June 26, 1951 J. M. L. JANSSEN ET AL 2,558,707

ELECTRICAL SWITCH ARRANGEMENT

Filed Sept. 28, 1949

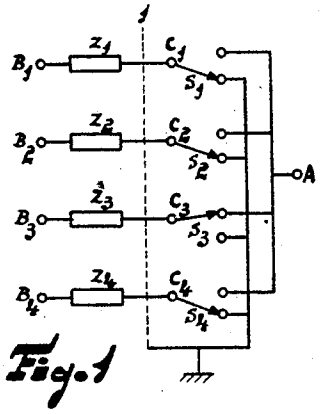


Fig. 1

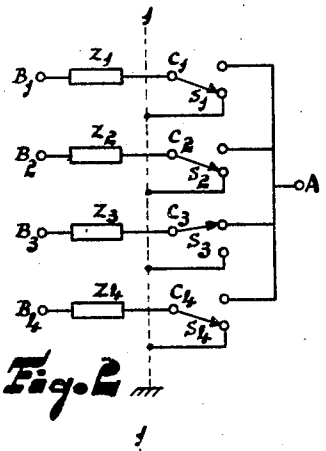


Fig. 2

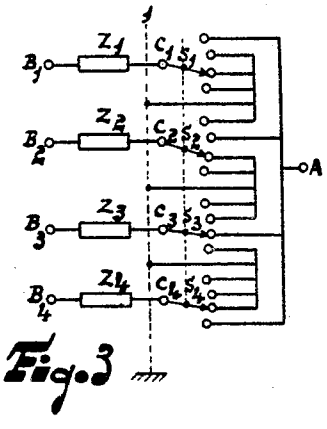


Fig. 3

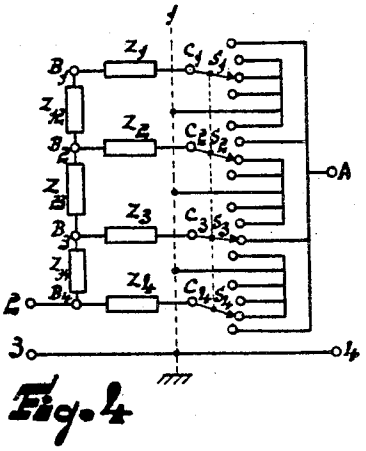


Fig. 4

INVENTORS
JOHANNES MARINUS LODEVICUS JANSSEN
ANDRE WILLEM STORM
BY
Fred Wm. Vogel
AGENT

Patented June 26, 1951

2,558,707

UNITED STATES PATENT OFFICE

2,558,707

ELECTRICAL SWITCH ARRANGEMENT

Johannes Marinus Lodevicus Janssen and Andre Willem Storm, Eindhoven, Netherlands

Application September 28, 1949, Serial No. 118,392
In the Netherlands October 1, 1948

2 Claims. (Cl. 178—44)

1

This invention relates to electrical switch arrangements by means of which a first terminal is adapted to be connected electrically to any one of a plurality of other terminals. The invention also relates to electrical attenuators comprising such a switch arrangement.

With the use of such switch arrangements, it often happens that the contacts of a selector switch from which a selection may be made carry voltages of which the frequencies and/or values vary greatly. If the first contact is connected to any one of the switch contacts, the desired voltage from the switch contact is set up at the first contact together with an undesired voltage. This undesired voltage is due to the coupling of the first contact and the switch contact connected thereto with other switch contacts by way of the parasitic capacities present in the selector switch. Furthermore, similar coupling between the switch contacts when not in use may also cause trouble.

It is known to counteract such undesired coupling by surrounding the first contact, the switch contact connected thereto and the means connecting these contacts, which means usually consists of a movable wiper, by shielding means. If a connection is to be established to a different switch contact, the shielding means is consequently required to be movable, for example is required to follow the rotation of the wiper. However, such a switch is expensive due to its special construction.

It is also known to earth the switch contacts not connected to the first contact. It is clear that, as a result thereof, the detrimental effect of the parasitic capacities between the switch contacts and the first contact is also removed. However, such earthing is not often possible in view of difficulties which would arise in circuit-arrangements connected to the switch and supplying voltages to the switch contacts.

