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C. L. PETERS

2,742,549

CONNECTOR FOR TWO WIRE TRANSMISSION LINES

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Fig-1

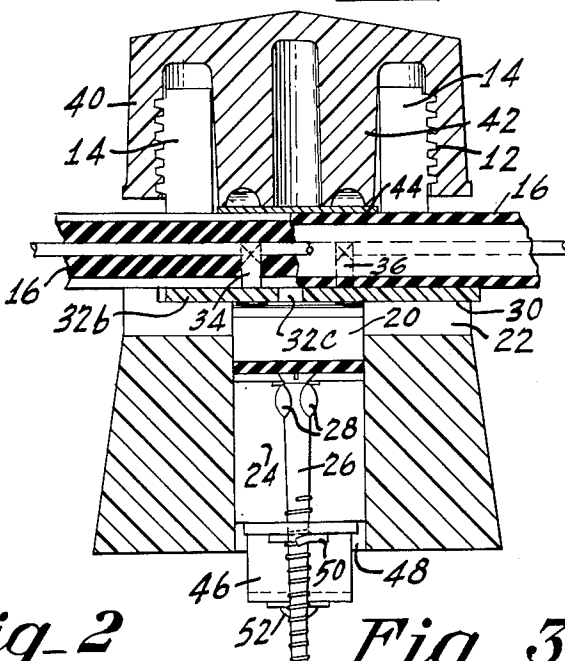


Fig-2

Fig-3

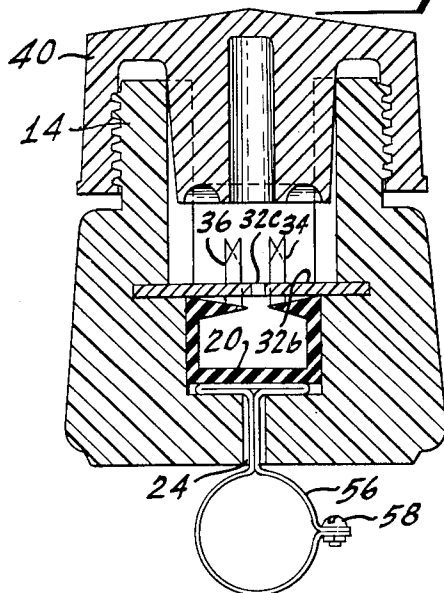
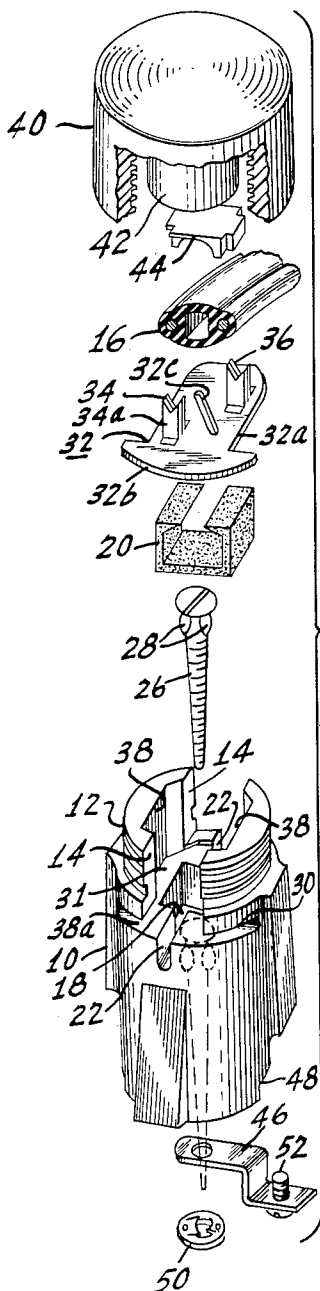
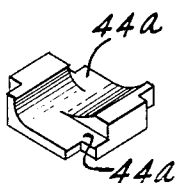


Fig-4



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2,742,549

CONNECTOR FOR TWO WIRE TRANSMISSION LINES

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27 Claims. (Cl. 201—63)

This invention relates to electrical connectors for tapping a two-wire transmission line.

