudes at said second toothed region on the opposite side with respect to said actuation head and has a diameter that is slightly smaller than the width of said slot and can be arranged so that it can slide within said

through slot.

9. The device according to one or more of the preceding claims, **characterized in that** a cavity is formed in said actuation head, on the opposite side with respect to said first toothed region and through part of its thickness, is open in an upward region and forms in a downward region a a preferably flat abutment surface.

10. The device according to one or more of the preceding claims, **characterized in that** a first through hole is formed in said stud and has an axis that coincides with the axis of said lug.

11. The device according to one or more of the preceding claims, **characterized in that** said actuation head has a circular cross-section.

12. The device according to one or more of the preceding claims, **characterized in that** said pivot, which can be inserted in said first hole, is provided, at a first end, with a head that is shaped complementarily with respect to said abutment surface so as to abut against it.

13. The device according to one or more of the preceding claims, **characterized in that** said pivot comprises a stem whose diameter is slightly smaller than that of said first hole, so as to allow a relative rotation between said pivot and said stud.

14. The device according to one or more of the preceding claims, **characterized in that** a second through hole is formed in the lateral surface of said shell.

15. The device according to one or more of the preceding claims, **characterized in that** it comprises a locking member, which can be accommodated inside said second through hole and can be connected to a second end of said pivot that lies opposite with respect to said first end.

16. The device according to one or more of the preceding claims, **characterized in that** said pivot can move axially with respect to said locking member, so that it can pass from a first position, also termed closure position, in which said pivot retains, by virtue of said head, said stud against said quarter, to a second position, also termed adjustment position, in which said head is spaced from said stud, allowing it to disconnect from said quarter, so that said first and second toothed regions also are disengaged and said coupling body is extracted from said receptacle, and vice versa.

17. The device according to claims 1 and 16, **characterized in that** a thread is formed on said pivot proximate to said second end and is suitable to engage a corresponding thread provided on said locking member.

18. The device according to claims 1 and 17, **characterized in that** said locking member is constituted by a nut.

19. The device according to one or more of the preceding claims, **characterized in that** the distance between the axis of said first hole and any one of the apexes or bases of said second teeth is equal to one quarter of the pitch of said first and second teeth.

20. The device according to one or more of the preceding claims, **characterized in that** a first series of notches and a second series of notches are provided on the outer lateral surface of said quarter and proximate to said receptacle and cooperate with a position indicator that is provided on the upper surface of said actuation head of said stud, so as to indicate the correct position that said stud must assume to achieve a given adjustment of the canting angle of the sports shoe.

21. The device according to one or more of the preceding claims, **characterized in that** said notches that belong to each one of said first and second series are mutually spaced, along the direction of motion of said stud with respect to said quarter, by a distance equal to said pitch of said first teeth and of said second teeth, said two series being mutually offset, in the same direction, by a distance equal to half of said pitch.

