Dec. 31, 1946. D. R. DE TAR 2,413,298

ULTRA-HIGH FREQUENCY SWITCH

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Fig. 1.

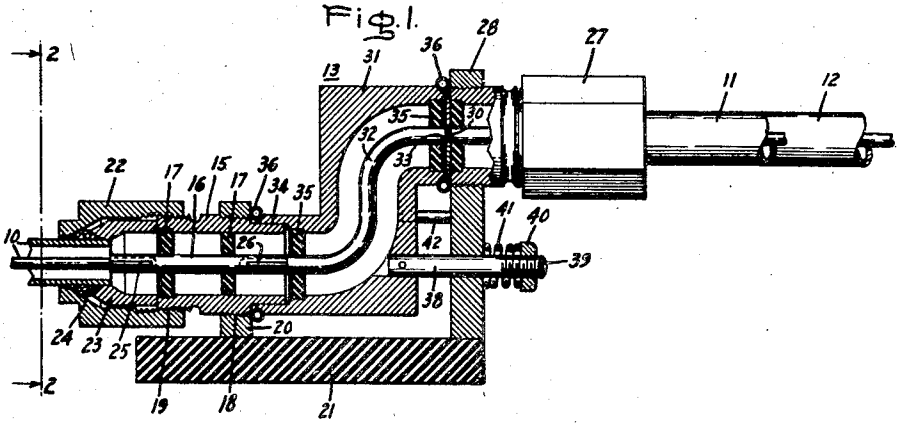
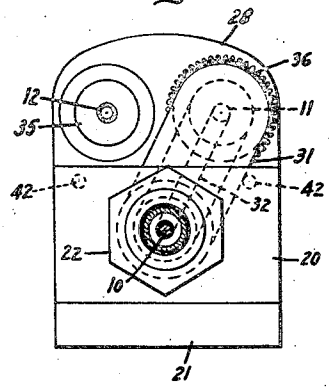


Fig. 2.



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ULTRA HIGH FREQUENCY SWITCH

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3 Claims. (Cl. 200—164)

1

My invention relates to high frequency transmission systems and in particular to high frequency transmission systems employing current carrying cables of the concentric conductor type. It is an object of my invention to provide an improved switching arrangement for connecting a main transmission line to a desired one of a plurality of feeder lines.

It is another object of my invention to provide an improved switching arrangement for high frequency transmission lines of the concentric conductor type, in which a main line may be selectively connected to any one of a plurality of branch lines and in which impedance matching is maintained for all connections to avoid the introduction of undesired reflections on the lines.

The features of my invention which I believe to be novel are set forth with particularity in the appended claims. My invention itself, however, both as to its organization and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawing, in which Fig. 1 is a vertical view, partly in section, of a switching arrangement embodying my invention and Fig. 2 is a side view along the lines 2—2 of the switching arrangement shown in Fig. 1.

Referring to Figs. 1 and 2, jointly, I have shown a main transmission line 10 of the concentric conductor type which is selectively connectable to either one of a pair of branch transmission lines 11 and 12 through a switching arrangement 13 adjacent ends of the lines 10—12 extending in substantially parallel directions. The transmission line 10 may be connected, for example, to the antenna of an ultra-high frequency radio system and the lines 11 and 12 may be connected, respectively, to the transmitter and receiver of an ultra-high frequency radio system. In such a system, of course, it is desirable, in switching from one connection to another, that impedances of the transmission line be matched throughout for all connections to avoid the introduction of any undesired voltage reflections.

To this end the inner conductors of each of the transmission lines 10—12 are connected to a coupling section which comprises a tubular member 15 and a rigid conductor 16 concentrically supported within the tubular member 15 by means of an insulator 17, the members 15 and 16 functioning as a short section of concentric transmission line. The tubular member 15 has a pair of externally threaded portions 18 and 19.

2

Threaded portion 18 engages cooperating threads within a support 20 rigidly attached in an upright position to a base member 21. Threaded portion 19 engages internal threads on a hexagonal clamping nut 22. A sleeve member 23, which surrounds the outer conductor of the transmission line 10 at its right-hand extremity, is abutted against the left-hand end of tubular member 15 and is retained in that position by means of nut 22 and a ferrule 24 of lead or any other suitable material. The conductor member 16 is provided with slots 25, 26 at its opposite ends to function as female contacts for extension of the inner conductor of transmission line 10.

As previously stated, the ends of each of the transmission lines 11 and 12 is provided with a clamping arrangement 27, substantially similar to that described in connection with transmission line 10, the clamping arrangements for these transmission lines being supported by a vertical member 28, also rigidly fastened to base member 21. The inner conductors of the transmission lines 11 and 12 are provided at their extremities with a contact surface 30 formed of silver or any other suitable contact material.

In order to provide means for selectively connecting the transmission line 10 to either of the transmission lines 11 and 12, the switching arrangement 13 employs an S-shaped section of concentric transmission line comprising an outer member 31 and an inner conductor 32. The left-hand end of this S-shaped section is coaxially aligned with transmission line 10 and the right-hand end of the section is movable between two limiting positions in which it is co-axially aligned with either transmission line 11 or transmission line 12.

