Dec. 10, 1957 D. B. CHERRY 2,816,198

COAXIAL SWITCH

Filed Nov. 5, 1954

Fig. 1

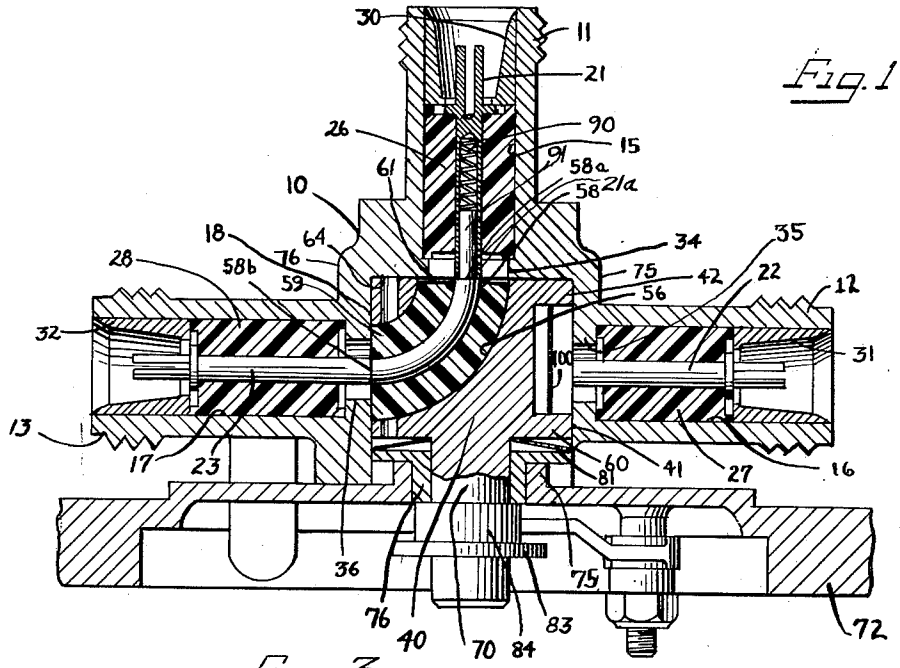


Fig. 3

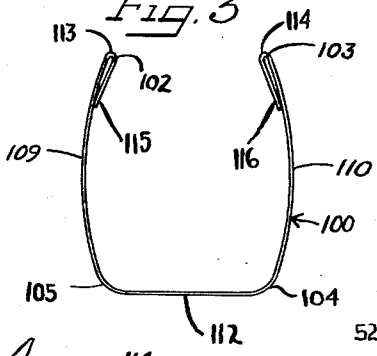


Fig. 4

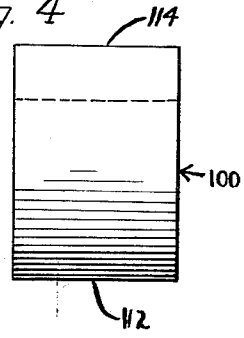
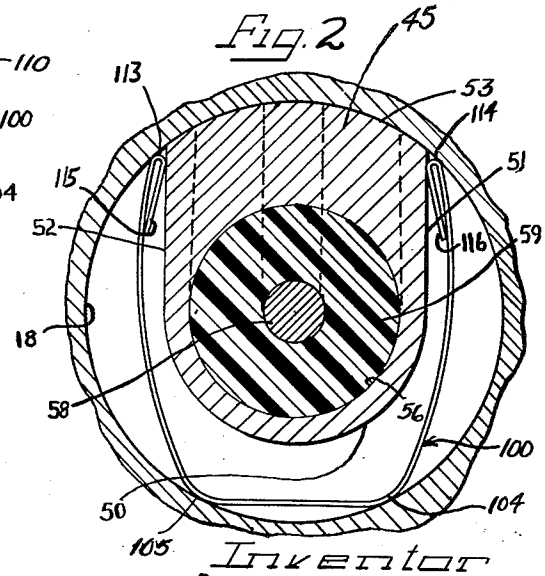


Fig. 2



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COAXIAL SWITCH

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Application November 5, 1954, Serial No. 467,170

5 Claims. (Cl. 200—153)

This invention relates to improvements in coaxial switches.

