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Remarks:
This application was filed on 11 - 12 - 1999 as a divisional application to the application mentioned under INID code 62.

(54) A holder and a method for transferring signals between apparatus and holder

(57) The invention related a holder (20) for a hand-held apparatus (11) for emitting radio signals, said apparatus comprising a patch-antenna (9). The holder comprises a patch antenna (19) which is adapted to cooperate with the corresponding patch antenna (9) on an apparatus placed in the holder.

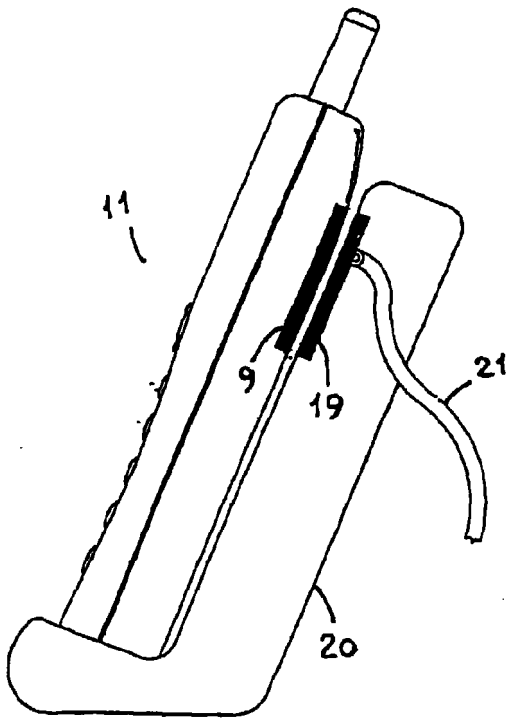

Fig. 6

EP 1 006 606 A1

Description

[0001] The invention relates to a hand-held apparatus comprising antenna means for emitting a radio signal, and to such an apparatus comprising a shield which consists of an insulating material and surrounds some of the electronic components of the apparatus, and which is metallized on the side facing away from the components as well as on the side facing the components in order to shield radio frequency signals. The invention moreover relates to a holder for a hand-held apparatus, provided with a patch antenna, for emitting radio signals, and to a method of transferring radio signals between such an apparatus and a radio installation fixedly mounted in a vehicle.

[0002] In e.g. modern mobile telephone systems the portable transmitter and receiver units are usually provided with antennas which have an omnidirectional radiation diagram, as this gives the greatest possible probability that a connection is established to the mobile telephone concerned at a given time, thereby facilitating the system planning of the system operators. Of course, also the users of the mobile telephones wish that the system has a coverage as good as possible.

[0003] The omnidirectional radiation diagram, however, has the drawback that the telephone will usually be arranged in such a manner with respect to a user's head that the head is present precisely where the electrical field from the antenna of the telephone is strongest. This means that a certain power loss will occur, as part of the radiation energy dissipates in the head, and also involves the risk that precisely this energy dissipation may constitute a health hazard. Because of the possible health hazard in particular, it is therefore desired that the radiation should be directed away from the user's head.

[0004] A proposal for the solution of this problem is known from WO 94/22235, in which a shield element is arranged between the antenna and the user's head. The shield element is intended to absorb, block or reflect the electromagnetic radiation from the antenna. In an alternative embodiment, the shield is an integral part of the antenna itself. However, this solution has the drawback that with the radio frequencies used, which may e.g. be 900 MHz or 1.8 GHz, the extent of the shield in the longitudinal direction is of the same order as the wavelength, which will reduce the effect of the shield since its outermost end will act as an antenna to some extent. Since, in this solution, the radiation is mainly directed away from the user's head, the transmission/reception conditions of the telephone will moreover be impaired, unless a base station is present precisely in this direction. Therefore, the solution is useful only in areas where the base stations are located so close to each other that there will always be a sufficiently close base station in the direction concerned.

[0005] Another solution is known from WO 95/24746. Here, a so-called inverted F-antenna is placed on the rear side of the telephone so that the free end of the telephone is present at the end of the telephone which is positioned against the user's ear in use. This means that here too the radiation from the antenna is mainly directed way from the user's head, and the solution therefore makes the same requirements with respect to the locations of the base stations as described above.

[0006] It is also known to provide a mobile telephone with two different antennas. US 5 530 919, e.g., describes an apparatus which has a built-in directional antenna and a rod antenna. The directional antenna is used as a transmitter antenna and the rod antenna as a receiver antenna. This apparatus, too, therefore relies on the presence of a base station in the direction in which the directional antenna is oriented, as the apparatus can only transmit in this direction. On the other hand, the rod antenna enables reception from all directions.

