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(54) **BICYCLE SHIFT DEVICE HAVING A LINEARLY SLIDING SHIFT LEVER OPERATED BY A PIVOTING COVER**

(75) Inventor: **Satoshi Shahana**, Osaka (JP)

(73) Assignee: **Shimano, Inc.**, Sakai-ku, Sakai (JP)

(*) Notice: This patent is subject to a terminal disclaimer.

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F16C 1/10 (2006.01)

(52) **U.S. Cl.** **74/502.2**; 74/502

(58) **Field of Classification Search** 74/473.14, 74/489, 501.6, 502, 502.2; *B62M 25/04*
See application file for complete search history.

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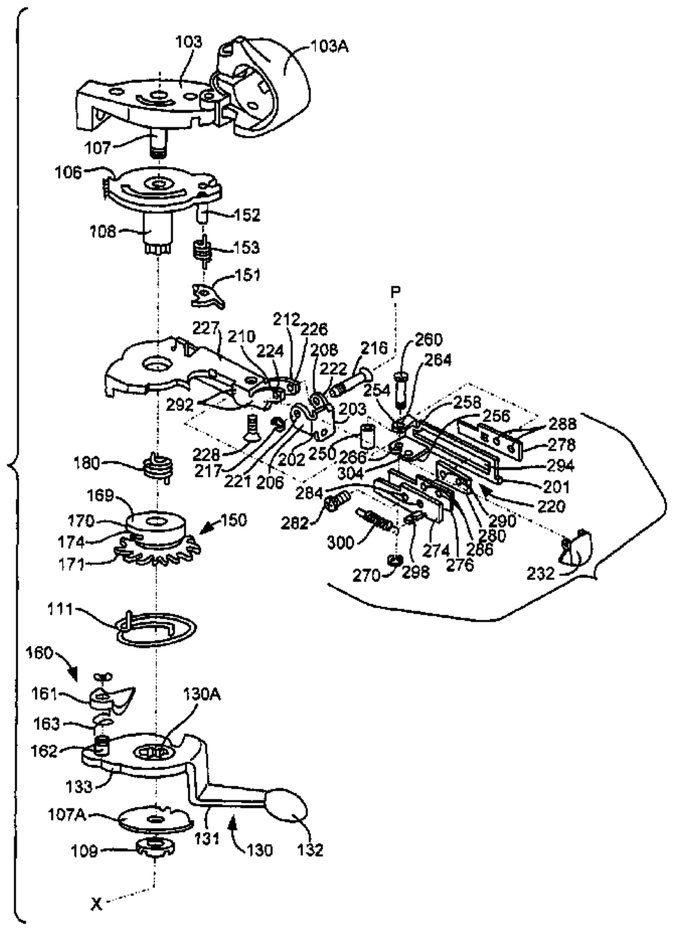
Primary Examiner — Vinh Luong

(74) *Attorney, Agent, or Firm* — James A. Deland

(57) **ABSTRACT**

A bicycle shift control device is provided which operates a shifting mechanism via a shift control cable, wherein the shift control device includes a control body rotatable about an axis for controlling the shift control cable, an operating body having an abutment in a position spaced apart from the control body and which is coupled to the shift control device for displacement between a home position and a shift position, a transmission including a plurality of ratchet teeth which converts the displacement of the operating body from the home position to the shift position into a rotational displacement of the control body, and an interface member movably mounted relative to the operating body. The interface member has an operating force receiving surface and an operating force applying surface, wherein the operating force receiving surface is adapted to receive an operating force from the rider, and wherein the operating surface applying surface applies the operating force to the abutment of the operating body for moving the operating body from the home position to the shift position.

19 Claims, 4 Drawing Sheets



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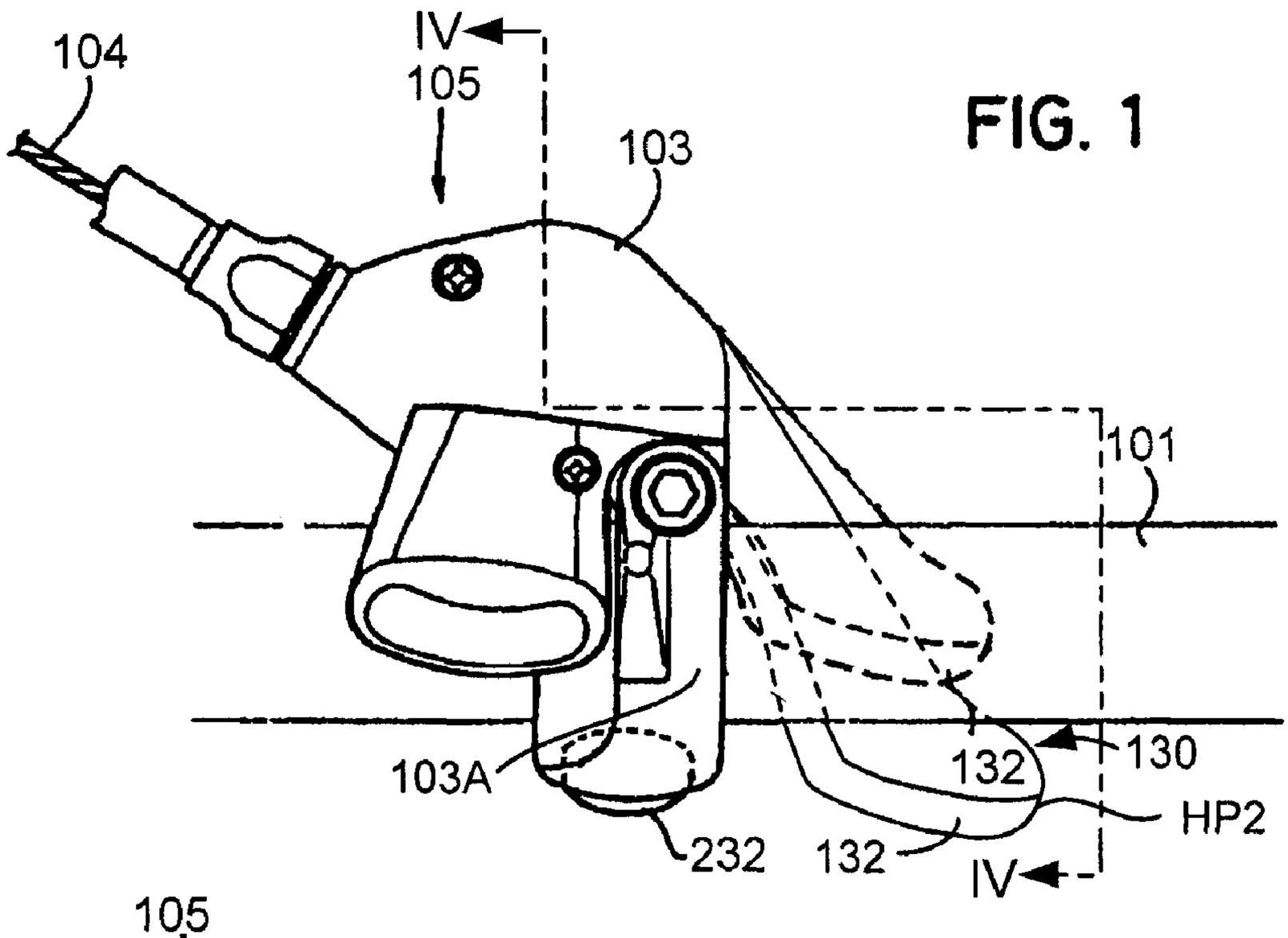
104
IV
105
103
101
103A
232
132
130
HP2
132
IV

