Feb. 2, 1971 H. D. STEINBACK 3,560,897

ANTENNA SWITCH

Filed April 17, 1969

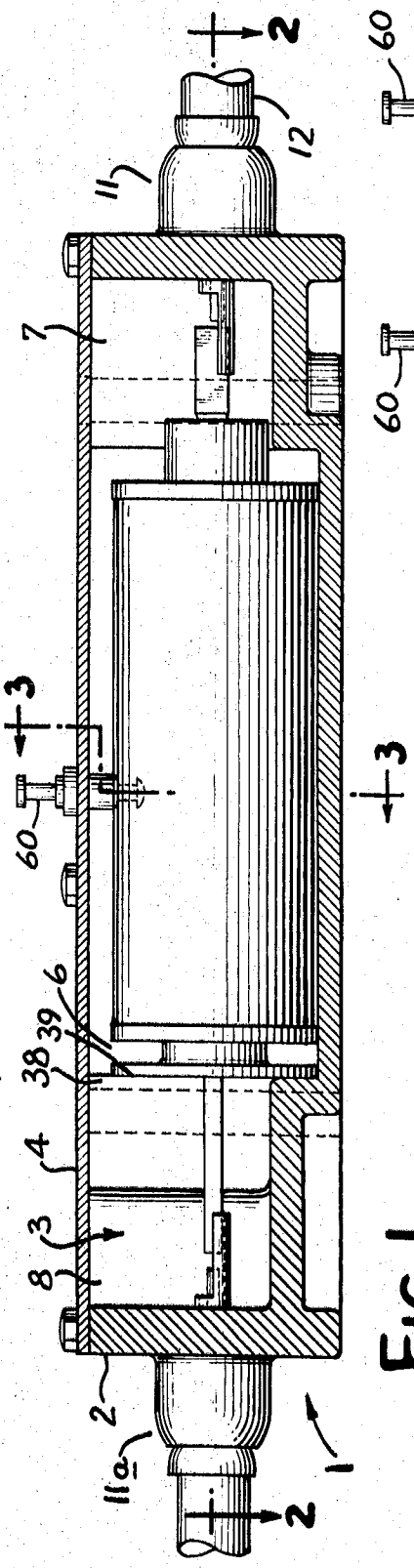


FIG. 1

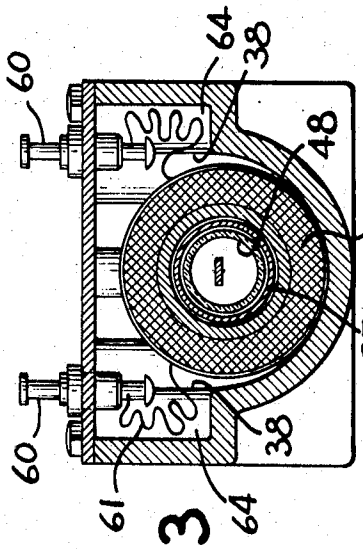


FIG. 3

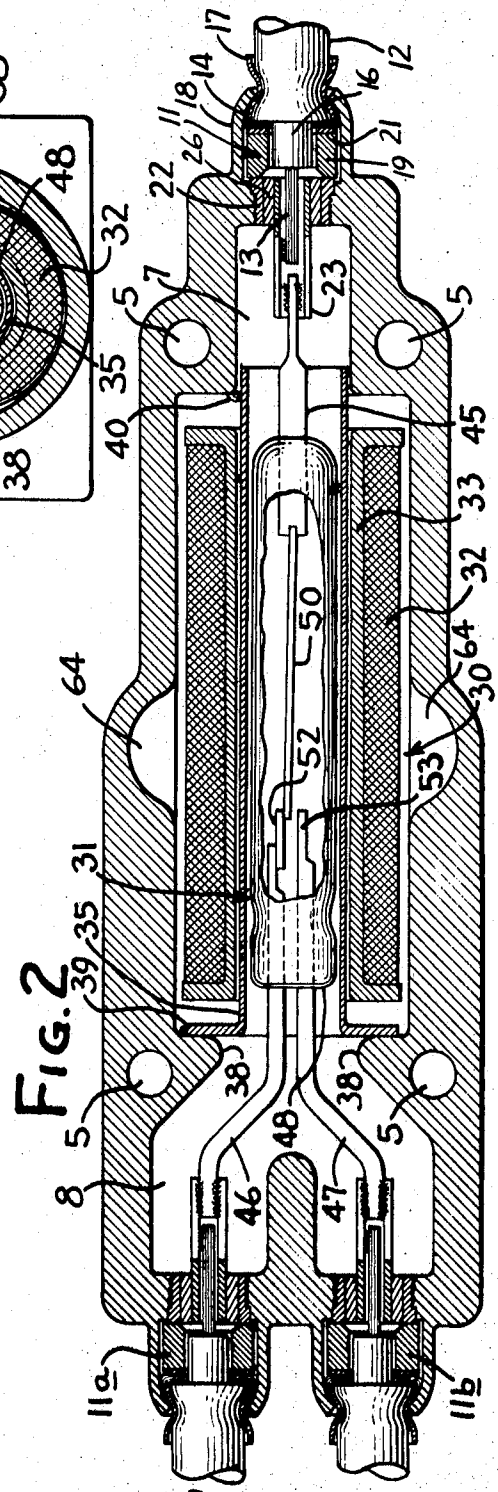


FIG. 2

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ANTENNA SWITCH

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ABSTRACT OF THE DISCLOSURE

An antenna switch that includes an electro-magnetic relay within a housing. The relay includes a reed switch that has contacts sealed in a longitudinally extending glass capsule, with the switch leads extending from opposite longitudinal ends of the capsule for connection to the inner conductors of coaxial cables that are terminated at the housing, the coaxial cable termination being a part of the housing. A cylindrical conducting shield which is electrically connected to the housing surrounds the switching capsule and is approximately coaxial with the leads between the switch terminals.

This invention relates to delays for radio circuits of high frequency, even up to and in excess of 900 megacycles per second. It is particularly concerned with a relay for switching a radio antenna to a radio receiver or a radio transmitter selectively.

Separate coaxial cables extend from the relay to the antenna, the transmitter and the receiver. It is an object of this invention to provide a relay and cable connecting structure which will have a standing wave ratio as close to unity as is practical at the very high frequencies involved. It is a further object of this invention to produce such a cable connecting structure suitable for use with an automobile radio transmitter-receiver. A further object of this invention is to produce an economical switch having lower insertion losses and better cross talk characteristics.

It is a still further object of this invention to produce a coaxial cable terminated unit having a relay switch therein for selectively establishing connection between the inner conductors of at least two coaxial cables.

The attainment of the above and further objects of this invention will be apparent from the following specification taken in conjunction with the accompanying drawing.

In the drawing:

FIG. 1 is a longitudinal sectional view through the housing of a unit of the present invention, with the electromagnetic relay therein shown in elevation;

FIG. 2 is a sectional view taken along the line 2—2 of FIG. 1; and

FIG. 3 is a sectional view taken along the line 3—3 of FIG. 2.

Reference may now be made more particularly to the drawing wherein like reference numerals designate like parts throughout.

