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Amended claims in accordance with Rule 86 (2) EPC.

(54) **Method for recognizing antenna types**

(57) A method for recognizing a type of an antenna (12), wherein the type of an antenna (12) is recognized by a control unit (5) connected to an antenna module (4) comprising the antenna (12), comprises the steps of sending an antenna identification signal from the control unit (5) to the antenna module (4), sending an antenna reply signal from the antenna module (4) to the control

unit (5) in response to the antenna identification signal, wherein the antenna reply signal comprises an antenna type information signal in a coded form, decoding the antenna reply signal by the control unit (5) for determining the type of the antenna (12) connected thereto, and adjusting receive and/or transmit parameters of the control unit (5) connected to the antenna module (4) according to the type of the antenna (12).

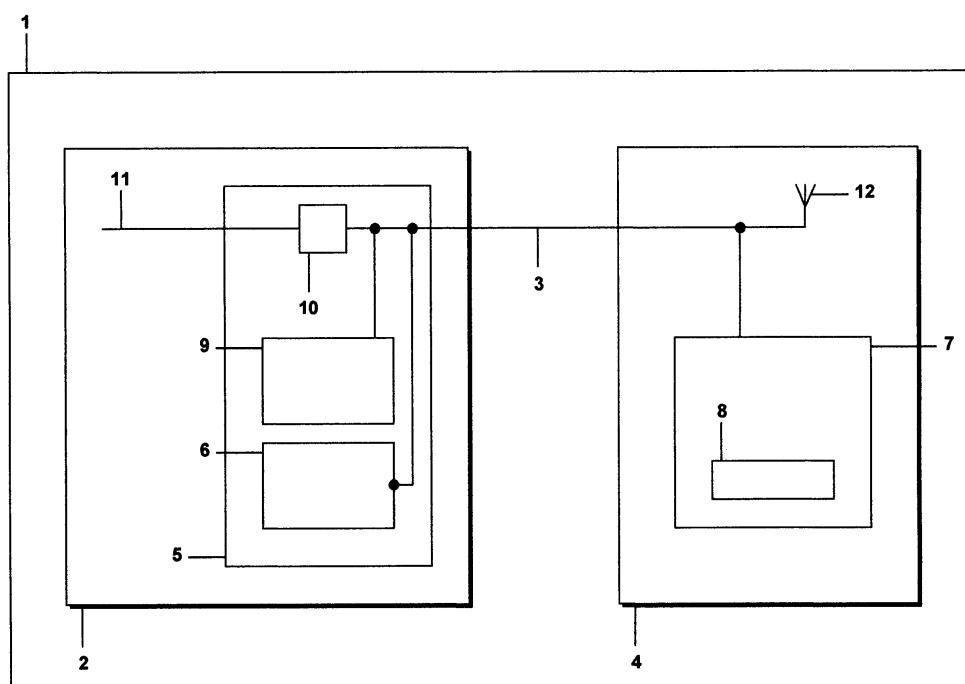


FIG. 1

Description

[0001] The present invention relates to a method, systems and devices for recognizing antenna types.

[0002] Radio frequency (RF) transmission devices, for example radios, car radios, car kits for mobile phones, car radios with integrated mobile phone units, and satellite receivers, are usually connected with external antennas. Each RF transmission device requires specific characteristics of the antenna connected to the device. If the antenna does not meet the required characteristics, the transmission quality may decrease, legal regulations may not be fulfilled any more, or even the transmission device may be damaged.

[0003] Especially in the case of transmission devices for emitting radio frequency signals, for example car radios with integrated mobile phone units, legal regulations require specific radiation characteristics, which can be met only, if the transmission device is adapted to the antenna. This has to be assured by the vendors and manufacturers of the transmission devices and antennas to get an approval for their devices. Currently, this is assured by specific connectors connecting the transmission device and the antenna, for example SMA and reverse SMA connectors. Assuring a correct combination of a transmission device and an antenna by a special connector is not satisfying, since this increases the number of different connectors and therefore the prices of the connectors, and additionally this does not solve the problem that some antennas might be usable for different RF transmission systems but can be connected only to one specific type of transmission device because of the specific connector.

[0004] Additionally, the use of different connector types does not help in case that no antenna is connected, which might also lead to an infringement of legal regulations or to a damage of the transmission device.

[0005] Therefore, a need exists to provide a method which assures that a transmission device connected to an antenna fulfils legal regulations, provides optimal transmit and receive characteristics with the antenna connected, and protects the transmission device from damage.

[0006] According to the present invention, this need is met by a method for recognizing a type of an antenna as defined in claim 1, an antenna recognition system for recognizing the type of an antenna as defined in claim 5, an antenna module as defined in claim 13, a transmission device as defined in claim 19, and a transmission system as defined in claim 20. The dependent claims define preferred and advantageous embodiments of the invention.

[0007] According to one aspect of the invention a method for recognizing a type of an antenna is provided. Recognizing the type of the antenna is performed by a control unit connected to an antenna module comprising the antenna, comprising the following steps:

[0008] An electrical antenna identification signal is

sent from the control unit to the antenna module. Next, an electrical antenna reply signal is sent from the antenna module to the control unit in response to the electrical antenna identification signal supplied from the control unit to the antenna module, wherein the electrical antenna reply signal from the antenna module comprises an antenna type information signal in a coded form. Then, the control unit decodes the electrical antenna reply signal received from the antenna module and determines thereof the type of the antenna of the antenna module connected to the control unit. Finally, the control unit connected to the antenna module adjusts receive and/or transmit parameters of the control unit according to the type of the antenna connected to the control unit.

[0009] With this method it is possible for the control unit to recognize the type of the antenna connected to it and to adjust the receive and/or transmit parameters for ensuring that legal regulations can be fulfilled, the receiver and/or the transmitter can be protected against wrong adaptation, and an optimum transmit and receive performance can be achieved.

[0010] In one embodiment of the present invention the method may furthermore comprise the steps that the antenna module provides additionally diagnostic data in the antenna reply signal. This additional diagnostic data might, for example, include the outside temperature of an antenna module installed outside or the state of an automatic car antenna, if it is completely extended or not.

[0011] In another embodiment of the invention the method may furthermore comprise the steps that the radio frequency information is transmitted in a high-frequency band and the antenna identification signal and the antenna reply signal are transmitted in a low-frequency band. The low-frequency band comprises a frequency range separated and below the high frequency band, wherein the low-frequency band and the high frequency band are separable in the control unit and the antenna module. The high frequency band may comprise frequencies used for radio broadcast transmissions, e.g. 80 MHz and above, and/or frequencies used for cellular phones, e.g. the 900 MHz and 1800 MHz GSM frequency bands, etc. The low-frequency band is manipulated by the antenna module generating the antenna type information signal in the coded form, which requires rather low frequencies only, e.g. several 10 kHz. Therefore the high frequency band may comprises frequencies above 1 MHz and the low-frequency band may comprises frequencies below 1 MHz.

[0012] In such an embodiment it is possible to transmit the radio frequency information, the antenna identification signal and the antenna reply signal via one media, e.g. a single antenna cable, thereby reducing cost for additional wiring between the control unit and the antenna module.

[0013] Furthermore, according to another aspect of the invention, an antenna recognition system for recognizing the type of an antenna is provided, wherein the antenna recognition system comprises a control unit for emitting

an antenna identification signal to an antenna module, the antenna module comprising an antenna and an antenna reply unit, which receives the antenna identification signal from the control unit and generates an antenna reply signal comprising the antenna type information in a coded form, and a decoder for decoding the antenna reply signal and determining the type of the antenna from the antenna reply signal.

[0014] Such an antenna recognition system enables a control unit connected to the antenna module to adjust the receive and/or transmit parameters of the control unit according to the type of the antenna of the antenna module to assure that legal regulations are met and that an optimum receive and transmit quality for the control unit connected to the antenna module is achieved.

