

SPECIFICATION **Concentric plugs**

This invention relates to concentric plugs. Such plugs are commonly used for domestic equipment such as audio apparatus and television receivers.

Concentric plugs are classified as large-size concentric plugs (sleeve diameter 6.3ϕ), small-size concentric plugs (sleeve diameter 3.5ϕ) and miniature concentric plugs (sleeve diameter 2.5ϕ).

To reduce the cost of manufacturing, storing and transporting these differently sized concentric plugs, a converting adapter 2 as shown in Figure 1 of the accompanying drawings has been proposed for converting a small-size concentric plug or a miniature concentric plug 1 to a large-size concentric plug. This adapter 2 is sometimes called a "plug-jack".

The interior of a knob 7 of the adapter 2 is constructed as a jack provided with two contacts. A tip 10 of the small-size plug 1 and a sleeve 9 thereof respectively engage with the two contacts in the knob 7. This means that the knob 7 of the adapter 2 must be quite long, and the total length of the combined concentric plug which is formed by the combination of the adapter 2 and the small-size plug 1 is quite large, which makes it inconvenient to handle. Moreover, the small-size plug 1 and the adapter 2 are held together only by contact pressure or frictional force. The combination may thus become loose while in use, resulting in contact failure.

According to the present invention there is provided a concentric plug comprising: a large-size concentric plug portion and a small-size concentric plug portion; said large-size concentric plug portion including a first sleeve having a hollow region, a core conductor in said hollow region, a first knob on said large-size concentric plug portion, and a first engagement means in said first knob; said small-size concentric plug portion including a second sleeve insertable into said hollow region of said large-size plug portion so as to be aligned with said first sleeve, a tip for contacting said core conductor of said large-size plug portion in said hollow region of said large-size plug portion, a second knob, and a second engagement means whereby said large-size plug portion and said small-size plug portion can be combined with each other by engagement of said first and second engagement means.

The invention will now be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a partly-broken side view of a previously proposed converting adapter and a cooperating concentric plug;

Figure 2 is a cross-sectional view of a first embodiment of concentric plug according to the invention;

Figure 3 is a side view of the first embodiment in a separated condition;

Figure 4 is a partly-broken-away side view of a second embodiment of concentric plug according

to the invention in a separated condition;

Figure 5 is a cross-sectional view on the line V—V of Figure 4; and

Figure 6 is a cross-sectional view on the line VI—VI of Figure 4.

Referring to Figures 2 and 3, the concentric plug comprises a large-size concentric plug portion 3 and a small-size concentric plug portion 4. In the small-size plug portion 4, external screw threads 6 are formed on the outer circumferential surface of the plug-end of a metallic knob 5. In the large-size plug portion 3, internal screw threads 8 are formed on the inner circumferential surface of a metallic knob 7, to be engaged with the screw threads 6 as shown in Figure 2. In the combined condition the whole length of the concentric plug is substantially equal to that of a conventional large-size concentric plug.

A contact portion of the small-size plug portion 4 comprises a sleeve 9 and tip 10 coaxial with the sleeve 9, and it is received by a hollow region 14 of a sleeve 13 of the large-size plug portion 3.

A tip 12 of the large-size plug portion 3 extends as a core conductor 15 almost to the centre of the sleeve 13, and the remaining part of the sleeve 13 defines the hollow region 14. An insulating collar 16 is fitted to the circumferential surface of the core conductor 15 by an insertion-moulding method or a press-fitting method.

A recess 17 is formed in the circumferential surface of the core conductor 15. A rib projection 18 is formed in the inner circumferential surface of the insulating collar 16. The recess 17 is engaged with the rib projection 18 to prevent the tip 12 from falling out.

In the large-size plug portion 3, the insulating collar 16 with the tip 12 is pressed into the sleeve 13. One end of the sleeve 13 is caulked to the knob 7 so as to be fixed to the latter. One end of the core conductor 15 is tapered to form a recess 19. When the small-size plug portion 4 is screwed into the large-size plug portion 3, the tip 10 of the small-size plug portion 4 is engaged with the recess 19 of the core conductor 15, and it is pressed to the latter in the axial direction by the action of the screw threads 6 and 8. Thus, the tip 10 of the small-size plug portion 4 is brought into reliable electrical contact with the core conductor 15 of the large-size plug portion 3.

