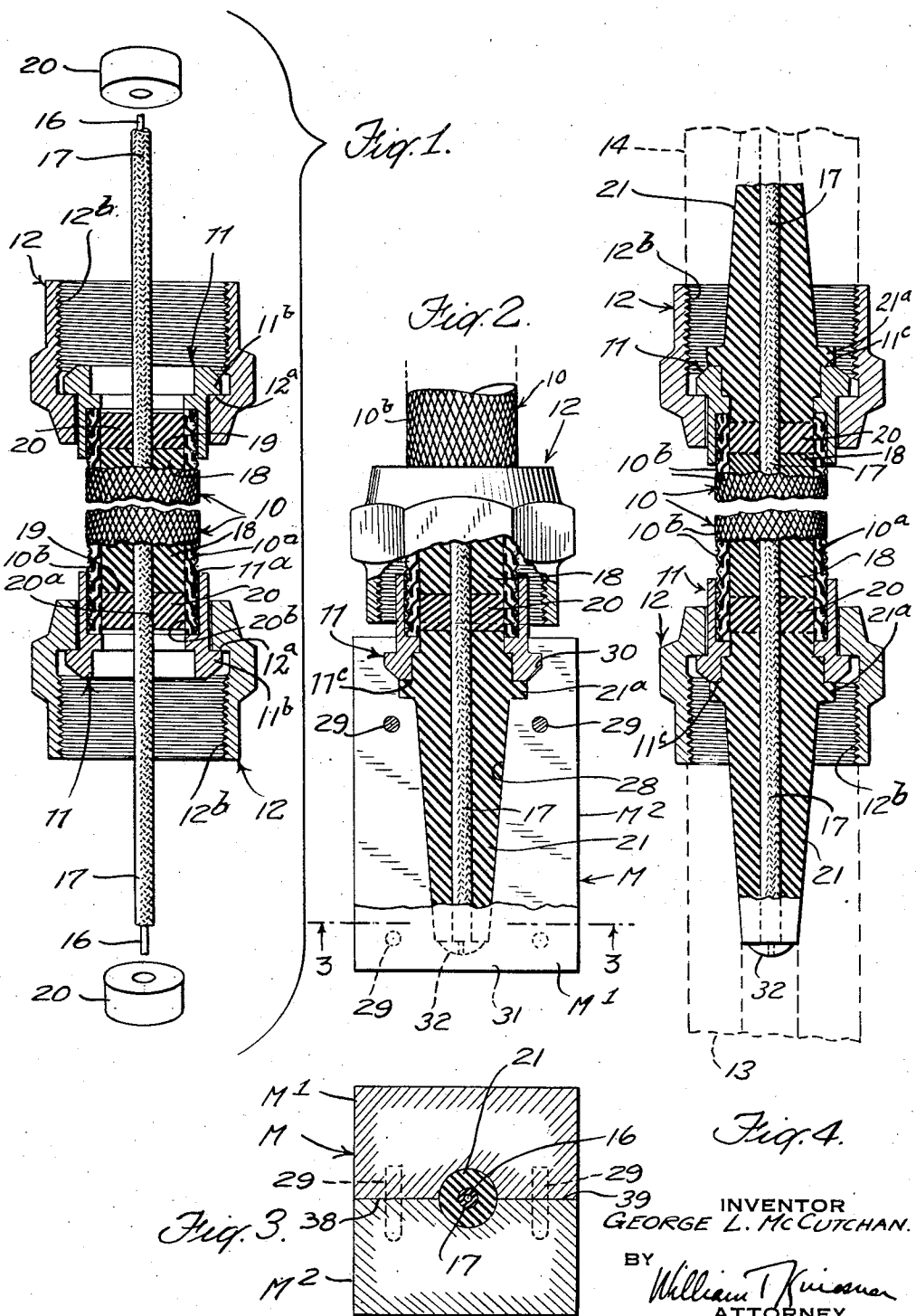


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SHIELDED ELECTRICAL CONDUCTOR CONSTRUCTION
AND METHOD OF MAKING THE SAME
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SHIELDED ELECTRICAL CONDUCTOR CONSTRUCTION AND METHOD OF MAKING THE SAME

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This invention relates to radio-shielded electrical conductor and terminal or connector construction, more particularly of the kind sometimes known as radio-shielded spark plug leads such as are employed in extending the electrical circuit connections from one manifold to individual spark plugs in internal combustion engines, and to a method of making the same.

