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(54) Abstract Title
Antenna coupler for hand-held radio

(57) An antenna coupler 3 for a hand-held radio has a first connector 11 for connection to the radio (1), a second connector (10) for connection to an aerial (2), and a third connector for connection to other equipment such as a vehicle roof-mounted aerial. The third connector may be in the form of bands 14, 15 round the coupler, which are contacted by prongs 28, 29. When the radio (1) is used in the vehicle, it is placed in a cradle (4), and a magnet switches reed switch 18, disconnecting the mobile aerial and connecting the roof-mounted aerial.

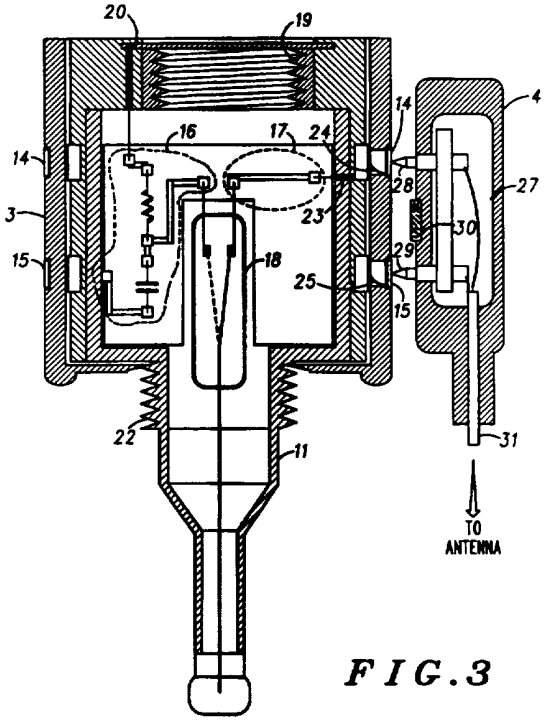

FIG.3

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

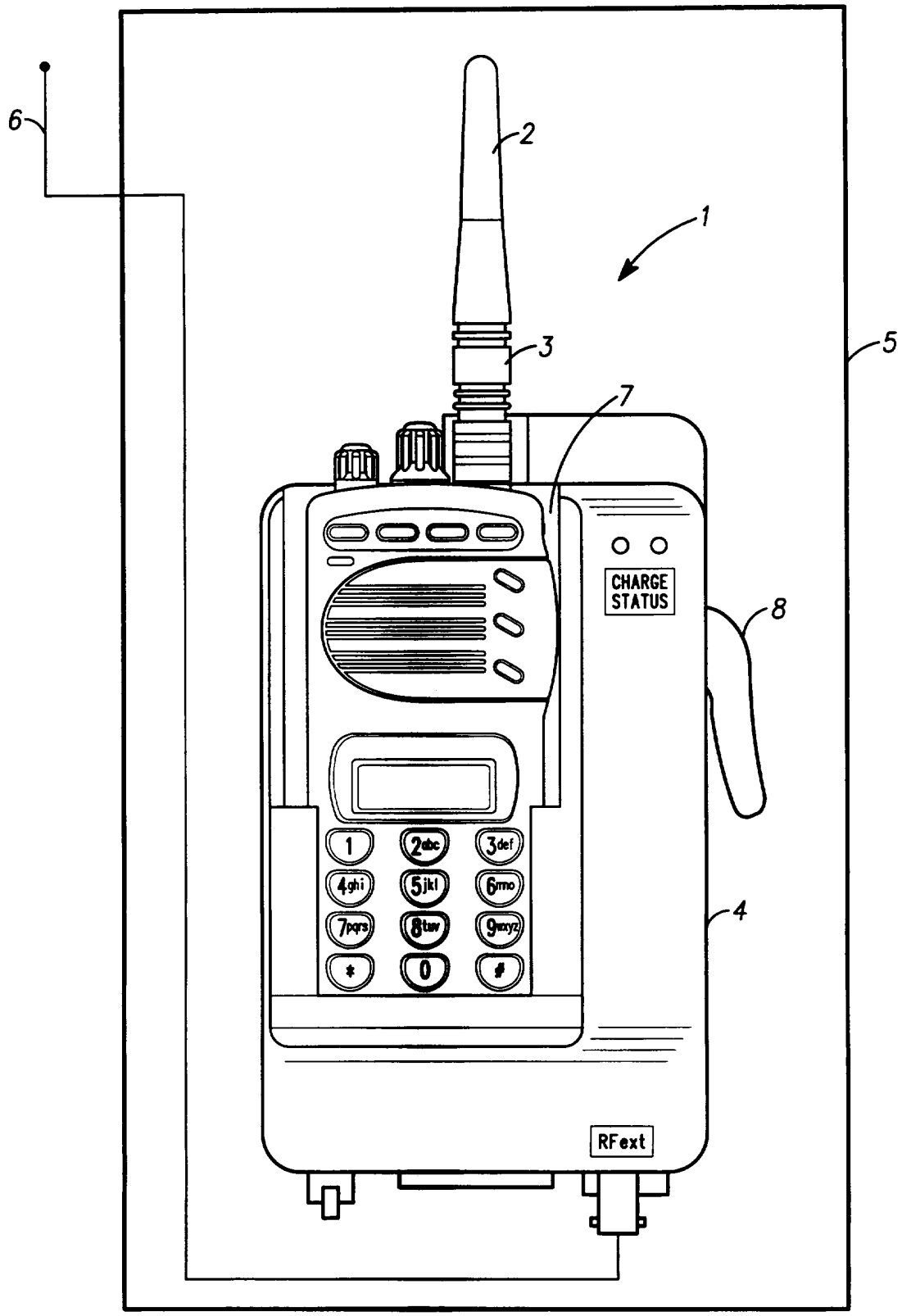

FIG.1

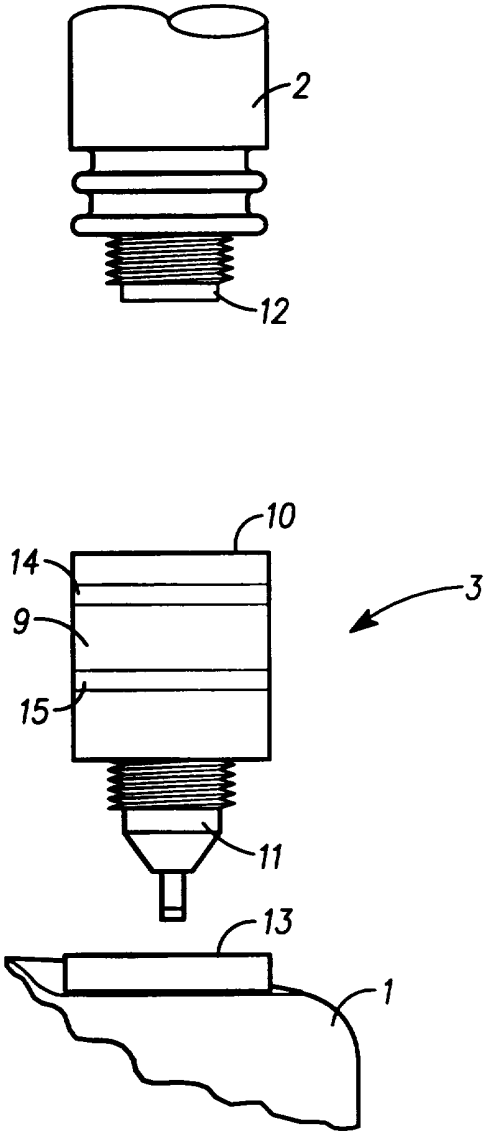

FIG. 2

