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Werling et al.

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(54) **MOBILE RADIO EQUIPMENT FORMING ANTENNA PATTERN TO PROJECT USER FROM RADIATION**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(57) **ABSTRACT**

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A radio communication apparatus includes a transceiver coupled to an antenna structure with many directional antennas that form a radiation pattern. The antenna structure gives greater importance to certain directions of transmission. A power regulation device is controlled by a control element for modifying the radiation pattern. The control element includes switches for selectively activating/deactivating the directional antennas to modify the radiation pattern. A proximity detection device measures at least one proximity parameter and feeds the control element with a proximity indication for controlling the power regulation device to reduce the radiation pattern in the direction of the radio communication apparatus user. The proximity detection device includes a humidity and/or a temperature detector.

(30) **Foreign Application Priority Data**

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(51) **Int. Cl.⁷** **H04B 1/38**

(52) **U.S. Cl.** **455/550; 455/129**

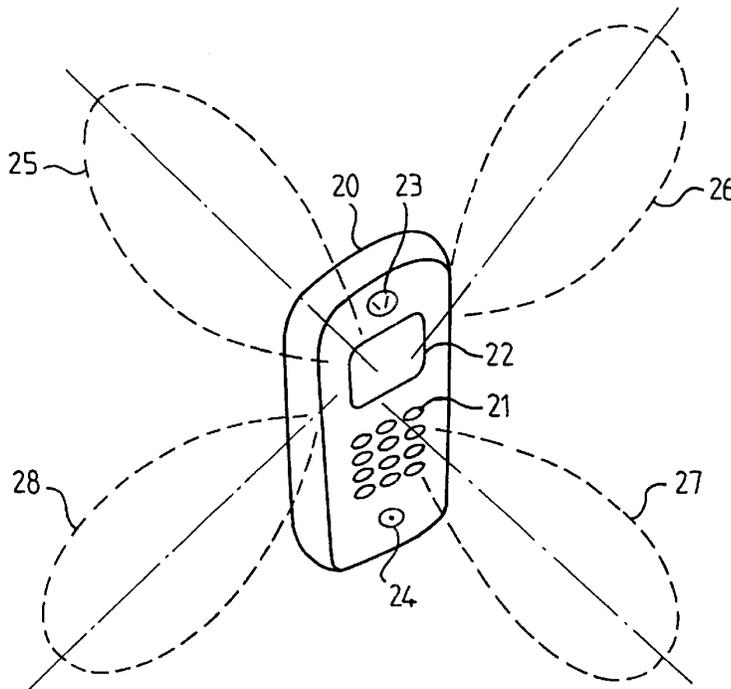
(58) **Field of Search** 455/129, 121, 455/125, 550, 90

