Oct. 17, 1967 W. C. HARTMAN ETAL 3,348,190

TEST CLIP

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FIG. 1

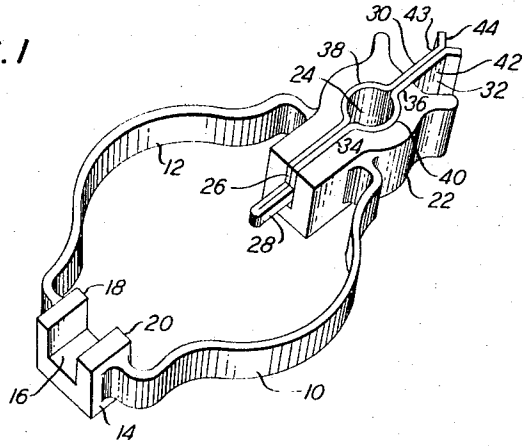


FIG. 2

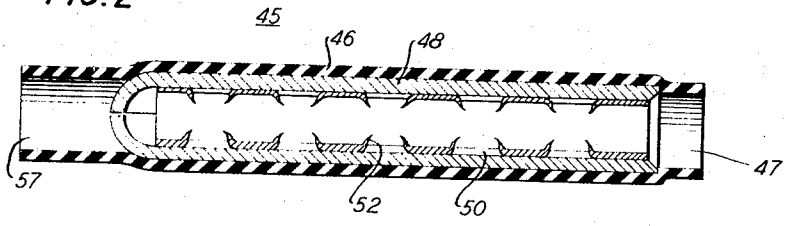


FIG. 3

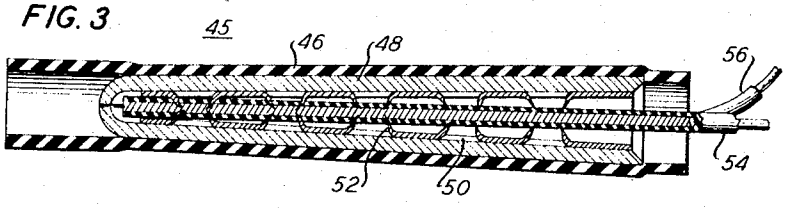
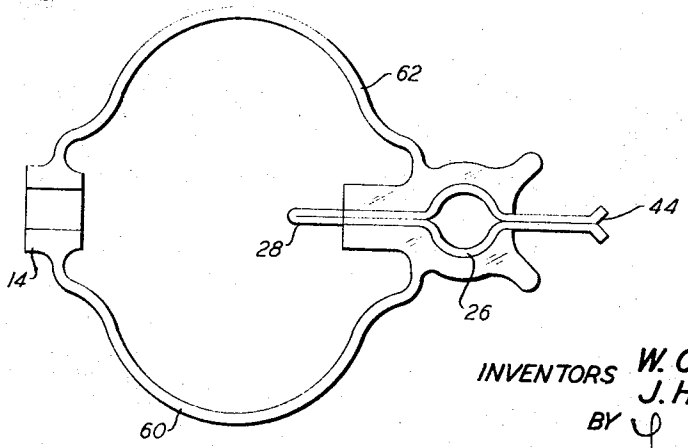


