Nov. 8, 1966 D. B. MUMMEY ET AL 3,284,755

COAXIAL PATCHCORD ASSEMBLY

Filed March 31, 1964 2 Sheets-Sheet 1

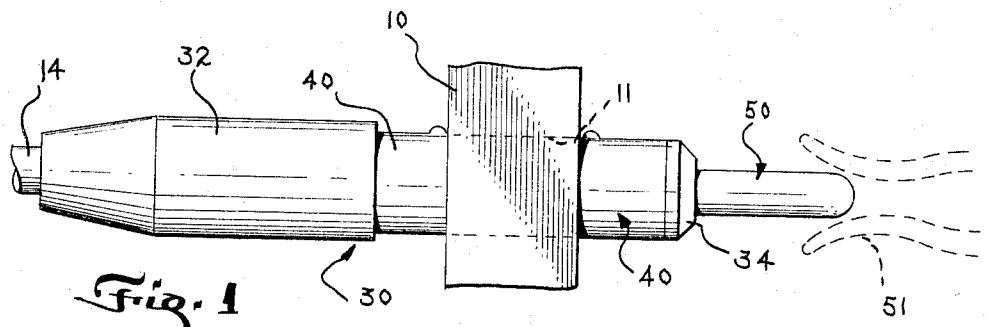


Fig. 1

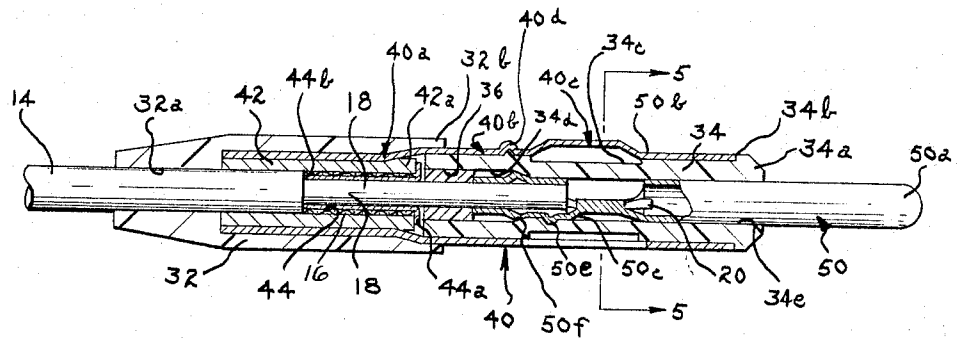


Fig. 4

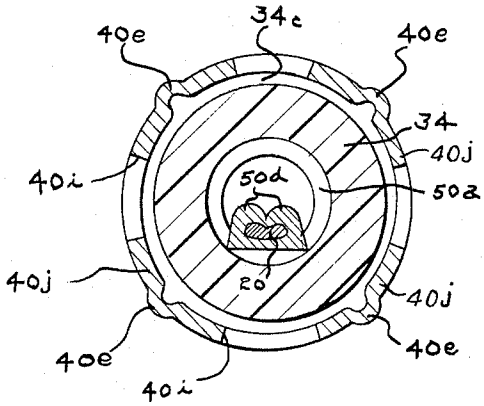


Fig. 5

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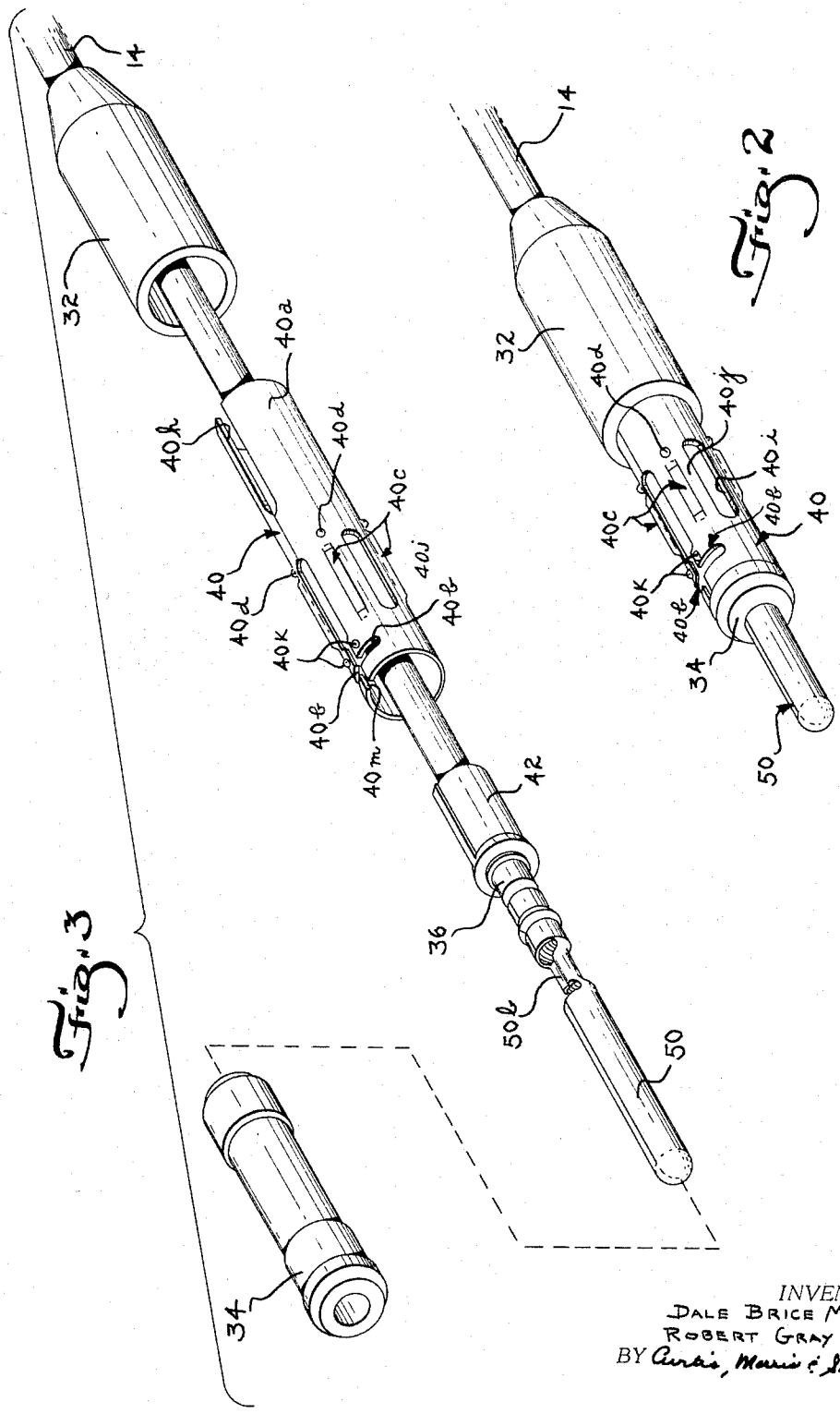


Fig. 2

Fig. 3

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COAXIAL PATCHCORD ASSEMBLY

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4 Claims. (Cl. 339—128)

This invention relates to an improved coaxial terminal device of the type utilized in plugboards.

It is an object of the invention to provide a plugable electrical contactor or terminal for coaxial cable.

It is a further object of the invention to provide a coaxial contactor wherein the inner and outer conductive members are crimped to the inner and outer conductive paths of coaxial cable.

It is another object of the invention to provide a coaxial contactor of the type adapted to be plugged into a board member and to be retained therein against accidental withdrawal by a positive snap action with frictional engagement.

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 are shown and described illustrative embodiments of the invention; it is to be understood, however, that these embodiments are not intended to be exhaustive nor limiting of the invention, but are 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 side view of the coaxial contactor of the invention inserted in a board member aperture in the position of use;

FIGURE 2 is a perspective of the contactor of the invention somewhat enlarged to show certain aspects thereof;

FIGURE 3 is an exploded perspective of the assembly shown in FIGURE 2;

FIGURE 4 is a longitudinal section of the contactor of the invention included to show the internal aspects including crimps of the various portions of the connector and the relationship of insulating members; and

FIGURE 5 is a section taken along lines 5—5 of FIGURE 4.