An electrical connector for two-wire transmission lines is described in U. S. Patent 2,440,748, to Johnson. There are similar types of transmission lines which employ pronged contacts over which the wire to be connected is inserted. The wire is then forced down as by a screw threaded cap to be pierced by the prongs which makes contact with the two insulation covered wires. In particular, for example as described in the said Johnson patent, the connector may be employed as a lightning arrester with a highly resistive element being connected between the two pronged connectors, the element being grounded to drain off undesired electrical charges. At the same time, the body is of sufficiently high resistance so that the electrical characteristic of the transmission line to which it is connected is not disturbed appreciably. In the past the transmission line to which the connection is to be made has been a substantially flat two-wire transmission line covered with a suitable dielectric. However, with the advent of higher frequencies into ordinary usage, such transmission lines may take other shapes, for example, the two wires may be imbedded in dielectric on opposite sides of a dielectric tube having a cross section somewhat oval or ellipsoid, the two wires in transverse cross section then appearing on opposite sides of the ellipse major axis. Sometimes the tube is circular. Sometimes the dielectric is not tubular but is of air-blown or bubbled dielectrics of various kinds. The wide variety of transmission lines has made it difficult to find a connector suitable for all or even a variety of the types of transmission lines manufactured, even though the nominal spacing of the wires of the transmission line remains approximately constant for a wide variety of lines, for example, the three hundred ohm twin lead line commonly used in television lead-in wires.

Another difficulty encountered with the prior connectors has been that they are subject to moisture penetration. When the moisture has once penetrated it does not readily dry. The presence of moisture is adverse to the transmission line, to the connector connection, and in the form in which the prior connectors was made, the moisture is retained to a large degree. The connector does not readily dry out. As the connectors are often exposed to the weather in normal usage over long periods of time, the continuous presence of moisture causes the life of the connectors to be less than what it would be in the absence of moisture. Moreover, moisture affects the electrical characteristics of the transmission line, and adversely affects the reception of signals transmitted over the line. In the prior devices, especially where used as lightning arrestors, it is sometimes desirable to mount the connector on a groundpipe or the like, and sometimes on a baseboard with a separate ground connection. Although both forms are manufactured commercially, only some of the parts thereof are interchangeable. Of course a high degree of interchangeability is desirable in lend-

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ing economy to the manufacture of the connector. Such interchangeability is especially desirable for the major body portion of the connector.

It is one object of the present invention to provide a highly adaptable transmission line connector.

Another object of the invention is to provide a connector freely usable with many different types of transmission lines, and in particular to provide a lightning arrester so usable.

A further object of the invention is to provide a connector, and particularly a lightning arrester, which is better resistant to exposure to weather and which is especially resistant to the ravages of moisture.

A further object of the invention is to provide a connector, and especially a lightning arrester, the main or body portion of which is interchangeable for a connector with a strap mounting or pipe or a connector to be mounted on a board or wood with a separate ground connection.

In accordance with a preferred embodiment of the invention as typified by a lightning arrester, a main body of dielectric is threaded at one end to receive a cap. When the cap is threaded into a place with a transmission line to be connected suitably seated, the cap forces the transmission line upon the connecting prongs. A removable insert is provided to fit under the cap and against the transmission line when required. The insert surface bearing against the transmission line is cylindrically concave. In this fashion the force exerted by the cap against the line to cause penetration of the dielectric by the prongs, is spread over the comparatively wide concave surface of the insert, so that a fragile line having a concave exterior is not crushed by the cap. However, this insert is readily removable, so that the same connector may be employed with the flat types of transmission line. The pronged contacts themselves are carried in a flat insert slidably inserted from one side of the main dielectric body, tapered to be retained in place by frictional engagement, and conveniently resting on a ledge between the cavity and the opening in which the line is laid. Under the pronged contact flat insert is a substantially rectangular cavity in the main body, to receive the high-resistance resistive element. This element is formed into a U shape, preferably of resistive rubber, and slots are cut in the main dielectric body on each side of the rectangular opening or hollow so that when the resistive body is in place there is free communication between the outer air and the inner sides of the resistive body and the cavity to afford ready drying-out of the connector. Between the resistor element cavity or chamber and the other end of the connector from the threaded end, the main body is provided with a narrow slot which has a central portion enlarged along the body axis. By reason of the slot, a screw having opposed ears on its shank may be inserted into the centrally enlarged portion and engaged against rotation by the ears fitting into the slot. The screw contacts the resistor element, and a lead is readily brought from the exposed portion of the screw for a separate ground lead in case the screw is used for wood mounting. On the other hand, if a ground strap mounting is desired, the two ends of the strap may be supplied through the slot and seated in the chamber bottom by folding the strap into a double T and passing the ends (corresponding to the T upright) through the slot after which they may be spread around and engaged against a suitable ground pipe for mechanical mounting and electrical contact.

