

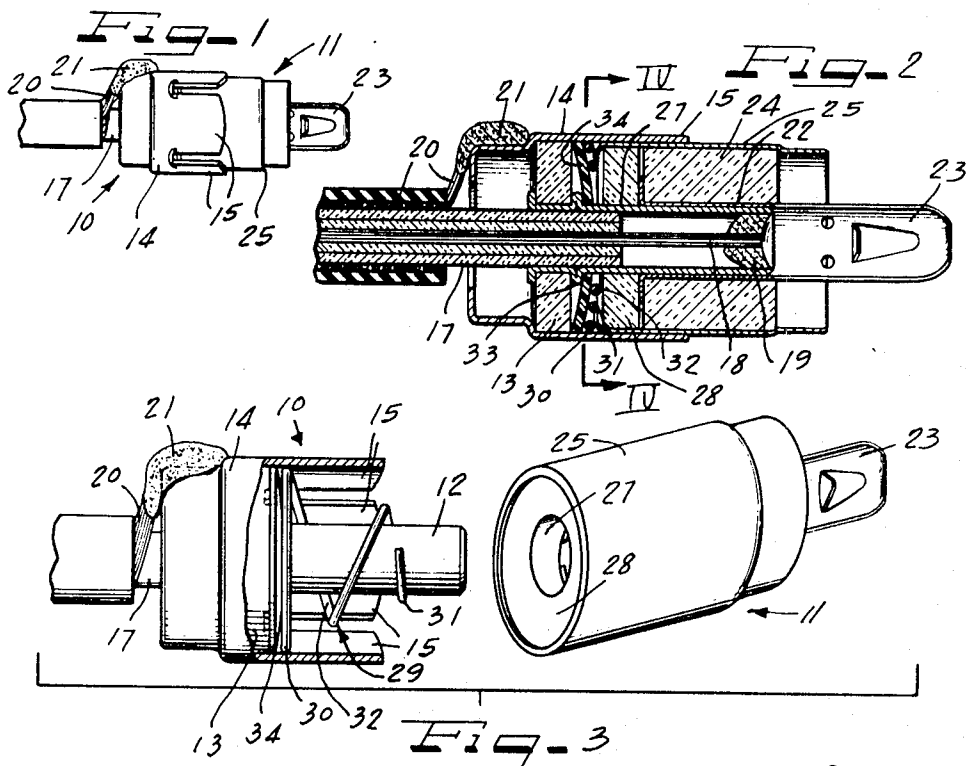
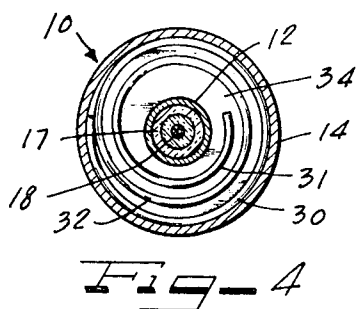
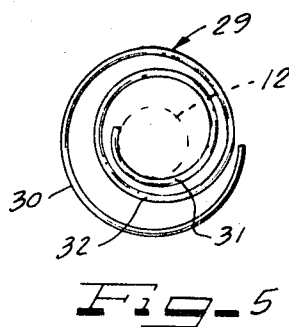
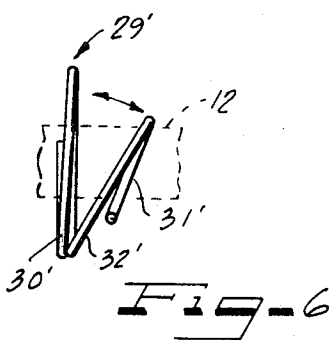
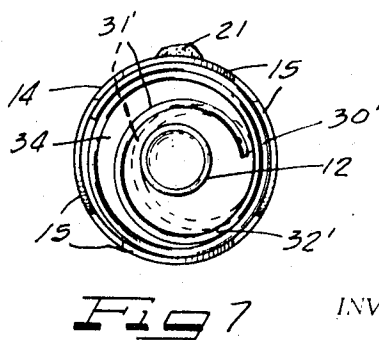
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3,467,940

ELECTRICAL CONNECTING SPRING DEVICE

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ELECTRICAL CONNECTING SPRING DEVICE

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11 Claims

ABSTRACT OF THE DISCLOSURE

A coiled compression spring mounted in a separable plug and jack connector automatically expands and grounds the plug in the absence of the jack and is inactivated upon being compressed by assembly of the jack with the plug.