The inner conductor 32 has a portion of reduced diameter at its left-hand end, which is received within the female contact 25, and is provided at its right-hand end with a suitable contact surface 33 similar to the contact surface 30 and formed of silver or any other suitable contact material.

The S-shaped outer conductor member 31 has an internal bearing surface 34 at its left-hand end which fits over a complementary bearing surface on the right-hand end of tubular member 15 for rotation thereabout. Insulators 35 provide means for holding the S-shaped inner conductor 32 in a fixed spaced relation with respect to the outer conductor 31. Contact members in the form of garter springs 36 are provided at the opposite ends of the S-shaped outer section 31 to insure continuous conduction between the outer

conductors of the fixed transmission lines 10, 11, 12 through the switching arrangement 13.

A shaft or pin member 38, fastened to member 31 and coaxially aligned with the inner conductor of transmission line 10, is rotatably supported in a hole or bearing in support 28 and is provided with a threaded portion 39 at its right-hand end. A nut 40, screwed on the threaded portion 39, compresses a biasing spring 41 between its right-hand surface and the left-hand surface of support 26. In this manner, the biasing spring 41 not only assures positive contact between the two silver contacts 30, 33, but permits a small amount of sliding motion between bearing surface 34 and the tubular conductor 15 so that the switching arrangement 13 may easily be rotated between a plurality of positions selectively to permit conduction from transmission line 10 to either of the transmission lines 11 or 12. A pair of stop members 42 provide means to align the right-hand end or leg of the S-shaped section of transmission line of switching arrangement 13 with the selected one of the transmission lines 11, 12.

The ratio of the outer diameter of S-shaped conductor 32 to the inner diameter of the S-shaped member 31 is made equal to the ratio of the outer diameters of the inner conductors of the transmission lines 10—12 to the inner diameters of the outer conductors of these lines in order to provide matching impedances throughout the switching arrangement. Accordingly, it is seen that the switching arrangement shown in Figs. 1 and 2 operates as a double throw switch for transmission lines of the concentric cable type in which electrical symmetry of the cables is maintained throughout the switch and all reflections and their consequent reduction of transmission efficiency are avoided.

While I have shown a transmission line in which the dielectric is substantially air, it is to be understood that the transmission lines may be of the solid dielectric type, in which the air is replaced by some solid material of suitable characteristics, such as polythene, in which case the S-shaped member would also be filled with such material.

Also, while I have shown my invention as applied to an arrangement whereby the engaging transmission line may be connected to a selected one of a pair of outgoing transmission lines, it is apparent that the features thereof may be applied for connecting an incoming line to a desired one of any number of outgoing lines. Hence, while I have shown a particular embodiment of my invention, it will of course be understood that I do not wish to be limited thereto since various modifications may be made, and I contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A switching arrangement for selectively connecting a first concentric transmission line to a desired one of a plurality of concentric transmission lines comprising, means for supporting the end of each of said plurality of lines in spaced parallel relation with the adjacent end of said one line, a curved section of concentric transmission line having one of its ends journalled on said adjacent end and the other of its ends rotatable between positions of axial alignment with respective ones of said ends of said plurality of lines, resilient means connected between said supporting means and said section for positively connecting the inner conductor of said other end with the inner conductor of a selected one of said plurality of lines, and a conductive garter spring encircling the outer conductor of said other end and adapted to be interposed between the outer conductor of said other end and the outer conductor of said selected line to provide positive connection therebetween.

2. An arrangement for connecting a main concentric transmission line to a selected one of a plurality of branch transmission lines comprising, means for supporting the adjacent ends of said main line and said branch lines in spaced parallel relation, a rigid curved section of concentric transmission line having one of its ends journalled on the said end of said main line and its other end rotatable between positions of axial alignment with said ends of said branch lines, the ratio of the inner diameter of the outer conductor to the outer diameter of the inner conductor of each of said main line, said branch lines, and said section being equal to provide impedance matching for all positions of said section, resilient means connected between said supporting means and said section for positively connecting the inner conductor of said other end with the inner conductor of said selected one of said branch lines, and a conductive garter spring interposed between the outer conductor of said other end and the outer conductor of said selected line for providing positive connection therebetween.

3. A switching arrangement for selectively connecting a first concentric transmission line to a desired one of a plurality of concentric transmission lines comprising, means for supporting the end of each of said plurality of lines in spaced parallel relation with the adjacent end of said one line, a curved section of concentric transmission line having one of its ends journalled on the adjacent end and the other of its ends rotatable between positions of axial alignment with respective ones of said ends of said plurality of lines, resilient means connected between said supporting means and said section for positively connecting the inner conductor of said other end with the inner conductor of a selected one of said plurality of lines, and conductive resilient means interposed between the outer conductor of said other end and the outer conductor of said selected line to provide positive connection therebetween, the ratios of the diameters of the conductors and the dielectric material therebetween for said first line, said section, and said plurality of lines being correlated to provide impedance matching for said positions of axial alignment.

DONALD R. DE TAR.