The foregoing and other objects, advantages and novel features of the invention will be apparent from the following description when read in connection with the

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accompanying drawing, in which like reference numerals refer to similar parts, and in which:

Fig. 1 is a longitudinal cross-sectional view of a lightning arrestor according to the invention in a plane through the body axis and including the strap slot, and having a strap in place for mounting on wood;

Fig. 2 is an exploded view of the lightning arrestor of Fig. 1;

Fig. 3 is a longitudinal cross-section view of an arrestor like that of Fig. 1, except that the plane of the view including the body axis is at right angles to that of Fig. 1, and a strap for mounting on a ground pipe is shown instead of the mounting screw; and

Fig. 4 is a perspective view of the removable insert employed in the lightning arrestor for connecting to transmission lines of the oval or circular rather than the flat type.

Referring to Figs. 1 and 2, a main dielectric 10 is externally threaded at one open end 12. The walls of the opening have a pair of diametrically opposite slots 14 to receive the transmission line 16 which may be laid thereacross and thus in the opening.

A rectangular cavity 18 is provided beneath the opening of slotted end 12, axially from the end 12, to receive a resistor element 20. A transverse slot 22 in a plane radial to the dielectric body axis communicates with the opening of end 12. The dielectric body 10 also has an internal radial slot 24 having a centrally enlarged portion and extending from the bottom of the rectangular cavity 18 through to the end of the dielectric body remote from the threaded end 12. The centrally enlarged portion of the end slot 24 is arranged to receive a wood screw 26 with its axis along the dielectric body axis and with its end exposed beyond the end of the dielectric body remote from the threaded end 12, and with its head resting at the bottom of the cavity 18. The screw 26 is provided at its shank with ears 28 which, when the screw 26 is in place, engage in the end slot and prevent the screw from rotating with respect to the dielectric body 10. Substantially in a transverse plane lying between the diametrically opposite slots 14 and the rectangular cavity 18 is a transverse entry slot 30 the lower wall 30a of which is substantially continuous with a ledge 32 between the rectangular cavity 18 and the threaded end portion 12. The entry slot 30 is arranged to receive a flat insert 32 which carries contact prongs 34 and 36. The portion 32a of the flat insert 32 carrying the prongs 34, 36 is inserted first and seated on the ledge with the prongs upward within the threaded end portion 12. The other portion 32b of the flat insert 32 has an outer edge contour conforming to that of the main dielectric body 10 when the insert 32 is completely inserted. The portion 32a of the flat insert has very slightly tapered side edges, the side edges being more closely spaced at the end first inserted than at the end near the portion 32b last received. The difference in spacing of the edges may be a few thousandths of an inch taper, so that when the flat insert 32 is in place it rests on the ledge 31 and is grasped firmly between the opposed parallel surfaces 38 planar diametrically opposite along a diameter through the body axis transverse to the diameter along which the pair of line-receiving slots 14 are located. The parallel surfaces 38 rise from the ledge 31. Thus the insert 32 may be easily inserted but once in place is firmly grasped.

An end cap 40 is internally threaded to engage with the threads of the end 12 of the dielectric body 10. A central protuberance 42 extends toward the open end of the end cap 40. A removable insert 44 is provided (see also Fig. 4) flat on one side where the protuberance 42 is to bear against it and cylindrically concave on the other side. On the cylindrically concave side, however, flat diagonally located corners 44a are provided to face the transmission line when the removable insert and line are in place.

