United States Patent [19]

Wallo

[11] **3,893,743**

[45] **July 8, 1975**

[54] **SOLID SHELL PHONOCONNECTORS**

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[22] Filed: **Jan. 30, 1974**

[21] Appl. No.: **437,905**

[52] **U.S. Cl.** ..... **339/183**; 339/256 R

[51] **Int. Cl.** **H01r 17/18**

[58] **Field of Search** ..... 339/177 R, 177 E, 183, 339/256 R, 256 C, 217 J

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[57] **ABSTRACT**

Superior press-on retention, improved electrical contact and elimination of radio frequency leakage are attained in phonoconnectors by having the shell of the pin plug assembly solid, in contrast to the conventional slotted tulip finger form provided with frictional inwardly projecting tips for effecting frictional retaining engagement with a mating phono-receptacle shell. Circumferentially spaced longitudinally extending ribs are provided on one of the mating shells. In the coupled relation of the pin plug assembly with the receptacle, the ribs deflectably tension the pin plug shell wall for efficient frictional gripping interengagement of the receptacle and pin plug shells. Alternatively or in addition to the preformed ribs, indented interlocking of the mated shells may be effected by means of a tool applied thereto.

18 Claims, 6 Drawing Figures

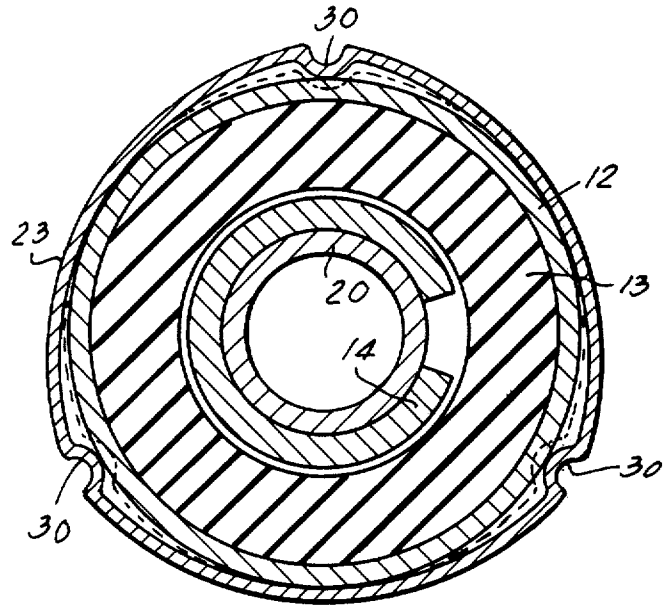
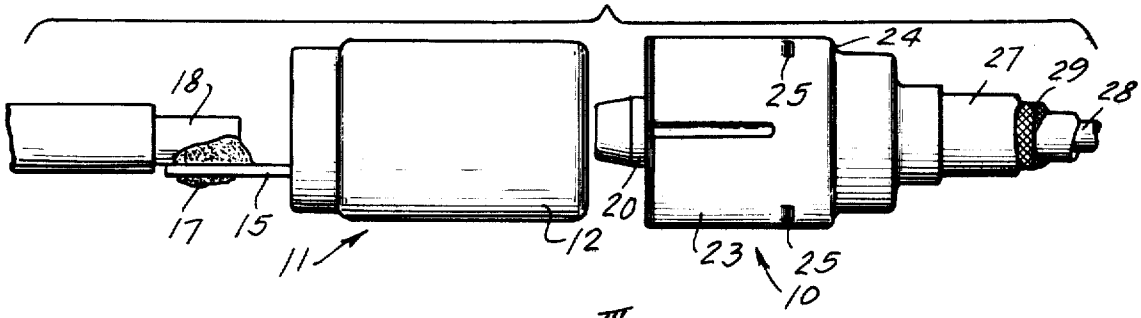