FIG. 1

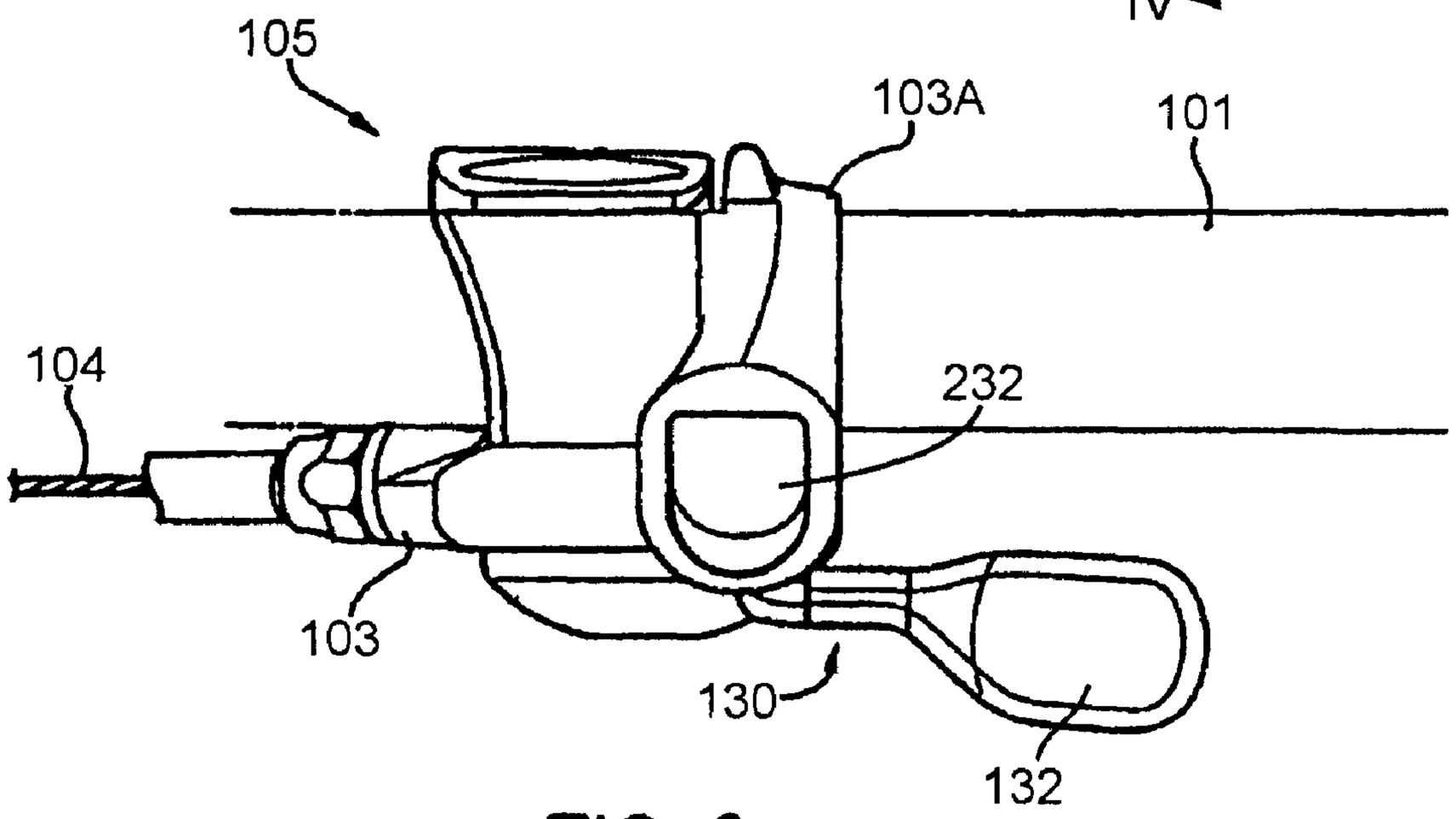
105
103A
101
104
232
103
130
132

FIG. 2

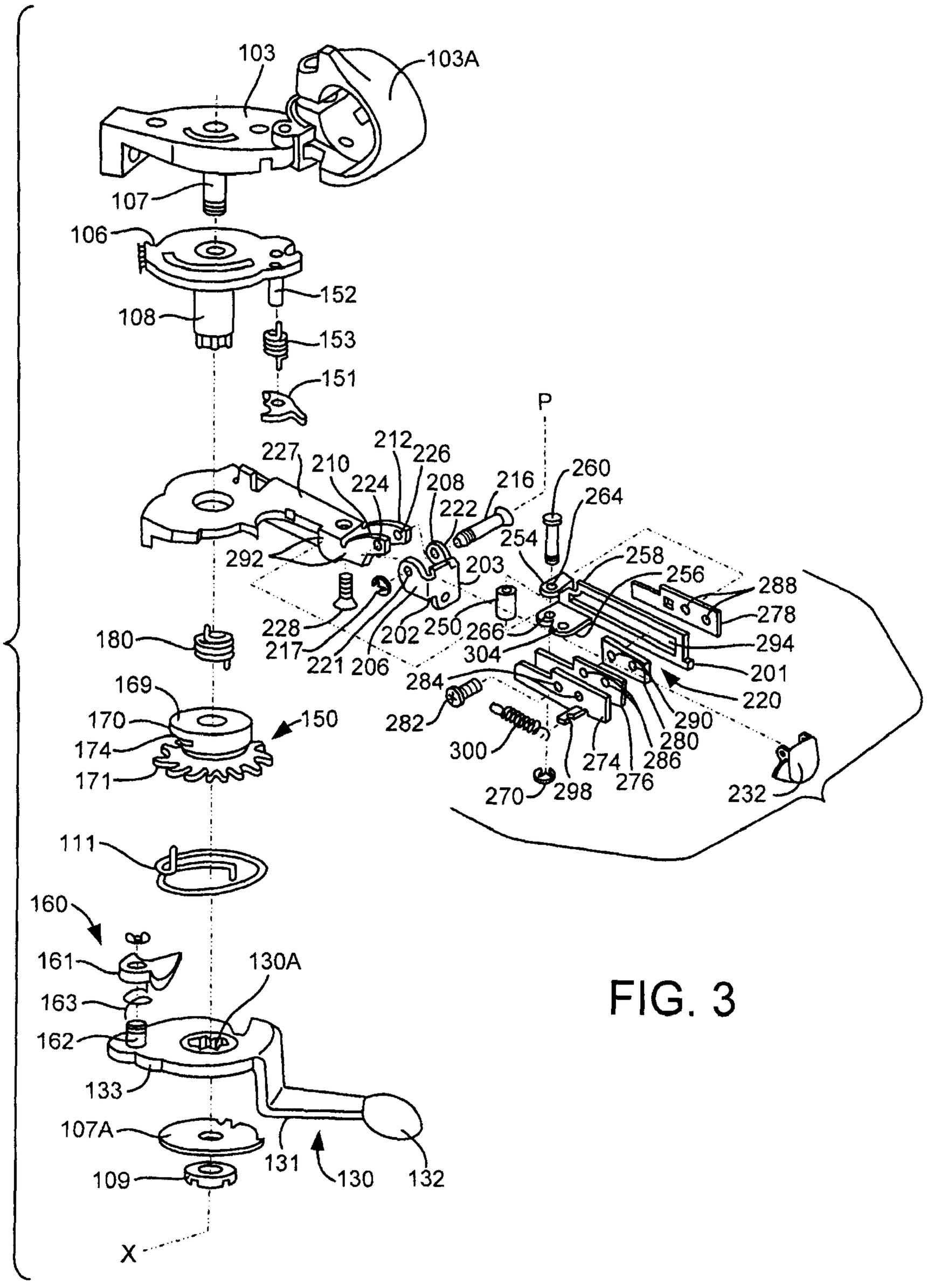
103
103A
107
106
152
108
153
151
P
212
227
210
226
224
208
216
260
264
222
254
292
203
258
256
288
278
228
217
221
206
202
250
266
