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CONNECTOR ELEMENT FOR IGNITION SYSTEMS

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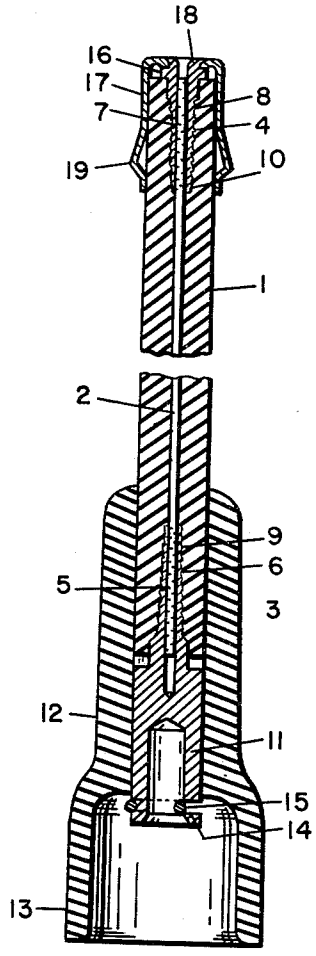

FIG. 1

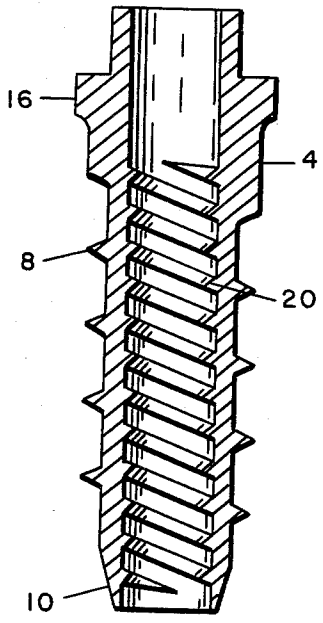

FIG. 2

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CONNECTOR ELEMENT FOR IGNITION SYSTEMS

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The invention relates to connector elements for ignition systems.

More specifically, the invention relates to an electrical connection comprising a cable having a strong-walled elastic insulating jacket and a solid internal conductor of synthetic material being loosely held in the insulating jacket and the material of the inner conductor being somewhat harder and less resilient than the material of the insulating jacket, connecting means for establishing an electrical connection with an implement to be associated and a metallic contact sleeve conductively connected therewith, said contact sleeve having first screw threads on its outer surface and being screwed into the insulating jacket, second screw threads having substantially the same pitch as the screw threads on the outer surface being formed on the inner surface of the contact sleeve and being screwed on the internal conductor in the meantime, when the screw threads on the outer surface of the contact sleeve are screwed in the insulating sleeve, said two threads being pressed or cut into the adjacent walls of the insulating jacket and the internal conductor of the cable respectively.

It is known that the ignition systems of motor vehicles can be prevented from emitting radiation, which disturbs radio and television reception, by interposing resistances of a few kilohms in the ignition cable at points close to the spark plugs and distributor. In order to save such resistances, ignition cables were developed in which the internal conductors themselves possessed a very high resistance. A section of such a cable which, for use in motor vehicles, has the usual length of the connecting conduits from the distributor to the spark plugs, namely about ½ meter, has the required resistance of a few kilohms.

A suitable cable of the type may be in the form of a strong-walled resilient insulating jacket with an internal conductor consisting of a synthetic resin having a carbon filler incorporated therein.

With this type of cable, it is very difficult to efficiently secure a connector thereon. Since the aforesaid internal conductors can not be brazed, only a clamp connection can be applied. However, it is necessary to clamp the internal conductor over a relatively large area because in the case of only a point contact the conducting carbon layer, becomes easily overloaded due to the extremely high contact resistance and may melt away.

It is already known to provide a connector for such a cable wherein the internal conductor is inserted into a slit sleeve having an inner diameter only slightly larger than the outer diameter of the conductor. The sleeve, having a wall thickness tapering toward one end and screw threads cut in its outer surface, is screwed into the space between the internal conductor and the resilient heavy-walled insulating cover of the cable. This causes the sleeve to be compressed by the insulating tube which has the effect of clamping the internal conductor over a large area.

However, such a connection is still subject to serious drawbacks which become apparent especially when large quantities of connectors are to be quickly fastened to ignition cables of the aforesaid type, as required by the great demand for such cables in automobile ignition systems.

