April 27, 1965 R. M. SCARLETT 3,181,062

TWO-WIRE TEST CLIP WITH INTEGRAL CAPACITIVE PROBE

Filed Aug. 16, 1960

FIG. 1

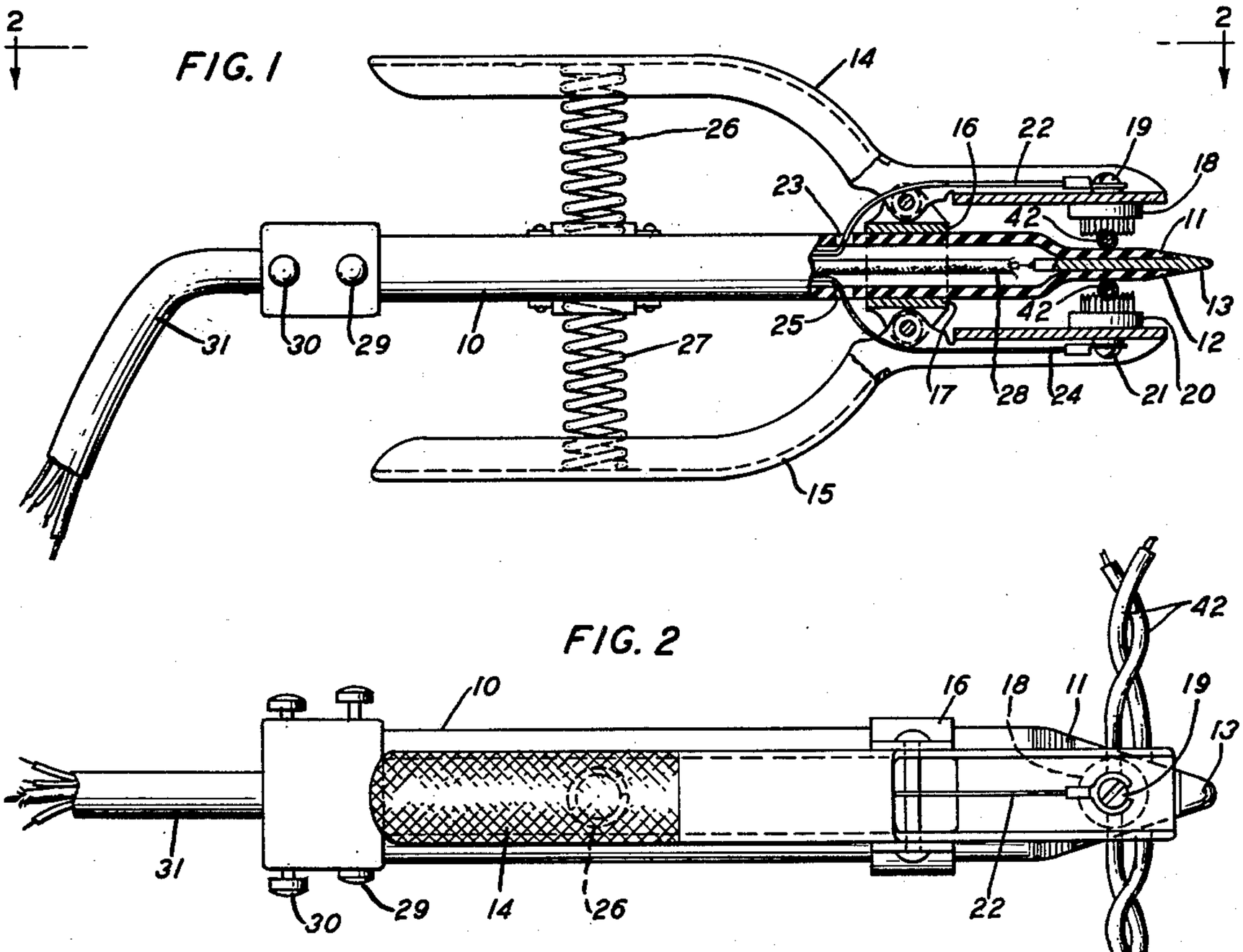


FIG. 2

FIG. 3

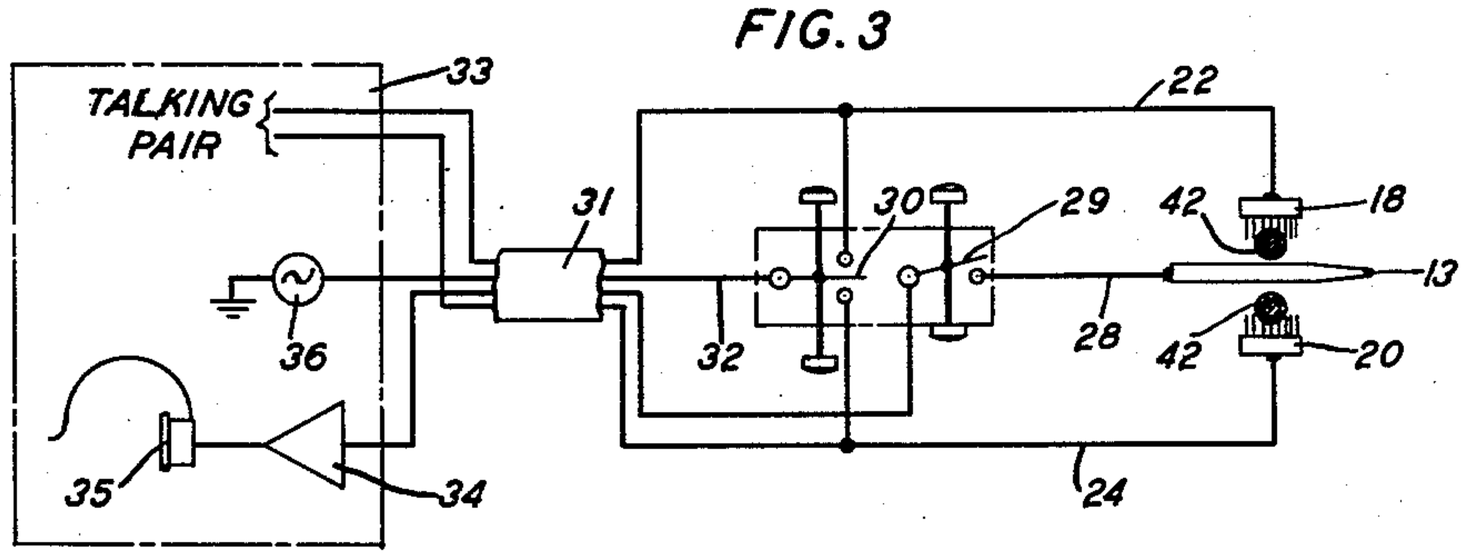
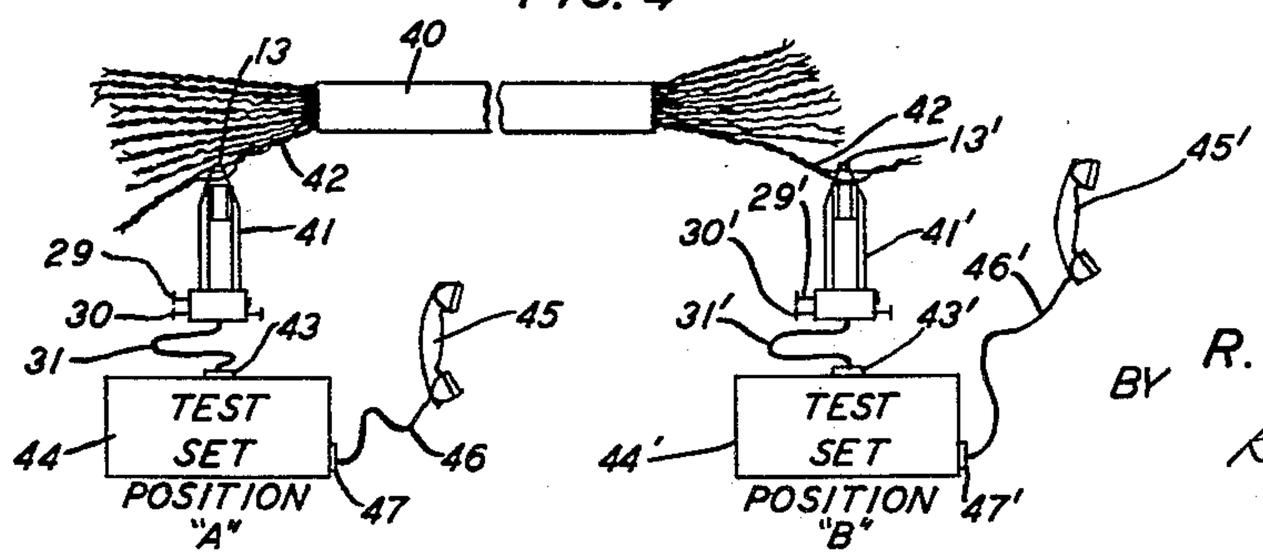


