

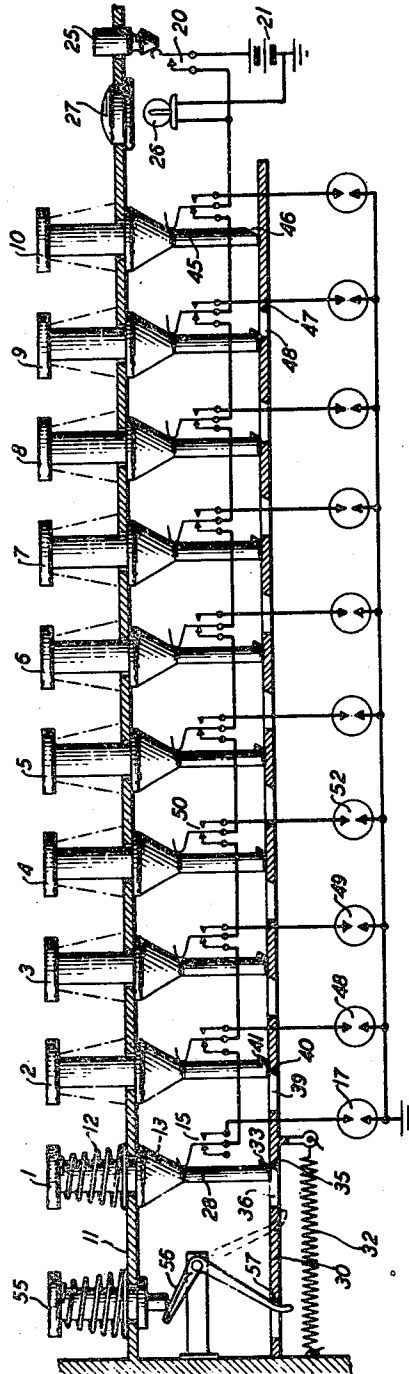
June 8, 1948.

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2,442,766

CIRCUIT CONTROLLING SWITCH

Filed March 8, 1945



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2,442,766

CIRCUIT CONTROLLING SWITCH

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Application March 8, 1945, Serial No. 581,593

6 Claims. (Cl. 200—5)

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This invention relates to circuit controlling systems and particularly to contact operating mechanisms and circuit arrangements controlled thereby.

An object is to simplify and improve such circuit controlling systems.

Another object is to increase the utility and reliability of operation of such systems as well as to simplify and improve the control and manipulation characteristics of such systems.

Heretofore circuit controlling devices have been used comprising a plurality of hand-operated keys or plungers for controlling individual springs and circuit connections and in which when one of the keys is operated it is locked in operated position and any previously operated key is released from its locked position under control of a common locking and releasing plate. In some instances the plungers were provided with cone shapes or wedge-shaped projections which acted on the locking and releasing plate to perform these functions.

The present invention relates to these types of circuit controlling devices and a feature thereof is a locking and releasing arrangement associated with a series of plunger keys operating separate sets of springs controlling separate circuit connections, whereby the plungers can only be operated in a definite order and whereby the operation of the first plunger in the series causes it to be locked in operated position and causes the next succeeding plunger to be freed for operation. The operation of this second plunger then causes the first plunger to be released and prevented from being reoperated while it is itself locked in operated position and frees the next succeeding plunger for operation. These operations are repeated during the succeeding operations of the plungers in the series until the last plunger is operated. This last plunger is, however, not locked in the operated position but frees the first plunger for reoperation. Thus the succeeding circuits are only operated and restored in the definite order in which the plungers are operable.

Another feature is a special plunger which operates contacts to enable the succeeding circuit connections established by the operation of the circuit controlling plungers to perform their assigned functions and by this means any group or any single one of these circuit connections may be enabled or disabled during the operation of the succeeding plunger.

Another feature is an additional plunger arrangement whereby after any one of said circuit controlling plungers has been operated this plunger may be released and all of said plungers except the first disabled.

Another feature is a signal arrangement to indicate the operation of the special enabling

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plunger. This control system may be employed for various purposes in which circuit connections are to be closed in succession in a definite order or where certain connections in preference to others are to be selected and enabled. For example, the system may be used in the firing of fuses for igniting explosive charges to discharge rockets in rocket launching devices where the rockets must be fired in the definite order or where single or groups of rockets are to be fired.

The invention has been illustrated in the accompanying drawing in which a series of ten plungers are arranged in a structure suitable to operate individual circuits.

Referring now to the drawing, the circuit controlling plungers 1 to 10 are arranged in a row in openings in a mounting plate 11 and are held in normal position by individual helical springs such as 12 for plunger 1, the normal position being determined by a cone-shaped projection such as 13 engaging the underside of plate 11 when the plunger is in normal position. Each cone-shaped projection 13 operates on a corresponding set of contact springs 15 to open the left-hand connection and close the right-hand connection when the corresponding plunger is depressed. The right-hand spring of each set of contacts 15 may be wired to one terminal of an individual fuse firing mechanism such as contacts 17 for the first plunger and the other contacts of all the fuse-firing mechanisms may be wired to ground. The middle spring and the left-hand spring of these sets of contacts 15 are wired in a series connection through special contacts 20 and battery 21 to ground. These special contacts 20 are operated to close on the operation of the special plunger 25 mounted in plate 11. Across contacts 20 and the battery 21 is wired a lamp 26 which is lighted when contacts 20 are closed to shine through the lens 27 mounted on the plate 11 to indicate that the contacts 15 are enabled for operation by their respective plungers.