Fig. 1



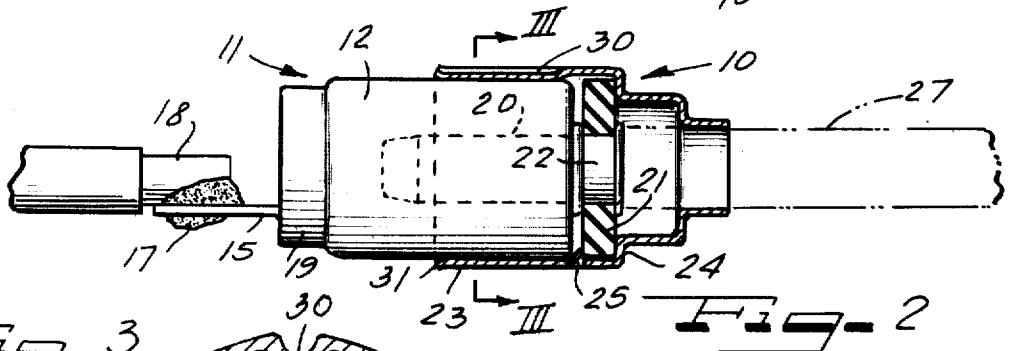


Fig. 2

Fig. 3

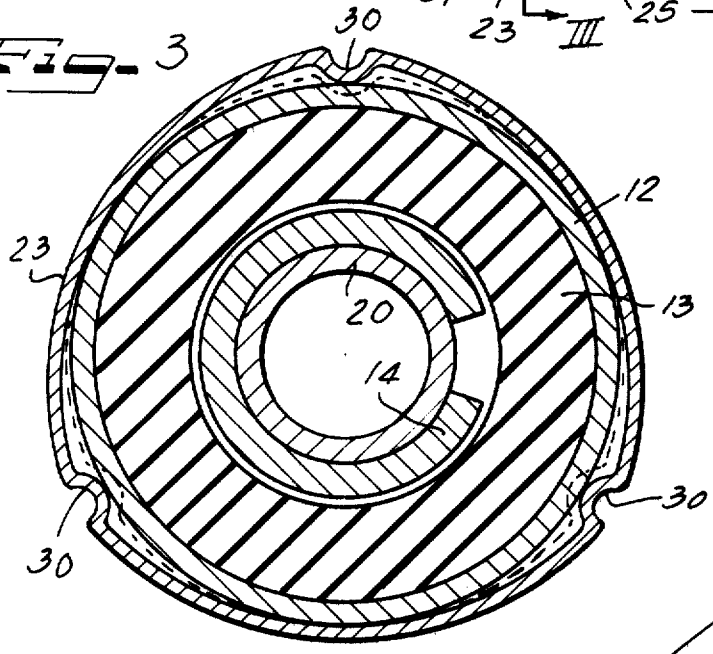


Fig. 6

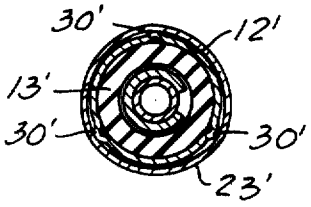


Fig. 4

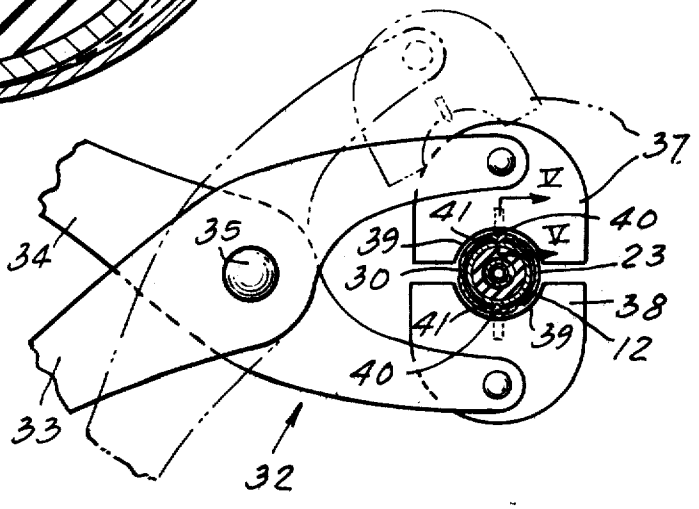
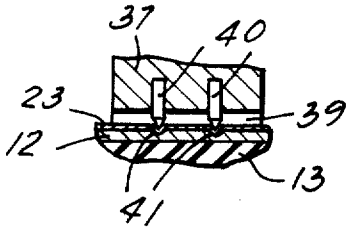


Fig. 5



SOLID SHELL PHONOCONNECTORS

This invention relates in general to separable electrical connectors, and is more particularly concerned with improvements in electrical couplings commonly referred to as phonoconnectors.

