March 3, 1959 A. ALFORD 2,876,303

COAXIAL SWITCH

Filed May 6, 1957 2 Sheets-Sheet 1

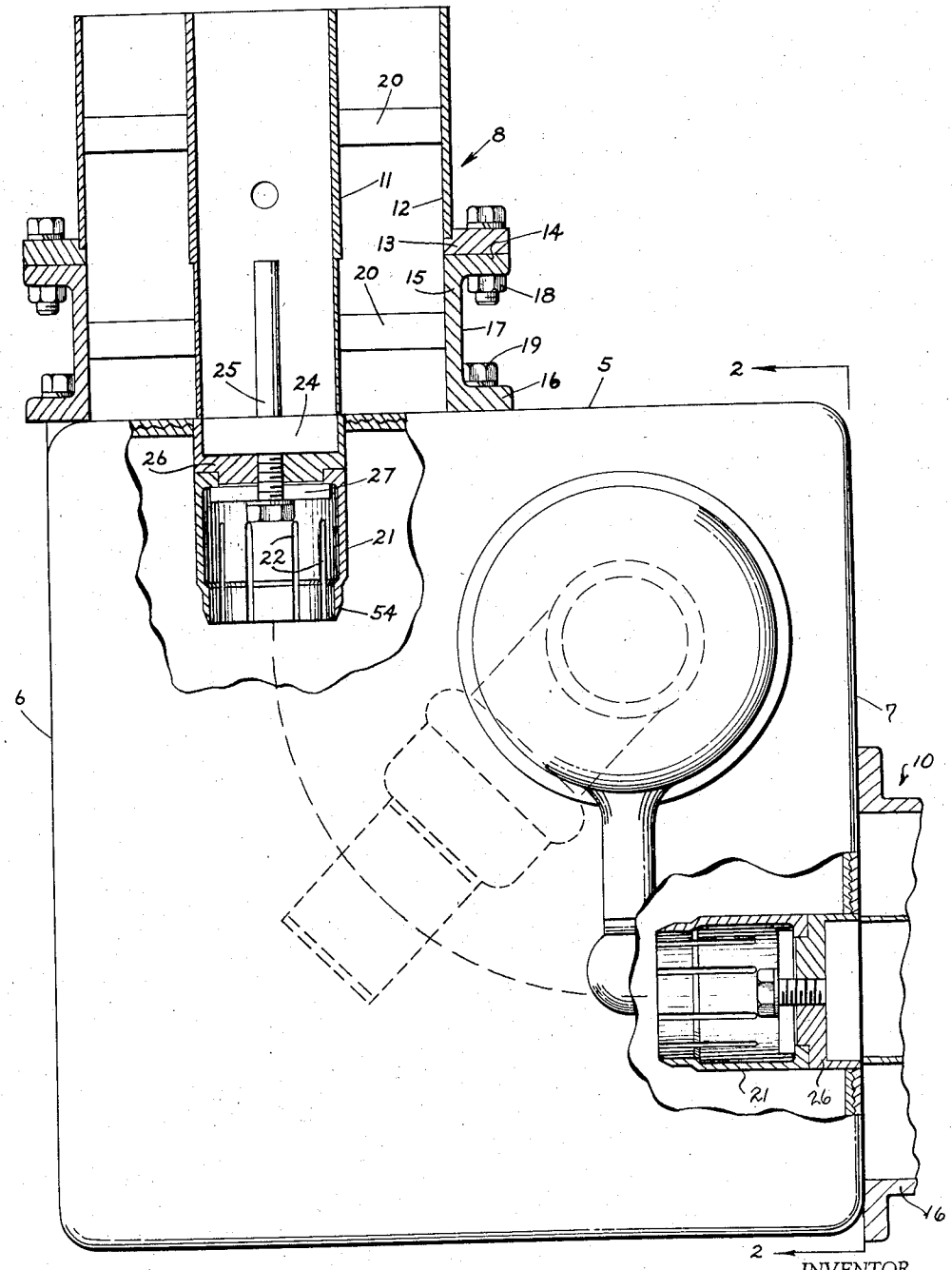


FIG. 1

INVENTOR.
Andrew Alford
BY Ezekiel Wolf
his Attorney

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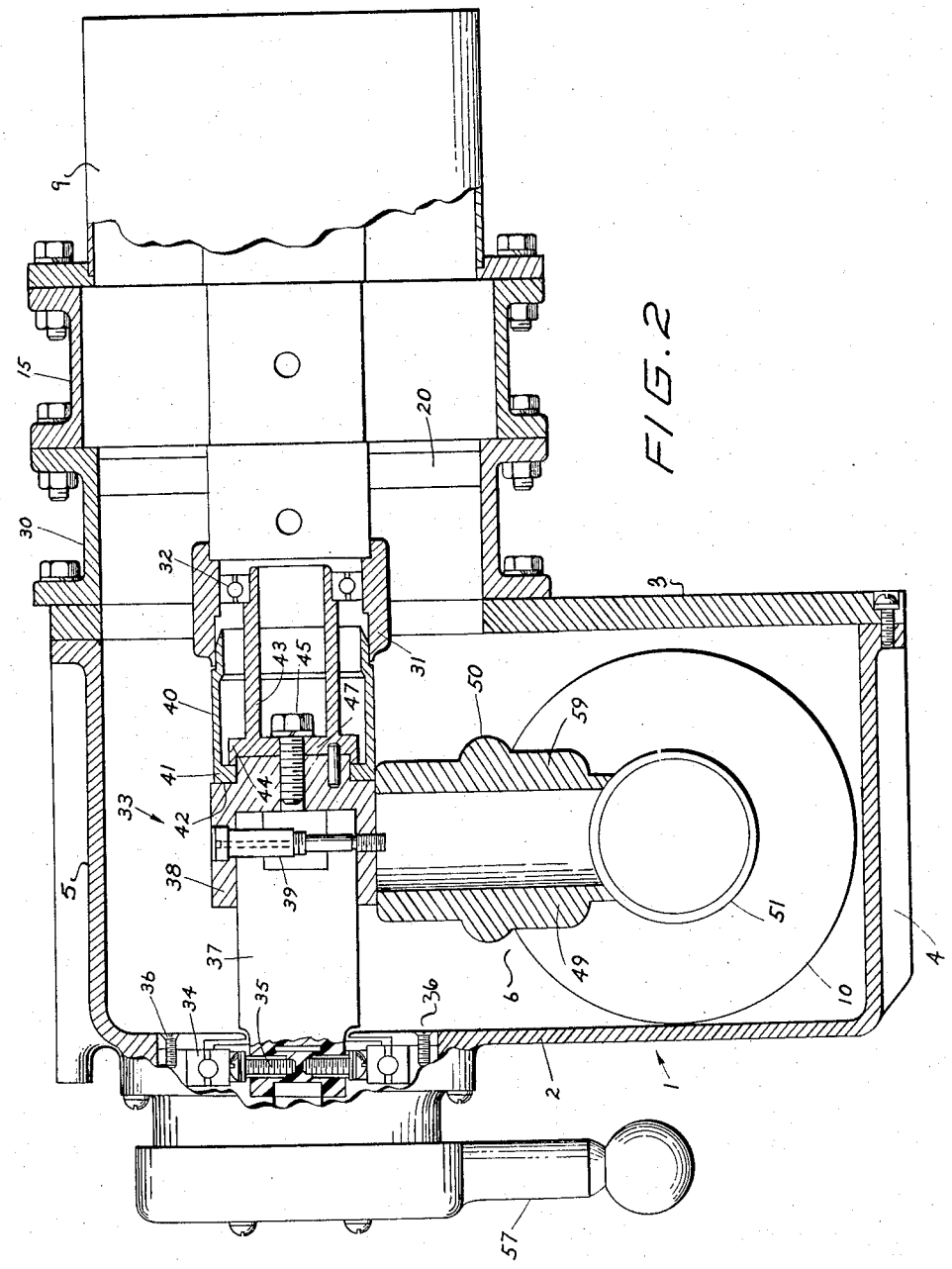


FIG. 2

INVENTOR.
Andrew Alford
BY Ezekiel Wolf
his Attorney

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2,876,303

COAXIAL SWITCH

Andrew Alford, Winchester, Mass.

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6 Claims. (Cl. 200—6)

This invention relates to a coaxial switch for connecting a coaxial line with one of two other coaxial lines.

