

[54] SHIELDED CABLE COUPLER

[75] Inventor: **Herbert E. Ransford, III**, Pittsburgh, Pa.

[73] Assignee: **Mark III, Inc.**, Pittsburgh, Pa.

[22] Filed: **Aug. 10, 1972**

[21] Appl. No.: **279,456**

[52] U.S. Cl. **339/60 C**, 339/61 R, 339/92 M, 339/137, 339/177 R, 339/185 R

[51] Int. Cl. **H01r 17/04**

[58] Field of Search 339/60, 61, 89 C, 339/91 P, 92, 94 C, 94 R, 94 M, 126 J, 129, 136, 177, 137

[56] References Cited

UNITED STATES PATENTS

3,514,741	5/1970	Noren	339/60 C
3,566,334	2/1971	Ziegler	339/177 R X
3,683,320	8/1972	Woods et al.	339/130 C X

OTHER PUBLICATIONS

Electrical Design, Coax Hyfen Connectors, 11-1959,

page 44

Primary Examiner—Marvin A. Champion

Assistant Examiner—Lawrence J. Staab

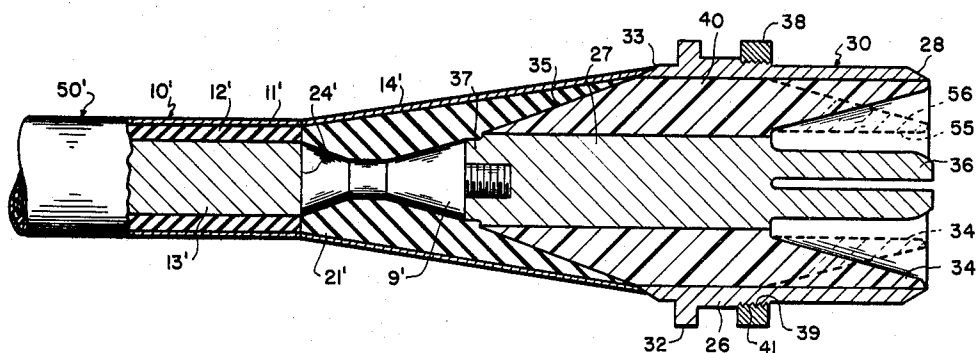
Attorney—Kent E. Baldauf

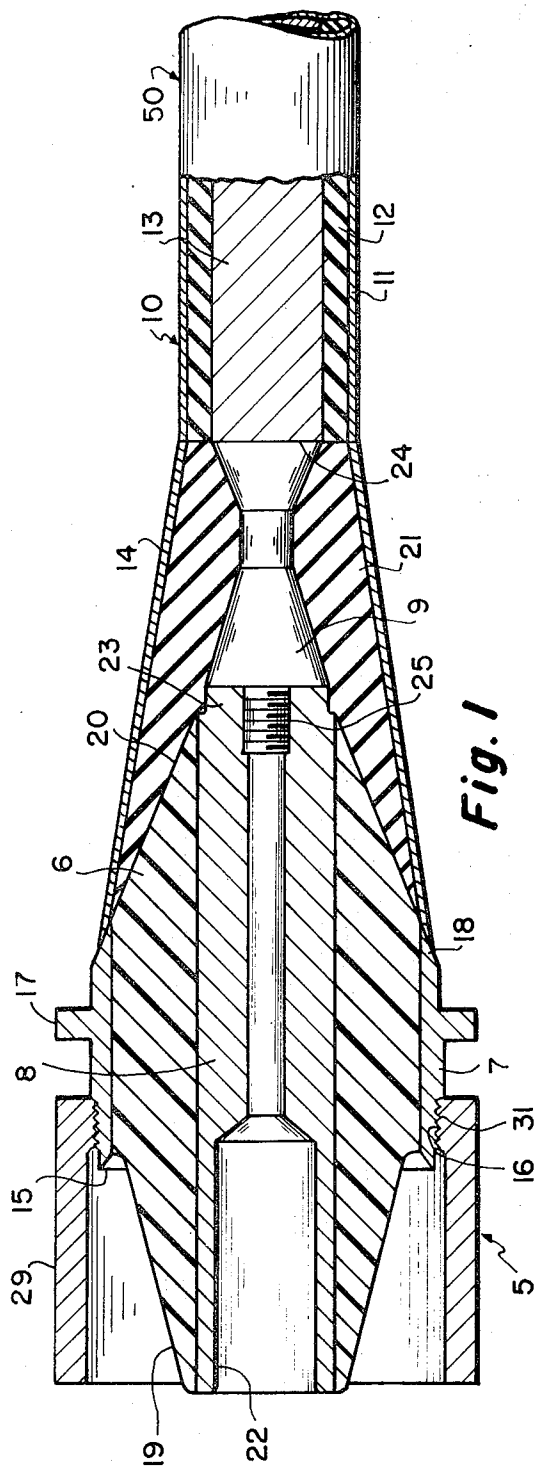
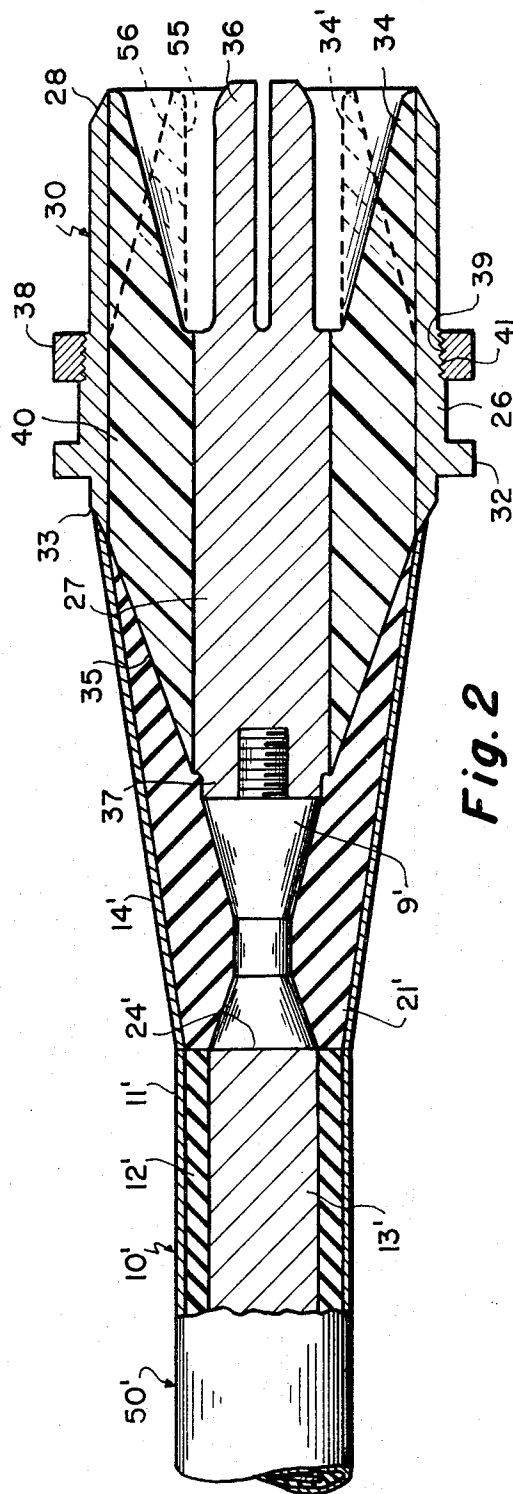
[57]

