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ROTATABLE CONNECTOR

This invention relates to connectors which are capable of rotary movement, and particularly connectors which are useful for telephone handsets and other similar devices.

5        In the present state of the art, various types of connectors exist for enabling rotating movement between two parts with an electrical terminal on each part. The present invention relates to an improved device of this type and, more specifically, one in which the electrical  
10 contacts of a modular plug are to be inserted which is at right angles to the major longitudinal axis of the entire connector. Due to the construction of the connector, upon any force being applied to this connector part in a direction substantially normal to the connector's  
15 longitudinal axis, the first part is caused to rotate relative to the second part. The improved connector of the present invention is particularly useful where the modular plug which is to be inserted into the first part is at the end of a cord, or wire, so that as the cord is  
20 moved, the first part of the connector is caused to rotate and the cord will not coil.

      In a first aspect the invention provides a rotatable connector for a telephone handset or the like comprising  
      a first part having terminal means thereon for  
25 connection to or in the handset,

a second part coupled to the first part for rotation relative to the first part about a central axis common to the first and second parts, the second part having modular terminal means thereon which are located on the second  
 5 part at a fixed angle displaced from the common axis to accept at the fixed angle from the common axis an external modular terminal having a cord attached thereto which can be twisted, the movement of the cord relative to the first part by movement of either the cord or the handset  
 10 providing a torque force to the second part at the angle displaced from the common axis so that the second part rotates relative to the first part to prevent twisting of the cord, and

means for providing electrical connection between  
 15 the terminal means of the first and second parts as one part of the connector rotates relative to the other.

Preferably the fixed angle is substantially a right angle.

Preferably the terminal means of one part is a plug  
 20 to be attached to the handset and the terminal means of the other part is a modular receptacle. Alternatively, the terminal means may be mounted in the handset itself.

The means for providing the electrical connection may comprise an electrical circuit formed with at least  
 25 one conductive track located in one of the connector parts and a wire connecting each of the conductive tracks to a respective terminal of the modular terminal means of the one connector part, and at least one spring biased contact means in the other connector part for contacting a  
 30 respective conductive track as the connector parts are rotated, and a wire connecting each of the contact means to a respective terminal of the terminal means of the other part. The electrical circuit may comprise a member having the circuit thereon, e.g. as a printed circuit. In  
 35 such a case the base of the printed circuit may have a surface on which the member with the circuit is

mounted, the base having a passage through which wire connected to a conductive track passes, the terminal means of the one connector part being attached to the base. In such a case, the axis of the modular terminal means of the second part is generally transverse to the plane of the circuit, each wire being bent by substantially 90 degrees to enter the modular terminal means, and means may be provided on the base for supporting the wires. The other connector part may be formed with a shelf which lies generally parallel to the plane of the member having the circuit, each contact means of the other connector part comprising a wire which is bent around the shelf and a contact tip connected to one end thereof for engaging a respective track of the circuit.

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The invention is illustrated by way of example with reference to the accompanying drawings in which:

Figure 1 is a perspective view of a telephone handset having a rotary connector according to the invention;

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Figure 2 is a view in cross-section of the connector;

Figure 3 is a cross-sectional view taken along lines 3-3 of Figure 2;

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Figure 4 is a sectional view in elevation showing a further embodiment of the invention;

Figure 5 is a view in cross-section along lines 5-5 of Figure 4; and

Figures 6, 7 and 8 are further sectional views of other embodiments of the invention similar to those of Figure 4.

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Figure 1 shows a typical telephone handset 10 but incorporating a rotatable connector according to the present invention. Of course, the connector may be used in any suitable application requiring the connection of two relatively rotatable sets of electrical contacts. In

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the first preferred embodiment of the invention, the handset has a receiver end 11 and a transmitter end 12 with a conventional modular type socket or receptacle 14 at the transmitter end. The modular receptacle 14 has the  
5 usual spring loaded contacts 16 (one of which is shown in Figure 2) into which a modular plug is to be inserted. Typically, a modular plug-receptacle arrangement uses four in-line contacts, although more or less can be used.

The rotatable connector 20 of the present invention  
10 is to be inserted into the modular receptacle 14 of the transmitter end 12 of handset 10. It is intended to provide electrical connection between the individual wires of a cord 82 and the handset contacts 16 in receptacle 14 while permitting the cord 82 to move relative to the  
15 handset without undesirable coiling or winding up.