A contact strip 46 has a hole at one end to fit over the screw 26 when the screw is in place and is received in a

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channel 48 transversely cut across the end of the dielectric body 10 remote from the threaded end 12. A lock nut 50 may be driven on to the work screw 26 to hold the contact strip 46 in place in the channel 48. The other end of the contact strip 46 is threaded to receive a screw 52 whereby contact with a ground wire may be made.

In assembly, the screw 26 is inserted first, the contact strip 46 slipped over the end of the screw into the channel 48 and the lock nut driven home. Next, the resistor element 20 is inserted. It will be noted that the resistor element 20 is U shaped, having a base and side arms, and has ears extending from the arms of the U. The resistor element 20 is placed into the rectangular cavity 18 with the open end of the U away from the bottom and the bottom end of the U bearing against the head of the screw. The channel in the U-shaped member 20 is arranged to communicate with the transverse slots 22. Next the flat insert 32 is inserted. Preferably, the rubber resistor element is of a size to extend slightly above the ledge 31 so that it must be slightly compressed in order to slide the flat insert 32 into place. After the flat insert is in place, the ears of the U-shaped resistor element 20 bear respectively against the inserts 34 and 36 so that each ear makes contact with the reverse side of one of the prongs 34, 36 which have a metallic portion extending through flat insert 32. A convenient way to form the prongs 34, 36 to be carried on the insert is to use a staple like element for the prongs which is driven through the insert and thereafter shoulders, as at 34a, formed to prevent the withdrawal or removal of the prongs. The flat insert 32 is preferably provided with a diagonal slot 54 extending along a diagonal which is opposite to the diagonal line between the contact prongs 34, 36 and is thus transverse to the line between the contact prongs.

The element is now ready for mounting and use. By turning the dielectric body 10 the wood screw may be driven into a suitable hole drilled in wood. When in place, a transmission line 16 may be laid into the diametrically opposite slots 14. The removable insert 44 is then laid with its concave surface bearing against the convex surface presented to it by the transmission line 16. The removable insert 44 is of a size and shape to just fit against the parallel surfaces 38 so that it easily slides down in the direction of the axis of the threads of open end 12. Rotation of removable insert 44 in the dielectric body 10 as the cap 40 is screwed on to the end 12 is prevented by the non-circular shape of the opening, to which its edges conform in complementary manner, but loosely so that it goes down easily. The sides of the opening, however, are parallel to the screw thread axis (the body axis) so that there is no binding. Protuberance 42 bears against the flat side of the removable insert 44 to force it down against the transmission line and thus force penetration of the prong contacts into the dielectric. If an ordinary flat twin-wire transmission line, such as is common in television usage, be employed, the removable insert 44 is omitted. The prongs 34, 36 placed on opposite sides of a central plane between the flat surfaces 38 are preferably of sufficient width to contact any of a wide variety of lines pierced by the prongs. The protuberance 42 is of sufficient diameter to press a flat line such as mentioned on to the prong contacts to be penetrated thereby. When the prongs pierce the transmission line dielectric and contact the twin leads of the transmission line, a connection is made with the prongs. The diagonal flat corners 44a are opposed to the prong contacts 34, 36 respectively, and the removal of the cylindrical surface enhances the easy piercing of the dielectric thereby. Because of the compression of the resistor element 20, its ears bear against the under side of the flat insert 32 and against the exposed portion of the prong metal which appears on that side. In this fashion, the transmission line 16 is shunted by the resistor element 20. The screw 28 is in contact with the resistor element which

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is connected through the screw to the contact strip 46 and then to the ground wire which may be attached by the screw 52. Accordingly, electrical charges which have collected on a T. V. antenna or the like are drained off through the resistor element 20 and ground wire. At the same time, there is substantially no adverse affect upon the characteristics of the transmission line. The prongs 34, 36 are small and do not cause an extensive irregularity in the dielectric of the transmission line. The resistor 20 shunts the transmission line with a resistance very high compared to the characteristic impedance of the transmission line. For example, the transmission line may have a nominal characteristic impedance of 300 ohms. The shunt resistance introduced by the resistor element 20 is of the order of 500,000 ohms. As explained hereinbefore, the resistor element may be of carbonized or conductive rubber, for example, a rubber having an admixture of carbon particles to make it conductive.

