July 2, 1968 R. G. LIVINGSTON 3,391,381

SHIELDED ELECTRICAL CONNECTOR

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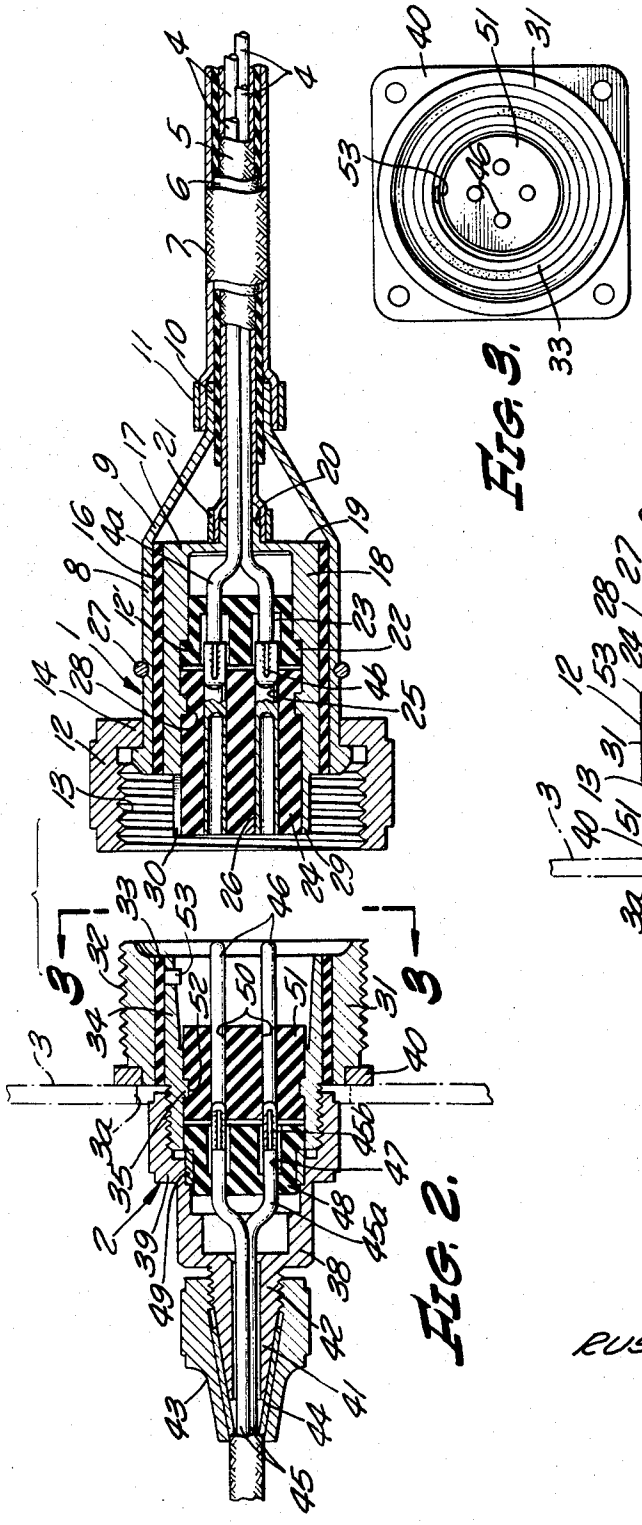

Fig. 2.

Fig. 3.