The connector 20 includes respective male and female parts 22 and 24 which can rotate relative to each other. The male part 22 includes a mounting base 26 having a raised peripheral lip 28 and a plurality of raised  
20 mounting tabs 30 extending from its front face, three of which are illustratively shown, although more or less can be used. A circular printed circuit board 34, or flexible web, with suitable circuit conductors 36 laid thereon is mounted on the base 26. The board 34 has a circular  
25 central conductive pad area 36-1 and three concentric surrounding circular tracks 36-2, 36-3 and 36-4 of progressively increasing diameter. There is a space between each of the tracks 36 and the tabs 30 of the mounting base 26 protrude through the space between the  
30 tracks 36-3 and 36-4 so that the circuit board can be mounted on base 26. This can be done either by an adhesive or by ultrasonically welding the tabs 30 to, or deforming the top parts thereof over, the printed circuit board.

35 A conventional modular plug 40 having the usual lever latch 44 thereon is mounted to the bottom end of the

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mounting base 26. The plug 40 has the usual set of protruding contacts 42 which are in contact with the corresponding spring type contacts 16 in the modular receptacle 14 of the handset. A respective wire 48  
5 protrudes through the circuit board 34 and is soldered to a respective track 36 thereon so that there is an individual contact with each of the tracks 36. This can be done by making a hole to each conductive area 36, through plating the hole, and making the solder contact in  
10 the hole. Thus, the front face of the board 34 will have no protrusion. The head end of each wire 48 is shown in Figure 3.

Each of the wires 48 as it exits from the rear face of the printed circuit board 34 is bent by 90 degrees to  
15 lie generally parallel to the rear face of the circuit board and thereafter bent another 90 degrees to enter into the body of the modular plug 40 where they are held by the usual crimping arrangement 43. The modular plug 40 is secured by an adhesive or ultrasonically welded to the  
20 lower end of the mounting base 26 at the area 50 where the two mate.

The female part 24 of the connector includes a shell 58 having a series of four holes therein in line with the four tracks 36 on the upper face of the printed circuit  
25 board 34. A spring loaded contact assembly 62 is formed by a laser welded coil spring, for example of beryllium copper, with a contact tip 64 welded to one end and a bare wire 66 to the other end. Each of the contact assemblies is first inserted through a respective hole 60 in the base  
30 of the shell, bare wire lead 66 first, until the spring assembly 62 is seated within the respective hole 60. The respective leads 66 are then bent over into a respective channel 68 formed on the bottom of the shell 58.

A wire guide 70 is then pressed onto the top portion  
35 of the shell 58 to overlies the channel 68. The wire guide 70 and cap 20 form a receptacle 75 for accepting a modular

type plug 80 which is separate from the connector. The wire guide 70 is formed with a shelf 72 which, when the cap is assembled to the shell, extends over the ends of shell channels 68 and forms a part of the receptacle for external jack 80. The shelf 72 has a plurality of channels 74 thereon corresponding to the number of contact assemblies and the channels 68 of the shell. The free ends of the wires 66 are respectively bent into the channels 68 to serve as the spring contacts for the external modular plug 80 having the usual conductors therein with leads which have the respective contacts 86.

As seen in Figure 2, the shell 58 of the female part 24 has a stepped lower end 59 and is held to the lower surface of the mounting base 26 of the male half by a spring loaded retaining clip 90 with an intermediate bearing washer 92 which can be of plastic, fiber or any other suitable material.

As seen from Figure 2, the plug 40 on male part 22 of the rotary connector plugs into the receptacle 14 of the handset 10 and the female part 24 provides receptacle 75 for the modular plug 80 to which the telephone cord 82 is connected. The receptacle 75 is at a right angle to plug 40. The two parts 22, 24 are held together by the retaining clip 90 which prevents them from separating. However, the female half can be rotated freely about the male half, i.e., the shell 58 has a rotating clearance relative to the base 26 of the male part 22.

