

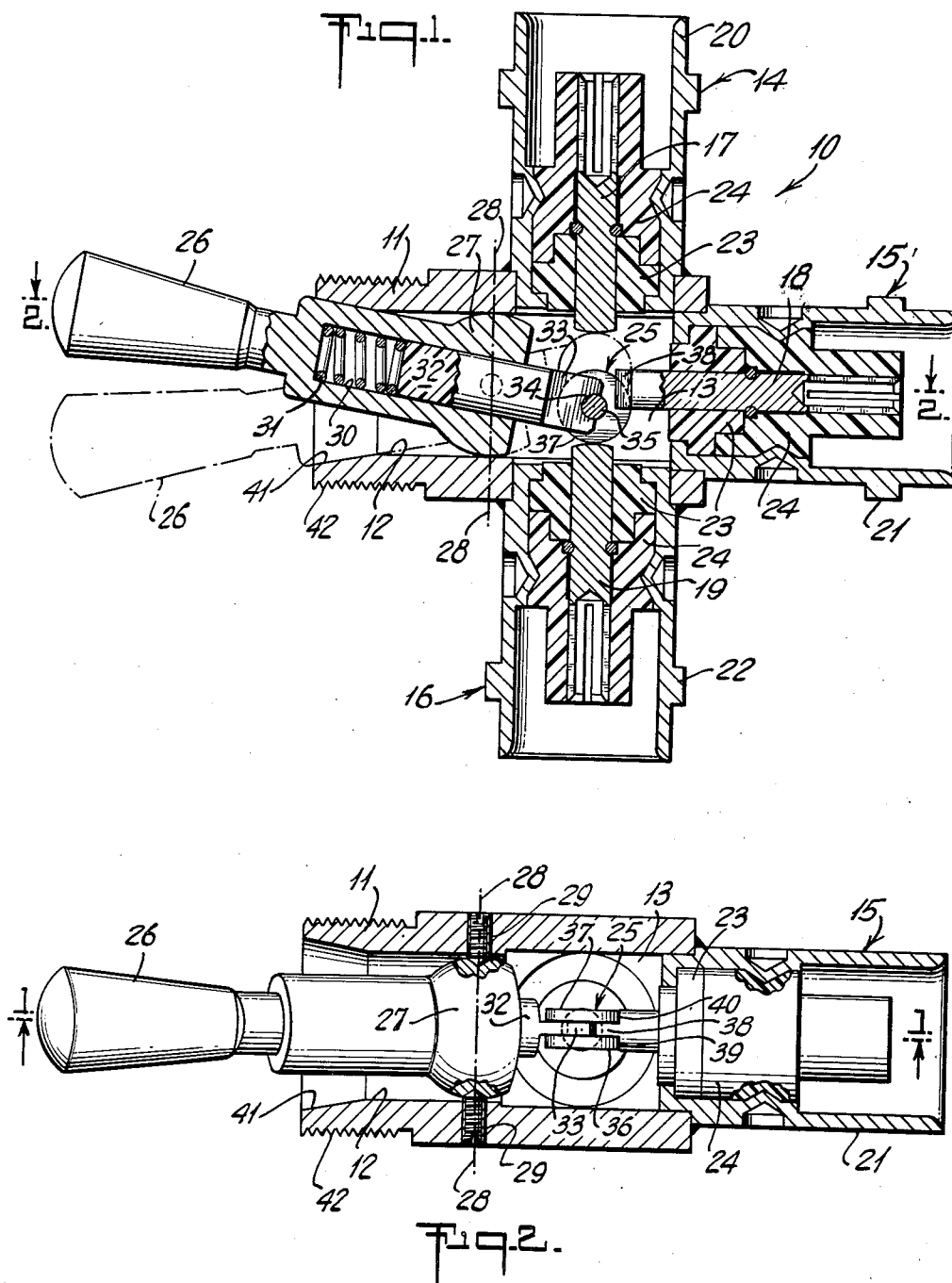
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TWO POSITION COAXIAL SWITCH

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TWO POSITION COAXIAL SWITCH

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The instant invention relates to a novel and improved manual coaxial switch for connecting a first high frequency coaxial line to individual ones of a pair of such transmission lines.