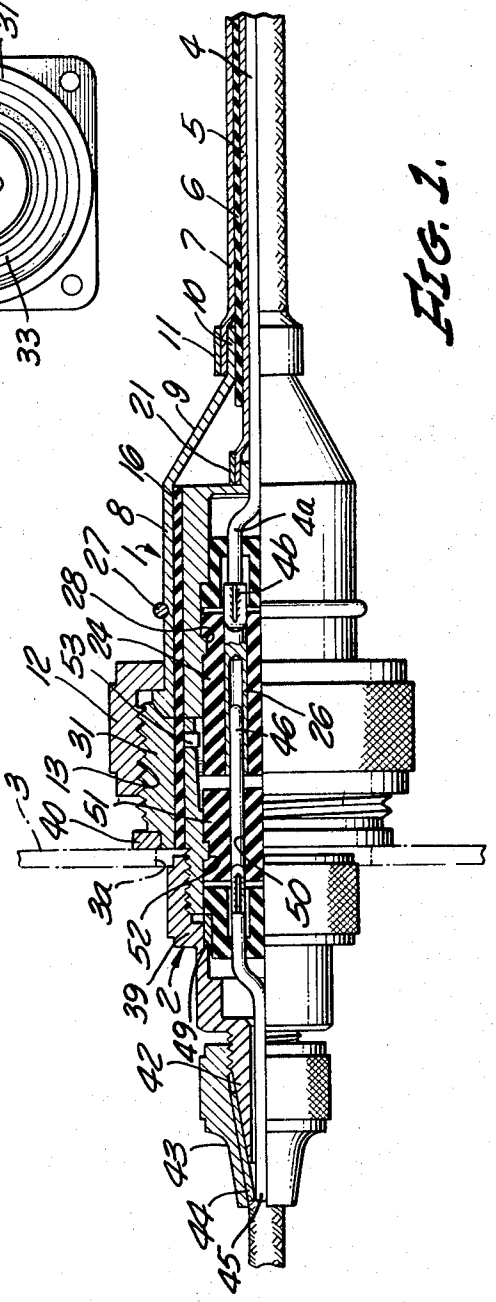

Fig. 1.

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SHIELDED ELECTRICAL CONNECTOR

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ABSTRACT OF THE DISCLOSURE

An electrical connector assembly for magnetically and electrostatically shielding the connection between electrostatically and magnetically shielded conduits in which the respective connector parts are each provided with concentric inner and outer shields co-engageable upon interconnection of the parts and insulated from one another.

The present invention relates to electrical connectors and more particularly to a shielded electrical connector.

In certain communications installations it is desirable that the transmission lines over which information is transmitted be shielded so that the information being transmitted can neither be picked up by a detection of the electrostatic emissions nor be picked up by magnetic field pickup devices.

It is known that in order to prevent either electrostatic or magnetic detection of information transmitted through transmission lines, the lines may be shielded by shrouding the conductors in a sheath, such a sheath being either of ferrous material to prevent the magnetic pickup of the information carried on the transmission lines, or nonferrous material to prevent the electrostatic pickup of the information on the transmission lines.

The present invention has as its principal object the provision of an electrical connector or means for establishing a connection between one or more transmission lines wherein the transmission lines are shielded by both a ferrous and nonferrous shielding sheath respectively insulated from one another, the connector shielding both the magnetic and electrostatic fields induced in the connector.

Another object of the invention is to provide an electrical connector whereby one or more transmission lines may be interconnected with one another, for example at the location at which the transmission lines pass through a bulkhead or wall and wherein the connector structure includes ferrous and nonferrous shielding elements insulated from one another and serving to prevent the pickup of information transmitted through the connector.

A more specific object of the invention is to provide an electrical connector wherein a pair of complemental connector parts provided with pin and socket means for establishing connection between one or more conductor lines are surrounded within a first shield which will prevent the magnetic pickup of information transmitted through the connector and surrounded by a second shield which will prevent the electrostatic pickup of information transmitted through the connector.

Other objects and advantages of the invention will be hereinafter described or will become apparent to those skilled in the art, and the novel features of the invention will be defined in the appended claims.

In the accompanying drawings:

FIG. 1 is a view partly in longitudinal section and partly in elevation illustrating an electrical connector made in accordance with the invention, the connector parts being coupled together and mounted in a wall;

FIG. 2 is a view in longitudinal section further illustrating the connector of FIG. 1 with the connector parts disconnected; and

FIG. 3 is an end elevational view of the wall-mounted connector part as taken on the plane of the line 3—3 of FIG. 2.

Like reference characters in the several views of the drawing and in the following description designate corresponding parts.