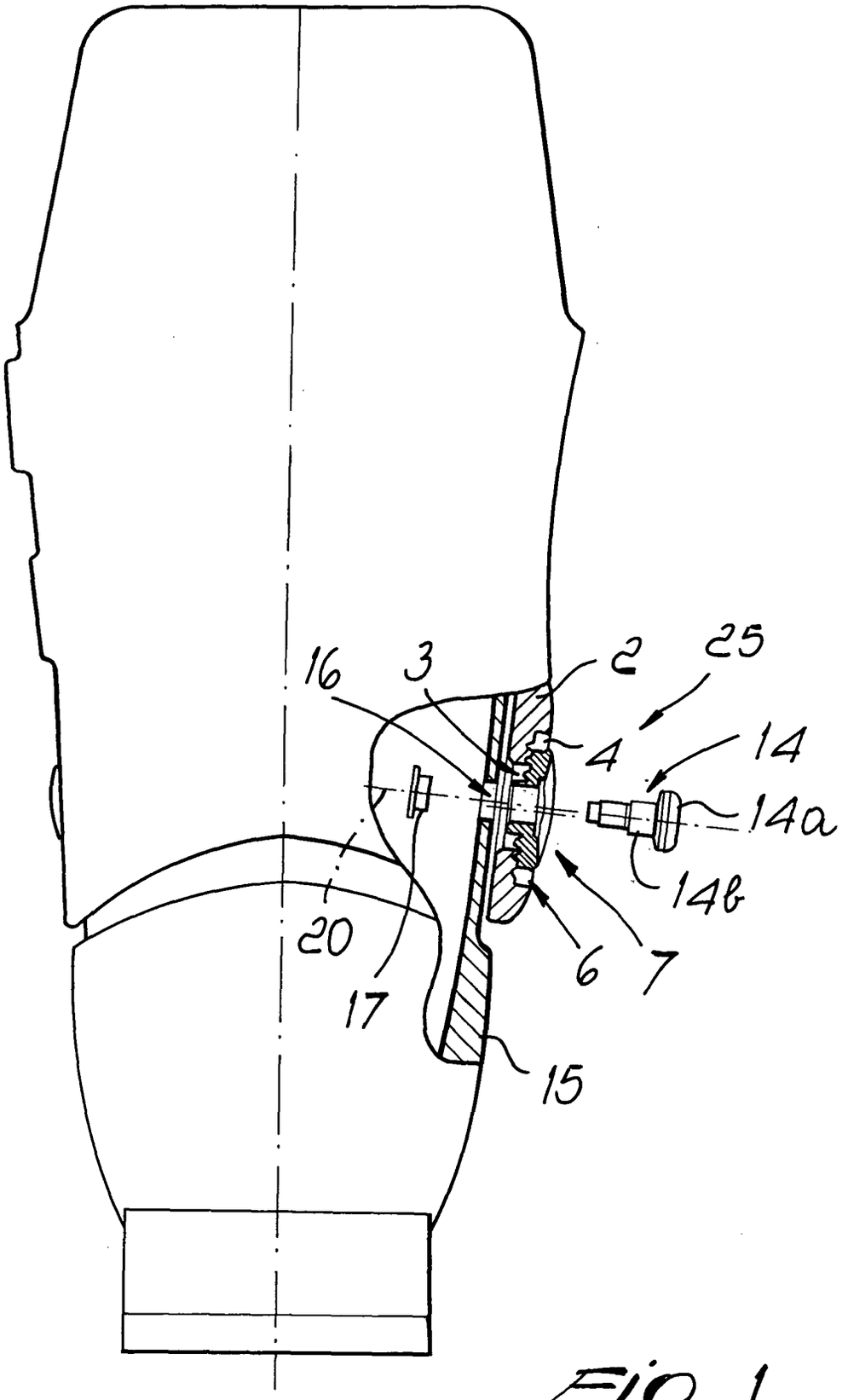

Fig. 1

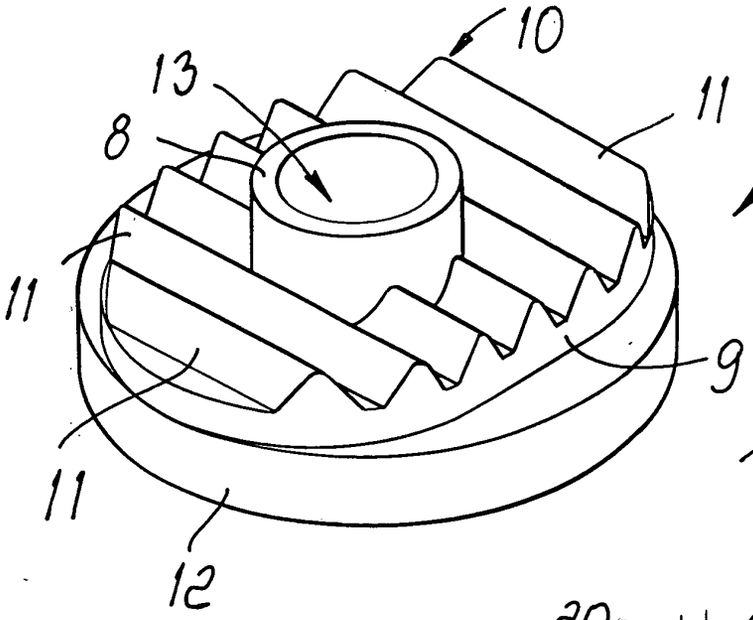

FIG. 4

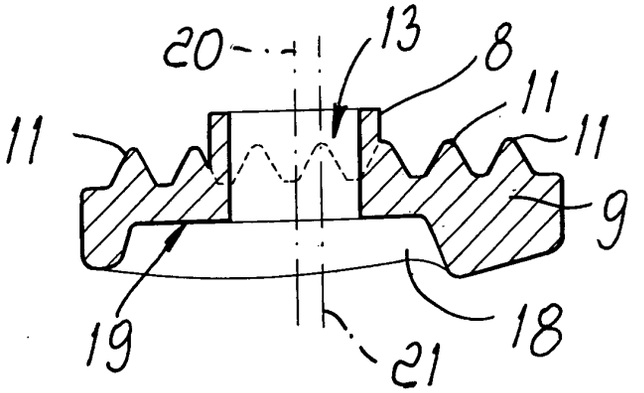

FIG. 3

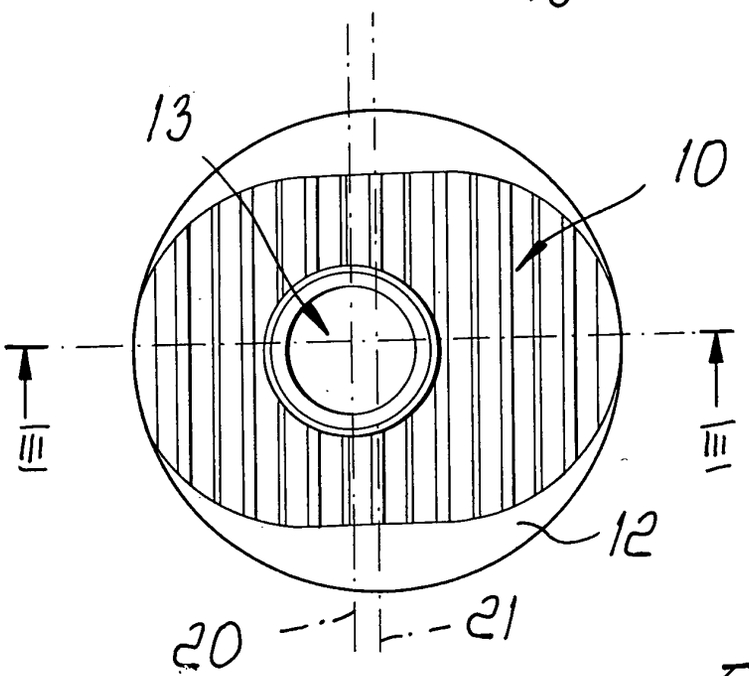

