Oct. 21, 1958 D. BERTIN 2,857,528

ELECTRIC SWITCHING SYSTEM

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FIG. 1

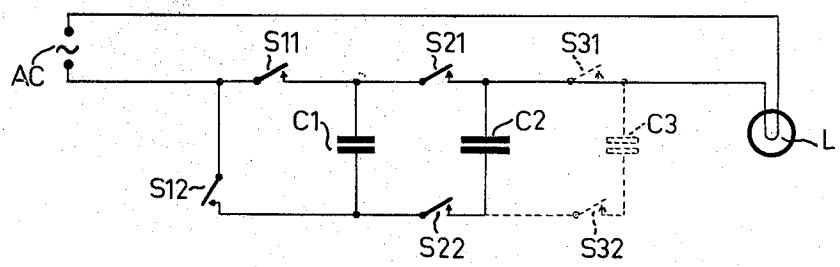
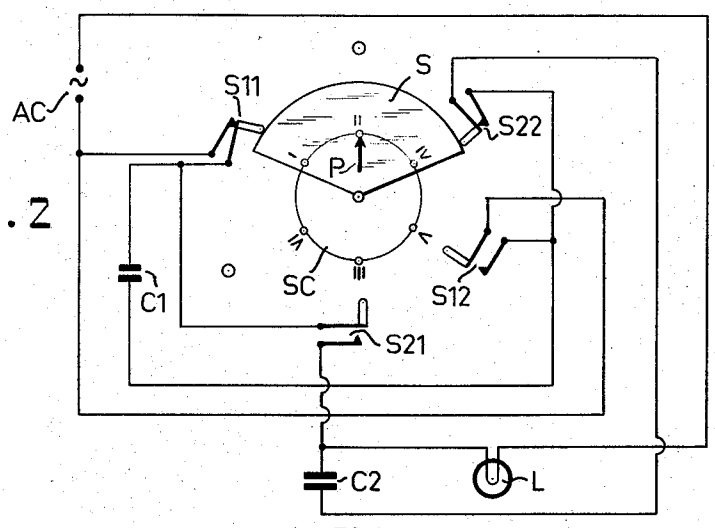


FIG. 2



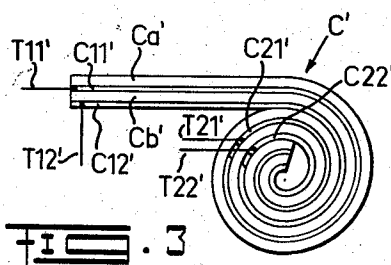


FIG. 3

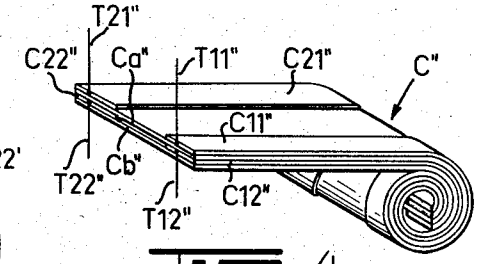


FIG. 4

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ELECTRIC SWITCHING SYSTEM

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3 Claims. (Cl. 307—115)

My present invention relates to an electric switching system adapted to vary the amount of current delivered to a load, e. g. a light bulb, in a plurality of predetermined stages.

In the case of alternating-current power supplies it has already been proposed to provide a plurality of fixed condensers adapted to be selectively connected in circuit with the load, so as to act as low-loss series impedances therefor. The necessity of providing a separate condenser for each switching stage, however, appears to be responsible for the fact that such systems have heretofore found little, if any, commercial use.

It is an object of my invention to provide a switching system of the character indicated in which a considerable number of switching stages, ranging from (preferably) no-current to maximum-current condition, are obtained with the aid of only a relatively small number of fixed condensers.

It is another object of my invention to provide a compact single unit adapted to serve as a multiple condenser for the purpose set forth.

A feature of the present invention resides in the provision of a switching arrangement for selectively connecting two or more condensers of different capacities individually or jointly (in parallel, in series, or in series-parallel) between a source and a load, whereby as many as six different conditions are obtainable with a single pair of condensers; this number is multiplied in the case of three or more condensers.

Another feature of the present invention is the provision of a rolled condenser unit comprising a flexible support, usually in the form of a pair of dielectric strips, bearing at least two mutually insulated conductive layers on one surface and leads for establishing conductive contact with each of these layers, each such layer forming part of a respective condenser.

A further feature of the present invention is constituted by the provision of a single switch adapted to bring about all the aforementioned operating conditions available with two associated condensers.

The invention will be described in greater detail with reference to the accompanying drawing in which:

Fig. 1 diagrammatically shows a circuit arrangement embodying the invention;

Fig. 2 more specifically shows a switching device adapted to be used in a two-condenser circuit arrangement of the general type illustrated in Fig. 1; and

Figs. 3 and 4 show two condenser units each adapted to be included in the arrangement of Fig. 1 or 2.

In Fig. 1 there has been shown a source of alternating current A. C., a load L symbolized as a lamp, and a pair of condensers C1, C2. The two terminals of condenser C1 are connected by way of respective switches S11, S12 to the lower terminal of source A. C.; the two terminals of condenser C2 are connected to corresponding terminals of condenser C1 by way of respective switches S21, S22. The upper terminal of condenser C2 is connected directly to one side of load L whose other side is connected directly to the upper terminal of source A. C.

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It will be seen that with the arrangement of Fig. 1 the following six distinct conditions are possible:

(I) Not more than one of the four switches S11—S22 closed: Open circuit; the lamp L is extinguished. (The same situation exists if only the pair of switches S11, S12 or the pair of switches S21, S22 are closed.)

