

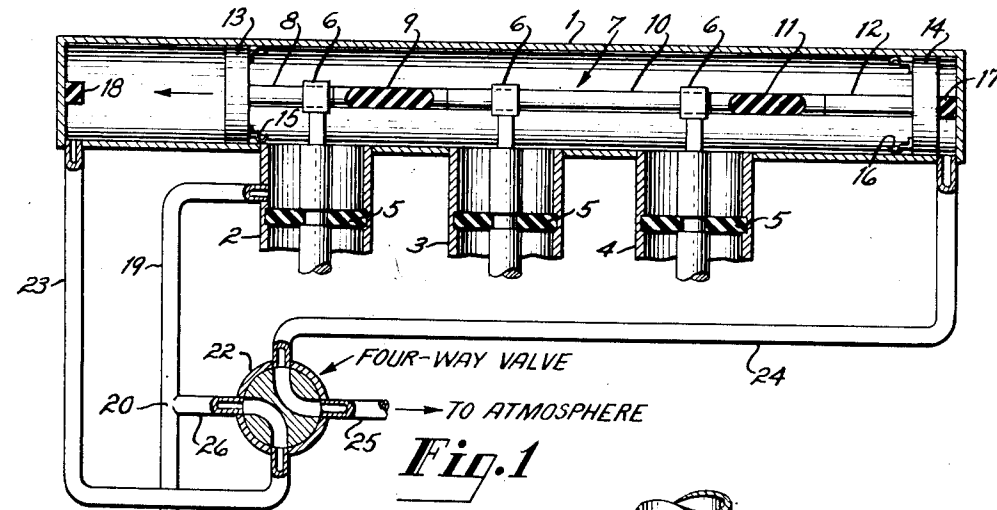
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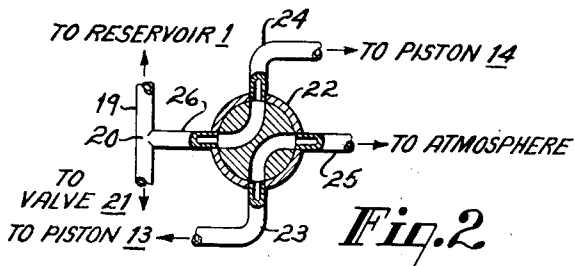
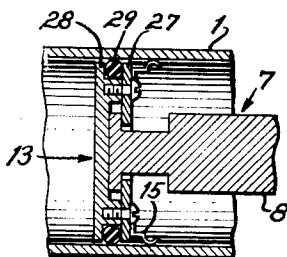
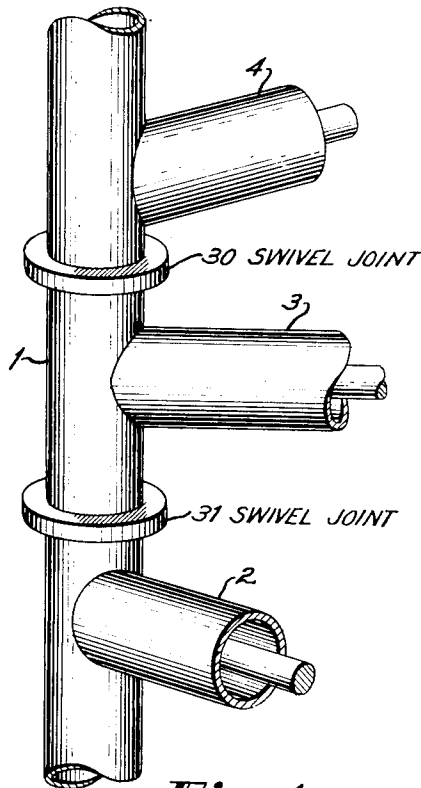
COAXIAL SWITCH

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BALL CHECK VALVE

TO HIGH PRESSURE SOURCE OF DRY GAS



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COAXIAL SWITCH

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This invention relates to a coaxial switch, and more particularly to a pneumatically-operated switch designed to connect a coaxial line selectively to either one of two additional coaxial lines, and to be capable of operation from a remote point.

Nearly all broadcasting stations, including amplitude modulation, frequency modulation and television stations, use one or more coaxial switches for the switching of radio frequency power. Such switches may be located either inside or outside the building which houses the transmitter house, by way of example, coaxial switches may be used for the switching of alternate transmitters or for the switching of alternate signal paths in a multi-stage transmitter, while on the tower, coaxial switches may be used for the switching of various portions of an antenna. No matter where the coaxial switches are located, it is desirable that they be capable of remote actuation, this being almost a necessity if they are located at the top of an antenna tower.