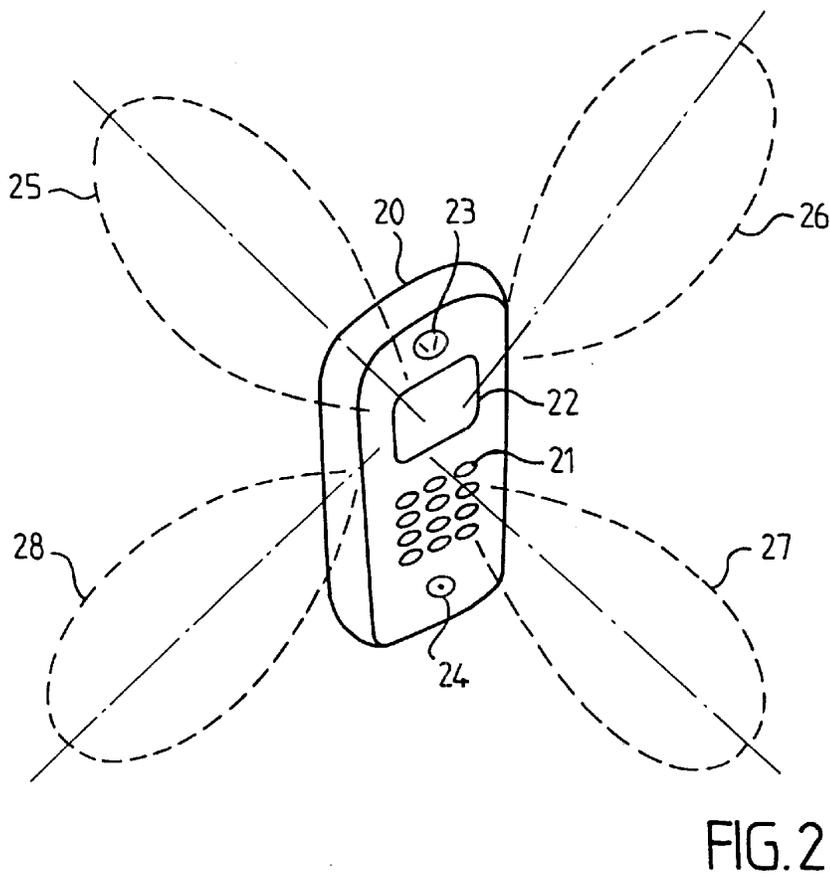
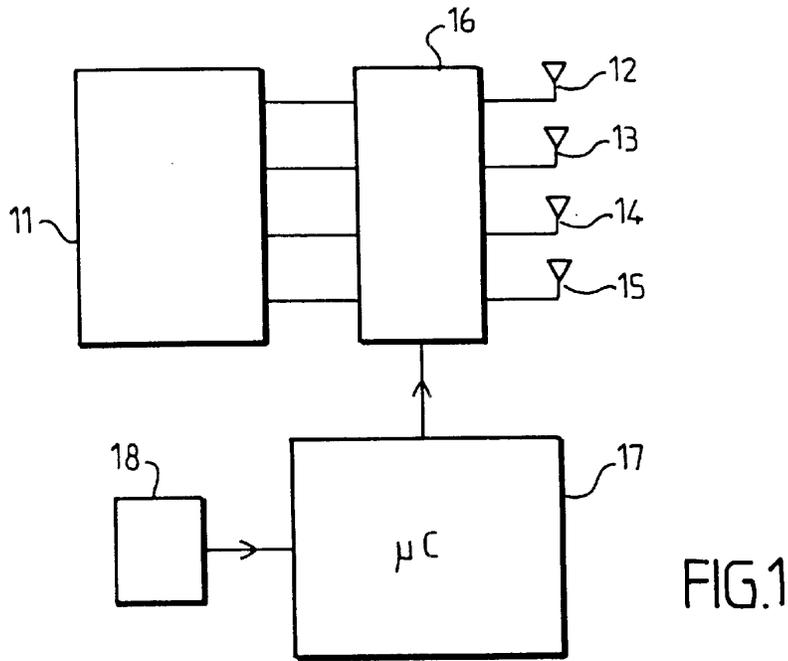
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12 Claims, 3 Drawing Sheets