One of the objects of this invention is to provide a simple, practical, and dependable radio-shielded spark plug lead construction that will be capable of dependable and efficient sealed connection with a manifold, or spark plug well, or the like. Another object is to provide a radio-shielded conductor construction in which leak-proof and insulating junctions may be effectively and dependably achieved between the radio-shielded conductor construction and a point of mechanical and electrical connection such as a spark plug well, manifold or conduit connecting element, and the like. Another object is to provide a construction of the above-mentioned character in which insulating materials of different physical properties may be employed for the terminal insulator and for the insulating compound filling the space between the conductor and the shielding conduit without having the purposes and functioning of the one detrimentally affected by the other. Another object is to provide a shielded conductor construction in which the terminal insulator is of a consistency or hardness to coact appropriately in effecting a sealed or gasketed mechanical connection, while the insulating or filler compound in the shielding conduit is of soft consistency, without having the characteristics or purposes of the one impaired by the other. Another object is to provide a simple, practical, and efficient method for making radio-shielded conductors with terminal insulators and capable of being efficiently carried on in practice with good uniformity of results. Another object is to provide a practical method for dependably assembling and sealing the radio-shielded conductor with filler compound and a terminal insulator having certain physical properties and functions different from those of the filler—all without impairment of the properties of the one by the properties of the other. Another object is, in general, to provide an improved method and construction of the above-mentioned nature, and other objects will be in part obvious or in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements, arrangements of parts, and in the several steps

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and relation and order of each of the same to one or more of the others, all as will be illustratively described herein, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawing, in which is shown, by way of illustration, a preferred embodiment of the mechanical features of my invention,

Fig. 1 is a central longitudinal sectional view, certain parts being shown in elevation and being partly broken away, of a radio-shielded conductor structure in one stage of its construction according to my method;

Fig. 2 is an elevation, partly in longitudinal cross-section, showing the construction in a succeeding stage;

Fig. 3 is a transverse sectional view along the line 3-3 of Fig. 2; and

Fig. 4 is a central longitudinal sectional view, certain parts being shown in elevation and certain parts being broken away, or indicated in broken lines, showing the completed shielded conductor and terminal construction.

Similar reference characters refer to similar parts throughout the several views of the drawing.

Referring, first, to Fig. 1, I preferably employ a conduit, generally indicated by the reference character 10, which, for purposes of effecting radio-shielding, is metallic and preferably comprises a flexible tube 10^a made of helically wound, corrugated, strip sheet-metal, such as is shown in United States Patent No. 1,198,392, employing, if desired, suitable means, such as solder, for achieving improved tightness and strength, in the manner shown and described in United States Patent No. 2,127,943, and preferably a covering 10^b of braided metal strands, as shown and described in United States Patent No. 1,340,818, snugly envelops the flexible tubing 10^a, being, of course, flexible therewith. The ends of the conduit 10 are received in suitable counter-bores 11^a of a suitably shouldered ferrule 11, to which they are secured in any suitable way to effect a sealed connection, for example, as by soldering. The ferrules 11 have shoulders or flanges 11^b, with which engage the end shoulders 12^a of nuts 12, internally threaded as at 12^b, whereby the respective ends of the conduit 10 and related parts, later described, may be secured, for example, to the externally-threaded shielding barrel or well 13 of a spark plug and to a similarly externally-threaded cylinder, or well, or socket 14 associated with the manifold (not shown) in which the various spark plug conductors are contained. By

means of the nuts 12, a mechanically secure connection to the parts 13 and 14 may be made, and, moreover, in coaction with other parts later described, dependable sealed junctions can be effected—all while achieving, also, a desirable quick detachability of the lead and terminal structural unit.