An object of this invention is to devise a novel type of coaxial switch which is capable of remote operation and yet which does not require any complicated or expensive interconnecting means between the operating point and the switch itself.

Coaxial switches handling high power are normally pressurized (that is, they contain a gas under pressure), since pressurization materially increases the power handling capacity of the switch. Prior switches of this type were ordinarily mechanically operated, and required projecting moving parts which had to be sealed through the wall of the pressurized container. The design and construction of such seals are often quite difficult and complicated.

Another object of this invention is to provide a pressurized coaxial switch which does not have any projecting moving parts.

A further object is to devise a pneumatically-operated coaxial switch.

A still further object is to devise a pneumatically-operated coaxial switch which can be operated pneumatically to a limited extent even if the supply of high-pressure fluid medium fails.

The objects of this invention are accomplished, briefly, in the following manner: a piston rod is mounted to move back and forth inside the metallic outer conductor of a coaxial line, by means of two pistons secured one to each end of the rod and fitting in a gas-tight manner inside such conductor. The conductor is sealed to form a gas-tight container, into which, between the two pistons, are sealed three parallel coaxial lines the inner conductors of which are provided with conducting sleeves through which the piston rod passes. The piston rod is provided with alternate electrically conducting and electrically insulating sections so that, as it moves back and forth, adjacent coaxial lines are either electrically interconnected or electrically insulated from each other. Means are provided for connecting that inner conductor

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which is not interconnected with the adjacent inner conductor, to the metallic outer conductor. That portion of the sealed container between the two pistons serves as a reservoir of high-pressure gas, supplied from a high-pressure source through a single small gas line, and for actuation of the switch this reservoir is caused to communicate selectively with the outer face of one or the other of the pistons. At the same time, atmospheric pressure is applied to the outer face of the piston not so selected. This actuation is brought about through a system of conduits and a gas flow reversing valve.

The foregoing and other objects of the invention will be better understood from the following description of an exemplification thereof, reference being had to the accompanying drawings, wherein:

Fig. 1 is a sectional view, shown partly schematically, of a coaxial switch according to this invention;

Fig. 2 is a schematic representation of the four-way valve in its other position;

Fig. 3 is a detail showing the construction of one of the pistons; and

Fig. 4 is an elevation of a portion of the switch, showing a structural modification.

Referring first to Fig. 1, all of the coaxial transmission line shown in solid outline may for example be of the $3\frac{1}{8}$ " diameter size which is commercially available. The main body of the switch is formed from a horizontally-extending portion 1 of coaxial transmission line having the inner conductor removed therefrom to provide an elongated hollow metallic body or cylinder. The coaxial line is made from tubing stock, and body 1 is made into a gas-tight container by covering its open ends. A plurality of coaxial lines, here illustrated as three lines 2, 3 and 4, are sealed into the side wall of body 1 near the central portion thereof. These three lines are substantially parallel to each other. The coaxial lines 2, 3 and 4 may be, and preferably are, of the same size as that used for body 1, although the inner conductors are not removed from lines 2, 3 and 4. The outer conductors of lines 2, 3 and 4 are sealed into the cylindrical side wall of body 1 in electrically conducting relation therewith and the open space between the inner conductor and the outer conductor of each of the lines 2, 3 and 4 is closed off near body 1 and made gas-tight by "gas stops" 5. These are preferably of the "Teflon" disc type customarily used in pressurized coaxial transmission lines and (since the inner conductors of the coaxial lines are solid or are made impervious, the inside of the body 1 forms a gas-tight container. The gas stops 5 are somewhat flexible and may change in position slightly as the gas pressure changes.

The ends of the inner conductors of all the coaxial lines 2—4 are constructed alike, so only one will be described in detail. A metallic sleeve member 6 is mounted on the end of each of the coaxial line inner conductors, these sleeve members being electrically connected to the respective inner conductors. The three sleeves are all bored cylindrically in the direction of the length of body 1 and are arranged substantially centrally of body 1 or coaxial with the hollow cylindrical body 1.

An elongated member, designated generally by numeral 7, is mounted for longitudinal movement in body 1, substantially centrally thereof. Member 7 may be termed a "piston rod" and has a diameter such as to slide freely through the sleeves 6 while yet contacting them sufficiently to be capable of conducting electrical current between the metallic portion of the rod and the sleeve in engagement therewith. Member 7 is mounted in the sleeve members 6 and has a length shorter than that of body 1, so that it can move longitudinally in said body. Member 7 is adapted to move horizontally in Fig. 1 and is illustrated at the extreme right-hand limit of its travel.