As is well known in the art, phonoconnectors are widely employed in effecting electrical couplings in television, stereo and high fidelity phonograph apparatus.

An important advantage accruing from use of phonoconnectors resides in that low cost, convenient means are provided for connecting two circuits together, or two pieces of apparatus, without requiring a soldered connection. Several problems have been encountered with conventional forms of phonoconnectors. More specifically the pin plug shells consisting of a plurality of tulip tabs or fingers formed by slotting the shells rely for retention upon inward crimping of the tab fingers to a diameter slightly smaller than the outside diameter of the phono-jack receptacle shells. Due to inherent variables in the metal from which the pin plug shells are made, it is virtually impossible to maintain a uniform tension of the finger tabs. If the pin plug shells are cocked slightly when coupling with the receptacles, the tabs may become deformed and retention is correspondingly diminished. Experience has shown that retention quality diminishes with each separation and recoupling. There is frequent lack of contact efficiency between the finger tabs because in any event they only make contact at their tips with the phono-jack shell, and if any one or more of the tabs is distorted or deformed may not make contact at all. Since the inside diameter of the pin plug shell inwardly beyond the contacting points of the tabs is somewhat larger than that of the mating receptacle shell, relative rocking action may occur, resulting in intermittence in electrical contact. This has caused some television manufacturers, for example, to solder the cable connected pin plug shell assembly to the phono-jack receptacle on the chassis to prevent accidental disassembly as well as to avoid intermittence. In addition, radio frequency leakage occurs through the inner ends of the slots, generally four in number, between the finger tabs, especially on the shorter forms of the tulip style pin plug shells.

An important object of the present invention is to overcome the foregoing and other disadvantages, deficiencies, inefficiencies, shortcomings and problems in electrical couplings, and more particularly phonoconnectors, and to provide new and improved solid shell phonoconnectors.

Another object of the invention is to provide a new and improved pin plug shell for phonoconnectors.

A further object of the invention is to provide a new and improved method of and means for efficient coupling of phonoconnector pin plugs with the shells of complementary receptacles.

Still another object of the invention is to provide superior electrical contact between the mating shells of electrical couplings such as phonoconnectors.

Yet another object of the invention is to effect improvements in the electrical contact characteristics of the mating components of phonoconnectors.

A still further object of the invention is to eliminate radio frequency leakage from phonoconnectors.

Other objects, features and advantages of the invention will be readily apparent from the following description of certain preferred embodiments thereof, taken in conjunction with the accompanying drawing although variations and modifications may be effected without departing from the spirit and scope of the novel concepts embodied in the disclosure, and in which:

FIG. 1 is a side elevational view of a phonoconnector embodying features of the invention and showing the pin plug and receptacle assemblies in separated aligned relation;

FIG. 2 is a sectional elevational view showing the phonoconnector assemblies in mated relation;

FIG. 3 is an enlarged sectional illustrative view taken substantially along the line III—III of FIG. 2;

FIG. 4 is an illustrative view of a tool for interlocking the mated shells of phonoconnectors;

FIG. 5 is an enlarged fragmentary sectional detail view taken substantially along the line V—V of FIG. 4; and

FIG. 6 is a view similar to FIG. 3 but showing a modification.

Phonoconnectors of the type with which the present invention is concerned comprise a pin plug assembly **10** (FIGS. 1 and 2) constructed and arranged to mate with a jack or receptacle assembly **11**. Component elements of the receptacle assembly **11** comprise a tubular shell **12** supporting, by means of insulation **13** (FIG. 3), a split sleeve receptacle socket **14** having a rearwardly extending solder lug **15** for electrical attachment thereto by means of soldering **17** of an electrical wire or cable **18**. On its rear end, the shell **12** has a collar flange **19** for electrically grounding connection to a chassis component.