In one type of coaxial switch now in commercial use, the coaxial lines to be interconnected are secured to terminals of a switch housing having a central rotor chamber. The inner and outer conductors of each terminal are disposed for continuity with the inner and outer conductors of a switch rotor within the chamber. Continuity between the outer conductors of the terminals and the rotor outer conductor is based on axial alignment of the conductors with a sufficient peripheral clearance or gap to allow rotation of the rotor in the housing.

The present invention is particularly concerned with such a coaxial switch, and is based on the discovery that cross talk between the interconnected terminals and the remaining non-connected terminals of the switch can be substantially reduced by positively grounding the rotor to the switch housing across the peripheral gap therebetween as close as possible to the R.-F. channel being used and/or providing electrostatic shielding at the peripheral gap as close as possible to the R.-F. channel being used. For example, for a switch having a positive ground between the rotor and housing at the gap as illustrated in the accompanying drawings, a minimum reduction in cross talk of 15 db and an average reduction of 25 db at 3000 megacycles were obtained. Thus, while without the positive ground at the gap the switch could only meet a 50 db cross talk specification, with the positive ground of the present invention the same switch was able to meet a minimum cross talk specification of 65 db and an average cross talk requirement of 75 db.

It is therefore an important object of the present invention to provide a novel and improved coaxial switch structure.

Another object of the invention is to provide a coaxial switch having a reduced cross talk characteristic.

Still another object of the invention is to provide a coaxial switch which readily adapts itself to large scale production methods and which is readily assembled.

A still further object of the present invention is to provide a particularly economical and simple means for materially reducing cross talk in coaxial switches.

Other objects, features and advantages of the present invention will be readily apparent from the following detailed description taken in conjunction with the accompanying drawings, in which;

Figure 1 is a partial longitudinal sectional view of a coaxial switch having a cross talk reduction means according to the present invention applied thereto;

Figure 2 is a fragmentary transverse sectional view taken through the coaxial switch of Figure 1 just below the upper flange of the switch rotor to show the cross talk reduction means in relation to the body of the rotor;

Figure 3 is a plan view of a cross talk reduction means constructed in accordance with the present invention; and

Figure 4 is a side elevational view of the structure of Figure 3.

In Figures 1 to 4 is illustrated a single pole double throw coaxial switch wherein a switch housing **10** provides a central axial terminal **11** for receiving a coaxial line to be interconnected with either a first branch line connected with terminal **12** or second branch line connected with terminal **13** of the housing. The terminals are illustrated as externally threaded for connection with the coaxial lines and have internal cylindrical passages **15**, **16** and **17**, respectively, leading to central rotor chamber **18**.

The terminals have coaxial therewith inner conductor members **21**, **22** and **23** for electrical continuity with the inner conductors of the respective lines connected with the terminals. These inner conductors are supported within the passages by means of dielectric sleeves **26**, **27** and **28** which are retained in the passages against axial displacement by metal insert members **30**, **31** and **32** at the outer ends and by internal shoulders **34**, **35** and **36** at their inner ends.

Disposed in the chamber **18** for establishing selective continuity between the central terminal **11** and branch terminals **12** and **13** is a rotor member **40**. This rotor member has upper and lower cylindrical flanges **41** and **42** of diameter to fit closely within the cylindrical rotor chamber **18**. Between these flanges extends a segmental rotor body **45** (Figure 2) having a semi-cylindrical exterior wall portion **50** merging into parallel side wall portions **51** and **52** which in turn are joined by a segmental cylindrical face **53** on the outer periphery of the rotor and flush with the exterior periphery of the flanges **41** and **42**.

For defining an outer conductor to bridge between the outer conductor of terminal **11** and the outer conductors of terminals **12** and **13**, the rotor **40** is provided with a curved rotor passage **56** extending from the central portion of the upper surface of the rotor in coaxial alignment with the passage **15** of terminal **11** downwardly and radially outwardly of the rotor to terminate centrally of the peripheral face **53** of the rotor. Disposed in this rotor passage **56** is a rotor elbow conductor **58** mounted by means of dielectric sleeve **59**. The ends **58***a* and **58***b* of the elbow conductor **58** terminate generally flush with the top surface of the rotor and with the peripheral face **53**, respectively. The sleeve **59** is counterbored at the top as indicated at **61**.