The connector of the invention as herein illustrated preferably may comprise a pair of complemental connector halves generally denoted at **1** and **2**, the connector half **1** being detachably connectable to the connector part **2** and the latter being mountable in an opening in a bulkhead or wall denoted at **3** and shown in broken lines in FIGS. 2 and 3.

Leading into the connector half **1** are a number of electrical conductors **4** by which in the case of the application of the invention to a communications system, signals representative of information are to be transmitted. As herein illustrated, the conductors **4** are shielded by an inner sheath **5** which may be composed, for example, of braided wire. Disposed about the shielding sheath **5** is an insulating sheath **6** of rubber or the like and disposed about the insulating sheath **6** is an outer shielding sheath **7** which also may be preferably formed of braided wire.

The shielding sheath **5** may be, for example, composed of braided tinned copper wire or other nonferrous material so as to shield the wires **4** against electrostatic or radio transmission of signals which may be detected by known pickup devices. On the other hand, the shielding sheath **7** may be composed of a ferrous material such as braided galvanized steel wire so as to shield the magnetic field and guard against magnetic field pickup of information transmitted on the conductors **4**.

The coupling part **1** includes an outer shielding shell **8** also composed of ferrous material having at one end a reduced portion **9** terminating in a neck **10** which is adapted to surround the insulating sheath **6** in engagement therewith. Means are provided for securing the outer shield **7** about the neck **10** of the shell **8** and illustratively the sheath **7** is shown as being secured to the neck **10** by a ferrule **11** which may be crimped or otherwise suitably affixed. Revolvable about the shell **8** is a connector nut **12** having internal threads **13** and an end flange **14** engageable with an outwardly extended end flange **15** on the shell **8**. A retainer ring **12'** may be disposed about the shell **8** to prevent displacement of the nut **12**. It will now be recognized that the shell **8** being of ferrous material and connected to the ferrous sheath **7** and having the nut **12** thereon provides an outer shield connector which will shield the magnetic field induced in the connector half **1**.

Within the shell **8** is an annular insulator **16** within which is disposed in insulated relation to the shell **8** an inner shield connector **17** comprising a hollow body **18** having an end wall **19** through which the conductors **4** extend into the body **17**. The end wall **19** is provided with a neck **20** extended about the conductors **4** and to which the inner shielding sheath **5** is suitably attached as by means of a ferrule **21** which may be crimped or otherwise suitably affixed. Thus, the inner shield connector and its associated parts are preferably composed of a nonferrous metal so as to shield the electrostatic field induced in the connector half **1**.

Within the hollow body **18** is a rubber or other insulating grommet **22** having a number of recesses **23** into which extend the terminals **4*a*** of the conductors **4**. Also within the hollow body **18** is an insulated pin socket assembly comprising a rubber or other insulating member **24** having openings **25** extended therethrough in which are disposed socket members **26**. These socket members are electrically connected to the bared ends **4*b*** of conductor terminals **4*a*** as by soldering or the like, and upon

assembly the socket members 26 connected to the conductor terminals 4a will be centralized within and insulated from the inner shield connector 17. Preferably, the hollow body 18 of the inner shield connector 17 has an inner shoulder 27 against which a complemental flange on the grommet 22 may abut to locate the grommet within the body 18 and the body 18 also has an inner annular flange 28 engageable in a complemental groove in the insulator 24 to locate the insulated socket assembly within the inner shield connector 17.

It will be understood that the insulator 24 as well as the grommet 22 may be preferably composed of resilient material which is susceptible of being deformed for installation in the hollow body 18, but otherwise a rigid insulating body 24 might be employed by suitably forming the body 18 in multiple sections adapted to be joined together to house the insulator 24 and grommet 22, as will be apparent to those skilled in the art.

The connector half 1 thus far described being connected to the shield conductors 4, is adapted to be coengaged with the conductor half 2 in such a manner that the outer shield connector 8, the insulator 16, the inner shield connector 17, the insulator 24, and the socket members 26, all will be brought into engagement with corresponding complemental elements in the connector half 2. In addition, means are provided for properly relatively orienting the sockets 26 in relation to the coupling half 2. In this latter connection, the hollow body 18 has a reduced end extension 29 surrounding the insulator 24 and having a longitudinally extended keyway or slot 30.