[0015] In another embodiment of the invention the antenna recognition system comprises an antenna reply unit comprising a signal manipulation unit for generating an antenna reply signal comprising an antenna type information in coded form. The signal manipulation unit receives the antenna identification signal emitted from the control unit and generates from this the antenna reply signal. The antenna identification signal and the antenna reply signal may have low frequencies within the low-frequency band as stated above. The radio frequency information, e.g. radio broadcast or mobile phone radio frequencies, transmitted between the control unit and the antenna module may have much higher frequencies within the high frequency band as stated above. As the high frequency band and the low-frequency band are separable, the signal manipulation unit is connected to the antenna via an inductor, which decouples the high-frequency signals transmitted between the antenna and the control unit from the low-frequency signals transmitted between the signal manipulation unit and the control unit. This embodiment enables to transmit both the high-frequency signal between the antenna and the control unit and the low-frequency signal between the signal manipulation unit and the control unit via one antenna connection cable. Therefore, this embodiment enables the use of the antenna recognition system without adding additional wiring between the control unit and the antenna module.

[0016] The signal manipulation unit may comprise a resistor, wherein the value of the resistor defines the type of the antenna, an RC circuit comprising a capacitor and a resistor, wherein the charging time of the capacitor defines the type of the antenna, a multi-vibrator, wherein the frequency of the multi-vibrator defines the type of the antenna, or a logic circuit capable of communicating via a pre-defined protocol, wherein the pre-defined protocol comprises means to communicate the type of the antenna.

[0017] The resistor and the RC circuit provide very cost-effective and simple embodiments of the signal manipulation unit. They can be used in applications where no additional diagnostic data in the antenna reply signal is needed and where the length of the antenna cable

between the control unit and the antenna provides a low resistance relative to the resistor used in the signal manipulation unit.

[0018] The multi-vibrator is also a rather cost-effective solution, does not provide the transfer of additional diagnostic data in the antenna reply signal, but can be used in applications where the antenna cable connecting the control unit and the antenna module might have very different lengths, as the frequency of the multi-vibrator does not depend on the resistance of the antenna cable, which corresponds to the length of the antenna cable.

[0019] The logic circuit capable of communicating via a pre-defined protocol is adapted to communicate bidirectionally with the control unit and therefore adapted to additionally provide diagnostic data in the antenna reply signal. This enables the control unit to recognize the antenna type and additionally to request diagnostic data of the antenna, for example the extension state in the case of an automatic car antenna, the manufacturer of the antenna, and the mounting position of the antenna.

[0020] In yet another embodiment of the invention the control unit is capable of supplying electrical power for the antenna module via the antenna cable to the antenna module. Therefore no additional power supply for supplying the antenna module and the signal manipulation unit with electrical energy is necessary, which reduces the wiring effort between the control unit and the antenna module and therefore reduces the costs implementing an antenna recognition system.

[0021] Moreover, the invention provides an antenna module, which comprises an antenna and an antenna reply unit as defined above, and a transmission device connectable to an antenna module, which comprises a control unit emitting an antenna identification signal to the antenna module and a decoder in the control unit for decoding an antenna reply signal and determining the type of the antenna from the antenna reply signal.

[0022] By integrating the antenna reply unit in the antenna module, no additional devices have to be arranged nearby the antenna module and connected to the antenna module during installation of the antenna module.

[0023] Integrating the control unit and the decoder in the transmission device, for example a car radio with an integrated mobile phone, enables the control unit to adjust the receive and/or transmit parameters of the control unit according to the type of the antenna connected to the control unit and according to the needs required from the transmission device.

[0024] Finally, according to another aspect of the invention a transmission system comprising a transmission device and an antenna module is provided.

[0025] The transmission device comprises a control unit for recognizing a type of an antenna connectable to the transmission device, wherein the control unit emits an antenna identification signal to the antenna module and comprises a decoder for decoding an antenna reply signal and determining the type of the antenna from the antenna reply signal. The antenna module comprises an

antenna reply unit, which is connected to the antenna and receives the antenna identification signal from the control unit and generates the antenna reply signal comprising an antenna-type information in a coded form.

[0026] This transmission system is capable of adjusting the receive and/or transmit parameters of the control unit of the transmission device according to the type of the antenna connected thereto. Hence, it can be assured that the combination of the transmission device and the antenna fulfils legal regulations and achieves an optimum receive and/or transmit performance.

[0027] The invention will now be described in more detail with reference to the accompanying drawings, in which:

Fig. 1 is a schematic diagram showing a transmission system according to the invention;

Fig. 2 shows a schematic diagram of an embodiment of the invention showing a control unit and an antenna module in more details;

Fig. 3 shows a schematic diagram of another embodiment of the invention, wherein the signal manipulation unit is a resistor;

Fig. 4 shows another embodiment of the invention, wherein the signal manipulation unit is a resistor;

Fig. 5a shows another embodiment of the invention, wherein the signal manipulation unit is a multi-vibrator and Fig. 5b shows the current modulated by the multi-vibrator;

Fig. 6a shows another embodiment of the invention, wherein the signal manipulating unit is a logic unit, which receives a modulated voltage shown in Fig. 6b and modulates a current as shown in Fig. 6c.

[0028] Now referring to the drawings, the embodiments of the present invention will be described.

[0029] Fig. 1 shows a transmission system 1 comprising a transmission device 2, an antenna module 4, and an antenna cable 3 connecting the transmission device 2 with the antenna module 4. The transmission system can, for example, be a car hifi system with an integrated mobile phone system with a hands-free speaking system. In this case the transmission device 2 would be the car radio with the integrated mobile phone, which is connected via an antenna cable 3 with an external antenna module 4 for receiving audio broadcast signals and for receiving and transmitting communication data for the mobile phone.

[0030] The transmission device 2 comprises a control unit 5, which comprises means for generating an antenna identification signal 9, a decoder 6, and means for adapting receive and/or transmit parameters 10. The decoder 6, the means for generating the antenna identification

signal 9 and the means for adapting receive and/or transmit parameters 10 are connected with the antenna cable 3 connecting the transmission device 2 and the antenna module 4. The means for adapting receive and/or transmit parameters 10 is additionally connected with the radio receiver (not shown) and the mobile phone module (not shown) of the transmission device via a line 11.

[0031] The antenna module 4 comprises an antenna 12 and an antenna reply unit 7 comprising a signal manipulation unit 8. The antenna 12 and the antenna reply unit 7 are connected with the antenna cable 3 connecting the transmission device 2 and the antenna module 4.

[0032] For recognizing the type of antenna connected to the transmission device 2, the means for generating the antenna identification signal 9 generates the antenna identification signal and sends this signal via the antenna cable 3 to the antenna reply unit 7. Inside of the antenna reply unit 7, the signal manipulation unit 8 generates an antenna reply signal from the antenna identification signal and transmits this signal via the antenna cable 3 to the decoder 6 of the control unit 5. The decoder 6 decodes the received antenna reply signal and the means for adapting receive and/or transmit parameters 10 adapts the receive and/or transmit parameters of the control unit 5 according to the antenna type decoded from the antenna reply signal.

[0033] In case the type of the antenna cannot be determined, the means for adapting receive and/or transmit parameters may adjust the receive and/or transmit parameters in such a way that only very low transmit powers are transmitted to guarantee not to exceed the maximum allowed transmit powers and the receive parameters are configured to be rather insensitive, to protect receive circuits from being damaged.

[0034] In case the antenna type can be determined, the receive and/or transmit parameters of the control unit 5 can be adjusted to achieve an optimum performance for reception and transmission via the connected antenna 12. This includes, for example, if an antenna with a very high gain is connected, that a mobile phone receiver is configured to be high-sensitive to achieve best receive quality, whereas the transmitter of the mobile phone module is configured to send with less output power, to meet the requirements of legal regulations.