ABSTRACT

A cable coupler device, of the type used in mining applications, suitable for interconnecting portions of shielded, three phase electrical cable which greatly reduces the hazard of phase-to-phase faults. The coupler device includes electrically shielded male and female coupling members which are adapted to be connected with the shielded portions and conductor portions of the phase conductors such that a continuous shield at ground potential is maintained around each phase conductor as it passes through the coupler device. The coupler device also includes annular insulators positioned between the electrical contacts and the shielded coupling members.

7 Claims, 5 Drawing Figures





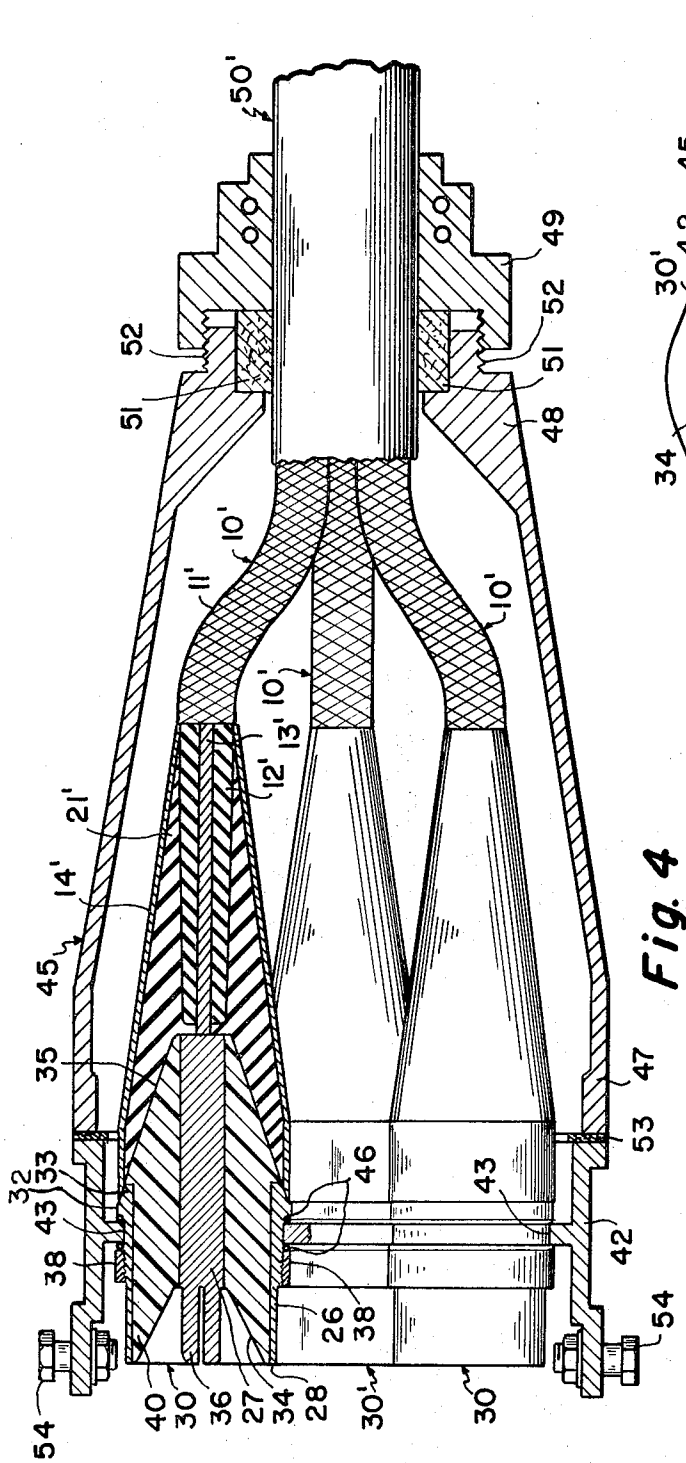


Fig. 4

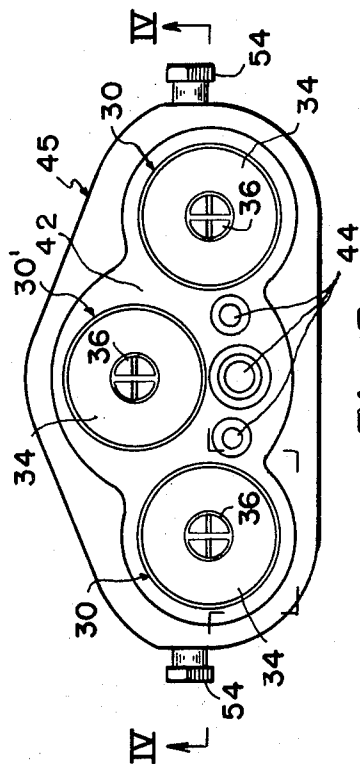


Fig. 5

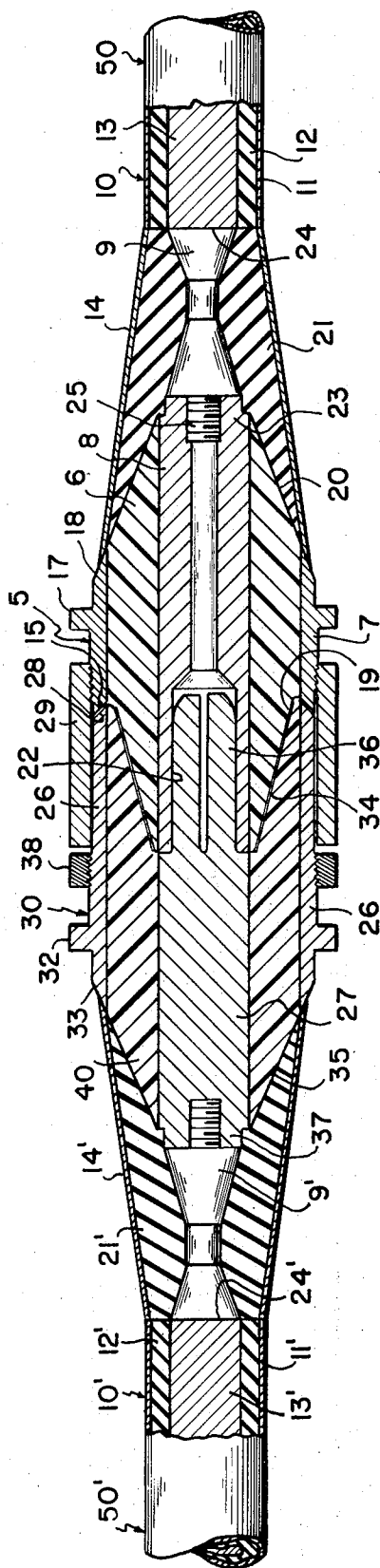


Fig. 3

SHIELDED CABLE COUPLER

My invention relates to electrical cable couplers of the type used to interconnect sections of high voltage electrical cable. More particularly, my invention relates to an electrical cable coupler which is especially adapted to interconnect the three phase conductors of shielded cable of the type commonly used in mining applications. Still more particularly, my invention relates to a cable coupler which greatly reduces the hazard of phase-to-phase faults due to the addition of a continuous, concentric shield around each phase conductor and each coupler contact.

In the mining industry, both surface and underground, it is necessary to transmit large amounts of electrical power, usually over long distances, to supply the power requirements of the mining equipment. The most economical and efficient way of accomplishing this is at high voltages, with transformers located near the points of use, which, in turn, reduce the high voltages to operating voltages needed for equipment. Generally, transmission potentials as high as 15,000 volts for underground mining and 25,000 volts in surface mining with currents as high as 500 amps are used. Power is usually transmitted through flexible, three phase cable. Due to the high potentials, the three phase conductors in the cable are individually shielded with a concentric, fine wire wrap or braid which is applied over the phase conductor insulation. These electrically conductive shields are maintained at ground potential and serve several safety functions. Since each shield is concentric relative to each phase conductor, it evenly distributes electrostatic stress radially through the insulation which surrounds each phase conductor. The shield likewise confines the electrical stress to the insulation between the shield and the conductor and; it greatly reduces shock hazard.