It is an object of the instant invention to provide a coaxial switch which in physical size may be made extremely small and which offers the further advantage of simplicity and economy with respect to fabrication.

It is a further object of the invention to provide an improved coaxial switch which offers the advantage of long life operation by reason of simplicity of design and minimum contact wear for effecting switch operation.

It is a further object of the invention to provide an improved manual coaxial switch that is adapted for operation at very high frequencies while exhibiting good cross-talk characteristics.

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 view of a switch incorporating the invention taken along line 1-1 of FIG. 2; and

FIG. 2 is a cross-section of said switch taken along line 2-2 of FIG. 1.

A switch 10 incorporating the principles of the invention is defined by a longitudinal switch body 11 made up of conducting material. Body 11 has a longitudinal cylindrical through bore 12 extending along the horizontal axis as depicted in the figures. An enclosed chamber 13 is established in bore 12 upon assembly of switch 10. Three electromagnetic wave transmission line coaxial connectors 14, 15, 16 are carried by switch body 11 on three sides thereof. For this purpose, switch body 11 has a pair of openings on opposite sides of the horizontal axis for supporting two of the connectors 14, 16. Connectors 14, 16 are axially aligned in the vertical, whereby connectors 14, 16 couple into chamber 13 from opposite sides of the horizontal axis. The third connector 15 is supported at the right hand end of body bore 12 and couples into chamber 13 along the horizontal axis. The inner conductor 17, 18, 19 of the three connectors are suitably supported within the outer conductors 20, 21, 22 thereof by front and rear insulator members 23, 24. The inner ends of conductors 17, 18, 19 extend sufficiently into chamber 13 to effect make and break contact with a roller contact 25 as described hereinafter. Body 11 and the three outer conductors 20, 21, 22 are electrically common. A pivotal handle 26 of conductive material is mounted in body bore 12. Handle 26 has a portion extending outwardly from body bore 12, whereby handle 26 may be manually gripped to rock same about its pivot axis. The interior part of handle 26 extends part way into body bore 12 and terminates with an enlarged spherical shaped segment 27. The periphery of segment 27 in the plane of its maximum diameter (line 28-28), as seen in FIG. 1, preferably slidably rides against the contiguous wall portions of body bore 12 as handle 26 is pivoted about its axis, whereby chamber 13 is substantially electrically shorted at all times in a plane taken along line 28-28. The plane of line 28-28 may be said to be the shorting wall and it is determined by the circumferential line contact between segment 27 and bore 12. Upon assembly of switch 10, segment 27 operatively cooperates with bore 12 and the front ends of connectors 14, 15, 16 to define enclosed chamber 13.

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Switch 10 is adapted to connect a first coaxial electromagnetic wave transmission line to individual ones of a pair of such transmission lines. Accordingly, the rear or outer ends of connectors 14, 15, 16 are provided with suitable fittings, whereby connector 15 may be connected to the first of such transmission lines and connectors 14 and 16 are connected to the individual ones of the pair of such transmission lines.