For retaining the rotor sleeve **59** in place during machining operations, a hole is drilled longitudinally through the rotor as indicated at **64** which intersects the passage **56** near the peripheral face **53**. During molding, material integral with the sleeve **59** extends into the bore **64** to provide an anchor for locking the sleeve **59** against displacement. After machining, the anchor is completely removed from bore **64**, and the insulating sleeve **59** and elbow conductor **58** are rendered free to slide as a unit in passage **56** for the purpose disclosed in my copending application Serial No. 376,424, now Patent No. 2,766,355, Oct. 9, 1956.

As seen in Figure 1, when the elbow conductor **58** is establishing electrical continuity between the inner conductor **21** of the fitting **11** and the inner conductor **23** of the fitting **13**, the walls of the rotor will be spaced from the inner conductor **22** to prevent short circuiting of the inner conductor **22** to its associated outer conductor provided by the passage **16**. This feature is disclosed and claimed in Jacques and Gates application, Serial No. 294,788, assigned to the same assignee as the present invention.

For moving the rotor between switching positions, the rotor is provided with an integral shaft **70** depending therefrom. The rotor shaft **70** extends axially through

an aperture in a mounting plate **72**. An inner boss **75** on the mounting plate **72** carries a bearing collar **76** which slidably receives the rotor shaft **70** therethrough. A spring washer **81** is interposed between the collar **76** and the lower surface of the rotor flange **41** and the switch is so designed the spring washer is placed under compression in assembled relation to urge the rotor upwardly in the chamber **18**. On the lower side of the plate **72**, a ratchet wheel **83** is secured to the shaft **70**, the ratchet wheel cooperating with detent means to establish precise switching positions of the rotor, for example in the manner described in Schunemann and Thoren application, Serial No. 267,246 assigned to the same assignee as the instant application.

It will be understood that the rotor may be moved between switching positions by a suitable indexing mechanism such as disclosed in Elliott application, Serial No. 259,979 assigned to the same assignee as the present application, the housing for said indexing mechanism being attached to the mounting plate **72**.

The side conductors **22** and **23** preferably comprise stationary fixed members which terminate substantially flush with the side wall of the chamber **18** to extend a close relation to the end of **58***b* of the rotor conductor **58** when registered therewith. However the conductor **21** has a cylindrically bored recess extending axially thereinto from the lower end which receives a spring **90** and plunger **91** therein. The plunger acts on the elbow conductor **58** to urge the elbow conductor-insulating sleeve unit arcuately downwardly in the elbow passage **56** to press the radial end **58***b* of the elbow conductor **58** against the stationary inner conductor **23**.

The lower end of inner conductor **21** is slotted from its lower margin to provide vertically elongated fingers **21***a* surrounding plunger **91** and having lower free ends. The fingers **21***a* are crimped inwardly so as to establish positive engagement between the plunger **91** and the fingers. By this means, R.-F. energy is shunted past spring **90** to prevent the spring from acting as an inductance at high frequencies.

The pressure exerted by fingers **21***a* on the plunger is preferably adjusted so that the plunger will not drop out of the housing when the housing is given a sharp rap on the palm of the hand before assembly of the rotor, and so that after depressing the plunger into the inner conductor recess and slowly releasing, the plunger extends a minimum of .035 inch above the adjacent wall of the rotor chamber with the housing inverted.

As illustrated in Figures 1 and 2, resilient conducting means is interposed between the rotor and the side wall of the rotor chamber. It has been found that by this provision, the cross talk of the switch is very materially reduced as discussed heretofore. Specifically, in the illustrated embodiment, the resilient conducting means comprises a stainless steel shim **100** which is clipped around the segmental rotor body portion **45**. As illustrated in Figure 2, the shim **100** provides elongated conductive portions **113** and **114** in resilient wedged engagement with the wall of the rotor chamber and with the wall of the rotor and bridging the peripheral clearance gap therebetween closely adjacent to the R.-F. channel in use as defined by the rotor outer conductor passage **17** of the housing registered therewith as shown in Figure 1. The shim **100** thus provides a positive conductive connection or ground between the rotor and housing across the peripheral gap therebetween as well as providing electrostatic shielding at the gap.