304
294
201
180
284
220
169
170
150
282
290
280
174
300
274
286
171
270
298
276
232
111
160
161
130A
163
162
133
107A
131
130
132
109
X

FIG. 3

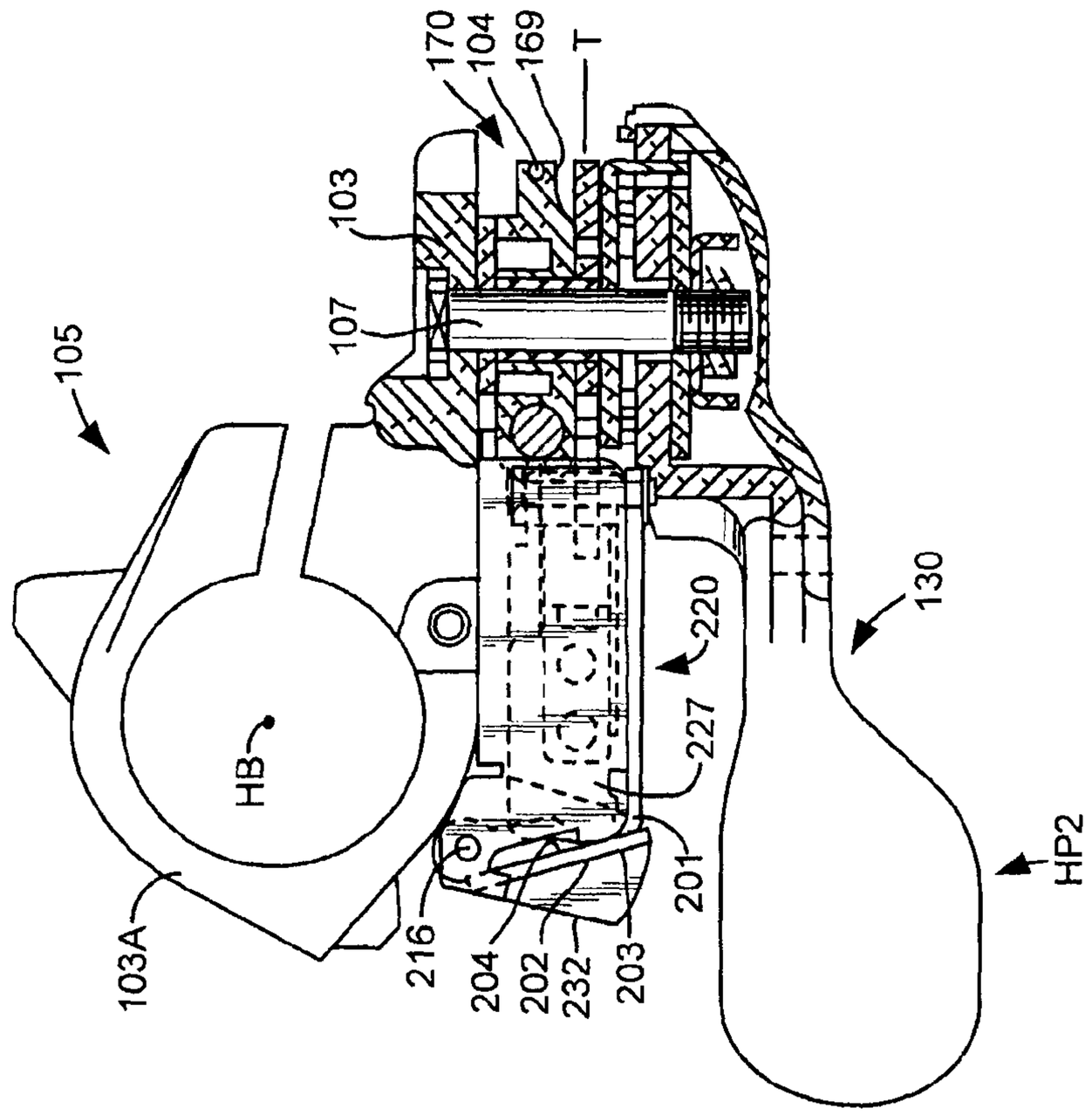
170
104
169
T
103
107
105
130
220
HB
227
HP2
201
103A
216
204
202
232
203