Extending within the conduit 10, and suitably insulated therefrom, is a conductor 16, which is preferably flexible and, hence, may be a stranded conductor; by way of the conductor 16, the high potential energy required to energize the spark plug is to be conveyed, and to insulate the conductor 16 from the radio-shielding metal parts of the conduit 10 I prefer to employ an insulating covering 17 about the wire 16, and this insulation 17 may be of any desired or suitable construction or composition, or of combinations of insulating compositions or elements, preferably adequate to dependably insulate the wire 16 for the voltage of the energy it is to carry, with usual or appropriate margins of safety. The wire 16 extends preferably coaxially of the conduit 10, which contains a suitable insulating compound 18 which can, if desired, be of a dielectric strength such as to provide for the adequate insulation of the wire 16 from the conduit 10 independently of the insulating covering or sheath 17 which, in such case, need not be employed, if desired, in so far as certain features of my invention are concerned. The compound 18 may be of any desired composition or material, preferably relatively flexible, and where the insulation 17 about the wire 16 is omitted, the consistency of compound 18 is preferably such as to coact in maintaining the conductor substantially coaxially within the conduit 10, or any other known means may be employed to maintain substantial coaxial relation.

With the insulating sleeve 17 about the wire 16, however, many advantages are achieved; for example, precise coaxial relation need not be provided for; the compound 18 can, desirably, be of more advantageous consistencies, preferably relatively soft or flowable, and thus better achieve, particularly when under compression, a more efficient and more reliable filling of all of the space within the conduit 10 and about the insulated conductor 16—17, and thus better guard against corona effects and against possible dielectric breakdown.

Any suitable means may be employed to inject the insulating compound 18 into the space between the conductor and the internal walls of the conduit, as by injecting a suitable quantity thereof upon completion of the assemblage of the ferrules and nuts to the conduit 10, and, by means of the nuts, suitable connection may be made to any suitable apparatus for injecting the material 18.

Having injected a suitable quantity of the compound 18 into the space between the conductor and the conduit walls, the compound 18 being in suitable plastic condition and being, illustratively, made up of any suitable uncured rubber-like material, such as natural rubber, any of the synthetic rubbers, or the like, each suitably compounded, such of the compound 18 as projects beyond the outer ends of the ferrules 11 is removed or cleaned off, so as to leave the end boundary of the material 18 substantially along a plane indicated at 19—all substantially as indicated in Fig. 1—the filler compound 18 being preferably compounded, in known manner, as by adding suitable ingredients or fillers thereto, so that,

upon the application of heat to cure it, it swells or expands in substantial or appropriate extent and so that, upon completion of the cure, it is preferably not hard or rigid, but has sufficient softness to be adequately flexible so as to bend with the bending of the conduit 10, as may be necessary.

Since the steps of my method and structural features according to my invention may be employed to construct the insulating terminal at each end of the conduit 10, it will suffice to describe in detail the steps and apparatus, and the parts employed, with respect to one end of the conduit 10. The conductor 16, as shown in Fig. 1, projects beyond the end of the conduit 10 throughout a length commensurate with the length of the insulated terminal structure to be employed, and, where the conductor 16 has an insulating jacket 17 thereabout, the jacket 17 is stripped from the extreme end portion of the conductor 16, thus to bare enough of the wire 16 to permit the application and connection thereof to any desired form of contact or terminal.

