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(54) Small extendible antenna for mobile terminals

(57) There is provided a small extendible antenna in a transceiver. An antenna housing is installed on the body housing, a helical antenna is installed inside the antenna housing, and an extendible rod antenna has a whip portion for acting as an effective antenna in an extended state, a conductive core wire installed inside the whip portion at a lower end thereof, and a metal pipe connected to the lower end of the whip portion. The conductive core wire is extended from and retracted into the metal pipe.

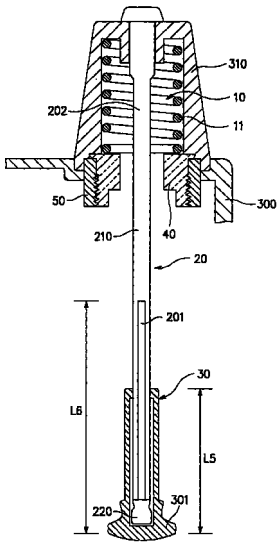

FIG. 1

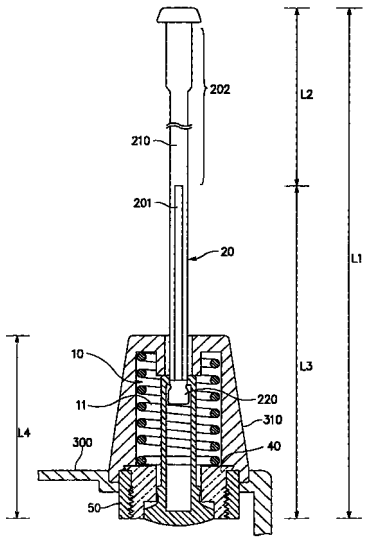

FIG. 2

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Description

[0001] The present invention relates to an antenna for a portable terminal and to a corresponding terminal, and in particular, to an antenna which is extendible.

[0002] A whip antenna and a helical antenna are typically used for a portable terminal like a cellular phone or a PCS (Personal Communication Service) phone. Such antennas are designed to be a λ/4- or λ/3-operating frequency in length. λ/4 is about 90mm and 40mm, respectively in the cellular system and PCS system currently in general use. If a λ/4-length antenna always protrudes externally, it will incur an inconvenience in carrying a portable terminal. The short physical length of the helical antenna can relieve the inconvenience, but results in poor efficiency in comparison with the whip antenna. The whip antenna is more popular than the helical antenna due to its better performance during talking. In this context, a retractable antenna type with the advantages of the helical and whip antennas has been developed. A well-recognized example of this type can be found in U.S. Patent No. 5,479,178.

[0003] The retractable antenna in the above patent incorporates a helical antenna and a whip antenna. In an idle state, the helical antenna is operated while the whip antenna is retracted into a terminal body. In an active state, the whip antenna is extended when necessary. If the terminal body is long enough to accommodate the whip antenna, the retractable antenna is effective. However, as a terminal body has shrunk due to the development of highly integrated circuits, the terminal body has a smaller space for accommodating the whip antenna. In the retractable antenna, the whip antenna should be decoupled from a feeding point in its retracted state, but an insufficient accommodation space cannot ensure the decoupling. This imposes constraints on designing the antenna.

[0004] It is the object of the present invention to provide an improved antenna arrangement of a mobile terminal, and a corresponding mobile terminal, including an extendible antenna suitable for miniaturization of the telephone terminal.

[0005] This object is solved by the invention as claimed in independent claims 1 and 7.

[0006] The invention provides a whip antenna longer than a terminal body which is retractable in the terminal body in two stages. In particular, there is provided an antenna housing installed on the body housing, a helical antenna installed inside the antenna housing, and an extendible rod antenna having a whip portion for acting as an effective antenna in an extended state, a conductive core wire installed inside the whip portion, and a metal pipe connected to a lower end of the conductive core wire. The conductive core wire is extended from and retracted into the metal pipe.

