June 13, 1950 B. ADLER 2,511,524

CAPACITATIVE COUPLING DEVICE

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FIG. 1.

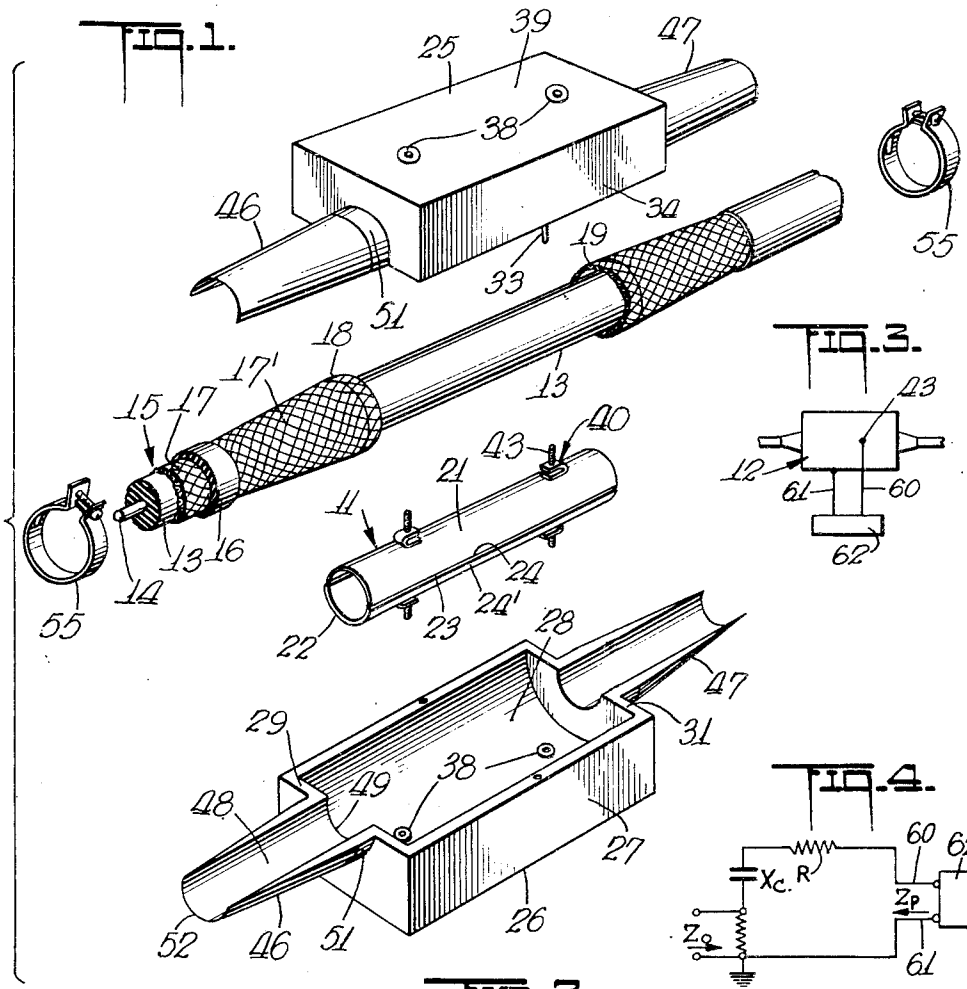
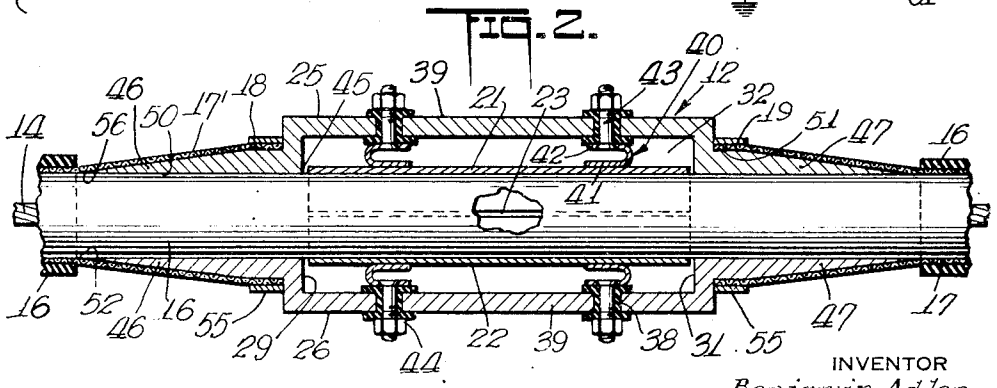