Due to the fact that, in mining, the point of power usage is moving, provision must be made to attach additional lengths of cable when necessary and also to replace sections of cable which become damaged. To facilitate this and handling ease, cable is generally sectionalized in 500 to 1,000 foot lengths. Interconnections must be made between each section and also between cable and switch gear and substations. These connections are generally made at the job site by cutting and stripping cable and attaching a cable coupler to the cable ends.

The most commonly used portable cable coupler presently employed in the art has several inherent shortcomings. The usual cable couplers consist of male and female plugs and sockets, mounted in a dielectric material such as glass reinforced polyester and positioned within a cast aluminum housing. The electrical connections between cable and coupler contacts have heretofore been made by first stripping both the insulation and braided shielding from each of the three phase conductors and then attaching each phase conductor to its respective male or female contact. Since the shielding around each phase conductor is terminated short of the contact in these prior coupler devices, it is necessary to construct so-called "stress relief cones" around the unshielded conductor area of each phase conductor. These stress cones are areas of increased insulation and are necessary to reduce the intensity of the increased electrical stress caused by the termination of the conductive shield. After the three phase conductors have been attached to the male or female contacts, and

after the stress relief cones are constructed around the phase conductors, the rear of the cast housing is usually filled with a hot asphalt-base insulating compound. The asphalt-base compound tends to give additional insulation between the unshielded phase conductors at the rear of the housing. It also is intended to prevent moisture from entering the coupler through cuts in the cable insulation.