[0007] Preferred embodiments are defined in the dependent claims.

[0008] The above objects and advantages of the present invention will become more apparent by describing in detail a preferred embodiment thereof with reference to the attached drawings in which:

FIG. 1 is a sectional view of an antenna in a retracted state according to a preferred embodiment of the present invention; and

FIG. 2 is a sectional view of the antenna in an extended state according to the preferred embodiment of the present invention.

[0009] A preferred embodiment of the present invention will be described in detail referring to the attached drawings. Like reference numerals denote the same components in the drawings. It is to be noted that a detailed description of a known function or structure of the present invention will be omitted if it is deemed to obscure the subject matter of the present invention.

[0010] Referring to FIGs. 1 and 2, a whip portion 210 of a small extendible antenna according to the present invention can be accommodated in a body housing 300 in two stages though the whip portion 210 is longer than a telephone body.

[0011] Since the telephone body can accommodate the whip portion 210 longer than the body in an idle state, the length of the body does not impose much constraint on designing the antenna despite the trend toward terminal miniaturization.

[0012] In an idle state, only a helical antenna 10 protrudes outward from the body housing 300 to thereby contribute to miniaturization of a portable telephone. In an active state, a whip antenna 20 is extended, increasing the physical length of the whip antenna limited by the scale-down of a terminal.

[0013] As shown in FIGs. 1 and 2, the small extendible antenna of the present invention includes the helical antenna 10 acting as an effective antenna in a retracted state, the whip antenna 20 acting as an effective antenna in an extended state, a metal pipe 30 for reducing the length of the whip antenna 20 in the retracted state, a stopper 220 connected to an end of a conductive core wire 201 of the whip antenna 20, for supporting the extension of the conductive core line 201, a stopper 301 connected to an end of the metal pipe 30, for supporting the extension of the metallic pipe 30, and a metal fixture 40 which acts as a feeder for the helical antenna 10 and the whip antenna 20 and through which the whip antenna 20 slides down when it is retracted. The metal fixture 40 is fixed to the body housing 300 by means of a fixing bushing 50.

[0014] In FIG. 2, reference character L1 denotes the length of the whip antenna 20 including an insulator 202 in the extended state, reference character L2 denotes the length of the insulator 202, reference character L3 denotes the conductor length of the whip portion 210 in the extended state, and reference character L4 denotes the physical length of the helical antenna 10 including the fixture 40.

[0015] In FIG. 1, reference character L5 denotes the reduced length of the whip portion 210 when the whip antenna 20 is retracted into the body housing 300, and reference character L6 denotes the conductor length of the whip portion 210 in the retracted state.

[0016] The helical antenna 10 is connected to the antenna fixture 40, protruding outward, and protected in an antenna housing 310. The helical antenna 10 acts as an independent antenna in an idle state.

[0017] The whip antenna 20 is retracted in the body housing 300 in the idle state and extended from the body in an active state. The extended whip antenna 20 acts as an effective antenna in the active state. The increase in the length of the effective antenna can reduce the degradation of antenna characteristics during talking.

[0018] Now, the operation of the small extendible antenna according to the present invention will be described in detail.

[0019] In the retracted state shown in FIG. 1, the conductive core wire 201 is completely inserted into the body housing 300 and the insulator 202 at the top portion of the whip antenna 20 is disposed in the antenna fixture 40, so that the whip antenna 20 is completely decoupled from the antenna fixture 40 and only the helical antenna 10 is operated.

[0020] As afore-mentioned, it is assumed that the length of the whip portion 210 is longer than the telephone body. On this assumption, it is impossible to simply accommodate the whip portion 210 in the body housing 300. In the present invention, the whip portion 210 is contracted while being retracted. In the course of inserting the whip portion 210 into the body housing 300, the end of the whip portion 210, that is, the metal pipe 30 reaches the bottom of the body housing 300 and the conductive core wire 201 is pushed into the metal pipe 30. Thus, the stopper 220 is inserted into the metal pipe 30 until it reaches the bottom of the body housing 300. This mechanism can be varied according to applications of the metal pipe 30.