Onto the projecting end of the conductor I now sleeve an axially short bushing 20 of insulating material having a bore 20^a of a diameter such that the conductor structure 16—17 passes therethrough relatively easily, and the fit therebetween may be not too snug, and having an outside diameter such that the cylindrical face 20^b is readily received within the conduit 10. The bushing 20 is preferably of a length, relative to the ferrule 11, substantially as indicated in Fig. 1, and is slid along the conductor structure 16—17 and into the conduit 10 so that its inner face abuts against the filler compound 18 along the above-mentioned plane 19, leaving the front or outer end face of the bushing 20 preferably spaced inwardly somewhat relative to the mouth of the ferrule 11.

The bushing 20 is made of a suitable insulating compound such as any of those earlier above mentioned, but compounded so that it is cured or vulcanized, prior to insertion or assembly, as above described, in any suitable mold or the like, to substantial hardness, though still retaining, if desired, some degree of resiliency; thus it may be premolded of natural rubber, synthetic rubber, or the like, appropriately compounded, and molded and cured or heat-treated in any suitable way. In such form it is easily assembled to the parts, as indicated in Fig. 1, requiring simply that it be sleeved onto the conductor and slid into the end of the conduit.

To the projecting portion of the conductor is now applied a suitable insulating material, shaped to form a suitable insulating sleeve or terminal insulator, and preferably the material, in the form of uncured or unvulcanized compound of natural rubber, synthetic rubber, or the like, preferably compounded to cure or vulcanize to suitable toughness and hardness, with some resiliency, is applied in the form of tape-like elements which are wrapped about the projecting portion of the conductor, the wrapping being applied in such varying numbers of layers as to approximate or generally simulate the ultimate shape or configuration which it is desired that the terminal insulator is to have. In Fig. 2 the insulating material or compound so applied is indicated by the reference character 21, and in its initial application it is made to extend up against the end face of the precured annulus or insert 20, and also to fill in the angularities at the outer ends of the ferrules 11, as well as to simulate in

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general the annular shoulder 21^a which is to overlie the front end face 11^a of the ferrule 11; this annular shoulder 21^a is ultimately to function as a gasket or seal, as is later described, and in the curing of the compound 18 and the compound 21, the former being preferably relatively soft, even when cured, contamination of the compound 21, particularly those portions of it that form the shoulder 21^a, by commingling therewith or flowing thereover of the compound 18, is avoided according to certain features of my invention.

The mass of insulating compound 21, at each end of the structure, is now ready to be conformed to its final, finished shape or configuration, and for this purpose I preferably employ a sectional mold M, conveniently made up of two blocks M¹ and M² of metal, each provided with a mold cavity 28, the two mold cavities 28 being complementary to each other, and, when assembled and brought in face-to-face contact, as shown in Fig. 2, the complementary mold cavities 28, 28, preferably circular in cross-section, provide a configuration of the shape and dimensions which it is desired to give the insulating material 21. The mold sections M¹, M² may be provided with suitable dowels and dowel cavities, indicated at 29, to guide and align them for assembly one to the other, and are preferably also provided with arcuate recesses 30, each of 180 degrees extent, shaped to snugly envelop and encase portions of the outwardly-projecting radial flange or shoulder 11^b of the ferrules 11, so that the mold sections M¹ and M² can envelop the flange or shoulder 11^b and thereby become dependably secured to the conduit and ferrule assembly, the nuts 12 being at each end sleeved away from the ferrules so as not to interfere with the application of the mold sections.

The sectional mold M has an end closing wall 31, half of which is in one mold section and the other half in the other mold section, and the wall 31 or the mold cavities 28—28 may, if desired, be given any suitable configuration to accommodate any desired form of conductive terminal contact, indicated at 32 in Fig. 2, and which may be applied in any suitable way to the bared end of the wire 16 at any suitable point in the process, illustratively, just before the compound 21 is wrapped in place, as above described.

The material 21 is applied in an amount somewhat in excess of the volume which the mold cavity 28—28 has when the two mold sections are brought tightly together, and, hence, when the sections of the mold are applied externally thereto, it requires the application of adequate force or pressure to bring the mold sections M¹, M² together and to bring their mating faces 38 and 39 into substantial contact, with the result that the moldable or plastic compound 21 is subjected to increasing compression as the escape orifice between the approaching mold faces 38 and 39 is diminished and finally closed.