[0035] Therefore, such a transmission system comprising a method for recognizing the type of antenna connected achieves optimum receive and/or transmit performance, while assuring that legal regulations are fulfilled and receive and transmit components of the transmission device are protected against too much input power or wrong impedance matching.

[0036] Fig. 2 shows an embodiment of the present invention in more detail. The control unit 5 comprises a decoder 6, a means for generating the antenna identification signal 9, the means for adapting receive and/or transmit parameters 10, an inductor 24 and a capacitor 23. The means for adapting receive and/or transmit parameters 10 is connected with the antenna cable 3 via

the capacitor 23. The decoder 6 and the means for generating the antenna identification signal 9 are connected via the inductor 24 with the antenna cable 3. The capacitor 23 and the inductor 24 decouple the high-frequency signals and the low-frequency signals transmitted on the antenna cable 3. The high-frequency signals are passing through the capacitor 23 and the means for adapting receive and/or transmit parameters 10 to and from the line 11. Line 11 is, for example, connected with a radio receiver (not shown) or a mobile phone module (not shown). The low-frequency signals are passing from the antenna cable 3 through the inductor 24 to the decoder 6 and from the means for generating the antenna identification signal 9 through the inductor 24 to the antenna cable 3.

[0037] In the antenna module 4 an inductor 22 passes the low-frequency signals received from the control unit 5 via the antenna cable 3 to the antenna reply unit 7.

[0038] By using the capacitor 23, the inductor 22 and the inductor 24 it is possible to transfer the high-frequency signals and the low-frequency signals via the same antenna cable 3 without interfering the high-frequency signals. Therefore, it is possible to realize an antenna recognition system just by modifying the control unit of the transmission device 2 and the antenna module 4, but without any changes on the wiring between the transmission device 2 and the antenna module 4, that means without any modifications on the antenna cable 3 and an antenna connector 21 and without any additional wiring.

[0039] Fig. 3 shows an embodiment, wherein the antenna reply unit 7 comprises a resistor 31 that represents the signal manipulation unit 8 of figure 1. The means for generating the antenna identification signal 9 comprises a supply voltage U and a resistor R. The detector 6 comprises a voltage sensing device 32. The supply voltage U is supplied via the resistor R and the inductor 24 to the antenna cable 3 and then via the inductor 22 to one connector of the resistor 31 in the antenna reply unit 7. The other connector of the resistor 31 is connected via the antenna connector 21 to ground. The voltage sensing device 32 is measuring the voltage over the inductor 24, the cable 3, the inductor 22 and the resistor 31 representing the signal manipulation unit of the antenna reply unit 7. The values of the resistors R and 31 should be selected such that the DC resistance of the inductor 24, the cable 3 and the inductor 22 are negligibly small compared to the resistance of resistor R and resistor 31. Then, the resistors R and 31 are working as a voltage divider and the decoder 6 in the control unit 5 can easily determine the value of the resistor 31 from the voltage U, the resistor R, and the voltage measured with the voltage sensing device 32. The resistor 31 has a specific value for each type of antenna. Therefore, the control unit can easily determine the type of the antenna 12 connected to the control unit 5 and just receive and/or transmit parameters in the means for adapting receive and/or transmit parameters 10 to assure that legal regulations are met and an optimum receive and/or transmit perform-

ance can be achieved.

[0040] Fig. 4 shows another embodiment of an antenna recognition system, wherein the antenna reply unit 7 comprises a resistor 31 representing the signal manipulation unit 8 of figure 1, and wherein the control unit 5 comprises a means for generating the antenna identification signal 9 generating a supply voltage U and a decoder 6 comprising a current sensing device 41.

[0041] The means for generating the antenna identification signal 9 supplies a supply voltage through the current sensing device 41 of the decoder 6 through the inductor 24 and via the antenna cable 3 to and through the conductor 22 and to a connector of the resistor 31 representing the signal manipulation unit of the antenna reply unit 7. The other connector of the resistor 31 is connected to ground. Again, the value of the resistor 31 is selected such that the DC resistance of the inductor 24, the cable 3, and the inductor 22 are negligibly compared to the value of the resistor 31. Therefore, the decoder 6 of the control unit 5 can easily determine the value of the resistor 31 from the supply voltage U and the current sensed by the current sensing device 41. As each value of the resistor 31 represents a specific type of antenna, the control unit 5 can easily determine the type of antenna connected to the control unit 5 achieving the advantages stated above.

[0042] Fig. 5a shows another embodiment of the present invention, wherein the type of the antenna is coded as a frequency of a multi-vibrator. The means for generating the antenna identification signal 9 provides a supply voltage U feeded through a current sensing device 41 of the decoder 6 through the inductor 24, the cable 3, and the inductor 22 to the antenna reply unit 7 of the antenna module 4. The antenna reply unit 7 comprises multi-vibrator 52 and a resistor 51. The multi-vibrator 52 modulates the supply current of the antenna reply unit by switching on and off the supplied voltage on the resistor 51. As a result, the supply current I is modulated as shown in Fig. 5b with a specific frequency indicating the type of the antenna 12 of the antenna module 4. The modulated current I is sensed by the current sensing device 41 of the decoder 6 in the control unit 5 and from this the decoder 6 can determine the type of the antenna 12 connected to the control unit 5 and adjust the receive and/or transmit parameters of the control unit 5 accordingly.

[0043] In addition to the advantages already stated above with reference to drawings 1-4, this embodiment is independent from the DC resistance of the inductor 24, the antenna cable 3 and the inductor 22 and therefore adapted to be used in environments where a wide range of antenna cable lengths can occur. Furthermore, the multi-vibrator 52 could, instead of having a 50% duty cycle only, provide a more complex signal comprising not only the type of the antenna, but also for example a manufacturer code in a binary coded form. This enables the control unit 5 to adjust the receive and/or transmit parameters even more precisely according to specific fea-

tures of the connected antenna module 4.

[0044] Fig. 6a shows another embodiment of the present invention wherein the type of the antenna connected to a control unit 5 is determined by a protocol exchanged between the control unit 5 and the antenna module 4.

[0045] A means for generating the antenna identification signal 9 is connected with one connector of a current sensing device 41 of the decoder 6 and the other connector of the current sensing device 41 is connected through the inductor 24, the antenna cable 3 and the inductor 22 to the logic circuit 61 of the antenna reply unit 7. The means for generating the antenna identification signal 9 provides a supply voltage U for the logic circuit 61 and additionally modulates a binary signal according to a predefined protocol on the supply voltage U as shown in Fig. 6b. This modulated signal on the supply voltage U is received by the logic circuit 61 and the logic circuit 61 generates an antenna reply signal according to the pre-defined protocol and transmits this reply signal in a binary form by modulating the supply current as shown in Fig. 6c. This antenna reply signal is sensed by the current sensing device 41 of the decoder 6 of the control unit 5 and hence the decoder 6 can determine the type of antenna connected to the control unit 5 and the receive and/or transmit parameters of the control unit 5 can be adapted in the means for adapting the receive and/or transmit parameters 10. Furthermore, the control unit 5 can, for example, request a manufacturer code of the antenna, an extension state of an automatic car antenna, a temperature of a temperature sensor provided within the antenna module 4 or can, for example, configure an antenna preamplifier provided within the antenna module 4.

Claims

1. A method for recognizing a type of an antenna (12), wherein the type of an antenna (12) is recognized by a control unit (5) connected to an antenna module (4) comprising the antenna (12), comprising the following steps:

- sending an electrical antenna identification signal from the control unit (5) to the antenna module (4) comprising the antenna (12),
- sending an electrical antenna reply signal from the antenna module (4) to the control unit (5) in response to the electrical antenna identification signal applied to the antenna module (4), wherein the electrical antenna reply signal from the antenna module (4) comprises an antenna type information signal in a coded form,
- decoding the electrical antenna reply signal received from the antenna module (4) by the control unit (5) for determining the type of the antenna (12) connected thereto,

- adjusting receive and/or transmit parameters of the control unit (5) connected to the antenna module (4) according the type of the antenna (12).