[0021] The metal pipe 30 may be a metal tube around which an elastic spring is densely wound, or an elastic metal pipe.

[0022] In FIG. 2, when the whip antenna 20 is extended from the body housing 300, its length is increased. Therefore, the extension of the antenna involves the extension of the antenna from the terminal body and the increase in the antenna length.

[0023] The conductive core wire 201 of the whip antenna 20 is extended outward from the metal pipe 30, while it is connected to the metal pipe 30 by the stopper 220. Though the whip antenna 20 protrudes from the body housing 300, the whip antenna 20 as well as the helical antenna 10 remains connected to the antenna fixture 40.

[0024] Because the helical antenna 10 is physically shorter than the whip antenna 20 and a helical winding 11 is in close contact with the whip antenna 20, only the whip antenna 20 is operated in electrical terms. The extension of the whip antenna 20 is supported by the stopper 301 of the metal pipe 30.

[0025] In accordance with the embodiment of the present invention as described above, the small extendible antenna according to the present invention is suitable for miniaturization of a terminal body because the whip portion of the antenna longer than the terminal body can be retracted into the body housing in two stages. Therefore, the length of the terminal body does not much constraint on designing the antenna. In an idle state, only the helical antenna protrudes outward, contributing to miniaturization of a portable telephone, and in an active state, the whip antenna which was retracted in two stages can be extended for use, thereby increasing the physical length of the whip antenna limited in a typical portable terminal.

[0026] While the present invention has been described in detail with reference to the specific embodiments, it is a mere exemplary application. Thus, it is to be clearly understood that many variations can be made by anyone skilled in the art within the scope of the present invention.

Claims

1. Antenna arrangement in a transceiver having a body housing (300) and an antenna housing (310) installed on the body housing, the arrangement comprising:

   a helical antenna (10) installed inside the antenna housing (310); and

   an extendible rod antenna (20) having a whip portion (210) for acting as an effective antenna in an extended state, a conductive core wire (201) installed inside the whip portion at a lower end thereof, and a metal pipe (30) connected to said lower end of the whip portion, the conductive core wire (201) and the metal pipe (30) being arranged slidably movable against each other.

2. The arrangement according to claim 1, wherein the metal pipe (30) is a metal tube shaped into a densely wound spring.

3. The arrangement according to claim 1, wherein the metal pipe (30) is an elastic metal pipe.

4. The arrangement according to one of claims 1 to 3, further comprising a stopper (220) at the lower end of the whip portion (210), said stopper electrically connecting said conductive core wire (201) with said metal pipe (30).

5. The arrangement according to one of claims 1 to 4,

further comprising a stopper (301) at a lower end of the metal pipe (30) for defining the end position of the rod antenna (20) in its extended state such that the conductive core wire (201) projects outward the antenna housing (310).

6. The arrangement according to one of claims 1 to 5, wherein the rod antenna (20) comprises an insulator (202) at its top portion for decoupling the rod antenna in its retracted state.

7. Mobile terminal, comprising:

a body housing (300);

an antenna housing (310) installed on the body housing; and

an antenna arrangement including a helical antenna (10) installed inside the antenna housing (310) and an extendible rod antenna (20) having a whip portion (210) for acting as an effective antenna in an extended state, a conductive core wire (201) installed inside the whip portion at a lower end thereof, and a metal pipe (30) connected to the lower end of the whip portion, the conductive core wire (201) and the metal pipe (30) being arranged slidably movable against each other.

8. The mobile terminal according to claim 7, wherein the antenna arrangement is constructed according to one of claims 2 to 6.