The working environment of the mine presents severe problems, especially to electrical equipment. The mining equipment is exposed to moisture, dirt, electrically conductive dust particles, vibration, rough handling, etc. With the above described conventional cable coupler, there is an ever present danger of a serious phase-to-phase fault since the three phase conductors are unshielded within the coupler housing. This phase-to-phase type of fault is especially serious since the phase-to-phase potential, with alternating current, can be as much as 1.8 times greater than the phase-to-ground potential. The safety check systems currently employed in many mines, detect faults by continuously monitoring the electrical circuitry. If a fault is to occur, a phase-to-ground fault is preferred since it can be monitored almost instantaneously before peak voltage is reached and the power automatically shut off before serious injury or damage is caused. But this is not the case with the phase-to-phase fault. Hence, it is desirable, from a safety standpoint, to lessen the probability of having phase-to-phase faults.

My invention accomplishes this desired result by providing a cable coupler, adapted for assembly at the work site, in which the conductive shielding of each of the three phase conductors is not terminated at the coupler as is the case in prior couplers but rather is extended, concentrically, around each phase conductor and around each contact completely through the male and female portions of the cable coupler.

My invention provides a cable coupler with concentrically shielded contact housings for the male and female contacts, adapted to be connected to the shielding of the phase conductors, which yields the same electrical and safety advantages at the coupler junction area as is present in the shielded cable itself.

My invention more specifically provides a cable coupler with increased safety. Because of the continuous, concentric shielding of each phase conductor through the coupler, electrical stress levels present in the conventional couplers of the prior art are lowered; and the possibility of dangerous and destructive phase-to-phase faults is virtually eliminated. If a fault would occur, it can be safely controlled as a phase-to-ground fault since the concentric shielding surrounds each phase conductor and is at ground potential. The conventional, ground check, safety monitor used in most mines can immediately detect any current in the ground circuit of the conductive shield. Before the phase-to-ground fault can reach peak voltage, the safety ground check system would automatically and instantaneously break the entire circuit, thus preventing serious injury and damage.

My invention likewise provides a three phase cable coupler which is smaller and lighter and easier to assemble than the prior coupler devices since there is no need for asphalt compound filling, no need to construct stress relief cones around each phase conductor and there is less cable to strip.

My invention also provides a cable coupler with an annular insulator which is more resistant to dirt, dust and water contamination and allows design for higher operating voltages.

My invention still further provides a three phase cable coupler device which eliminates the problem of electrical noise caused by the unshielded couplers of the prior art.

Briefly stated, my cable coupler device is adapted to interconnect the shielded, three phase conductors of a first high voltage cable with the shielded, three phase conductors of a second cable and comprises a first coupler housing and a second coupler housing, both having hollow interiors. Three female coupling members are provided and are adapted to be mounted within the first coupler housing and three male coupling members are likewise provided and are adapted to be mounted within the second coupler housing. Each of the male and female coupling members comprises a concentrically shaped cylindrical contact housing having electrically conductive properties and also having a rear portion adapted to be attached to the conductive shielding of each phase conductor. The cylindrical contact housing members of the male and female coupling members also have front edge portions shaped to matingly contact one another when the couplers are joined so as to establish the electrical continuity of the concentric shield from the three phase conductors of the first cable through the coupler and to the three phase conductors of the second cable. Each of the aforementioned male or female coupling members also includes an annular insulator having a central bore therethrough and positioned within the cylindrical contact housing member. The front surface portions of the male and female insulators are shaped to matingly engage one another when the coupler is joined. Male and female electrical contacts are positioned within the bore of each of the male and female annularly shaped insulators. The rear portions of said male and female contacts are adapted to be connected to their respective phase conductors while the front portions of said contacts are formed to matingly engage one another when the coupler is joined so that electrical continuity is established between the three phase conductors of the first cable and the three phase conductors of the second cable.

In the accompanying drawings, I have shown the presently preferred embodiment of my invention in which:

FIG. 1 is a longitudinal cross-section of the female coupling member showing it attached to a shielded phase conductor;

FIG. 2 is a longitudinal cross-section of the male coupling member showing it attached to a shielded phase conductor;

FIG. 3 is a longitudinal cross-section of the male and female coupling members of FIGS. 1 and 2 shown in mated relationship;

FIG. 4 is a longitudinal cross-section of the coupler housing showing the three male coupling members of FIG. 2 mounted within, the view taken along lines IV-IV of FIG. 5; and

FIG. 5 is a front elevation of the coupler housing of FIG. 4.

Reference will now be made to the specific details of the drawings, wherein like parts will be designated by like numbers throughout the various views and similar parts will be designated by primed numbers.

In FIG. 1, the female coupling member, generally designated 5, is shown in cross section as it would appear after it has been attached to a phase conductor 10. It is, of course, understood that the complete high voltage cable (not shown in FIG. 1) contains three such phase conductors, exactly like the phase conductor 10. The three phase conductors 10' can be most easily seen by referring to FIG. 4, wherein the entire cable 50' is shown.

Each of the three phase conductors of a high voltage cable will receive an identical female coupling member 5. Therefore, since each of the three phase coupling connections are identical, only one will be described herein.

Referring to FIG. 1, female coupling member 5 comprises a first cylindrical contact housing 7 which is concentrically shaped about its longitudinal axis and has a central cylindrical bore formed therethrough, said bore extending from its front edge portion 15 to the rear edge portion 18 of the housing 7. Contact housing 7 is made of an electrically conductive material, preferably metal; however, other materials such as plastic may be employed if the surface of the housing 7 is given electrically conductive properties, as is accomplished by applying a conductive glaze. It is, likewise, desirable that contact housing 7 be concentric about its longitudinal axis so as to establish a uniform electrical stress within each coupling member.

An annular shaped, first electrical insulator 6 is securely positioned, preferably by molding, within the cylindrical bore of female contact housing 7. Insulator 6, likewise, has a central, cylindrical bore extending therethrough; said insulator 6 includes a front portion 19 which has a conically shaped surface extending outwardly from the front edge portion 15 of female contact housing 7. Insulator 6 is constructed of a dielectric material, preferably silicone, epoxy, or EPDM (ethylene-propylene-diene monomer). The rear portion 20 of insulator 6, likewise, has a conical surface, outwardly extending from rear edge portion 18 of female contact housing 7. The surfaces of front portion 19 and rear portion 20 of insulator 6 are conically shaped so that a longer electrical creepage path is established between the conductive portions of the coupling member 5.