The present invention provides a rotary switch means for connecting one coaxial transmission line with one of two other lines. In this invention the first line has extending from its inner conductor a rotary joint, an arm is connected to this rotary joint and is adapted to pivot in a plane normal to it. The arm terminates at its free end in a ring adapted to fit a bullet or inner conductor of a coaxial terminal. A pair of coaxial terminals are arranged in the plane of the arm with their bullets or inner conductors adapted to be engaged selectively by the rotation of the arm. This structure is suitably mounted in a housing and is operatvely connected to the drive unit which may, if desired, be a hand operated drive unit. The structure of the present invention is compact, rugged in nautre, certain of operation and provides a connection in which the mismatch is substantially negligible.

In designing the coaxial switch of the present invention means have been provided to reduce the impedance discontinuities of the switch with these means including in part the shape of the outer conductor or housing as well as the ring which forms a portion of the connecting member. Particular design features have also been incorporated into the structure to account for overcompensation of the capacitive reactance.

The present invention also provides a structure which is pecularily adapted to handle high amounts of power at ultra high frequencies. Thus in the present invention the means for minimizing mismatch does not reduce the power capacity of the unit.

These and other objects of the present invention will be clearly understood when considered in connection with a description of the embodiment of the accompanying drawings in which, Figure 1 is an end view of the invention and Figure 2 is a cross-sectional elevation taken substantially along the line 2—2 of Figure 1 with portions omitted for clarity. In the arrangement illustrated, there is provided a rectangular housing 1 having opposite side walls 2 and 3, top and bottom walls 4 and 5 and opposite end walls 6 and 7. If desired, side wall 3 may be formed as a removable plate suitably secured by screws or other means to the adjacent wall. Two similar coaxial lines 8, and 10 terminate at and are secured to the housing 1 with each line terminating at a wall adjacent to the walls at which the other lines terminate. Each of these lines comprises an inner conductor 11, an outer conductor 12. The outer conductor 12 is provided with an outwardly extending flange 13 at its end which faces the outwardly extending flange 14 of the collar member 15. The collar member 15 has a base peripheral flange 16 interconnected to the flange 14 by a sleeve section 17. The flanges 13 and 14 are secured together by a plurality of nuts and bolts 18 while collar 15 is in turn secured to the housing 1 by a plurality of bolts 19. The inner conductor 11 suitably spaced from the outer

conductor by dielectric pins 20, or the like. The inner conductor extends through the collar 15 and the adjacent wall of the housing projecting a short distance therethrough. A bullet 21 consisting of a sleeve section having a plurality of slots 22 parallel with one another and extending from the free edge of the bullet is secured to the end of the inner conductor 11. To secure this bullet 21 in position there is provided an insert or diaphragm 24 across the end of the inner conductor. A bolt 25 passes through and is threaded to this diaphragm 24 as well as the member 26, 27. The member 27 fits on an inwardly extending flange formed on the inner surface of the bullet 21. Coaxial conductor 9 is similarly secured to a collar 15. This collar, however is secured to a similarly constructed collar 30, collar 30 being secured to wall 3. The inner conductor of line 9 terminates within the collar 30. Fitted securely over this inner conductor at the inner end thereof is a conductive sleeve 31 within which there is mounted the ball bearing race 32. This sleeve 31 has a larger diameter than the inner conductor of the line 9. A rotatable shaft generally designated 33 is supported at one end by the ball bearing race 32 and at the other end by the ball bearing race 34. The ball bearing race 34 is mounted on the wall 2 with the inner portion of the race being secured by screws 35 or similar means to the shaft 33 and the outer portion of the race being secured by screws 36 or similar means to the housing. The shaft 33 comprises a dielectric section 37 made of a material such as "Teflon." One end of this section 37 is secured as indicated to a ball bearing race. The other end of this section is fitted within a recess of the cap member 38. This cap member 38 may be secured to the section 37 by a screw means such as indicated at 39. The bullet 40 is secured to the end of the cap member 38 with the outer diameter of the bullet substantially equal to the outer diameter of the cap member. This bullet is provided with an inwardly extending flange 41 fitting the shoulder 42 on the cap 38. The bullet is secured in position by an inner coaxial member 43 having a peripheral flange 44 which engages the flange 41 of the bullet 40 and secures it in the shoulder 42. The member 43 has a coaxial section fitting the inner portion of ball bearing race 32 and is supported by it. The member 43 is in turn secured to the cap 38 by a screw 45 which projects through the portion 47 of the member 43 into the cap 38. A lever arm 49 is welded or otherwise suitably secured to the cap 38 with the arm 49 extending inwardly to the shaft 33. A enlarged section in the form of a ring is formed about the arm 49 as indicated at 50 for the purpose of providing capacitive compensation. At the free end of the lever arm 49 there is provided a ring 51 made preferably of silver. This ring 51 has an inner diameter adapted to fit over the ends of the bullets at the ends of lines 8 and 10. It will be noticed that the height of this ring is rather short and can thereby readily fit over the beveled edges 54 at the ends of these bullets. Suitable means may be provided external of the housing 1 for rotating the shaft 33 from a position whereby the ring 51 is in contact with line 8 to a position whereby the ring 51 is in contact with line 10. Such means may comprise a hand operated lever as indicated at 57. The lever is suitably connected, as by an axial key and recess arrangement, directly to the shaft whereby the entire shaft 33 will rotate. It should be noted, that regardless of the position of rotation of the lever arm 49 there is a continuous conductive path between the line 9 and the ring 51, with this path providing a continuous inner conductor of a coaxial line.