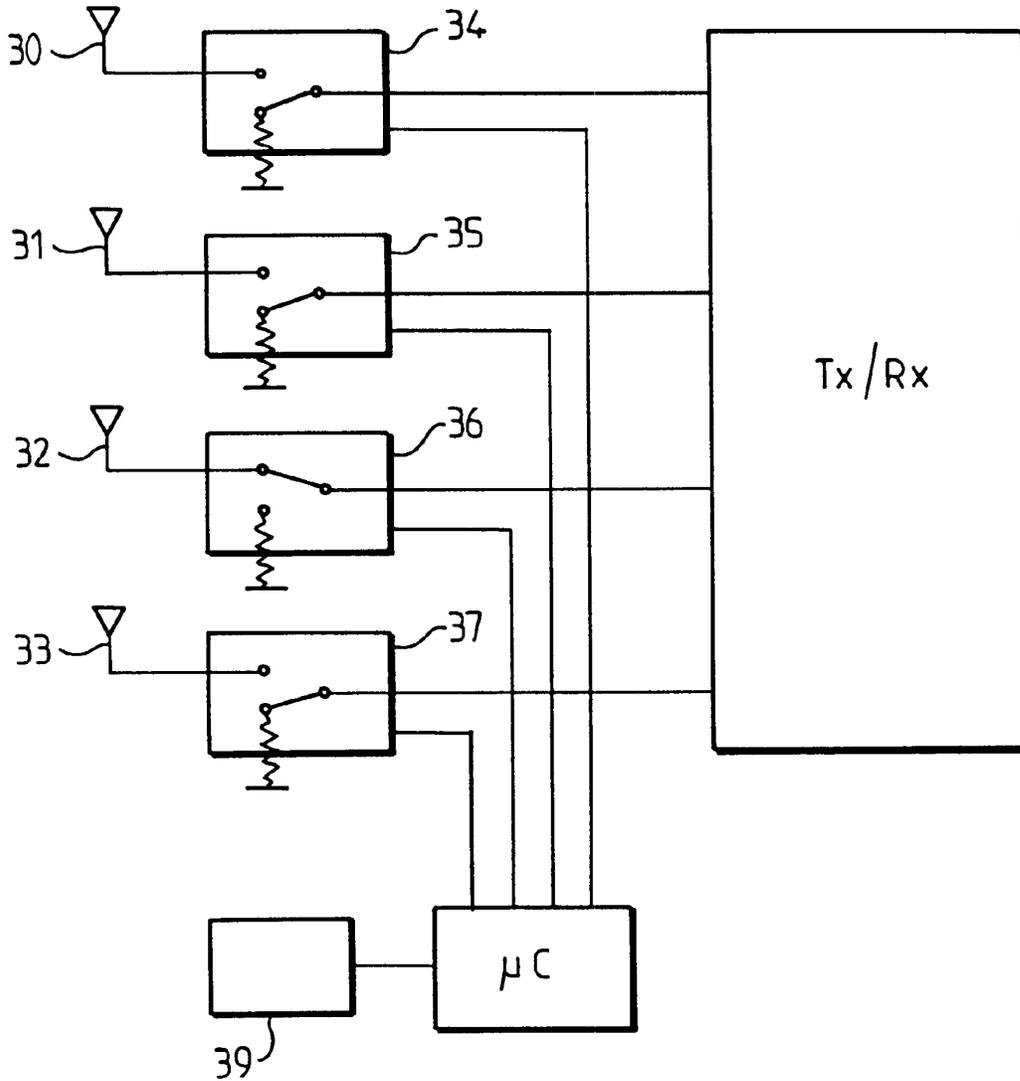


FIG. 3

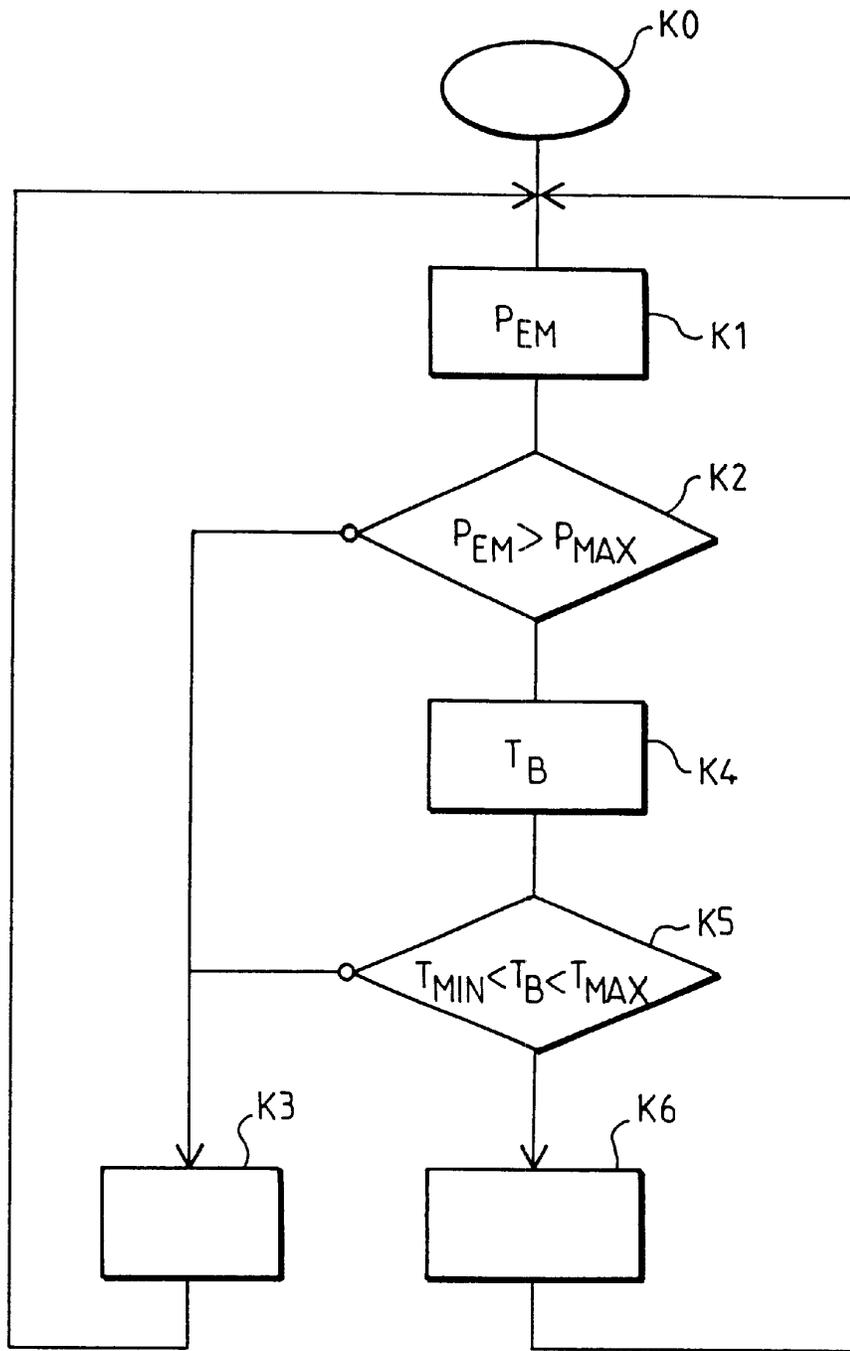


FIG.4

1

MOBILE RADIO EQUIPMENT FORMING ANTENNA PATTERN TO PROJECT USER FROM RADIATION

FIELD OF THE INVENTION

The invention relates to a radio communication apparatus comprising:

transceiver means coupled to an antenna structure featuring a radiation diagram which antenna structure gives greater importance to certain directions of transmission and

a power regulation device controlled by a control element for modifying said radiation diagram.