The shim **100** may be so dimensioned that with a .495 plus or minus .001 inch block between the legs of the shim at point **102** and point **103**, points **102**, **103**, **104** and **105** will contact a circumscribed circle of .788 plus or minus .001 inch diameter but will not contact with a circumscribed circle of .813 plus or minus .001 inch diameter. The diameter of the rotor flanges in the illustrated embodiment may be .780 plus or minus .001 inch. The spacing between the side walls **51** and **52** of the segmental rotor body portion **45** may be .500 inch.

In initial condition of the shim with legs **109** and **110** parallel, the legs **109** and **110** may be separated by distance of .453 inch, and the legs may be .640 inch long. After bending the shim to the configuration of Figure 3, the distance end to end is reduced to .620 inch, while the maximum bowing measured from point **102** to the most remote lateral point of the leg **109** may be .047 inch. The bowed legs **109** and **110** are a maximum of .620 plus or minus .030 inch apart with a .495 block in the open end between points **102** and **103**. The shim may be made of stainless steel and be .005 inch thick and .437 plus or minus .015 inch high. The rear end face **112** of the shim should be parallel to its forward rounded faces **113** and **114** to within very close tolerances. The distance between the flanges **41** and **42** of the rotor may be .519 inch for example.

As illustrated in Figure 3, the rounded faces **113** and **114** are defined by turning the ends **115** and **116** of the shim inwardly, the faces being in wedged engagement between the sides **51** and **52** of the rotor and the cylindrical wall of the rotor chamber **18**. Additional contact with the wall of the rotor chamber is made at points **104** and **105**. It will be understood that the shim is so dimensioned as to be under a resilient compression when in assembly with the rotor within the rotor chamber.

It will be understood that many modifications and variations may be effected without departing from the scope of the novel concepts of the present invention.

I claim as my invention:

1. In a rotary switch construction, a housing having a generally cylindrical rotor chamber, a rotor rotatably mounted in said chamber and having generally axially extending wall portions spaced from the side wall of said chamber, and a flat spring member of substantial axial extent confined between the walls of the chamber and the walls of said rotor under resilient compression.

2. A rotary coaxial switch construction comprising a housing having a plurality of peripherally spaced switching stations therein, a rotor movably mounted in said chamber and having a rotor inner conductor for switching continuity with the respective stations, the rotor including a segmental body portion having a semi-cylindrical exterior wall portion and generally parallel wall portions extending from the opposite margins of said semi-cylindrical wall portion to the periphery of the rotor, and a crosstalk shim of thin flat construction embracing said segmental rotor body portion and of generally U-shape with corners of the base leg thereof engaging against the wall of the chamber and with the ends of the side leg portions wedged against the side walls of the rotor body portion.

3. A rotary coaxial switch construction comprising a housing having a chamber with a plurality of peripherally spaced switching stations therein, a rotor movably mounted in said chamber and having an inner conductor for switching continuity with the respective stations, the rotor including a segmental body portion having a semi-cylindrical exterior end wall portion and generally parallel side wall portions extending from the opposite margins of said semi-cylindrical end wall portion to the periphery of the rotor, and a crosstalk shim of thin flat construction embracing said segmental rotor body portion and of generally U-shape with corners of the base leg thereof engaging against the wall of the chamber and with the ends of the side leg portions wedged between the side walls of the rotor body portion and the adjacent portions of the wall of the chamber.

4. A high frequency switch construction comprising a switch body, a switch member angularly movable relative to the switch body with a peripheral clearance gap

therebetween, said switch member in one angular position thereof providing a high frequency channel extending in said switch body and in said switch member and across said clearance gap therebetween, and cross talk reducing conducting means positioned closely adjacent said channel at said gap.

5. A high frequency switch construction comprising a switch body, a switch member angularly movable relative to the switch body with a peripheral clearance gap therebetween, said switch member in one angular position thereof providing a high frequency channel extending in

said switch body and in said switch member and across said clearance gap therebetween, and cross talk reducing conducting means positioned closely adjacent said channel at said gap and positively engaging said switch body and said switch member and bridging therebetween at said gap.

References Cited in the file of this patent

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