A first electrical contact or female contact 8 is mounted within the central bore of the female insulator 6. Female contact 8 has a conventional front mating portion 22 in the shape of a concentric bore. Rear portion 23 of female contact 8 is adapted to be connected to high voltage, stranded conductor portion 13 of phase conductor 10. The attachment between conductor 13 and the rear portion 23 of contact 8 will generally be made at the mine site or other job site and can be made in any conventional manner. The rear portion 23 of contact 8 may be provided with internal threads 25 so as to allow attachment of an adapter plug 9 thereto. The plug 9 may then be attached, at face 24, to stranded conductor 13 by crimping or soldering. Alternately, rear portion 23 of female contact 8 may be provided with an unthreaded bore at 25 so that stranded conductor 13 may be attached directly thereto using conventional crimping techniques. It is understood that coupling member 5 of my invention is to be attached to the phase conductor at the job site, wherein the method of assembly would be as follows.

A portion of the high voltage cable 50 would be stripped of insulation, sufficient to expose each of the three phase conductors 10, which are located therein. Each phase conductor 10 comprises a central, stranded conductor 13 which is surrounded by a layer of insulation 12. Around insulation 12 is wrapped the conductive shield 11, usually in the form of a copper braid. Each phase conductor 10 would be stripped of insulation 12 so as to expose a portion of stranded conductor 13. The conductor 13 would then be attached to rear portion 23 of female contact 8 by conventional means, as mentioned above.

Intermediate insulation 21 is then applied around the exposed conductor 13 and also around phase conductor 10 if desired, as shown in FIG. 4, to and around the rear surface portion 20 of female insulator 6. Intermediate insulation 21 may be in the form of wrapped electrical grade tape or it may be a pottable type of insulator such as epoxy. After intermediate insulation 21 is in place, an intermediate, concentric, conductive shield 14 is formed. Intermediate shield 14 may be constructed of copper braid or any other electrically conductive material. The concentric shield 14 may also be in the form of a vacuum metallized surface. In this construction, the shield 14 and insulation 21 may be formed by using a premetallized plastic mold (not shown). The hollow mold would have a conical shape similar to that of concentric shield surface 14 of FIG. 1 or surface 14' of FIG. 4. The surface of the mold would be electrically conductive, due to its metallized surface, and would be attached to rear edge portion 18 of housing 7 at one end and to conductive shield 11 of the phase conductor 10 at the other end. The interior of the mold would then be filled with a liquid potting compound such as epoxy. Once cured, the epoxy would serve as intermediate insulation 21 and the metallized surface of the mold would act as concentric shield 14. After completion, intermediate concentric shield 14 would contact conductive shield 11 of phase conductor 10 and would extend, around intermediate insulation 21 to, and making contact with, rear edge portion 18 of female housing 7. Additional insulation (not shown) such as tape may also be applied around the intermediate shielding 14 to insure that contact is maintained between shield 11 and intermediate shield 14 and housing 7.

After the above described assembly has been completed, electrical continuity is established between phase conductor 13 and female contact 8. Likewise, electrical continuity is established between the conductive shield 11 of phase conductor 10, intermediate shield 14 and female contact housing 7.

Referring now to FIG. 2, the male coupling member, generally designated 30, is shown in cross section as it would appear after it has been attached to a phase conductor 10' of a second high voltage, three phase cable (not shown in FIG. 2). Male coupling member 30 is quite similar, structurally, to female coupling member 5, described above.

Male coupling member 30 comprises a second cylindrical contact housing 26 which is concentrically shaped about its longitudinal axis and has a central cylindrical bore formed therethrough, extending from its front edge portion 28 to its rear edge portion 33. Front edge portion 28 of cylindrical contact housing 26 may be formed at an angle, so as to match the angular slant of front edge portion 15 of the female housing 7, FIGS.

1, 3. A slanted edge design allows for greater exposed edge surface area, and, hence, greater electrical contact area. In the joined position, FIG. 3, front edge portions 28 and 15 matingly touch so as to establish electrical continuity between male and female contact housings 26 and 7 respectively. Male housing 26, like female housing 7, is constructed of electrically conductive material or it is given a conductive surface.

Referring again to FIG. 2, an annular shaped, second electrical insulator 40 is positioned with the cylindrical bore of contact housing 26. Insulator 40 has a central, cylindrical bore extending therethrough, and includes a front portion 34 which has a conically shaped surface extending rearwardly from front edge 28 of the housing 26. Conically shaped front surface portion 34 of insulator 40 is shaped to matingly engage the contour of front surface portion 19 of female insulator 6, FIGS. 1, 3. A snug engagement of surfaces 34 and 19 is desirable since it will increase the creepage strength of the mated coupler device by keeping any moisture, dirt, or air from entering or being trapped therein. Insulator 40, like insulator 6, is constructed of a dielectric material preferably silicone, epoxy or EPDM. It may be recommended that male insulator 40 and female insulator 6 be constructed of different dielectric materials, for example, one insulator should be silicone and the other epoxy. If both insulators are made from the same materials, there is a tendency for them to adhere or weld together when the coupling members are interconnected, thus making detachment a problem. This is especially true when both insulators 40 and 6 are constructed of silicone.

