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(54) **Snap-fit antenna for portable communications devices**

(57) An antenna is provided with a snap-fit attachment. The configuration of the snap-fit feature allows the antenna to be clipped into the back cover of the portable device. By this means the direction of installation of the

antenna is normal to the main printed circuit board of the device and a reduction in components is achieved. The installation of this antenna into the device is in the direction preferred for manufacturing assembly and testing.

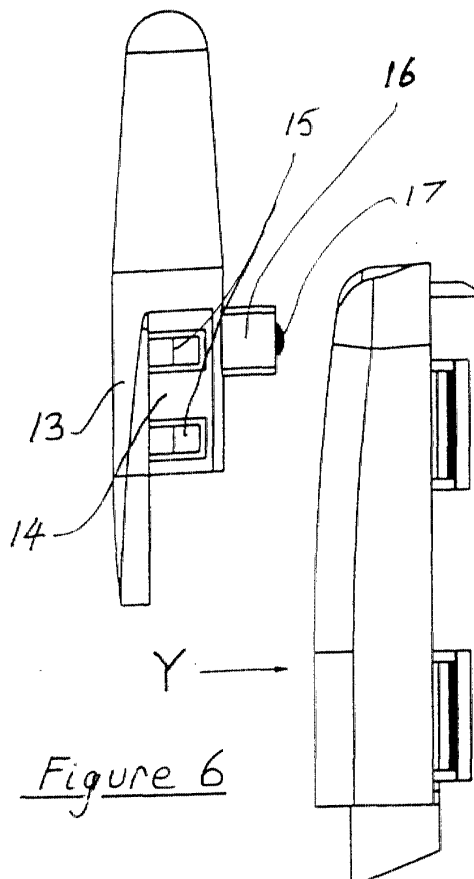


Figure 6

EP 1 146 588 A2

Description

[0001] This invention relates to antennas for use with portable communication devices such as mobile phones.

[0002] A robust design is necessary for portable communication devices because of the harsh treatment inflicted on these devices during normal daily use. Some antennas are enclosed within the housing of the device and are afforded protection from physical damage by the housing. Many antennas, however protrude from and stand proud of the housing and therefore are particularly susceptible to damage. Amongst prospective customers for portable communication devices there is an expectation of low purchasing costs. There exists also a highly competitive market for mobile phones and the like acting as a spur to reduce manufacturing costs further.

[0003] The design and placement of an antenna for a radiotelephone is affected by a number of factors including performance in radio transmission and reception, size, weight and ease of manufacture and assembly into the communication device. Reductions in costs for manufacturing are related, *inter alia*, to the number of components in a particular sub-assembly and the time taken to incorporate the sub assembly into the communication device.

[0004] Extendable antenna assemblies are prone to breakage and presently, so called stub antennas are favoured. These stub antennas are less susceptible to breakage and generally are more convenient for the user of the communication device. Owing to the expectation of antenna breakages arising from previous designs some existing designs embody features to allow easy replacement of the antenna. A snap-in feature has often been used to provide for ease of replacement for antennas and other components or sub-assemblies.

[0005] Some prior art antennas with snap-in features are discussed in US 5 343 213 to Kottke, US 5 949 386 to Elliott, US 5 809 135 to Chang and GB 2 308 013 assigned to Nokia Mobile Phones Limited. Kottke provides resilient members depending co-axially from the antenna section for temporary engagement with the housing via snaps included in the resilient members. The extendable antenna is fitted in an axial direction. Elliott also provides for a snap fit of an antenna by pushing the antenna into the housing in an axial direction. A snap fit attachment in an axial direction is provided by Chang to allow connection of a mobile phone to a car antenna. The snap fit antenna mounting of GB 2 308 013 operates in an axial direction.

[0006] With regard to electronic devices it is axiomatic for manufacturers and suppliers to discourage users from breaking the integrity of the main housing. Owing to the damage sustained by prior art antennas, however, it is usual for the snap fit mechanisms for antennas to provide for easy release from outside of the main housing. Provision of an external release feature detracts

from a firm attachment.

[0007] When antennas are inserted into the housing for attachment in an axial direction it is necessary to provide additional components to secure the electrical path from antenna to the internal circuits. The distance from the antenna contact to the internal circuits via a PCB within the main housing may be small but additional components with the attendant cost and assembly complications are required nevertheless. The PCT pamphlet WO 99/50927 to Allgon AB discusses the problems associated with bridging the gap between antenna and PCB and provides a means for interconnection.