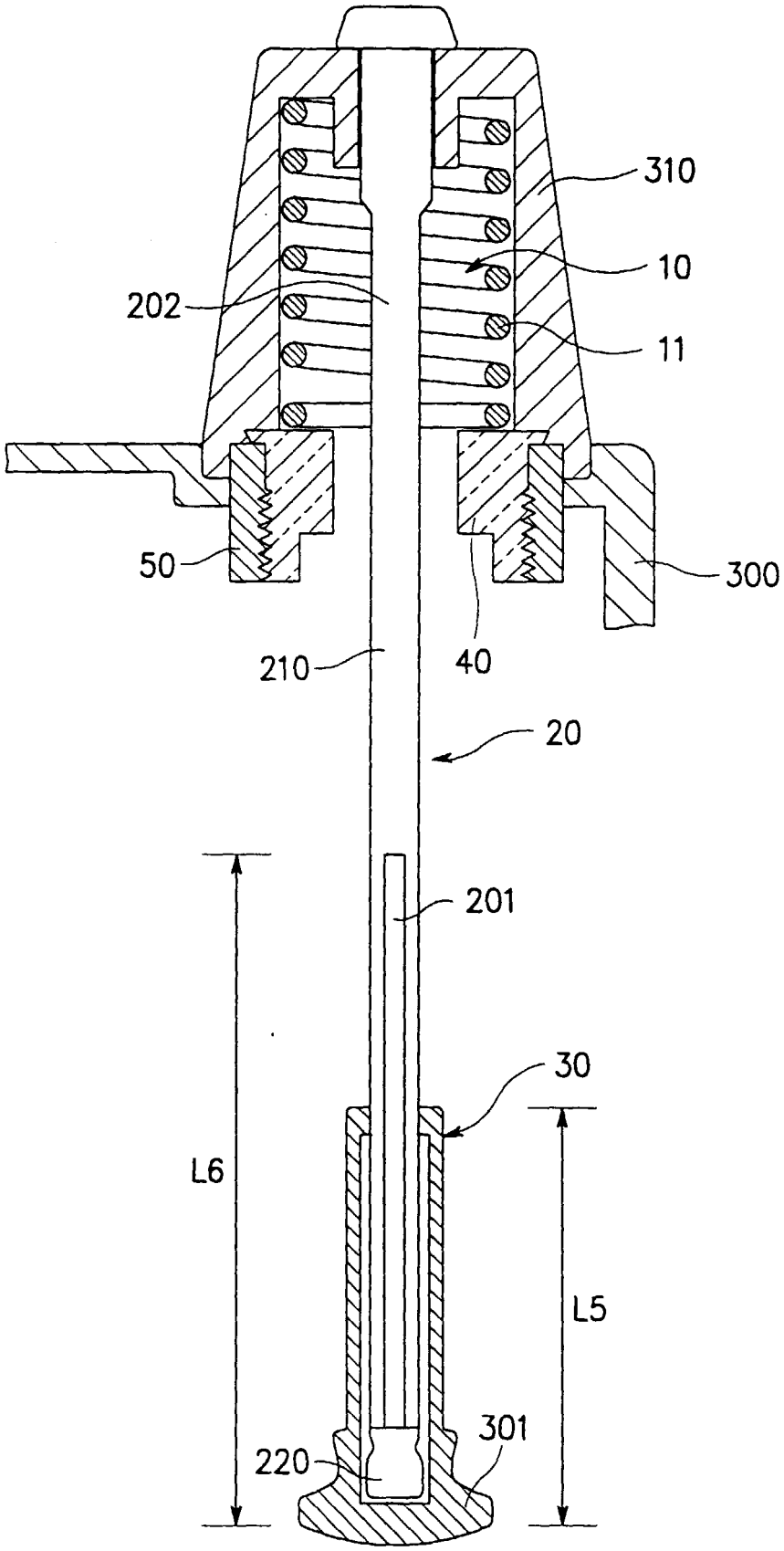

FIG. 1