Component elements of the pin plug assembly **10** comprise an electrically conductive elongated pin plug **20** dimensioned to be received in coaxial electrically connected relation within the socket sleeve **14**. A solid or hollow tubular construction of the pin plug **20** may be employed, as preferred. In the pin plug assembly, the pin **20** is mounted concentrically on a dielectric mounting disk **21** by means of a crimped base **22**. The mounting disk **21** supports the pin **20** in insulated spaced concentric relation within an electrically conductive shell **23** by which the plug pin assembly **10** is maintained in coupled relation with the phono-jack receptacle **11**. Means for retaining the insulating and mounting disk **21** in position within the shell **23** comprise an annular shoulder **24** formed on the shell **23** spaced a suitable distance from its mouth end and on which the disk is seated. For retaining the disk **21** on the shoulder **24** a circumferentially spaced series of locking indents or lugs **25** is formed as by striking of the material of the shell **23** in suitably spaced relation to the shoulder **24** and into opposing relation to the margin of the disk **21** which is thereby held on the seat **24**. In a suitable arrangement, three of the locking lugs **25** located at 120° intervals has been found satisfactory. As thus mounted, the plug pin **20** is adapted to be electrically connected with an insulated electrical cable **27** inserted into the reduced diameter end portion of the shell **23** and having an end portion of its electrical lead **28** extending into and secured or at least electrically connected as by soldering to the base portion of the pin **20**, with an armor sheath **29** in electrically grounded connection with the shell **23**. Thereby when the phono-plug assembly **10** is coupled with the phono-jack assembly **11**, a suitable electrical connection is effected between the cable leads **18** and **28**, and a grounding

connection with the chassis effected through the coupled shells **12** and **23.**

According to the present invention, the coupling shell **23** is provided as a solid, unslotted tubular member which may be drawn from suitable sheet material such as brass or steel. In a typical phonoconnector size, the main body portion of the shell **23** between its mouth and the shoulder **24** may be about ⅜ of an inch long, with a material gauge of about 0.016. As a result of drawing, the material of the shell **23** is hardened and of stiff resilience. To enable mating of the shell **23** with the shell **12,** a suitable matching oversize differential is provided in the diameters of the shell **23** relative to the diameters of the shell **12.** For example, where the outside diameter of the shell **12** is about 0.328 inch, the inside diameter of the shell **23** should be 0.332 to 0.335 inch. However, such a differential would provide no retaining grip of one shell with the other. Therefore, the shell **23** is provided with preformed projection means for gripping the shell **12.** In a preferred form, the projection means comprise circumferentially spaced indentations **30** in the wall of the shell **23.** A satisfactory arrangement comprises three longitudinally extending indented ribs **30** of suitable length such as about ¼ inch where the shell length is ⅜ of an inch and running out at the mouth of the shell which is preferably formed with a slightly bell mouth leadin flare **31.** Thus, by having the indented friction ribs pressed in to an inside diameter of 0.318 to 0.320 inch, and suitably spaced apart circumferentially to permit resilient flexing of the intermediate portions of the wall of the shell **23,** the shell **23** can be forcibly pushed into mating relation with the shell **12.** As shown in FIG. **3,** in somewhat exaggerated form for illustrative purposes, by having the friction ribs **30** at three circumferentially equidistantly spaced, 120° positions, in the mated relation of the shells, the shell **12** forces the gripping ribs **30** radially outwardly, thus tensioning the circumferentially intermediate portions of the shell **23** inwardly to effect a close frictional gripping engagement of the intermediate shell wall portions supplemental to and mutually complementary to the frictional gripping engagement of the shell **12** effected by the ribs **30.** As the intermediate portions of the shell **23** are radially inwardly deflected by the tension generated by radial outward deflection of the ribs **30** in contact with the shell **12,** gripping engagement of the intermediate wall portions of the shell **23** against the wall of the shell **12** resists further radially outward deflection of the ribs **30** thereby drawing them firmly against the perimeter of the shell **12.** This mutual tensioned gripping by the shell **23** of the shell **12** throughout the effective length of the ribs **30** provides a firm frictional retention of the shell **12** within the shell **23.** Nevertheless, the shells can be separated by forcibly pulling them apart when necessary. Because of the solid form of the shell **23,** constant, indestructible retention grip is maintained between the mating shells regardless of the number of separations and recouplings effected. A further advantage resides in superior electrical contact maintained between the mating shells **12** and **23** because of the positive constant retention. Considerably more surface area of the shells **12** and **23** is in electrical contact along the ribs **30** and the intervening drawn-in portions of the shell **23** than is possible with the conventional tulip slotted pin plug coupling shell. Furthermore, radio frequency leakage is eliminated through the solid wall of the shell **23.**