2. A method as defined in claim 1, **characterized in that** the antenna module (4) provides additionally diagnostic data in the antenna reply signal.
3. A method as defined in claim 1 or 2, **characterized in that** the radio frequency information is transmitted in a high frequency band and the antenna identification signal and the antenna reply signal are transmitted in a low frequency band, wherein the low frequency band comprises a frequency range separated and below the high frequency band, wherein the low frequency band is manipulated by the antenna module (4) generating the antenna type information signal in the coded form.
4. A method as defined in claim 3 **characterized in that** the high frequency band comprises frequencies above 1 MHz and the low frequency band comprises frequencies below 1 MHz.
5. Antenna recognition system for recognizing the type of an antenna (12) comprising:
 - a control unit (5) emitting an antenna identification signal
 - an antenna module (4) comprising the antenna (12) and an antenna reply unit (7), the antenna reply unit (7) receiving the antenna identification signal and generating an antenna reply signal comprising a type information of the antenna (12) in a coded form, and
 - a decoder (6) decoding the antenna reply signal and determining the type of the antenna (12) from the antenna reply signal.
6. Antenna recognition system as defined in claim 5, **characterized in that** the antenna reply unit (7) comprises a signal manipulation unit (8) for generating an antenna reply signal comprising a type information of the antenna (12) in a coded form from the antenna identification signal emitted from the control unit (5), wherein the signal manipulation unit (8) is connected to the antenna (12) via an inductor for decoupling high frequency signals received and/or transmitted by the antenna (12) from low frequency signals of the signal manipulation unit (8).
7. An antenna recognition system as defined in claim 6, **characterized in that**,

the signal manipulation unit (8) comprises a resistor (31), wherein the value of the resistor (31) defines the type of the antenna (12).

8. An antenna recognition system as defined in claim 6 or claim 7,

characterized in that,

the signal manipulation unit (8) comprises a RC circuit comprising a capacitor and a resistor, wherein the charging time of the capacitor defines the type of the antenna (12).

9. An antenna recognition system as defined in any one of claims 6-8,

characterized in that,

the signal manipulation unit (8) comprises a multivibrator (52), wherein the frequency of the multivibrator (52) defines the type of the antenna (12).

10. An antenna recognition system as defined in any one of claims 6-9,

characterized in that,

the signal manipulation unit (8) comprises a logic circuit (61) capable of communicating via a predefined protocol, wherein the predefined protocol comprises means to communicate the type of the antenna (12).

11. An antenna recognition system as defined in any one of claims 6-10,

further comprising an antenna cable (3) connecting the control unit (5) and the antenna module (4), wherein

the antenna cable (3) transmits radio frequency information from and to the antenna (12), the antenna identification signal and the antenna reply signal between the control unit (5) and the antenna module (4).

12. An antenna recognition system as defined in claim 11

characterized in that,

the electric power for the antenna module (4) is provided by the control unit (5) and supplied via the antenna cable (3).

13. An antenna module,

comprising

an antenna (12) and an antenna reply unit (7), the antenna reply unit (7) receiving an antenna identification signal and generating an antenna reply signal comprising a type information of the antenna (12) in a coded form.

14. An antenna module as defined in claim 13,

characterized in that

the antenna reply unit (7) comprises a signal manipulation unit (8) for generating the antenna reply sig-

nal, wherein the signal manipulation unit (8) is connected to the antenna (12) via an inductor for decoupling the high frequency signals received and/or transmitted by the antenna (12) from low frequency signals of the signal manipulation unit (8).

15. An antenna module as defined in claim 14,

characterized in that

the signal manipulation unit (8) comprises a resistor (31), wherein the value of the resistor (31) defines the type of the antenna (12).

16. An antenna module as defined in claim 14 or claim 15,

characterized in that

the signal manipulation unit (8) comprises a RC circuit comprising a capacitor and a resistor, wherein the charging time of the capacitor defines the type of the antenna (12).

17. An antenna module as defined in any one of claims 14-16,

characterized in that

the signal manipulation unit (8) comprises a multivibrator (52), wherein the frequency of the multivibrator (52) defines the type of the antenna (12).

18. An antenna module as defined in any one of claims 14-17,

characterized in that

the signal manipulation unit (8) comprises a logic circuit (61) capable of communicating via a predefined protocol, wherein the predefined protocol comprises means to communicate the type of the antenna (12).

19. A transmission device connectable to an antenna module (4),

characterized by comprising

- a control unit (5) emitting an antenna identification signal to the antenna module (4), and
- a decoder (6) decoding an antenna reply signal received from the antenna module and determining the type of an antenna (12) of the antenna module (4) from the antenna reply signal.

20. A transmission system, comprising

- an antenna module (4) as defined in any one of claims 13-18, and
- a transmission device (2) as defined in claim 19.

Amended claims in accordance with Rule 86(2) EPC.

1. A method for recognizing a type of an antenna (12), wherein the type of an antenna (12) is recognized by a control unit (5) connected to an antenna module (4) comprising the antenna (12),
comprising the following steps:

- sending an electrical antenna identification signal from the control unit (5) to the antenna module (4) comprising the antenna (12),
- sending an electrical antenna reply signal from the antenna module (4) to the control unit (5) in response to the electrical antenna identification signal applied to the antenna module (4), wherein the electrical antenna reply signal from the antenna module (4) comprises an antenna type information signal in a coded form,
- decoding the electrical antenna reply signal received from the antenna module (4) by the control unit (5) for determining the type of the antenna (12) connected thereto,
- adjusting receive and/or transmit parameters of the control unit (5) connected to the antenna module (4) according the type of the antenna (12),

characterized in that

the antenna module (4) provides additionally diagnostic data in the antenna reply signal, wherein a radio frequency information to be transmitted or received by the antenna is transmitted in a high frequency band and the antenna identification signal and the antenna reply signal are transmitted in a low frequency band, wherein the low frequency band comprises a frequency range separated and below the high frequency band, wherein the low frequency band is manipulated by the antenna module (4) generating the antenna type information signal in the coded form.

2. A method as defined in claim 1

characterized in that

the high frequency band comprises frequencies above 1 MHz and the low frequency band comprises frequencies below 1 MHz.

3. Antenna recognition system for recognizing the type of an antenna (12) comprising:

- a control unit (5) emitting an antenna identification signal
- an antenna module (4) comprising the antenna (12) and an antenna reply unit (7), the antenna reply unit (7) receiving the antenna identification signal and generating an antenna reply signal comprising a type information of the antenna (12) in a coded form, and

- a decoder (6) decoding the antenna reply signal and determining the type of the antenna (12) from the antenna reply signal,

characterized in that the antenna module (4) provides additionally diagnostic data in the antenna reply signal,

wherein the antenna reply unit (7) comprises a signal manipulation unit (8) for generating an antenna reply signal comprising a type information of the antenna (12) in a coded form from the antenna identification signal emitted from the control unit (5), wherein the signal manipulation unit (8) is connected to the antenna (12) via an inductor for decoupling high frequency signals received and/or transmitted by the antenna (12) from low frequency signals of the signal manipulation unit (8).

4. An antenna recognition system as defined in claim 3,

characterized in that,

the signal manipulation unit (8) comprises a resistor (31), wherein the value of the resistor (31) defines the type of the antenna (12).

5. An antenna recognition system as defined in claim 3 or claim 4,

characterized in that,

the signal manipulation unit (8) comprises a RC circuit comprising a capacitor and a resistor, wherein the charging time of the capacitor defines the type of the antenna (12).