A pair of aligned set screws 29 enter opposite portions of body 11 and engage opposite sides of enlarged portion 27. Set screws 29 serve as pivot means for handle 26. A hollow bore 30 extends into handle 26 from its inner end. A spring 31 is seated in hollow bore 30. Spring 31 is held in compression by a contact holder 32 made of insulating material and slidably seated in hollow bore 30. The front end of contact holder 32 is undercut to form a thin centralized tongue 33. The front edge 34 of tongue 33 is curved to fit over a shaft 35 of roller contact 25, whereby movement of contact 25 is regulated by movement of contact holder 32. Roller contact 25 is made of conductive material and includes two parallel spaced discs 36, 37 connected by shaft 35 extending therebetween wherein tongue 33 projects between the confronting inside faces of discs 36, 37. The front end of conductor 18 is also undercut to form a centralized and narrow tongue 38 extending between discs 36, 37. The two tongues 33, 38 enter between discs 36, 37 from opposite sides of the axis of shaft 35, however tongue 38 does not reach shaft 35. The undercut at the front end of conductor 18 defines horizontal shoulders 39, 40 on the opposite sides of tongue 38 whereby each roller contact disc 36, 37 is adapted to roll along and against an individual one of said shoulders 39, 40 as handle 26 is pivoted from one to the other of its "closed contact" positions. At all times after assembly of switch 10, roller contact 25 is in register against shoulders 39, 40 under the force of spring 31, whereby contact holder 32 and spring 31 are held seated in hollow bore 30. This also keeps roller contact 25 in register with contact holder 32 and in particular holds curved edge 34 on shaft 35 so that roller 25 rolls along shoulders 39, 40 whenever handle 26 is rocked from one to the other of its "closed contact" positions.

When handle 26 is in the solid line position shown in FIG. 1, roller contact 25 is in conductive "closed contact" with inner conductors 18 and 19, whereby the individual transmission lines and loads connected to connectors 15, 16 are electrically connected through switch 10. When handle 26 is in the dashed outline position shown in FIG. 1, roller contact 25 is in conductive "closed contact" with inner conductors 17 and 18 and the individual transmission lines and loads connected to connectors 14, 15 are electrically connected through switch 10. The diameter of roller discs 36, 37 are selected so that for either of these positions, roller contact 25 circumferentially bridges inner conductor 18 and the individual ones of inner conductors 17 and 19 to effect switch "closed" operation. To facilitate the make and break contact with inner conductors 17, 19 and to facilitate the spring lock which will be described hereinafter, the front ends of these inner conductors are rounded smooth. It has been noted that roller contact 25 is large enough to bridge the gap between inner conductor 18 and individual ones of inner conductors 17 and 19 for the foregoing "closed contact" positions of operation, whereby the points of contact along the periphery of discs 36, 37 are spaced circumferentially apart about 90°. For example, noting the solid line illustration of roller 25 in FIG. 1, it contacts the center of inner conductor 19 at "6 o'clock" and the lower edge of inner conductor 18 at "3 o'clock."

When handle 26 is in an intermediate position, that is

to say, moving away from one "closed contact" position and towards the other, and in particular, when handle 26 is axially aligned with inner conductor 18, the axial separation between line 28—28 (also the pivot axis) and the point of contact along shoulders 39, 40 is a minimum whereby contact holder 32 is experiencing a maximum retraction into hollow bore against the force of spring 31. Roller contact 25 breaks conductive contact with the individual inner conductors 17, 19 when handle 26 is in its intermediate position. However, roller 25 is always in conductive contact with conductor 18. As handle 26 continues its movement to the other of its "closed" switch positions, contact holder 32 gradually advances out of bore 30 under the force of spring 31 until handle 26 arrives at the other "closed" position as shown in solid or dashed outline in FIG. 1, at which time contact holder 32 is at its relatively maximum projection out of bore 30 under the force of spring 31. In other words, the spring force urging roller 25 against shoulders 39, 40 is relatively smaller when handle 26 is in either of its "closed contact" positions and of greater force when handle 26 is passing through its intermediate position during switching action. This factor in cooperation with the fact that contact roller 25 is bridging the gap between inner conductor 18 and individual ones of inner conductors 17 and 19, spring loads handle 26 to resist any accidental shifting of handle 26 after it is manually set in either of its "closed contact" positions. Accidental shifting away from such positions is against the force of spring 31. However, handle 26 can be readily pivoted for switching action by a manual force overriding spring 31. The rearward end of body bore 12 is chamfered at 41 to accommodate rocking of handle 26 to its opposed "closed contact" positions. To attach switch 10 to a panel board or other supporting means, the rearward end of body 11 may be inserted through a hole in the panel board and then clamped there-to by a nut engaging the outer thread 42 at such end. As noted herein, holder edge 34 smoothly fits over roller shaft 35 wherein roller 25 is always free to turn about its shaft axis as its discs roll along the shoulders 39, 40 upon pivoting of handle 26. Since roller contact 25 is always in register against these shoulders after assembly of the switch, contact 25 cannot escape from holder 32. In addition, since tongue 38 extends between contact discs 36, 37, this feature in cooperation with the aligned tongue 33 extending between the discs and engaging shaft 35 maintains the assembled roller contact 25 in suitable alignment so that its discs ride along the shoulders as described hereinbefore. It will be understood that the front ends of connectors 20, 22 extend symmetrically into chamber 13 from opposite sides of the horizontal axis, whereas connector inner conductor 18 is aligned with such axis.

