Feb. 17, 1931. F. A. HINSHAW 1,792,496

SWITCHING DEVICE

Filed May 25, 1929

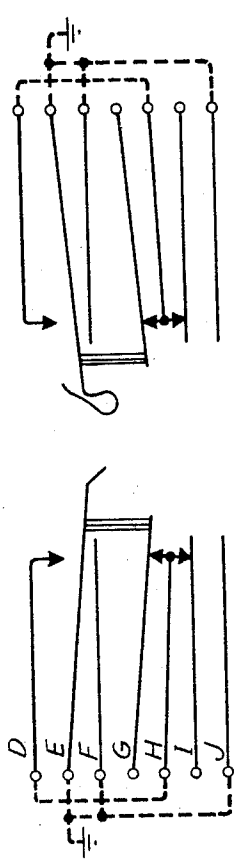

FIG. 2

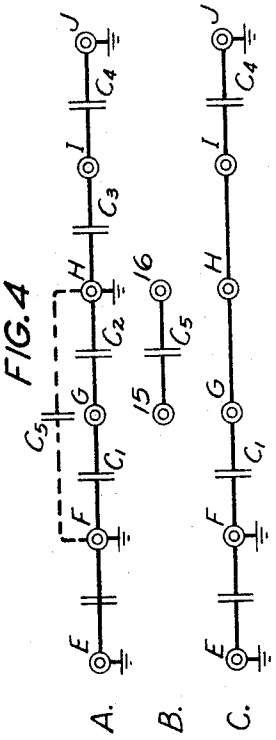

FIG. 4

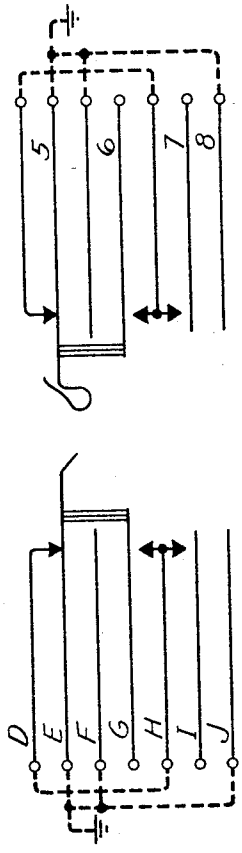

FIG. 3

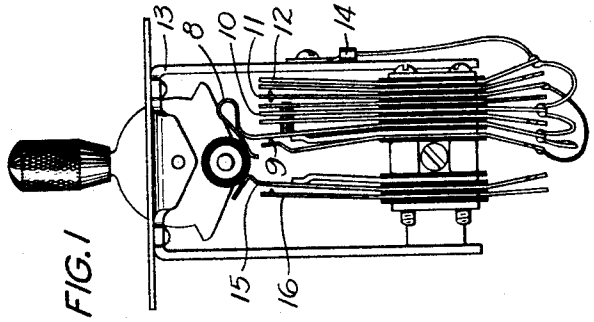

FIG. 1

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UNITED STATES PATENT OFFICE

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SWITCHING DEVICE

Application filed May 25, 1929. Serial No. 365,819.

This invention relates to circuit controlling devices and more particularly to switches employed in high frequency testing circuits.

Circuit controlling switches such as telephone keys have, as parts thereof, a plurality of constact springs or the equivalent. In such key constructions it is necessary that each of these contact springs be insulated from adjacent contact springs in order to prevent a flow of current between springs when they are in their unoperated positions. It is further necessary in such key constructions, particularly when employed in high frequency alternating current circuits, that some means be provided for preventing "spilling over" or "pick-up" between open contacts, a condition which occurs when large differences in voltage or current levels are encountered.

The basic remedy for such an objectionable feature is to decrease the capacity between open contact points of such keys. Heretofore attempts have been made to obtain such a remedy by decreasing the exposed surfaces of adjacent contact springs, thereby cutting down the capacity. Owing to the mechanical requirements of such structures, this method can only be employed within certain limits, so that, though the capacity is reduced, its magnitude is such as to still cause trouble in some circuits.

In most studies of alternating current and particularly in testing circuits involving the use of alternating currents within the carrier and radio frequency ranges, it is desirable that this capacity between open contact springs be reduced to a minimum so that tests made, may be uninfluenced thereby and be accurate and dependable.

It is the object of this invention to reduce the capacity existing between open contact points of switching devices associated with high frequency circuits.

This object is attained in accordance with a feature of the invention, by the provision of grounded shielding springs which are located between adjacent contact springs and extend the entire length thereof.