FIG. 4



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TWO-WIRE TEST CLIP WITH INTEGRAL CAPACITIVE PROBE

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This invention relates to the identification and selection of conductors in a multiconductor cable in which the ends terminate at locations remote from each other and, more particularly, to an electrical connection clip and probe device to simplify such a procedure.

Multiconductor cables such as telephone cables are usually constructed with a relatively small number of conductor pairs in a single group or bundle, or a large number of pairs divided into several groups or bundles. These conductor pairs, either in groups or in bundles, are combined in a common sheath or covering of lead or some other suitable sheathing material to form the cable. It is essential that the conductor pairs in these groups which make up the cable be connected to their proper terminals at each end of the cable and the corresponding conductor pairs of another cable.

It is particularly important that the conductor pairs in each cable length be properly identified and selected so that they may be spliced together to provide a long, continuous length of cable wherein the conductor pairs at one termination may be expeditiously connected to their respective terminals at the other end.

In one method of identifying conductor pairs in multiconductor cable which is in common usage today, the services of two workmen are required, a splicer and a splicer's helper. The splicer is located at one end of the cable and the helper at the other end. One pair of conductors is selected by the helper and an audible tone is placed thereon. The splicer at the other end of the cable, by means of a probe, amplifier and suitable receiver, is able to detect this audible tone and thus identify this conductor pair. A talking connection may then be set up over this pair, by which the splicer and his helper may cooperate in identifying the equipment or conductor pairs from another cable to be connected to each terminal of each pair of the first cable.

The above described method for identifying conductor pairs requires the use of a probe to pick up the audible tone as well as some kind of connector means to establish the tone applying and talking connections. Moreover, these connections must be changed many times during the splicing of a single cable length. Indeed, this procedure must be repeated once for each conductor pair in the cable. It is obvious that this operation is long and tedious and requires the repeated manipulation of several pieces of apparatus.

The object of the present invention is to reduce the time required for conductor identification in multiconductor cables.

It is a more particular object of the invention to integrate all of the functions required for conductor identification in multiconductor cables into a single unitary structure or tool which can be used to detect audible tones, make direct conductive connections to a pair, and apply audible tone to either conductor of a pair.

In accordance with the present invention, the splicer's tool comprises an insulated body member having at one end thereof a pair of opposed bearing surfaces separated by a spade-shaped insulated separator with a metallic tip. A pair of jaw members are hingedly supported by the insulated body and provided with needle contact cups at one end. These jaw members are spring-loaded to urge the contact cup portion yieldingly against the bearing surfaces

on the insulated body. Separate electrical connections are made to each of the contact cups and lead wires therefrom are brought out through the jaw members and the insulated body. A separate electrical connection is made to the metallic tip of the spade-shaped separator and a lead wire therefrom also brought out through the insulated body member.

Included in the insulated body member are two slide type switches, one of which may be used to open the lead connected to the metallic tip of the separator. The other sliding switch provides a means to connect the leads from either of the contact cups to a tone lead.

When it is desired to identify the conductors in a multiconductor cable, one workman at one end of the cable inserts the spade-shaped separator between the twisted wires of a pair, using the separator as a means to spread the conductors apart and guide them to the flat bearing surfaces. The needle contacts, under the influence of the spring-loading, pierce the insulation of the conductors and make electrical contact with their metallic cores. Tone may then be applied to either conductor of the pair through one of the sliding switches and the lead wire to the appropriate contact cup.