FIG. 5



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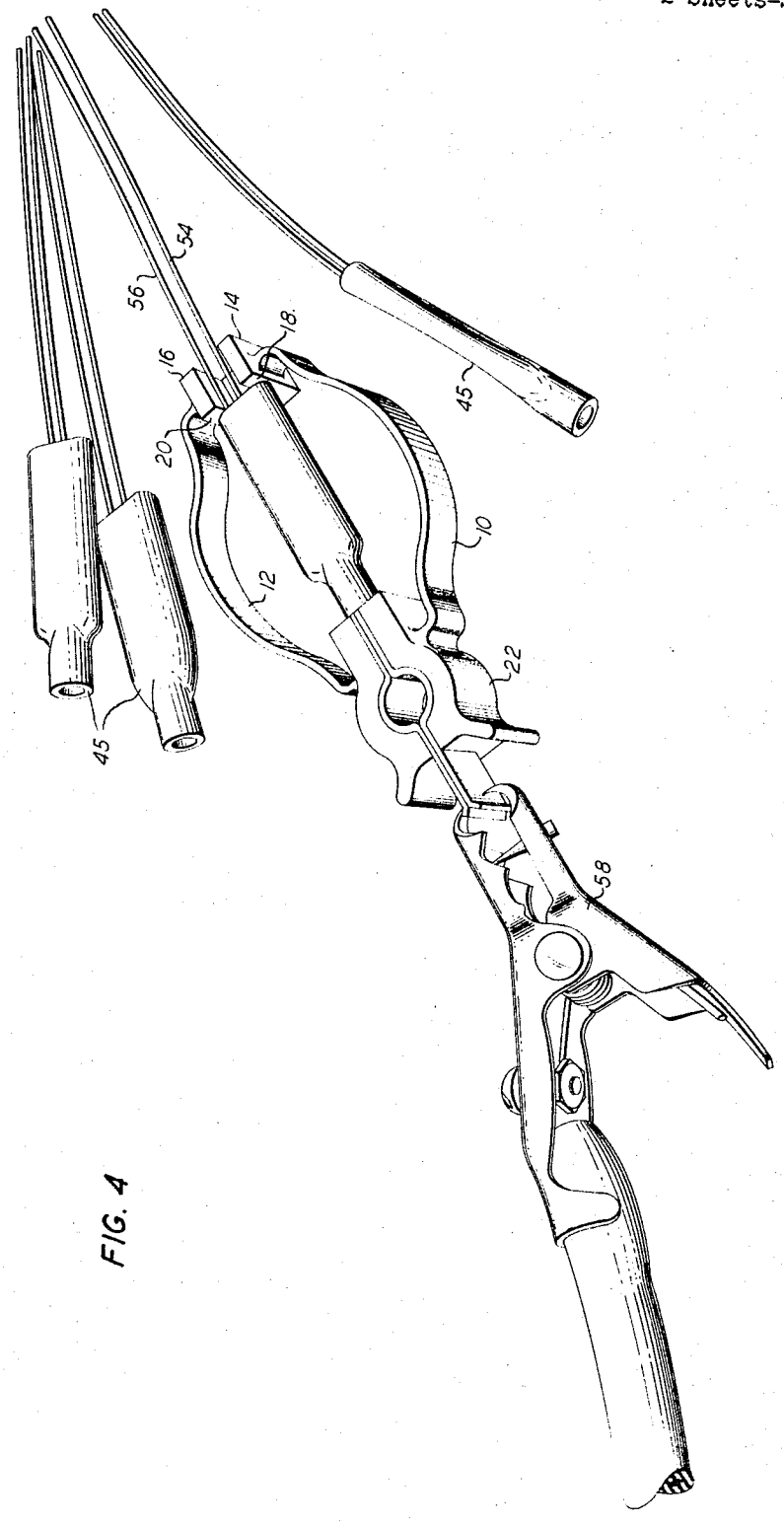


FIG. 4

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3,348,190

TEST CLIP

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This invention relates to electrical fastening clips, particularly for establishing and maintaining electrical contact with the conductive interior of a so-called B-wire connector whose exterior is insulated and whose basic structure is described in Patent No. 3,064,072, issued Nov. 13, 1962.

Such B-wire connectors are generally used for joining the individual wires that make up a multiconductor cable with the wires that make up another multiconductor cable so as to form a splice bundle. The individual B-wire connectors comprise an inner hard metal tube-shaped liner having inwardly-projecting tangs. A soft metal tube-shaped liner surrounds the hard metal liner. In present B-wire connector designs an outer insulating sleeve, open at both ends and shrunk-fit about the soft metal liner, protects the liners electrically. When two insulated wires, one from each cable, are inserted to an open end of the connector and the connector is squeezed radially by a vise-like tool, the inwardly-projecting tangs penetrate the wire insulation and enter the conductive surface of each wire so as to establish firm contact. The soft metal liner maintains this contact after the squeezing stops. To assure adequate insulation, the outer shrunk-fit insulating sleeve extends well beyond the liner end. Thus, a craftsman, in order to test the individual connections of a splice bundle, perhaps some years after the splice bundle is completed, must gain access to the connector's conductive interior despite the effect of the sleeve.

In the past, such contacts have been attempted by penetrating the outer insulating sleeve with a sharp clip, thereby impairing the sleeve's insulating effect. On the other hand, acquiring such electrical contact by inserting test probes into the open end of the sleeve has proven inconvenient because the cable wires to be connected are thin and flaccid. Therefore, long-time contact of the connector with probes requires the craftsman to hold the probe and the connector continuously and interferes with his ability to adjust test equipment. He thus finds it difficult to run tests on several connections simultaneously.