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Member 7 is made up of alternate electrically conducting and electrically insulating sections. From left to right in Fig. 1, it comprises a short electrically conducting (metallic) section 8, a longer electrically insulating section 9, a still longer electrically conducting (metallic) section 10, an electrically insulating section 11 of substantially the same length as section 9, and finally an electrically conducting (metallic) section 12 of substantially the same length as section 8.

The switch of this invention operates to connect the inner conductor of the central coaxial line 3 selectively to the inner conductor of coaxial line 4 or to the inner conductor of coaxial line 2. It may thus be thought of as a single-pole double-throw switch. The conducting member 10 has a length substantially equal to the distance between the sleeves of adjacent coaxial lines such as 3 and 4, or 2 and 3. When member 7 is at its extreme right-hand position as illustrated in Fig. 1, the conducting section 10 contacts or engages the sleeves of both coaxial lines 3 and 4, so that in this switch position the inner conductors of coaxial lines 3 and 4 are electrically connected together. The adjacent section 9 of member 7 is an electrically insulating section and this section is between the sleeves of coaxial lines 2 and 3; therefore, in the switch position illustrated the inner conductors of coaxial lines 2 and 3 are insulated from each other and no electrical connection is made therebetween. In other words, in this switch position the inner conductors of coaxial lines 3 and 4 are interconnected and those of lines 2 and 3 are disconnected or electrically insulated from each other.

A metallic piston 13 is secured to the left end of cylindrical member 7, in electrically conducting relation with section 8 thereof. This piston is cylindrical in shape and the periphery thereof engages and makes a gas-tight fit with the inner cylindrical wall of body 1. Similarly, a piston 14 is secured to the right end of member 7, in electrically conducting relation with section 12 thereof. Piston 14 is also cylindrical in shape and the periphery thereof engages and makes a gas-tight fit with the inner cylindrical wall of body 1. How pistons 13 and 14 fit in a leak-proof manner in the body 1 and yet are free to slide therein, will be explained more in detail hereinafter. Piston 13 has mounted thereon near its periphery one or more metallic contact springs 15 which engage the inner cylindrical wall of body 1 and make good electrical contact between metallic piston 13 and conducting section 8, on the one hand, and the metallic body 1 and outer conductor of coaxial line 2, on the other hand. Similarly, piston 14 has mounted thereon near its periphery one or more metallic contact springs 16 which engage the inner cylindrical wall of body 1 and make good electrical contact between metallic piston 14 and conducting section 12, on the one hand, and the metallic body 1 and outer conductor of coaxial line 4, on the other hand.

Conducting section 8 of piston rod 7 has a length sufficient to contact the sleeve 6 associated with coaxial line 2 when the rod is in its right-hand position illustrated. Therefore, in the switch position illustrated the contact springs 15 form an electrical short-circuit through the piston 13 and conducting section 8 attached thereto from the outer conductor of coaxial line 2 to the inner conductor thereof.

The member 7 is illustrated at the extreme right-hand limit of its travel. Travel of piston rod 7 is limited in this direction by a stop member 17 which is fastened to the right end wall of the coaxial outer conductor 1, substantially centrally thereof. The outer face of piston 14 engages stop 17 to limit travel of member 7 in the right-hand direction. Travel of piston rod 7 is limited in the left-hand direction by a stop member 18 which is fastened to the left end wall of the coaxial outer conductor 1, substantially centrally thereof. The outer face of piston 13 engages stop 18 to limit travel of member 7 in the

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left-hand direction. Stops 17 and 18 are made elastic, to reduce shock load.

In the left-hand position of the switch, with the outer face of piston 13 engaging stop 18, conducting section 10 engages the sleeves associated with coaxial lines 2 and 3. In this switch position, the inner conductors of coaxial lines 2 and 3 are interconnected. Insulating section 11 is then between the sleeves of coaxial lines 3 and 4, so that the inner conductors of coaxial lines 3 and 4 are disconnected or electrically insulated from each other. At the same time, conducting section 12 contacts the sleeve 6 associated with coaxial line 4. Then, the contact springs 16 form an electrical short circuit through the piston 14 and conducting section 12 attached thereto from the outer conductor of coaxial line 4 to the inner conductor thereof.

The outer coaxial conductor or hollow body 1 is used as the operating cylinder for the switch and also as a pneumatic (high-pressure gas, for example) reservoir. The gas-tight container or pneumatic reservoir is formed by the portion of hollow body 1 between pistons 13 and 14. This portion of body 1 is sealed off and made sufficiently gas-tight to withstand any appreciable leakage of compressed gas therefrom, by structure including the gas stops 5 and pistons 13 and 14.

