

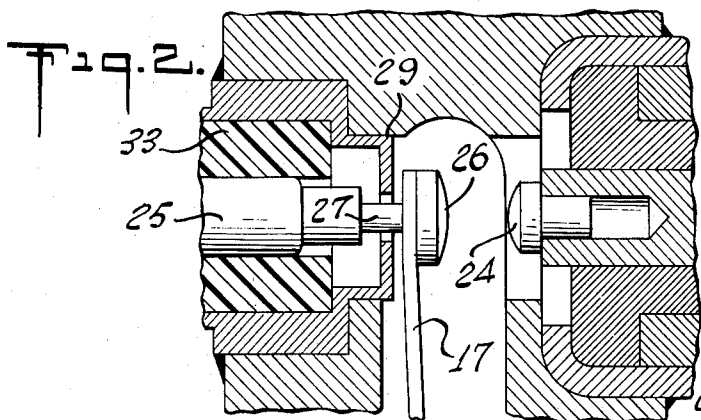
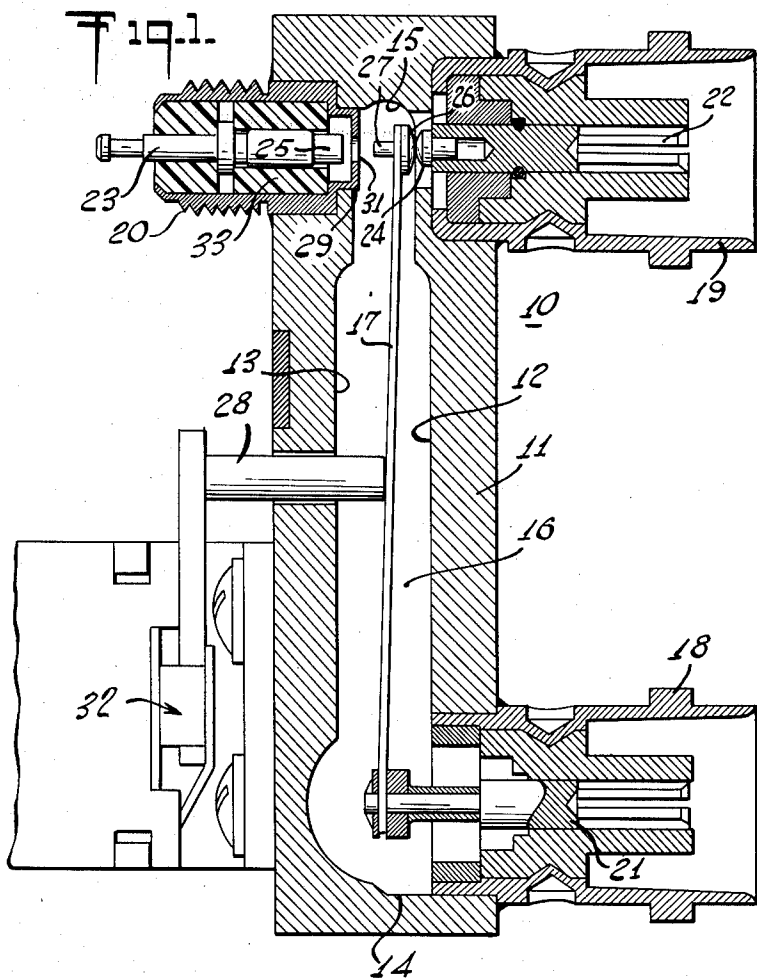
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COAXIAL SWITCH HAVING IMPROVED CROSS-TALK CHARACTERISTICS

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COAXIAL SWITCH HAVING IMPROVED CROSS-TALK CHARACTERISTICS

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1 Claim. (Cl. 333-7)

This invention relates to improved coaxial switch apparatus for connecting the circuit of a first transmission line to the individual circuits of a plurality of transmission lines and in particular the improvements involved, a coaxial switch designed to eliminate cross-talk between such circuits over a wide frequency band of operation for all the various phases of switch operation.