Another workman at the remote end of the cable, with an identical tool, searches for the pair with the tone on it by bringing the metallic tip of the separator in close proximity to each of the pairs in turn. The metallic tip, together with the metallic core of the conductors, forms a capacitive pickup probe by means of which audible frequency energy is picked up from the energized pair and conducted through the lead-in wire and switch to an amplifier and suitable receiver. When the workman at this location thereby locates the proper pair, he inserts his separator through the twisted pairs and makes electrical connections thereto by means of the needle contacts on his tool. The direct electrical connections now existing between the two workmen can be used as a talking path for conveying further information and may also be used to identify the tip and ring conductors of the pair, again using the audible tone and applying it first to one and then the other of the conductors of the pair.

It can be seen that the entire conductor identification and splicing process can be implemented by means of the single tool herein described. Separate connection clips and probes heretofore required are no longer necessary.

These and other objects and features, the nature of the present invention and its various advantages may be more readily understood upon consideration of the attached drawing and of the following detailed description of the drawing.

In the drawing:

FIG. 1 is a side elevational view, partially in section, of the splicer's tool in accordance with the present invention;

FIG. 2 is a top plan view of the tool of FIG. 1;

FIG. 3 is a schematic circuit drawing of the electrical circuit of the tool of FIG. 1 and certain additional electrical components; and

FIG. 4 is a view illustrating the typical layout of equipment used for conductor identification in accordance with the present invention.

The splicer's tool shown in FIGS. 1 and 2 comprises a tubular insulated central member 10, flattened at one end around a pointed metal plate 13 to form two opposing bearing surfaces separated by metallic plate 13. The pointed end of plate 13 extends substantially beyond surfaces 11 and 12 to form a pointed probe.

A pair of jaw members 14 and 15 are hingedly attached to lugs 16 and 17, which in turn are secured to central member 10. At one end of jaw member 14, a needle contact cup 18 is insulatingly mounted by means of screw 19, which passes through a lip on jaw 14 and engages a

threaded portion in cup 18. Similarly, a needle contact cup 20 is insulatingly mounted on jaw 15 by means of a screw 21 which passes through a lip on jaw 15 and engages a threaded portion of cup 20.

A flexible insulated lead wire 22 is connected to cup 18 by means of screw 19 and brought through a portion of jaw 14 to an aperture 23 in the wall of tubular member 10. Similarly, a flexible insulated lead wire 24 is connected to contact cup 20 by means of screw 21 and is brought out through a portion of jaw 15 to an aperture 25 in tubular member 10. Jaws 14 and 15 are spring-loaded by means of coil springs 26 and 27, respectively, to urge the needle contacts of cup 18 against the flat bearing surface 11 and to urge the needle contacts of cup 20 against the flat bearing surface 12. When insulated wires are placed on these bearing surfaces the spring-loading is of sufficient strength to force the contact needles through the insulation and into direct contact with the metallic core of the conductors.

An electrical conductor 28 is connected to metallic separator 13 by soldering or other known techniques and brought out through the center of tubular member 10. Lead wire 28 is an insulated flexible conductor having a braided metallic sheath to shield against undesirable coupling of electrical energy therefrom.

Lead wires 22, 24 and 28 are brought through the center tubular member 10 to a pair of sliding contact switches 29 and 30, to be hereinafter described, and thence to a cable 31 attached to the open end of tubular member 10. For a better understanding of the electrical portion of the tool shown in FIGS. 1 and 2, reference will now be had to FIG. 3.

In FIG. 3 there is shown a schematic diagram of electrical circuit of the tool shown in FIGS. 1 and 2 and certain other electrical circuits connected thereto. In FIG. 3, cups 18 and 20 and probe 13 are shown schematically along with conductors 22, 24 and 28. Switch 29, as can be seen in FIG. 3, is used to interrupt lead 28 and thus break the circuit to metallic plate 13. Switch 30 is a three position switch which, in one position, connects tone lead 32 to conductor 22, in another position connects tone lead 32 to conductor 24 and in the third position leaves tone lead 32 disconnected from both conductor 22 and conductor 24. Switch 30 is of the non-locking type and makes connections to conductors 22 and 24 only when moved out of its neutral position and held against stops in the closure positions.

Lead 28 is connected through cable 31 to an amplifier 34 in a test set 33 and the output of amplifier 34 applied to a receiver 35 in the workman's hand set or head set. Tone lead 32 is connected through cable 31 to an audible tone source 36 in test set 33. Conductors 22 and 24 are also brought out through cable 31 to test set 33 and may be used as a talking pair for communication with the workmen at the remote end of a cable.