[0007] Also EP 214 806 describes an apparatus with a built-in directional antenna and a rod antenna. Both antennas are used here as receiver antennas in order to obtain receiver diversity, while only the rod antenna is used as a transmitter antenna. Thus, this apparatus does not avoid radiation into the user's head.

[0008] Accordingly, an object of the invention is to provide a solution which, under poor transmission/reception conditions, is capable of transmitting and receiving with a quality which corresponds to the normal mobile telephones having omnidirectional radiation characteristic, while exposing the user's head to the least possible radiation risk.

[0009] This is achieved according to the invention in that the hand-held apparatus for emitting a radio signal comprises at least two transmitter antennas which have different radiation characteristics.

[0010] Consequently, it is possible to use one or both antennas depending on the reception conditions. It may be ensured in this manner that the user's head is exposed to radiation only when this is necessary owing to the transmission/reception conditions.

[0011] This is possible in particular when one transmitter antenna, as stated in claim 2, has an omnidirectional radiation characteristic, and the other has a directional radiation characteristic. The antenna having omnidirectional radiation characteristic is then used only when it is necessary owing to the transmission/reception conditions.

[0012] In an expedient embodiment of the invention, which is defined in claim 3, the antenna having omnidirectional radiation characteristic is a telescoping antenna, while the antenna having directional radiation characteristic is a patch antenna.

[0013] The telescoping antenna may be adapted to be connected only when it is extended fully or partly, as stated in claim 4. Hereby, it is the user himself who decides whether the transmission/reception conditions are so poor that it is necessary to connect the telescop-

ing antenna.

[0014] Alternatively, as stated in claim 5, the apparatus may comprise means for connecting and disconnecting the telescoping antenna in response to a received signal. This may take place e.g. in that a base station, when it is difficult for it to receive the signal emitted from the apparatus, requests the apparatus to connect the telescoping antenna. Another possibility, which is defined in claim 6, is that the apparatus comprises means for measuring the field strength of a signal received on the patch antenna, and that the telescoping antenna is adapted to be connected only when said field strength is below a specific value, the received signal level being then used as an indicator of whether the transmitted signals are sufficiently strong in a direction toward the base station. This is possible since the apparatus normally transmits to and receives from one and the same base station.

[0015] Particularly as regards mobile telephones, a small and handy size is of great importance, and this therefore makes it necessary that the two antennas must be capable of being integrated in the apparatus without this adding considerably to the size of it. Since the omnidirectional antenna is already included in the design of most existing apparatuses, this means that it must be possible to incorporate the directional antenna without changing the design of the apparatus considerably.

[0016] The above-mentioned US 5 530 919 discloses an apparatus which has an incorporated antenna and a shield which is disposed between the antenna and the user's head. However, they are two separate components which therefore still take up some space. Accordingly, a further object of the invention is to provide an apparatus having a built-in patch antenna which takes up less space than in the known devices.

[0017] This is achieved, when the apparatus, as stated in claim 7, comprises a shield which surrounds some of the electronic components of the apparatus and consists of an insulating material metallized on the side facing away from the components as well as on the side facing the components, in that at least part of the metallization facing away from the components constitutes a patch antenna which is adapted to transmit and/or receive said radio signals.

[0018] Typically, devices of this type will be provided with a shield against radio frequency signals. It will usually be a metallized plastics shield which is metallized on both sides for reasons of production, so that in fact it is a double shield. When the outer side of the shield (or part thereof) is used as a patch antenna, the inner side of the shield can still serve the function of a shield against radio frequency signals, as stated in claim 8, while constituting the ground plane associated with the patch antenna.

[0019] Since the radiation diagram from such a patch antenna will be very directional, the desired radiation diagram is achieved in that the patch antenna, like in claim 9, is disposed on the side of the apparatus which, when used by a person, faces away from the person. For a mobile telephone, this will be the rear side of the telephone. The directional effect is achieved because the other metal parts and printed circuit boards of the telephone perform a shielding effect toward the person.

[0020] When hand-held devices for the emission of radio signals, such as e.g. portable mobile telephones, are used in cars, the telephone is frequently connected to an antenna on the roof of the car in order to increase the range of the telephone. The transport of radio frequency signals between the car telephone and the external antenna of the car usually takes place via coaxial cables, typically in that the telephone has a coaxial connector in the bottom to which the external antenna of the car is connected. In practice, this is inexpedient, however, as the coaxial connectors concerned are relatively expensive and also rather fragile and thus subjected to wear.