In a coaxial switch as contemplated herein a movable switch arm is operatively supported in an internal chamber of a switch body wherein the free contact end of the arm is alternated from one to another of two positions for achieving electrical make-and-break contact with respect to an inner conductor element in the chamber. Under normal conditions, cross-talk occurs in the circuit of the inner conductor element when the switch arm is withdrawn therefrom and this is attributed to the fact that the inner conductor element is not completely electrically isolated from the electromagnetic field in the chamber adjacent the location where the inner conductor element projects into the chamber.

Accordingly, it is the principal object of the invention to overcome cross-talk pick-up by simple mechanical means of isolating the inner conductor element from the chamber by an electrical shield which completely encloses the element, except for a small passage. The passage permits a pin-like projection on the free contact end of the switch arm to enter through same to make electrical contact with the element and to withdraw from same when breaking such electrical contact whereby during the latter phase of operation the shield effectively isolates the inactive inner conductor element from the active circuits of the switch.

Further objects and advantages will become apparent from the following description of the invention taken in conjunction with the figures, in which:

FIG. 1 is a cross-sectional elevational view of a switch incorporating the invention; and

FIG. 2 is a fragmentary enlargement of the switch shown in FIG. 1 with the switch arm making contact with the isolated element.

Reference is now made to the figures which illustrate a coaxial switch 10 employing the principles of the invention. As known in the art, coaxial switch 10 is made up of a switch body 11 having interior opposed conducting walls 12, 13 including end walls 14, 15 defining an internal and longitudinal chamber 16. A longitudinal conductive and resilient switch arm 17 is operatively supported in chamber 16 and co-operates therewith to define a section of coaxial line for coupling the transmission line circuit connected to a connector 18 to individual ones of the transmission line circuits connected to respective connectors 19, 20. Connectors 18, 19 are supported by switch body 11 at the opposite ends of chamber 16. Connector 20 is supported by switch body 11 adjacent and opposite connector 19. The outer conductors of connectors 18, 19, 20 are in conductive contact with the chamber walls. Each connector has an individual inner conductor 21, 22, 23 extending into chamber 16 to couple electrically the circuits of the individual transmission lines to chamber 16.

One end of switch arm 17 is fixedly supported and electrically connected to inner conductor 21. The opposite

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and free end of arm 17 extends between inner conductors 22, 23 to effect electrical connection with one or the other of same. The end portions of inner conductors 22, 23 in chamber 16 are provided with suitable contact tips 24, 25, respectively, for making electrical connection with the confronting ones of the contact tips 26, 27 on the opposite sides of the free end of switch arm 17. Contact tip 27 is cylindrically shaped and adapted to make conductive connection with inner conductor tip 25 of connector 20 as shown in FIG. 2 when switch 10 is in its normal position of operation. Switch arm 17 is deflected to its other switch position by a dielectric member 28. As known in the art, member 28 passed through a wall of switch body 11, whereby its inner end engages arm 17 to depress or move same to the right for connecting switch contact tip 26 to contact inner conductor tip 24 of connector 19. This action is effected by energizing a clapper relay 32 supported on the exterior of switch body 11. The relay operatively engages a portion of member 28 outside of chamber 16. De-energization of the relay restores arm 17 to normal position by reason of the return spring action of arm 17.

As used herein, cross-talk means picking up a voltage signal in the inactive transmission line circuit which may be opened, grounded or resistor terminated as a result of a relatively imperfect isolation of such inactive line from the active circuit. Accordingly, when switch arm tip 27 is connected to inner conductor tip 25, the opposite inner conductor tip 24 of the inactive circuit is capable of picking up some voltage through the electromagnetic field in chamber 16, particularly, when a high standing wave ratio exists in the chamber.