FIG. 5

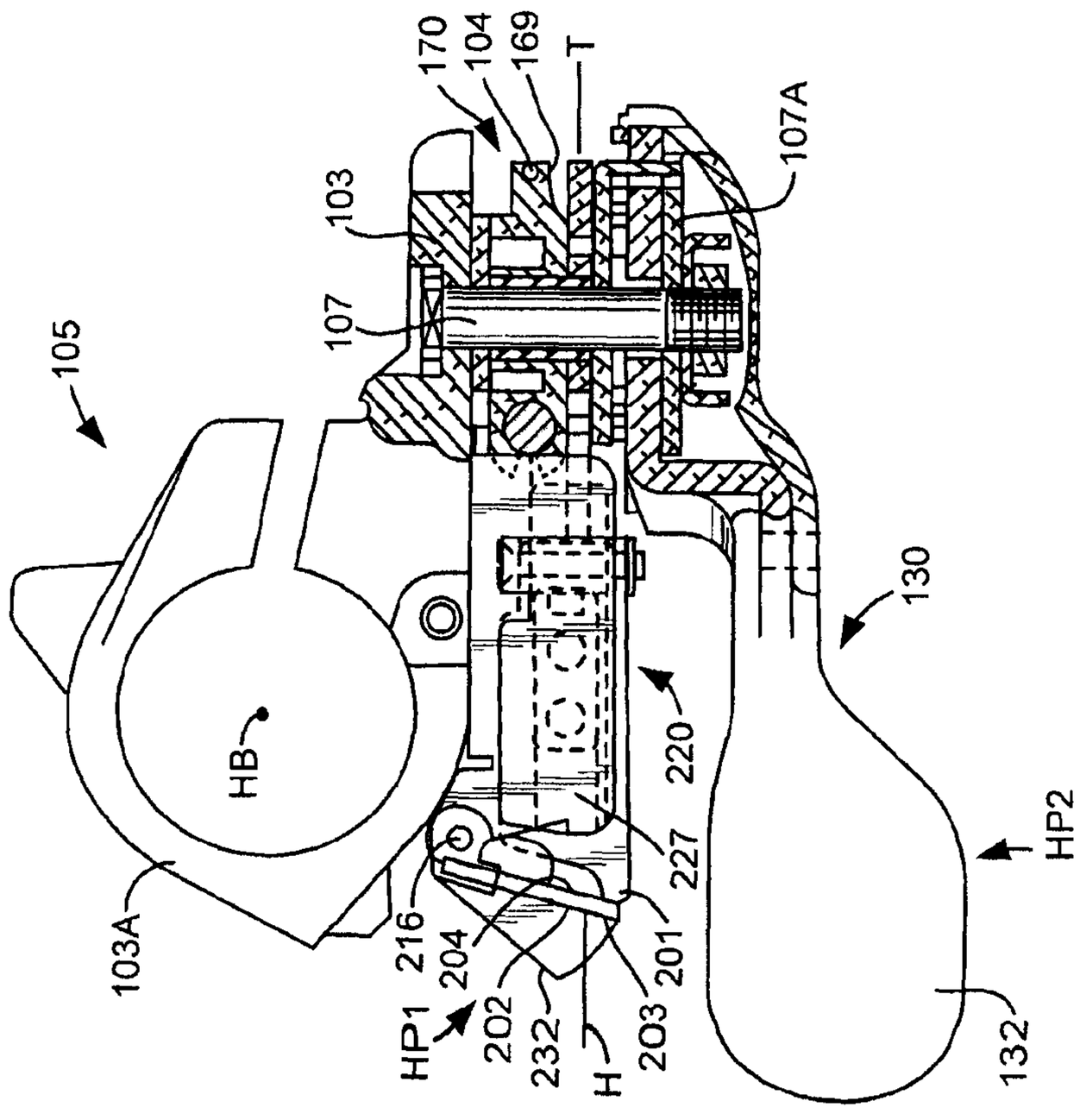
170
104
169
T
107A
103
107
105
130
HB
220
227
HP2
103A
216
204
201
HP1
202
232
H
203
132

FIG. 4

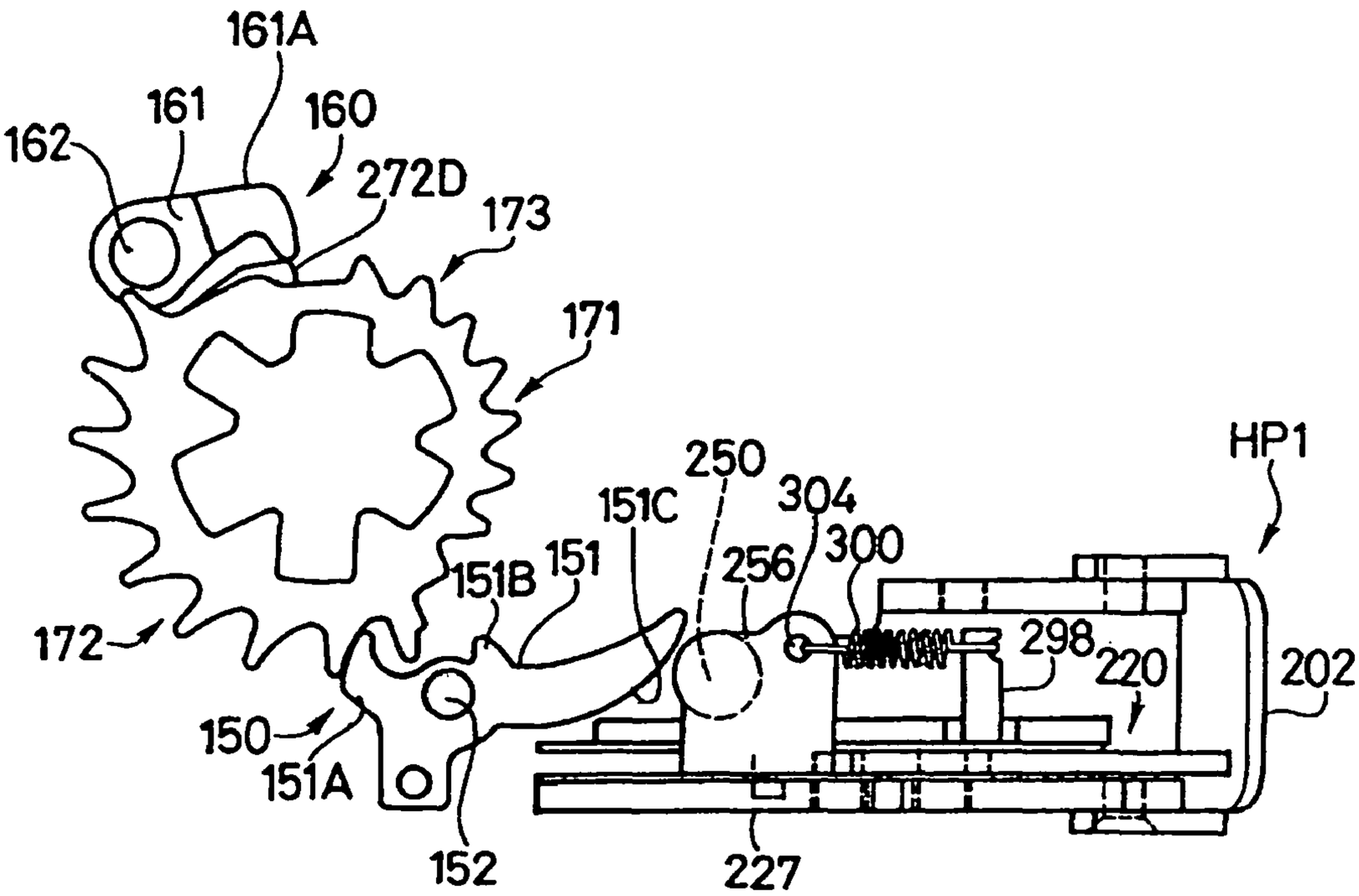
161A
161
160
162
272D
173
171
HP1
250
304
151C
151
151B
256
300
172
298
220
202
150
151A
152
227