The invention also relates to mobile radio equipment suitable for communicating with at least one radio base station of a radio telecommunication system, said equipment comprising:

radio transceiver means coupled to an antenna structure featuring a radiation diagram which antenna structure gives greater importance to certain directions of transmission and

a power regulation device controlled by a control element for modifying said radiation diagram.

The invention further relates to a radio base station of a radio telecommunication system suitable for communicating with at least one mobile radio terminal, said station comprising:

radio transceiver means coupled to an antenna structure featuring a radiation diagram which antenna structure gives greater importance to certain directions of transmission and

a power regulation device controlled by a control element for modifying said radiation diagram.

The invention finally relates to a power control method for controlling the power radiated in a given direction by a plurality of directional antennas which have respective transmit powers.

The invention finds many applications in the field of telecommunication by radio channel, notably radiotelephony. The invention particularly applies to systems called third generation systems, operating according to a Universal Mobile Telecommunications System (UMTS) standard using the technique of Code-Division Multiple Access (CDMA). Equipment provided for such systems comprises a plurality of directional antennas suitable for emitting noxious radiation absorbed by human tissue situated in the proximity of these apparatus.

BACKGROUND OF THE INVENTION

European patent application no. EP 752 735, published in the German language, describes an apparatus of the type defined in the opening paragraph, comprising means for limiting the power of radiation absorbed by human tissue. The apparatus comprises an antenna array electrically connected to a control unit for individually regulating the transmit power of each antenna as a function of the calculated variation between the impedance measured at the level of the antenna and a reference value corresponding to its impedance in the clear field. This difference represents a measure of the radiation power absorbed by human tissue.

SUMMARY OF THE INVENTION

The present invention proposes means for avoiding the emission of radio waves in the direction of human tissue, which means are easier to implement and more effective

2

than those described in cited document. Therefore, an apparatus as mentioned in the opening paragraph is provided, characterized in that it comprises a proximity detection device for measuring at least one proximity parameter and feeding the control element with a proximity indication for controlling the power regulation device.

According to an important characteristic feature of the invention, the antenna structure comprises a plurality of directional antennas which have each a transmit power in a given direction and the power regulation device comprises power control means for regulating the transmit power of the directional antennas.

According to another characteristic feature of the invention, the power control means comprise a switch for selectively activating/deactivating one or various directional antennas.

According to two particular embodiments of the invention, the proximity detection device comprises a temperature detector and/or a humidity detector enabling to distinguish, among the various obstacles to the radio propagation, the presence of a human being in any obstacle. As it is an object of the invention to limit the emission of noxious radiation for the benefit of the user's health, it is very advantageous to use such proximity detectors.

These detectors further feature two additional advantages. As they are passive, they are harmless to the user, because they emit no radio wave at all. Moreover, they make both the transmit power measurements and the calculations of the power differences recommended by the method cited previously redundant. These detectors are not only energy consumers but are also noxious, since they imply to transmit at a certain power level for making the measurements before possibly effecting a power level control intended to limit the user's absorption of radiation.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other aspects of the invention will be apparent from and elucidated with reference to the embodiments described hereinafter.

In the drawings:

FIG. 1 is a block diagram of a communication apparatus according to the invention,

FIG. 2 represents an example of the mobile radio equipment according to the invention,

FIG. 3 is a block diagram of a particular embodiment of the equipment represented in FIG. 2, and

FIG. 4 is a flow chart for illustrating an example of a method of controlling transmit power according to the invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

The example represented in FIG. 1 may be integrated with a radiotelephone using various directional transmitting antennas. The communication apparatus comprises a transceiver device **11** coupled to a plurality of directional antennas **12** to **15** (having a radiation diagram giving greater importance to certain directions of transmission). Each antenna is electrically connected to a power regulation device **16** controlled by a control element **17**. Such an element may be formed by a suitably programmed microcontroller μC which includes a programmable read-only memory, a random-access memory, an input/output interface having an analog/digital converter and a digital/analog converter and all the devices necessary for the interface with the various peripherals.

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