An even more secure retention, with additional contacting surface can be obtained by proportionate lengthening of the coupling shells **12** and **23.** For example to provide for **75** ohm antenna connection the length of the coupling shells **12** and **23** may be lengthened by about 3/**16** inch for excellent results.

Where for any reason it is desired to lock the coupled shells **12** and **23** together more securely than can be attained by the rather firm frictional grip normally provided in the coupled relationship of the shells, crimping as by means of a tool **32** (FIG. **4**) may be effected. Conveniently, the tool **32** may be in plier form comprising levers **33** and **34** intermediately connected by a pivot **35** and respectively provided with crimping jaws **37** and **38.** Complementary opposed cavities **39** in the jaws **37** and **38** receive the outer shell **23** substantially centered therein so that crimping projections **40** projecting into the cavities **39** in diametric opposition to one another will thrust into and deform complementary interlocking indentations **41** in the shell walls through crimping pressure applied by bringing the jaws **37** and **38** forceably together toward the connector assembly nested therebetween in the jaw recesses **39.** In a desirable form, the crimping projections **40** may be in the form of hardened sharp tipped pins set into the jaws **37** and **38.** Although each of the jaws **37** and **38** may have just one of the crimping pins **40,** one or both of the jaws may carry a plurality of such pins as depicted in FIG. **5.** In this instance the jaw **37** is depicted as having two of the pins **40** spaced longitudinally within the recess **39** and thus longitudinally along the engaged shell **23.** By virtue of the rather small area of the indentations **41** provided by the fairly sharp tips of the crimping pins **40** formation of the interlocking indentations **41** can be effected with only moderate manual force applied to the plier levers **33** and **34.** Further, the interlocking crimped indentations **41** will permit forceable separation of the shells **12** and **23** when necessary to separate the connector coupling assemblies **10** and **11,** without permanent damage to the assemblies. Then, when the assemblies are recoupled, the indentations **41** in the shell **23** will supplement the gripping rib indentations **30** in effecting a secure gripping frictional retention of the mated connector shells **12** and **23.**

Instead of providing the retention ribs **30** on the shell **23,** this shell may remain cylindrical and the ribs formed on the shell **12.** To this end, as shown in FIG. **6,** the receptacle shell **12'** has the circumferentially spaced, longitudinally extending retention ribs **30'** projecting radially outwardly. Thereby, to the same effect as described for the ribs **30,** the shell **23** is deflected radially outwardly where engaged by the ribs **30'** and resiliently tensioned radially inwardly between the ribs into frictional gripping engagement with the shell **12.** Relative dimensions of the shells **12'** and **35'** and the ribs **30'** may be the same as described for the shells **12** and **23** and the ribs **30** of assemblies **10** and **11,** except that the ribs **30'** project to a slightly larger diameter than the inside diameter of the shell **23'.**

It will be understood that variations and modifications may be effected without departing from the spirit and scope of the novel concepts of this invention.

I claim as my invention:

1. In a phonoconnector pin plug assembly for coupling with a phono receptacle, said assembly having an electrically conductive pin plug and an electrically con-

ductive socket shell in electrically insulated concentric relation thereabout, the improvement comprising:

said shell having a circumferentially solid but resiliently flexible wall;

said shell having inwardly projecting indentation means in said wall for retaining engagement with the perimeter of a phono receptacle shell coupled therein; and

said shell wall having plain arcuate areas extending to a substantial width from opposite sides of the projection means and which areas are resiliently flexibly deflectable radially inwardly into engagement with the receptacle shell by radially outward tensioning of the indentation means when engaged with the receptacle shell.

2. An assembly according to claim **1**, wherein said indentation means comprise a plurality of circumferentially spaced indentations in said wall.