Referring now to FIGURE 1, numeral **10** identifies a board member apertured as at **11** to receive the contactor assembly of the invention shown as **30**, which effectively terminates a coaxial cable **14**. Board member **10** may be a portion of a connector block or may be part of a plugboard assembly having hundreds or thousands of apertures such as **11** into which large numbers of contactors **30** may be inserted to, in effect, program connections between leads such as **14** and thereby between computer components connected to such leads. The board **10** may be of an insulating material such as phenolic resin, diallyl phthalate or the like, or may be of metal such as aluminum with the apertures **11** molded or drilled therein. One of the requirements for contactor **30** is that it have a fixed insertion and withdrawal force in an axial sense so as not to become dislodged accidentally from the board aperture. An accidental dislodgement could arise by reason of some force or blow striking the end of the contactor shown as pin **50**, or in plugboard use by reason of a plugboard spring member shown dotted in as **51** engaging pin **50**. In plugboard use, contactor **30** must be frequently withdrawn from the aperture **11** and reinserted in some other aperture to effectively change the program to that desired. As a further requirement, contactor **30** must and should provide a shielding of the center conductive path of cable **14** which is continuous from the cable itself up to and through the board **10**.

Contactor **30** accomplishes the above requirements by including an assembly separately terminating the inner and outer conductive paths of cable **14** to spaced and separate conductive paths insulated each from the other by a dielectric material. The assembly components are shown generally as **40**, a conductive metallic sleeve forming the outer conductive path and **50**, a conductive metallic pin forming the inner conductive path, with **40** and **50** being spaced apart and insulated each from the other by a dielectric insert **34**. The rear portion of contactor **30** is surrounded and captivated by an insulating boot **32** made of rubber, plastic or some other insulating material. During insertion and withdrawal, contactor assembly **30** is normally gripped by means of boot **32** to avoid placing undue strains on cable **14**. With the construction featured by the invention, however, the connector assembly can, if it is necessary, be withdrawn by pulling upon cable **14** without destroying the connection between the cable conductors and the conductive components of the assembly. In prior art devices wherein the conductive paths of the cable were soldered to the components of the connector, pulling forces applied on cable **14** frequently cracked the solder bond to cause a connection failure. This is avoided in the assembly of the invention in a manner to be hereinafter described.

Referring now to FIGURE 2, the outer conductive path of cable **14** is extended through the assembly **30** by means of the shell or sleeve **40** which is of conductive metallic material having spring characteristics. The rear portion of **40**, shown in FIGURES 3 and 4 as **40*a***, is terminated to a ferrule member **42** which in turn is connected to the outer conductive braid **16** of cable **14** by means to be described. The portion **40*a*** is relieved as at **40*h*** to provide upon crimping a working of the outside surface of **42** to lock **40** to ferrule **42** with respect to relative rotational movement between the members.

Extending forwardly from portion **40*a*** is a portion of enlarged diameter shown as **40*b*** carrying a series of four radially extending dimples **40*d*** which serve to limit the inward travel of the contactor in aperture **11** of board **10**. Forward of the dimples **40*d***, and as an integral part of sleeve **40**, is a section **40*c*** having a series of axially extending spring members **40*j*** defined by relieved portions **40*i***. Each of the spring members **40*j*** has an embossment **40*e*** struck outwardly to provide a tight frictional spring action which operates to hold assembly **30** within board **10**. The preferred length and width of embossments **40*e*** can best be discerned from FIGURES 3–5.

The forward portion of sleeve **40** extends outwardly to an end engaging a flange **34*b*** of an insert **34** of insulating material. Spaced from the dimples **40*d*** by a distance approximately equal to or slightly greater than the thickness of the board in which the assembly is to be used are a series of further dimples **40*k*** similar to **40*d*** which serve to provide a snap action during the insertion of the contactor within the board. Dimples **40*k*** in part serve to hold the contactor against accidental dislodgment. It is preferred that the forward dimples **40*k*** be disposed on the top only and centered in the flange portions as shown, to avoid excessive insertion and withdrawal forces and incident damage to the board or insert **34**. As can be seen, the forward portion of **40** is split in a transverse sense by a slot **40*l***, and in an axial sense by a slot **40*m***. These slots further serve to prevent excessive insertion and withdrawal forces which might arise if by slight manufacturing tolerance deviation the ends of the portions were to be jammed together to define a diameter larger

than the diameter of aperture **11** in board **10**. This is particularly true with respect to uses wherein the board **10** is of metal.