FIG. 3.

FIG. 4.

FIG. 2.



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CAPACITATIVE COUPLING DEVICE

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17 Claims. (Cl. 178—44)

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This invention relates to coupling devices more particularly of the type including a capacitative pick-up member for transferring radio frequency energy from along the length of a coaxial cable transmission line to a radio frequency receiver.

Where a coaxial cable transmission line is tapped at various places along the length thereof to transfer energy from the line to radio frequency receivers such as, for example, television receivers, if the tap should cause any change in the spacings of the conductors, as the value of the characteristic impedance of the line at the tap would change, this would cause an impedance discontinuity in the line. Such impedance discontinuity would cause reflection of the signals passing along the line with resultant standing waves and consequent loss of energy and distortion of the signal.

This loss of energy may cause such a weak signal to be transferred to the radio frequency receiver that the signal to noise ratio would be very low with resultant unsatisfactory functioning of the receiver. Moreover such defect would be aggravated where several receivers are tapped in along the length of the line, for due to the plurality of impedance discontinuities, successive receivers would receive less and less energy with the result that they would function in an unsatisfactory manner or not at all.

With these fundamental concepts of transmission line theory in mind, it is to be noted that where a direct connection is to be made to the conductors of the coaxial cable along the length thereof, it is necessary that a portion of the outer insulating casing first be removed, the outer conductor severed and pushed apart to afford access to the dielectric casing in which the inner conductor is embedded, and such dielectric casing must then be cut away so that a lead may be soldered or otherwise affixed to the exposed inner conductor.

After this is done, the dielectric casing and outer conductor must be restored so that they have substantially their original physical characteristics, for as the coaxial cable is symmetrical along its entire length, if the thickness of the dielectric casing is changed, as by melting because of the heat evolved during the soldering operation, or if the soldering should increase the diameter of the inner conductor at the joint, the spacing between the conductors would be changed and an impedance discontinuity would result with the attendant disadvantages heretofore pointed out.

When conventional T-couplings are used to tap

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into the coaxial cable, the latter must be completely severed, and precise soldering must be done, without undue heating of the dielectric casing, to affix the individual conventional coaxial connector required at each end of the severed cable in order to join them to the T-coupling. The soldering operations are relatively delicate to perform and time consuming and would require the services of a skilled radio technician and at best the coupling may still cause an impedance discontinuity in the line with the resultant reflections and standing waves on the line heretofore pointed out.

It is accordingly among the objects of the invention to provide a device of the above type that may readily be coupled to a coaxial cable transmission line with a minimum physical disturbance thereof, by even a relatively unskilled electrician in but a few minutes, with but a few simple tools, without need for the exercise of great care or any special precautions and without need for cutting the dielectric casing between the conductors or for making any soldered connections, which device will transfer energy from along the length of the coaxial transmission line to a radio frequency receiver with a minimum of impedance discontinuity in the line at the point of transfer and consequent minimum amount of reflection and standing waves on the line and hence a minimum loss of energy.

Another object is to provide a device of the above type that is simple in structure and relatively inexpensive to manufacture, having but few parts which are sturdy and not likely to become out of order and which may be assembled for its intended purpose in a relatively short time.