The invention will be readily understood from the following detail description made with reference to the accompanying drawing in which Fig. 1 is a side elevation of a telephone key embodying the features of this invention; Figs. 2 and 3 are schematic representations of key spring pile-ups in their operated and unoperated positions respectively, and show the adaptation of applicant's invention thereto; Fig. 4 is a schematic showing the various distributions of capacities—(A) shows the distribution of capacities in the spring pile-up shown in Fig. 3, (unoperated); (B) shows the capacities in a pile-up of the type shown in Figs. 2 and 3 when the shielding springs are omitted; and (C) shows the distribution of capacities in the spring pile-up shown in Fig. 2, (operated).

It is believed unnecessary to enter into a detailed description of the mechanical construction of the key shown in Fig. 1, as this key is of the well known lever type and has been chosen merely for the purpose of exemplifying one of the applications of the invention.

However, it is pointed out that the front springs only are disclosed, it being understood that similar sets of springs under ordinary conditions are mounted on the back of the key structure. The left hand spring pile-up is shown unshielded whereas the shielding springs 10, 11 and 12 are employed in the right hand spring pile-up. Springs 10 and 12 are shown grounded to the key frame 13 by means of the ground clamp 14. The grounding of the shielding springs to the key frame may assume any desirable construction and applicant does not intend to be limited to the exact method disclosed. Spring 11 is shown connected to spring 9 which engages with spring 8 when the switch is in the non-operate position. Spring 8 is connected to the ground clamp 14. The shielding springs extend the entire length of the contact springs.

Referring to Figs. 2 and 3 the shielding springs F and J are shown permanently connected to ground, whereas spring H is grounded only when the pile-up is in its normal or unoperated position, as shown in Fig. 3. When operated, as shown in Fig. 2, the spring E is removed from engagement with spring D thereby removing ground from

springs D and H which are strapped together.

Ordinarily, that is, in a spring pile-up to effect the same spring combinations from a circuit standpoint, as are effected by those disclosed in Figs. 2 and 3, but two springs would be required, namely springs 15 and 16 as disclosed in Fig. 1. The distribution of capacities between such springs is schematically represented by (B) in Fig. 4. It is readily observed that between each pair of springs, (the springs being represented by the small concentric circles 15 and 16 Fig. 4—B) there is an appreciable capacity C_5, the value of which depending to some extent upon the surface area of the springs. With the inclusion in the spring pile-up, of grounded shielding springs F, H and J the distribution of capacities is as represented at (A), Fig. 4. By comparing the two schematics (A) and (B) of Fig. 4, it will be observed that the capacity C_5 between open switch points, springs G and I, disclosed in Figs. 1 and 3 and 15 and 16 disclosed in Fig. 1, has been changed in each case from a capacity between open switch points to a capacity such as C_1, C_2, C_3 and C_4 from each switch point to ground. This materially reduces the capacity C_5 between open switch points in pile-ups of this character and minimizes the objectionable effects incident thereto, such as leakage, pick-up, etc.

When the spring pile-up is operated as in Fig. 2, the ground connection is removed from spring H, since in this particular spring combination, spring H serves as a contact carrying spring and takes part in the circuit controlled by springs G and I. The schematic (C) of Fig. 4 indicates the distribution of capacities when the spring pile-up is operated. It will be observed, as in (A) Fig. 4, that each capacity between springs still is connected directly to ground.

The ground springs J and F serve to shield the spring from the capacity effect produced by the key frame, or whatever is used as a mounting for the springs.

Though applicant has disclosed a key structure, it is to be understood that the invention is not to be limited to this particular application. Relay springs and any other types of springs that are employed to control electrical circuits may be protected in the same manner as described in connection with the key structure disclosed.

What is claimed is:

1. A circuit controlling device comprising a plurality of contact members, means associated with said contact members for making and breaking contact therebetween and an electrostatic shield extending the entire length of said contact members and interposed therebetween.

2. A circuit controlling device comprising a plurality of contact carrying springs, means for actuating said springs and permanently grounded spring members interposed between certain of said contact carrying springs.

3. A circuit controlling device comprising a plurality of contact springs, means for actuating said springs, shield springs interposed between said contact springs and a ground connection for said shield springs, some of said shield springs being permanently secured to said ground connection and others secured thereto only when the circuit controlling device is in its unoperated position.

4. A circuit controlling device comprising a plurality of circuit controlling springs, means for actuating said springs and electrostatic shield springs interposed between certain of said circuit controlling springs, certain of said shield springs serving as a contact spring upon the operation of said spring actuating means.

5. In a key structure, a mounting frame, a plurality of contact springs secured to said frame, other spring members interposed between said contact springs, a ground clamp secured to said mounting frame with which certain of said other spring members are permanently associated and means for actuating said contact springs.

In witness whereof, I hereunto subscribe my name this 23d day of May, 1929.

FOSTER A. HINSHAW.