The present invention has for its object to provide a switch arrangement in which the aforesaid disadvantages are mitigated.

According to the invention, an electrical switch arrangement by means of which a first terminal is adapted to be connected electrically to any one of a plurality of other terminals, of which terminals the terminals not connected to the first terminal are electrically connected to earth is characterized in that the other terminals are each connected, by way of an impedance, to any one of a plurality of further terminals and means are provided for connecting the first terminal to one of the further terminals, selected at will, and for earthing the further terminals

2

not connected to the first terminal, electrostatic shielding means being provided, at one side of which the other terminals and the impedances, and at the other side of which the first terminal and the further terminals are located.

Consequently, all of the other terminals not in use are connected to earth by way of an impedance, whereas the selected other terminal is connected, likewise by way of an impedance, to the first terminal. In general, it is possible to select these impedances such that on the one hand earthing, by way of the said impedance, of the other terminals not in use does not involve trouble, and on the other hand the impedance present between the selected other terminal and the first terminal does not involve trouble. In the present case, the parasitic capacities occurring between the further terminals and the first terminal are harmless, since the further terminals do not carry voltage, inasmuch as they are not connected to the first terminal. Therefore, at the side of the shielding means where the first terminal is located, there are no voltages other than those set up at the first terminal and the further terminal connected thereto. The other terminals located at the other side of the shielding means and the impedances connected thereto will exhibit parasitic capacities with respect to each other, it is true, but since no movable connections need be present in this part of the switch arrangement, elimination of the detrimental effect of these parasitic capacities does not constitute a problem. This may be effected in a manner known per se.

It is obvious that the switch arrangement according to the invention may be used with advantage when trouble is likely to be experienced from parasitic capacities. This applies more particularly to attenuators which are adjusted in step by means of a switch arrangement, since in this case voltages are set up at the different selector contacts, of which the magnitude may greatly vary and on the other hand the accuracy often aimed at with these attenuators must not be adversely affected by parasitic capacities present in the switch arrangement. With the use of the switch arrangement according to the invention, in an electrical attenuator a simplification is achieved by providing that the impedances connecting the other terminals to the further terminals form part of the attenuator network.

In order that the invention may be more fully understood and readily carried into effect, it will now be described more fully with reference to the

accompanying drawing, given by way of example, in which:

Figs. 1, 2 and 3 represent switch arrangements according to the invention, Fig. 4 showing an electrical attenuator comprising a switch arrangement according to the invention.

By means of the switch arrangement shown in Fig. 1, a first terminal A is adapted to be electrically connected to any one of four other terminals B_1, B_2, B_3 and B_4. To this end, the other terminals are connected, by way of impedances Z_1, Z_2, Z_3 and Z_4 to further terminals C_1, C_2, C_3 and C_4, respectively. By means of the selector switches S_1, S_2, S_3 and S_4 any one of the further terminals may be connected to the first terminal A, the further terminals not so connected being connected to earth. Earthed electrostatic shielding means are placed between the impedances Z and the further terminals C. In the position of the selector switches represented the first terminal A is directly connected to the further terminal C_3 and, by way of impedance Z_3 electrically connected to the other terminal B_3. The further terminals C_1, C_2 and C_4 are earthed. The other terminals B_1, B_3 and B_4 are not directly earthed which, as has been pointed out, would involve unwanted effects, but are connected to earth by way of impedances Z_1, Z_2 and Z_4. If, for instance the first terminal A is required to be electrically connected to the other terminal B_1, the selector switches S_1 and S_3 must be changed over, due to which the first terminal A is directly connected to the further terminal C_1, and the further terminal C_3 is earthed.

In the remaining figures corresponding parts bear the same reference numerals.

Fig. 2 represents a switch arrangement according to the invention, in which the further terminals C not connected to the first terminal A are connected directly to the shielding means 1. This often yields somewhat better results than the switch arrangement shown in Fig. 1.