FIG. 2

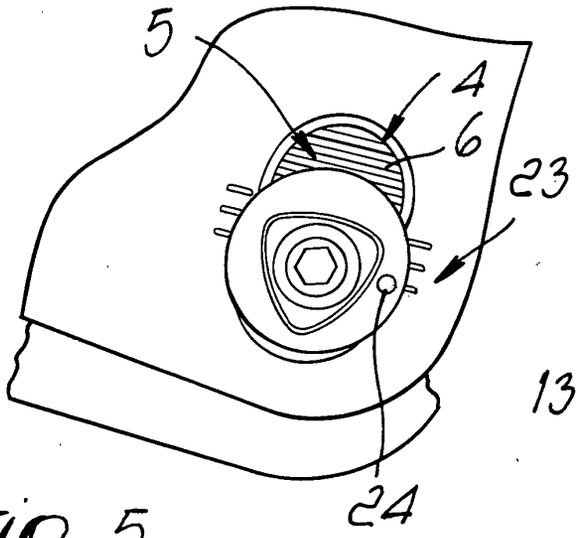

FIG. 5

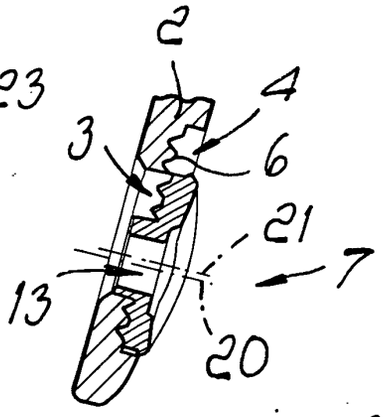

FIG. 6

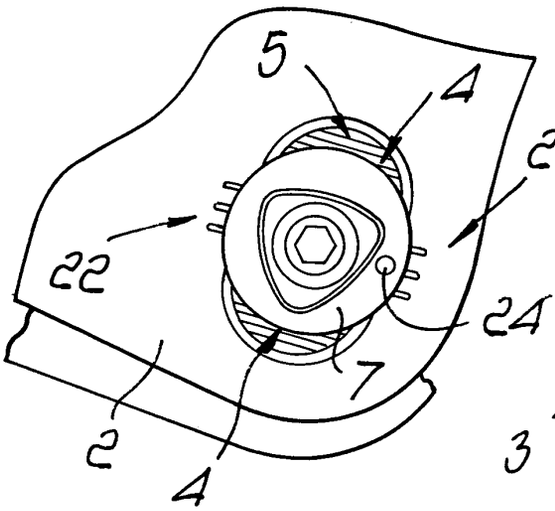

FIG. 7