This invention relates to the art of electrical connecting devices, and is more particularly concerned with a compression spring device which automatically makes an electrical connection between two electrically conductive elements in the expanded condition of the spring and is inactivated upon being compressed.

An example of electrical mechanism in which an automatic electrical connection is necessary in one condition of the mechanism and a disconnection or inactivation is necessary in another condition of the mechanism, is in that type of electrical connection known as a phonoplug connector which provides a low cost means for connecting two circuits together or two pieces of apparatus together without requiring a soldered connection. This type of connector is efficiently utilized in television sets having both VHF and UHF tuners. The jack portion of the connector is suitably connected to the VHF tuner, and the plug portion of the connector is attached to a section of armored cable which is soldered directly into the UHF chassis. Part of the UHF tuner circuitry is a conversion crystal which is highly sensitive to buildup of static charges. Such charges are liable to develop when the connector is separated. Therefore, means are provided for grounding the plug, connected to the UHF tuner, when the plug is pulled out of the socket of the jack portion of the connector.

As heretofore effected, grounding of the plug has been by means of a tension spring connected to the grounded cable armor and normally thrusting toward the plug, to be displaced laterally when the plug is inserted into the mating socket or jack. Such a spring has been an expensive component, costly to install, and unduly susceptible to damage.

An important object of the present invention is to provide new and improved electrical spring means which will overcome the disadvantages and deficiencies of the prior constructions and which will afford numerous advantages including lower cost, ease of installation, practical freedom from damage, and highly efficient performance.

Another object of the invention is to provide substantially improved means for effecting selective electrical connection and disconnection between electrically conductive members.

A further object of the invention is to provide a new and improved spring means for automatically electrically connecting conductive elements in a separable connector when the separable members of the connector are separated and which will automatically disconnect upon assembly of the separable members of the connector.

Other objects, features and advantages of the present invention will be readily apparent from the following detailed description of certain preferred embodiments thereof taken in conjunction with the accompanying drawing, in which:

FIGURE 1 is a side elevational view of an electrical connector embodying features of the invention;

FIGURE 2 is an enlarged longitudinal sectional detail view through the connector of FIGURE 1;

FIGURE 3 is a separated assembly view of the separable members of the connector, with certain parts broken away and in section to show details of structure;

FIGURE 4 is a transverse sectional detail view taken substantially on line IV—IV of FIGURE 2;

FIGURE 5 is a top plan view of the compression shorting spring of the connector shown in its normal biased or expanded condition;

FIGURE 6 is a side elevational view of a modification of spring; and

FIGURE 7 is a plan showing the spring of FIGURE 6 in its compressed condition.

An example of a jack and plug connector, of the kind referred to in the television industry as a phonoplug, is shown in FIGURES 1–3 and comprises a plug assembly 10 and a jack assembly 11. In this instance the plug assembly 10 is especially devised to be connected to an UHF tuner in a television set while the jack assembly 11 is arranged to be electrically connected to the VHF tuner of the set.

Component elements of the plug assembly 10 comprise an electrically conductive hollow tubular plug 12 mounted on a dielectric disk 13 which supports in insulated relation about the plug an electrically conductive shell 14 providing a connector retaining sleeve longitudinally slotted to provide resilient gripping fingers 15. Into the base end portion of the plug 12 is adapted to be inserted the end portion of an insulated electrical cable 17, having the end portion of its electrical lead 18 electrically attached to the plug as by means of solder 19. The cable 17 is of the armored type having a grounding electrically conductive armor sheath 20 which is electrically attached to the shell 14 as by means of solder 21.

Component elements of the jack member 11 comprise an electrically conductive tubular socket 22 complementary to the plug 12 to receive the plug in electrically connective slidable relation therein and having a rearwardly extending solder lug 23 for electrical attachment thereto of a connecting electrical cable. Mounted about the socket tube 22 is a dielectric sleeve 24 which supports a tubular connector shell 25 in insulated relation about the socket and of a diameter to sit in snug retained relation when pressed into the retaining fingers 15 of the plug assembly. A lead-in bore 27 aligned with the lead-in end of the socket 22 is provided by a dielectric disk 28 supported by the front end portion of the shell 25. Through this arrangement, ready connection and separation of the plug 10 and the jack 11 are adapted to be effected by frictionally coaxially pressing them together or pulling them apart.

