ELECTRICAL CONNECTOR OF THE PLUG OR SOCKET VARIETY


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ABSTRACT OF THE DISCLOSURE

An electrical connector comprises a contact member at one end for engagement with a spark plug or a distributor and a ferrule member at the other end, the ferrule member includes an insulation-engaging section and a conductor-engaging section. The insulation-engaging section is provided with tabs at ends thereof for interlocking engagement within the insulation of a conductor means upon the insulation-engaging section being crimped into engagement therewith. The conductor-engaging section includes leg members which are foldable inwardly toward each other and are engageable with each other along sections thereof over a stripped area exposing a section of the conductive member of the conductor means to define a conductor-engaging area for bearing against the exposed section of the conductive member and pressing this exposed section against the stripped area.

This invention relates to electrical connectors and more particularly to a plug or socket type connector. Ignition cable, as used in the automobile industry today, consists of a high resistance conductor, insulation, a braid woven over the insulation to prevent stretching of the finished cable and to increase tensile strength of the wire and an outer protective jacket.

Of primary interest is the conductor itself in that it comprises multiple fibrous threads impregnated with graphite or carbon to render the fibrous material conductive and optionally covered with a braided fibrous or extruded rubber coating which are also rendered conductive; however, other suitable materials may be used. The conductor member is such that the insulation strips in order to expose a section of the conductor member extending axially along part of the stripped insulation so that the exposed section of the conductor member can be electrically engaged by conductor-engaging members of a connector.

Most existing spark plug terminals of this type contain a conductor penetrating or stapling means which stems from the fact that prior ignition cable had metal conductor strands and required that the spark plug terminal penetrate or pierce strands thereof; however, since fibrous materials are now used, a spark plug terminal utilizing a pressure type crimper upon the conductive strands greatly reduces cutting or tearing and from penetrating the conductor and thereby increases the mechanical and electrical properties of the connection itself.

Therefore, it is the object of this invention to provide an improved spark plug terminal for making contact to the center conductor of an ignition cable without severing the strands thereof.

It is also an object of this invention to provide an interlocking means on the insulation barrel to prevent spring-back of the barrel after the crimp is made and also to prevent opening of the barrel due to the heat of the engine; said interlocking means also increases tensile as a result of piercing the rubber insulation.

Another object is to increase the tensile strength of the connection by utilizing indents in the insulation barrel which bite into the insulation of the cable.

Another object is to provide a means to prevent opening of the connecting barrel and to prevent over-stressing of the contact spring by providing overlapping interlocking surfaces whereby any side-to-side movement tending to loosen the connection is greatly reduced by outward projections on one locking surface mating with corresponding openings in the other surface.

Another object is the provision of a new and improved connection between spark plug terminal and ignition cable via a connector element.

Other objects and attainments of the present invention will become apparent to those skilled in the art upon a reading of the following detailed description when taken in conjunction with the drawings in which there is shown and described an illustrative embodiment of the invention; it is to be understood, however, that this embodiment is not intended to be exhaustive nor limiting of the invention but is given for purposes of illustration in order that others skilled in the art may fully understand the invention and the principles thereof and the manner of applying it in practical use so that they may modify it in various forms, each as may be best suited to the conditions of a particular use.

In the drawings:

FIGURE 1 is a top plan view of terminal;
FIGURE 2 is a side view of the terminal;
FIGURE 3 is a view taken along lines 3—3 of FIGURE 2;
FIGURE 4 is a view along lines 4—4 of FIGURE 2 showing the wire barrel before being crimped to the center conductor of a cable means;
FIGURE 5 is a view similar to FIGURE 4 but shows the wire barrel after being crimped onto the center conductor of the cable means;
FIGURE 6 is a perspective view showing a prepared spark plug cable prior to crimping;
and FIGURE 7 is a top view showing the spark plug terminal crimped onto ignition cable.