6. An antenna recognition system as defined in any one of claims 3-5,

characterized in that,

the signal manipulation unit (8) comprises a multivibrator (52), wherein the frequency of the multivibrator (52) defines the type of the antenna (12).

7. An antenna recognition system as defined in any one of claims 3-6,

characterized in that,

the signal manipulation unit (8) comprises a logic circuit (61) capable of communicating via a predefined protocol, wherein the predefined protocol comprises means to communicate the type of the antenna (12).

8. An antenna recognition system as defined in any one of claims 3-7,

further comprising an antenna cable (3) connecting the control unit (5) and the antenna module (4), wherein

the antenna cable (3) transmits radio frequency information from and to the antenna (12), the antenna identification signal and the antenna reply signal between the control unit (5) and the antenna module

(4).

9. An antenna recognition system as defined in claim 8

characterized in that,

the electric power for the antenna module (4) is provided by the control unit (5) and supplied via the antenna cable (3).

10. An antenna module, comprising

an antenna (12) and an antenna reply unit (7), the antenna reply unit (7) receiving an antenna identification signal and generating an antenna reply signal comprising a type information of the antenna (12) in a coded form,

characterized in that the antenna module provides additionally diagnostic data in the antenna reply signal,

wherein the antenna reply unit (7) comprises a signal manipulation unit (8) for generating the antenna reply signal, wherein the signal manipulation unit (8) is connected to the antenna (12) via an inductor for decoupling the high frequency signals received and/or transmitted by the antenna (12) from low frequency signals of the signal manipulation unit (8).

11. An antenna module as defined in claim 10,

characterized in that

the signal manipulation unit (8) comprises a resistor (31), wherein the value of the resistor (31) defines the type of the antenna (12).

12. An antenna module as defined in claim 10 or claim 11,

characterized in that

the signal manipulation unit (8) comprises a RC circuit comprising a capacitor and a resistor, wherein the charging time of the capacitor defines the type of the antenna (12).

13. An antenna module as defined in any one of claims 10-12,

characterized in that

the signal manipulation unit (8) comprises a multivibrator (52), wherein the frequency of the multivibrator (52) defines the type of the antenna (12).

14. An antenna module as defined in any one of claims 10-13,

characterized in that

the signal manipulation unit (8) comprises a logic circuit (61) capable of communicating via a predefined protocol, wherein the predefined protocol comprises means to communicate the type of the antenna (12).

15. A transmission device connectable to an antenna

module (4),

characterized by comprising

- a control unit (5) emitting an antenna identification signal to the antenna module (4), and
- a decoder (6) decoding an antenna reply signal received from the antenna module and determining the type of an antenna (12) of the antenna module (4) from the antenna reply signal,

characterized in that the control unit additionally requests diagnostic data of the antenna.

16. A transmission system, comprising

- an antenna module (4) as defined in any one of claims 10-14, and
- a transmission device (2) as defined in claim 15.