As can be seen from FIGURE 4, the sleeve **40** extends well back over the cable **14** and is commoned to a ferrule member **42** which is relatively thick and preferably of a malleable material such as annealed copper. The ferrule **42** has a forward portion **42***a* which is slightly enlarged to fit within the transition portion of **40** as shown. Ferrule **42** is made to extend over a substantial portion of cable **14** and is crimped inwardly thereagainst over a portion of the cable outer insulating sheath **15** and inwardly against the cable braid **16** against a metallic backing ferrule **44**. The backing ferrule **44** is of a harder material to resist crushing of the cable dielectric **18** by the crimp applied to ferrule **42**. The braid **16** is then thus terminated to the ferrule assembly **42** and **44**, and thereby to the sleeve **40** to extend the conductive path of the cable along the contactor assembly to the end of **40** proximate **34***b* as shown in FIGURE 4. The backing ferrule **44** includes a flange **44***a* which is turned outwardly to define a surface against which the dielectric insert **34** is butted and at the opposite end as at **44***b* the ferrule is beveled to prevent braid **16** from being cut or separated during the crimping operation. The interior bore of **44** is slightly larger than the maximum diameter of the cable dielectric **18**.

In the forward portion of sleeve **40**, as best shown in FIGURES 3 and 4, the dielectric or insulating insert **34** includes a bevelled end **34***a* adapted to facilitate insertion of the contactor within aperture **11** of board **10**. A transverse surface **34***b* is provided to engage the end of sleeve **40** and hold the members against relative axial movement. Spaced therefrom and underlying the portion **40***c* of **40** is an annular relief or recess **34***c* provided in **34** to permit the spring arms **40***j* to be compressed inwardly upon insertion of the contactor within aperture **11** of board **10** without compressing the insert material. It has been found that combinations of tolerance deviations, as for example an undersized aperture **11** and an oversized contactor assembly **30**, can cause contactor failure if the spring arm **40***j* is forced to work against a solid dielectric **34**. The provision of relief by **34***c* precludes this.

A major portion of **34** includes an inner bore shown as **34***e* of a diameter to receive the contactor central pin member **50** in a sliding fit. The rear portion of **34** includes a bore **34***d* of a slightly greater diameter to permit **50** to be inserted in **34** and held against outward axial displacement. Except for the relieved portion **34***c*, insert **34** is in contact and gripped by **40** along its length. At the inner end of **34** proximate the ferrule members is provided a separate dielectric spacer insert **36** which is included to facilitate assembly of the contactor assembly **30** and at the same time positively hold the central contact pin member **50** against accidental engagement with the outer conductive path at ferrule flange **44***a*.

The center conductive pin member **50** has a forward contact portion **50***a* and a central portion which is cut away and adapted to be formed as by crimping to mechanically and electrically connect the center conductor **20** of cable **14** to pin **50**. The portion **50***b* is raised upwardly to provide clearance as at **50***c* and includes flanges **50***d* folded inwardly as shown in FIGURE 5. On at least one surface of central pin member **50** is a dimple **50***e* which extends radially to bite into and engage the material of insert **34** and prevent relative movement in a rotational sense between pin **50** and sleeve **40**. Adjacent dimple **50***e* is an outwardly flared portion **50***f* which operates by engaging **34***d* to lock **50** against axial withdrawal from the contactor assembly. The sloped or tapered surface of **50***f* readily facilitates assembly of the pin within insert **34**. Axial displacement of pin **50** to the left relative to the assembly is prevented by the dimple **50***e* and by the pin engagement with insert **36** which in turn is butted against the flange **44***a* of ferrule **44**. The conductive pin member **50** is thus mechanically secured to the insert **34** and to sleeve **40** and thereby to boot **32**; against rotational and axial movements during insertion and during withdrawal of the contactor.