Unlike similar designs where a cord enters the connector axially, i.e. the two parts of the connector would make an in-line, or axial, connection and the input and output ends are in-line, in the present invention, the cord 82 enters at 90 degrees relative to the connector's longitudinal axis. Thus, as someone moves the handset 10 or the cord 82, instead of the cord 82 coiling or "winding up", turning force is provided for the connector female part 24 to overcome any friction between the male and

female parts and causing the female part 24 to rotate relative to the male part 22. That is, the connector uses the leverage from the cord or the handset which are at right angles to each other to cause relative rotation of  
5 the two connector parts.

As should be apparent, electrical contact is provided between each of the wires of the cord 82 through a respective contact 86 of the modular plug 80 and the wire end 68 and the tip of a contact assembly 62. The  
10 rotatable contact is maintained between the two connector parts by the tips 64 of the contact assemblies 62 riding on the conductive tracks 36 of the printed circuit board. Thereafter the wires 48 connected to the tracks 36 enter the male modular plug 40 and the end of each wire is  
15 provided with an electrical terminal 42 which makes contact with spring type terminal 16 of the modular receptacle of the handpiece.

Figures 4 and 5 show a first further embodiment of the invention where one part of the connector is  
20 integrally mounted as part of the handset 10. Here a mounting base 126 of a suitable insulating material, corresponding to the base 26 of Figures 1-3, is provided. The base is attached to the end wall of the handset via screws 127. Base 126 holds the printed circuit board 34  
25 in the manner previously described with reference to Figures 2 and 3.

The base 126 has a central opening 128 through which the wires 130 protrude to the printed circuit board 34. There are four wires 130, although one is shown. Figure 5  
30 shows the printed circuit board 34, the tracks 36 and the wire connections 48 as shown in Figure 3.

The second part 140 of the connector is generally cylindrical overall and has a reduced diameter bottom end 141 which is inserted through a central opening 142 in the  
35 handset. The second part 140 includes the spring loaded contacts 64 for riding on and making contact with the

respective tracks 36 of the printed circuit board and also the bent spring contacts 66 for making contact with the individual contacts 82 of the modular connector 80 which is inserted into the opening 143 in the second part 140.

5 A resilient latch member 145 is provided to hold the modular plug 80.

The reduced diameter portion 141 of the second part 140 is permitted to rotate within the opening 142 for a full 360 degrees. It is held to the opening by a metal  
10 retaining clip 147 attached to the reduced diameter part 141 which acts against a thrust washer 148.

The operation of the connector of Figures 4-5 is as previously described. That is, as the cord 82 attached to the modular jack is rotated, connector part 140 rotates  
15 and prevents the cord from winding up.

Figure 6 shows a further embodiment of the invention which is similar to that shown in Figures 4 and 5. Here, a different arrangement is used at the end of the handset by providing its end wall with a recess 160 in which the  
20 printed circuit board 34 is mounted, for example as previously described or by an adhesive. There is an opening 161 at the end wall of the handset to provide entry of the wires 130 to the printed circuit board 34.

A protruding collar 164 is moulded onto the end of  
25 the handset. The collar has an upstanding wall 165 with an inturned, angled lip 167 which forms a track 166.

The second part 140 of the connector has an angled groove 169 and shoulder 170 formed at its lower end. The second part 140 is pushed into the collar 164 until the  
30 shoulder 170 snaps into the track 166. The angled lip 167 and angled groove 169 provide stability as part 140 is rotated.

Figure 7 shows a further embodiment of the invention in which an outwardly projecting pedestal through which  
35 the wires 130 extend. Here, the second part 140 has an inturned lip 184 at its bottom end which snaps over the

pedestal top. The inturned lip rotates around the pedestal leg.

Figure 8 shows a further embodiment of the invention in which a base 190 is held at the end of the handset by screws 192. The base 190 includes the spring loaded contacts 64.

The second part of the connector 200 has a lower end 194 of reduced diameter which extends into the opening 196 at the end of the connector. In this embodiment, the printed circuit board 34 is mounted in recess 195 in the lower end 194. The second part 200 is permitted to rotate with the opening 196 and is held by the retaining clip 147 and thrust washer 148.

In the construction of the connector, all of the other parts are of any suitable insulating material and are preferably moulded of a plastics material.