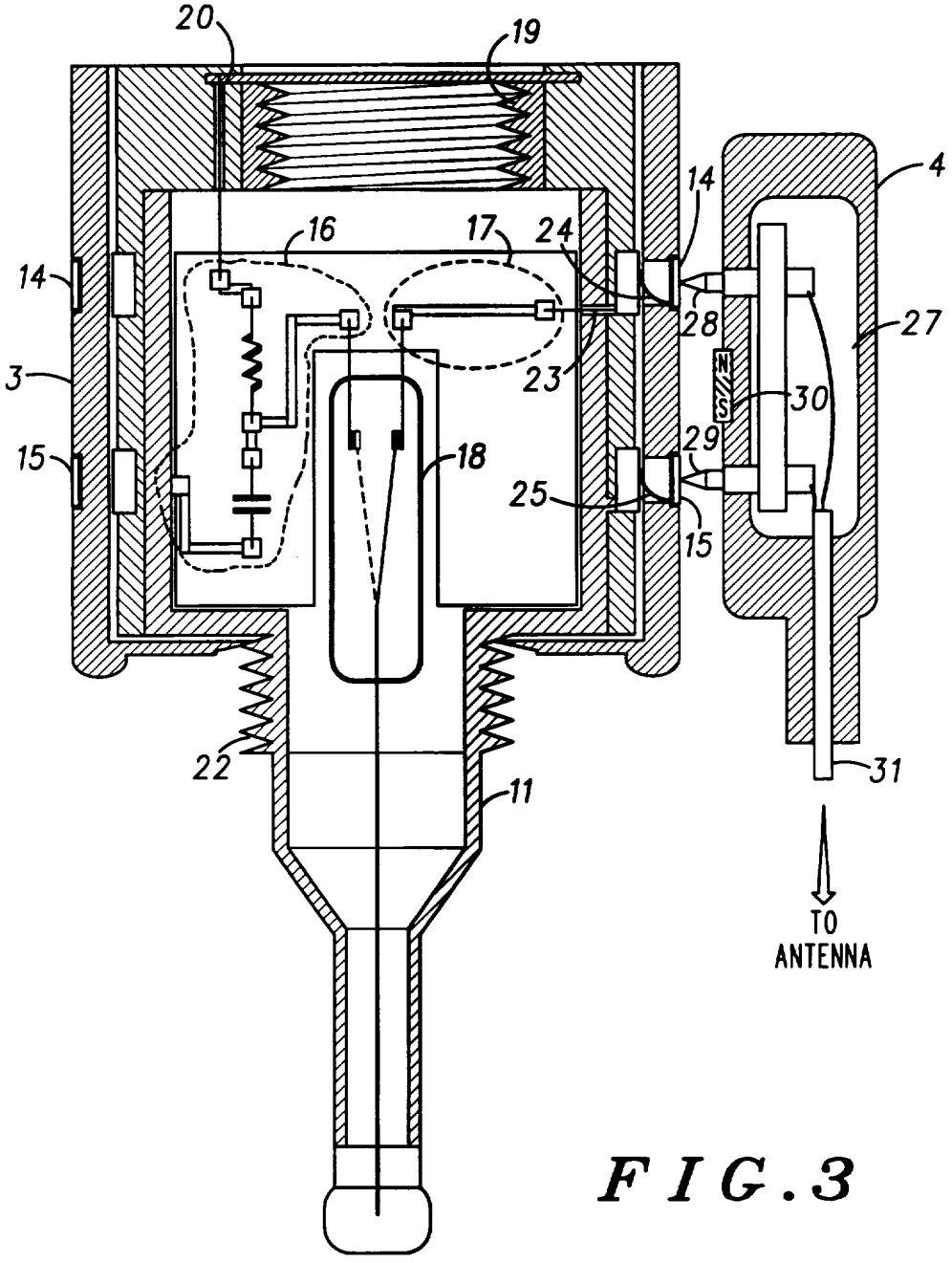

FIG. 3

Antenna Coupler

Field of the invention

This invention relates to an antenna coupler for coupling radio frequency (rf) radiation to and or from an antenna

Background to the invention

Users of two way radio equipment are usually expected to travel in vehicles and also on foot. Such users include police and security personnel and they are typically provided with hand-held radios. When travelling in the vehicle it has been proposed that the hand-held radio is positioned in a cradle fixed to the vehicle. This will enable the radio to utilise the vehicle's battery to conserve its own battery and to utilise a roof mounted antenna to ensure efficient reception and transmission. Other circuitry may be interfaced to the radio by the cradle such as a hands-free microphone and speaker arrangement.

A problem with cradles is that of ensuring an efficient connection of the radio to the vehicle mounted antenna. A number of ways have been proposed which include manual disconnection of the antenna from the port provided for that purpose on the radio and the connection to that port of a coaxial cable the other end of which is connected to the vehicle mounted antenna. Whilst this would result in an efficient connection it is considered to be inconvenient to the user.

Another proposal has been the provision on the radio of a further antenna port which is connected to the vehicle antenna when the radio is placed in the cradle. A problem with this proposal is that the further port requires an additional path in the radio body for the radio frequency (RF) output or input which is undesirable for it takes space and can result in interference to the signals caused by the radio circuitry itself.