FIG. 6

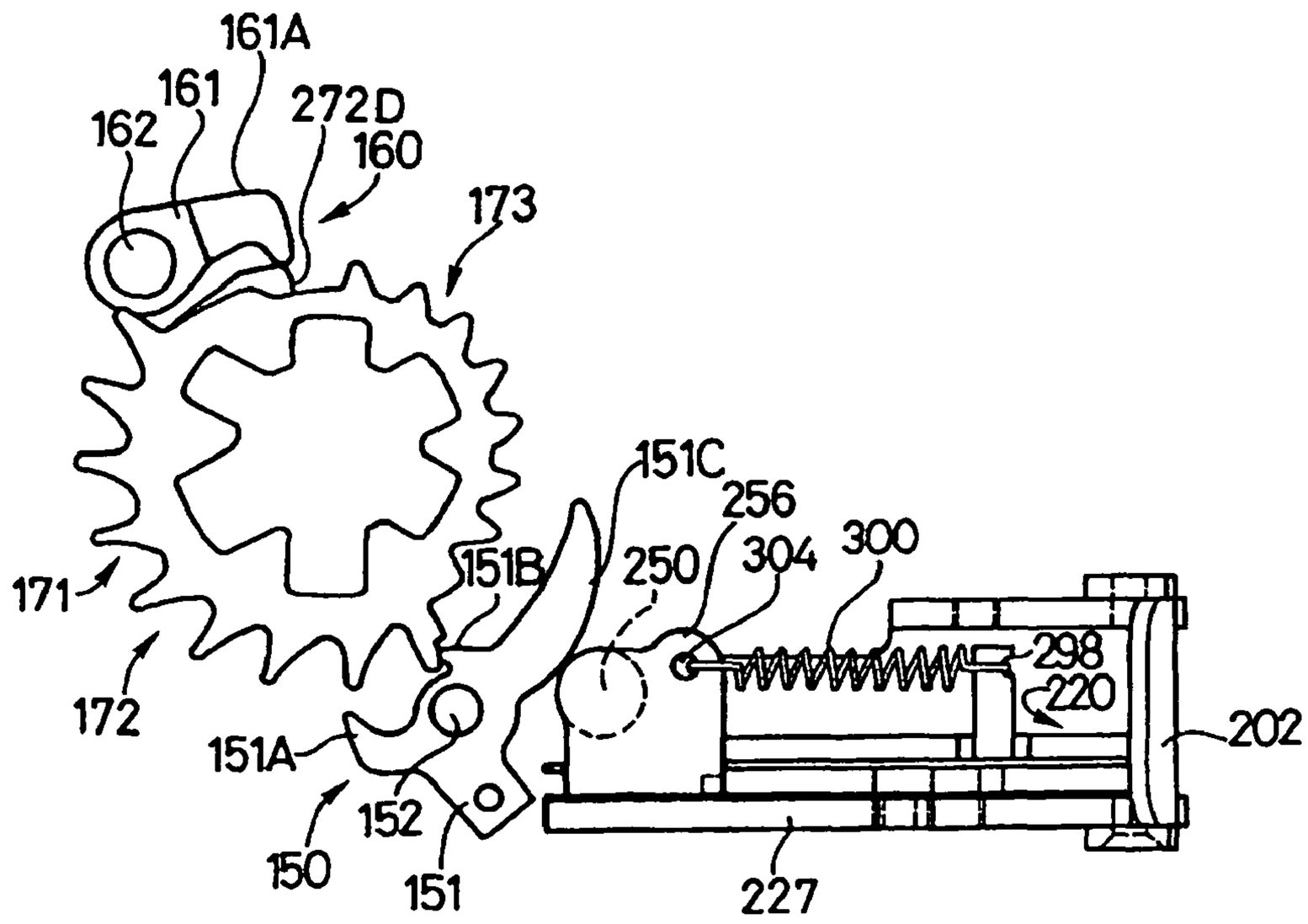
161A
161
162
272D
160
173
151C
256
250
304
300
171
151B
298
220
202
172
151A
152
150
151
227

FIG. 7

BICYCLE SHIFT DEVICE HAVING A LINEARLY SLIDING SHIFT LEVER OPERATED BY A PIVOTING COVER

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

BACKGROUND OF THE INVENTION

The present invention is directed to a bicycle shift control device which operates a shifting mechanism via a shift control cable, and specifically concerns a device in which a take-up body that takes up the shift control cable is caused to rotate in the take-up direction by means of a first shift lever which freely returns to a home position, and is caused to rotate in the pay-out direction by means of a second shift lever which freely returns to a separate home position.

