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CAPACITIVE SWITCH

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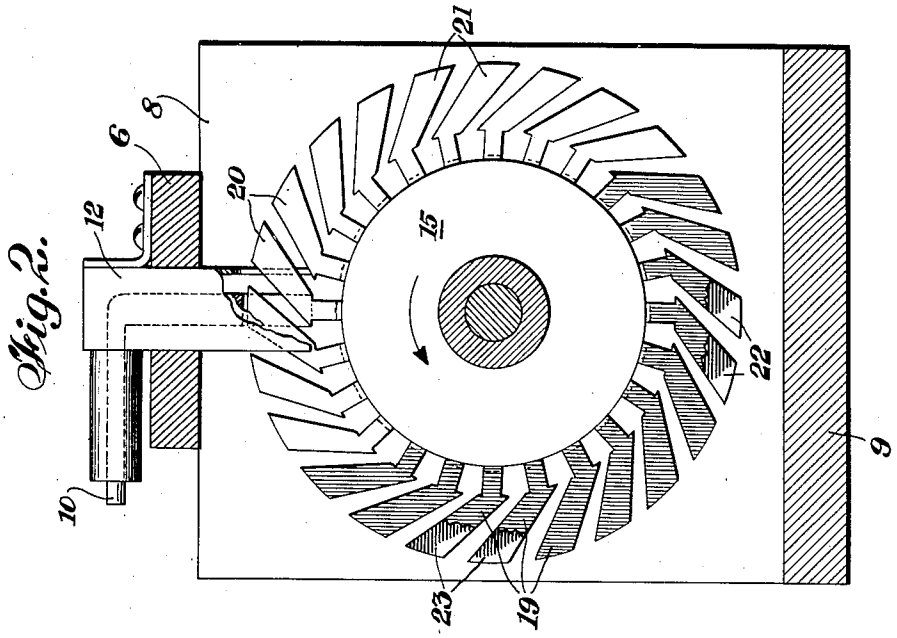

Fig. 2.

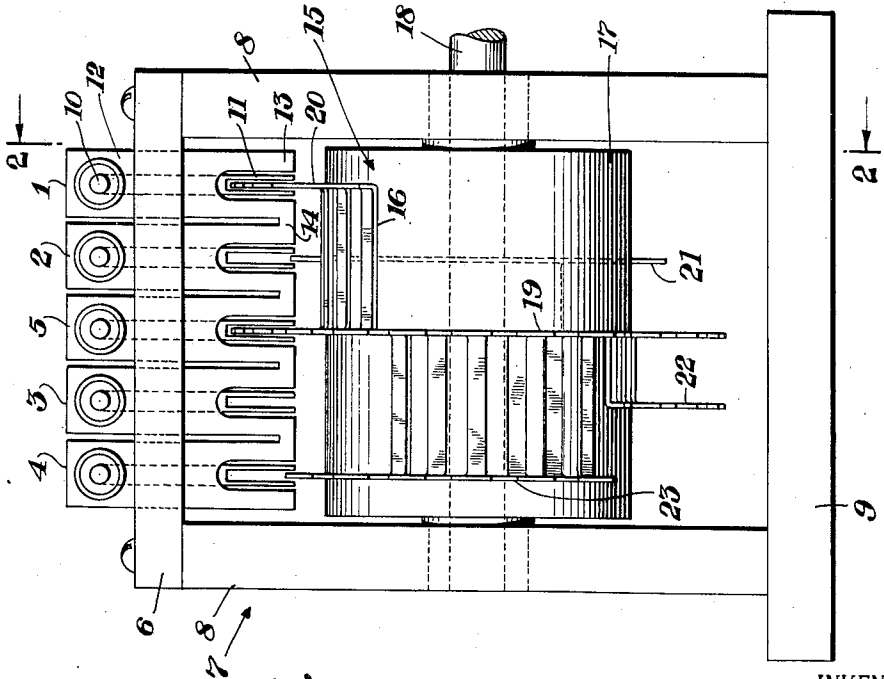

Fig. 1.

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CAPACITIVE SWITCH

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The present invention relates to switches of the capacitive type.

