

## Battery Connector

**DETAILED DESCRIPTION****(Field of invention)**

This invention relates to a battery connector for connection to a battery built in a cell phone or portable phone or the like and for mating connection to a mating connector mounted on a body side circuit board in the cell phone or the like.

**(Prior art)**

In general, the battery built-in the cell phone takes two kinds of forms such as a battery pack building-in a battery in a rear cover of the cell phone, and a battery separately provided at the rear cover side. Each form of the batteries is adapted to connect to the circuit board by interconnecting a battery connector connected to the battery to the mating connector mounted on the circuit board provided in the body of the cell phone

As one of this kind of conventional battery connectors, a battery connector shown in Fig. 7 is for example known (see JP A 7-192797). The battery connector 100 includes a housing 110 having a plurality of contact receiving cavities 111 therein and extending in an elongate direction, and a plurality of contacts 120 mounted in the contact receiving cavities 111.

Each contact 120 is formed by stamping and forming sheet metal and has a plate-like base portion 121 to be press-fitted in a housing wall of the contact receiving cavity 111. From a rear end (a left end in Fig. 7) of the base portion 121, a board connection portion 122 extends for solder connection onto a circuit board (not shown) that is connected to a battery. From a lower portion of a front end of the base portion 121, a contact portion 123 extends for contact with a mating tab contact (not shown) of a mating connector. The base connection portion 122 has a flat plate portion 124 extending rearwardly from a lower portion of the rear end of the base portion 121 and folded in a direction substantially perpendicular to the base portion 121, and a leg portion 125 extending rearwardly from a lower end of the flat plate portion 124 for solder connection onto the circuit board. On the other hand, the contact portion 123 has a resilient spring portion extending diagonally from the lower end of the front end of the base portion 121 toward outside of thickness of the base portion 121, and a tip portion 128 folded back to opposite

side to a contact surface of the resilient spring portion 126.

5       When the mating tab contact of the mating connector enters the  
contact receiving cavity 111 formed the housing 110, the mating  
contact makes resilient contact with the contact surface 127 of the  
contact portion 123 of the contact 120, and thus electrical  
connection is established between the battery and a circuit board  
(not shown) of a mating side.  
10

**(Problems to be solved by the invention)**

      However, the conventional battery connector 100 includes the  
following problems:     Since the leg portion 125 to be a solder  
15     connection portion of the contact 120 is folded at the lower end of  
the flat plate portion 124 that extends from the lower portion of the  
rear end of the plate-like base portion 120 that has a relatively wide  
area, a solder connection area to the circuit board is small to weaken  
solder connection strength.     Accordingly, the battery connector  
20     100 may drop off from the circuit board due to a shock upon  
dropping after the battery connector is mounted onto the circuit  
board.     In order to solve the problem, a separate reinforcing  
member (not shown) may be attached to the housing 110 other than  
solder connection of the contact 120 onto the circuit board, and the  
25     reinforcing member is soldered onto the circuit board.     However,  
this case has a defect that area occupied by the battery connector 100  
on the circuit board becomes large.

30       Furthermore, since the solder connection of the leg portion 125  
is positioned biased relative to a center of a bottom surface of the  
battery connector 100 and the position of the solder connection to  
the battery connector 100 is not in good balance, the frond end side  
of the housing 110 may rise up when the mating connector mates

with the connector from the front side.

Therefore, this invention has been made in view of the above and an object of this invention is to provide a battery connector that does not need a separate reinforcing member by enhancing solder  
5 connection strength of a contact to a circuit board so as to reduce occupied area on the circuit board, and that solder connection can be positioned in good balance on a bottom surface of the connector.

#### 10 (Means to solve the Problems)

In order to solve the above problems, a battery connector in accordance with claim 1 of this invention comprises an insulative housing and contacts mounted in said housing and solder-connected to a circuit board, characterized in that: said contact has; and a  
15 bottom surface of said base portion is a soldering surface to said circuit board.

The battery connector in accordance with claim 2 of this  
20 invention is characterized in that said bottom surface of said base portion is formed with a recess for forming a solder fillet.

#### (Embodiment of the Invention)

25 An embodiment in accordance with this invention is now described with reference to accompanied drawings. Fig. 1 is a perspective view of a battery connector in accordance with this invention viewed from the oblique top. Fig. 2 is a perspective view of the battery connector of Fig. 1 viewed from the oblique  
30 bottom. Fig. 3 shows the battery connector of Fig. 1, and (A) is a plan view, (B) is a front view and (C) is a bottom view. Fig. 4 is a perspective view of a contact used in the battery connector of Fig. 1.

The battery connector shown in Figs. 1-3 is adapted to connect to a battery of a battery pack in which the battery is built in a rear cover (not shown) of a cell phone or a separate battery provided at the rear cover side, and includes an insulative housing 10 and a plurality of contacts 20 mounted in the housing 10. The battery connector 1 is adapted to be mounted on a circuit board A (see Fig. 3(B)) connected to the battery.