The internal conductor of the ignition cable which is made of a synthetic resin has in its preferred form a diameter of approximately 2 mm., the theoretical value of

which must be accurately observed, in spite of many difficulties, to permit efficiently securing the connector to the cable and clamping the internal conductor therebetween with the necessary pressure. If the internal conductor is too thick, it will slide only with difficulty into the clamping sleeve of the connector and there is danger of shearing it off when the connector is screwed on. On the other hand, if the internal conductor is too thin it is not possible to clamp it with sufficient force in the clamping sleeve.

A further important feature is involved. The internal conductor of synthetic resin is only loosely held in the strong-walled insulating jacket of conventional resistance cables and is, therefore, easily movable therein. Moreover, it is harder and less resilient than the insulating jacket. When the connectors are to be removed from the spark plugs and from the distributor it is customary to grasp the ignition cable at the insulating jacket thereof. Since the latter stretches to a greater extent than the internal conductor, there is danger in having the conductor slide out of the clamping sleeve, as a result of the pulling action, if it is not clamped with sufficient force. It is very doubtful whether the conductor is capable of later sliding back into the clamping sleeve to the extent necessary for restoring contact over a large area between the conductor and the connector.

An object of this invention is to provide an efficient and easily constructed connection element for cables having a strong-walled elastic insulating jacket and an internal conductor of elastic material, preferably of a synthetic material.

A further object of this invention is to provide a connection element for the aforesaid cable in which there is created a contact over a large area having a low transitional resistance with respect to the internal conductor.

An additional object of this invention is to provide a strong mechanical connection between the connector element and the internal conductor of synthetic material so that the latter can not be drawn out of the connector element when the cable is being pulled. Still another object of this invention is the feature of quickly and easily securing the connector element to the aforesaid cable in such a way that a good contact and strong hold is achieved in spite of relatively great fluctuations in the diameter of the internal conductor.

Still another object of the invention is the provision of an internal conductor for a cable which need not be stripped of its insulating jacket at its connecting ends but only has to be cut off, thus avoiding the loss of cable material.

With the foregoing objects in view, the inventive connector element consists of means for establishing an electrical connection with an implement and a contact sleeve conductively connected therewith which has screw threads cut into its inner surface. The contact sleeve of the present invention is inserted, like the clamping sleeve of the aforesaid known connector, by screwing it into the space between the internal conductor and the insulating jacket. In order to facilitate the screwing in of the contact sleeve and improve the consolidation of the connector and cable, it is desirable to retain the outer screw thread used in the known clamping sleeve. It is possible to insure that the sleeve is screwed in to a depth that is the same for both the internal conductor and the insulating jacket, by making the two screw threads on the outer and inner cover of the contact sleeve with the same pitch. The diameter and the depth of the two screw threads have such dimensions that, upon screwing the contact sleeve into the joint of the insulating jacket and the internal conductor of the cable, the threads will cut into the adjacent walls of the insulating jacket and the internal conductor of the cable, or at least are pressed into same.

The screw thread in the internal conductor of synthetic material has the effect of greatly increasing the contact surface between the internal conductor and the screwed in contact sleeve. A strong pull of the cable would cause the internal conductor itself to come apart before permitting its threaded portion to be withdrawn from the contact sleeve.

The contact sleeve with its inner threads need not be of the slit type thus making possible its complete manufacture on an automatic lathe. The dispensing of the additional slitting step represents in mass production a considerable saving in the manufacturing cost.

Moreover, it is possible to admit considerably greater tolerances for the diameter of the internal conductor, since the larger contact surfaces and the improved consolidation of the internal conductor and contact sleeve have the effect of minimizing the drawbacks resulting from serious fluctuations. It is possible to still further improve these properties by suitably cutting a double screw thread into the inner surface of the contact sleeve. For the same reason, advantageous properties are obtained by the use of a saw tooth thread which has a flat pitch on the side facing the cable and a steep pitch on the opposite side.

The cutting of the threads into the synthetic material can also be facilitated by the selection of a thread having suitable characteristics, for example a wood screw thread.