The jack formed in the previously proposed converting adapter 2 of Figure 2 is not required in the large-size plug portion 3 of this embodiment. Thus, the total length is reduced, and a reliable electrical contact which will not become loose is obtained with a simple construction.

The small-size plug portion 4 is the same as a conventional small-size concentric plug except for the screw threads 6. The tip 10 is connected through a core conductor (not shown) to a terminal plate 20. The sleeve 13 of the large-size plug portion 3 is electrically connected through the screw threads 6 and 8 of the knobs 5 and 7 to the sleeve 9 of the small-size plug portion 4. The sleeve 9 of the small-size plug portion 4 is connected to a terminal plate 21.

In the second embodiment shown in Figures 4 to 6, to which reference is now made, a bayonet engagement replaces the screw threaded engagement used in the first embodiment.

- 5 A projection 23 is formed in the inside wall of a knob 7 in a large-size concentric plug portion 3'. As shown in Figures 4 and 6, an L-shaped recess 25 is formed in the outer circumferential surface of the end portion of a knob 5 in a small-size concentric plug portion 4'. The L-shaped recess 10 25 consists of an axial part 25a and a circumferential part 25b. A boundary between the axial part 25a and the circumferential part 25b has a taper 25c.
- 15 In combining the plug portions 3' and 4', the small-size plug portion 4' is inserted into the large-size plug portion 3' in the direction shown by an arrow A so that the projection 23 enters the axial part 25a of the L-shaped recess 25. The 20 small-size plug portion 4' is then rotated in the direction shown by an arrow B. The projection 23 clears the tapers 25c and engages with the circumferential part 25b of the recess 25. In the engaged condition, the projection 23 and the 25 circumferential part 25b of the recess 25 are urged into engagement in the axial direction. Thus, the tip 10 of the small-size plug portion 4' is brought into close contact with the core conductor 15 of the large-size plug portion 3'. Accordingly, a good 30 electric connection is obtained between the plug portions 3' and 4', and unless the small-size plug portion 4' is rotated in the direction opposite to the direction shown by the arrow B, the plug portions 3' and 4' cannot be separated from each other.
- 35 As an alternative, the recess 25 may be formed in the large-size plug portion 3', and the projection 23 may be formed in the small-size plug portion 4'. Moreover, other engagement means may be used for combining the large-size and small-size 40 concentric plug portions 3' and 4'. For example, a tapped hole may be formed in the knob 7 of the large-size plug portion 3', extending in the radial direction of the knob 7, and a screw is then engaged with the tapped hole for combining the 45 plug portions 3' and 4'.

CLAIMS

1. A concentric plug comprising:
a large-size concentric plug portion and a small-

- size concentric plug portion;
- 50 said large-size concentric plug portion including a first sleeve having a hollow region, a core conductor in said hollow region, a first knob on said large-size concentric plug portion, and a first engagement means in said first knob;
- 55 said small-size concentric plug portion including a second sleeve insertable into said hollow region of said large-size plug portion so as to be aligned with said first sleeve, a tip for contacting said core conductor of said large-size plug portion in said 60 hollow region of said large-size plug portion, a second knob, and a second engagement means whereby said large-size plug portion and said small-size plug portion can be combined with each other by engagement of said first and second 65 engagement means.
2. A concentric plug according to claim 1 wherein said first and second engagement means are screw threads.
3. A concentric plug according to claim 1 70 wherein said first engagement means is a projection formed in the inside wall of said first knob, and said second engagement means is an L-shaped recess formed in the outer circumferential surface of said second knob, said projection and 75 said L-shaped recess being engageable with each other.
4. A concentric plug according to claim 1 wherein said first engagement means is an L-shaped recess formed in the inside wall of said 80 first knob, and said second engagement means is a projection formed in the outer circumferential surface of said second knob, said projection and said L-shaped recess being engageable with each other.
- 85 5. A concentric plug according to claim 1 wherein said tip and said second sleeve of said small-size plug portion are received in said hollow region of said large-size plug portion.
- 90 6. A concentric plug according to any one of the preceding claims wherein said first and second knobs are made of metal.
7. A concentric plug substantially as 95 hereinbefore described with reference to Figures 2 and 3 of the accompanying drawings.
8. A concentric plug substantially as hereinbefore described with reference to Figures 4 to 6 of the accompanying drawings.