This inner conductor, as above noted, is not of uniform diameter along its entire length as it provides larger diameters at the sleeve 31 and at the section 50 and 59.

Each of these relative enlarged diameters is provided for the purpose of capacitive compensation. It will be noted that the width of the housing between the walls 2 and 3 is substantially the diameter of the outer coaxial conductors, while the distance between walls 6 and 7 is substantially greater than the diameter of the outer conductors. This arrangement has been found to be peculiarly adapted to compensate for the capactive reactance which would otherwise occur in the switch. Thus, the substantial space provided at the corners of this housing reduce the capacitive reactance substantially. The large space provided by the rectangular structure, in fact, overcompensates to some extent for the capacitive reactance. This overcompensation, therefore, requires the utilization of the enlarged diameters on the inner conductor in the particular locations set forth above. It has been found that by utilizing a rectangular housing of substantially the relative diameters indicated, the diameter of the inner conductor at the switch may be maintained, thus avoiding the necessity of reducing the power capacity of the switch.

It has also been found that the utilization of the lever arm and ring arrangement adapted to engage the bullets of the two coaxial lines, provides not only a better mechanical action for the switch but additionally provides a further means avoiding reflection of waves within the unit. Thus, this design may be utilized for the transmission of large amounts of power in the ultra high frequency range.

For final adjustment of impedances conductive plates which are relatively thin, may be secured to the side wall of the housing facing the lever arm 49. These plates should be preferably less than the thickness of the housing wall 2 and should have a length and width of approximately no more than one-fourth the length and width of the housing.

Having now described my invention, I claim:

1. A coaxial switch comprising at least two non planar coaxial line terminals each having inner and outer conductors, means forming a pivotable arm electrically continuous with one of said inner conductors and having a free end coplanar with and adapted to be electrically and pivotally engaged with the other of said inner conductors, means for pivoting said arm, means forming an electrically continuous conductor between said outer conductors, and said free end comprising an electrically conductive ring having an inner diameter sized to fit over the end of said other inner conductor in electrical contact.

2. A coaxial switch comprising three mutually perpendicular coaxial line terminals each having inner and outer conductors being arranged tangential to an arc described about the axis of the other inner conductor, means pivotally supporting a conductive arm for arcuate movement over said arc and in electrical contact with said other conductor, said arm having a free end adapted to be selectively electrically engaged with said two inner conductors, and comprising a ring having an inner diameter sized to closely fit and form an electrical contact with the ends of said two inner conductors, and means providing an electrical continuity between said outer conductors.

3. A device as set forth in claim 2 wherein said means providing electrical continuity comprises a rectangular conductive housing with each terminal on a wall adjacent to the walls on which the other terminals are supported.

4. A device as set forth in claim 3 in which the walls of said housing supporting the outer conductors for said two inner conductors are substantially no greater in width than the diameters of said last mentioned outer conductors.

5. A device as set forth in claim 3 wherein said arm and said means supporting said arm are each provided with enlarged diameters along restricted portions of their length whereby reactive compensation is provided.

6. A device as set forth in claim 3 wherein said means supporting a conductive arm comprises a shaft having a portion of its length formed of an insulating dielectric material and a portion formed of conductive material, and bearing means supporting said shaft at either end.

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