A relatively easy assembly of the parts forming the contactor of the invention is made possible by the use of the one-piece outer shell in conjunction with an insulating insert capable of being fitted over the end of the central pin member. This assembly is best shown from FIGURE 3 and is accomplished by first stripping the coaxial cable **14** in the manner indicated from FIGURE 4 and then slipping the member **40**, ferrule members **42** and **44**, and insert **36** on the cable. Thereafter the pin **50** may be placed on the central conductor **20** and crimped thereto. The ferrule **44** is worked under the braid material and over the dielectric sheath **18** and then the ferrule **42** is brought forward. Thereafter the insert **34** is positioned as indicated in FIGURE 4, being forced down over **50** to butt against the flange **44***a* of ferrule **44**. During this operation the insert **36** prevents the pin **50** from being jammed in against the ferrule assembly to cause a short between outer and inner conductive paths and as previously mentioned, assures that pin **50** will be properly spaced from the ferrule assembly during use in the presence of axial forces applied to the end of **50** which might tend to work the pin down toward the ferrule assembly. The outer insulating sheath **34** in being worked into the position shown in FIGURE 4 tightly grips the pin member, and through dimple **50***e* is locked thereto against relative rotational movement. Following this step the sleeve **40** is then applied in a suitable manner as for example by being brought up over the assembly from the position shown in FIGURE 3. The rear portion of **40***a* is then crimped inwardly and thereafter a boot such as **32** may be applied by being worked up over the assembly from the position shown in FIGURE 3 to the position shown in FIGURE 4. Alternatively, the boot may be molded on the assembly after the final positioning of assembly **40** and crimping of the ferrules.

In an actual embodiment the center pin member **50** was formed of a stamping of brass sheet material approximately twelve thousandths of an inch in thickness overplated with a layer of nickel and gold to provide desirable electrical characteristics and to resist corrosion of the parts. The other sleeve **40** was formed of spring grade brass, nickel plated and approximately of ten thousandths of an inch in thickness. The ferrules **42** and **44** were of leaded copper in the annealed condition and gilding copper, respectively; the ferrule **42** being of fifty thousandths of an inch in thickness. The dielectric insert **34** and the insulating bead **36** were of polyethylene material and the relief **34***c* was approximately seven thousandths of an inch.

Changes in construction will occur to those skilled in the art and various apparently different modifications and embodiments may be made without departing from the scope of the invention. The matter set forth in the foregoing description and accompanying drawings is offered by way of illustration only. The actual scope of the invention is intended to be defined in the following claims when viewed in their proper perspective against the prior art.

We claim:

1. A plug contactor for terminating coaxial cable of the type having a center conductor surrounded by an insulating member and an outer conductor, the contactor including a metallic shell member of a diameter to be inserted within the aperture of a contactor board member, the said shell member having a plurality of integral spring members of a length approximating the thickness of the board member disposed generally parallel to the longitudinal axis of said contactor and positioned radially outwardly from the main body of said shell member such as to be driven inwardly by insertion in the board mem-

ber aperture to frictionally engage said board aperture substantially along the length thereof, stop means located on said shell extending radially to limit the insertion of said contactor in said board member, ferrule means disposed in the rearward end of said shell and connected to the outer conductor of said cable, an insulating medium disposed within said shell extending approximately from said ferrule means to the forward end of said shell, a central conductive pin member connected to the cable center conductor and supported by said insulating medium coaxially of a portion of the length of said shell, said pin member extending forwardly of said insulating medium and said shell, the said insulating medium including a portion disposed between the inner end of said pin member and said ferrule means to preclude axial displacement of said pin member toward said ferrule means during assembly and use of said contactor.

2. The contactor of claim **1** wherein said portion of said insulating medium is formed by a sleeve having an inner diameter slightly larger than the center conductor of said cable and an outer diameter at least equal to that of said center pin member.

3. The contactor of claim **1** wherein said shell member is split along its length to provide a generally C-shaped cross section and the said ferrule means and insulating medium each include portions having a circumference

slightly greater than the circumference of the interior surface of said shell member whereby said shell member is fitted over said ferrule means and insulating medium with a spring action operable to hold said shell member on said ferrule means and insulating medium.

4. The contactor of claim **1** wherein the said shell member is split along at least the forward portion of the contactor and is of a circumferential length slightly less than that of said insulating medium at the same relative position to permit deformation of said shell member inwardly upon insertion of said contactor within said board aperture and there is provided a relieved portion proximate the end of said shell member defining a flange adapted for movement inwardly in a spring action, radial extensions extending from said flange outwardly to provide a snap action upon insertion of said contactor through the aperture of said board member.

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