[0021] When, as stated in claim 10, a holder for such an apparatus is provided with a patch antenna which is adapted to cooperate with the corresponding patch antenna on an apparatus placed in a holder, it is ensured that the radio frequency signals can be transferred wirelessly between the two patch antennas, thereby avoiding the use of coaxial connectors.

[0022] When, moreover, as stated in claim 11, the holder comprises means for ensuring a specific position of the two patch antennas with respect to each other when an apparatus is placed in the holder, the best possible transfer of signals is obtained between the two patch antennas, as these will be positioned in the same manner with respect to each other each time.

[0023] Finally, the invention relates to a method of transferring radio signals between a hand-held apparatus and a radio installation fixedly mounted in a vehicle, comprising transferring the signals between two patch antennas which are placed in the apparatus and a holder therefor, respectively.

[0024] The invention will now be explained more fully below with reference to the drawing, in which

fig. 1 shows part of a circuit in an existing mobile telephone,

fig. 2 shows the structure of a patch antenna according to the invention,

fig. 3 shows the radiation from a mobile telephone having a patch antenna according to the invention,

fig. 4 shows the radiation from a mobile telephone having a patch antenna as well as an activated telescoping antenna,

fig. 5 shows a block diagram for an alternative embodiment of the invention, and

fig. 6 shows a mobile telephone placed in a specially adapted holder having a path antenna.

[0025] It is shown in fig. 1 how part of the circuit in existing mobile telephones may be designed. A printed circuit board 1 mounts a plurality of electronic components 2, and owing to incident and emanating radiation of radio frequency signals the components are surrounded by a shield 3, which typically consists of a plastics material 4 provided with a metallization 5, 6 on both sides. Metallization on one of the sides will normally be sufficient to perform the shielding function; but, generally, the shield will be metallized on both sides for reasons of production. This means that the metallization on the outer side may be used for other purposes.

[0026] It is shown in fig. 2 how this may be utilized for a patch antenna according to the invention. The metallization 6 is still present on the inner side of the plastics material 4, while the metallization 5 from fig. 1 on the areas 7 and 8 is removed. The metallization constitutes a patch antenna 9 on the central part of the outer side. This patch antenna, inter alia because of the shielding metallization 6, will particularly radiate radio frequency signals in a direction away from the plastics material 4 and thereby away from the components 2. The printed circuit board 1 itself and the other metal parts of the telephone will provide a further shielding effect in the opposite direction. Fig. 3 shows that when the shield 4 with the patch antenna 9 is placed on the rear side 10 of a telephone 11, a radiation diagram is obtained where the radiation 12 is directed away from the person 13 who uses the telephone. It will be seen that the telephone 11 is also provided with a rod antenna 14 which, in this situation, is not connected and therefore does not emit radio signals.

[0027] As appears from fig. 4, the rod antenna 14 may be arranged as a telescoping antenna which is connected only when it is extended. In that case, it has an omnidirectional radiation diagram, which means that when it is extended, the telephone 11, generally speaking, emits (and receives) radio signals equally well in all directions, and thus also in the direction of the person 13. The idea is thus that in areas having sufficient radio coverage, the radiation 12 from the patch antenna 9 will be sufficient to ensure connection, as there will usually be a sufficiently close base station in the direction of the radiation 12. The telescoping antenna 14 may thus be retracted and thereby be disconnected. Then, the person 13 will not be exposed to the strong radiation from the telephone. This corresponds to the situation shown in fig. 3.

[0028] In areas where the radio coverage is not good enough for this, the antenna 14 may then be extended and thereby connected so that the telephone 11 has the omnidirectional radiation diagram with the radiation 15. In this situation, which corresponds to fig. 4, the person 13 is exposed to radiation in the same manner as in ordinary mobile telephones which are just provided with an omnidirectional antenna; but, as mentioned, this will just be the case where the radio coverage is not very good. In practice, the radio coverage in urban areas will usually be sufficient for the situation in fig. 3 to be used, thereby avoiding exposing the person to the incident radiation, while outside the urban areas it will typically be necessary to supplement with the telescoping antenna and the associated incident radiation of radio energy. For the great majority of subscribers, the radiation to which they are exposed will thus be reduced considerably.