A bicycle shift control device of the type noted above for operating a shifting mechanism via a shift control cable is disclosed in U.S. Pat. No. 5,921,138. The shift control device includes a control body for mounting to a bicycle in close proximity to a handlebar for controlling a pulling and releasing of the shift control cable. A first lever is mounted to the control body for movement which causes the control body to effect pulling of the shift control cable, and a second lever is mounted to the control body for movement which causes the control body to effect releasing of the shift control cable. One lever is pivotally coupled to the control body, and the other lever is coupled for linear movement relative to the control body. The lever structured for linear movement is coupled to a transmission mechanism for operating the control body in such a way that very little linear movement is needed to operate the control body. The transmission mechanism includes a plurality of ratchet teeth disposed in a common plane, wherein the path of movement of the linear operating body is parallel to the plane of the ratchet teeth.

Since the linearly moving lever moves in a direction perpendicular to the handlebar, for optimum operation the rider must position his or her thumb directly in front of the linearly operating lever and press the lever in the direction perpendicular to the handlebar. However, during competitive riding the rider usually does not want to worry about having to precisely position the thumb to operate the shifting device. Thus, it is desirable to have a shift control device of the kind noted above wherein the rider does not have to precisely position the thumb in front of the linearly operating lever for optimum operation.

SUMMARY OF THE INVENTION

The present invention is directed to a bicycle shift control device which allows the shifting operation to be performed without requiring precision placement of the rider's hand. In one embodiment of the present invention, a bicycle shift control device is provided which operates a shifting mechanism via a shift control cable, wherein the shift control device includes a control body rotatable about an axis for controlling the shift control cable, an operating body having an abutment in a position spaced apart from the control body and which is coupled to the shift control device for displacement between a home position and a shift position, a transmission including a plurality of ratchet teeth which converts the displacement of the operating body from the home position to the shift position into a rotational displacement of the control body, and an

interface member movably mounted relative to the operating body. The interface member has an operating force receiving surface and an operating force applying surface, wherein the operating force receiving surface is adapted to receive an operating force from the rider, and wherein the operating surface applying surface applies the operating force to the abutment of the operating body for moving the operating body from the home position to the shift position.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a top view of a particular embodiment of a shift control device according to the present invention attached to a handlebar;

FIG. **2** is a front view of the shift control device;

FIG. **3** is an exploded view of the shift control device;

FIG. **4** is a *partial* cross sectional view of the shift control device*, taken along line IV-IV in FIG. 1,* in an inoperative state*, wherein the hatching shown in FIG. 4, resulting from the use of a short line symbol superimposed perpendicular on each parallel oblique stroke, represents no specific material*;

FIG. **5** is a *partial* cross sectional view of the shift control device*, as shown in FIG. 4,* showing the linearly operating body in an operating position*, wherein the hatching shown in FIG. 5, resulting from the use of a short line symbol superimposed perpendicular on each parallel oblique stroke, represents no specific material*;

FIG. **6** is a detailed bottom view of the linearly operating body in a home position; and

FIG. **7** is a detailed bottom view of the linearly operating body in an operating position.

DETAILED DESCRIPTION OF THE EMBODIMENTS

FIGS. **1-7** are various views of a particular embodiment of a shift control device **105** according to the present invention. As shown in those Figures, shift control device **105** is constructed for pulling and releasing a shift control cable **104**, and it includes a mounting bracket **103** with an annular mounting sleeve **103**A defining a handlebar mounting axis (HB), wherein mounting sleeve **103**A fits around a handlebar **101** to fasten bracket **103** to handlebar **101** in a known manner. An arm-shaped linearly sliding operating body **220** (FIGS. **4-7**) of shift control device **105** is slidingly mounted to an intermediate bracket **227** attached to mounting bracket **103** through a screw **228**. Sliding operating body **220** is located below handlebar **101** and terminates at an end **201** forming an abutment. An interface member in the form of an operating tab **202** with an operating force receiving surface **203**, an operating force applying surface **204** and parallel spaced mounting ears **206** and **208** is pivotably coupled to corresponding parallel spaced mounting ears **210** and **212** on intermediate bracket **227** through a pivot shaft **216** and a C-clip **217**, wherein pivot shaft **216** extends through openings **221**, **222**, **224** and **226** in mounting ears **206**, **208**, **210** and **212**, respectively. A decorative cap **232** (FIGS. **1** and **2**) having the same general structure as operating tab **202** also may be pivotably mounted to mounting ears **210** and **212** on intermediate bracket **227** or may be otherwise placed over operating tab **202** in order to vary the shape or inclination of the surface that is operated by the thumb.

A pivoting operating body **130** of the shift control device **105** also extends below the handlebar **101**. A finger contacting part **132** of operating body **130**, in the form of a button, is disposed beneath and to the right of operating tab **202**. As a

result, operation of both operating bodies is possible with the thumb of the hand gripping the handlebar **101**.

As is shown in FIG. **3**, shift control device **105** includes a pawl support plate **106** with a supporting shaft **108** and a pivot pin **152**, all of which are rigidly fastened to bracket **103** by means of an attachment bolt **107**, a washer **107**a and a nut **109**. A control body in the form of a take-up body **170** is mounted around supporting shaft **108** for rotation around an axis (X). A first ratchet mechanism **150**, used as a first transmission means, transmits the displacement of sliding operating body **220** to the take-up body **170** to cause the rotation of the take-up body **170** in one direction, and a second ratchet mechanism **160**, used as a second transmission means, transmits the displacement of pivoting operating body **130** to the take-up body **170** to cause the rotation of the take-up body **170** in the other direction. In this embodiment, displacement of pivoting operating body **130** causes the take-up body **170** to pull on cable **104**, and displacement of sliding operating body **220** causes the. take-up body **170** to release cable **104**.

The take-up body **170** is equipped with a drum part **169** which is constructed so that the shift control cable **104** from a shifting mechanism (not shown) on the front or rear of the bicycle is taken up along a wire groove **174**. By rotating in the forward direction or reverse direction with respect to the supporting shaft **108**, the take-up body **170** takes up or pays out the shift control cable **104**. Take-up body **170** is coupled to a drive plate **171** for integral rotation therewith. As shown in FIGS. **6** and **7**, drive plate **171** includes a plurality of drive teeth **173** and a plurality of position retaining teeth **172**, all of which are disposed in a common plane T, as illustrated in FIGS. **4** and **5**.

