

Dec. 3, 1957

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2,815,478

REMOTE POSITIONING APPARATUS

Filed March 30, 1956

2 Sheets-Sheet 1

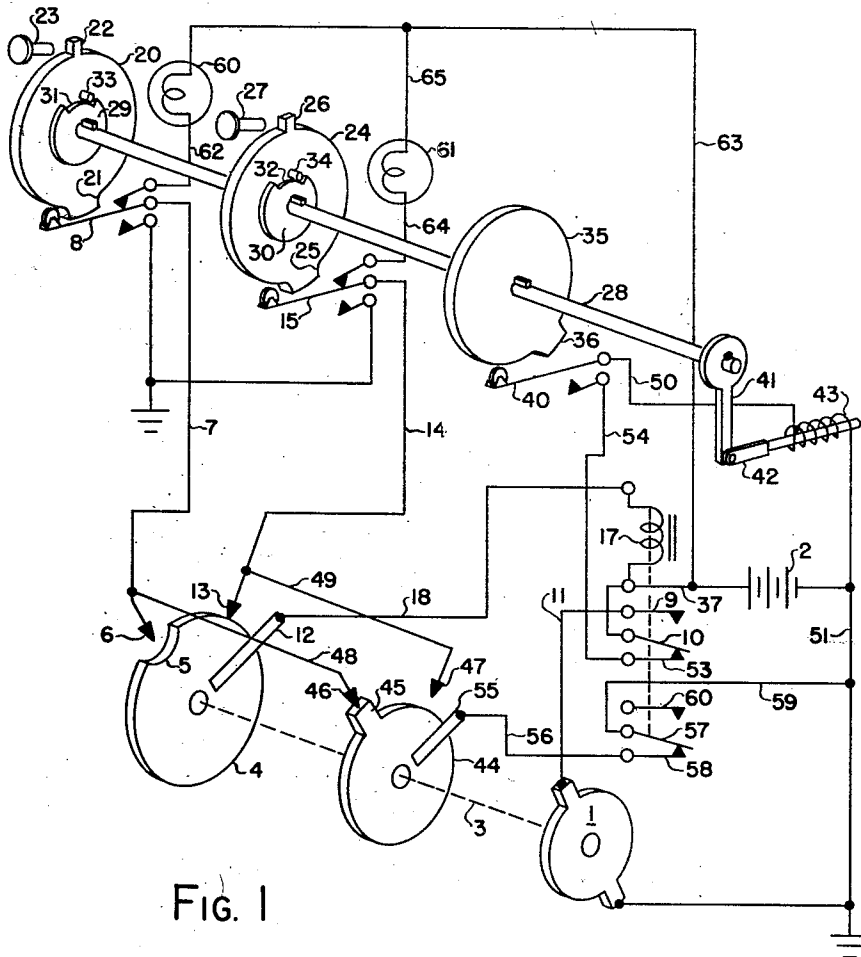
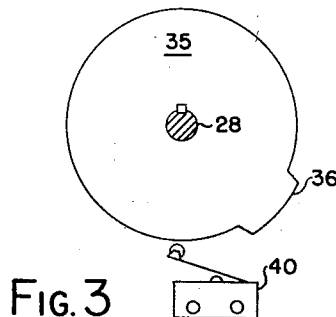
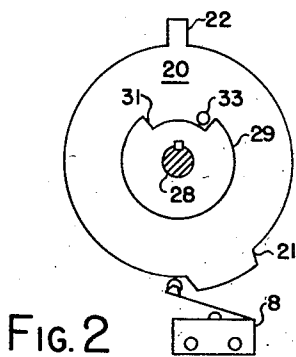