With the switch shown in Figs. 1 and 2 it is necessary to operate the selector switches S_1, S_2, S_3 and S_4 separately or to operate them jointly by means of a cam disc, or the like. In the construction shown in Fig. 3, a number of identical, mechanically coupled selector switches S_1, S_2, S_3 and S_4 is provided for connecting the first terminal A to the further terminals C, which number corresponds to the number of further terminals C i. e. four in the case under view. Each of these selector switches comprises four switch contacts, of which one is connected to the first terminal A. The three remaining switch contacts are connected to earth or to the earthed screen 1. The selector switches are so coupled that in each position only one of the further terminals C is connected to the first terminal A, whereas the remaining further terminals C are earthed. The selector switches S may, as in Fig. 3, be selector switches of usual type, since the parasitic capacities are not troublesome. Alternatively, by using the electrically somewhat more complicated selector switches known per se for wavelength changing in radio sets, the number of selector switches, four in the example given, may be reduced such that a single selector switch is sufficient.

Fig. 4 represents an attenuator comprising a switch arrangement according to the invention. This attenuator comprises two pairs of output terminals 2, 3 and A, 4 either of which may be used as input terminals or output terminals. The attenuator comprises the series-connected

impedances Z_{34}, Z_{23} and Z_{12}. This series arrangement is connected to the parallel-impedances Z_1, Z_2, Z_3 and Z_4 as shown in the drawing. The number of attenuator cells operative between the two pairs of output terminals of this attenuator is adjustable by means of the selector switches S_1, S_2, S_3 and S_4. The terminal 2 is connected to the series-arrangement, terminals 3 and 4 being earthed. It is known per se to connect the first terminal A, by way of a selector switch, to any one of points B of the attenuator network, in which case all points C are earthed. As has been pointed out, trouble is then experienced from the parasitic capacities occurring in the switch arrangement, and it is advantageous to use the switch arrangement according to the invention. Simplification is achieved by using the impedances Z_1, Z_2, Z_3 and Z_4 initially present in the attenuator, for the impedances required for the connection of points B and C in the switch arrangement according to the invention. Therefore, the part of Fig. 4 on the right hand side of the shielding means 1, together with the impedances Z_1, Z_2, Z_3 and Z_4, is exactly similar to Fig. 3. One of points C, in the position of the switches represented, point C_3 is connected to the first terminal A, the remaining points C being earthed. Consequently, the circuit-arrangement of this attenuator is slightly different from the usual arrangements, since one of points C is consistently not earthed. This should be taken into account in choosing the value of the attenuator impedances and may, if desired, result in a constant input and/or output impedance similarly to the usual arrangements.

If trouble is experienced from the capacities between the points B and the impedances at the left hand side of the shielding means 1, known measures may be taken for reducing this trouble.

What we claim is:

1. An electrical attenuator comprising a first group of impedances, a first plurality of connector means interconnecting said first group of impedances in series, a second group of impedances, a second plurality of connector means interconnecting one terminal of each of said second group of impedances into each of said first plurality of connector means at points therein, respectively, a selector switch means connected to the other terminal of each of said second group of impedances, respectively, first and second pairs of output terminals one of said first pair of terminals being connected to said first group of impedances in series therewith, each of said selector switch means including pole means for selectively interconnecting with one of said second pair of terminals, shielding means between said selector switch means on one hand and said first and second groups of impedances on the other, both of the others of said first and second pairs of terminals being connected to said shielding means, and other pole means included in said selector switch means for connecting said shielding means into all of the remaining switch means upon selective connection of said one of said second pair of terminals to one of said switch means.

2. An electrical attenuator comprising a first group of impedances consisting of a predetermined number thereof, a first plurality of connector means interconnecting said first group of impedances in series, a second group of impedances consisting of said predetermined number plus one, a second plurality of connector means interconnecting one terminal of each of said second group of impedances into each of said first plurality of connector means at points therein, respectively, a

selector switch means connected to the other terminal of each of said second group of impedances, respectively, first and second pairs of output terminals, one of said first pair of terminals being connected to said first group of impedances in series therewith, each of said selector switch means including pole means for selectively interconnecting with one of said second pair of terminals, earthed shielding means between said selector switch means on one hand and said first and second groups of impedances on the other, both of the others of said first and second pairs of terminals being connected to said shielding means, and other pole means included in said selector switch means for connecting said shielding

means into all of the remaining switch means upon selective connection of said one of said second pair of terminals to one of said switch means.

JOHANNES MARINUS
LODEVICUS JANSSEN.
ANDRE WILLEM STORM.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,223,585	Tarpley	Dec. 3, 1940