10

The housing 10 is formed by molding insulative plastic, and has a substantially rectangular shape extending in an elongate direction thereof. In the housing, a plurality of contact receiving cavities 11 are formed with a predetermined interval in the elongate direction for receiving the contacts 20 therein. Each contact receiving cavity 11 is open to a front surface 12 of the housing 10 and is formed so as to penetrate top and bottom surfaces 13,14. In both side walls of each contact receiving cavity 11, side wall receiving recesses 15 are formed to open to the bottom surface 14 for receiving therein both side wall portions 22 and both side wall extension portions 23 of the contact 20 that will be described below. On both end walls of the housing 10, a pair of projections 16 are formed which project in the elongate direction. On a bottom surface of each projection 16, an alignment post 17 is formed which projects downwardly. The alignment post 17 is provided for alignment of the battery connector 1 when the battery connector 1 is mounted on the circuit board A that is connected to the battery.

(0013)

30 As best shown in Fig. 4, each contact 20 is formed by stamping and forming sheet metal, and has a flat base portion 21. A bottom surface of the base portion 21 forms a solder connection surface to the circuit board A and is adapted to be solder-connected to a conductive pad on the circuit board A when the battery connector 1

is mounted on the circuit board A that is connected to the battery. At a front edge (left edge in Fig. 4) and a rear edge of the base portion 21, projecting plate portions 21a, 21b are formed that project for increasing solder connection area and for inspecting the solder connection portion. As best shown in Fig. 2, a recess 21c is formed in the bottom surface of the base portion 21 for forming solder fillet. A pair of side wall portions 22 upstand parallel with each other from both sides of the base portion 21, and a side wall extension portion 23 upstands from an upper edge of a rear end side of each side wall portion 22. A pair of contact arms 24 are provided on each side wall extension portion 23 for contact with a mating contact 70 that will be described below, which extend forwardly to oppose to each other from a substantially center of a front edge of the side wall extension portion 23. Each contact arm 24 extends obliquely forward from the front edge of each side wall extension portion 23 so as to incline inwardly toward the other contact arm 24 and is bent so as to be parallel to the side wall portion 22. At a tip of each contact arm 24, contact projection 25 is formed to project inwardly for connection with the mating contact 70.

At front edges and rear edges of both side wall portions 22 and rear edges of both side wall extension portions 23 of each contact 20, a plurality of barbs 26 are provided. These barbs 26 engage front and rear walls of the side wall receiving recesses 15 when both side wall portions 22 and both side wall extension portions 23 of the contact 20 are received in the side wall receiving recesses 15 formed in the housing 10, whereby the contact 20 is press fitted in and secured to the housing 10.

When the battery connector 1 having the above mentioned constitution is assembled, both side wall portions 22 and both side

5 wall extension portions 23 of the contact 20 are inserted into the side wall receiving recess 15 from the bottom surface 14 side of the housing 10 with the contact projection 25 of the contact portion 24 positioned forwardly, then the contact 22 is secured to the housing by press fitting, and the above operation continues for the plurality of contacts 20. When each contact 20 is press fitted, both side wall portions 22 and both side wall extension portions 23 are inserted into the side wall receiving recesses 15 until top ends 23a of both side wall extension portion 23 of the contact 20 abut against upper walls (not shown) of the side wall receiving recesses 15 so that outer surfaces of both side wall portions 22 and both side wall extension portions 23 make contact with wall surfaces of the housing 10. Then, as shown in Figs. 2 and 3(B), the bottom surface of the flat base portion 21 of the contact 20 become substantially flush with the bottom surface 14 of the housing to be exposed. Since the bottom surface of the base portion 21 of the contact is exposed, there is no need to form a wall of the housing under the base portion 21 so that the battery connector can be low profiled. And since each contact arm 24 extends obliquely forward from the front edge of each side wall extension portion 23 so as to incline inwardly toward the other contact arm 24 and is bent so as to be parallel to the side wall portion 22, each contact arm 24 can deflect inwardly and outwardly in each contact receiving cavity 11 after the contact 20 is press fitted in the housing 10. Furthermore, the contact 20 is formed in a substantially C-shape in cross section having the flat base portion 21 and the pair of side wall portions 22 upstanding from both sides of the base portion 21, and is inserted into the side wall receiving recesses 15 so that the outer surfaces of both side wall portions 22 make contact with wall surfaces of the housing 10, thereby enhancing strength of the housing 10.

The battery connector 1 assembled as described above is then

mounted onto the circuit board A connected to the battery. At the same time, the bottom surface of the base portion 21 of the contact 20 is solder-connected to the conductive pad formed on the circuit board A. Since the base portion 21 is formed in a flat plate  
5 extending between both side walls 22 and area of the bottom surface thereof is relatively large, solder connection strength can be high. Accordingly, since there is no need for a separate reinforcing member to firmly secure the battery connector 1 to the circuit board A, area occupied by the battery connector 1 on the board can be  
10 reduced. Furthermore, since solder connections of the base portions 21 are positioned symmetrically relative to a center in the bottom surface of the battery connector 1, the solder connections for the battery connector 1 are positioned in good balance so that the solder connections can endure if the mating connector is inserted in  
15 any direction. Moreover, since the recess 21c for forming solder fillet is formed in the bottom surface of the base portion 21, the soldering strength can be further enhanced upon soldering of the base portion 21 to the circuit board A.