The lower end of each plunger is provided with a stem such as 28, for plunger 1 and these stems except the first are normally in a position to be blocked from movement or downward depression by a locking and releasing plate 30 when this plate is in its normal position where it is held by a spring 32. The stem 28 of the first plunger, when depressed will engage by means of its locking projection 33 a slanting surface 35 of the opening 36 in the plate 30 and thereby shift this plate towards the right. Similar openings are provided for the other plungers but in such position that none of these plungers can normally be depressed by having its stem enter the associated opening in plate 30 when this plate is in normal position. However, after plunger 1 is operated, the projection 33 will lock under the plate 30 as the plate springs back slightly after the pro-

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jection 33 passes the slanting surface 35 in opening 36. The plate 30 is therefore not released back to its normal position but remains shifted towards the right sufficient to permit plunger 2 to be operated as the opening 39 will then have its slanting surface 40 opposite the projection 41 of plunger 2 and then if plunger 2 is depressed the plate 30 will be shifted an additional distance towards the right and this plunger 2 will then be locked in actuated position under the plate by the projection 41 engaging the undersurface thereof. As the plate is thus shifted by plunger 2, it causes the release of plunger 1 from its actuated position as the projection 33 will be disengaged from the undersurface of the plate and this plunger 1 allowed to return to normal under tension of spring 12, this additional shifting of the plate will also free plunger 3 for operation. Thus these openings in plate 30 provided for the succeeding plungers are so arranged that on the operation of a succeeding plunger, the preceding plunger is released and prevented from being separated, the plunger depressed is locked and the next succeeding plunger freed for operation. By this means the contact sets 15 will be successively operated and released as the plungers are operated in succession in a definite order. When the last plunger 10 is depressed, it will be noted that this plunger has on its stem 45 merely a slanting surface 46 which engages the slanting surface 47 of the opening 48 for this plunger which causes the plate to be further shifted towards the right and thereby releases the preceding plunger 9 while plunger 10 will be permitted to return to normal. As this plunger 10 returns to normal it permits the plate 30 to return to its normal position as shown in this figure and therefore free plunger 1 for a second operation. If before the plungers 1 to 10 are operated in this manner key 25 is depressed, circuits will be completed from battery 21, contacts 20 through the various succeeding contact sets 15 to operate their respective fuse firing mechanisms by the circuits established between the middle spring and the right-hand spring in each set 15 as it is operated. It is therefore seen that the fuses can only be fired in a definite order as under no circumstances can the plungers be depressed except in the order from 1 to 10.

It is however evident that any fuse or group of fuses may be selected for firing during the operation of the plungers in sequence. For example, if the first three fuses 17, 48 and 49 are not to be fired the plunger 25 is not operated immediately but plungers 1, 2, 3 and 4 are first operated and key 25 is then operated to close the circuit from battery through contacts 20 and contacts 50 to fire fuse 52. Then if the succeeding fuses are to be fired, the succeeding plungers are operated in succession. If it is desired to fire only a single fuse or a limited number of the succeeding fuses, the plungers up to and including the plunger associated with the particular last fuse to be fired are operated and then plunger 25 is released to prevent succeeding fuses from being fused. Then an arrangement is provided to shift the plate 30 towards the right to release this last-operated plunger and restore the plate to normal to free the first plunger 1 for a succeeding operation. This shifting of the plate 30 may be arranged in any suitable manner for example by first releasing plunger 25 and then operating the remaining plungers in succession, as by shifting this plate by hand or by operating the special plunger 55 which through lever 56 acting on a pin 57 shifts

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the plate 30 towards the right to effect this release. It is also obvious that in place of fuses such as 17 et cetera, other circuit arrangements may be provided, for example relays may be wired into the separate circuits from contact sets 15 for operation in this order or selected as desired without departing from the spirit of the invention.

What is claimed is:

1. In a contact operating switch, a series of keys, sets of circuit operating contacts, each set controlled by the operation of a corresponding key, and means for enabling the operation of one key at a time in a certain order only and for locking this key when operated and for releasing it on the operation of the succeeding key in the said certain order.

2. In a contact operating switch, a series of keys, groups of circuit operating contacts, each group controlled by the depression of a corresponding key, and means for enabling the operation of one key at a time in a certain order only and for locking each key when operated and for disabling it on the operation of the succeeding key in the said certain order.

3. In a contact operating switch, a series of keys, groups of circuit operating contacts, each group controlled by the depression of a corresponding key, a plate for said keys arranged to be shifted by one key, when operated, to enable another key to be operated, said shifting of the plate enabling the keys for operation in a certain order only.

4. In a contact operating switch, a series of keys, groups of circuit operating contacts, each group controlled by the depression of a corresponding key, a plate associated with all of said keys so as to be shifted by one key, when operated, to lock said key in operated position, to release the preceding key from its locked position and to enable the operation of a succeeding key, said plate being so arranged that the keys can only be operated in a certain predetermined order.

5. In a contact operating switch, a series of keys, groups of circuit operating contacts, each group controlled by the depression of a corresponding key, means for enabling the operation of one key at a time only beginning with the operation of a first key in said series, a special key and means controlled by said special key, when operated, for disabling all but the first key in said series regardless of which one of the remaining keys was last operated at the time of the operation of said special key.

6. In a contact operating switch, a series of keys, groups of circuit operating contacts, each group controlled by the depression of a corresponding key, a plate associated with all of said keys so as to be shifted by one key, when operated, to lock said key in operated position, to release the succeeding key from its locked position and disable it and to enable the operation of a succeeding key, said plate being so arranged that the keys can only be operated in a predetermined order.

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