Sliding operating body **220** includes a pawl pushing roller **250** rotatably mounted between roller support ears **254** and **256** disposed at a pawl operating end **258** of sliding operating body **220** through a pivot shaft **260** and a C-clip **270**, wherein pivot shaft **260** extends through openings **264** and **266** in mounting ears **254** and **256**, respectively. Sliding operating body **220** is slidingly mounted to intermediate bracket **227** between a release plate **274**, slide shims **276** and **278**, and a release plate bushing **280**, all of which are mounted to intermediate bracket **227** through bolts **282** (only one such bolt is shown in FIG. **3**) that extend through openings **284**, **286**, **288** and **290** in release plate **274**, slide shims **276** and **278** and release plate bushing **280**, respectively, and through two pairs of opposed openings **292** (only two such openings are shown in FIG. **3**) in intermediate bracket **227**. Sliding operating body **220** also includes an elongated opening **294** for accommodating bolts **282** so that bolts **282** do not interfere with the sliding operation of sliding operating body **220**.

Release plate **274** includes a spring coupling abutment **298**. One end of a return spring **300** is attached to spring coupling abutment **298**, and the other end of return spring **300** is attached to mounting ear **256** in sliding operating body **220** through an opening **304**. Return spring **300** biases sliding operating body **220** toward a home position HP**1** shown in FIGS. **4** and **6**.

The first ratchet mechanism **150** comprises a first pawl **151** that is rotatably attached to pivot pin **152** extending from pawl support plate **106**, the plurality of position retaining teeth **172** which are formed on the outer circumferential surface of the drive plate **171**, and a spring **153** which drives the first pawl **151** clockwise (in FIGS. **6** and **7**) in the direction of engagement with position retaining teeth **172**. First pawl **151** includes pawl tips **151**A and **151**B for engaging position retaining teeth **172** and a pawl operating part **151**C for engaging pawl pushing roller **250** on sliding operating member **220**. The operation of first ratchet mechanism **150** is the same as in the shift control device disclosed in U.S. Pat. No. 5,921,138, incorporated herein by reference, so a detailed description of its operation shall be omitted. The path of motion of sliding operating body **220** is substantially parallel to the ratchet teeth plane T.

The pivoting operating body **130** is equipped with a second arm part **131**, the second finger contact part **132** which is formed on the tip of the second arm part **131** in order to allow finger operation, and a pawl supporting part **133**. A spring **111** is connected between washer **107**A and pawl supporting part **133** for biasing pivoting operating body **130**, and hence finger contacting part **132**, to the home position HP**2** shown in FIG. **4**. The path of motion of pivoting operating body **130** is substantially parallel to the ratchet teeth plane T.

The second ratchet mechanism **160** comprises a second pawl **161** that is rotatably attached to a pivot pin **162** extending from pawl supporting part **133**, the plurality of drive teeth **173** formed on the outer circumferential surface of the drive plate **171**, and a spring **163** which biases the second pawl **161** clockwise (in FIGS. **6** and **7**) in the direction of engagement with drive teeth **173**. When pivoting operating body **130** is in the home position HP**2** shown in FIGS. **4** and **5**, a tip **161**A of pawl **161** rests on a ledge **272**D of intermediate bracket **227**, thus uncoupling pawl **161** from drive plate **172**. The operation of second ratchet mechanism **160** also is the same as the shift control device disclosed in U.S. Pat. No. 5,921,138, so a detailed description of its operation shall be omitted.

Because sliding operating body **220** operates pawl **151** by pressing pawl pressing roller **250** against pawl operating part **151** C, very little movement (e.g., 9 millimeters) is required to operate pawl **151**. Operating force receiving surface **203** of operating tab **202** is inclined relative to a horizontal axis H which, in this embodiment, is parallel to ratchet teeth plane T. Thus, operating tab **202** will pivot counterclockwise as shown in FIGS. **4** and **5** even if the rider's thumb applies a vertically downward force. As a result of the small movement required to operate pawl **151** and the inclined nature of operating tab **202**, operating tab **202** may operate sliding operating body **220** without requiring the rider to press perpendicular to the handlebar and without precision placement of the rider's thumb. Indeed, sliding operating body **220** could be operated even by a downward sliding motion of the thumb across the front face of shift control device **105**.

While the above is a description of various embodiments of the present invention, further modifications may be employed without departing from the spirit and scope of the present invention. For example, operating body **220** may cause take-up body **170** to rotate in the cable pay out direction, and operating body **130** may cause take-up body **170** to rotate in the cable take-up direction. If desired, operating body **220** may be constructed for pivoting displacement, and operating body **130** may be constructed for sliding displacement with the operating tab **202** described above. Both operating bodies **220** and **130** may be sliding operating bodies, each with their own operating tab. While the path of movement of sliding operating body **220** in the above embodiment is substantially parallel to the plane of the ratchet teeth T, the path may vary, for example, by plus or minus thirty degrees.

Thus, the scope of the invention should not be limited by the specific structures disclosed. Instead, the true scope of the invention should be determined by the following claims. Of course, although labeling symbols are used in the claims in order to facilitate reference to the figures, the present invention is not intended to be limited to the constructions in the appended figures by such labeling.

What is claimed is:

1. A bicycle shift control device which operates a shifting mechanism via a shift control cable, the shift control device comprising:

a control body rotatable about an axis (X) for controlling the shift control cable;

a mounting member adapted to mount the shift control device to a handlebar, wherein the mounting member defines a handlebar mounting axis (HB);

wherein the axis (X) is oriented substantially perpendicular to the handlebar mounting axis (HB);

an operating body having an abutment in a position spaced apart from the control body and which is coupled to the shift control device for displacement between a home position and a shift position;

wherein the operating body moves linearly in a straight line between the home position and the shift position;

a transmission which converts the displacement of the operating body from the home position to the shift position into a rotational displacement of the control body, wherein the transmission includes a plurality of ratchet teeth; and

an interface member movably mounted relative to the operating body and having an operating force receiving surface and an operating force applying surface, wherein the operating force receiving surface is adapted to receive an operating force from a rider, and wherein the operating force applying surface applies the operating force to the abutment of the operating body for moving the operating body from the home position to the shift position.

2. The device according to claim **1** wherein the operating force-receiving surface is inclined relative to a horizontal axis (H).

3. The device according to claim **2** wherein the plurality of ratchet teeth are disposed in a ratchet teeth plane (T), and wherein the horizontal axis (H) is parallel to the ratchet teeth plane (T).

4. The device according to claim **1** wherein the operating body is movably retained to an intermediate mounting member, and wherein the interface member is coupled to the intermediate mounting member.

5. The device according to claim **4** wherein the interface member is pivotably coupled to the intermediate mounting member.

6. The device according to claim **5** wherein the operating force receiving surface is inclined relative to a horizontal axis (H).

7. The device according to claim **6** wherein the plurality of ratchet teeth are disposed in a ratchet teeth plane (T), and wherein the horizontal axis (H) is parallel to the ratchet teeth plane (T).