20

As shown in Figs. 5 and 6, the mating connector 50 mounted on a circuit board B of the cell phone body side for connection with the battery connector 1 includes an insulative housing 60 of rectangular shape and the plurality of mating tab contacts 70 provided in an  
25 elongate direction of the housing 60 with a predetermined interval. The mating contacts 70 are mounted in the housing 60 with the same interval as that of the contacts 20 so as to make contact with the contacts 20 of the battery connector 1. The mating contacts 70 project from a top surface of the insulative housing 60, bottom  
30 surfaces thereof are solder-connected to conductive pads on the circuit board B.

Upon use of the sell phone, the rear cover of the cell phone is

closed to align the cover with a chassis 80 of the cell phone body side. Then, the contact projections 25 of the pair of contact portions 24 of the contact 20 in the battery connector 1 sandwich the mating contact 20 of the mating connector 50 from the top, whereby  
5 the contact 20 makes contact with the mating contact 70 to cause the battery to be connected to the circuit board B and to power to be supplied to the circuit board B. Since the contact receiving cavity 11 in the housing 10 is formed so as to penetrate the top and bottom surfaces 13,14, the mating contact 70 enters the contact receiving  
10 cavity 11 from the top surface 13 side of the housing 10 to enter between the contact projections 25 of the contact portion 24. Since the each contact receiving cavity 11 is open to the front surface 12 of the housing 10 and the contact projections 25 of the contact portion 24 are positioned forwardly, the contact projections  
15 25 of the contact 20 can make contact with the mating contact 70 not only from the top but also from the side.

When the battery is exchanged, the battery connector 1 is  
20 disengaged with the mating connector 50 in a process that is reverse to the above process and a new battery is then mounted.

The above embodiment according to this invention has been described. But this invention is not limited to the above embodiment, and various modifications are possible for those skilled  
25 in the art. For example, the pair of contact arms 24 extend forwardly from the center of the front edges of the side wall extension portions 23 so as to oppose to each other, but the arms may extend directly from the side wall portions 22 so as to oppose to each other.

30

#### **(Advantages of the invention)**

As described above, since the battery connector according to claim 1 of this invention is characterized in that the contact has a

flat base portion, a pair of side wall portions upstanding from both sides of the base portion, and a pair of contact arms extending from each of the pair of side wall portions so as to oppose to each other for making contact with a mating contact; and a bottom surface of the base portion is a soldering surface to the circuit board, the area of the solder connection surface can be relatively large to enhance the solder connection strength. Accordingly, since there is no need for a separate reinforcing member to firmly secure the battery connector to the circuit board, the area occupied by the battery connector on the board can be reduced. And the solder connections of the base portions are not biased at the bottom surface of the battery connector and the solder connections for the battery connector are positioned in good balance so that the solder connections can endure if the mating connector is inserted in any direction.

According to the battery connector of claim 2 of this invention, in the invention of claim 1, the bottom surface of the base portion is formed with a recess for forming a solder fillet so that the soldering strength can be further enhanced upon soldering of the base portion to the circuit board.

## **BRIEF DESCRIPTION OF DRAWINGS**

Fig. 1 is a perspective view of a battery connector in accordance with this invention viewed from the oblique top.

Fig. 2 is a perspective view of the battery connector of Fig. 1 viewed from the oblique bottom.

Fig. 3 shows the battery connector of Fig. 1, and (A) is a plan view, (B) is a front view and (C) is a bottom view.

Fig. 4 is a perspective view of a contact used in the battery connector of Fig. 1.

Fig. 5 is a perspective view of a mating connector.

Fig. 6 is a cross section of the battery connector and the mating connector in a mating condition.

Fig. 7 is a perspective view partially in cross section of a conventional battery connector.

5

**(Description of Reference Numerals)**

- 1....battery connector
- 10...housing
- 20...contact
- 10 21...base portion
- 21c...recess
- 22...side wall portion
- 24...contact arm
- 70...mating contact
- 15 A...circuit board



### CLAIMS

1. A battery connector comprising an insulative housing and contacts mounted in said housing and solder-connected to a circuit board, characterized in that:
  - 5       said contact has a flat base portion, a pair of side wall portions upstanding from both sides of said base portion, and a pair of contact arms extending from each of said pair of side wall portions so as to oppose to each other for making contact with a mating contact; and
  - 10       a bottom surface of said base portion is a soldering surface to said circuit board.
2. The battery contact of claim 1, wherein said bottom surface of said base portion is formed with a recess for forming a solder fillet.