ELECTRIC CONTROL DEVICE FOR A MOTOR-DRIVEN DERAILLEUR FOR BICYCLES

The present invention relates to an electric control device for a motor-driven derailleur for bicycles.

More precisely, the invention relates to a control device of the type comprising:

- a supporting body provided with means for fixing it to a bicycle handlebar,
- a brake control lever hinged to the supporting body,
- a pair of electric switches to control gear change carried by the supporting body, and
- a gear change lever that can be operated manually to control at least one of said switches.

A control device of the type specified above is known from the U.S. Pat. No. 5,470,277 by the same Applicant, which describes an electric control device provided with two switches positioned in a supporting body fixed to the handlebar of a bicycle. A first switch is operated by a gear change lever positioned immediately behind the brake control lever and a second switch is operated by a push button positioned on a side wall of the supporting body. The two electric switches may be used to operate in opposite directions an electric motor associated with a derailleur for bicycles. Operation of the derailleur motor in a first direction shifts the chain in a first direction, for example towards higher speed gears and operation in the opposite direction shifts the chain in the opposite direction, for example towards lower speed gears.

The document U.S. Pat. No. 6,015,036 describes an electric control device for a bicycle including a gear change switch supported by the brake lever. A second gear change switch may be positioned near the brake lever. This solution is less advantageous than the one in which both switches are positioned on the supporting body, as it is necessary to take an electric connection to the brake lever which pivots in relation to the supporting body.

The object of the present invention is to provide an electric control device of an improved type which is ergonomic, of simple construction and more functional than prior art devices.

According to the present invention, this object is attained by a control device with the characteristics contained in claim 1.

The present invention shall now be described in detail with reference to the accompanying drawings, provided purely as a non-limiting example, in which:

FIGS. 1 and 2 are sectional side views of a control device according to the present invention in two operating positions,

FIGS. 3 and 4 are sections according to the line III—III in FIG. 1 in two operating positions,

FIGS. 5 and 6 respectively show a second and a third variant of the solution illustrated in FIGS. 3 and 4,

FIG. 7 shows a fourth variant of the solution according to the invention,

FIG. 8 is a detail in a larger scale of the encircled part in FIG. 7,

FIG. 9 shows the variant in FIG. 7 in the operating position,

FIG. 10 is a detail in a larger scale of the encircled part in FIG. 9,

FIG. 11 shows a fifth variant of the solution according to the invention,

FIG. 12 shows the variant in FIG. 11 in the operating position,

FIG. 13 is a section corresponding to FIG. 3 showing a variant of the solution according to FIG. 3, and

FIG. 14 is a partially sectioned plan view of a further embodiment of the present invention.

With reference to FIGS. from 1 to 4, number 10 indicates an electric control device for a motor-driven derailleur for bicycles. The control device according to the present invention may be used to control a motor-driven gear change, for example of the type described in the U.S. Pat. No. 5,470,277 by the same Applicant.

The control device 10 comprises a supporting body 12 provided with means of conventional type for fixing it to a bicycle handlebar 14. The control device 10 comprises a brake control lever 16 hinged to the supporting body 12 by means of a pivot pin 18. One end 20 of a brake control cable 22 is fixed in a conventional manner to a top portion of the brake control lever 16. As can be seen in FIGS. 1 and 2, the brake control lever 16 may be made to pivot manually around the pivot pin 18 to control the brake of the bicycle, in an entirely conventional manner.

The supporting body 12 carries a pair of electric switches to control gear change, indicated with 24 and 26 in FIGS. 3 and 4. In accordance with a first embodiment of the invention, these switches are positioned on opposite faces of a supporting plate 28 fixed to the supporting body 12. The switches 24, 26 are microswitches per se known, including a body fixed to the supporting plate 28 and a mobile operating push button. The operating push buttons of the switches are covered by respective deformable membranes. In the Figures, the real switches are not visible and therefore the reference numbers 24, 26 used to distinguish the switches in fact indicate the deformable membranes of the switches. In the example of embodiment shown in the Figures, the supporting plate 28 also carries a third switch 30 (FIGS. 1 and 2) suitable to control a cycle computer (not shown).