In the second embodiment shown in Figures 4 to 6, to which reference is now made, a bayonet engagement replaces the screw threaded engagement used in the first embodiment.

A projection 23 is formed in the inside wall of a knob 7 in a large-size concentric plug portion 3'. As shown in Figures 4 and 6, an L-shaped recess 25 is formed in the outer circumferential surface of the end portion of a knob 5 in a small-size concentric plug portion 4'. The L-shaped recess 25 consists of an axial part 25a and a circumferential part 25b. A boundary between the axial part 25a and the circumferential part 25b has a taper 25c.

In combining the plug portions 3' and 4', the small-size plug portion 4' is inserted into the large-size plug portion 3' in the direction shown by an arrow A so that the projection 23 enters the axial part 25a of the L-shaped recess 25. The small-size plug portion 4' is then rotated in the direction shown by an arrow B. The projection 23 clears the tapers 25c and engages with the circumferential part 25b of the recess 25. In the engaged condition, the projection 23 and the circumferential part 25b of the recess 25 are urged into engagement in the axial direction. Thus, the tip 10 of the small-size plug portion 4' is brought into close contact with the core conductor 15 of the large-size plug portion 3'. Accordingly, a good electric connection is obtained between the plug portions 3' and 4', and unless the small-size plug portion 4' is rotated in the direction opposite to the direction shown by the arrow B, the plug portions 3' and 4' cannot be separated from each other.

As an alternative, the recess 25 may be formed in the large-size plug portion 3', and the projection 23 may be formed in the small-size plug portion 4'. Moreover, other engagement means may be used for combining the large-size and small-size concentric plug portions 3' and 4'. For example, a tapped hole may be formed in the knob 7 of the large-size plug portion 3', extending in the radial direction of the knob 7, and a screw is then engaged with the tapped hole for combining the plug portions 3' and 4'.

CLAIMS

1. A concentric plug comprising:
a large-size concentric plug portion and a small-

size concentric plug portion;

50 said large-size concentric plug portion including a first sleeve having a hollow region, a core conductor in said hollow region, a first knob on said large-size concentric plug portion, and a first engagement means in said first knob;

55 said small-size concentric plug portion including a second sleeve insertable into said hollow region of said large-size plug portion so as to be aligned with said first sleeve, a tip for contacting said core conductor of said large-size plug portion in said hollow region of said large-size plug portion, a second knob, and a second engagement means whereby said large-size plug portion and said small-size plug portion can be combined with each other by engagement of said first and second engagement means.

2. A concentric plug according to claim 1 wherein said first and second engagement means are screw threads.

3. A concentric plug according to claim 1 wherein said first engagement means is a projection formed in the inside wall of said first knob, and said second engagement means is an L-shaped recess formed in the outer circumferential surface of said second knob, said projection and said L-shaped recess being engageable with each other.

4. A concentric plug according to claim 1 wherein said first engagement means is an L-shaped recess formed in the inside wall of said first knob, and said second engagement means is a projection formed in the outer circumferential surface of said second knob, said projection and said L-shaped recess being engageable with each other.

5. A concentric plug according to claim 1 wherein said tip and said second sleeve of said small-size plug portion are received in said hollow region of said large-size plug portion.

6. A concentric plug according to any one of the preceding claims wherein said first and second knobs are made of metal.

7. A concentric plug substantially as hereinbefore described with reference to Figures 2 and 3 of the accompanying drawings.

8. A concentric plug substantially as hereinbefore described with reference to Figures 4 to 6 of the accompanying drawings.