8. A bicycle **[**shifter**]** *shift* control device which operates a shifting mechanism via a shift control cable, the shift control device comprising:

a control body rotatable about an axis (X) for controlling the shift control cable;

a mounting member adapted to mount the shift control device to a handlebar, wherein the mounting member defines a handlebar mounting axis (HB);

wherein the axis (X) is oriented substantially perpendicular to the handlebar mounting axis (HB);

a linear operating body which forms an abutment in a position spaced apart from the control body and which is coupled to the **[**operating**]** *shift control* device for linear displacement between a first home position and a first shift position;

an interface member movably mounted relative to the linear operating body and having a first finger contact and an operating force applying surface, wherein the operating force applying surface applies **[**the**]** *an* operating force to the abutment of the linear operating body for moving the linear operating body from the first home position to the first shift position;

a second operating body which forms a second finger contact part in a position spaced apart from the control body and which is coupled to the **[**operating**]** *shift control* device for displacement between a second home position and a second shift position;

a first transmission which converts the linear displacement of the linear operating body from the first home position to the first shift position into a rotational displacement of the control body, wherein the first transmission includes a plurality of ratchet teeth disposed in a ratchet teeth plane (T);

a second transmission which converts the displacement of the second operating body from the second home position to the second shift position into a rotational displacement of the control body; and

wherein a path of movement of the linear operating body is substantially parallel to the ratchet teeth plane (T).

9. The device according to claim **8** wherein the operating force **[**receiving**]** *applying* surface is inclined relative to a horizontal axis (H).

10. The device according to claim **9** **[**wherein the plurality of ratchet teeth are disposed in a ratchet teeth plane (T), and**]** wherein the horizontal axis (H) is parallel to the ratchet teeth plane (T).

11. The device according to claim **8** wherein the *linear* operating body is movably retained to an intermediate mounting member, and wherein the interface member is coupled to the intermediate mounting member.

12. The device according to claim **11** wherein the *linear* operating body moves linearly in a straight line between the *first* home position and the *first* shift position.

13. The device according to claim **12** wherein the interface member is pivotably coupled to the intermediate mounting member.

14. The device according to claim **13** wherein the operating force **[**receiving**]** *applying* surface is inclined-relative to a horizontal axis (H).

15. The device according to claim **14** **[**wherein the plurality of ratchet teeth are disposed in a ratchet teeth plane (T), and**]** wherein the horizontal axis (H) is parallel to the ratchet teeth plane (T).

16. A bicycle shift control device which operates a shifting mechanism via a shift control cable, the shift control device comprising:

a control body rotatable about an axis (X) for controlling the shift control cable;

an operating body having an abutment in a position spaced apart from the control body and which is coupled to the shift control device for displacement between a home position and a shift position;

wherein the operating body includes a roller for controlling the operation of the control body;

a transmission which converts the displacement of the operating body from the home position to the shift position into a rotational displacement of the control body, wherein the transmission includes a plurality of ratchet teeth; and

an interface member movably mounted relative to the operating body and having an operating force receiving surface and an operating force applying surface, wherein

the operating force receiving surface is adapted to receive an operating force from a rider, and wherein the operating force applying surface applies the operating force to the abutment of the operating body for moving the operating body from the home position to the shift position.

17. A bicycle **[**shifter**]** *shift* control device which operates a shifting mechanism via a shift control cable, the shift control device comprising:

a control body rotatable about an axis (X) for controlling the shift control cable;

a mounting member adapted to mount the shift control device to a handlebar and defining a handlebar mounting axis (HB);

wherein the axis (X) is substantially perpendicular to the handlebar mounting axis (HB);

a linear operating body which forms an abutment in a position spaced apart from the control body and which is coupled to the **[**operating**]** *shift control* device for linear displacement between a first home position and a first shift position;

wherein the linear operating body includes a roller for controlling the operation of the control body;

an interface member movably mounted relative to the linear operating body and having a first finger contact and an operating force applying surface, wherein the operating force applying surface applies **[**the**]** *an* operating force to the abutment of the linear operating body for moving the linear operating body from the first home position to the first shift position;

a second operating body which forms a second finger contact part in a position spaced apart from the control body and which is coupled to the **[**operating**]** *shift control* device for displacement between a second home position and a second shift position;

a first transmission which converts the linear displacement of the linear operating body from the first home position to the first shift position into a rotational displacement of the control body, wherein the first transmission includes a plurality of ratchet teeth disposed in a ratchet teeth plane (T);

a second transmission which converts the displacement of the second operating body from the second home position to the second shift position into a rotational displacement of the control body; and

wherein a path of movement of the linear operating body is substantially parallel to the ratchet teeth plane (T).

18. A bicycle shift control device which operates a shifting mechanism via a shift control cable, the shift control device comprising:

a control body rotatable about an axis (X) for controlling the shift control cable;

an operating body having an abutment in a position spaced apart from the control body and which is coupled to the shift control device for displacement between a home position and a shift position;

a transmission which converts the displacement of the operating body from the home position to the shift position into a rotational displacement of the control body, wherein the transmission includes a plurality of ratchet teeth; and

an interface member movably mounted relative to the operating body and having an operating force receiving surface and an operating force applying surface, wherein the operating force receiving surface is adapted to receive an operating force from a rider, and wherein the interface member pivots so that the operating force applying surface applies the operating force to the abutment of the operating body for moving the operating body from the home position to the shift position.

19. A bicycle **[**shifter**]** *shift* control device which operates a shifting mechanism via a shift control cable, the shift control device comprising:

a control body rotatable about an axis (X) for controlling the shift control cable;

a linear operating body which forms an abutment in a position spaced apart from the control body and which is coupled to the **[**operating**]** *shift control* device for linear displacement between a first home position and a first shift position;

an interface member movably mounted relative to the linear operating body and having a first finger contact and an operating force applying surface, wherein the interface member pivots so that the operating force applying surface applies **[**the**]** *an* operating force to the abutment of the linear operating body for moving the linear operating body from the first home position to the first shift position;

a second operating body which forms a second finger contact part in a position spaced apart from the control body and which is coupled to the **[**operating**]** *shift control* device for displacement between a second home position and a second shift position;

a first transmission which converts the linear displacement of the linear operating body from the first home position to the first shift position into a rotational displacement of the control body, wherein the first transmission includes a plurality of ratchet teeth disposed in a ratchet teeth plane (T);

a second transmission which converts the displacement of the second operating body from the second home position to the second shift position into a rotational displacement of the control body; and

wherein a path of movement of the linear operating body is substantially parallel to the ratchet teeth plane (T).

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