It has already been pointed out that the insulating jacket of conventional resistance ignition cables is softer and more resilient than the internal conductor of synthetic material. If there is a great difference in elasticity there will be a tendency, as the contact sleeve is screwed in, for the insulating jacket to be twisted around to an extent greater than the internal conductor of the cable and thus fall short of the latter, for example by half a screw thread. In that case, the depth reached by the sleeve as it is screwed in would be half a screw thread shorter in the insulating jacket than in the insulating conductor. This deficiency can be removed by selecting for the outer thread of the contact sleeve a somewhat steeper pitch than for its inner thread.

In the accompanying drawings:

FIGURE 1 shows an ignition cable having the inventive connection elements at both its ends.

FIGURE 2 shows the contact sleeve with its inner and outer screw threads in a larger scale.

The ignition cable in FIGURE 1 consists of a strong-walled elastic insulating jacket 1 with the internal conductor 2 of synthetic material concentrically imbedded therein.

Contact sleeves 3 and 4 are screwed in at opposite ends of the cable between the internal conductor and the insulating jacket. Both contact sleeves have wood screw threads 5, 6 and 7, 8 respectively provided in their inner and outer surfaces, the diameter and depth of said threads being proportioned in such a way that they will be cut or at least pressed into the adjacent walls as the sleeve is screwed in. The inner and outer screw threads have the same pitch.

The threads shown in FIGURE 1 are all of the single thread type, whereas FIGURE 2 shows the inner screw thread 20 having a double thread in the enlarged representation of contact sleeve 4 of the upper connector in FIGURE 1.

In order to facilitate the insertion of the threaded sleeves 3 and 4 into the cable, the ends 9 and 10 thereof are respectively conically tapered to a point at the outside and bored open at the inside over a short section extending to the outer thread diameter, as clearly shown in FIGURE 2.

The threaded sleeve 3 is provided at its other end with a socket 11 which fits over the stud of a spark plug.

The socket 11 and the threaded sleeve 3, in accordance with the present invention, are both spun from one piece and pressed into an insulating body 12 the enlarged appendage 13 of which is fitted over the spark plug when the socket 11 is secured to the stud of the spark plug. A groove is carved into the outer surfaces of the socket 11 close to the free end thereof and a slit 14 is cut tangentially inside the groove so that the socket wall is pierced at parts of its circumference. A hairpin-shaped spring 15 made of round wire having its ends bent inwardly at right angles is slipped into said groove and slit 14. The socket 11 is held in known manner by this spring on the stud of the spark plug.

The end of the insulating body 12 adjacent to the cable is approximately as long as contact sleeve 3. However, it provides for a free space around said sleeve for receiving the insulating jacket 1 of the ignition cable.

The clamping sleeve 4 at the other end of the cable is provided with a collar 16 which supports a covering sleeve 17. The appendage 18 extending outside of collar 16 is turned over thereby fastening covering sleeve 17. The covering sleeve 17, which may have longitudinal slits, embraces the insulating jacket 2 of the cable and serves as a connector for insertion into the distributor of an automobile. The resilient bends 19 at the free end of covering sleeve 17 insure the most satisfactory grip and contact of the connector in the socket of the distributor.

In both the connector elements shown in FIGURE 1, the ignition cable can be simply turned or twisted in when equal lengths of the insulating jacket 1 and the internal conductor 2 are cut off. The fastening of the connector can be quickly carried out by means of a simple device. Moreover, the ends of the cables need not be insulated which also eliminates wasteful cutting of the cable.

I claim:

1. An electrical connection comprising a cable having a strong-walled elastic insulating jacket and a solid internal conductor of synthetic elastic material, loosely held in the insulating jacket, the material of the inner conductor being somewhat harder and less resilient than the material of the insulating jacket, connecting means having a metallic contact sleeve conductively connected therewith, said contact sleeve having first screw threads on its outer surface and second screw threads on its inner surface, said first and second screw threads having substantially the same pitch, said second screw threads being screwed onto the internal conductor at the same time as the first screw threads on the outer surface of the contact sleeve are screwed into the insulating jacket, and being forced into the adjacent walls of the insulating jacket and the internal conductor of the cable respectively.

2. An electrical connection as set forth in claim 1 wherein the threads are pressed into the adjacent walls of the insulating jacket and the internal conductor of the cable respectively.

3. An electrical connection as set forth in claim 1 wherein the threads are cut into the adjacent walls of the insulating jacket and the internal conduit of the cable respectively.

4. An electrical connection as set forth in claim 1 wherein the second screw threads are double.

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