[0008] It is an object of the invention to provide for a portable communication device an antenna incorporating features for simple and firm attachment to a communication device and requiring fewer components than heretofore.

[0009] According to the invention there is provided a snap-fit antenna for a portable communication device, the antenna having attachment means and the device having a receptacle for receiving the antenna and engaging the attachment means wherein the antenna engages with and is secured within the receptacle in response to a lateral movement of the antenna toward the receptacle.

[0010] An example of the invention will now be described with reference to the accompanying drawings in which like reference numerals identify identical elements and in which:

figure 1 shows a rear view of a mobile phone housing with antenna in accordance with the prior art,

figure 2 is a cross section through A-A of figure 1,

figure 3 is rear view of the antenna mounted in a phone,

figure 4 is a side elevation of figure 3,

figure 5 is an isometric view of the antenna assembled into the phone,

figure 6 is a side view of the antenna before assembly,

figure 7 is a cross section through B-B of figure 3,

figure 8 is an isometric view of the antenna before assembly.

[0011] With reference to figures 1 and 2 representations of a prior art antenna and mounting are shown. A main housing **1** has an integrally formed mounting **2** for support of the antenna **3**. The prior art antennas of this type are assembled by means of operating a snap fit connection in an axial direction as shown in figures 1 and 2. That is to say that the antenna is pushed into the

housing of the phone from a position around the top of the phone in a direction along the longitudinal axis of the antenna (from P to P'). As shown in figure 2 the longitudinal axis of the main housing along Q-Q' is offset by a small angular amount from the longitudinal axis of the antenna P-P'.

[0012] The electrical radiating and receiving elements of the antenna terminate in a contact **4** which is connected to the internal circuitry of the phone via a contact assembly **5**. The contact assembly **5** comprises a contact block **6** and a spring contact **7**. A resilient member **8** provides a snap fit with the body of the mounting **2**.

[0013] Figures 3 through 8 illustrate an antenna constructed in accordance with the present invention and part of a mobile phone into which the antenna is attached. The antenna shown generally at **11** comprises an active antenna element **12** and a base section **13**. The active element **12** may be of any suitable type. Some suitable antenna types are; a helical coil wrapped around a former (see US 5 341 149 for background) and a printed conductive filament (see GB 2 330 951 for background). Many other antenna types e.g. patches, may be used with the invention. Patch antennas are discussed in US 5 627 550. The profile of the body of the antenna can be shaped to accommodate the particular type of active element used and its matching circuits, if necessary.

[0014] The antenna **11** is shown in figures 3, 4, 5 and 7 attached to the phone housing **20**. In the figures 6 and 8 the antenna is shown detached from the housing. The direction shown by the arrow **X** of figure 7 is the axial direction referred to in relation to the prior art references. The lateral direction used for attachment of the antenna in this example is shown as arrow **Y** in figure 6 and the arrow **Z** in figure 8. In this instance the longitudinal axes of the antenna, housing and receptacle are parallel one with another. More generally the longitudinal axes of the antenna and receptacle are substantially parallel with each other but not necessarily are the antenna and receptacle axes parallel with the axis of the housing.

[0015] Antenna base section **13** has a depending flange **14** carrying four snap catches **15**. The snap catches **15** are resilient members incorporating a barb for engagement with the slots **18** within receptacle **21**. A connector block **16** also depends from antenna base **13** and the connector block **16** carries at its distal end an electrical connector **17** which is connected within the base **13** to the active antenna element **12**.

[0016] When the antenna is to be attached to the phone, the body of the antenna **11** is positioned adjacent the receptacle **21** and the antenna **11** is moved in a lateral direction toward the receptacle **21** as illustrated in figures 6 (direction **Y**) and 8 (direction **Z**). When the antenna **11** is inserted fully into the receptacle **21** the locking mechanism operates to secure the antenna in its mounted position. Locking is effected by means of the barbs of the snap catches **15** which spring into slots **18** to secure the antenna within receptacle **21**. With refer-

ence to figure 7 which shows the antenna attached to the housing, the electrical connector **17** contacts the internal wiring of the phone via the PCB **19**.