Male insulator 40 may also be formed in a different configuration, as is depicted by the dotted line representation of front surface portion 34', FIG. 2. In this preferred embodiment, insulator 40 would be molded from a flexible dielectric material, such as silicone or EPDM. Front surface portion 34' has cylindrically shaped inner sidewall portion 55 which is substantially parallel to the sidewall of the front portion 36 of male contact 27 and in spaced relationship therefrom. Outer sidewall portion 56 of front surface 34' slopes inwardly from the housing 26 to meet inner sidewall 55 at a point substantially near front edge portion 28 of contact housing 26. Due to the flexible characteristics of a dielectric such as silicone, when female coupling member 5 is interconnected with male coupling member 40, the preferably rigid dielectric material of conically shaped front surface 19 of female coupling member 5 would contact inner sidewall 55 of front surface 34' and force it to flex outwardly toward and against the sidewall of the male contact housing 26. Once the connection is completed between the two coupling members 5 and 40, front surface 34' would have the same conical shape as front surface 34. The main advantage in forming front surface 34' in such a manner is that during insertion, front surface 34' tends to forceably slide along conical surface 19 of the female member 5 and, in effect, wipes any moisture and dirt away from the high voltage contact area. This cleaning action would greatly improve the creepage strength of the coupler.

The rear portion 35 of male insulator 40 has a conical surface outwardly extending from rear edge portion 33 of male housing 26. Conical surface 35, likewise, presents a longer electrical creepage path between the conductive portions of male coupling member 30.

A second electrical contact or male contact 27 is mounted within the central bore of male insulator 40. Male contact 27 has a conventionally, outwardly extending front contact portion 36, formed to matingly engage cavity portion 22 of female contact 8 when coupling members 5 and 30 are interconnected, FIGS. 2, 3. Rear portion 37 of male contact 27 is adapted to be connected to the stranded conductor portion 13' of high voltage phase conductor 10' of the second high voltage three phase cable (not shown in FIG. 2). Attachment of stranded conductor 13' to rear portion 37 of male contact 27 would be made in the same or similar manner as was described above for attaching female contact 8 to stranded conductor 13. Intermediate insulation 21' is similarly applied around the intermediate connection area and intermediate conductive shield 14' is likewise constructed in the same manner as previously described: concentrically over insulation 21' so as to establish electrical continuity between shielding 11' of phase conductor 10' and rear edge portion 33 of male contact housing 26.

After three female coupling members 5 have each been attached to the three phase conductors 10 of a first high voltage cable and after the three male coupling members 30 have each been attached to the three phase conductors 10' of a second high voltage cable, the coupling members 5 and 30 may be mounted within their respective main coupler housings. FIG. 4 shows the three male coupling members 30 mounted within main coupler housing, generally designated 45. Both male and female housings are substantially identical; therefore, only the male coupler housing 45 need be described. Coupler housing 45 has a hollow interior of sufficient size to accommodate the three coupling members 30. Coupler 45 may be made of cast aluminum alloy since it offers strength and yet it is light weight. Coupler housing 45 is generally bell shaped, having the largest opening at its front portion 47 so as to permit the positioning of the three coupling members 30 at that location. Coupler housing 45 also includes a rear portion 48 which may contain an external threaded section 52 and an internal bore formed therein adapted to fit around the high voltage cable 50' in cooperation with cable sealing means, preferably in the form of conventional, rubber sealing gasket 51 and threaded closing ring 49. Closing ring 49 is screwed onto threaded section 52 of rear portion 48 of housing 45, forcing ring-shaped, rubber gasket 51 into tight engagement with the sidewall jacket of cable 50', effectively sealing the rear interior of the coupler housing 45 from dirt and moisture.

The coupling members 30 are mounted within the interior of the coupler housing 45 by suitable mounting means. The coupling member mounting means preferably comprises a mounting plate 42 which is adapted to be attached to the front portion 47 of coupler housing 45 by conventional securement means such as screws or bolts (not shown). A sealing gasket 53 may also be positioned at the interface between plate 42 and housing 45 so as to prevent the entry of dirt and moisture into the housing 45. Mounting plate 42 has at least three mounting holes 43 positioned in spaced relationship therethrough. Mounting holes 43 are appropriately formed to accommodate the outside diameters of the three male contact housings 26. Each coupling member 30 is placed into a mounting hole 43; a pair of rubber O-rings 46 may also be placed on either side of

the mounting hole 43 in order to insure a moisture and dirt free seal. Referring to FIG. 2, the male coupler 30 may include a mounting flange 32 outwardly extending from the contact housing 26 and an exterior threaded section 39, positioned forwardly of the flange 32. After coupler 30 is positioned within mounting hole 43, a locking ring 38, having internal threads 41 which match threads 39, is screwed onto male coupling member 30 so as to secure member 30 within mounting plate 42, FIG. 4.

Female coupling members 5 would be secured to a mounting plate similar to mounting plate 42. Referring to FIG. 1, female coupler member 5, is likewise provided with an outwardly extending mounting flange 17 on contact housing 7. Forward from flange 17 is threaded section 31 which is formed on the exterior surface of housing 7 so as to accommodate a locking ring 29. Locking ring 29 has a cylindrical bore with an internally threaded section 16 formed at one end. Threaded section 16 of locking ring 29 is formed to engage threaded section 31 so that locking ring 29 may be screwed onto female contact housing 7 in order to secure the female coupler member 5 within the mounting plate 42 of its coupler housing; in the same manner as was described above for male coupling member 30. A pair of O-rings 46 may also be used at either side of the mounting hole to insure a good seal. It is preferable that locking ring 29 be cylindrically shaped and of sufficient length so that it extends to a point near the end of front surface portion 19 of insulator 6. In this manner, locking ring 29 will protect the outwardly extending insulator surface 19 from any handling damage and also will aid in aligning the male coupling member 30 when it is joined with female member 5 since the inside diameter of locking ring 29 is constructed slightly larger than the outside diameter of male contact housing 26, as can be seen in FIG. 3. Hence, male contact housing 26 will slidably fit within the confines of locking ring 29 of female coupling member 5 when the cable couplers 45 are interconnected.