The coupling half 2 comprises an outer shield connector 31 externally threaded at 32 for engagement by the connector nut 12. This outer shield connector 31 is provided with or may have formed thereon a mounting flanged 40 adapted to be suitably secured to the bulkhead or wall 3 so as to support the coupling half 2 on the bulkhead or wall 3 in an opening 3a. Within the connector shield 31 is an insulating sleeve or member 33 within which is disposed a skirt 34 of an inner shield connector 35. This inner shield connector 35 at the end opposite the skirt 34 is provided with a threaded neck 36 engageable by a nut section 37 of a hollow body 38. The body 38 also has a tapered end 41 extended axially from a threaded portion 42 whereby a tapered shielding clamp 43 may be threadedly engaged with the threaded section 42 to effect the clamping of the end of a braided shield 44 between the tapered clamp 43 and the tapered end 41 of the body 38. This shield 44 is, in accordance with the invention, similar to and upon connection of the halves 1 and 2 will be conductively connected to the shield 5 about conductors 4 and therefore would preferably be composed of a nonferrous braided wire.

Into the body 38 through an opening in the tapered end 41 extends a suitable number of conductor leads 45 having terminal portions 45a adapted to be connected to connector pins 46, the terminals 45a having bared ends 45b adapted to be electrically connected to the pins 46 as by soldering. Terminals 45a extend into recesses 47 in a rubber grommet 48 which seats in the body 38 against a spacer sleeve 49. The pins 46 extend through openings 50 in a pin insulator 51 which, like insulator 24, is composed of rubber or other insulating material. In the illustrative embodiment the inner shield connector 35 has an internal flange 52 adapted to engage in a complemental groove in the insulator 51 to locate the latter upon assembly.

As previously mentioned, the inner shield connector of coupling half 1 has in the reduced end extension 29 thereof a longitudinally extended keyway or slot 30. The inner shield connector 35 of coupling half 2 is provided with a key or pin 53 adapted to engage in the keyway or slot 30 so that the connector halves 1 and 2 may be coengaged only when pin 53 is aligned with slot 30. Thus, the connector halves are connectable only when the pins 46 are in a predetermined relationship to the sockets 26. Therefore, the relationship between conductors 4 and 45 may be pre-established and maintained during repeated connections and disconnections of the connector.

It will also be noted that upon assembly of the coupling halves as shown in FIG. 1, the tapered skirt 34 of inner shield connector 35 of coupling half 2 will be brought into coengagement with the end extension 29 of inner shield connector body 18 of the connector half 1. In addition, the insulators 16 and 33 respectively of connector halves 1 and 2 will be brought into engagement, and coengagement of the outer shield connectors of the respective body halves is effected by coengagement of the connector nut 12 of the outer shield connector 32 and the connector half 2. Thus, upon interconnection of the connector halves, the conductors 4 will be shielded by an outer ferrous shield and an inner nonferrous shield insulated from one another by the insulators 16 and 33 up to the wall or bulkhead 3 so that no electrostatic or radio signal emissions may be picked up at the right hand side of the wall 3 as shown in FIGS. 1 and 2, nor may any magnetic pickup device be employed since the conductors are also shielded by the ferrous outer shield which terminates at the bulkhead or wall 3.

While specific structural details have been shown and described, it should be understood that changes and alterations may be resorted to without departing from the spirit of the invention as defined in the appended claims.

I claim:

1. An electrical connector, comprising: a pair of complemental connector halves; separable connector means in each half coengageable to establish an electrical connection; means shielding said connector means including inner and outer shield members extended about the respective connector means and coengageable upon coengagement of said connector means; and insulator means between said connector means and said inner shield members and between said inner and outer shield members.

2. An electrical connector as defined in claim 1, wherein said inner and outer shield members are nonferrous and ferrous.

3. An electrical connector as defined in claim 1, wherein said inner shield members are composed of nonferrous material and said outer shield members are composed of ferrous material.