(II) Switches S11 and S22 closed: A circuit is closed from source A. C. to load L by way of condensers C1 and C2 in series; this represents the maximum finite circuit impedance available and the lamp L burns with a low glow.

(III) Switches S12 and S21 closed: Condenser C1, assumed to represent the smaller one of the pair, is now alone connected in series with source A. C. and load L; the lamp burns a little brighter.

(IV) Switches S12 and S22 closed: The larger condenser C2, alone, is now in series with the load; lamp L thus receives somewhat more current.

(V) Switches S12, S21 and S22 are closed: Both condensers C1 and C2 are now connected in parallel with each other between the source and the load, the combined impedance of these condensers being thus at a minimum and allowing the passage of a still larger current.

(VI) Switches S11 and S21 closed: Lamp L is connected directly across source A. C. and receives maximum current.

It will be noted that the condensers C1, C2 with their associated switches S11, S12 and S21, S22 represent sections of a ladder-type network which could be extended at will, if desired, by including one or more additional sections such as a condenser C3 and switches S31, S32 shown in dotted lines. In the light of the foregoing it will be apparent that in such case each of the three condensers may be individually connected in circuit, that two or all three of them may be connected either in series or in parallel with one another, and that series-parallel combinations are possible (e. g. by closing switches S11, S22, S31 and S32, thereby placing condenser C1 in series with the parallel combination of condensers C2 and C3). A substantially larger variety of operative conditions is thus made available.

In Fig. 2 the system of Fig. 1, limited to the two condensers C1 and C2, has been redesigned in such manner as to enable the use of a single switch member S, shown as a sectoral cam, to operate all of the switch contacts S11, S12, S21, S22 in the various combinations described. Cam sector S is of transparent material and carries a pointer P which co-operates with a scale SC whose six positions, representing respective corners of a hexagon designated I through VI, correspond to the six operating conditions previously outlined. For physical reasons these positions, corresponding to progressively greater brightness of lamp L, do not follow one another in their natural order on scale SC.

It will be seen that switch contacts S11 and S22 are spaced 120° apart around the periphery of switch member S and that switch contacts S12 and S21 follow contacts S22 at 60° intervals, the spacing between contacts S21 and S11 thus being again 120°. In switch position I, therefore, only contacts S11 are closed so that lamp L will be open-circuited as previously noted. In position II, which is the one illustrated in the drawing, contacts S11 and S22 are closed simultaneously, and in subsequent positions the results outlined above will similarly be obtained. Rotation of switch member S, therefore, controls the energization of lamp L in six stages from total darkness to maximum light.

In Fig. 3 I have shown a condenser unit C′ comprising a pair of flexible dielectric strips Ca′, Cb′ superimposed

upon each other and wound into a roll. Strip *Ca'* carries a conductive layer C11' over part of its length and another conductive layer C21', separated by a gap from layer C11', over the remainder of its length. Strip *Cb'* carries similar conductive layers C12' and C22' coextensive with layers C11' and C21', respectively. Terminal leads T11', T12', T21', T22' connect with layers C11', C12', C21', C22', respectively.

It will be seen that strips C11' and C12' together constitute a condenser which may be the element C1 of Figs. 1 and 2, strips C21' and C22' similarly constituting a condenser representative of element C2.

Fig. 4 shows a somewhat similar condenser unit C'' comprising a pair of dielectric strips *Ca''* and *Cb''*. Strip *Ca''* carries two parallel, spaced-apart conductive layers C11'', C21'' extending over its entire length; strip *Cb''* carries two similar layers C12'', C22'' coextensive with layers C11'', C21, respectively. With this arrangement not only the terminal leads T11'', T12'' of condenser C11'', C12'' but also the terminal leads T21'', T22'' of condenser C21'', C22'' may be connected to their respective conductor strips at the outer end of the roll C''.

Whereas in unit C' of Fig. 3 the conductor strips C11' and C21' should be of different lengths in order to bring about a difference in capacitance, such result will be accomplished in the case of unit C'' by making the strips C11'' and C21'' of different widths.

It will be understood that the number of conductor layers carried on a dielectric supporting strip either side by side, as in Fig. 3, or following one another, as in Fig. 4, may be greater than two so that three or more condensers may be combined in a single unit. It will also be apparent, on the other hand, that in some cases the layers on one side of the supporting strip may be combined into a single layer, thereby providing a plurality of condensers permanently connected together at one of their plates.

The invention is, of course, not limited to the specific embodiments described and illustrated but is susceptible of various modifications and adaptations within the spirit and scope of the appended claims.

I claim:

1. An electric switching system comprising a source of alternating current, a load, and a pair of ladder-type network sections connected in series between said source and said load; one of said sections including a first condenser, a first switch and a second switch for selectively connecting a terminal of said source to opposite terminals of said first condenser; the other of said sections including a second condenser, a third switch and a fourth switch for selectively connecting said source terminal to opposite terminals of said second condenser in series with said first and second switches, respectively; and conductor means completing a circuit independent of said switches from a terminal of said second condenser to said source by way of said load.

2. A system according to claim 1, further comprising operating means for selectively closing said switches in the following combinations: first and fourth; second and third; second and fourth; second, third and fourth; first and third.

3. A system according to claim 2, wherein said first, fourth, second and third switches are positioned in that order at respective corners of a hexagon, said first switch being positioned between two unoccupied corners of said hexagon, said operating means comprising a cam member pivoted centrally of said hexagon and spanning an angle in excess of 120°.

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