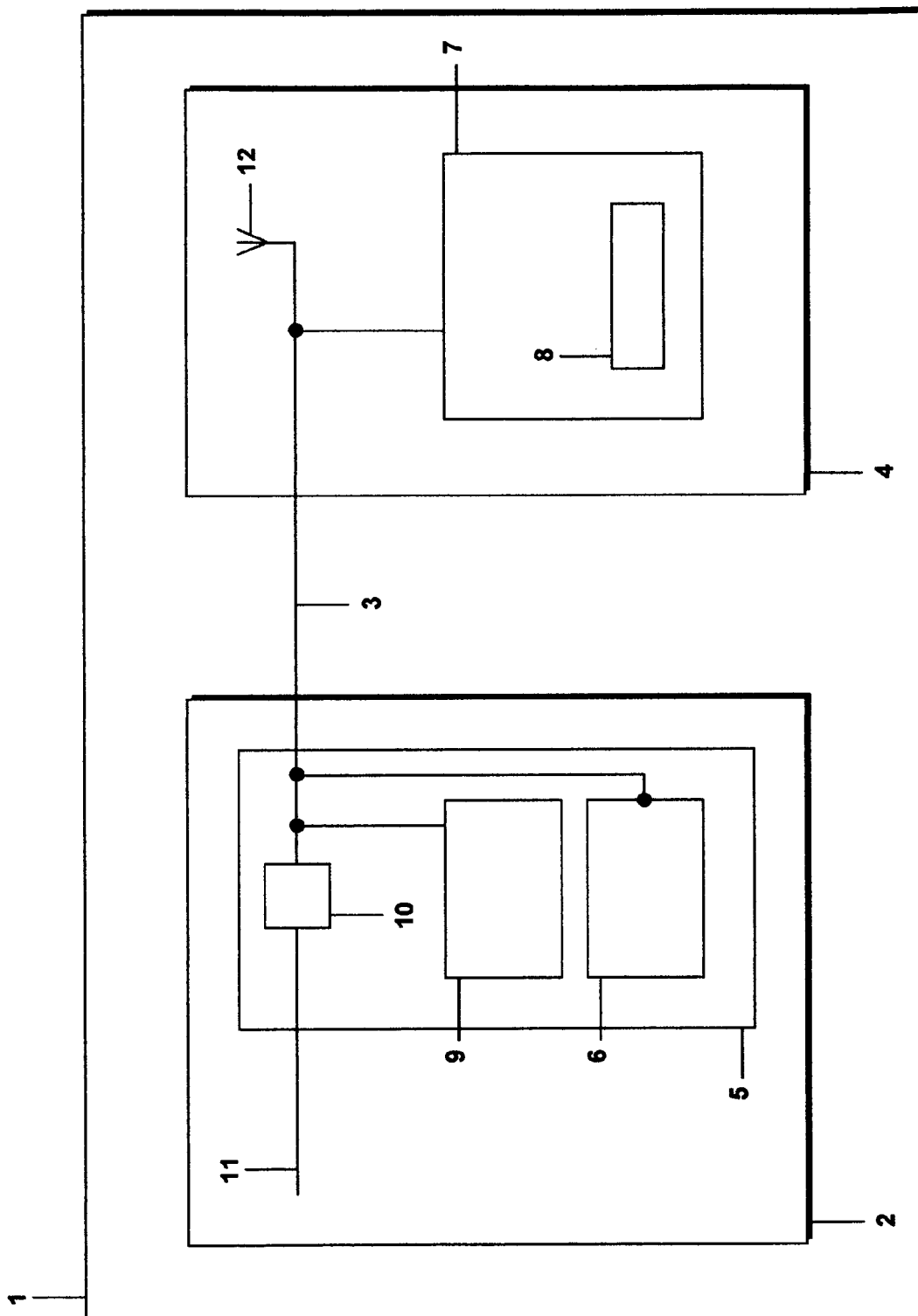


FIG. 1

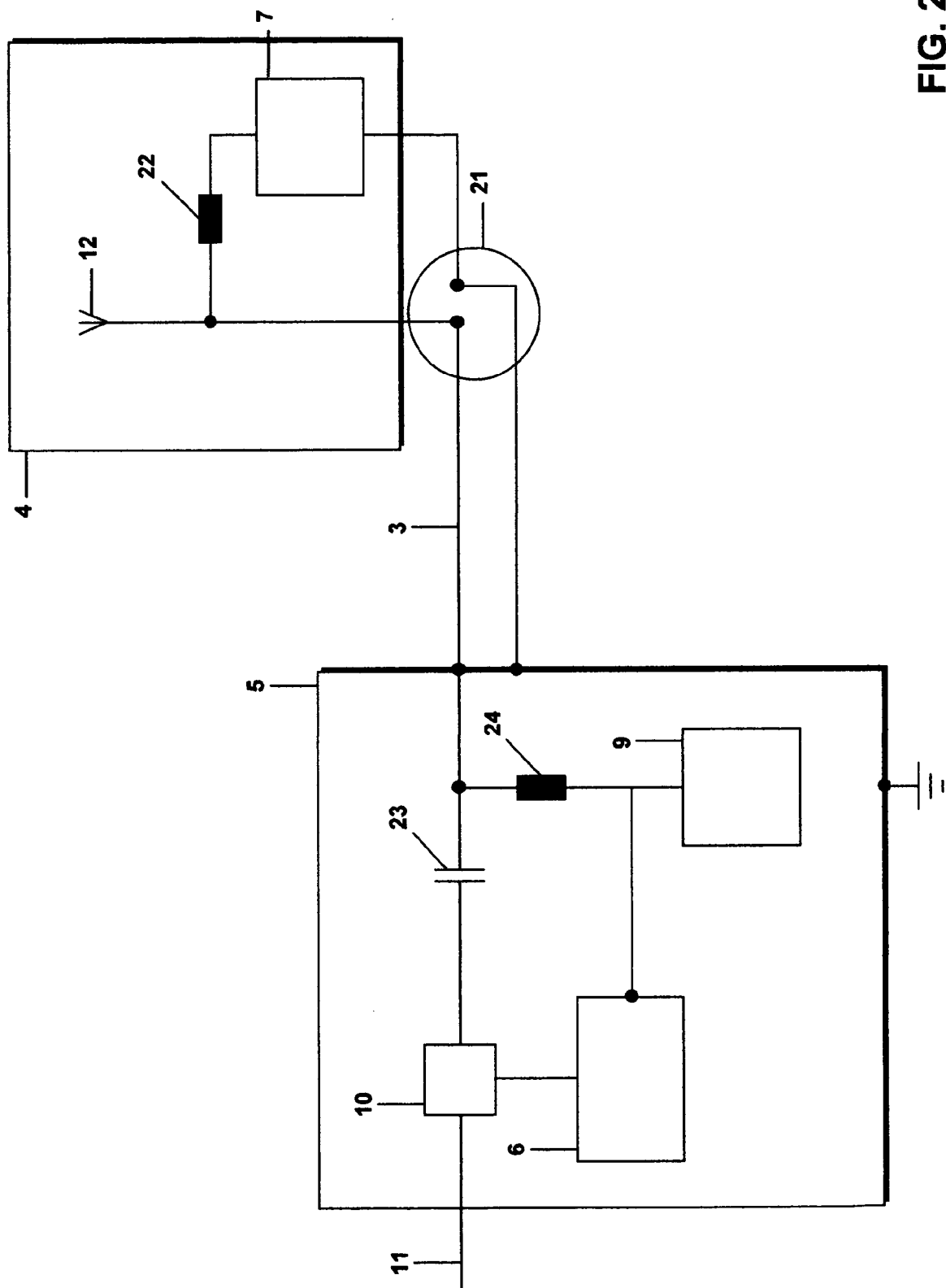


FIG. 2

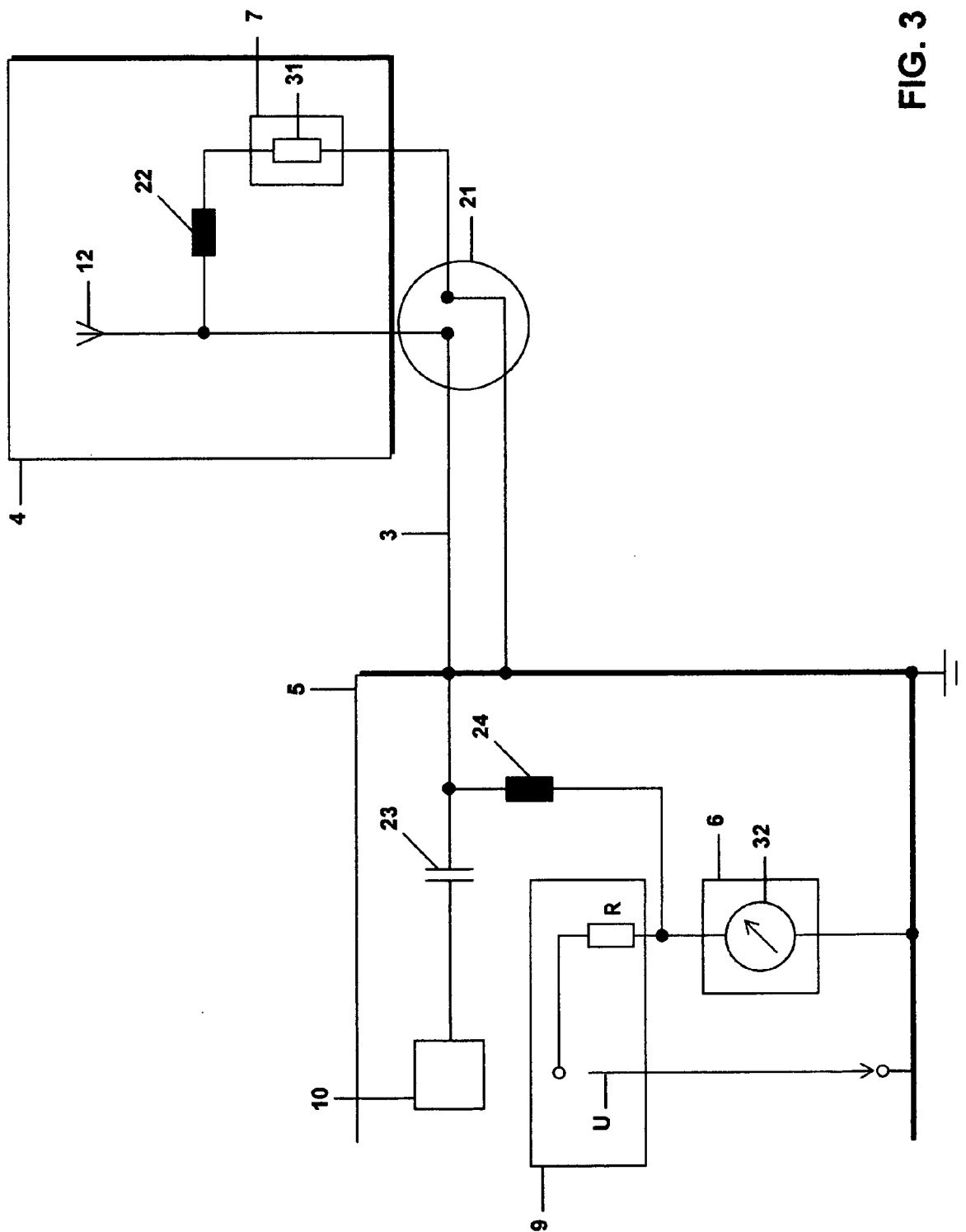


FIG. 3

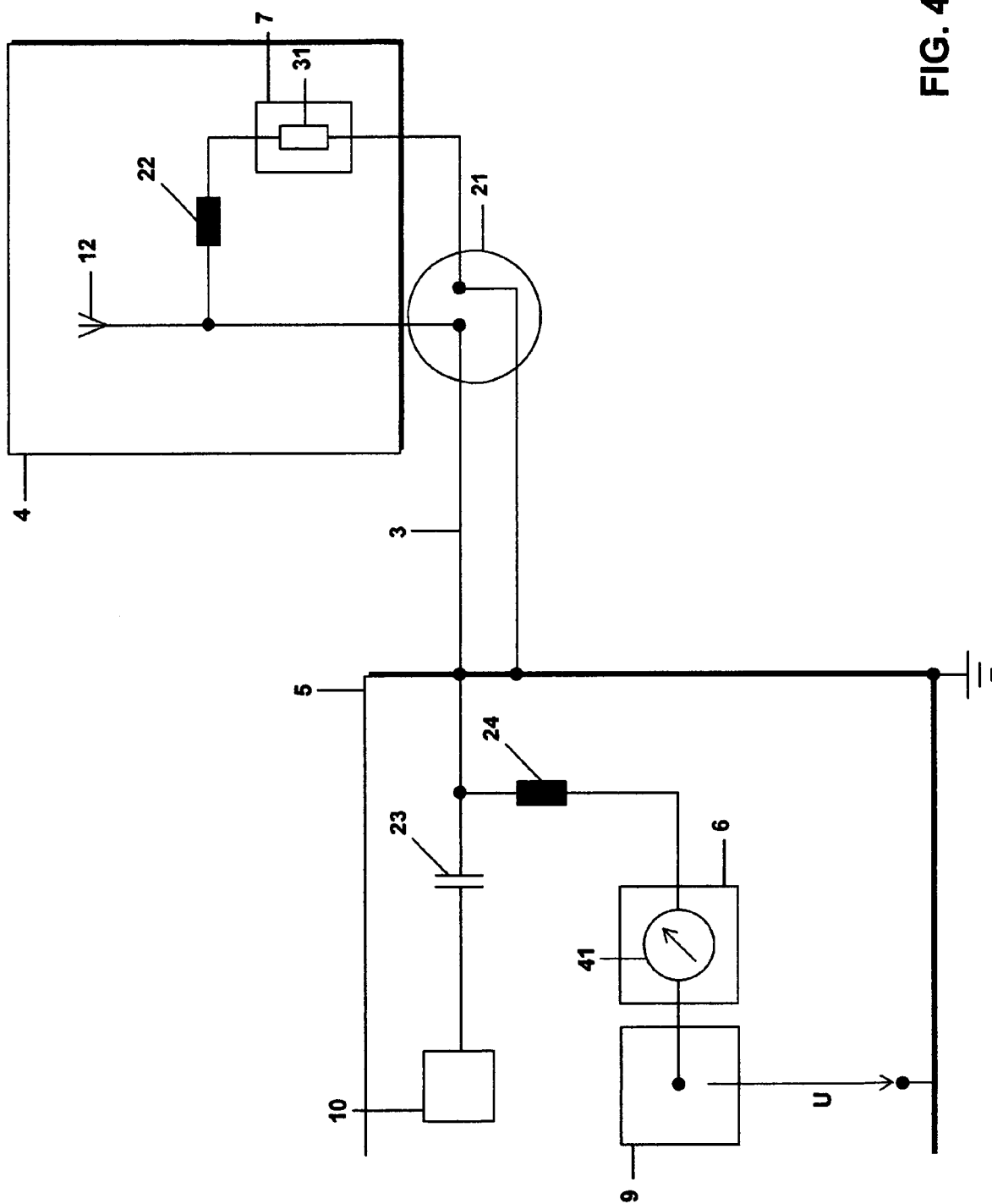


FIG. 4

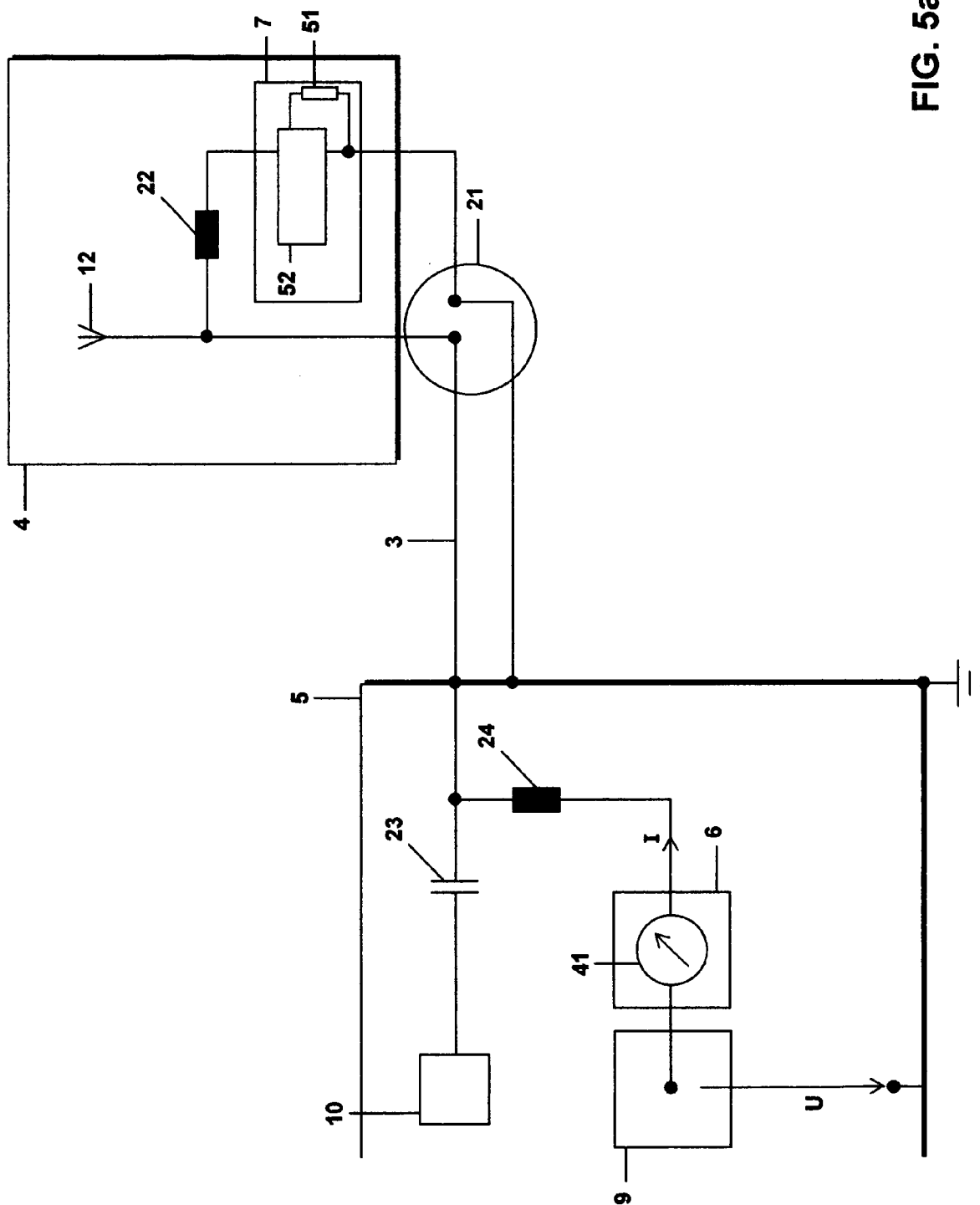


FIG. 5a