The present invention arose in an attempt to alleviate these problems.

Summary of the invention

According to the invention there is provided an antenna coupler comprising a first coupling for, in use, connecting the antenna to a radio device and a second coupling for, in use, coupling the radio device to other equipment.

Preferably, the second coupling comprises at least one connector which extends about the periphery of the antenna coupler.

By the provision of a second coupling comprising at least one connector extending about the periphery of the antenna coupler, coupling connection can be made at more than one location on the periphery. This allows connection to be more easily made .

The connector may extend part of the way about the complete periphery but in the preferred embodiment it extends about the complete periphery. Thus, in the preferred embodiment where the antenna coupler is substantially cylindrical, the connector is formed as an annulus extending in a peripheral circumferential direction of the antenna coupler. This will allow coupling to be made at any point. Consequently, the positioning of the antenna when it is located on the antenna port on the radio is not critical to ensure that the second coupling can be subsequently used. The first coupling can therefore be a screwthread coupling or a push-fit coupling without there being any alignment problems.

In order to facilitate un-coupling of the antenna from the radio device when the second coupling is used to connect the radio to other equipment, a switch is preferably provided. The switch may be located on the radio or a cradle associated with the radio. However, the switch is preferably included in the antenna coupler.

The preferred switch to use is a reed switch. In such a preferred antenna coupler, the reed switch is actuated by the presence of a magnet located at the cradle such that location of the radio device causes the switch to connect the radio device via the second coupling to the other equipment. Alternatively, the switch may be provided in the cradle and the magnet in the antenna coupler.

Brief description of the drawings

Figure 1 shows an antenna coupler in accordance with the invention used to couple a radio device to a roof mounted antenna or to an antenna mounted on the radio device;

Figure 2 shows the antenna coupler, radio device and antenna prior to assembly; and

Figure 3 shows the antenna coupler and a radio cradle in cross-section.

Specific description of a preferred embodiment

With reference to figure 1, a radio device 1 having an antenna 2 with an antenna coupler 3, in accordance with the invention, is shown located in a cradle 4. The cradle 4 is fixed to a dashboard of a motor vehicle 5 having a roof mounted antenna 6.

The radio device 1 is a two way radio which (when not placed in the cradle 4) is usable as a handheld portable radio.

The antenna 2 is a conventional portable radio antenna which is helically wound. It terminates at its lower end (as shown in figure 2) with a conventional male screw-threaded connector 2a.

The cradle 4 comprises a box-like structure having formed in its front face a recess 7.

The recess 7 is shaped to receive the radio device 1 and includes electrical contacts to enable the required type of connection to circuitry in the carrier. The circuitry includes battery charging circuits for charging a battery of the radio device 1 and for connection to a loudspeaker and microphone (not shown) mounted in the vehicle 5.

The recess 7 also includes a locking mechanism to retain the radio device 1 in the recess. This mechanism is operated by means of an external locking lever 8 to lock the radio device 1 into the recess 7 or to subsequently release it.

The antenna coupler 3 is shown in greater detail in figure 2. In figure 2 the antenna 2 is shown disconnected from the coupler 3 which is also shown disconnected from the radio device 1. The coupler 3 has a generally cylindrical body 9 the ends of which are provided with connecting portions. End 10 has a threaded female connector and end 11 has a threaded male connector. In use, the antenna 2 is screwed into threaded engagement with the end 10 by means of the threaded male connector 12. In turn the end 11 is screwed into threaded engagement with a female connector 13 provided in the radio device 1. The coupler 3 has two peripherally extending contact bands 14 and 15. These are formed of gold plated metal and are therefore electrically conductive.

As is shown in figure 3 the contact bands 14 and 15 are in electrical contact with internally located components of the coupler 3. These include a first coupling comprising a coupling circuit 16 and a second coupling comprising a coupling circuit 17. The circuits are formed of transmission lines, resistors and capacitors and are enclosed by a broken line in order that they may be referred to collectively for convenience. The coupler also includes a reed switch 18.

The coupling circuit 16 connects the reed switch 18 to an internally threaded sheath 19 located in the end 10 by means of connection 20. The

coupling circuit 16 is also connected to the ground of the radio by means of the threaded portion 22 of end 11.