The first switch 24 is provided for operating an electric motor for gear change (not shown) in a first direction for example to shift the chain towards higher speed gears (or upshifting). The second switch 26 is provided for operating the same gear change motor in the opposite direction, for example to shift the chain towards lower speed gears (or downshifting). The control device 10 may be used irrespectively to control the front derailleur or the rear derailleur of a bicycle. Therefore, in the control device positioned on the right side of the handlebar of the bicycle (normally used to control the rear derailleur) the switch 24 controls shift towards lower speed gears (that is towards gears with a larger number of teeth) and the switch 26 controls shift towards higher speed gears (gears with a smaller number of teeth). On the contrary, in the control device positioned on the left side of the handlebar, usually destined to control the front derailleur, the situation is reversed so that the switch 24 controls shift towards higher speed gears (towards a sprocket wheel with a larger number of teeth) and the switch 26 controls shift towards lower speed gears (towards a sprocket wheel with a smaller number of teeth).

In the embodiment according to FIGS. 1 to 4 the switch 26 facing the external side of the supporting body is preferably controlled by a push-button lever (indicated by the reference number 80 in FIG. 14) that can be pushed downwardly by the cyclist's thumb while the hand engages the supporting body 12 or the curved part of the handlebar 14, as described in the Italian patent application no. TO2000A000540 by the same applicant, not yet published on the filing date of the present application.

The control device 10 comprises a gear change lever (or control lever) 38 connected in a pivoting manner to the

supporting body 12 and positioned immediately behind the brake control lever 16. The lever 38 is composed of two separate parts hinged together: an upper part 40 hinged to the supporting body 12 around a first axis 42 and a lower part 44 hinged to the upper part 40 around a second axis 46. The two pivotal axes 42, 46 are orthogonal or substantially orthogonal in relation to each other. In the embodiment shown in the figures, the first axis 42 extends along a substantially orthogonal direction in relation to the pivotal axis 18 of the brake control lever 16 and, consequently, the second pivotal axis 46 is parallel or substantially parallel in relation to the pivotal axis 18 of the brake control lever 16. Alternatively, this layout could be inverted so that the upper part 40 of the lever 38 is hinged to the supporting body 12 around an axis parallel or substantially parallel to the pivotal axis of the brake control lever while the lower part 44 of the lever 38 is hinged to the upper part 40 around an axis orthogonal to the pivotal axis of the brake control lever.

In the embodiment shown in FIGS. 1 to 4, the upper part 40 of the lever 38 is hinged to the supporting body 12 by means of a pin 48 which extends according to a direction substantially parallel in relation to the supporting plate 28 which carries the control switches of the gear change 24, 26. A first return spring 50 is associated with the upper part 40 of the lever 38 and tends to hold the lever 38 in the position at rest shown in FIG. 3. The lower part 44 and the upper part 40 of the lever 38 are hinged to each other by means of a pin 52. The pin 52 has a head 53 facing the switch 24. A second return spring 54 is positioned coaxially to the pin 52 and cooperates with the two parts 40, 44 of the lever 38. The spring 54 tends to push the second part 44 towards its position at rest shown in FIG. 1.

As can be seen by comparing FIGS. 1 and 2, when the control lever of the brake 16 pivots around its pivotal axis 18 to control braking, the first part 40 of the lever 38 remains motionless, while the second part 44 of the lever 38 pivots around the pivotal axis 46 and follows the movement of the brake control lever. When the brake control lever 16 is released, the second return spring 54 returns the second part 44 of the lever 38 to the position at rest in FIG. 1. To control gear change, the cyclist applies light pressure in the direction indicated by the arrow 56 in FIGS. 3 and 4 to a control portion 58 of the lever 38. Following this pressure, the lever 38 pivots around the first axis 42 as illustrated in FIG. 4 and the head 53 of the pin 52 operates the switch 24. When the cyclist releases the pressure on the control portion 58, the gear change lever 38 is returned to the position at rest shown in FIG. 3 under the return action of the spring 50. It can be noted that the pin 52 always remains facing the switch 24, even when the second part 44 of the lever 38 pivots around the axis 46 to follow the braking movement of the brake control lever 16. Therefore, the cyclist may control gear change by means of the lever 38 even while operating the brake control lever 16, as shown in FIG. 2.