In utilizing the tool of FIGS. 1 and 2 for identifying conductors in multiconductor cables, the arrangement illustrated in FIG. 4 may be used. A workman at position A at one end of multiconductor cable 40 inserts the tip of his tool 41 between the conductors of the pair 42 in cable 40. Tool 41 is connected by means of cable 31 and plug 43 to test set 44. The lineman's hand set 45 or any suitable head set is connected to test set 44 by means of cable 46 and plug 47. By operating switch 30 the workman in position A applies an audible tone from a source 36 (FIG. 3) to one conductor of pair 42.

A workman at position B locates pair 42 by placing the probe tip 13' of his tool 41' successively in close proximity to each of the conductor pairs at the remote end of cable 40. During this process, switch 29' is in a position to close conductor 28 in tool 41' and apply signals picked up by probe tip 13' to amplifier 34 (FIG. 3) in test set 44'. The output of the amplifier 34 in test set 44' is applied by way of plug 47' and cable 46' to the receiver of hand set 45'. Thus, when a workman in position B hears the audible tone in the receiver of his hand set, he knows that probe tip 13' is in close proximity to conductor pair 42. He then inserts the tip of tool 41' between the conductors of pair 42 and makes electrical connection to the conductors of this pair by means of the jaw members and needle contacts on his tool. A talking path is then available through pair 42 by which the workmen at positions A and B may communicate with each other to indicate the proper disposition of the two ends of pair 42.

It will be noted that the components at each of positions A and B are identical and hence tones may be initiated at either end of the cable and may be detected at either end of the cable. It is therefore possible to reverse the identification procedure at any time during the splicing operation and apply tones at position B and detect these tones at position A. The single unitary tools 41 and 41' may be used to apply tones to the conductors of a pair to detect these tones at remote location on the pair and to make electrical connections to conductors of the pair to provide a talking path. Furthermore, if it becomes necessary to distinguish between tip and ring conductors of the pair, the tone from source 36 (FIG. 3) may be applied by means of switch 30 to either conductor of the pair. Switching means in the test set, not shown, may be used to connect either one of the conductors of the pair at the remote location to the receiver in the corresponding hand set.

It is to be understood that the above described arrangements are merely illustrative of one of the many possible applications of the principles of the invention. Numerous and varied other physical arrangements of the tool elements may be devised in accordance with these principles by those skilled in the art without departing from the spirit and scope of the invention.

What is claimed is:

1. An electrical connection clip comprising an insulated supporting member including two bearing surfaces separated by a spade-shaped metallic separator, spring-loaded contact members pivotally attached to said supporting member, at least one needle shaped contact secured to each of said contact members, said spring-loaded contact members arranged for bringing each said needle-shaped contact yieldingly against a respective one of said bearing surfaces, means for making an electrical connection with each of said contact members, signal detecting means, and means for making a separate electrical connection between said metallic separator and said signal detecting means.

2. An electrical connection clip according to claim 1 further including switching means for interrupting said separate electrical connection to said metallic separator.

3. An electrical connection clip according to claim 1 further including switching means for selectively connecting a control lead to either of said needle-shaped contacts.

4. An electrical testing device comprising a tubular central member of insulating material, said tubular central member being closed and flattened at one end thereof around a pointed metallic probe member extending beyond the end of said tubular member, said one end of said tubular member providing a pair of oppositely disposed bearing surfaces, a pair of jaw members pivotally attached to said tubular member, a plurality of needle contacts secured to one end of each of said jaw members and spring means for pivoting said jaw members and urging said needle contacts on said jaw members yieldingly against said bearing surfaces.

5. A testing device comprising a pair of movable jaw members each carrying a plurality of needle-shaped contacts, a tubular supporting member of insulating material extending between said jaw members and providing flat bearing surfaces registering with said needle-shaped contacts, a pointed metallic probe secured within and extending beyond the end of said tubular member, means for making an electrical circuit connection to said probe

and means for urging said needle contacts yieldingly against said bearing surfaces.

6. The testing device according to claim 5 further including a source of alternating-current signals and means for selectively applying the output of said signal source to the needle contacts on either of said jaw members.

7. The testing device according to claim 5 further including amplifying means, means for selectively connecting said electrical circuit connection means to said amplifying means, a signal reproducing means, and means for applying the output of said amplifying means to said signal reproducing means.

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