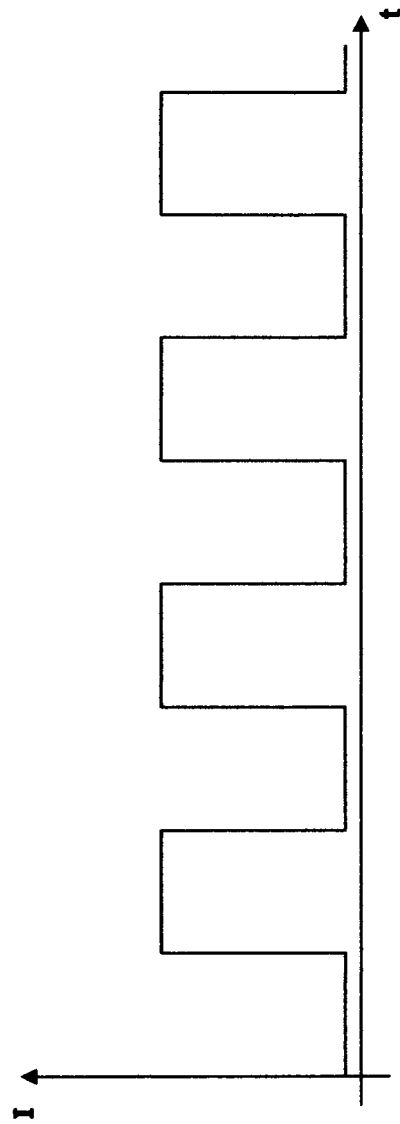
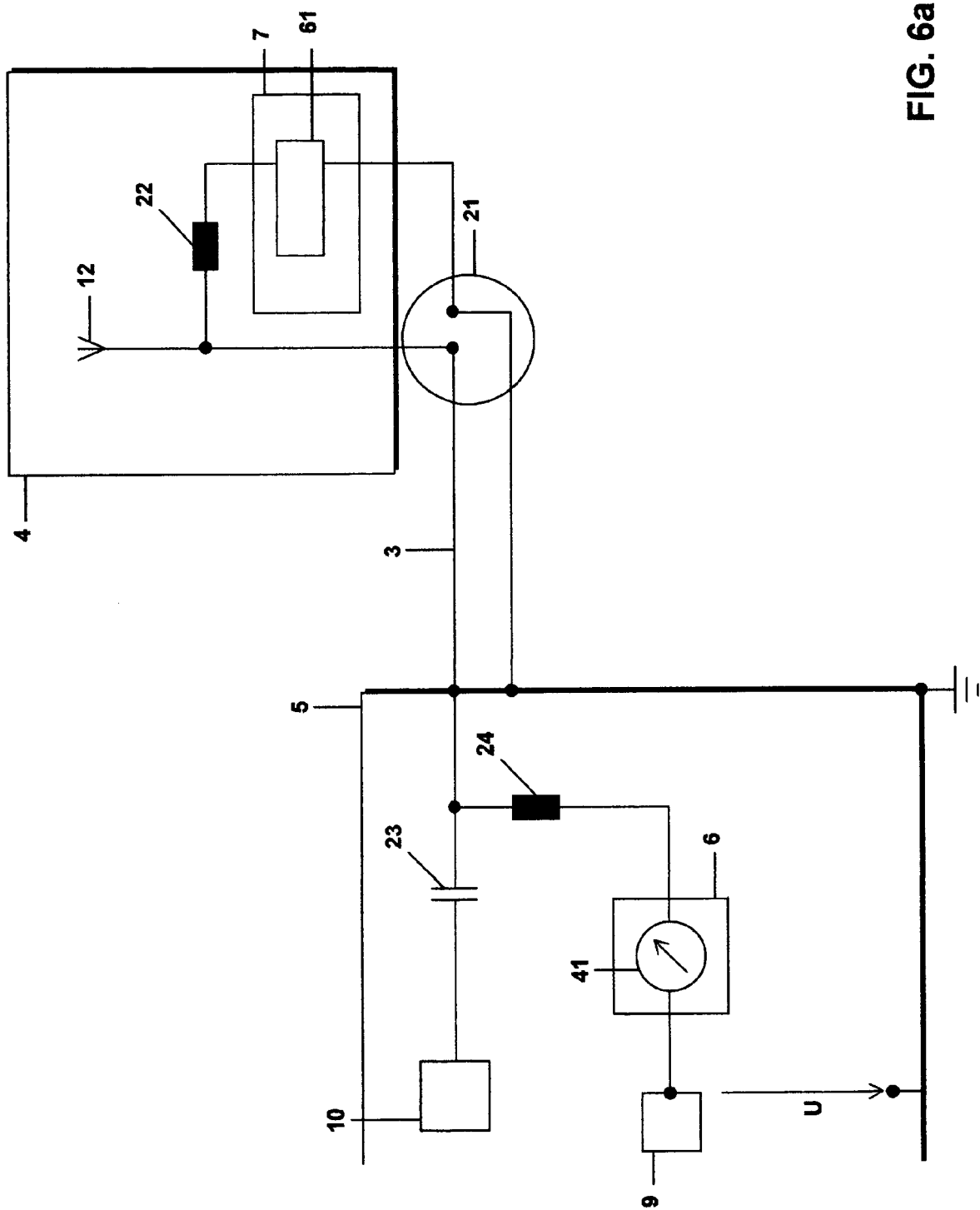


FIG. 5b



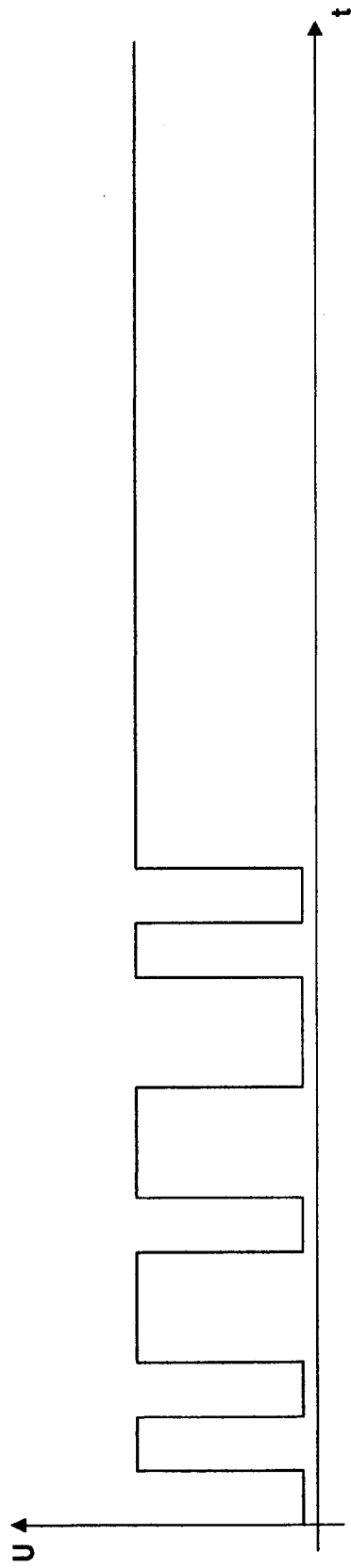


FIG. 6b

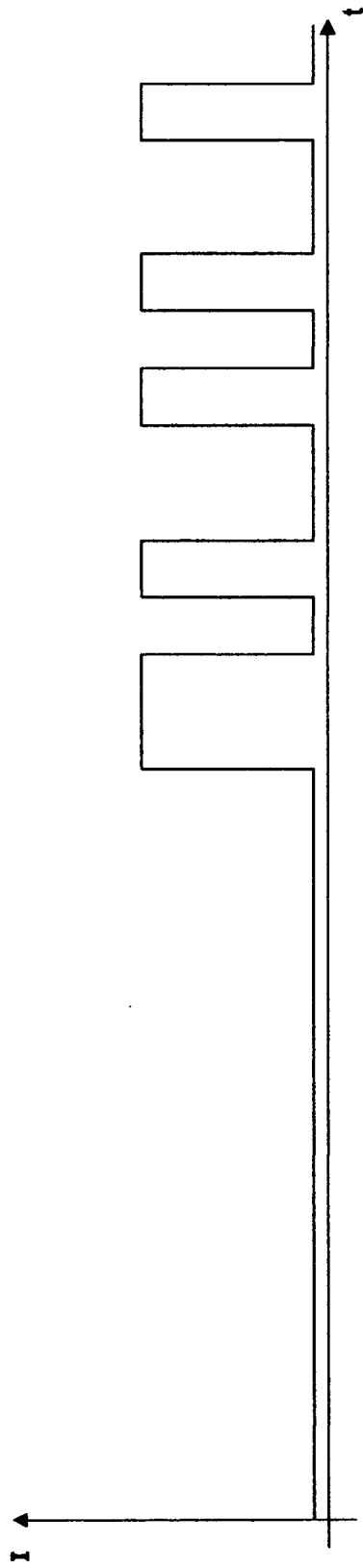


FIG. 6c



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 06 01 1234

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Place of search Munich		Date of completion of the search 13 July 2006	Examiner Saur, E
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
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