[0017] The antenna body around the base section and the corresponding parts of the receptacle are shaped to provide an aesthetically pleasing profile. Conveniently the antenna body can be fabricated by welding together a two part moulding of a suitable plastic material e.g. PC/ABS. The two parts of the moulding are symmetrical about B-B of figure 3. The attachment means are therefore integral with and produced as part of the body of the antenna. An additional benefit in terms of mechanical strength is realised from the profiling of the antenna base section and the receptacle. As shown in the figures the area and disposition of the mating surfaces between the antenna body and the receptacle provide firm support. The user could not easily gain access to the interior of the device to release the antenna from engagement. Nor would the user be encouraged to do so because with the increased strength of the antenna attachment the likelihood of damage is significantly reduced.

[0018] In accordance with current manufacturing techniques, electronic components are placed on a PCB in a direction normal to the face of the board. This direction is therefore the preferred direction of assembly of components for existing production machinery and tooling. The antenna of the present invention is assembled in the preferred direction so as to make less demands on the design of the production machinery and tooling. There is provided thereby a further significant advantage over the prior art antennas in this respect.

[0019] An automated test of the phone to include RF performance can proceed much more easily before the antenna is assembled than was previously the case. Production testing of the phone is also simplified because of the relatively straight forward access to an RF test point where contact **17** would mate with the PCB **19**. With prior art arrangements such as shown in figure 2, access to an RF test point is problematic.

[0020] An antenna may be used whose axial direction, when mounted, makes a small angle with the axis of the housing as is shown for the prior art illustration of figure 2. The shape of the receptacle will need to accommodate the small angle and its axis aligned for reception of a laterally moving antenna.

[0021] When the active antenna element is a patch antenna or another type of antenna with a low profile, shaping of the antenna body and corresponding receptacle will allow an assembled antenna to lie flush with the external housing of the portable device. The antenna would not be recognised as such, in this arrangement and would be less prone to damage.

[0022] In the exemplification of the invention given above, the antenna is mounted on the outside of the housing. When it is desirable to mount an antenna within the main housing of a device, however, the invention may also be carried into effect. For internal antenna

mounting attachment means carried on the antenna body engage with a receptacle formed on an inner surface of one of the exterior housings of the device.