The coupling circuit 17 connects the reed switch 18 to the contact band 14 by means of connection 23 and a sprung wiper 24. A similar wiper 25 is provided to connect the ground of the radio to the contact band 15.

The wipers 24 and 25 ensure efficient electrical contact whatever the resultant orientation of the components when the coupler is assembled. (In alternative arrangements the prongs 28 and 29 may connect directly to the bands 14 and 15.

The cradle recess includes a connector pad 27. The connector pad 27 includes two sprung electrically conductive prongs 28 and 29 and a magnet 30. The prongs 28,29 resiliently engage the bands 14,15 when the radio is located in the recess. They connect the bands 14,15 to the earth and inner core of a coaxial cable 31 which in turn is connected to the roof mounted antenna 6.

The reed switch 18 is connected at its remaining terminal to a central core connector 32 of the end 11. The switch 18 interoperates with the magnet 30 such that when the radio is placed in the recess the reed connects the radio via the coupling circuit 17 ,the bands 14 and 15, and the prongs 28 and 29 to the roof mounted antenna 6. When the radio is removed from the cradle the reed of the reed switch returns to its rest position shown in broken outline which results in the radio being connected to the antenna 2 by the circuit 16, connection 29 and threads 19.

Whilst in the above described embodiment two prongs are provided one per band in alternative embodiments more than one prong per band may be used. This may reduce the contact resistance. Circuits 16 and 17 provide matching of the antenna to the radio and this matching may be made frequency dependant.

The coupler may also be used to couple the radio to test equipment by placing the radio into a cradle in which the prongs are connected to the test equipment rather than a further antenna.

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The radio and the coupler will typically be part of a communication system which will include a number of other units mobile and portable.

Claims

1. An antenna coupler comprising a first coupling for, in use, connecting an antenna to a radio device and a second coupling for, in use, coupling the radio device to other equipment.

2. A coupler as claimed in claim 1 wherein the second coupling comprises at least one connector which extends about at least part of the periphery of the antenna coupler.

3. A coupler as claimed in claim 2 wherein the connector extends about the complete periphery.

4. A coupler as claimed in claim 1, claim 2 or claim 3 arranged to interoperate with a switch for switching the coupling of the radio device form the antenna to the other equipment.

5. A coupler as claimed in claim 4 wherein the switch is incorporated into the coupler.

6. A coupler as claimed in claim 4 or claim 5 wherein the switch is a reed switch.

7. An antenna coupler substantially as hereinbefore described with reference to and or as illustrated by the drawings.

8. A radio comprising an antenna coupler as claimed in any preceding claim.

9. A vehicle comprising a radio as claimed in claim 7.

10. A communication system comprising a radio as claimed in claim 8.

Amendments to the claims have been filed as follows

Claims

1. An antenna coupler comprising a first coupling for, in use, connecting an antenna to a radio device and a second coupling for, in use, coupling the radio device to other equipment wherein the second coupling comprises at least one connector which extends about at least part of the periphery of the antenna coupler.

2 A coupler as claimed in claim 1wherein the connector extends about the complete periphery.

3 A coupler as claimed in claim 1, or claim 2 arranged to interoperate with a switch for switching the coupling of the radio device from the antenna to the other equipment.

4 A coupler as claimed in claim 3 wherein the switch is incorporated into the coupler.

5 A coupler as claimed in claim 3 or claim 4 herein the switch is a reed switch.

6. An antenna coupler substantially as hereinbefore described with reference to and or as illustrated by the drawings.

7. A radio comprising an antenna coupler as claimed in any preceding claim.

8. A vehicle comprising a radio as claimed in claim 7.

9. A communication system comprising a radio as claimed in claim 7.

The Patent Office

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Application No: GB 9807670.6
Claims searched: 1 - 10

Examiner: Paul Nicholls
Date of search: 15 July 1998

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including **GB, EP, WO & US** patent specifications, in:

UK Cl (Ed.P): H2E ECAAX, ECSH

Int Cl (Ed.6): H01R 11/01, 13/703, 31/02

Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	GB 1,408,968 A (MOTOROLA) - See figure 1	1, 4-6
X	EP 0,697,771 A1 (ROBERT BOSCH) - See figure 3	1, 4, 5, 8-10
X	WO 93/22846 A1 (TOSHIBA) - See figures 1a, 1b	1, 4-6, 8-10

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.