Connector element C comprises an insulation and conductor-engaging section 1a and contact section 1b with section 1a containing interlocking insulation-piercing tabs 2 and conductor-engaging members 14. The tabs have a pentagonal configuration including a sharp outer cutting edge which bites into the cable insulation, thereby providing more tensile between the connector element and ignition cable. Inwardly directed projections 4 having a V-shape in cross-section also cut into the cable insulation to provide additional tensile. Projections 4 may also be dimple-shaped for engagement with the cable insulation without penetration thereof. Of course, projections 4 may take any other desirable form to attain the desired result.

Conductor-engaging members 14 contain generally upstanding sidewalls with inwardly bent ends 16 adapted to engage the center conductor of the ignition cable when crimping occurs. The contact section utilizes overlapping surfaces 8 and 9 with outward projections 18 snapped into respective openings 50 thereby providing a positive locking means to prevent opening of the contact section in that any side-to-side movement tending to loosen the connection is greatly reduced. Detent 10 enhances the mechanical and electrical characteristics of the connection by snapping into a circumferential groove on the spark plug terminal.

When the connector element is used as a plug to be inserted within a distributor socket, the contact section has a diameter larger than the sockets therein in order to snugly fit within the sockets and the free edge of surface 9 is in alignment with stepped section 8a so that the free edge can engage stepped section 8a and apply contact pressure when disposed within the sockets; however, the the contact section may be substantially cylindrical with stepped section 8a being eliminated.
Cable 7 is stripped as illustrated in FIGURE 6 and portion 7a of the cable which has been stripped is centrally located within the portion of section 1a containing conductor-engaging members 14 and tabs 2 are disposed adjacent a non-stripped portion.

Because the environment of this particular application demands a locking means which will prevent loss of tensile strength caused by the insulation-engaging section opening when stresses, tabs 2 interlock and pierce the rubber insulation of said cable thereby preventing springback or opening of the insulation-engaging section and thereby adding to the tensile of the connection. Of particular importance are the interlocking tabs which interlock in dovetail fashion. As can be seen in the drawing, any transverse movement is hindered by the dovetail configuration of the tabs.

Actual termination between center conductor 6 of cable 7 and the connector element is effected by means of a pressure contact.

It is desirable when crimping the open barrel connector element of the present invention to use crimping dies of the type disclosed in U.S. Patent Nos. 2,600,012, and 2,618,632. In use, the connector elements are fed or placed within the crimping area of the crimping dies, the stripped cable being placed within the connector element. The crimping dies of the crimping dies is operated causing bent ends 16 of conductor-engaging members 14 to be forced inwardly toward each other and downwardly toward the bottom of the connector element with each bent end being embedded within the insulation and the conductor-engaging members engaging each other and pressing conductor 6 against the insulation as illustrated in FIGURE 5. Thus, the conductor-engaging members do not penetrate the conductor, they press the conductor against the insulation thereby effecting an excellent mechanical and electrical connection.

The tabs on section 1a are simultaneously folded inwardly and downwardly and are interlocked with one another in a dovetail fashion so as to provide along with projections 4 a termination on ignition cable that has excellent tensile characteristics. While the present invention has been directed to ignition cable having a center conductor of carbon-impregnated threads, the present invention can be applied to other types of ignition cable because the crimp would be just as effective thereon.

As can be discerned, there has been disclosed a unique connector means for terminating insulated conductor means as well as a unique spark plug terminal for terminating ignition cable to be used to connect with a spark plug as a socket or to be inserted within a distributor as a plug.

It will, therefore, be appreciated that the aforementioned and other desirable objects have been achieved; however, it should be emphasized that the particular embodiment of the invention which is shown and described herein, is intended as merely illustrative and not restrictive of the invention.

What is claimed is:

1. In a connector element for terminating ignition cable, the combination comprising a wire barrel and a contact end, said wire barrel including interlocking tabs to interengage one another within insulation of said cable, said connector element to said cable and detents to engage said insulation to increase tensile between said wire barrel and cable, conductor-engaging elements to be bent inwardly toward each other and to engage each other adjacent the insulation so as to engage a center conductor of said cable by the engaged elements pressing a stripped portion of said center conductor against said insulation, said contact end including overlapping surfaces provided with latching means to maintain the surfaces in an overlapped position.