[0029] In the embodiment described above, the omnidirectional antenna 14 is thus connected in that the user himself extends it when the transmission/reception conditions so require. Fig. 5 shows a block diagram for an alternative embodiment. The signal to and from the antenna 4 is here connected to the transmitting/receiving circuit 16 of the telephone via a switch 17. A detecting circuit 18 can measure the field strength of a signal received on the patch antenna 9 and control the switch 17 in response thereto. If the field strength is above a predetermined threshold value, the connection between the antenna 14 and the transmitting/receiving circuit is disconnected, while, correspondingly, this connection is established when the field strength of the received signal is below this threshold value. Thus, the antenna 14 is connected only when the signal received on the patch antenna 9 is too low to ensure a good connection. Since transmission takes place to one and the same base station, the signal received will frequently be a sufficiently good indicator of whether the emitted signal is sufficiently strong. If, in this situation too, the antenna 14 is a telescoping antenna, the full effect of this principle is achieved only if the antenna is extended, of course.

[0030] Alternatively, a special signal may be transmitted from the base station to the telephone if the signal received therefrom is too weak, and the detecting circuit 18 may then be adapted to receive this signal and control the switch 17 in response thereto. Hereby, it will be the signal received on the base station that decides whether it is necessary to connect the omnidirectional antenna 14.

[0031] With the patch antenna, described above, on the rear side of the telephone, it is also possible to obtain a much simpler connection to an external antenna in e.g. a car than has been possible in the past. An external antenna on e.g. the roof of the car is used for increasing the range of the telephone. Till now, the transfer of the radio frequency signals between the mobile telephone and the external antenna has usually taken place by means of coaxial cables, as the telephone e.g. has a coaxial connector in the bottom to which the external antenna may be connected.

[0032] According to the invention, however, the coaxial tables may be replaced by two patch antennas arranged opposite to each other, as will be seen in fig. 6. The holder 20, also called cradle, of the telephone is provided with a patch antenna 19 whose size corre-

sponds to the size of the patch antenna 9 in the telephone, and which is arranged so that it will be right opposite it when the telephone is placed in the holder. The patch antenna 19 is connected to the external antenna by means of the cable 21. The holder 20 may moreover be provided with e.g. guide rails capable of ensuring that a telephone is always placed in the holder such that the two patch antennas are right opposite each other and at a well-defined distance from each other.

[0033] The radio frequency signals are thus transferred wirelessly between the two patch antennas. This means that the coaxial connectors may be saved, while obtaining a solution which is not subjected to wear, as is the case with the coaxial connectors.

[0034] Although a preferred embodiment of the present invention has been described and shown, the invention is not restricted to it, but may also be embodied in other ways within the subject-matter defined in the following patent claims.

Claims

1. A holder (20) for a hand-held apparatus (11) for emitting radio signals, said apparatus being provided with a patch-antenna (9), characterized in that the holder comprises a patch antenna (19) which is adapted to cooperate with the corresponding patch antenna (9) on an apparatus placed in the holder.

2. A holder according to claim 1, characterized in that it moreover comprises means for ensuring a specific position of the two patch antennas (9, 19) with respect to each other when an apparatus is placed in the holder.

3. A method for transferring radio signals between a hand-held apparatus (11) for emitting such radio signals and a radio installation fixedly mounted in a vehicle, characterized in that the signals are transferred between two patch antennas (9, 19) which are placed in said apparatus and a holder (20) therefor, respectively.