Other attempts at establishing these continuous contacts have been unsuccessful.

An object of this invention is to improve connector clips for contacting connectors of the above-mentioned type.

Another object of the invention is to establish such contact with a simple, easily-manufactured clip.

Still another object of the invention is to establish contact with a B-wire connector of the above-mentioned type by means of a clip requiring little or no attention once contact is made.

Still another object of the invention is to establish and maintain such contact as simply as possible while at the same time permitting simple release without complex tools.

Yet another object of the invention is to avoid destruction of any parts of the connector to which contact is made.

According to the invention these ends are achieved by holding a conductive prong in a block of insulating material and pointing it toward a wire-holding cradle that is joined to the block by a pair of spring-like outwardly-bowed arms whose resilience establishes a space between

the cradle and block and also urges the prong into one end opening of the connector, while the cradle holds the wires emerging from the other end of the connector and abuts against that end of the connector. By furnishing a fin to the other end of the prong, a snap-type or alligator clip can grip and make contact with the conductive liners.

According to another feature of the invention the spring-like arms are bowed-out sufficiently so that when they are squeezed inwardly from the relaxed position the prong travels from the cradle a distance greater than the distance between the open end of the connector and the interior conductive liners. By virtue of this feature a craftsman can establish a connection to the connector with one hand. He simply grasps the bowed arms between his thumb and middle finger while holding the cradle opening toward his forefinger. He then slips the wires to be connected into the cradle opening with the aid of his forefinger and draws back until the cradle abuts against the end of the connector from which the wires emerge. He then squeezes the arms, and by manipulating the wire connector, arranges the prong so that upon releasing the arms the prong enters the end of the connector and establishes the desired contact.

These and other features of the invention are pointed out in the claims. Other objects and advantages of the invention will become obvious from the following detailed description when read in light of the accompanying drawing wherein:

FIG. 1 is a perspective view of the clip embodying features of the invention;

FIG. 2 is a cross-sectional view of the connector to which the clip of FIG. 1 is to be attached;

FIG. 3 is a cross-esctional view of the connector in FIG. 2 joining two wires;

FIG. 4 is a perspective view of a clip embodying features of the invention and engaged to a connector forming part of a splice bundle; and

FIG. 5 is a plan view of a connector embodying those features of the invention which permit single-hand operation.

In FIG. 1, showing a connector clip according to the invention in an unstressed condition, a pair of outwardly-bowed opposing arms **10** and **12** terminate at the sides of a block-shaped cradle **14** having a rectangular depression or cutout **16**. The cradle **14** exhibits two inwardly-directed faces **18** and **20** merging at their bottoms. Connected integrally to the other ends of the bowed arms **12** and **13** is a clamp **22** whose Φ-shaped opening **24** holds a contact member **26**. The latter comprises a shaped ribbon folded at a prong **28** between the bowed arms **10** and **12**. Its two fold-over portions **30** and **32** are force-fitted into the slots **34** and **36** of the opening **24** and exhibit symmetrical arcuate portions **38** and **40** that are force-fitted into the round portion of the Φ-shaped opening **24**. The ends **42** and **43** of the fold-over portions **30** and **32** project together beyond the block **22** to form a bifurcated fin **44**.

The block **22**, the arms **10** and **12** and the cradle **14** ares molded integrally from a plastic material available from the E. I. du Pont de Nemours and Company of Wilmington, Del., under the name Delrin or from the Celanese Corporation under the mark Celcon. The contact member **26** is composed of a conductive material such as a copper alloy.

The clip shown in FIG. 1 grasps and connects to the interior portion of a connector **45** such as shown in FIGS. 2 and 3. This connector structure is based upon the connector described in Patent No. 3,064,072, issued Nov. 13, 1962 to H. J. Graff et al. Here, an outer insulating sleeve **46** is shrunk-fit about a soft metal liner **48** closed

on one end embracing a hard metal liner **50** having inwardly-projecting tangs **52**. Such a connector is used by inserting two insulated wires to be connected into the open end **47** of the liners **48** and **50** and then squeezing the entire assembly so that the tangs **52** penetrate the wire insulation and contact the conductors as shown in FIG. 3. Here, the wires to be connected are designated **54** and **56**. The connector now has one open end **57** and one end **47** from which the wires **54** and **56** emerge.

The connectors of FIGS. 2 and 3 are generally used for connecting the wires in two or multiconductor cables so as to form a splice bundle having perhaps one hundred or more connections of the type shown in FIG. 4. It is with the connectors **45** of such a splice bundle that the clip of FIG. 1 is most useful.