At lower frequencies, capacitance switching has been employed, but at the higher frequencies usually from several hundred to a few thousand megacycles, the dimensions of the ordinary capacitive switch become unduly large relative to the wavelengths employed and consequently at these higher frequencies, transmission line effects are introduced which adversely affect the signal being switched as well as the switching operation itself.

An object of the present invention is the provision of an improved capacitive switch which is suitable for operation at the higher order of frequencies mentioned. A further object of the present invention is the provision of a capacitive switch which is adapted for continuous and cyclical switching, as for example, in a direction finding system.

Other and further objects of the invention will become apparent and my invention will be best understood from the following description of an embodiment thereof, reference being had to the drawings, in which:

Fig. 1 is a front elevational view of a capacitive switch embodying my invention; and

Fig. 2 is a sectional view, partly broken away, taken substantially along the line 2—2 of Fig. 1.

Referring now to the drawing, particularly Fig. 1, in the embodiment there illustrated a plurality of coaxial line terminals 1, 2, 3, and 4 are to be sequentially and cyclically coupled to a common coaxial line terminal 5. Terminals 1, 2, 3 and 4 may be connected to separate sources which are switched to terminal 5 as for example in the co-pending application of H. G. Busignies–90, for "Direction finders," Serial No. 553,598, filed September 11, 1944, in which energy from four goniometers each covering a quadrant of the azimuth is sequentially and cyclically switched to a direction finding receiver. On the other hand, the common terminal 5 may be connected to a single source and terminals 1, 2, 3 and 4 connected to separate loads.

Terminals 1—5 are mounted on the top 6 of a frame 7 having side walls 8—8 and a bottom 9. The frame 7 may be of conductive material which serves to shield the interior of the switch. Front and rear walls (not shown) may be further provided to complete the shielding.

Switching between the various terminals is accomplished by capacitive coupling. For this purpose the inner conductor 10 of each of said terminals 1—5 extends downwardly through the top 6 and terminates at its extremity in a bifurcated portion forming a pair of plates acting as the stator member 11 for the capacitive coupling. The outer conductor 12 of each of said coaxial terminals 1—5 extends downwardly also and is likewise bifurcated at its lower extremity as indicated at 13 and it surrounds and is spaced

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from the inner conductor plates or stator member 11. The bifurcated portions 13 of the outer conductors 12 serve to shield the stator members 11 of each of said terminals from each other, and may be connected together as indicated at 14 for maintaining a common ground potential. This prevents cross-coupling between the stator members and thus eliminates cross-modulations. The outer conductors 12 are preferably also connected to the metallic frame 7 so that said frame also serves as a ground.

Switching is accomplished by means of a capacitive switching member 15 which provides for sequential coupling to the stator members of terminals 1—4 and continuous coupling to the stator member of common terminal 5. The capacitive switching member 15 is comprised of a plurality of U-shaped electrically separated and spaced-apart conductors 16 mounted on a cylinder 17 of insulating material. The cylinder 17 is pivoted for rotation on a central shaft 18 journaled in the side walls 8—8.

The arms of the U-shaped conductors 16 serve as the coupling members and provide coupling to the various stator members. Continuous coupling to the stator member of terminal 5 is provided by a group of central coupling members 19 consisting of one arm of each of said U-shaped conductors 16. The coupling members 19 are mounted on cylinder 17 in line with the stator member of terminal 5 and are closely spaced completely around cylinder 17. The other arms of the U-shaped conductors are divided into four equal groups of coupling members 20—23 which are so spaced laterally that each group is aligned with a separate one of the stator members of terminals 1—4 respectively. Circumferentially, the four groups are spaced so that each occupies a successive quadrant of the circle defined by the circumference of the cylinder 17.

As cylinder 17 rotates, the central coupling members 19 are continuously in coupling relationship with the stator member of terminal 5. If the cylinder 17 is in the position indicated in the drawings, the coupling members 20 are in coupling relationship with the stator member of terminal 1. As the cylinder 17 continues to rotate in the direction of the arrow (see Fig. 2), the coupling members 20 will move out of coupling relationship with the stator member of terminal 1 and the coupling members 21 will move into coupling relationship with the stator member of terminal 2. Then coupling members 22 and finally coupling members 23 will move into and out of coupling relationship sequentially with their stator members connected respectively to terminals 3 and 4. Since coupling members 20, 21, 22 and 23 occupy the entire circumference of cylinder 17, there is no interruption between the quadrants and terminal 5 is at all times coupled to one of the other terminals 1—4.