According to the invention from its broader aspects, the transfer of the signal voltage from along the length of the coaxial transmission line to the radio frequency receiver is accomplished by means of a coupling device including a pick-up member, placed against the dielectric casing of a section of the line from which the outer insulating covering has been removed and the outer conductor severed to expose such dielectric casing, to form an electric capacitor with respect to the inner conductor of the line.

The capacitative pick-up member, which may be in the form of a shell, desirably has an inner diameter substantially the same as that of the outer conductor so that it will snugly encompass the dielectric casing and be flush therewith.

In order to close the break in the outer conductor and to provide electrical continuity there-

of, a conductive structure is provided having a portion thereof extending parallel to the shell and spaced therefrom, means being provided on said structure to connect the severed ends of the outer conductor thereto. The structure is of such dimensions and so constructed and arranged that the pick-up member and said parallel portion will constitute a section of transmission line having a characteristic impedance substantially equal to that of the coaxial cable transmission line, thereby avoiding any substantial impedance discontinuity in the line due to the interposition of the coupling device.

More specifically, according to one aspect of the invention, the conductive structure may comprise a pair of substantially identical trays, each having a semi-cylindrical floor therein, which floors when the trays are juxtaposed, form a cylindrical cavity, and means are desirably provided at each end of the trays and in communication with the floors thereof, to which, when such trays are juxtaposed, the severed ends of the outer conductor may be affixed and through which the dielectric casing may extend.

The capacitative pick-up member associated with said conductive structure may comprise a pair of semi-cylindrical shells affixed respectively on the floors of said trays and each desirably slightly less than a semi-circle in cross section so that the longitudinal edges of the shells may be slightly spaced from each other when the trays are juxtaposed with said shells clamped against said dielectric casing.

In the accompanying drawings in which are shown one or more of various possible embodiments of the several features of the invention,

Fig. 1 is an exploded perspective view of the device and the coaxial cable with the latter prepared for mounting of said device,

Fig. 2 is a longitudinal cross sectional view of the device mounted on the ccaxial cable,

Fig. 3 is a diagrammatic view showing a receiver connected to the device, and

Fig. 4 is an equivalent circuit showing the device mounted on a transmission line and a receiver connected thereto.

Referring now to the drawings, the coupling device comprises a capacitive pick-up member 11 and a conductive structure 12 in which said member may be positioned.

The pick-up member desirably comprises two substantially semi-cylindrical shells or plates 21 and 22 of conductive material having a radius of curvature substantially the same as that of the dielectric casing 13 so that the latter may be interposed between such shells. Each shell desirably is slightly less than a semi-circle in cross section so that a narrow gap 23 may be provided between each of the longitudinal edges 24, 24' of the shells when they are positioned around dielectric casing 13.

In order to retain the shells 21, 22 snugly against said dielectric casing 13, the conductive structure 12 desirably comprises two identical trays 25, 26, which may be cast or otherwise formed from any suitable metal.

Although the shape of the exterior of the trays 25, 26 is immaterial, they each may have a substantially box-like outer body portion 27 having a semi-cylindrical floor 28 therein the diameter of which may be determined in the manner hereinafter described. Floor 28 extends longitudinally of said body portion 27 from one end wall 29 to the other end wall 31, whereby when the trays are juxtaposed, a housing having a cylindrical cavity 32 will be formed, dowel means 33 being provided to insure accurate alignment of said floors 28.

Each of the trays desirably has a plurality of insulating grommets 38, illustratively two in number, extending through the base 39 of the tray and securely affixed in said base.

Although any suitable means could be used to affix the shells 21, 22 to their associated pair of grommets 38, in the embodiment herein shown, a plurality of spring spacers 40 are provided, illustratively two in number, for each of said shells. Each spacer 40 desirably comprises a reversely bent strip of resilient conductive material having one of the legs 41 thereof affixed as by soldering or welding to the convex surface of the associated shell. The other or outer leg 42 of the spacer desirably has a threaded stud 43 affixed thereon, extending outwardly therefrom, at right angles thereto. The spacers on each of the shells are so separated that the studs thereon may be inserted through the grommets 38 in the trays 25, 26 respectively, and are retained in place by nuts 44 screwed on the ends of the stud projecting from the outer end of the grommets.