Means are provided for effecting an electrical connection between the plug element 12 and the shell element 14 whenever the connector members are separated, and for automatically breaking such electrical connection when the connector members are assembled in their operative relation. According to the present invention such means comprise an electrically conductive compression spring 29 normally biased to effect the electrical connection between the elements 12 and 14. For this purpose, the spring 29 is of spiral form comprising a relatively large base loop 30 at one end, a relatively smaller loop 31 at its opposite end and a connecting portion 32 which normally biases the loops into spaced apart relatively eccentric relation. The large loop 30 is of a diameter substantially complementary to the inside diameter of the connector shell 14 to be received therein in snug slidable electrically connected relation, with the spring encompassing the plug 12. The small loop 31 is of a size

to receive the plug 12 therethrough freely, and the biased eccentricity of the small loop 31 is such that in the normally biased, expanded condition of the spring 29 the small loop slidably engages the plug 12 in firm electrically connecting relation as best seen in FIGURES 3 and 5.

When the plug member 10 and the jack member 11 are assembled to effect an electrical connection, the jack member 11 compresses the spring 29 toward the base provided by the dielectric element 13. As a result the loop 31 and the connecting portion 32 of the spring assume a substantially regular spiral relationship to the large loop 30, wherein the small loop 31 is substantially concentric with the large loop, and thereby also assumes a substantially concentric, spaced relation to the stem or plug 12, as shown in FIGURES 2 and 4. Thus, automatically on assembling the connector members 10 and 11 operatively, the electrical connection between the elements 12 and 14 is broken. Conversely, automatically upon separating the members 10 and 11, an electrical connection is made between the elements 12 and 14 by expansion of the spring and movement of the small loop into its biased eccentric plug-engaging relation. In order to avoid electrical contact of the small loop 31 in its compressed condition with a retaining crimp collar 33 on the base of the plug 12, a dielectric insulating disk 34 is interposed between the base loop 30 of the spring 29 and the collar 33.

By having the connecting portion 32 of substantial length, a range of longitudinal sliding electrical engagement of the small loop 31 with the post or plug 12 is attainable as the jack 11 is pulled from the plug assembly 10. For example, the eccentric and longitudinal biasing effect of the connecting portion 32 may be such as to provide for biased contact of the small loop 31 with the plug 12 after only partial withdrawal of the jack 11 from the receptacle shell 14 and then progressive outward longitudinal sliding of the small loop along the plug, with progressively increasing eccentric biasing pressure, as jack separation continues. The small loop 31 thus effects a self-cleaning, working-in rubbing, electrical contact assuring circuit making connection with the engaged surface of the plug 12 in advance of electrical separation of the plug and jack. This affords a valuable safety factor in a critical situation where positive assurance of electrical connection and absence of potential buildup or sparking is desirable.

Where a shorter spring is desired, and longitudinal sliding along the post is not important, or instantaneous make/break contact is advantageous, the spring 29' of FIGURES 6 and 7 may be used. This arrangement may be such that by having the connecting portion 32' of a relatively short length between the larger base loop 30' and the smaller eccentrically biased loop 31', a swinging movement of the small loop 31' between its collapsed and its biased expanded positions is effected, as indicated by the directional arrow in FIGURE 6. Thus, in the compressed condition of the spring, the smaller loop 31' swings into circuit-breaking relation away from the plug 12 and into generally concentric relation thereto as shown in full outline in FIGURE 7. When the spring is released, the connecting portion 32' swingingly biases the small loop into the electrical circuit making contacting relation to the plug 12, as shown in dash outline in FIGURE 7 and as indicated in the full outline position of the small loop 31' relative to the dash outline showing of the plug 12 in FIGURE 6.

In both forms of the spring 29 and 29', it will be appreciated that a low cost, effective electrical connection spring device has been provided. Low cost is attained in one respect because the simple spiral structure of the spring is the most economical compression spring from a manufacturing standpoint since it is free from any special or peculiar bends requiring complicated die structures to produce. Further, utmost economy in mounting the spring with the connector plug assembly is attained

because all that is necessary is to thrust the spring into position within the receptacle provided by the connecting shell of the plug assembly which thus requires no special tooling or machining, crimping or special connecting means for mounting the spring. Further, the spring is thoroughly protected within the receptacle shell against catching on extraneous objects or being otherwise liable to damage in handling, packaging or in use of the associated plug. Since the spring is so thoroughly protected against damage or maladjustment, it is highly reliable for its intended functions.