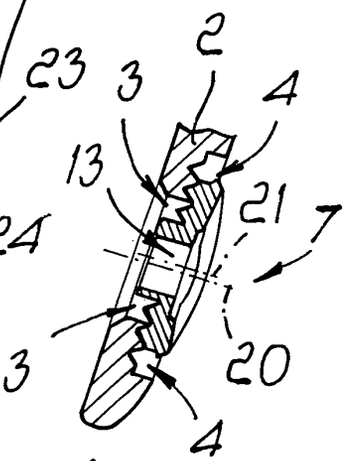

FIG. 8

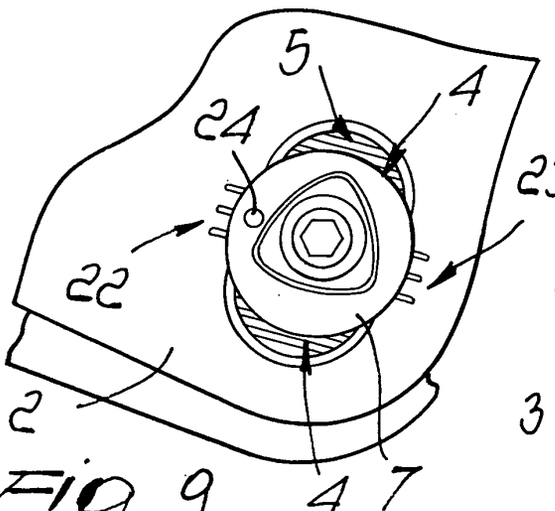

FIG. 9

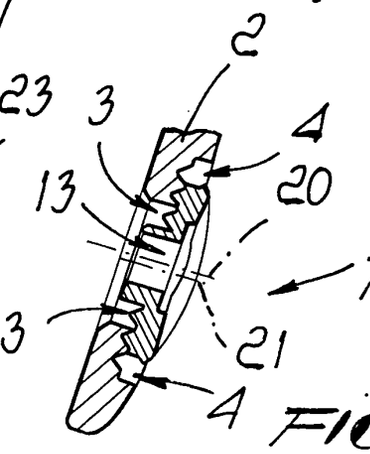

FIG. 10

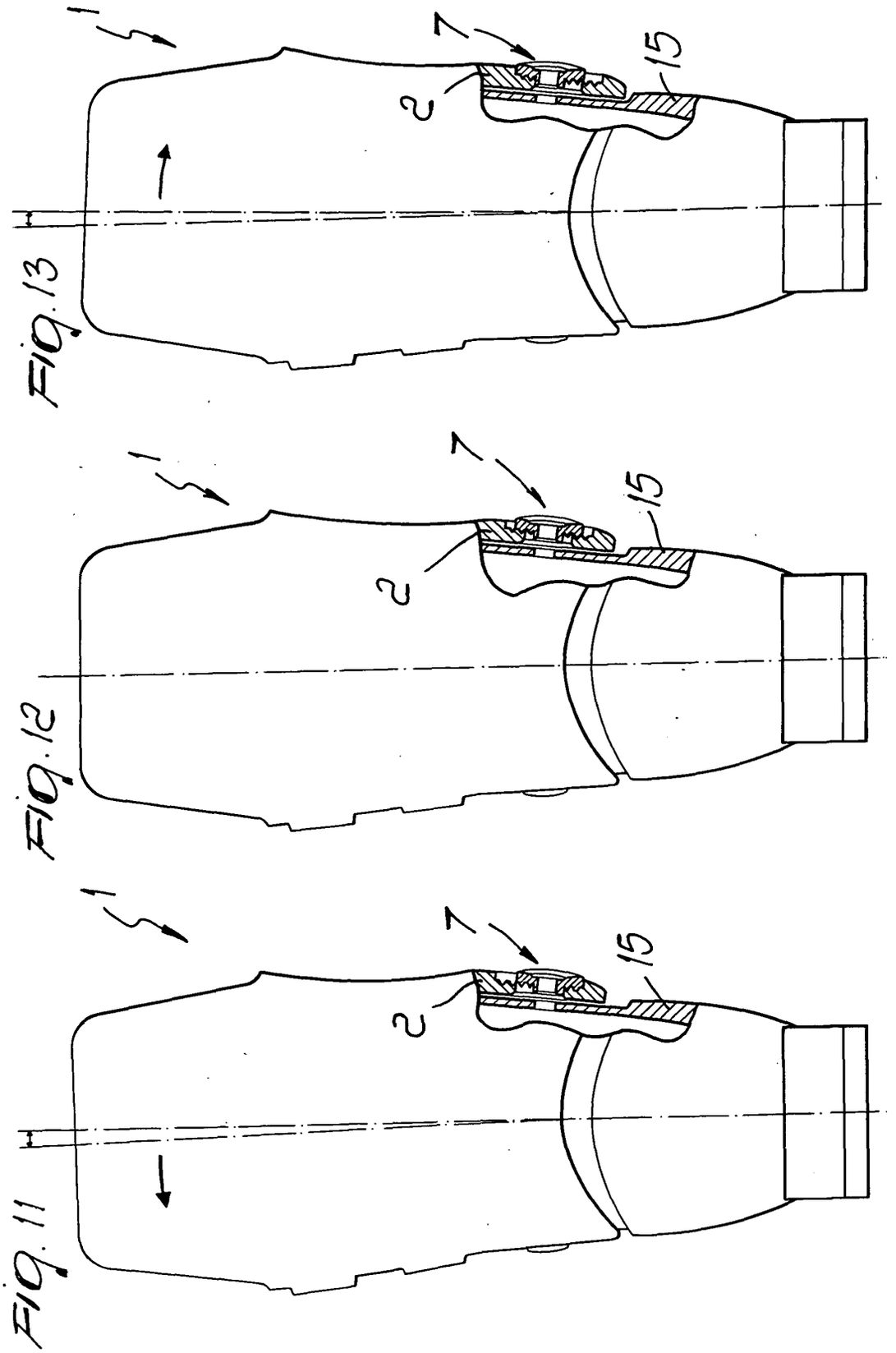