By means of such construction when the trays are juxtaposed as heretofore described, with the shells 21, 22 positioned around the dielectric casing 13, the spring spacers 40 will be slightly compressed, resiliently urging the shells against said casing 13 which will be encompassed by said shells.

In order that the shells 21, 22 be electrically insulated from the trays 25, 26, the length thereof is slightly less than that of the semi-cylindrical floors 28 in said trays, providing a gap 45 between the ends of the shells and the associated end walls 29, 31 of the trays.

To provide for electrical continuity between the ends 18, 19 of the severed outer conductor 17, means are provided to connect such ends to the associated ends of the conductive structure or housing 12 when the trays 25, 26 thereof are juxtaposed. Desirably such means may comprise a pair of connector members 46, 47 preferably formed integrally with the ends of each of the trays respectively and extending outwardly therefrom. Each connector member has a semi-cylindrical trough 48 therein of diameter substantially the same as the diameter of the casing 13. Troughs 48 are coaxial with floor 28 of the associated tray and are in communication with said floor 28 through a semi-circular notch 49 in each of the end walls 29 and 31 which notches 49 have the same diameter as trough 48.

The troughs 48 in the connector member 46, 47 are so positioned with respect to the floor 28 of the associated tray that when the trays are juxtaposed, with the shells 21, 22 therein encompassing casing 13, the inner surfaces of the troughs 48 in the connector members, will be longitudinally aligned with the inner surface of the shells, thereby ensuring that the dielectric casing 13 will be resting against the inner surfaces of troughs 48, which form a bore 50, and against the inner surfaces of shells 21, 22.

Preferably each of the connector members 46, 47 at its root end has a semi-cylindrical ledge 51 and the thickness of the connector member is gradually reduced from said ledge 51 to the nose end 52 thereof, tapering to substantially a knife edge thereat, with the outer diameter of said knife edge 52 being substantially the same as the inner diameter of the outer conductor 17.

To install the device it is first necessary to

prepare the coaxial cable 15 by removing a small section of the outer covering 16 thereof of length slightly greater than the overall length of the housing 12 including the connector members 46, 47. The exposed outer conductor 17 is severed in the mid portion thereof without cutting the dielectric casing 13 therebelow and each of the severed ends 18 and 19 of said outer conductor is pushed back as shown in Fig. 1. This will cause the braided outer conductor to flare out as at 17' so that it will be of greater diameter at its severed ends.

One of the trays, illustratively tray 26, with a shell 22 mounted therein as heretofore described, is thereupon positioned about the coaxial cable so that the exposed dielectric casing 13 rests on the associated shell 22 and in the troughs 48 in connector members 46, 47, with the knife edges 52 at the noses of such members 46, 47 extending between the outer conductor 17 at the severed end thereof and the dielectric casing 13. This procedure is repeated with the other tray 25, the dowels 33 aligning such trays when they are juxtaposed.

The flared ends of the outer conductor 17 are thereupon pushed up on the juxtaposed connector members which form a frusto-conical contour, until the ends 18, 19 of the outer conductor 17 are on the associated ledge 51. By means of any suitable clamp means 55 positioned around the root ends of the juxtaposed connector members, over the ends 18, 19 of the outer connector 17 and the ledge 51, the ends 18, 19 may be securely retained against their associated ledge 51, the clamp also securely retaining the juxtaposed trays 25, 26 together.

As the knife edges 52 of the connector members extend between the flared portions 17' of the outer conductor 17 and the dielectric casing 13 to contact the inner surface of such outer conductor as at 56 where it has substantially its original diameter, and as the inner surface of the shells 21 and 22 are aligned with the inner surface of said troughs in the connector members, it is apparent that for all practical purposes, the casing 13 will have an outer conductor thereabout the distance of which, from the inner conductor 14, will not be varied by the interposition of said coupling unit. As the electrical continuity of the outer conductor is provided by the housing itself, and as the inner conductor 14 is not physically disturbed by the coupling device, the gaps 45 between the shells 21, 22 and the housing, will have negligible effect in producing an impedance discontinuity in the coaxial cable 15.

The coupling device itself essentially comprises a section of coaxial transmission line interposed in the main line with the shells 21, 22 forming the inner conductor and the wall of the cavity 32 forming the outer conductor. It is important that the characteristic impedance of the coupling device be substantially the same as that of the line to prevent impedance discontinuity.

As the diameter of each of the shells 21, 22 is determined by the diameter of the casing 13 which they straddle it is only necessary to determine the inner diameter of the floors 28 which, when juxtaposed, form the cylindrical cavity about the shells 21, 22. This may readily be calculated from the formula

$$Z_0=138 \log_{10}\frac{b}{a}$$

where Z_0=characteristic impedance of the line,

b=inner diameter of the outer conductor and a=outer diameter of the inner conductor. Assuming the cable to have a characteristic impedance Z_0 of 52 ohms and the outer diameter a of the shells to be .34 inch, we find

$$52=138 \log_{10}\frac{b}{.34}$$

or $b=2.4\times.34=.82$ inches, which is the required diameter of floors 28 so that the coupling device will have a characteristic impedance of 52 ohms.

A radio frequency receiver may be connected to the coupling device as shown in Fig. 3 by attaching one of the leads i. e. lead 60 from the receiver 62, to the projecting end of a stud 43 on one of the shells and by connecting the other lead, i. e. lead 61, to the housing 12. As the shells 21, 22 are electrically insulated from each other, one of them may be used to couple energy to one unit and the other to couple energy to another unit (not shown).

As only a portion of the energy in the transmission line 15 is generally required to actuate the receiver 62 a series resistance R may be inserted in one of the feeder leads, illustratively lead 60 as shown in Fig. 4.

The following are typical calculations to determine the value of R at 100 megacycles which is illustratively chosen as the mid point of the frequency range at which at receiver, such as a television set, is to operate.

Where, for example, it is desired that voltage fed into the receiver 62 be 30 decibels less than the voltage across the transmission line, the impedance Z_p looking into the feeder leads 60, 61 at the receiver toward the coupling device should be approximately 31 times the characterisic impedance Z_0 of the tranmission line itself.

Assuming the characteristic impedance Z_0 of the transmission line to be 52 ohms, its capacitance per foot is known to be approximately 29 mmf. Assuming the length of the pick-up shells to be two inches each, then the capacitance of the pick-up member will be

$$\frac{29}{6}$$

or approximately 5 mmf.

At 100 mc., the capacitance reactance X_c of the pick-up member can readily be ascertained by the formula

$$Z_c=\frac{1}{2\pi fc}$$

when f=frequency in megacycle and c=capacitance in mmf., and is found to be approximately 320 ohms.

Applying conventional formulas then

$$Z_p=[(Z_0+R)-JX_c]=31Z_0$$

and R is found to be approximately 1530 ohms.

Since R is large as compared to X_c, Z_p will not vary appreciably over the range of frequencies from 50 mc. to 200 mc. thereby assuring almost constant signal voltage transfer to a television receiver at all frequencies in this range.

If desired resistor R may be eliminated if the shells are constructed of resistive material such as carbon or nichrome. The equivalent electrical circuit will still be such that a resistor will appear in series with the pick-up producing the required isolation.

With such coupling device, long runs of line may be used between the coupling device and a receiver with no effect on the main transmission line on which the coupling device is mounted and

a short circuit between the shells 21 and 22 and the outer conductor 17 or the housing, either in the device itself or external to it will not affect the signals passing hrough the ttransmission line 15 for such short circuit will merely electrically restore the line to its original form and only disable the receiver connected to the defective coupling device.

The number of receivers that may be fed from a distribution line utilizing the coupling device herein described is limited mainly by the length of the line, as discontinuity losses in the line produced by the tapping in of such receivers is kept at a minimum.

Because the device is capacitive, more voltage will be transferred to the receivers at high frequencies than at low frequencies hence automatically compensating for the greater losses in the line at such higher frequencies.

As the coupling unit may be added to the line with but a few operations without need for cutting the dielectric casing or inner conductor and without need for soldering, the addition of such device is a relatively simple procedure that does not require the services of a skilled radio mechanic but may be performed by any electrician.

As many changes could be made in the above construction, and many apparently widely different embodiments of this invention could be made without departing from the scope of the claims, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A device for transferring energy from along the length of a coaxial cable transmission line, said device comprising a capacitative pick-up member adapted to encompass and extend longitudinally of the dielectric casing of such cable from which a portion of the outer covering has been removed and the outer conductor severed to expose such dielectric casing, means to retain said pick-up member against such dielectric casing, a conductive structure having a portion thereof extending parallel to said pick-up member and spaced therefrom, said parallel extending portion and said pick-up member being spaced so as to form a section of transmission line having the same characteristic impedance as the coaxial cable to which the device is affixed, and means to connect the severed ends of such outer conductor to said structure.

2. The combination set forth in claim 1 in which said pick-up member comprises a plurality of substantially semi-cylindrical shells of conductive material.

3. A device for transferring energy from along the length of a coaxial cable transmission line, said device comprising a capacitative pick-up member adapted to encompass and extend longitudinally of the dielectric casing of such cable from which a portion of the outer covering has been removed and the outer conductor severed to expose such dielectric casing, and a conductive structure having a cylindrical cavity therein encompassing said pick-up member and coaxial therewith, the wall of said cavity and said pick-up member being spaced so as to form a section of transmission line having the same characteristic impedance as the coaxial cable to which the device is affixed, said structure having means thereon for connection thereto of the severed ends of the outer conductor.

4. The combination set forth in claim 3 in which means are provided on said pick-up member coacting with said structure and insulated therefrom securely to retain said pick-up member against such dielectric casing.

5. A device for transferring energy from along the length of a coaxial cable transmission line, said device comprising a capacitative, substantially cylindrical pick-up member adapted to encompass and extend longitudinally of the dielectric casing of such cable from which a portion of the outer covering has been removed and the outer conductor severed to expose such dielectric casing, said pick-up member having an inner diameter substantially the same as that of such outer conductor, a housing of conductive material having a cylindrical cavity therein encompassing said pick-up member and coaxial therewith, the wall of said cavity and said pick-up member being spaced so as to form a section of transmission line having the same characteristic impedance as the coaxial cable to which the device is affixed, means on said pick-up member coacting with said housing and insulated therefrom securely to retain said pick-up member against such dielectric casing and means on said housing for connection thereto of the severed ends of the outer conductor.

6. The combination set forth in claim 5 in which said last named means comprises a pair of frusto-conical conductive members extending longitudinally outward from said housing at each end thereof and rigid therewith, said members each having a bore therethrough coaxial with said cylindrical cavity and of diameter substantially equal to that of such dielectric casing, which casing extends through said bore, whereby said frusto-conical members may be positioned between the severed ends of the outer conductor respectively and the dielectric casing, and clamp means are provided associated with each of said frusto-conical members respectively, to affix the severed ends of such outer conductor thereto.

7. The combination set forth in claim 5 in which said last named means comprises a pair of frusto-conical conductive members extending longitudinally outward from said housing at each end thereof and rigid therewith, said members each having a bore therethrough coaxial with said cylindrical cavity and of diameter substantially equal to that of such dielectric casing, which casing extends through said bore, said frusto-conical members each having a ledge portion at the root end thereof and substantially a knife edge at the nose end thereof, whereby said frusto-conical members may be positioned between the severed ends of the outer conductor respectively and the dielectric casing, with said severed ends respectively resting on an associated ledge and clamp means are provided associated with each of said frusto-conical members respectively to affix the severed ends of such outer conductor thereto, said knife edge of said frusto-conical members having an outer diameter substantially the same as the inner diameter of such outer conductor.

8. A device for transferring energy from along the length of a coaxial cable transmission line, said device comprising a capacitative, substantially cylindrical pick-up member adapted to encompass and extend longitudinally of the dielectric casing of such cable from which a portion of the outer covering has been removed and the outer conductor severed to expose such dielectric casing, said pick-up member having an

inner diameter substantially the same as that of such outer conductor, a housing of conductive material, means on said pick-up member coacting with said housing and insulated therefrom securely to retain said pick-up member against such dielectric casing, said housing comprising a pair of substantially identical trays each having a body portion with a longitudinal semi-cylindrical floor therein, which floors when said trays are juxtaposed, form a substantially cylindrical cavity encompassing said pick-up member and coaxial therewith, the wall of said cavity and said pick-up member being spaced so as to form a section of transmission line having the same characteristic impedance as the coaxial cable to which the device is affixed and means on said housing for connection thereto of the severed ends of the outer conductor.

9. A device for transferring energy from along the length of a coaxial cable transmission line, said device comprising a capacitative, substantially cylindrical pick-up member adapted to encompass and extend longitudinally of the dielectric casing of such cable from which a portion of the outer covering has been removed and the outer conductor severed to expose such dielectric casing, said pick-up member having an inner diameter substantially the same as that of such outer conductor, a housing of conductive material, means on said pick-up member coacting with said housing and insulated therefrom securely to retain said pick-up member against such dielectric casing, said housing comprising a pair of substantially identical trays, each having a body portion with a longitudinal semi-cylindrical floor therein, said floors having a greater diameter than said pick-up member, and a pair of substantially identical connector members of conductive material extending longitudinally outward from the tray at each end thereof respectively and rigid therewith, said connector members each having a semi-cylindrical longitudinal trough therein in communication with the semi-cylindrical floor in said body portion and coaxial therewith and of diameter substantially equal to that of the dielectric casing, whereby when said trays are juxtaposed and positioned about said pick-up member, the semi-cylindrical floors of the body portions will form a cylindrical cavity encompassing said pick-up member and the troughs in said connector members will form a bore through which the dielectric casing may extend, the wall of said cavity and said pick-up member being spaced so as to form a section of transmission line having the same characteristic impedance as the coaxial cable to which the device is affixed and means coacting with the juxtaposed connector members to affix the severed ends of such outer conductor thereto.

10. The combination set forth in claim 9 in which said connector members each have a ledge portion at their root ends and taper to substantially a knife edge at their nose ends and the severed ends of such outer conductors are flared from the ends of the portions of such cable from which the outer covering has been removed, whereby when said connector members are juxtaposed, associated pairs thereof may be positioned between the severed ends of the outer conductor respectively and the dielectric casing, with such severed ends resting on said ledges respectively and said knife edge nose extending to the ends of the portion of the cable from which the outer covering has been removed and in engagement with the inner wall of such outer conductor and clamp means are provided coacting with said ledges respectively, securely to retain such severed ends thereagainst.