The structural arrangement of inner conductor tip 25 and the outer conductor wall surrounding same in operative relation with pin-like tip 27 are devised to eliminate voltage pick-up by tip 25 and thus avoid cross-talk in its circuit when switch arm tip 26 is connected to inner conductor tip 24. This arrangement includes designing inner conductor tip 25 as an axially short cylindrical member which is substantially recessed with respect to chamber 16, that is to say, the inner end of tip 25 extends only slightly into chamber 16. Furthermore, inner conductor tip 25 is completely surrounded by annular conductive shield member 29 which electrically isolates inner conductor tip 25 from chamber 16. Shield 29 may be an integral extension of the inner end of the outer conductor of connector 20, wherein the innermost end of shield 29 is reduced in diameter as illustrated in the figures. Contact 25 is supported concentrically within the outer conductor by insulating material 33. The coacting parts including contact 25, the connector outer conductor including shield portion 29 thereof and insulating material 33 are suitably dimensioned to provide desired impedance match with the circuit of chamber 16. Except for a small central opening 31 in shield 29, inner conductor tip 25 is completely isolated from chamber 16. Opening 31 is aligned with inner conductor tip 25 to permit free passage of the pin-like switch arm tip 27 in and out of same for making and breaking contact with the confronting flat face of inner conductor tip 25. Since switch arm tip 27 extends through the shield opening 31 upon contacting inner conductor tip 25 as seen in FIG. 2, the coacting structures are designed so that no part of tip 27 or arm 17 touches the grounded shield 29. Moreover, the foregoing coacting structures are so designed that when switch arm 17 is deflected to the right to contact inner conductor tip 24, the end of contact tip 27 nearest to tip 25 is completely withdrawn to the right of shield 29 as seen in FIG. 1, whereby inner conductor tip 25 is substantially completely electrically isolated from the electromagnetic

wave in chamber 16 so that cross-talk in the inactive line connected to connector 20 is eliminated.

Tests employing the foregoing shield structure have indicated a cross-talk as low as -65 db, that is to say, the voltage pick-up by contact tip 25 is less than $\frac{1}{1000}$ of the voltage at the active line contact tip 24. In order to minimize power loss in shield 29 while the line connected to connector 20 is active, the cross-sectional thickness of shield 29 (as viewed in FIG. 2) is made preferably as thin as practicable. Although the illustrated switch shows only one contact incorporating the invention, it will be understood that the closely spaced contacts 24, 25 may be similarly shielded when cross-talk is to be eliminated for both lines.

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.

What is claimed is:

In a coaxial switch for connecting a first microwave frequency transmission line to individual ones of a plurality of microwave frequency transmission lines, wherein said switch having a switch body provided with an internal chamber for supporting microwave frequency signals and defined by opposed interior conductive walls, and said switch also having a plurality of connectors supported by said switch body and each connector having an individual inner conductor extending into said chamber, the combination comprising, a lengthwise conductive arm operatively supported in said chamber by being conductively attached to the inner conductor of a first connector, a pair of connectors having respective inner connectors wherein each of said last-mentioned inner connectors entering said chamber from opposite walls and having confronting spaced apart ends defining a gap, said arm having a free contact supported in said gap, said contact having opposite sides equipped for effecting alternate make and break electrical connection with

respective ones of the last-mentioned pair of inner conductors, the end of one of said last-mentioned inner conductors projecting a relatively short distance into said chamber, a conductive member having a central portion supported in fixed and spaced relationship adjacent to and extending across said one inner conductor to partition same from the main portion of said chamber, said central portion having a peripheral edge conductively connected to said chamber walls and also having a relatively small hole aligned with the end of said one inner conductor for allowing make and break connection of same with the confronting side of said free contact, said last-mentioned contact side including a cylindrical contact tip axially aligned for extending through said hole to effect electrical contact with the end of said one inner conductor, and means for moving said switch arm from one to another of two positions to effect alternate make and break contact between the opposite sides of said free contact and respective ones of said pair of inner conductors, said contact tip being characterized to avoid conductive connection with said conductive member when said tip extends through said hole for making conductive contact with said one inner conductor, said contact tip being completely withdrawn from said hole and suspended in the main portion of said chamber upon the other contact side making contact with the other inner conductor of said pair, wherein during this latter phase of switching operation said one inner conductor is relatively electrically shielded from the microwave signal coupled between said chamber and other inner conductor.

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