At 1 there is indicated a coaxial cable switching connector for switching a radio antenna to a transmitter or to a receiver selectively. The connector comprises a housing that includes a cast metal body 2 having a longitudinally extending cavity 3 closed by a cover 4 that is bolted or otherwise secured in place. The body 2 has holes 5 extending therethrough, which do not open into the cavity 3, and are in alignment with corresponding holes in the cover 4 for receiving mounting bolts for mounting the unit 1. The cavity 3 is divided into three aligned chambers, namely a longitudinally extending central relay receiving chamber 6 which opens at its opposite ends into a first connected chamber 7 and a second connector chamber 8. Identical coaxial cable terminations 11, 11*a* and 11*b* secure corresponding coaxial cables to the housing. The termination 11 comprises a coaxial cable 12 having a central inner conductor 13 surrounded by a conducting shield 14 which is insulated from the inner conductor 13 by solid insulation 16. The end of the shield 14 is turned back and clinched between a metal cable bushing 17 and a sleeve 18 that is cast as an integral part with the body 2 of the housing, thereby to establish electrical connections between the shield 14 and the housing. A lead bushing 19 and a lead washer 21 surround the insulation 16, the washer 21 pressing against the shield 14. The center cable conductor 13 projects through a mounting terminal arrangement in the housing wall, and into the chamber 7. The mounting termination arrangement comprises an outer ring 22 separated from an inner conductive tube 23 by a dielectric ring 26 of glass or the like compressed between the two. The top of the tube 23 is cut away for half the length thereof and constitutes a conductive termination for the cable conductor 13. It is the means for establishing substantially in-line electrical connections to the coaxial cable conductor 13, which is electrically and mechanically secured to the tube 23.

Within the central chamber 6 there is mounted a reed type magnetic relay 30. The relay 30 comprises a hermetically sealed reed type switch 31 surrounded by an actuating electromagnetic coil 32 on a bobbin 33. Between the bobbin and the switch 31 there is interposed a metallic shield 35. The shield is an electrically conductive non-magnetic metal tube closely surrounding the switch 31 and in turn closely surrounded by the bobbin 33. The shield 35 permits the magnetic flux generated by the coil 32 to pass freely therethrough. At its lefthand end the metal shield 35 includes a circular flange that rests against stop walls 38—38 that are parts of the cast metal body 2 and which in effect divide the central relay receiving chamber 6 from the chamber 8. The flange of the shield 35 is electrically secured to the cast metal body as by tack welding, soldering, compression or the like indicated at 39 thereby permitting grounding. The opposite end of the shield 35 fits snugly within the connector chamber 7 and is tack welded or spot soldered to the cast metal body at a series of spots, one of which is indicated at 40.