In order that there be no interruption in the

coupling as each individual coupling member succeeds the next, and in order that the amount of coupling be constant, the coupling members are shaped and arranged as can be best seen in Fig. 2. The coupling members overlap each other and are tapered both to the forward and to the rear ends thereof. As the coupling members move in and out of the stator members, there is a constant amount of total surface of the coupling members which is inserted into the stator member. Thus there is a substantially constant amount of coupling between each of the stators and its coupling members and therefore there is on fluctuation introduced into the energy being switched such as rippling. Furthermore because of the overlapping relationship the coupling is continuous. Each conductor 16 is galvanically separated from the other conductors 16 and each conductor 16 has negligible capacitive coupling to its adjacent conductor 16. Each conductor therefore acts separately from the others. These conductors introduce substantially no transmission line effects because, for example, of their electrical isolation from each other and their relatively small dimensions.

While the embodiment of my invention as described in the foregoing is particularly adapted for direction-finding use, it is obvious that the structure is susceptible of many variations within the scope of the invention depending on the use made of it. For example, in some cases there need not be continuity among the rotor groups of coupling members, either respecting the common terminal or the switched terminals. Furthermore, while as shown the rotor is centrally located, the switch may also be made with a centrally fixed stator and a cylindrical shell about said fixed stator carrying the rotor plates, the shell serving also as a shield.

While I have described above the principles of my invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation on the scope of my invention as defined in the accompanying claims.

I claim:

1. In a capacitive switch, a pair of terminals, a pair of stator members each connected to one of said terminals, and a capacitive switching means comprising a plurality of conductors electrically separated from each other and mounted uniformly circumferentially on a rotatable drum for movement into successive coupling relationship simultaneously with both said stator members said conductors being formed of U-shaped blades having arms extending radially around the periphery of said drum, each arm of said blade being shaped to provide circumferential overlap between the successive blades to provide a substantially constant degree of coupling between said terminals at any position of said switching means.

2. A capacitive switch comprising a common terminal, and a pair of other terminals, and means for sequentially separately coupling said common terminal to said other terminals comprising three stator members each coupled to one of said terminals, a first series of coupling members electrically separated from each other and mounted for movement into successive coupling relationship with the stator member connected to said common terminal, a second series of coupling members electrically separated from each other and mounted for movement into successive coupling relationship with the stator

member connected to one of said other terminals, and a third series of coupling members electrically separated from each other and mounted for movement into successive coupling relationship with the other of said other terminals, the coupling member of said second series being electrically connected to some of the coupling members of the first series, the other coupling members of the first series being electrically connected to the coupling members of the third series, and means for moving a connected pair of coupling members simultaneously into coupling relationship with their associated members.

3. A capacitive switch according to claim 2 wherein said moving means further comprises a drum and said coupling members are mounted on said drum and adapted to be rotated for continuously and cyclically switching between said common terminal and the other terminals.

4. A capacitive switch according to claim 2 wherein each of said connected pairs of coupling members are in the form of a U with the arms thereof forming the coupling members and the bottom thereof connecting said coupling members.

5. In a capacitive switch, a pair of terminals, a pair of stator members each connected to one of said terminals, a plurality of coupling members electrically separated from each other and mounted for movement into successive coupling relationship with one of said stator members, a second plurality of coupling members electrically separated from each other and mounted for movement into successive coupling relationship with the other of said stator members, each of said first mentioned plurality of coupling members being electrically connected with a separate one of said second plurality of coupling members, and means for moving the connected pairs of coupling members simultaneously into coupling relationship with their associated stator members, each of said connected pairs of coupling members being in the form of a U with arms thereof forming the coupling members and the bottom thereof forming the connection therebetween.

6. A capacitive switch according to claim 5 in which the coupling members are mounted on a rotatable drum said members being formed of blades extending radially around the periphery of said drum and said blades formed to provide a circumferential overlap between successive blades such that at least one coupling member of one of said pluralities is always in coupling relationship with its associated stator member as said pluralities move into and out of coupling relationship.

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