In the variant shown in FIG. 5, the lower part 44 of the lever 38 has an operating portion 60 facing the switch 24 and the pin 52 is moved upwards in relation to the switch 24. In the variant shown in FIG. 6 the pin 52 is moved downwards in relation to the switch 24 and the upper part 40 of the lever 38 has an operating portion 62 facing the switch 24. Operation of the devices according to the variants in FIGS. 5 and 6 is identical to the operation described previously, the only variation being that the switch 24 is operated by the portions 60 and 62 as opposed to the head 53 of the pin 52.

The gear change lever 38 may be associated with a check device that limits the pivoting stroke of the lever 38, to avoid damages to the switch 24 in the case in which the lever 38 is pushed against the switch with excessive force. This check device may be produced as described in the Italian patent application no. TO2000A000540 by the same Applicant.

FIGS. 7 to 10 show an alternative embodiment of the control device according to the present invention. The parts corresponding to those previously described are indicated with the same reference numbers. In this embodiment, the upper part 40 of the gear change lever 38 is composed of an elastic element which may be used to shift the lower part 44 of the gear change lever 38 between the position at rest shown in FIGS. 7 and 8 and the operating position shown in FIGS. 9 and 10. The upper part 40 of the gear change lever 38 is preferably composed of an elastic lamina of metal material with a base 64 fixed to the support 12, for example by means of a screw 66. The lamina has an elastically deformable branch 68 at the lower end of which the lower part 44 is hinged by means of a pin 52. In the position at rest, the deformable branch 68 holds the lower part 44 in the position shown in FIGS. 7 and 8. When the cyclist applies pressure to the control portion 58 in the direction indicated by the arrows 56, the deformable branch 68 of the upper portion 40 becomes elastically deformed and allows the lower portion 44 to move towards the operating position shown in FIGS. 9 and 10. When the cyclist releases the pressure on the operating portion 58, the deformable branch 68 of the upper portion 40 elastically returns to its position at rest and returns the lower portion 44 of the gear change lever to the position at rest shown in FIGS. 7 and 8.

FIGS. 11 and 12 show a further embodiment of the control device according to the invention. In this case, the upper part 40 of the gear change lever 38 is composed of a block which slides in a direction parallel or substantially parallel in relation to the operating direction of the switch 24. In the embodiment shown in FIGS. 11 and 12, the block forming the upper part 40 is slidably mounted on a pair of guide elements 70 integral with the supporting body 12 and which extend in an orthogonal direction in relation to the plate 28 carrying the switches 24, 26. An elastic element 72, composed for example of a compressed helical screw, is interposed between the block and the plate 28 and tends to maintain the block in the position at rest shown in FIG. 11. At its lower end, the block forming the upper end 40 carries the pivot pin 52 around which the lower part 44 of the lever 38 is mounted pivotally. FIGS. 11 and 12 show the control device in the position at rest and in the operating position, respectively. As in the case described above, shift from the position at rest to the operating position is obtained by applying pressure on the control portion 58 and the lever 38 returns to the position at rest by the action of the spring 72 after releasing the pressure in the direction indicated by the arrow 56.

The described embodiments perform the upshifting and the downshifting by means of two levers (the control lever 38 and the push button lever 80). In accordance with a further aspect of the present invention, both said functions can be performed by a single lever.

As shown in FIG. 13, the first switch 24 can be mounted on a first plate 28 and the second switch 26 can be mounted on a second plate 29 facing the first plate 28. The pin 52 is preferably provided with a second head 55 facing the second switch 26. The control lever 38 is illustrated in a central rest position in which none of the two switches 24 or 26 is operated. The control lever 38 can be pivoted in a first direction 56 for operating the first switch 24 and in the opposite direction 57 to operate the second switch 26.

The control lever 38 can operate both the switches 24 and 26 also in the embodiments in accordance with FIGS. 5 to