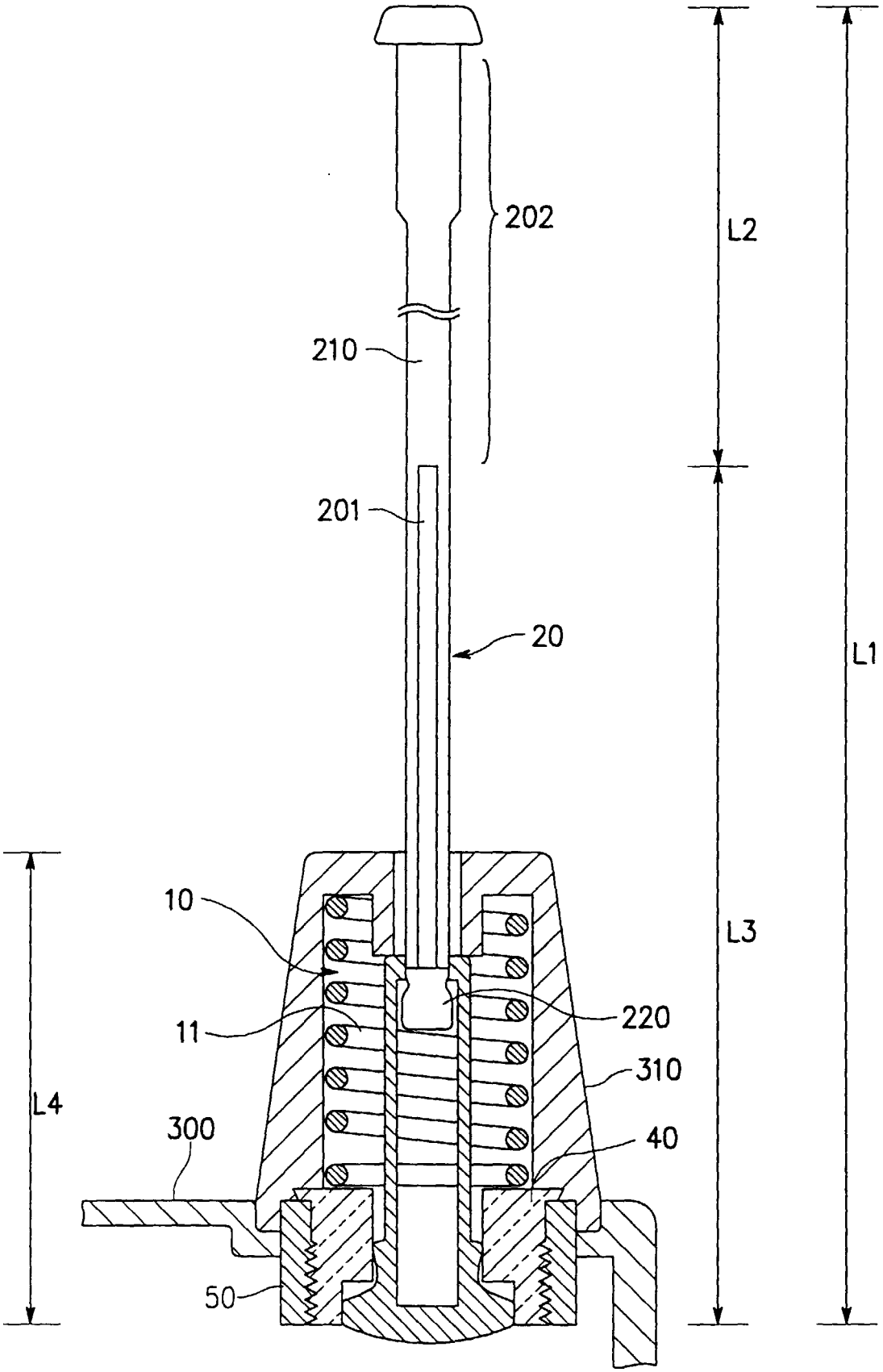

FIG. 2