Fig. 13

Fig. 12

Fig. 11

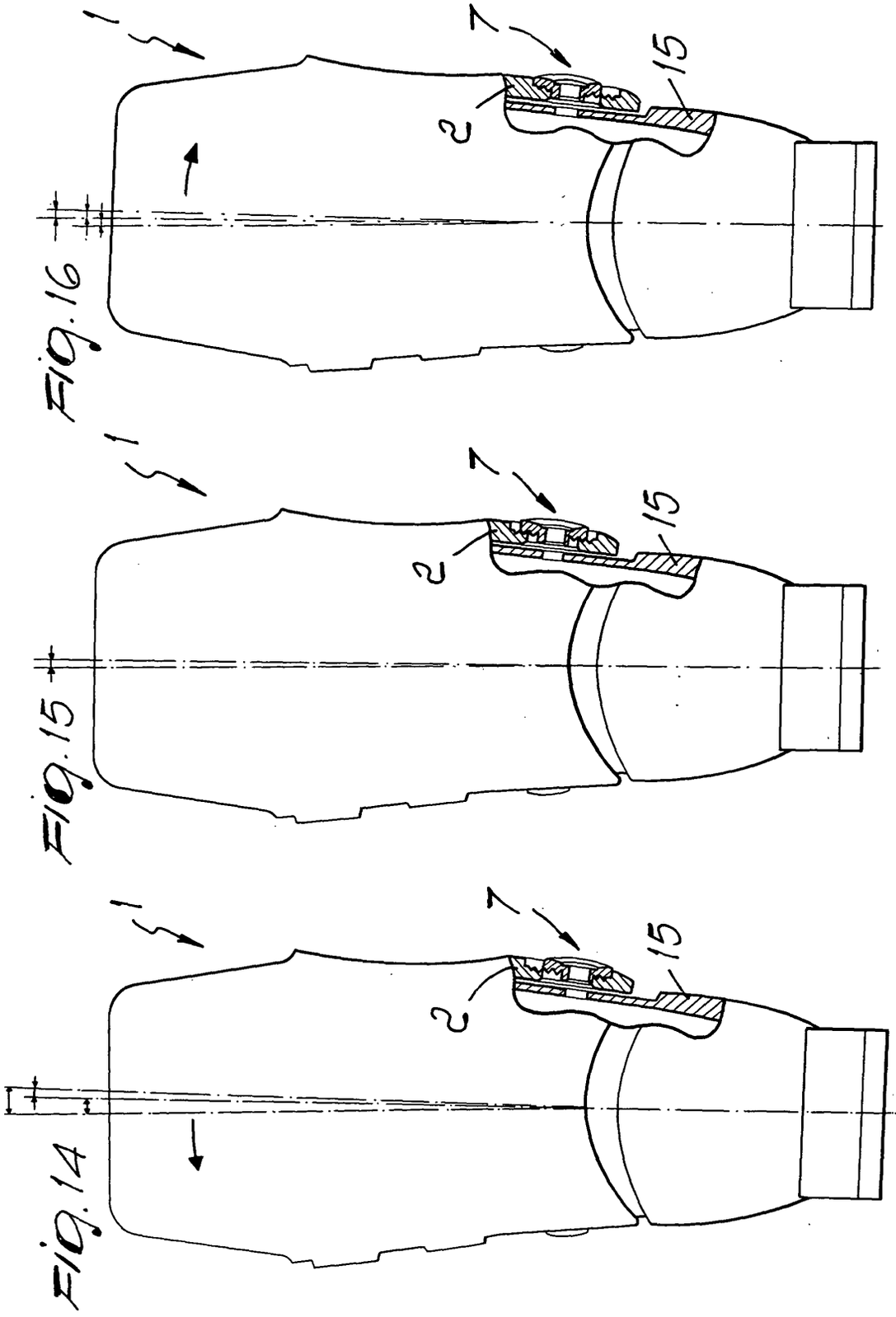

Fig. 16

Fig. 15

Fig. 14

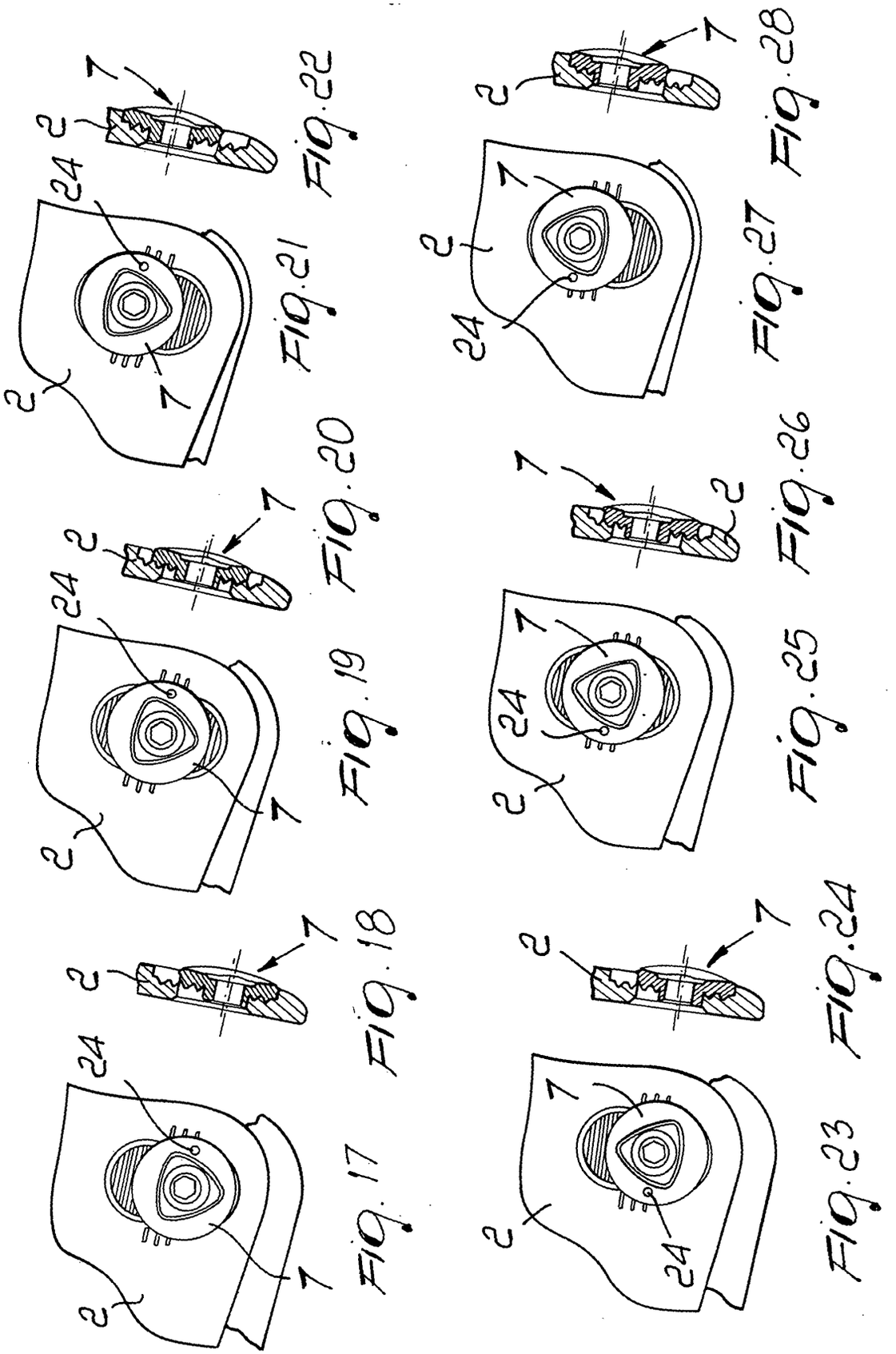

Fig.17 Fig.18 Fig.19 Fig.20 Fig.21 Fig.22

Fig.23 Fig.24 Fig.25 Fig.26 Fig.27 Fig.28

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Application Number
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Place of search	Date of completion of the search	Examiner
The Hague	13 January 2005	Schölvinck, T.S.

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