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### CLAIMS

1. A rotatable connector for a telephone handset or the like comprising  
a first part having terminal means thereon for connection to or in the handset,  
5 a second part coupled to the first part for rotation relative to the first part about a central axis common to the first and second parts, the second part having modular terminal means thereon which are located on the second part at a fixed angle displaced from the common axis to  
10 accept at the fixed angle from the common axis an external modular terminal having a cord attached thereto which can be twisted, the movement of the cord relative to the first part by movement of either the cord or the handset providing a torque force to the second part at the angle  
15 displaced from the common axis so that the second part rotates relative to the first part to prevent twisting of the cord, and  
means for providing electrical connection between the terminal means of the first and second parts as one  
20 part of the connector rotates relative to the other.
2. A rotatable connector according to claim 1 wherein the fixed angle is substantially a right angle.
- 25 3. A rotatable connector according to claim 1 or 2 wherein the terminal means of one part is a plug to be attached to the handset and the terminal means of the other part is a modular receptacle.
- 30 4. A rotatable connector according to any one of claims 1 to 3 wherein the means for providing the electrical connection comprises an electrical circuit formed with at



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- least one conductive track located in one of the connector parts and a wire connecting each of the conductive tracks to a respective terminal of the modular terminal means of the one connector part, and at least one spring biased contact means in the other connector part for contacting a respective conductive track as the connector parts are rotated, and a wire connecting each of the contact means to a respective terminal of the terminal means of the other part.
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5. A rotatable connector according to claim 4 wherein the electrical circuit comprises a member having the circuit thereon.
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6. A rotatable connector according to claim 5 wherein the one connector part comprises a base having a surface on which the member with the circuit is mounted, the base having a passage through which each wire connected to a conductive track passes, the terminal means of the one connector part being attached to the base.
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7. A rotatable connector according to claim 5 or 6 wherein the axis of the modular terminal means of the second part is generally transverse to the plane of the circuit, each wire being bent by substantially 90 degrees to enter the modular terminal means, and means on the base for supporting the wires.
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8. A rotatable connector according to claim 7 wherein the other connector part is formed with a shelf which lies generally parallel to the plane of the member having the circuit, each contact means of the other connector part comprising a wire which is bent around the shelf and a contact tip connected to one end thereof for engaging a
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- respective track of the circuit.



9. A rotatable connector according to any one of claims 5 to 8 wherein the member has the conductive tracks thereon in the form of a printed circuit.
- 5 10. A rotatable connector according to any one of the preceding claims wherein the connector is totally detachable from the handset.
11. A rotatable connector according to any one of claims 10 1 to 9 wherein the first connector part is integrally attached to the handset.
12. A rotatable connector according to claim 10 wherein the means for providing the electrical connection 15 comprises a member having the circuit thereon with at least one conductive track mounted in one of the connector parts and a wire connecting each of the conductive tracks to a respective terminal of the terminal means of the one connector part, and at least one spring biased contact 20 means in the other connector part for contacting on a directly opposing basis a respective conductive track as the connector parts are rotated, and a wire connecting each of the contact means to a respective terminal of the terminal means of the other part.
- 25 13. A rotatable connector according to claim 12 wherein the member with the track is located on the one connector part which is integrally attached to the handset and the spring biased contact means are mounted on the other part.
- 30 14. A rotatable connector according to claim 12 wherein the spring biased contact means are mounted on the connector part which is integrally attached to the handset and the member with the tracks is located on the other 35 connector part.



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15. A rotatable connector according to any one of the preceding claims wherein the two connector parts have mating means for attaching one connector part to the other connector part while permitting rotation of the one part  
5 relative to the other part.

16. A rotatable connector according to claim 15 wherein the mating means comprises a collar formed on the one part with a recessed track therein and a shoulder on the other  
10 part fitting into the track.

17. A rotatable connector according to claim 15 wherein the mating means comprises a pedestal on the one part having a top and a recessed area in the bottom of the  
15 second part for receiving the pedestal top.

18. A rotatable connector substantially as hereinbefore described with reference to figures 1 to 3 of the accompanying drawings.

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19. A rotatable connector substantially as hereinbefore described with reference to figures 4 and 5 of the accompanying drawings.

25 20. A rotatable connector substantially as hereinbefore described with reference to figure 6 of the accompanying drawings.

21. A rotatable connector substantially as hereinbefore  
30 described with reference to figure 8 of the accompanying drawings.

22. A rotatable connector substantially as hereinbefore described with reference to figure 7 of the accompanying  
35 drawings.

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