In order to initially fill the reservoir referred to, and to replace any gas used from such reservoir, one end of a suitable conduit or gas line 19 opens into the open space in coaxial line 2, above its gas stop 5. The open space just referred to is a part of the reservoir portion of body 1. Conduit 19 leads past a T-junction 20 and through a ball check valve 21 to a suitable high-pressure source of dry gas, such as dry nitrogen under 45 p. s. i. pressure. The ball check valve 21 may be a spring-loaded ball of more or less conventional design which operates to retain the pressure in the reservoir portion of body 1 if the high-pressure gas source fails for any reason. In other words, the ball in valve 21 operates to close off the reservoir from the high-pressure source if the latter fails (it is illustrated for convenience in this position in Fig. 1), but the ball does not close off this connection when there is pressure on both sides of valve 21. During normal operation of the switch, the ball is in this latter position, not closing off such connection.

The actual coaxial switching elements 6, 10 etc. are pressurized, since these elements are inside the reservoir portion of body 1, which is maintained filled with gas under pressure as just described. Pressurization materially increases the power-handling capacity of the switch. For example, a gauge pressure of 50 p. s. i. raises the power capacity of the switch to 150% of that at atmospheric pressure.

The third leg of the T-junction 20 is connected to a conduit 26 which provides one of the four flow connections to a four-way valve 22, which is preferably solenoid operated but which may alternatively be pneumatically operated. Valve 22 serves to change the direction of gas flow, in a manner to be described hereinafter.

In order to operate the coaxial switch from the actuating gas contained in the reservoir (which is also the switching chamber, that portion of body 1 between pistons 13 and 14), conduits or gas lines connect the outer faces of pistons 13 and 14, respectively, to valve 22. In this connection, the "outer faces" of the pistons 13 and 14 are the respective faces thereof which are opposite to the reservoir or container portion of body 1, that is, the faces closest to the respective stops 18 and 17. A conduit 23 connects the outer face of piston 13 to one of the four flow connections of valve 22, while a conduit 24 connects the outer face of piston 14 to still another of the four flow connections of valve 22. The fourth flow connection of valve 22 comprises a conduit 25 opening to the atmosphere or to atmospheric pressure, or to a lower pressurized section of transmission line.

The conduits 23 and 24 are substantially diametrically

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opposite to each other in their connections to valve 22, while the conduits 26 and 25 are substantially diametrically opposite to each other in their connections to valve 22. The four-way valve 22 is capable of selective operation from a remote point (either by means of an electrically-energized solenoid or pneumatically) to either one of two positions, one of which is illustrated in Fig. 1 and the other of which is illustrated in Fig. 2.

In the Fig. 1 position of valve 22, conduits 24 and 25 are connected together and conduits 26 and 23 are connected together. In this position of the gas flow reversing valve, compressed gas is applied from the reservoir or container portion of body 1 (the central portion of such body, between pistons 13 and 14) by way of conduits 19, 26 and 23 to the outer face of piston 13, while atmospheric pressure is applied by way of conduits 25 and 24 to the outer face of piston 14. Gas flows from the reservoir to the outer face of piston 13, and, because of the difference in pressures on the outer faces of pistons 13 and 14, the movable portion of the switch (comprising pistons 13 and 14 and member 7) moves to the right until the outer face of piston 14 contacts the stop 17, as illustrated in Fig. 1. This is the extreme right-hand position of the coaxial switch, in which the inner conductors of coaxial lines 3 and 4 are connected together by conducting section 10 and the inner conductor of coaxial line 2 is short-circuited to its outer conductor by means of elements 8, 13 and 15.

When the member 7 has moved so that piston 14 contacts stop 17, the left side chamber (the portion of body 1 to the left of piston 13, between the outer face of piston 13 and stop 18) remains constant in volume and the pressures on the two faces of piston 13 become equalized, since these two faces are connected together through conduits 19, 26 and 23. Since the pressures on both faces of piston 13 are the same when the member 7 is in its extreme right-hand position (the pressure on both faces then being the high pressure, for example 45 p. s. i.), there is then no longitudinal stress on the member or piston rod 7.