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Claims

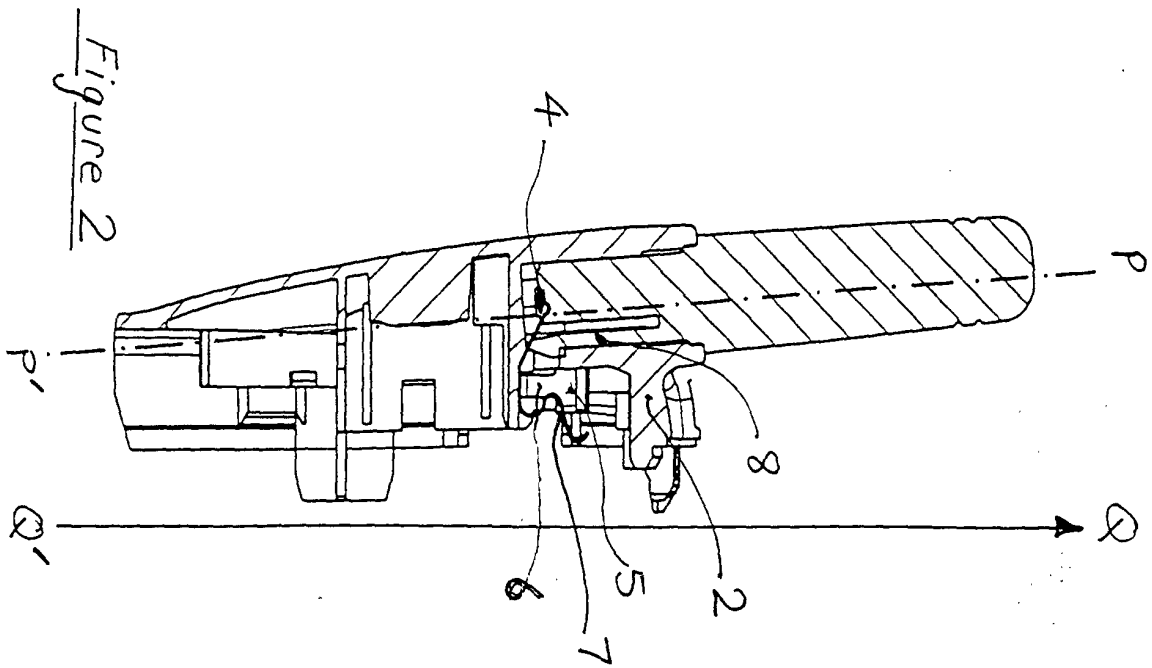
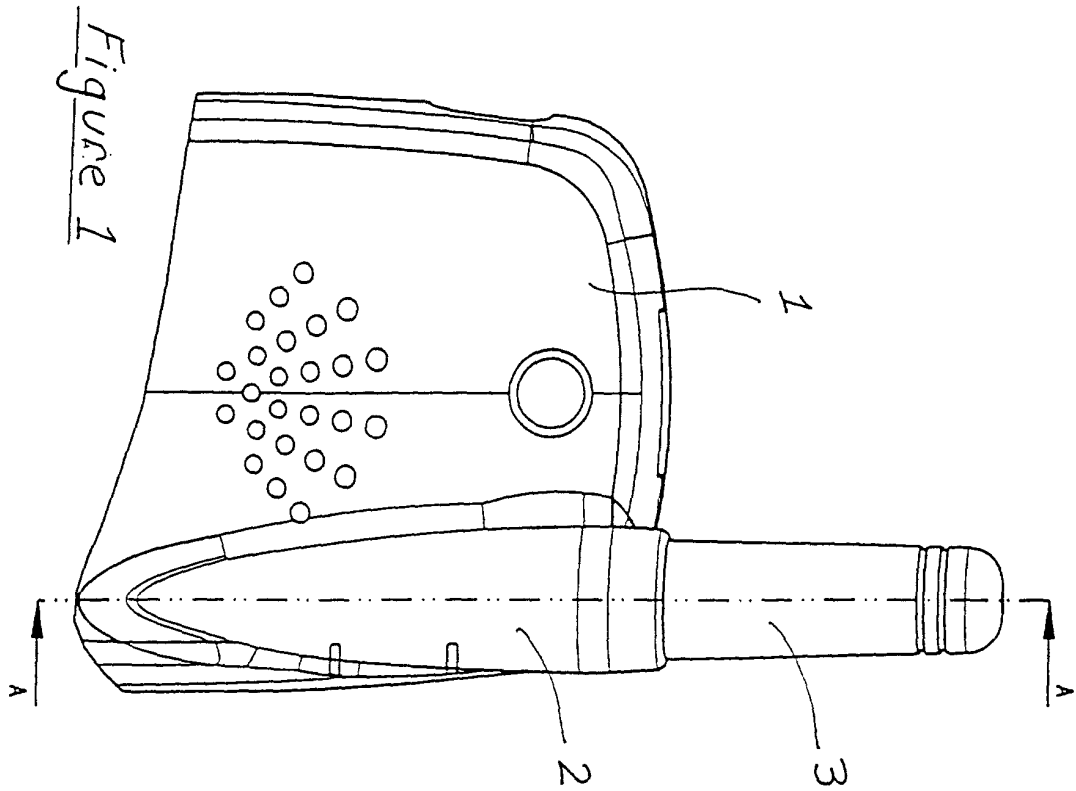
1. A snap-fit antenna for a portable communication device, the antenna having attachment means and the device having a receptacle for receiving the antenna and engaging the attachment means wherein the antenna engages with and is secured within the receptacle in response to a lateral movement of the antenna toward the receptacle 10
2. A snap-fit antenna as in claim 1 in which the attachment means is integral with and formed as part of the body of the antenna. 15
3. A snap-fit antenna as in claims 1 and 2 in which the attachment means comprises resilient members carrying barbs for engagement with slots in the receptacle. 20
4. A snap-fit antenna as in any preceding claim mounted within the housing of the device. 25
5. A snap-fit antenna as in any preceding claim in which the portable communication device is a mobile phone. 30
6. A snap-fit antenna as in any preceding claim in which the antenna is a patch antenna.
7. A snap-fit antenna substantially as described herein and as illustrated by the accompanying drawings. 35