The various components constituting switch 10, such as body 11 and the three connectors 14, 15, 16, may be easily put together and soldered to effect a finished assembly. This type of switch offers long life operation by reason of minimum contact wear with roller contact 25. Since switch 10, and in particular, chamber 13 and the switch elements inside chamber 13 may be designed for very short electrical lengths, switches of this type may be adapted for operation at very high frequencies up to 10 kmc. Good circuit isolation, that is to say, cross-talk, is a further advantage of switch 10 because a fair size contact gap can be maintained between the inactive inner conductor (conductor 17 in FIG. 1 when handle 26 is in its solid outline position) and the active inner conductors 18 and 19 by keeping the penetration of the front edges of the inner conductors into chamber 13 at a minimum.

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:

1. A coaxial switch for connecting a first high frequency coaxial transmission line to individual ones of a

pair of such transmission lines comprising, a switch body of conductive material having a longitudinal through bore for defining an enclosed internal chamber, a first coaxial connector carried by said body at one end of said through bore for connection to the first transmission line, said connector having inner and outer conductors wherein said inner conductor has a front end extending into said chamber from said one bore end, a pair of coaxial connectors for connection to individual ones of said pair of transmission lines and carried by said body on opposite sides of the longitudinal axis of said through bore, said pair of connectors having respective inner and outer conductors wherein the inner conductors thereof enter said chamber from opposite sides of said longitudinal axis, said last-mentioned inner conductors being in alignment in said chamber along an axis orthogonal to said longitudinal axis, said outer conductors and said body being electrically common, a switch handle supported for pivoting in the other end of said through bore and having a spherical-shaped segment of conductive material slidably in contact against the circumferential contiguous portions of said through bore to electrically short same thereat, whereby said spherical segment in cooperation with said connectors and the wall portions of said through bore define said enclosed chamber, a contact holder of insulator material carried by said handle and having a front end extending into said chamber, a roller contact of conductive material mounted at said front end, said inner conductors extending into said chamber to effect make and break electrical contact between said roller contact and pairs of said inner conductors, and means for pivoting said handle from a first position to a second position, pivoting said handle to its first position causes said roller to conductively contact the inner conductor of said first connector and the inner conductor of one of said pair of connectors, pivoting of said handle to its other position causes said roller to conductively contact the inner conductor of said first connector and the inner conductor of the second of said pair of connectors.

2. Apparatus as defined in claim 1 wherein said handle having a hollow bore confronting said chamber, a spring seated in said hollow bore, said contact holder being slidably seated in said hollow bore and urging said spring in compression, said roller contact at all times engaging the front end of the inner conductor of said first connector, said contact member experiencing maximum retraction into said hollow bore against the force of said spring when said handle is axially aligned with the inner conductor of said first connector at which time said handle is in a position intermediate said first and second positions wherein said roller contact avoids conductive contact with said other inner conductors, said contact holder gradually advancing slidably out of said hollow bore under the force of said spring as said handle rocks from its intermediate position towards its first or second positions, said contact holder experiencing relatively maximum advancement out of said hollow bore when said handle is in either of its first or second positions, whereby said handle resists accidental shifting from its said first or second positions by reason of the force of said spring.