In the Fig. 2 position of valve 22, conduits 24 and 26 are connected together and conduits 23 and 25 are connected together. In this position of the gas flow reversing valve, compressed gas is applied from the reservoir or container portion of body 1 by way of conduits 19, 26 and 24 to the outer face of piston 14, while atmospheric pressure is applied by way of conduits 25 and 23 to the outer face of piston 13. Gas then flows from the reservoir to the outer face of piston 14 and, because of the difference in pressures on the outer faces of pistons 13 and 14, the movable portion of the switch moves to the left until the outer face of piston 13 contacts the stop 18. This is the extreme left-hand position of the coaxial switch, in which the inner conductors of coaxial lines 2 and 3 are connected together by conducting section 10 and the inner conductor of coaxial line 4 is short-circuited to its outer conductor by means of elements 12, 14 and 16.

When the member 7 has moved so that piston 13 contacts stop 18, the right side chamber (the portion of body 1 to the right of piston 14) between the outer face of piston 14 and stop 17) remains constant in volume and the pressures on the two faces of piston 14 become equalized, since these two faces are now connected together through conduits 19, 26 and 24. Since the pressures on both faces of piston 14 are the same when the member 7 is in its extreme left-hand position (the pressure on both of these piston faces then being the high pressure, for example 45 p. s. i.), there is then no longitudinal stress on the member or piston rod 7.

Each of the stops 17 and 18 has an aperture extending entirely therethrough and also through the wall of body 1. Each of these apertures is normally plugged so that the body 1 is normally gas-tight and the switch can be operated by gas pressure in the manner previously described. However, each of the plugs is removable with a

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simple tool, such as a wrench. For hand (emergency) operation of the switch, for example when the gas pressure entirely fails, the proper one of these plugs would be removed, leaving a hole entirely through one of the stops 17 or 18. A rod can then be inserted through this hole from the outside end and by pushing on the piston 14 or 13 the switch can be manually operated as desired.

It may be noted that all of the moving parts of the switch are contained entirely within the body 1. This means that there are no projecting moving parts which must be sealed into a pressurized container. Also, it may be noted that the main switch parts (the parts of the switch between pistons 13 and 14) are entirely sealed in a dehydrated atmosphere, since dry gas is contained in the reservoir portion of body 1. This insures, as nearly as possible, that outside contaminants such as dirt or moisture will not impede operation of the switch at high or low temperatures.

Since the switch is actuated mainly by the gas in reservoir 1, the switch can be actuated several times from the gas in this reservoir, if the high pressure (45-50 p. s. i. gauge) source of gas fails. In this event, ball check valve 21 operates to close off the reservoir and retain its pressure if the high pressure source fails; there is enough gas in the reservoir 1 alone to operate the switch several times.

Due to the facts that there is no stress in the member 7 when the switch is in either end position and also that there is no bias of any sort on this member, the switch will remain in its last position upon the complete failure of pressure.

Although the switch has been disclosed as being operated from a high-pressure gas supply, it can also be operated from a low-pressure supply such as a dehydrator, which might provide a pressure of only 8-9 p. s. i. gauge.

The reservoir portion of body 1 contains the gas for actuating the switch. Even though a fairly large volume of gas must be moved for actuating the switch, the conduits 19 (on the switch side of T-junction 20), 26, 23 and 24 are all rather short, so they can easily be made of fairly large diameter without unduly increasing the cost or weight. The high-pressure source does not need to supply a large volume of gas for actuating the switch, so that conduit 19 below T-junction 20 can be of small diameter and as long as needed for convenience. In this invention, it is not necessary to rapidly move a large volume of gas through a long and small diameter gas line. The switch of this invention can be operated from a remote point by one connection (pneumatic or electric) to the four-way valve or gas flow reversing valve 22, and only a single small gas line from the high-pressure source to the T-junction 20.

Now referring to Fig. 3, this is a detail of the "floating" but gas-tight piston rod construction used at both ends of member 7. Each conducting portion 8 and 12 of member 7 is clamped between two metallic members 27 and 28 which fit loosely inside body 1 and provide a groove at their peripheries. In this groove there is positioned an O ring 29 of resilient material, which provides a gas-tight seal between piston 13 (which is made up of members 27 and 28) and the inner wall of body or hollow cylinder 1. At the same time, the resilient ring 29 provides a "floating" piston rod construction. This allows the piston rod 7 to move eccentrically, as will be required when the changing gas pressure inside the reservoir portion of body 1 changes the deflection of the flexible gas stops 5 and thus changes the position of sleeve members 6.