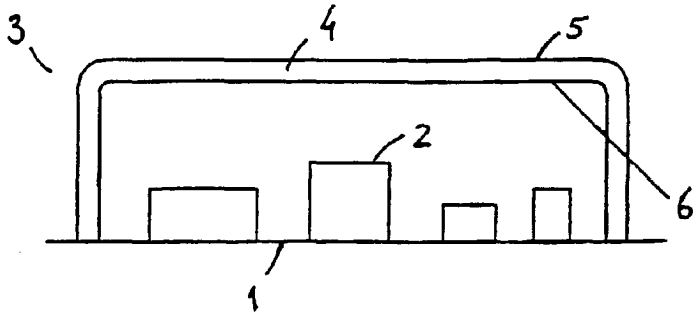

Fig. 1

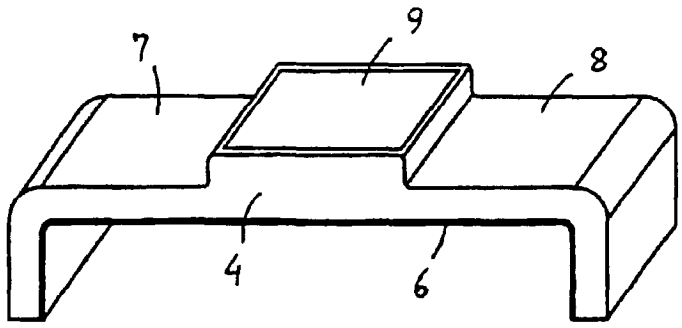

Fig. 2

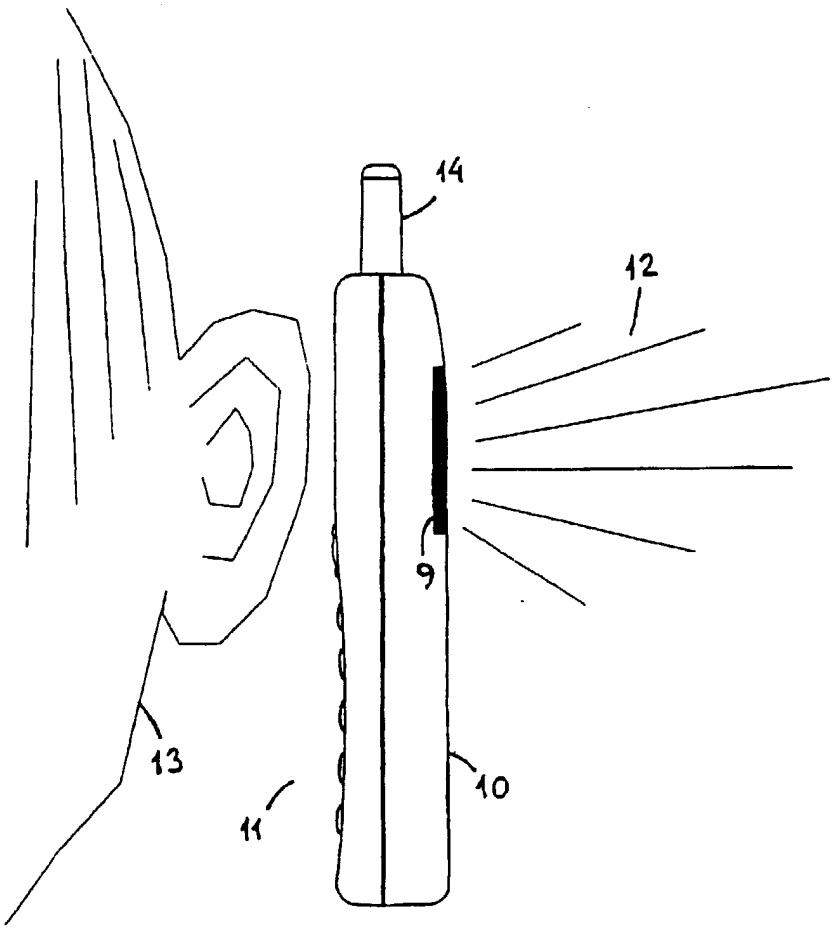

Fig. 3

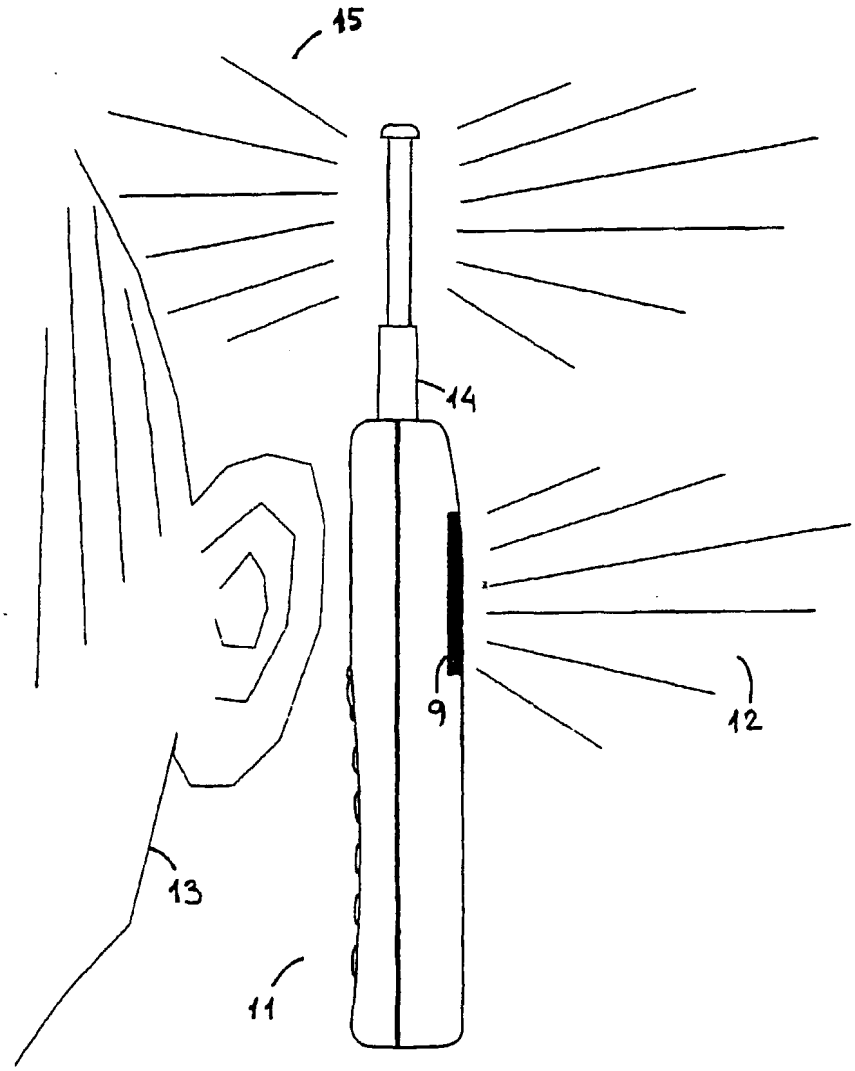

Fig. 4

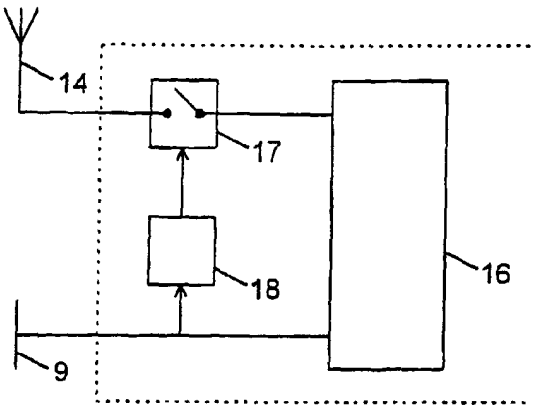

Fig. 5

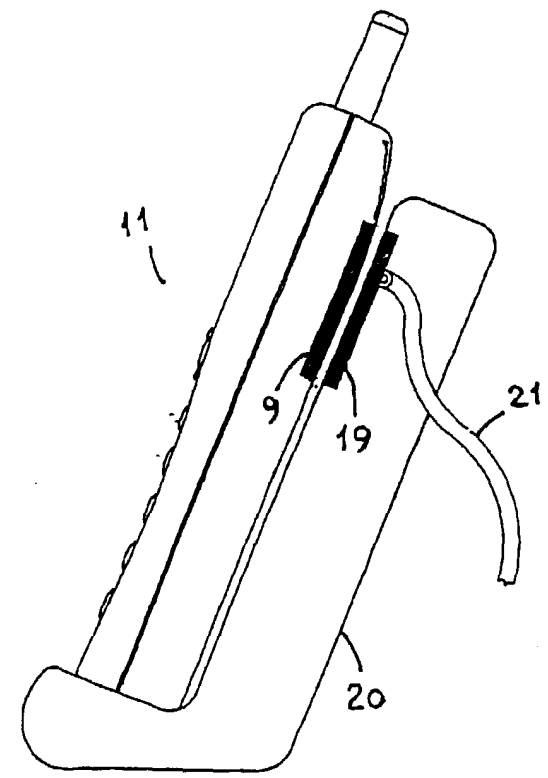

Fig. 6

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 12 4721

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 5 239 669 A (MASON ET AL.) 24 August 1993 (1993-08-24) * column 2, line 19 - column 3, line 7; figures 1-5B * ---	1-3	H01Q1/24 H01Q1/32 H04B1/38 H04Q7/32
X	GB 2 266 997 A (LES WALLEN MANUFACTURING) 17 November 1993 (1993-11-17) * page 3 - page 5; figures 1-3 * ---	1-3	
A	US 4 829 591 A (HASHIMOTO ET AL.) 9 May 1989 (1989-05-09) * abstract; figure 1A * ---	1-3	
E	WO 97 48147 A (ERICSSON) 18 December 1997 (1997-12-18) * page 4 - page 6; figures 3,4 * -----	1-3	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

H01Q
H04B
H04Q

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	7 April 2000	Angrabeit, F

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 99 12 4721

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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