3. Apparatus as defined in claim 2 wherein said roller contact comprising, a pair of discs connected by a shaft, the front end of the inner conductor of said first connector being undercut to define a tongue having a shoulder extending laterally on either side of said tongue, said tongue extending between said discs and each disc being adapted to roll along an individual one of said shoulders during travel of said handle from one to another of its positions.

4. Apparatus as defined in claim 1, wherein said handle having a hollow bore confronting said chamber, a spring seated in said hollow bore, said contact holder being slidably seated in said hollow bore and urging said spring

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in compression, said roller contact at all times engaging the front end of the inner conductor of said first connector, said contact member experiencing maximum retraction into said hollow bore against the force of said spring when said handle is axially aligned with the inner conductor of said first connector at which time said handle is in a position intermediate said first and second positions wherein said roller contact avoids conductive contact with said other inner conductors, said contact holder gradually advancing slidably out of said hollow bore under the force of said spring as said handle rocks from its intermediate position towards its first or second positions, said contact holder experiencing relatively maximum advancement out of said hollow bore when said handle is in either of its first or second positions, said roller contact circumferentially bridging the front end of said inner conductor of said first connector and individual ones of said other inner conductors when said handle is in its first and second of its positions, whereby said handle resists accidental shifting from its said first or second positions by reason of the force of said spring.

5. Apparatus as defined in claim 1 further including, spring means continuously urging said roller contact at all times in rollable electrical contact against the front end of the inner conductor of said first connector, said roller contact experiencing a relatively large spring force for urging same against said front end when said handle is in a position intermediate said first and second positions, at which time said handle is substantially axially aligned with the inner conductor of said first connector whereby said roller contact avoids conductive contact with said other inner conductors, said roller contact experiencing a relatively smaller spring force for urging same against said front end when said handle is in its first and second positions, whereby said handle resists accidental shifting from its first or second positions by reason of the force of said spring.

6. A coaxial switch for connecting a first high frequency coaxial transmission line to individual ones of a pair of such transmission lines comprising, a switch body of conductive material having a longitudinal through bore for defining an enclosed internal chamber, a first coaxial connector carried by said body at one end of said through bore for connection to the first transmission line, said connector having inner and outer conductors wherein

said inner conductor has a front end extending into said chamber from said one bore end, a pair of coaxial connectors for connection to individual ones of said pair of transmission lines and carried by said body on opposite sides of the longitudinal axis of said through bore, said pair of connectors having respective inner and outer conductors wherein the inner conductors thereof enter said chamber from opposite sides of said longitudinal axis, said last-mentioned inner conductors being in alignment in said chamber along an axis orthogonal to said longitudinal axis, said outer conductors and said body being electrically common, a switch handle supported for pivoting in the other end of said through bore and having a spherical-shaped segment of conductive material slidably in contact against the circumferential contiguous portions of said through bore, the periphery of said spherical segment being circumferentially in contact with said bore to electrically short same thereat, whereby said spherical segment in cooperation with said connectors and the wall portions of said through bore define said enclosed chamber, a contact holder of insulator material carried by said handle and having a front end extending into said chamber, a conductive roller contact mounted at said front end, said inner conductors extending into said chamber to effect make and break electrical contact between said roller contact and pairs of said inner conductors, and means for pivoting said handle from a first position to a second position, said roller contact circumferentially bridging the inner conductor of said first connector and individual ones of said other inner conductors when said handle is in its first and second positions, pivoting said handle to its first position causes said roller contact to conductively contact the inner conductors of said first connector and the inner conductor of one of said pair of connectors, pivoting of said handle to its second position causes said roller contact to conductively contact the inner conductor of said first connector and the inner conductor of the second of said pair of connectors.

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