Fig. 4 illustrates a structural modification, by means of which the coaxial lines 2 and 4 may be brought to and coupled into the switch at any desired angle. A swivel joint 30 is provided in body 1 between lines 3 and 4, and another swivel joint 31 is provided in body 1 between lines 2 and 3. This enables the angular position of lines 2 and 4 to be adjusted to suit the conditions of any particular installation. The swivel joints 30

and 31 should of course be gas-tight. Sleeve members 6 can rotate with respect to member 7, to allow for the angular adjustment of lines 2 and 3. Conduits 19, 23 and 24 can of course be positioned to function as required, for any particular angular location of lines 2 and 3.

What is claimed is:

1. A multiposition switch for selectively connecting a plurality of coaxial transmission lines comprising an elongated hollow body, a plurality of spaced coaxial transmission lines the inner conductors of which extend into said body to a position substantially centrally thereof, an elongated member mounted for longitudinal movement in said body substantially centrally thereof and engaging said inner conductors, said member having alternate electrically insulating and electrically conducting sections, one of said conducting sections having a length substantially equal to the distance between adjacent ones of said inner conductors, and pneumatic means for causing longitudinal movement of said member.

2. A multiposition switch for selectively connecting a plurality of coaxial transmission lines comprising an elongated hollow body, a plurality of spaced coaxial transmission lines the inner conductors of which extend into said body to a position substantially centrally thereof, an elongated member mounted for longitudinal movement in said body substantially centrally thereof and engaging said inner conductors, said member having alternate electrically insulating and electrically conducting sections, one of said conducting sections having a length substantially equal to the distance between adjacent ones of said inner conductors, at least one piston secured to said member and engaging the inner surface of said body, and pneumatic means operating on said piston to cause longitudinal movement of said member.

3. A multiposition switch for selectively connecting a plurality of coaxial transmission lines comprising an elongated hollow body, a plurality of spaced coaxial transmission lines the inner conductors of which extend into said body, said lines lying essentially in parallel planes, each of said inner conductors having a longitudinally-extending conducting sleeve member secured thereto, an elongated member mounted in said sleeve members and arranged for longitudinal movement in said body substantially centrally thereof, said member having alternate electrically insulating and electrically conducting sections, one of said conducting sections having a length substantially equal to the distance between adjacent ones of said sleeve members, and pneumatic means for causing longitudinal movement of said member.

4. A multiposition switch for connecting a first coaxial transmission line selectively to one of a plurality of other coaxial transmission lines comprising an elongated hollow metallic body, a plurality of spaced coaxial transmission lines the inner conductors of which extend into said body to a position substantially centrally thereof, an elongated member mounted for longitudinal movement in said body substantially centrally thereof and engaging all of said inner conductors, said member having alternate electrically insulating and electrically conducting sections, one of said conducting sections having a length substantially equal to the distance between adjacent ones of said inner conductors, whereby adjacent ones of said inner conductors may be interconnected, means including another one of said conducting sections for connecting an inner conductor other than the interconnected inner conductors to said metallic body, and pneumatic means for causing longitudinal movement of said member, thereby to change the ones of said inner conductors which are interconnected.

5. A multiposition switch for selectively connecting a plurality of coaxial transmission lines comprising an elongated hollow body, a plurality of spaced coaxial transmission lines the inner conductors of which extend into said body to a position substantially centrally thereof, an

elongated member mounted for longitudinal movement in said body substantially centrally thereof and engaging said inner conductors, said member having alternate electrically insulating and electrically conducting sections, one of said conducting sections having a length substantially equal to the distance between adjacent ones of said inner conductors, a pair of pistons one secured to each end of said elongated member, said pistons both engaging the inner surface of said body, and pneumatic means operable on said pistons to cause longitudinal movement of said member.

6. A multiposition switch for selectively connecting a plurality of coaxial transmission lines comprising an elongated hollow body, a plurality of spaced coaxial transmission lines the inner conductors of which extend into said body to a position substantially centrally thereof, an elongated member mounted for longitudinal movement in said body substantially centrally thereof and engaging said inner conductors, said member having alternate electrically insulating and electrically conducting sections, one of said conducting sections having a length substantially equal to the distance between adjacent ones of said inner conductors, a pair of pistons one secured to each end of said elongated member, said pistons both engaging the inner surface of said body, and pneumatic means operable selectively on said pistons to cause selective longitudinal movement of said member in one direction or the other.

7. A multiposition switch for selectively connecting a plurality of coaxial transmission lines comprising an elongated hollow body, a pair of longitudinally-spaced pistons within said body and engaging the inner surface of said body to form a gas-tight container between such pistons, a plurality of spaced coaxial transmission lines having their inner conductors sealed into said container and extending thereinto to a position substantially centrally thereof, an elongated member positioned between said pistons and secured at its respective ends to said pistons, said member carrying at least one contact element adapted to engage said inner conductors, a supply of a fluid medium under pressure in said container, and means for placing the interior of said container in communication with the piston faces opposite to said container.