Referring to Fig. 5, the main coupler housing 45 is shown in front elevation, depicting a preferred arrangement of coupling members 30 mounted in holes 43 of mounting plate 42. Two of the coupling members 30 are positioned in parallel, spaced relationship at the outer extremity of mounting plate 42 and coupler housing 45. The third coupling member 30' is positioned intermediate the aforementioned two coupling members 30 substantially at the vertical centerline of the mounting plate 42 and housing 45. Third coupling member 30' is, likewise, positioned in spaced relationship, offset vertically, from the horizontal centerline of the two outermost coupling members 30. Additional circuit connections 44 may also be included, if desired, below coupling member 30' and intermediate members 30. Additional mounting holes may be provided on mounting plate 42 if additional circuits 44 are desired. Circuit connections 44 are conventional in mining applications and are usually used for interconnecting such items as ground check circuits and telephone circuits. These extra circuits are generally included within main cable 50.

It can be appreciated that the aforementioned positioning of coupling members 5 and 30 within housing 45 yields a compact and low profile coupler housing 45, which is desirable in mining applications since there will be less chance of snagging when the cable and cou-

pler housings are dragged along the floor of a mine. The offset positioning of coupling members 30 and 30' also results in a coupler housing 45 which can be interconnected in only one orientation, thus eliminating the need for special alignment keys or slots.

Referring to Figs. 4-5, coupler housing 45 may also include a pair of locking bolts 54 positioned near the front of housing 45, outwardly extending on either side therefrom. Locking bolts 54 may be secured to housing 45 by conventional securement means such as a threaded nut or by welding. Once in place, bolts 54 may be used to aid in clamping the two coupler housings 45 together after they have been interconnected. Appropriate clamping means (not shown) would be attached to bolts 54 of coupler housing 45 to insure that a tight fit is maintained between the coupler housings 45.

Once the above described assembly of each male coupling member 30 is completed within the coupler housing 45 and after the same assembly has been completed within the coupler housing for each of the three female coupling members 5, the two high voltage cable sections would be ready to be interconnected. Each of the three phase interconnections would be as in Fig. 3 where the mated shielded coupling member is shown. Once the three coupling members of the coupler housings 45 are interconnected, a continuous, concentric shield would exist around each of the three phase conductors; from the shield of 11 of phase conductor 10 of a first cable 50 to intermediate shield 14, continuing to the first female contact housing 7 and thence to the second male contact housing 26, then to intermediate shield 14' and finally to shield 11' of phase conductor 10' of the second high voltage cable 50'; Fig. 3.

Hence, it can be appreciated that each of the three phase conductors 10 and 10' will be continuously shielded as they pass through their respective coupling members 5 and 30 and their coupler housings 45. As a result of this continuous shielding, any chance for a phase-to-phase fault is virtually eliminated. Also, due to the fact that the shielding is concentric relative to the phase conductor, the electrical stresses will be uniform throughout the couplers with no concentrations of high electrical stress as is present in the conventional couplers used heretofore.

While I have described my presently preferred embodiments of my invention, it is to be understood that it may be otherwise embodied within the scope of the appended claims.

I claim:

1. A shielded coupling member for interconnecting a shielded phase conductor of a first high voltage electrical cable with a shielded phase conductor of a second high voltage electrical cable, which comprises:

A. a concentrically shaped first contact housing having electrical conductive properties and having a central cylindrical bore extending therethrough, said housing also including a front edge portion and a rear portion, said rear portion adapted to allow attachment from the conductive shielding of the shielded phase conductor of the first electrical cable thereto;

B. a first annularly shaped electrical insulator, positioned in the central bore of the first contact housing, said first insulator having a central cylindrical bore extending therethrough, said first insulator also including a front portion and a rear portion,

said front portion of the first insulator having a conically shaped surface, outwardly extending from the front edge portion of the first contact housing, the rear portion of said first insulator having a conically shaped surface, outwardly extending from the rear edge portion of the first contact housing;

C. a first electrical contact positioned within the central bore of the first electrical insulator, said first contact including a front portion and a rear portion, the rear portion of the first contact adapted to allow attachment from the conductor portion of the shielded phase conductor of the first cable thereto;

D. a second concentrically shaped contact housing having electrically conductive properties and having a central cylindrical bore extending therethrough, said second contact housing also including a front edge portion and a rear portion, the front edge portion of said second contact housing adapted to engagingly contact the front edge portion of the first contact housing when the two contact housings are matingly engaged, so as to establish electrical continuity between the two contact housings, the rear portion of said second contact housing adapted to allow attachment from the conductive shielding of the shielded phase conductor of the second cable thereto, so as to continue the concentric shield from the shielded phase conductor of the first cable, through the coupling member, and to the shielded phase conductor of the second cable;

E. a second annularly shaped electrical insulator positioned in the bore of the second contact housing, said second insulator having a central cylindrical bore extending therethrough, said second insulator also including a flexible front portion and a rear portion, said front portion adapted to closely engage the outwardly extending, conically shaped front portion of the first electrical insulator, the rear portion of said second insulator having a conically shaped surface, outwardly extending from the rear edge portion of the second contact housing, the flexible front portion of the second insulator has a cylindrically shaped inner sidewall portion adjacent to a second contact and substantially parallel with the bore of the second contact housing, said front portion also having an outer sidewall portion which slopes inwardly from the contact housing to meet the aforementioned inner sidewall portion at a point substantially near the front edge portion of the second contact housing in spaced relationship therefrom so that when the first and second contact housings are interconnected, the flexible front portion of the second insulator will slidably wipe and tightly conform to the conical shape of the front surface portion of the first insulator; and

F. the second electrical contact being positioned within the central bore of the second insulator, said second contact including a front portion and a rear portion, said front portion of the second contact adapted to slidably engage the front portion of the first electrical contact of the first contact housing, the rear portion of said second contact adapted to allow attachment from the conductor portion of the shielded phase conductor of the second electri-

cal cable thereto, so as to establish electrical continuity from the phase conductor of the first cable through the coupling member to the phase conductor of the second cable when the contact housings are interconnected.