The resultant pressure compacts the compound 21 tightly against and about the conductor structure which it envelops, and also causes some flow or movement of the compound 21 in a direction inwardly against the precured insert 20, being also compactly conformed to the configurations of the mold cavity and of the ferrule 11. The material 21 is, thus, also compacted tightly against the insert 20, which in turn is compressed inwardly against the compound 18, taking up any possible play or looseness which might have occurred when the insert 20 was initially set into

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place. The insert 20, being appropriately cured and, thus, having adequate rigidity for the purpose, may also serve to hold the conductor structure substantially coaxially of the conduit 10 and ferrule 11, and thus prevent radial displacement thereof should, thereby, for any reason, a radially-acting differential force tend to radially displace the conductor as the two mold sections are forced into closing position.

The effect of the closing of the mold sections M¹, M² in putting the compound 21 under substantial pressure, so that hydraulic flow thereof takes place axially inwardly against the insert 20, has the advantage that, according to the selected looseness of fit between the bushing insert 20 and the conductor structure and the internal wall of the conduit 10, some of the compound 21 is forced inwardly into the narrow annular crevices or spaces between these parts, and it may or may not, according to circumstances, reach the compound 18 which, under the piston-like action of the insert 20, becomes subjected to some pressure to oppose this action, and probably some of the compound, which is preferably compounded to be more flowable than the compound 21, enters these annular crevices from the other side of the insert 20. Thus some compacting of the filler material 18 against both the conductor and the walls of the conduit may be effected at this stage, since the material 18 can thus be subjected to some pressure.

During this action at one end of the spark plug lead, any suitable means may be employed at the other end to prevent the exerted axial pressure upon the filler 18 from causing it to emerge from the other end of the conduit, and a convenient means for this purpose, as is indicated in the drawing, may comprise a companion insert 20 and a companion sectional mold M with insulating compound 21, all applied at the other end of the spark plug lead, so that the processing steps may be carried on substantially simultaneously at both ends.

Any suitable means (not shown) may be employed to force the mold sections together to exert the above-described hydraulic forces and to hold them securely assembled upon having brought their mating faces 38—38 together; such a means may be a screw clamp or the like which, in holding the mold sections together, holds them also securely interengaged with and locked to the ferrule 11. With both ends of the lead structure thus provided with assembled and clamped molds, as indicated in Fig. 2, the entire entity may now be subjected to suitable heat treatment to effect curing of the compound 18 within the conduit 10 and of the compound 21 at each of the terminal ends, these compounds and also the material of the cured inserts being so selected and being so compounded that, during curing, they become integrally joined or united with each other throughout such areas where they are brought into contact with each other, as above described, thus forming a continuous and uninterrupted insulating envelope about the conductor 16 from one end thereof to the other. The material 21 thus becomes dependably united to the insert 20 at its outer annular face, and the compound 18 becomes united to the insert 20 throughout its inner annular face, the above-described pressures and those later herein mentioned insuring that these unions take place dependably so that a possible leakage path, extending radially, does not result, so that dielectric strength is not impaired, as by included layers

of air or gas, as might be the case if such junctions were not effected.

Preferably the materials employed for the filler 18, and also for the sleeve or terminal insulating material 21, are compounded, in known manner, to include ingredients so that, upon the application of heat for curing or vulcanization, some swelling of the compounds takes place, particularly of the compound 18, thus increasing such pressures as they may already be subjected to as a result of the above-described closing of the mold sections.