8. A multiposition switch for selectively connecting a plurality of coaxial transmission lines comprising an elongated hollow body, a pair of longitudinally-spaced pistons within said body and engaging the inner surface of said body to form a gas-tight container between such pistons, a plurality of spaced coaxial transmission lines having their inner conductors sealed into said container and extending thereinto to a position substantially centrally thereof, an elongated member positioned between said pistons and secured at its respective ends to said pistons, said member carrying at least one contact element adapted to engage said inner conductors, a supply of a fluid medium under pressure in said container, and means for placing the interior of said container in communication selectively with that face of one or the other of said pistons which is opposite to said container.

9. A multiposition switch for selectively connecting a plurality of coaxial transmission lines comprising an elongated hollow body, a pair of longitudinally-spaced pistons within said body and engaging the inner surface of said body to form a gas-tight container between such pistons, a plurality of spaced coaxial transmission lines having their inner conductors sealed into said container and extending thereinto to a position substantially centrally thereof, an elongated member positioned between said pistons and secured at its respective ends to said pistons, said member carrying at least one contact element adapted to engage said inner conductors, a supply of a fluid medium under pressure in said container, and means for placing the interior of said container in communication selectively with that face of one or the other

of said pistons which is opposite to said container, said means also operating to apply atmospheric pressure to the piston face not selected to be placed in communication with the container interior.

10. A multiposition switch for selectively connecting a plurality of coaxial transmission lines comprising an elongated hollow body, a pair of longitudinally-spaced pistons within said body and engaging the inner surface of said body to form a gas-tight container between such pistons, a plurality of spaced coaxial transmission lines having their inner conductors sealed into said container and extending thereinto to a position substantially centrally thereof, an elongated member positioned between said pistons and secured at its respective ends to said pistons, said member carrying at least one contact element adapted to engage said inner conductors, means for supplying a fluid medium under pressure to said container, and means for placing the interior of said container in communication with the piston faces opposite to said container.

11. A multiposition switch for selectively connecting a plurality of coaxial transmission lines comprising an elongated hollow body, a pair of longitudinally-spaced pistons within said body and engaging the inner surface of said body to form a gas-tight container between such pistons, a plurality of spaced coaxial transmission lines having their inner conductors sealed into said container and extending thereinto to a position substantially centrally thereof, an elongated member positioned between said pistons and secured at its respective ends to said pistons, said member carrying at least one contact element adapted to engage said inner conductors, means for supplying a fluid medium under pressure to said container, and means for placing the interior of said container in communication selectively with that face of one or the other of said pistons which is opposite to said container, said last-mentioned means also operating to apply atmospheric pressure to the piston face not selected to be placed in communication with the container interior.

12. A multiposition switch for selectively connecting a plurality of coaxial transmission lines comprising an elongated hollow body, a pair of longitudinally-spaced pistons within said body and engaging the inner surface of said body to form a gas-tight container between such pistons, a plurality of spaced coaxial transmission lines having their inner conductors sealed into said container and extending thereinto to a position substantially centrally thereof, an elongated member positioned between said pistons and secured at its respective ends to said pistons, said member having alternate electrically insulating and electrically conducting sections which engage said inner conductors, one of said conducting sections having a length substantially equal to the distance between adjacent ones of said inner conductors, a supply of a fluid medium under pressure in said container, and means for placing the interior of said container in communication with the piston faces opposite to said container.

13. A multiposition switch for connecting a first coaxial transmission line selectively to one of a plurality of other coaxial transmission lines comprising an elongated hollow metallic body, a pair of longitudinally-spaced pistons within said body and engaging the inner surface of said body, a plurality of spaced coaxial transmission lines having their inner conductors sealed into said body intermediate said pistons and extending thereinto to a position substantially centrally thereof, an elongated member positioned between said pistons and secured at its respective ends to said pistons, said member having alternate electrically insulating and electrically conducting sections which engage said inner conductors, one of said conducting sections having a length substantially equal to the distance between adjacent ones of said inner conductors, whereby adjacent ones of said inner conductors may be interconnected, contacts carried by said pistons and engaging said metallic body, and

means including said contacts and another one of said conducting sections for connecting an inner conductor other than the interconnected inner conductors to said metallic body.