2. In a connector element for terminating spark plug cable with the cable being partially stripped at one end to expose a section of a conductor member extending along insulation, the combination including a wire barrel and a contact section; said wire barrel comprising interlocking tabs adapted to be folded over said insulation adjacent said partially stripped end and pierce said insulation in an interlocking manner upon the application of crimping pressure thereto, conductor-engaging elements defining generally upstanding sidewalls with inwardly bent ends, said ends adapted to penetrate the insulation adjacent said Section of said conductor member, to engage each other an engage said exposed section and press same against said insulation to form an electrical connection therebetween; said contact end having overlapping surfaces and an inwardly-directed detent, one of said overlapping surfaces being provided with outwardly-directed projections which are mateable with openings in the other surface thereby providing locking means to maintain said contact end in a contact-engaging position.

3. In a connector element comprising a wire barrel and a contact end; said wire barrel comprising interlocking tabs to interengage one another in a dovetail fashion and to penetrate insulation of an insulated conductor member to secure said connector element to said conductor member, detents to engage said insulation to increase tensile between said wire barrel and cable, conductor-engaging elements to engage a center conductor of said conductor member by pressing a stripped portion of said center conductor against said insulation without penetrating the center conductor; said contact end having overlapping surfaces and an inwardly-directed detent, one of said overlapping surfaces being provided with outwardly-directed projections which are mateable with openings in the other surface thereby providing locking means to maintain said contact end in a contact-engaging position.

4. An electrical connector comprising at one end a contact member for connection with an electrode of a spark plug and at the other end a ferrule member including an insulation-engaging section for engaging insulation of a conductor means and a conductor-engaging section for electrically engaging conductive means exposed along a stripped area of said conductor means adjacent an end thereof, said insulation-engaging section provided with tabs at ends thereof for interlocking engagement within said insulation upon said insulation-engaging section being crimped into engagement therewith, said conductor-engaging section including leg members adapted to be folded inwardly toward each other and to engage each other along sections thereof over said stripped area to define a conductor-engaging area for bearing against said conductive means and pressing said conductive means against the stripped area.

5. An electrical connector of claim 4 wherein said contact member includes overlapping sections defining an inner section and an outer section, one of said sections having a stepped section and the other section provided with an edge in alignment with said stepped section located so that the edge can engage and apply contact pressure when disposed within a socket member, one of said overlapping sections having outwardly-directed projections mateable with openings in the other of said overlapping sections to maintain said contact end in position to engage a plug member.

6. An electrical connector according to claim 4 wherein inwardly-directed detent members are disposed in said insulation-engaging section.

7. In an electrical connection between an insulated conductor member and a connector member, said conductor member having insulation stripped at one end to expose a portion of a conductor member, said section of said insulated cable, said conductor member having an insulation-engaging section and a conductive-engaging section, said insulation-engaging section including interlocking tabs penetrating into the insulation of said conductor member in dove-tailed fashion thereby
securing said connector member and conductor member together, said conductive-engaging section having arm members engaging each other and electrically engaging and pressing said stripped portion of said conductive member against said section of insulation, and a contact end extending outwardly from said insulation-engaging and conductive-engaging sections.

8. In an electrical connection according to claim 7 wherein inwardly-directed detents are located on said insulation-engaging section and are disposed in said insulation to increase the tensile strength between said connector member and conductor member.

9. In an electrical connection according to claim 7 wherein said arm members have ends penetrating into said section of insulation on each side of said stripped portion of said conductive-member.

References Cited
UNITED STATES PATENTS
1,672,201 6/1928 Champion 339—223
2,142,818 1/1939 Jacobson 339—223
2,845,606 7/1958 Fuller 339—223
3,169,814 2/1965 Collins 339—223
3,200,367 8/1965 Blanchenot 339—223
3,231,850 1/1966 Kilburg 339—223
3,278,889 10/1966 Elliott 339—223
3,286,221 11/1966 Blakesley 339—223
2,917,198 4/1943 Kasper 339—276
2,699,535 1/1955 Flora 339—258
3,141,724 7/1964 Raymond 29—630
3,286,223 11/1966 Narozny et al. 339—258
3,221,294 11/1965 Roberts 29—630

FOREIGN PATENTS
516,640 1/1940 Great Britain.

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