The increased pressure to which the compound 18 is thus subjected, and this is desirable in order that the compound 18 be tightly compacted against the conductor structure and against the conduit walls, has the effect of causing some flow of the compound 18, at its respective ends, in directions outwardly of the conduit 10, and, were any of it allowed to creep or flow, during curing, along the surfaces of the ferrule 11 and thus reach the shoulder 21^a, it could commingle with the compound of the shoulder 21^a or overlie the external surfaces thereof by movement along the faces of the mold cavity 20—28. Detrimental contamination of the shoulder 21^a would thus result, for the compound 21 is compounded to cure to substantial hardness with sufficient resiliency so that the annular shoulder 21^a can, in the ultimate installation of the spark plug lead, be mechanically clamped and form a dependable seal, while the compound 18 is compounded to cure to relative softness, and, hence, is inappropriate for gasketing action. Such contamination of the gasket-forming shoulder 21^a has been found, according to certain prior attempts, to take place mainly in certain portions only of the peripheral extent of the shoulder 21^a, giving rise to so-called "soft spots" through which the gasket gives way.

According to my process, however, the insert 20, at each end, takes part in guarding against such contamination. The annular spaces between it and the conductor and the conduit wall provide axially long paths of possible movement of the filler compound 18 and, thus, coact to isolate the gasket shoulder 21^a from the contaminating material; these paths of flow, moreover, are substantially sealed at their outer ends by the entry therinto of compound 21 under pressure as a result of the clamping together of the mold sections and, in effect, seal off these possible narrow passages, thus blocking material flow of the filler 18, these actions being aided by the comparative narrowness of the annular spaces or crevices within which the correspondingly radially thin layer of compound 21 is difficult or impossible to displace by the more liquid or more flowable filler compound 18. In thus preventing detrimental escape of filler compound 18 from the conduit 10, during cure, a better compacting of the filler 18 within the conduit 10 and about the conductor is effected, because its expansion or swelling during cure is substantially unaffected by escape of material portions of it. Thus, also, the expansion of the filler compound 18 during cure can act hydraulically against the insert 20, causing the latter, in turn, to exert pressure upon the compound 21 that is undergoing cure also, and, in exerting such piston-like pressure thereon at the inner end thereof, presses the compound 21 against the ferrule surfaces and also more tightly into the mold cavity, particularly the shoulder-forming cavity portion, and thereby also lessens accessibility of filler com-

pound 18 to the shoulder portion 21^a. This piston-like action can also function to more tightly compact such of the compound 21 as has entered, or is additionally made to enter, the annular crevices at the outer and inner annular faces of the insert 20.

Upon completion of the cure, the mold sections are removed and the completed structure is ready for installation in the manner above described and as is indicated in Fig. 4, where the nuts 12 are shown threaded onto the casing or well parts 13—14 to compress the gasket flanges 21^a securely in sealing relation between the ferrules and the parts 13 and 14, respectively. In such sealing relation and action, it is only the cured material of the terminal insulators 21, specifically appointed, as above mentioned, for gasketing action, that effects the desired sealed relationships; the sealing flange in each case has a uniform sealing action, being unaffected or uncontaminated by the soft, cured filler 18, the characteristics of which are appropriate for coaction between the conduit and conductor and other parts, but are not appropriate to take part in a gasketing or sealing action. Were the sealing flange to be contaminated, in whole or in part, as by leakage above mentioned, dependability or permanency of seal would not be achieved and, instead, rapid failure would result at the point or points of contamination, it being understood that the sealed connection sometimes has to withstand substantial pressures, such, for example, as could be caused by leakage of high-pressure gases from the engine cylinder through the spark plug connection thereto.

In Fig. 4 the parts 21, 20, and 18 are cross-hatched as they appear in Fig. 2, which illustrates one stage of the process, but in Fig. 4 the adjacent lines of demarcation between these three parts are indicated in broken lines to indicate the integral uniting together of the three parts at the respective faces of the inserts 20.