Because of the communication afforded by the slots 22 with the internal portion of the resistor element 20, there is rapid water drainage and free access of outer drying air to the inner portion of the resistor element. Such free access is further enhanced by the flat insert slot 32c. Furthermore, the flat insert slot 32c reduces the capacity coupling which otherwise would exist between the prongs 34 and 36. Because of the spacing of the prongs 34, 36 substantially no shunt capacity is introduced across the transmission line. Although there have been introduced into the market recently as many as five or six transmission lines nominally of 300 ohms characteristic impedance and affording different external surfaces such as circularly cylindrical, elliptically cylindrical, and variations thereof, it has been found that the connector will accommodate and provide connection to any of these various lines, as well as a flat transmission line of 75 or 300 ohms characteristic impedance.

If it is desired to employ a strap connection, rather than a screw mounting, it may be accomplished as illustrated in Fig. 3, by inserting the ends of a strap 56 folded at the top to provide a T shape, the arms 56a of which rest under the resistor element 20 and are contacted thereby in much the same manner as the screw head. The strap 56 may be encircled around a pipe and tightened with a nut and bolt 58 provided therefor. In other respects the arrangement in Fig. 3 is the same as that of Fig. 1 except that the view is taken in a plane transverse to that of the end slot 24.

It will be apparent that the invention thus discloses a connector which provides for free access of drying air into the internal cavity thereof, thereby increasing the usable life of the connector. Either a strap or screw connection may be used in the dielectric body of the connector. A wide variety of types of transmission line may be connected with the connector.

What is claimed is:

1. A connector comprising a main insulating body having an axis, an insert for said body having a pair of prong contacts each for connection respectively to a different conductor of a two conductor dielectric covered transmission line, said body being threaded at one axial end, a cap threaded to engage said end and having an inwardly facing protrusion to force said prong contacts to penetrate the transmission line dielectric and into contact with the respective transmission line conductors to make said connections, a resistor element of high resistance having a base portion and a pair of arm portions, said insulating body having a cavity to receive said element and an opening to receive said protrusion, the opening walls being slotted to receive the transmission line between said protrusion and said insert and with the insert between the transmission line and said resistor element, said insert having exposed on the side adjacent said element means to connect said prong contacts respectively to different ones of said arms, said cavity walls being radially slotted to afford free communication with

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the space between said base and arms and the space outside said body, whereby the said cavity is freely exposed to drying atmosphere.

2. The connector claimed in claim 1, said cavity walls being radially slotted on opposite walls.

3. A connector comprising a main insulating body having an axis, an insert for said body having a pair of prong contacts each for connection respectively to a different conductor of a two conductor dielectric covered transmission line, said body being threaded at one axial end, a cap threaded to engage said end and having an inwardly facing protrusion to force said prong contacts to penetrate the transmission line dielectric and into contact with the respective transmission line conductors to make said connections, said insulating body having an opening to receive said protrusion, the opening walls having a pair of slots to receive said transmission line between said protrusion and said insert, a further removable insert for said body having two sides, one said side having a cylindrically concave surface portion for bearing against the transmission line when in place and the other side for receiving force from said protrusion, whereby any one of a number of different types of transmission lines may be accommodated by said connector, still including a flat transmission line by removal of said removable insert.

4. The connector claimed in claim 3, said removable insert having at corners on a diagonal line through said axis when the insert is in place flat portions each to oppose a different one of the prong contacts as the said removable insert forces the transmission line against the said contacts.

5. The connector claimed in claim 3, said pair of slots in the walls of said opening being diametrically opposite with respect to said axis, said opening walls affording a pair of guide surfaces parallel to each other and to said axis and on diametrically opposite sides with respect to said axis along a diameter transverse to the diameter of said diametrically opposite slots.

6. The connector claimed in claim 3, the internal surfaces of said opening being parallel to the axis of the threads of said threaded end and being non-circular about said axis, and the said removable insert having a contour complementary to said irregularities to be guided without rotation by the walls of said opening it forces a transmission line against said prongs.