3. An assembly according to claim **2**, wherein said indentations comprise longitudinally extending ribs.

4. An assembly according to claim **3**, wherein said ribs run out at a mouth end of the socket shell, and said mouth end has a flared leadin.

5. An assembly according to claim **1**, wherein said indentation means comprise three circumferentially spaced indentations.

6. An assembly according to claim **5**, wherein said indentations comprise longitudinally extending ribs.

7. In a phonoconnector having a receptacle provided with a shell and a phonoconnector pin plug assembly provided with a socket shell mated with the receptacle shell;

said socket having a circumferentially solid resiliently flexible wall and being of differentially slightly larger diameter than the receptacle shell;

and one of said shells having performed projection means and separated substantial circumferentially arcuate areas at opposite sides of the projection means;

said projection means pressing into engagement with the other of said shells and tensioning wall area of the socket shell radially outwardly at the projection means to a sufficient extent to effect radially inward tensioning deflection of wall areas of the socket shell at opposite sides of the projection means into frictional engagement with the receptacle shell.

8. In a phonoconnector according to claim **7**, said projection means being on the socket shell and deflected radially outwardly in engagement with said receptacle shell, and the wall of the socket shell being thereby reactively tensioned radially inwardly at said wall areas into said frictional engagement with the receptacle shell.

9. An assembly according to claim **7**, wherein the projection means comprise a plurality of circumferentially spaced radially inward projections on said socket shell and said projections being tensionably deflected radially outwardly by the receptacle shell and acting to tensionably deflect the intermediate portions of the socket shell comprising said areas radially inwardly frictionally into engagement with the receptacle shell.

10. A phonoconnector according to claim **7**, wherein said projection means comprise a plurality of circumferentially spaced longitudinally extending ribs.

11. A phonoconnector according to claim **10**, including pinpoint interlock indentations in said socket shell in addition to said ribs and interlocking the socket shell and the receptacle shell.

12. A phonoconnector according to claim **7**, wherein said projection means are formed on said receptacle shell and project radially outwardly into engagement with the socket shell.

13. A phonoconnector according to claim **12**, wherein said projection means on the receptacle shell comprise a plurality of circumferentially spaced longitudinally extending and radially outwardly projecting ribs.

14. In a method of coupling a phonoconnector pin plug assembly with a phonoconnector receptacle having a shell, and wherein the pin plug is provided with a circumferentially solid but resiliently flexible wall socket shell of differentially larger diameter than the receptacle shell:

mating the receptacle shell within the socket shell;

in such mating pressing preformed radially extending projection means on the wall of one of said shells into frictional retaining engagement with the wall of the other of said shells and tensioning wall area of the socket shell radially outwardly at the projection means; and

deflectably radially inwardly tensioning plain circumferentially arcuate wall areas of the socket shell at opposite sides of the projection means into frictional engagement with the receptacle shell.

15. A method according to claim **14**, comprising effecting said projection tensioning at three circumferentially spaced places, and effecting said area deflection tensioning at three areas intervening between said projection places.

16. A method according to claim **14**, including crimpingly interlocking said shells.

17. A method according to claim **16**, comprising effecting the crimping interlocking by pressing pinpoint crimping projections of a crimping tool into the mated shells.

18. In a phonoconnector pin plug assembly for coupling with a phono receptacle, said assembly having an electrically conductive pin plug and an electrically conductive socket shell in electrically insulated concentric relation thereabout, the improvement comprising:

said shell having a circumferentially solid wall;

said shell having inwardly projecting indentation means in said wall for retaining engagement with the perimeter of a phono receptacle shell coupled therein;

said shell having a mouth end and an annular seat spaced inwardly from said mouth end and spaced from said indentation means;

an insulating disk supporting said pin plug concentrically within said socket shell and having one side of an annular margin seated on said seat; and

a plurality of circumferentially space indentations in said shell wall spaced from said seat substantially the same distance as the thickness of the disk and engaging the opposite side of the disk margin and thereby locking said disk in retained relation on said seat;

said shell wall being resiliently flexible and having plain arcuate areas extending to a substantial width from opposite sides of the projection means and which areas are resiliently flexibly deflectable radially inwardly into engagement with a receptacle shell by radially outward tensioning of the indentation means when engaged with the receptacle shell.

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