As above indicated, the filler 18 and the material of the terminal insulator 21 may be compounded out of any suitable insulating materials and ingredients, all for the purposes above described. Illustratively, and preferably, neoprene is employed for both, the compounding thereof being suitably or appropriately varied according to the respective characteristics desired for the filler 18 and terminal insulators 21. Whatever materials are employed, such as those earlier above mentioned, the respective compounding thereof for the filler 18 and for the terminal insulators 21 may be effected, in any known manner, to give the filler 18, when cured, A Shore durometer reading on the order of 15 and a Shore durometer reading for the material of the insulators 21, when cured, on the order of 65. Where substantial swelling of the filler 18 during cure is desired, suitable ingredients are added in the compounding thereof to cause materially greater swelling thereof during heat treatment than it might normally have, and also some control of the factor of swell may be effected by correspondingly controlling the extent and character of mechanical working of the compound, as on mill rolls. Additions, during mechanical working, of oils, such as an oil of petroleum base, or of other suitable oleaginous substances which become well and highly dispersed throughout the material, may also be employed to materially increase the swelling characteristics, and, when employed, they have the additional advantage of plasticizing the com-

pound and acting as a lubricant, to facilitate injection of the filler 18 into the space between the conductor and the internal walls of the conduit; in such case the rubber-like base material employed is preferably selected from the types that are oil-resistant, of which neoprene is a good illustration. And it will be understood that other fillers and ingredients usually employed in otherwise plasticizing and processing rubber or rubber-like materials, and including plasticizing agents, vulcanizing agents, accelerators, retardants, or the like, may and preferably are also employed in respective amounts or proportions to give the desired processing and curing characteristics. The material of the member 20 may be, and preferably is, compounded and cured to have characteristics similar to those above described in connection with the material of the terminal insulator 21; as earlier above noted, member 20 is preferably molded and cured before its insertion into the assemblage.

It will thus be seen that there has been provided in this invention a radio-shielded conductor and terminal insulator construction and method of making the same in which the various objects above noted, together with many thoroughly practical advantages, are successfully achieved. The construction is thoroughly dependable and of uniform action, and it will be seen that the method can be reliably carried out in practice with the attainment of consistent results conducive to quantity production.

As many possible embodiments may be made of the mechanical features of the above invention and as the art herein described might be varied in various parts, all without departing from the scope of the invention, it is to be understood that all matter hereinabove set forth, or shown in the accompanying drawing, is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. In a method of preventing contamination of the gasket-forming portion of an external terminal insulator by the vulcanizable insulating compound within the conduit of a radio-shielded lead that has fittings at an end thereof that comprise a ferrule that is in fluid-tight connection with the conduit and that has an annular face against which to receive a gasket, the steps which comprise placing a conductor within the conduit with a portion projecting beyond said ferrule, filling the annular space between the conduit and the conductor with a vulcanizable insulating compound that is compounded to expand upon heat treatment, inserting through the ferrule and into the end of the conduit an annular member of substantial length made of a cured insulating material by sleeving it onto the projecting end of said conductor and dimensioned to substantially close off mechanically said annular space at the end of said insulating compound, thereby providing two restricted, annular, high-resistance paths of possible flow, one between the conductor and said member and the other between said member and the conduit wall, molding an insulating material about the projecting portion of said conductor and into engagement with the end face of said member and to form also an annular gasket-forming shoulder engaging said ferrule annular face and holding the molded insulating material in place by a detachable enclosing mold, and subjecting the assemblage to heat treatment to cure said molded insulating material and join

it to said member and to cure said insulating compound and join it to said member and to expand it, said high-resistance paths of flow accommodating in part surplusage of compound caused by its expansion and protecting said annular gasket-forming portion of said molded insulating material against access thereto of and contamination by said compound.