4. An electrical connector as defined in claim 1, wherein said outer shield member includes means for separably interconnecting said connector halves together.

5. An electrical connector as defined in claim 1, wherein one of said connector halves includes means for mounting the same to a wall.

6. An electrical connector as defined in claim 1, wherein said inner shield member includes cooperative means for establishing a predetermined orientation of said halves upon connection thereof, and said connector means includes a plurality of pin and socket connector elements carried by the respective halves.

7. An electrical connector, comprising a pair of complemental connectable and separable connector halves each including: inner and outer shield members and insulating means between said shield members, complemental electrical connector means within said inner shield members connectable together and having means for electrical connection to an electrical conductor, means insulating said connector means from said inner shield member, and said shield members of each connector half having coengageable means engageable with the shield member of the other half upon connection of said connector halves, one of the corresponding inner and outer shield members of each connector half being composed of ferrous material and the other shield member being composed of nonferrous material.

8. An electrical connector as defined in claim 7, where-

in the coengageable means of said outer shield members comprises internal and external threaded portions on said outer shield members for joining said connector halves together.

9. An electrical connector as defined in claim **7**, wherein the coengageable means of said outer shield members comprises internal and external threaded portions on said outer shield members for joining said connector halves together, and coengageable interfitting end portions on said inner shield members.

10. An electrical connector as defined in claim **7**, wherein the coengageable means of said outer shield members comprises internal and external threaded portions on said outer shield members for joining said connector halves together, and coengageable interfitting end portions on said inner shield members, said interfitting end portions having pin and groove means for establishing a predetermined relative orientation of said connector halves.

11. An electrical connector as defined in claim **7**, wherein said inner and outer shield members of one of said connector halves respectively include means for connecting the same to a shielding sheath disposed about an electrical conductor extending into said connector half.

12. An electrical connector as defined in claim **7**, wherein said inner and outer shield members of one of said connector halves respectively include means for connecting the same to a shielding sheath disposed about an electrical conductor extending into said connector half, and said inner shield member of the other of said connector halves includes means for connecting the same to a shielding sheath extending about an electrical conductor extending into said other connector half, the outer shield member of said other connector half having means thereon for mounting said other connector half on a support.

13. An electrical connector as defined in claim **7**, wherein said shield members include anchor means for connecting the same to a shielding sheath extended about a conductor extending into the respective connector halves, said anchor means including a neck on the shield member defining an opening through which said conductor may extend, and clamping means engageable with a shielding sheath about said neck.

14. An electrical connector as defined in claim **7**, wherein said shield members include anchor means for connecting the same to a shielding sheath extended about a conductor extending into the respective connector halves, said anchor means including a neck on the shield member defining an opening through which said conductor may extend, clamping means engageable with a shielding sheath about said neck, said neck being provided with an external tapered surface and said clamping means being provided with an internal tapered surface, and said neck and said clamping means being cooperatively threaded to effect movement of said tapered surfaces toward one another to clamp said shielding sheath therebetween.

15. In an electrical conductor having internal and external shielding sheaths insulated from one another, a connector assembly for connecting the conductor to another conductor having at least one shielding sheath disposed thereon, said connector comprising a pair of complemental connector halves, one of said connector halves including an outer connector shield and means for connecting said outer connector shield to the outer of the sheaths on said conductor, an inner connector shield within said outer connector shield, means insulating said connector shields from one another, means on said inner connector shield for connecting the same to the inner shielding sheath of said conductor, electrical connector means within said inner connector shield, means insulating said electrical connector means from said inner connector shield, the other of said connector halves including an outer connector shield and an inner connector shield, means insulating said last mentioned inner and outer connector shields from one another, and electrical connector means within the inner connector shield of the other of said connector halves and connectable to the first mentioned electrical connector means.

References Cited

UNITED STATES PATENTS

2,449,983	9/1948	Devol	339—177 X
2,515,333	7/1950	Buffington.	
2,700,140	1/1955	Phillips	339—89 X
2,762,025	9/1956	Melcher	339—143
3,281,756	10/1966	O'Keefe et al.	339—143 X

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