7. A connector comprising a main insulating body having an axis, an insert for said body having a pair of prong contacts each for connection respectively to a different conductor of a two conductor dielectric covered transmission line, said body being threaded at one axial end, a cap threaded to engage said end and having an inwardly facing protrusion to force said prong contacts to penetrate the transmission line dielectric and into contact with the respective transmission line conductors to make said connections, a resistor element of high resistance having a base portion and a pair of arm portions, said insulating body having a cavity to receive said element, an opening to receive said protrusion, the opening walls being slotted to receive said transmission line between said protrusion and said insert and with the insert between the transmission line and said resistor element, said insert having exposed on the side adjacent said element means to connect said prong contacts respectively to different ones of said arms, said body having at its other axial end a slot affording communication between said cavity and space outside said body, said slot including said axis, and having an enlarged portion along the axial line, whereby said body may accommodate one of a ground strap in said slot and a screw in said enlarged slot portion.

8. A connector comprising a main insulating body having an axis, a flat insert for said body having a pair of prong contacts each for connection respectively to a different conductor of a parallel two-conductor dielec-

tric-covered transmission line, said body being threaded at one axial end, a cap threaded to engage said end and having an inwardly facing protrusion to force said prong contacts to penetrate the transmission line dielectric and into contact with the respective transmission line conductors to make said connections, said cavity having an opening to receive said protrusion, the opening walls being slotted to receive the transmission line between said protrusion and said insert, said body having a further transverse slot entering said body from one side thereof to receive said flat insert, the relative dimensions of said slot and flat insert preventing entry of said insert beyond a certain point.

9. The connector claimed in claim 8, the sides of the insert which fit into said further slot against the narrow walls thereof fitting tightly to afford a frictional grasp of the said flat insert when fully inserted therein.

10. The connector claimed in claim 8, said insert having tapered sides which fit into said further slot against the narrow, substantially parallel walls thereof tightly to afford easy insertion and a tight frictional grasp of the said flat insert when fully inserted therein to prevent easy withdrawal.

11. The connector claimed in claim 8, further comprising a resistor element, a cavity in said body communicating with said opening, said body having a pair of ledges on opposite sides of the opening between the said cavity and said opening, said further slot communicating with the opening so that said ledges are coplanar and a continuation of a wall of said further slot, said flat insert resting with its flat side adjacent said cavity supported at their sides by said ledges and separating said cavity and said opening.

12. In a transmission line connector of the type including an insulator member having a pair of opposite surfaces, a pair of prongs formed with pointed ends extending from one surface of said member for engaging different conductors of a transmission line and contact ends extending from the opposite surface of said member, and an insert element formed of resistive material located adjacent said opposite surface of said member and in contact with said contact ends to provide a resistive connection between said prongs; said resistive element being formed as a generally U-shaped element with the free ends of the U engaging said projections, whereby the capacitance introduced by said resistive element is relatively low.

13. A resistive element comprising a member of generally U-shaped configuration formed of resistive material, the free ends of said U being adapted to engage conductors in a transmission line circuit, whereby said resistive member introduces only a small amount of capacitance in said circuit.

14. A resistive element as set forth in claim 13, the free ends of said U-shaped member extending toward one another and terminated in an edge which is narrower in cross sectional configuration than the remainder of the U-shaped member.

15. In a transmission line connector including an insulating structure formed with a channel in an end thereof within which a parallel wire transmission line is adapted to be laid and a cavity beneath said channel, a plurality of pins projecting from said cavity into said channel with the points of said pins positioned to engage separate ones of said parallel wires when said line is pressed down thereon, the improvement comprising, a generally U-shaped insert formed of resistive material located in said cavity adjacent to the inner ends of said pins with the free ends of said U engaging different ones of said pins.

16. In an arrangement as set forth in claim 15, further including a conductive member in electrical contact with said resistive insert and extending from the interior of said insulating structure, the extension of said conductive member being adapted to be connected to ground.

17. In a transmission line connector including a body formed of insulated material slotted at one end thereof and including a cavity located beneath said slot, an insert element formed of insulating material, a pair of prongs having pointed ends extending from one surface of said element and contact ends extending from the opposite surface of said element, said element being adapted to be positioned in said slot with said pointed ends facing said one end of said structure, a cap adapted to be secured over said one end of said insulator body and, when an insulated transmission line is positioned in said slot, to force said line against said pointed ends of said prongs and said prongs to pierce the insulation of said line and make contact with the conductors of said line, and resistive means adapted to be placed in said cavity to engage the contact ends of said insert member, the improvement comprising said insert element formed with an aperture therethrough extending from said one surface thereof to said opposite surface thereof for permitting water to pass through said aperture and into said cavity, and an aperture in said wall of said structure leading from said cavity in said structure to the exterior of said structure for permitting water in said cavity readily to evaporate.