2. The shielded coupling member of claim 1 wherein the flexible dielectric material of the second annularly shaped electrical insulator is silicone and the dielectric material of the first annularly shaped electrical insulator is epoxy.

3. A cable coupler device adapted to interconnect the shielded, three phase conductors of a first high voltage cable with the shielded, three phase conductors of a second high voltage cable, which comprises:

A. three female coupling members, for attachment to the three phase conductors of the first cable, each of said female coupling members including:

1. an electrically conductive, concentrically formed female contact housing, said housing having a front edge portion and a rear portion, said female contact housing adapted to be connected adjacent said rear housing portion to the shielded portion of the phase conductor of the first cable;

2. a female contact, positioned within each of the female contact housings, suitable for connection with each of the three phase conductors of the first high voltage cable;

3. each of said female contact housings also containing an annular insulator, positioned between said female housing and said female contact, said insulator also having a conically shaped front surface portion and a conically shaped rear surface portion outwardly extending from the front and rear edges of the female contact housing respectively;

B. a first coupler housing having a hollow interior, said first coupler housing also having a front portion and a rear portion, said rear portion adapted to sealably receive the end of the first high voltage cable, said hollow interior of said first coupler housing formed to receive the three female coupling members therewithin;

C. means for mounting said three female coupling members within the interior of the first coupler housing in spaced relationship therewithin;

D. three male coupling members, for attachment to the three phase conductors of the second cable, each of said male coupling members including:

1. an electrically conductive, concentrically formed male contact housing having front and rear portions, said male housing adapted to be connected adjacent the rear portion to the shielded portion of the phase conductor of the second cable, said male contact housing also including a front edge portion formed to contact the front edge portion of the female contact housing when the coupling members are interconnected;

2. a male contact, positioned within each of the three male contact housings, suitable for connection with each of the three phase conductors of the second high voltage cable, said male contacts also adapted to matingly contact the three female contacts of the first coupler housing;

3. an annular insulator, positioned within each contact housing between said male housing and

said male contact, said insulator having a flexible front surface portion, said flexible front surface having a cylindrically shaped inner sidewall portion adjacent to the male contact and substantially parallel with the bore of the male contact housing, said front portion also having an outer sidewall portion sloping inwardly from the male contact housing to meet the inner sidewall portion at a point substantially near the front edge portion of the male contact housing, whereby when the male and female contact housings are interconnected, the flexible front portion of the male insulator slidably wipes and tightly conforms to the conical shape of the front surface portion of the female insulator and a conically shaped rear surface portion outwardly extending from the rear portion of the male contact housing;

E. a second coupler housing have a hollow interior and a front portion, said front portion formed to engage the front portion of the first coupler housing, said second coupler housing also having a rear portion adapted to sealably receive the end of the second high voltage cable; the hollow interior of said second coupler housing adapted to receive the three male coupling members therewithin; and

F. means for mounting said three male coupling members within the interior of the second coupler housing in spaced relationship with the front edge thereof so that the contacts of said male and female coupling members align and matingly engage one another when the first and second coupler housings are interconnected and, likewise, so that the aligned pairs of shielded male and female contact housings of each coupling member contact one another at their front edge portions so as to allow a continuous electrical shield to exist around each of the three phase conductors of the first cable through the male and female coupling members to and around the three phase conductors of the second cable.

4. The cable coupler device of claim 3 wherein the means for mounting said three female coupling members and said three male coupling members within their respective first and second coupler housings includes:

A. a pair of mounting plates adapted to be attached to the front portion of each of said first and second coupler housings, said pair of mounting plates each having three mounting holes positioned in spaced relationship therethrough, said mounting holes formed to accommodate the outside diameter of the male and female coupling members;

B. each of said male and female coupling members also including a mounting flange, outwardly extending from the contact housing of the coupling members, each coupling member also including a threaded section formed on the exterior of the contact housing, positioned forwardly in spaced relationship from said mounting flange;

C. each male and female coupling member also including a locking ring, each of said locking rings having an internal threaded section, the threads of which are formed to engage the aforementioned external threads of the contact housings, so that when the male and female coupling members are positioned within the mounting holes of their respective mounting plates, they will be held in place

13

by their respective mounting flanges on one side of the plate and by their locking rings on the other side.

5. The cable coupler device of claim 4 wherein the pair of mounting plates for mounting the male and female coupling members, each contain three mounting holes therethrough positioned such that two of said holes are aligned in parallel, spaced relationship at the outer extremity of the mounting plate, the third mounting hole for said coupling members being offset vertically from the horizontal centerline of the aforementioned two mounting holes and positioned substantially

14

at the vertical centerline of said mounting plate.

6. The cable coupler device of claim 3 wherein the first and second coupler housings are constructed of aluminum.

7. The cable coupler device of claim 3 wherein either the first or second coupler housings include a pair of locking bolts, fixedly secured near the front of the housing, outwardly extending on either side therefrom, to aid in clamping the first and second coupler housings together after they have been interconnected.

* * * * *

15

20

25

30

35

40

45

50

55

60

65

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,783,434 Dated January 1, 1974

Inventor(s) Herbert E. Ransford, III

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 3 Line 59 --couling-- should read --coupling--.
Column 6 Line 10 --with-- should read --within--.
Column 6 Line 63 --strenth-- should read --strength--.
Column 7 Line 3 --conventionally-- should read
--conventional--.

In the Claims:

Claim 1 Column 10 Line 8 --c.-- should read --C.--
Claim 4 Column 12 Line 53 --femlae-- should read
--female--.

Signed and sealed this 16th day of April 1974.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents