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SHORTING PLUG FOR DIPLEX TRANSMISSION LINES

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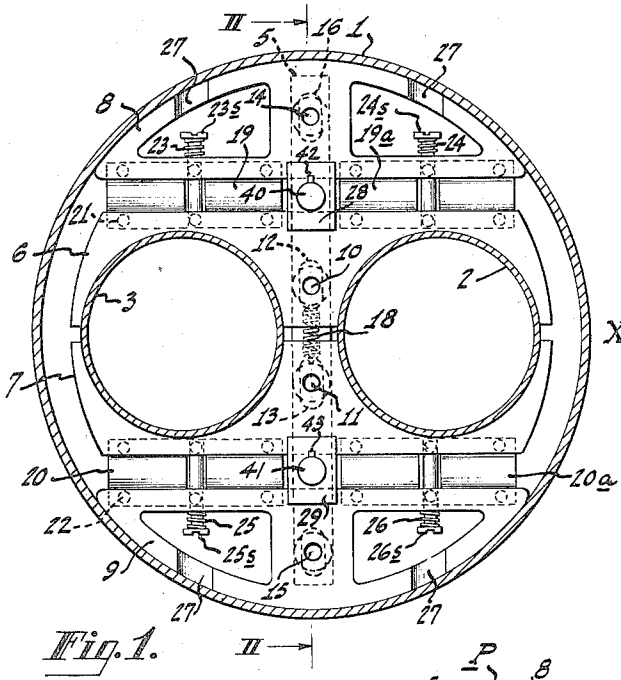


Fig. 1.

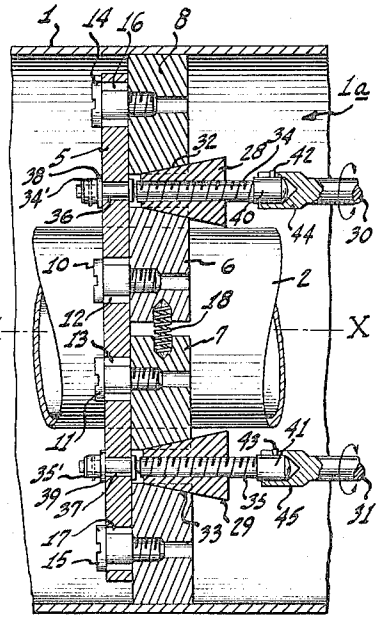


Fig. 2.

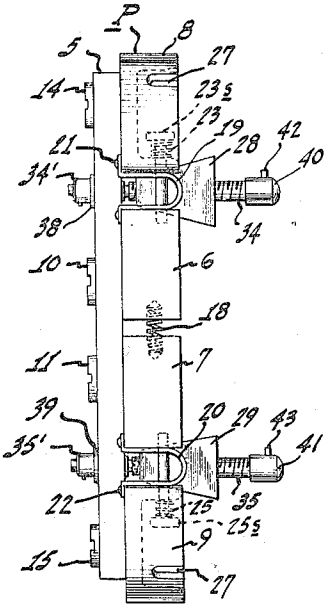


Fig. 3.

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SHORTING PLUG FOR DIPLEX TRANSMISSION LINES

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5 Claims. (Cl. 178—44)

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This invention is a shorting-plug for altering the effective mechanical length and hence the electrical tuning of a transmission line of the ("diplex") type comprising a hollow outer-conductor having a longitudinal axis and containing a plurality of inner-conductors arranged in spaced parallel relation on opposite sides of said axis.

The principal object of the invention is to provide an expansible-contractible shorting-plug which shall be capable of being inserted, in its assembled condition, through the open end of a "triple conductor" and then moved and clamped, with ease and dispatch, to a desired point in the line to provide a low impedance connection between all three of the said conductors.

The invention will be described in connection with the accompanying drawing wherein: Fig. 1 is an end view of a triple conductor containing a shorting-plug constructed in accordance with the principle of the invention, Fig. 2 is a longitudinal sectional view, taken on the line II—II of Fig. 1 and, Fig. 3 is a side elevation of the shorting-plug per se.

In Figs. 1 and 2 of the drawing x—x designates the inner central axis of a so-called "diplex" transmission line of the type comprising a hollow outer conductor 1 containing two inner conductors 2 and 3, respectively, which are disposed on opposite sides of the axis x—x with their outer surfaces presented in capacitive relation across an intervening space to the inner surface of the outer conductor, as is required in the simultaneous transmission of two carrier waves (e. g. television "picture" and "audio") of very high frequency. The outer conductor 1 has an open end 1*a* through which access may be had to its interior for the purpose of inserting the shorting plug P at a desired point in the line.

The supporting element or base of the shorting plug of the present invention comprises a metal rod or bar 5 of a length less than the diameter of the outer conductor 1 and of a width sufficiently narrow to be received between the inner conductors 2 and 3. The bar 5 serves as a central support for two complementary yoke pieces 6 and 7 which, jointly, surround the inner conductors 2 and 3, and also serves as a support for two arcuate members 8 and 9 which occupy the spaces between the individual yoke pieces and the inner surface of the outer conductor 1. The yoke pieces 6 and 7 are supported for relative movement upon the supporting bar by screws 10 and 11, respectively, which extend through vertically elongated slots 12 and 13, respectively, in

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the said bar. The "top" and "bottom" arcuate members 8 and 9, respectively, are similarly supported for relative movement by screws 14 and 15 which extend, respectively, through elongated slots 16 and 17 in the bar 5.

The complementary yoke pieces 6 and 7 serve, in a manner later described, to exert a clamping force upon the two inner conductors 2 and 3, but are normally biased to their open or unclamped position by means of a coil spring 18, the opposite ends of which are seated in holes provided for the purpose in the adjacent faces of the said pieces adjacent to the center of the plug, i. e. at the rear of the bar 5.

It will be observed upon inspection of Fig. 1 and 3 that each of the arcuate members 8 and 9 is connected to the yoke piece which lies adjacent thereto by a pluraliy of horizontally disposed folded metal strips 19, 19*a*, 20, 20*a*, respectively, which are secured along their opposite edges to the said members by screws 21 and 22. These folded strips 19, 19*a*, 20, 20*a* are preferably constituted of phosphor bronze or other spring-metal and exert their biasing force in the same direction as the stronger spring 18, i. e. outwardly on the arcuate members 8 and 9. The bias provided by the coil spring 18 and the spring metal strips 19, 19*a*, 20, 20*a* tends to increase the overall diameter of the plug and, as a possible consequence might render it difficult to insert the plug within the outer conductor. The said biasing forces must therefore be restrained and the arcuate members drawn inwardly against said bias a sufficient distance to permit the plug to be inserted within the line, by the provision of a compensating mechanism. The compensating mechanism for each arcuate member comprises a pair 23—24 (25—26) of screw-actuated coil springs which are connected through their screws 23*s*—24*s* etc. to the adjacent yoke piece. It will be observed that access may be had to each screw from the outer surface of the arcuate member which it serves through holes 27 in the said surface. It will also be observed that the weight of the plug is minimized by making the body of the arcuate members about the heads of the screws 23*s*, 24*s* etc. of hollow or open-work construction.

In order to effect the relative inward movement required to clamp the yoke pieces about the inner conductors, and the relative outward movement required to urge the arcuate members into engagement with the inner surface of the outer conductor, two metal wedges 28 and 29 are provided at the rear of the plug where they are ac-

cessible for adjustment by two removable rod-like wrenches 30 and 31. The wedges 28 and 29 are mounted, respectively, between the straight surface or "chord" of each yoke member and the parallel surface of the arcuate member which lies adjacent thereto, and are received in complementary wedge-shaped seats 32 and 33, respectively, comprising inwardly inclined slots located at or adjacent to the center of the said parallel surfaces.

The wedges 28 and 29 are of duplicate construction and are each provided with a threaded bore containing a screw 34, 35 which extends through a clearance hole 36 (37) in the supporting bar 5 at the front of the shorting plug. A cap 34' (35') on the front end of each screw and a washer 38 (39) beneath the said cap permits the screws to be turned while holding them against longitudinal movement. Thus, torque applied to the rear end of the screws 34 and 35, as by turning the wrenches 30 and 31, will move the wedges 28 and 29 forwardly or rearwardly as determined by the direction in which the screws are turned. A collar, 40 (41) on the rear end of each of the screws 34 and 35 contain a bayonet pin 42 (43) for engagement with a complementary bayonet slot in the socket 44 (45) of its wrench, thus the wrenches 30 and 31 may be removed from the screw collars 40 and 41 when the shorting-plug has been clamped at a desired point in the transmission line.

It will now be apparent that the present invention provides an improved shorting-plug and one capable of being inserted, in its assembled condition, into the open end of a "diplex" transmission line and then moved and clamped with ease and dispatch to a desired point in the line to provide a low impedance connection among all three conductors of the line.

What is claimed is:

1. A shorting-plug for altering the electrical length of a transmission line of the type comprising a hollow outer conductor having a longitudinal axis and containing a plurality of inner conductors arranged in spaced relation parallel to said axis, said device comprising: a support of a length less than the inside diameter of said outer conductor and of a width sufficiently narrow to be accommodated between said inner conductors, a plurality of complementary yoke pieces mounted for relative movement on said support and adapted to receive said inner conductors, a plurality of arcuate members mounted for relative movement on said support and adapted to extend across said axis in the space between said inner conductors and the inner surface of said outer conductor, a wedge mounted on said support between each of said yoke pieces and the arcuate member which lies adjacent thereto, and means for actuating said wedges whereby to clamp said yoke pieces about said inner conductors and simultaneously to urge said arcuate members into engagement with the inner surface of said outer conductor.

2. The invention as set forth in claim 1 and wherein spring means are provided between said yoke pieces for biasing said yoke pieces to their open position.

3. The invention as set forth in claim 1 and wherein means are provided for biasing said yoke pieces radially inward toward said longitudinal axis.

4. The invention as set forth in claim 1 and wherein said yoke pieces and said arcuate members are provided with spaced apart parallel surfaces and are electrically connected adjacent to said parallel surfaces by expansible metal inserts mounted between said surfaces.

5. The invention as set forth in claim 1 and wherein said wedge-actuating means comprises a screw extending through said wedge, said screw being secured at its inner end to said common support and provided adjacent to its rear end with a bayonet pin for engagement with a complementarily shaped socket wrench.

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