18. In a transmission line connector for use with a plural wire transmission line, in combination, an insulating body having an opening therein through which said transmission line is adapted to extend, and formed with a cavity beneath said opening; a plurality of prongs individual to respective ones of said wires formed with pointed ends projecting into said opening in a direction normal to the direction of extension of said transmission line and contact ends extending a relatively short distance into said cavity; means for pressing said wires into intimate contact with said pointed ends of said prongs; and a resistive element formed of resilient material located in said cavity, said element being of slightly larger size than said cavity in the direction of said opening, whereby the contact ends of said pins slightly compress said resilient element and make good electrical contact therewith.

19. In a transmission line connector as set forth in claim 18, said transmission line having solely two conductors said connector including solely two prongs, one for each conductor, and said resistive element having a generally U-shaped cross-sectional configuration and being positioned in said cavity so that the free ends of said U engage the contact ends of said prongs.

20. In a transmission line connector as set forth in claim 19, said insulating body being formed with an aperture therein extending from said cavity to the exterior of said body, and said U-shaped resistor element being positioned so that the opening in the side of said U is adjacent said aperture, whereby any water which collects in said cavity is readily evaporated.

21. A twin wire transmission line connector comprising, in combination, a body of insulating material formed with a slot in one end thereof and a cavity beneath said slot; an insert element of insulating material adapted to be located in said slot with a surface thereof adjacent said cavity; solely a pair of prongs mounted in said insert element having pointed ends extending from one surface of said insert element and contact ends extending a relatively short distance from the opposite surface of said insert element, whereby, when said insert element is in position in said body with said pointed ends extending toward said one end thereof, said contact ends extend a short distance into said cavity; a cap adapted to be secured over said one end of said body and, when an insulated twin wire transmission line is in place in said slot, to force said line against said pointed ends of said prongs and said prongs to pierce the insulation of said line and make contact with the conductors of said line; and a resilient, resistive element of slightly larger dimension than said cavity in the direction of said one end of

said body, whereby when said insert element is in place in said body said contact ends of said pins slightly compress said resilient, resistive member and make good electrical contact with the latter.

22. In a transmission line connector as set forth in claim 21, further including conductive means in electrical contact at one end with said resistive element when the latter is in place in said body and adapted to be connected at the other end to ground.

23. In a transmission line connector as set forth in claim 21, said resistive element being of generally U-shaped cross-sectional configuration and positioned in said slot so that the free ends of the U engage the contact ends of said prongs.

24. In a transmission line connector as set forth in claim 21, further including another insert element formed with one surface thereof having a contour complementary to the contour of the exterior surface of said insulated transmission line, whereby, when said last-named insert element is in place between said cap and said transmission line with the complementary surfaces of said insert element and transmission line engaging one another, movement of said cap toward said insulator body causes said last-named insert element to distribute pressure evenly over said surface of said transmission line.

25. In a transmission line connector as set forth in claim 21, said body being formed with a second slot

having a long dimension lying in a plane perpendicular to the end-to-end axis of said body and located adjacent the intersection of said cavity with said first slot, and extending to the exterior surface of said body, said insert element being adapted to slide into said second slot and to frictionally engage the sides thereof when in position in said body.

26. In a transmission line connector as set forth in claim 23, said insert element being formed with an aperture therein extending from said one surface thereof to the opposite surface thereof to permit water which collects on said one surface thereof to pass through said aperture and into said cavity, and said body being formed with an aperture therein extending from said cavity to the exterior of said body, whereby any water collected in said cavity may readily be evaporated.

27. In a transmission line connector as set forth in claim 21, said pair of prongs being staggered with respect to one another in the direction of the wires of said transmission line so as to increase the spacing of said prongs and reduce the capacitance introduced by said prongs to said line.

References Cited in the file of this patent

UNITED STATES PATENTS

2,440,748 Johnson May 4, 1948