The reed switch includes a common reed terminal 45, and second and third terminals 46 and 47 insulated from one another. The three terminals 45, 46 and 47 extend into a sealed glass capsule 48 of the switch 31 making a sealing fit. The capsule may be evacuated or it may be filled with an inert gas. On the inside of the capsule the terminal 45 has a flexible reed 50 mounted thereon constituting the switch blade. The reed 50 is biased into engagement with a switch contact 52 at the end of the terminal 46. When the magnetic coil 32 is energized the reed moves to its alternate position disengaging the contact 52 and engaging a contact 53 on terminal 47.

The reed switch 31 is of a standard construction. It may include one or more permanent magnets as is well known in the art to bias the reed to one of its two possible positions, the reed moving to its other position under the electromagnetic field produced by the coil 32, as is known in the art.

The cover 4 has two terminals 60—60 to which the respective lead wires from the electromagnetic coil 32 are connected, for establishing circuit connections to the coil. The respective lead wires 61—61 are of an excess length so that they may be connected to the underside of the respective terminals 60—60, while the cover 4 is not connected to the body 2. When the cover is positioned over the cavity, the respective excess lead wires from the coil 32 are in pockets 64—64 formed in the wall of the body 2.

In compliance with the requirements of the patent statutes, there has herein been shown a preferred embodi-

ment of the present invention. This is merely illustrative of the principles of the invention.

What is considered new and sought to be covered by Letters Patent is:

1. A coaxial cable connector and switch comprising an electrically conductive housing including a body having a longitudinally extending cavity and a cover therefor, said cavity comprising a central relay-receiving chamber which opens at one end into a first connector chamber and at its opposite end in a second connector chamber, said cover overlying a longitudinal opening in the body at the three chambers, a first coaxial cable termination at one end of the housing and in said first chamber, second and third coaxial cable terminations at the other end of the housing and in said second chamber, said terminations each including a conductive member for the inner conductor of a coaxial cable, each conductive member extending into and being secured to the housing but insulated therefrom, means at each termination for establishing an electrical connection between said housing and the shielding conductor of a coaxial cable which is insulated from but surrounds the inner coaxial conductor for substantially its full length, a relay including a reed switch comprising a capsule having a longitudinally extending electrically conducting reed on the inside thereof, said reed being mounted on a first reed switch terminal that extends through the capsule at one end thereof and with its outwardly extending part electrically connected to the conductive member of the first coaxial cable termination, said reed having a magnetic flux-responsive portion on the inside of the capsule, the reed switch also including at the opposite end of the capsule second and third reed switch terminals insulated from one another and extending from the outside to the inside of the capsule and terminating therein in switch contacts selectively engageable by the reed, said reed being movable from one position where it engages one of the contacts to an alternate position where it engages the other contact, the outer ends of said second and third reed switch terminals extending to and being electrically connected to conductive members of the second and third coaxial cable terminations, respectively, the ends of the three reed switch terminals external of the capsule being supported by the respective cable terminations on the inside of the housing, an electrically conductive shielding member surrounding said capsule, an energizing magnetizing coil within the body cavity for producing a magnetic field penetrating the capsule to move the reed from said one position to its alternate position, said reed switch,

coil and shielding member constituting a unit that is insertable through said longitudinal opening for seating in said housing and attachment of said reed switch terminals to the respective cable terminations, and means for establishing electrical connections through the housing to the magnetizing coil.

2. A structure as defined in claim 1 wherein the terminals support the reed switch within the body cavity.

3. A structure as defined in claim 2 wherein the magnetizing coil surrounds the capsule.

4. A structure as defined in claim 3 having a nonmagnetic electrically conducting shielding sleeve surrounding the capsule and in turn surrounded by the magnetizing coil, said sleeve being electrically connected to the conducting housing.

5. A coaxial cable connector and switch for high frequency coaxial circuits comprising a current-conducting housing, a cover closing an opening into the cavity of the housing, coaxial terminators each of which is mounted on the housing, each terminator having an outer conductor grounded to the housing and inner conductor means projecting into said cavity, and a unit comprising a sealed capsule having switch contacts with terminals extending from said switch contacts and outwardly of said capsule, each said inner conductor means being open toward said cover, said unit being inserted through said opening whereby the switch contact terminals are seated and electrically connected into said inner conductor means.

6. A structure as defined in claim 5 in which said unit further includes a shielding outer coaxial conductor surrounding said capsule, and said shield and housing having cooperating means for electrically connecting and mechanically locking the two together.

7. A structure as defined in claim 6 in which said unit further comprises an energizing magnetizing coil that surrounds said shielding outer conductor, and means for establishing electrical connections through said cover to said magnetizing coil.

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