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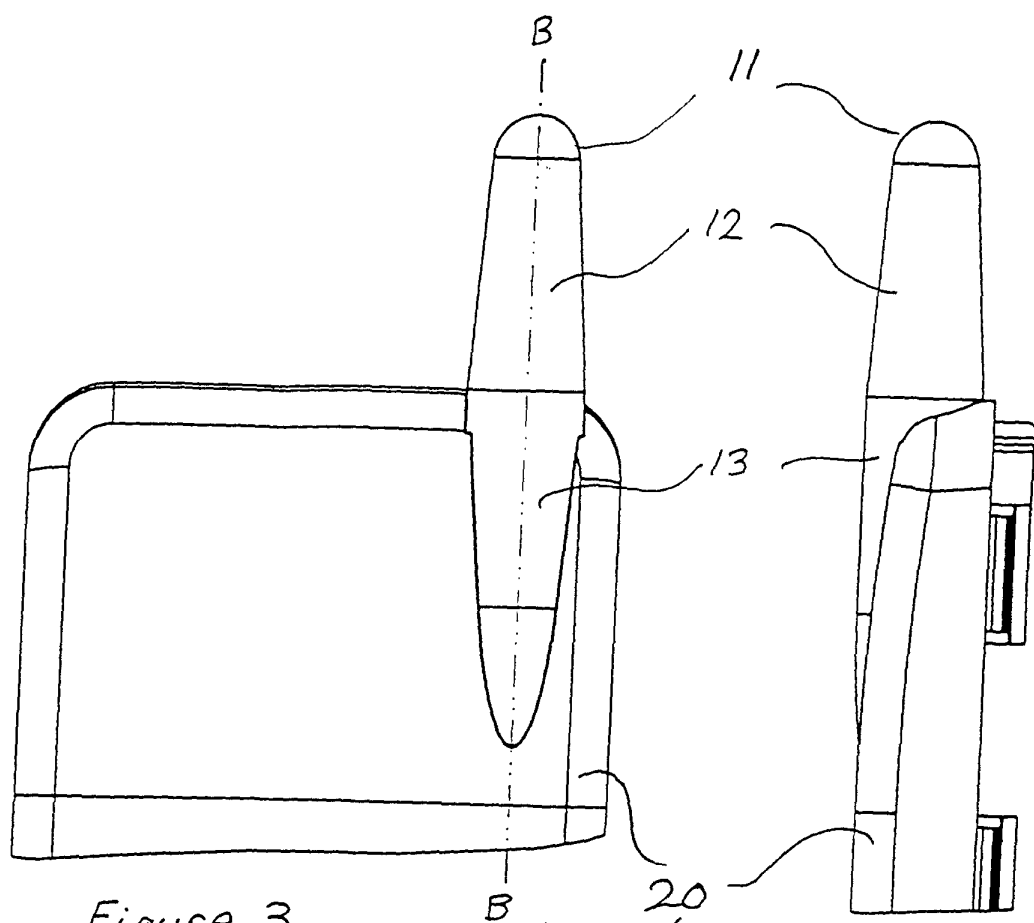


Figure 3

Figure 4

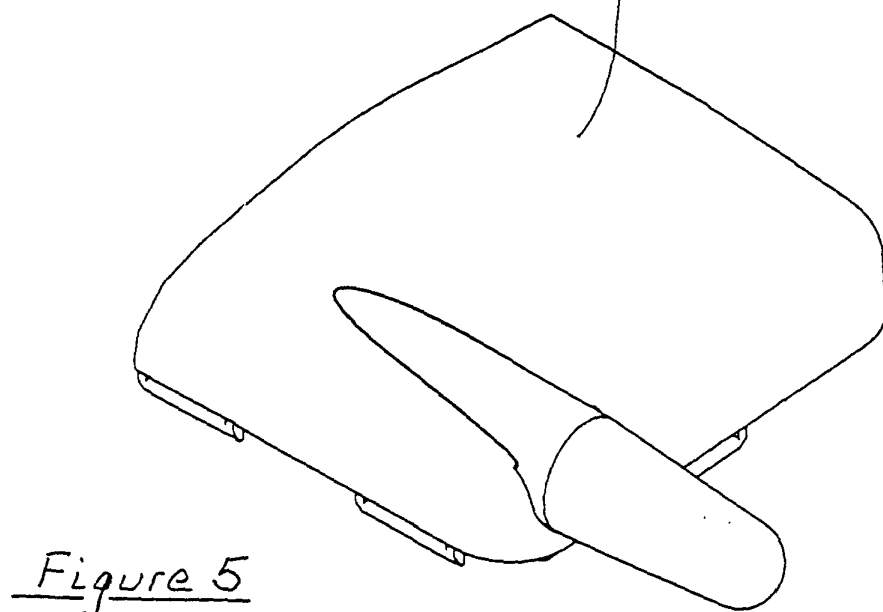


Figure 5