11. A device for transferring energy from along the length of a coaxial cable transmission line, said device comprising a capacitative pick-up member including two substantially semi-cylindrical shells, each having a radius of curvature substantially equal to that of the dielectric casing of such cable from which a portion of the outer covering has been removed and the outer conductor severed to expose such dielectric casing, a housing of conductive material having a cylindrical cavity therein, means on said shells coacting with said housing and insulated therefrom securely to retain said shells against such dielectric casing extending longitudinally thereof with said cylindrical cavity encompassing said pick-up member and coaxial therewith, the wall of said cavity and said pick-up member being spaced so as to form a section of transmission line having the same characteristic impedance as the coaxial cable to which the device is affixed, and means on said housing for connection thereto of the severed ends of the outer conductor.

12. A device for transferring energy from along the length of a coaxial cable transmission line, said device comprising a capacitative pick-up member including two substantially semi-cylindrical shells, each having a radius of curvature substantially equal to that of the dielectric casing of such cable from which a portion of the outer covering has been removed and the outer conductor severed to expose such dielectric casing, a housing of conductive material, means on said shells coacting with said housing and insulated therefrom securely to retain said shells against such dielectric casing, said housing comprising a pair of substantially identical trays each having a body portion with a longitudinal semi-cylindrical floor therein, said floors having a greater diameter than said pick-up member, which floors when said trays are juxtaposed form a substantially cylindrical cavity encompassing said pick-up member and coaxial therewith, the wall of said cavity and said pick-up member being spaced so as to form a section of transmission line having the same characteristic impedance as the coaxial cable to which the device is affixed, and means on said housing for connection thereto of the severed ends of the outer conductor.

13. A device for transferring energy from along the length of a coaxial cable transmission line, said device comprising a capacitative pick-up member including two substantially semi-cylindrical shells, each having a radius of curvature substantially equal to that of the dielectric casing of such cable from which a portion of the outer covering has been removed and the outer conductor severed to expose such dielectric casing, a housing of conductive material, means on said shells coacting with said housing and insulated therefrom securely to retain said shells against such dielectric casing, said housing comprising a pair of substantially identical trays, each having a body portion with a longitudinal semi-cylindrical floor therein, said floors having a greater diameter than said pick-up member and a pair of substantially identical connector members of conductive material extending longitudinally outward from the trays at each end thereof respectively, said connector members each having a semi-cylindrical longitudinal trough therein in communication with the semi-cylindrical floor in said body portion and of diameter substantially

equal to that of the dielectric casing, whereby when said trays are juxtaposed and positioned about said pick-up member, the semi-cylindrical floors in the body portions will form a cylindrical cavity encompassing said pick-up member and the troughs in said connector members will form a bore through which the dielectric casing may extend, the wall of said cavity and said pick-up member being spaced so as to form a section of transmission line having the same characteristic impedance as the coaxial cable to which the device is affixed and means coacting with the juxtaposed connector members to affix the severed ends of such outer conductor thereto.

14. The combination set forth in claim 13 in which each of said shells is slightly less than a semi-circle in cross section and the longitudinal edges of said shells are spaced from each other when retained against such dielectric casing.

15. The combination set forth in claim 13 in which said shells are of highly resistive material.

16. The combination set forth in claim 13 in which the means on said shells to retain the latter against the dielectric casing comprises a reversely bent strip of resilient conductive material, one of the legs of said reversely bent strip being affixed to said shell, said other leg having an outstanding threaded stud thereon, said trays each having a grommet of insulating material therein through which said stud extends.

17. A transmission line comprising a coaxial cable from which a portion of the outer covering has been removed and the outer conductor severed to expose the dielectric casing in which the inner conductor is embedded, a coupling device comprising a capacitative pick-up member having a generally cylindrical shell encompassing such exposed dielectric casing and spaced from said outer conductor to form an electric condenser with respect to the inner conductor, and a conductive structure electrically connecting the severed ends of such outer conductor, extending parallel to said shell and spaced therefrom so as to form a section of transmission line having substantially the same characteristic impedance as such coaxial cable, whereby when a radio frequency receiver is connected to said conducting structure and said shell, energy will be transferred from said coaxial cable to such receiver without any substantial impedance discontinuity in said coaxial cable.

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