Applying the clips of FIG. 1 to a connector **45** is a simple operation. A craftsman merely slips the prong **28** into the opening **57** and then squeezes the arms **10** and **12** until the cradle **14** travels far enough from the block **22** for the cutout **16** to receive the wires **54** and **56**. The resilience of the arms **10** and **12** urges the block faces **18** and **20** against the end **47** while urging the prong **28** into contact with the liner **48**. A suitable spring clip **58** can then simply grasp the connector **26** near the fin **44** for electrical engagement.

Often the splice bundles are found in comparatively inconvenient locations below ground. Frequently, they are sufficiently inaccessible so that it is desirable to apply the clip of FIG. 1 to a connector **45** illustrated in FIG. 4, with one hand. This can be done by using the clip shown in FIG. 5 where the arms **60** and **62** bow out further than in FIG. 1. When the arms **60** and **62** of FIG. 5 are squeezed, the block **22** retracts from the cradle **14** much further than in FIG. 1. However, the block **22**, when the arms **60** and **62** are unstressed, returns to a position whose distance from the cradle is the same as that of FIG. 1. To apply the clip of FIG. 5 with one hand a craftsman need merely grasp the arms **60** and **62** with the thumb and middle finger so that the opening **16** is opposite his forefinger and the prong **28** points outwardly from his hand. With the connector **45** pointing at him, he pushes the wires **54** and **56** emerging from the connector **45** into the opening **16** with his forefinger and draws back the entire clip of FIG. 1 until the faces **18** and **20** hit the sleeve **46** at opening **47** from which the wires **54** and **56** emerge. Squeezing the arms **60** and **62** moves the block **22** away from the cradle **14** until the prong **28** can enter the open end **57** of the connector **45**. Slight manipulation of the wires with the forefinger will align the prong **28** and connector end **57**. By releasing the arms **60** and **62** the prong makes contact with the interior liner **48** of the connector **45**.

By virtue of the invention, a craftsman can electrically engage and maintain contact with any of the connected wires in the splice bundle without creating the danger of short circuits and without any destructive effects upon the connectors. Several such clips can be applied to a number of connectors and various snap clips can then be connected to the clips of FIG. 5 for running any number of tests.

Removing each of the clips of both FIGS. 1 and 5 is a one-hand operation. A craftsman need merely squeeze the arms **10** and **12**, and **60** and **62** lightly between his thumb and middle finger and then push the connector **45** with his forefinger so that the wires **54** and **56** come out of the cradle **14**.

While an embodiment of the invention has been described in detail, it will be obvious to those skilled in the art that the invention may be embodied otherwise without departing from its spirit and scope.

What is claimed is:

1. A test clip for contacting an insulated connector from which wires protrude at one end and which has an opening at the other end, comprising insulating cradle means for receiving the wires emerging from one end of the connector and for abutting aganst the one end of said connector, insulating block means made of the same material as said cradle means, conductive prong means projecting from said block means toward caid cradle means, variable means for establishing a predetermined spacing betwen said cradle means and said block means when said variable means are unstressed, said variable means including a pair of outwardly-bowing resilient insulating arms extending from said cradle means to said block means and being integral with both of said last-named means, said prong means being retractable from said cradle means by squeezing said arms inwardly, said spacing being small enough so that when said cradle means abuts against the end of the connector to be contacted said arms resiliently urge said prong means into said opening.

2. A clip as in claim **1** further comprising conductive fin means integral with said prong means and projecting away from said cradle means so as to be graspable by a snap clip.

3. A clip as in claim **1** wherein said cradle means include a pair of flat surfaces for abutting against the one end of the connector to be contacted.

4. A clip as in claim **1** wherein said block means, said cradle means and said variable means are composed integrally of the same resilient insulating material.

5. A clip as in claim **1** wherein said block means include a Φ shape depression for force-fit holding said prong means and said fin means.

6. A clip as in claim **1** wherein said prong means and said fin means comprise two sheet metal portions in face-to-face relation having outwardly-curved center portions and exhibiting a Φ shape.

7. A clip as in claim **1** wherein said cradle means include an insulating mass having a longitudinal recess from one end thereof to the other aligned with the direction of said prong means.

8. A clip as in claim **1** wherein said arms are bowed sufficiently so that when squeezed said prong means retract from said block means a distance greater than the length of prong means needed to enter said connector to make contact.

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