2. In a method of preventing contamination of the gasket-forming portion of an external terminal insulator by the vulcanizable insulating compound within the conduit of a radio-shielded lead that has fittings at an end thereof that comprise a ferrule that is in fluid-tight connection with the conduit and that has an annular face against which to receive a gasket, the steps which comprise placing a conductor within the conduit with a portion projecting beyond said ferrule, filling the annular space between the conduit and the conductor with a vulcanizable insulating compound, inserting an annular member made of a cured insulating material and being of substantial axial length into the end of the conduit and into engagement with the compound in the conduit and thereby provide two restricted, high-resistance paths of possible flow, one between the conductor and the member and the other between the member and the conduit, assembling to the ferrule and about the projecting portion of the conductor an uncured insulating material shaped in the form of a terminal insulator and provided with an annular, gasket-forming portion engaging said annular ferrule face, and subjecting the assembled entity to heat treatment and pressure to cure the material of the terminal insulator and join it integrally to said cured member and to cure said compound and join it integrally to said cured member, said restricted high-resistance paths accommodating, in part at least, flowable compound and protecting said annular gasket-forming portion of the terminal insulator from access thereto of and contamination by said compound.

3. In a method of preventing contamination of the gasket-forming portion of an external terminal insulator by the curable insulating compound within the conduit of a radio-shielded lead that has means at an end thereof providing an annular face against which to receive a gasket, the steps which comprise placing a conductor within the conduit with a portion projecting from said end, closing off the annular space between the conductor and the conduit adjacent said end by inserting therein an annular member of relatively rigid insulating material and thereby provide two restricted, high-resistance paths of possible flow, one between said member and the conductor and the other between said member and said conduit, applying about the projecting portion of said conductor and against said member insulating material that is curable to substantially rigid condition and that has an annular portion engaging said annular face, applying an insulating compound that is curable to relatively flexible, non-rigid condition within the space between the conductor and said conduit and against said member, and curing the assemblage under conditions of pressure applied to said compound within the conduit to cause it to be compacted against the conductor and against the conduit walls whereby, during cure, said high-resistance paths oppose material flow thereinto of compound under pressure and thereby protect said annular portion that engages said annular face

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against access thereto of and contamination by said compound.

4. A radio-shielded lead with terminal gasket-forming insulator comprising a fluid-tight radio-shielding conduit having a ferrule in fluid-tight connection therewith at an end thereof, said ferrule having an annular gasket face for the reception thereagainst of a gasket, a sleeve-like terminal insulator of cured relatively rigid insulating material extending from said ferrule and having an annular gasket portion to overlie said annular ferrule face, a conductor extending within said conduit and through said sleeve-like terminal insulator, a cured relatively flexible insulating compound within said conduit and about the conductor therein, there being interposed between the ferrule end of said terminal insulator and said cured compound an annular member of relatively rigid insulating material that is integrally united with the material of the terminal insulator and with said cured compound under conditions of pressure of said compound during cure and of relationship of the annular surfaces of said interposed member to the wall of the conduit and to said conductor as to provide restricted high-resistance paths of possible flow of compound under pressure during cure to thereby protect the annular gasket portion of said terminal insulator against access thereto of and contamination by said compound.

5. In a method of preventing contamination of the gasket-forming portion of an external ter-

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5. minal insulator by the curable insulating compound within the conduit of a radio-shielded lead that has means at an end thereof providing an annular face against which to receive a gasket, the steps which comprise placing a conductor within the conduit with a portion projecting from said end, closing off the annular space between the conductor and the conduit adjacent said end by inserting therein an annular member of relatively rigid insulating material and thereby provide two restricted high-resistance paths of possible flow, one between said member and the conductor and the other between said member and said conduit, applying about the projecting portion of said conductor a member of insulating material shaped in the form of a terminal insulator and having an annular portion engaging said annular face, applying an insulating compound that is curable to relatively flexible non-rigid condition within the space between the conductor and said conduit and against said inserted member, and curing the compound in said conduit under conditions of pressure applied thereto to cause it to be compacted against the conductor and against the conduit walls whereby, during cure, said high-resistance paths oppose material flow thereinto of compound under pressure and thereby protect said annular portion of the terminal insulator that engages said annular face against access thereto of and contamination by said compound.

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