14. A multiposition switch for connecting a first coaxial transmission line selectively to one of a plurality of other coaxial transmission lines comprising an elongated hollow metallic body, a pair of longitudinally-spaced pistons within said body and engaging the inner surface of said body to form a gas-tight container between such pistons, a plurality of spaced coaxial transmission lines having their inner conductors sealed into said container and extending thereinto to a position substantially centrally thereof, an elongated member positioned between said pistons and secured at its respective ends to said pistons, said member having alternate electrically insulating and electrically conducting sections which engage said inner conductors, one of said conducting sections having a length substantially equal to the distance between adjacent ones of said inner conductors, whereby adjacent ones of said inner conductors may be interconnected, contacts carried by said pistons and engaging said metallic body, means including said contacts and another one of said conducting sections for connecting an inner conductor other than the interconnected inner conductors to said metallic body, a supply of a fluid medium under pressure in said container, and means for placing the interior of said container in communication with the piston faces opposite to said container, to thereby cause longitudinal movement of said member and to change the ones of said inner conductors which are interconnected.

15. A multiposition switch for connecting a first coaxial transmission line selectively to one of a plurality of other coaxial transmission lines comprising an elongated hollow metallic body, a pair of longitudinally-spaced pistons within said body and engaging the inner surface of said body to form a gas-tight container between such pistons, a plurality of spaced coaxial transmission lines having their inner conductors sealed into said container and extending thereinto to a position substantially centrally thereof, an elongated member positioned between said pistons and secured at its respective ends to said pistons, said member having alternate electrically insulating and electrically conducting sections which engage said inner conductors, one of said conducting sections having a length substantially equal to the distance between adjacent ones of said inner conductors, whereby adjacent ones of said inner conductors may be interconnected, contacts carried by said pistons and engaging said metallic body, means including said contacts and another one of said conducting sections for connecting an inner conductor other than the interconnected inner conductors to said metallic body, a supply of a fluid medium under pressure in said container, and means for placing the interior of said container in communication selectively with that face of one or the other of said pistons which is opposite to said container, to thereby cause longitudinal movement of said member and to change the ones of said inner conductors which are interconnected.

16. A multiposition switch for connecting a first coaxial transmission line selectively to one of a plurality of other coaxial transmission lines comprising an elongated hollow metallic body, a pair of longitudinally-spaced pistons within said body and engaging the inner surface of said body to form a gas-tight container between such pistons, a plurality of spaced coaxial transmission lines having their inner conductors sealed into said container and extending thereinto to a position substantially centrally thereof, an elongated member positioned between said pistons and secured at its respective ends to said pistons, said member having alternate electrically insulating and electrically conducting sections which engage said inner conductors, one of said conducting sec-

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tions having a length substantially equal to the distance between adjacent ones of said inner conductors, whereby adjacent ones of said inner conductors may be interconnected, contacts carried by said pistons and engaging said metallic body, means including said contacts and another one of said conducting sections for connecting an inner conductor other than the interconnected inner conductors to said metallic body, means for supplying a fluid medium under pressure to said container, and means for placing the interior of said container in communication selectively with that face of one or the other of said pistons which is opposite to said container, to thereby cause longitudinal movement of said member and to change the ones of said inner conductors which are interconnected, said last-mentioned means also operating to apply atmospheric pressure to the piston face not selected to be placed in communication with the container interior.

17. A multiposition switch for selectively connecting a plurality of coaxial transmission lines comprising an elongated hollow body, a plurality of spaced coaxial transmission lines the inner conductors of which extend into said body to a position substantially centrally thereof, an elongated member mounted for longitudinal movement in said body substantially centrally thereof and engaging said inner conductors, said member having alternate electrically insulating and electrically conducting sections, one of said conducting sections having a length substantially equal to the distance between adjacent ones of said inner conductors, and means for causing longitudinal movement of said member.

18. A multiposition switch for connecting a first co-

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axial transmission line selectively to one of a plurality of other coaxial transmission lines comprising an elongated hollow metallic body, a plurality of spaced coaxial transmission lines the inner conductors of which extend into said body to a position substantially centrally thereof, an elongated member mounted for longitudinal movement in said body substantially centrally thereof and engaging all of said inner conductors, said member having alternate electrically insulating and electrically conducting sections, one of said conducting sections having a length substantially equal to the distance between adjacent ones of said inner conductors, whereby adjacent ones of said inner conductors may be interconnected, means including another one of said conducting sections for connecting an inner conductor other than the interconnected inner conductors to said metallic body, and means for causing longitudinal movement of said member, thereby to change the ones of said inner conductors which are interconnected.

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