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 an electrical assembly having insulated electrically conductive elements laterally offset from one another along an assembly axis and adapted to have a member relatively movably cooperative therewith along said axis: an electrically conductive compression spring mounted in association with said elements and normally eccentrically biased to effect an electrical connection between said elements;

said spring being compressible by movement of said member in one direction relative to said elements to break said electrical connection.

2. An electrical assembly as defined in claim 1, in which said spring is of spiral construction having one portion thereof in permanent electrical connection with one of said elements and a second portion which is movable eccentrically relative to said first portion into electrical engagement with the other of said elements in the biased condition of the spring and is movable away from said second element toward said first portion when the spring is compressed by movement of said member.

3. An assembly as defined in claim 1, comprising a connector plug member in which said elements comprise respectively a plug adapted to have an armored cable electrically attached thereto and the other of the elements comprising a receptacle shell adapted to have the armor sheath of the cable electrically attached thereto, dielectric base means connecting the plug and receptacle in insulated relation, said compression spring being helical and having a large base loop electrically engaged within said receptacle concentric with the plug and having a smaller loop which is of larger diameter than the plug and has the plug extending therethrough, and a connecting portion of the spring between said loops normally biasing the smaller loop into eccentric relation relative to the larger loop and into electrically contacting relation against the plug.

4. An assembly as defined in claim 3, in which said connecting portion is of a length to effect longitudinal sliding engagement with the plug as the spring is released from its compressed condition.

5. An assembly as defined in claim 3, in which said connecting portion is relatively short such that the smaller loop moves in a swinging relation relative to the larger loop between the compressed and normally biased conditions of the spring.

6. An assembly as defined in claim 1, in which one of said elements comprises an elongated member, the other of said elements comprises a receptacle shell about said elongated member, a dielectric base structure mounting said elements in spaced relation, said elongated member including a larger diameter shoulder collar engaging said base structure within the receptacle of said shell; said spring being of coiled helical form about the elongated member and having a relatively large loop engaging the shell within the receptacle adjacent to the base structure substantially spaced from the elongated member and a smaller loop normally biased into eccentric spaced relation to the larger loop and into engagement with said elongated member but movable out of engagement with the elongated member upon compression of the spring, and a dielectric spacer between said spring and said col-

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lar to avoid contact thereof by the smaller loop during said compression.

7. For use in an electrical assembly having insulated electrically conductive elements adapted to have a member relatively movably cooperative therewith:

an electrically conductive compression spring having a relatively large loop-like portion adapted to be in electrical contact with one of said elements and a relatively movable portion with an integral portion connecting them;

said connecting portion normally biasing said movable portion relative to said loop-like portion to make electrical connection with the other of said elements; and said movable portion moving into electrical connection-breaking relation to said other element by compressing the spring.

8. A spring as defined in claim 7, in which said loop-like portion and said relatively movable portion are respective differential diameter loops of a helically coiled spring, and said connecting portion is of substantial length and the loops are movable thereby into substantial axially spaced apart eccentric relation in the normally biased expanded relation of the spring.

9. A spring as defined in claim 8 in which said relatively movable portion loop has a substantial range of longitudinal and eccentric movement between the normal biased and compressed relations of the spring.

10. A spring as defined in claim 7, in which said connecting portion is relatively short such that said movable portion swings between its normally biased relation and a compressed relation to said loop-like portion.

11. In an electrical assembly comprising an electrically

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conductive receptacle and an electrically conductive plug within said receptacle and insulated therefrom and adapted to have a member relatively movably cooperative therewith:

an electrically conductive spiral compression spring having a relatively large base loop permanently engaged with the receptacle electrically and having a smaller loop, with a connecting portion between said loops normally biasing the smaller loop into engagement with said plug to effect an electrical connection between said receptacle and said plug;

said spring being compressible by movement of said member in one direction relative to said receptacle and plug to break said electrical connection.

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339—19, 177; 200—51.1