FIG. 1



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2 Sheets-Sheet 2

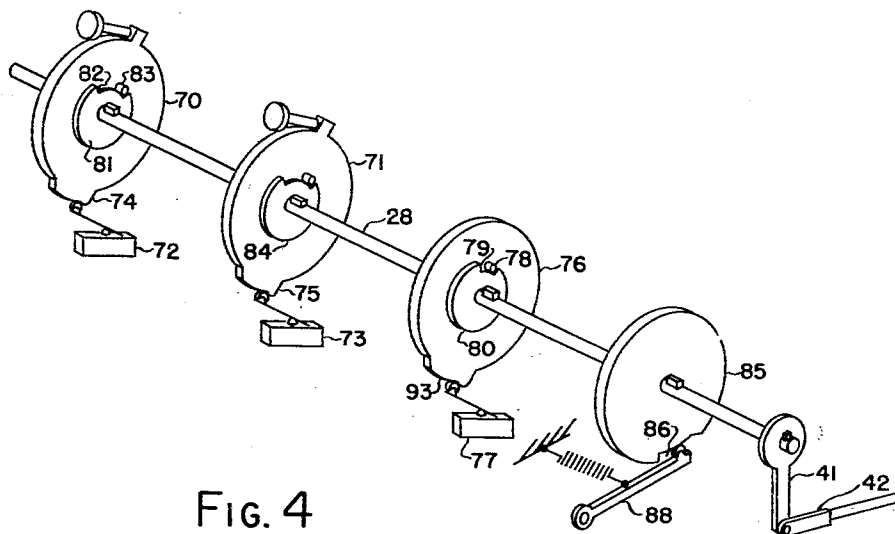


FIG. 4

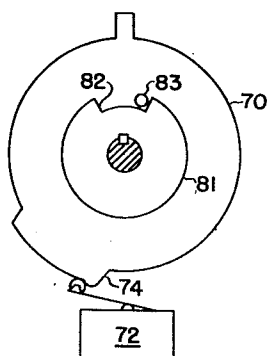


FIG. 5

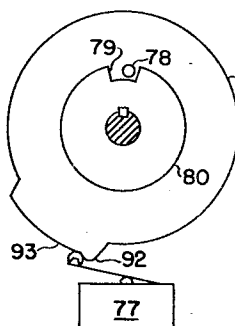


FIG. 6

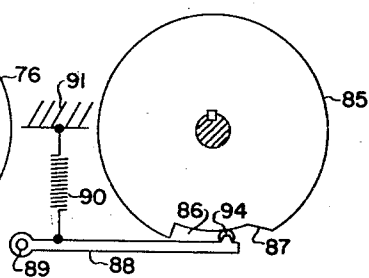


FIG. 7

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REMOTE POSITIONING APPARATUS

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Application March 30, 1956, Serial No. 575,144

9 Claims. (Cl. 318—467)

This invention relates to a latching device adapted to be conditioned for operation by the movement of a shaft from a rest position for the purpose of initiating an action which may take place at a distant location, and to operate to reposition the shaft upon the completion of said action.

As an example of a use to which the device of this invention is adapted, there may be considered a multiple channel selection circuit used in electrical communication systems. There is a class of these devices which employ a separate push button operated cam disc for tuning the system to each channel. Rotation of each disc by its push button closes a switch to complete a circuit which is only opened by the attainment of the desired tuning setting. In the past there has been required a separate relay for each of the push button actuated circuits to reposition its cam disc after the tuning action initiated by the operation of its push button.

It is an object of this invention to provide a means requiring only a single relay or comparable electrically actuated means to reposition all or any of the manually operated circuit closure means of a remote control system employing a plurality of pre set open seeking control circuits.

It is another object of the invention to provide such a means which is simple and inexpensive.

It is a further object of the invention to provide a remote channel selecting means which may be actuated by a single manual movement and which will then reliably complete the channel selection and reposition itself for subsequent actuation, without further attention.

The foregoing and other objects and advantages of the invention are substantially realized by an arrangement employing a shaft common to the manually operated circuit closure means and having operatively connected to it a local switch closing device which is operated after a time lag by operation of any of the manual circuit closure means. The switch closed by the device is in a circuit including an electrical shaft repositioning device and a switch at the remote location which is closed only by the completion of the control function of the activated circuit and its consequent interruption.

In the drawing:

Fig. 1 is a schematic circuit diagram of an arrangement embodying the invention, with the mechanical portions in perspective;

Fig. 2 is an elevational view of one of the push button actuated cam discs of the arrangement of Fig. 1;

Fig. 3 is an elevational view of the shaft actuated cam disc of Fig. 1;

Fig. 4 is a perspective view of an alternative form of cam disc and shaft arrangement; and,

Figs. 5, 6 and 7 are elevational views of the various cam discs of the arrangement of Fig. 4.

Referring now more particularly to the drawing, there is shown in Fig. 1 a remote control system adapted to the remote selection of communication frequency channels for a radio transmitter or receiver. In this system a motor 1 is energized by a battery 2 to drive a shaft 3 which

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rotates conventional tuning devices (not shown) to tune the radio apparatus to the desired frequency channel.

The system shown is arranged to respond to remote actuation to drive the shaft 3 to a selected one of two possible tuning positions, and when the selected position has been attained, to interrupt the remote control circuit so as to bring the system to rest until it is desired to select the other tuning position. While the system shown has been restricted to two tuning positions or frequency channels, this has been done for simplicity's sake and it should be understood that the system illustrated could easily be modified to accommodate many more frequency channels, if desired.

The shaft 3 has mounted on it for rotation therewith a conductive disc 4, provided in its peripheral portion with a cutout 5. The circuit for setting up one of the frequency channels comprises a contact element 6 which makes contact with the peripheral portion of the disc 4. This element is connected via a conductor 7, and the movable arm and lower fixed contact element of a switch 8, to ground. One terminal of the motor 1 is also grounded. The other terminal of the motor 1 is connected by a conductor 11 to one fixed contact element 9 of a single-pole double-throw switch 10. The movable blade of switch 10 is connected by a conductor 37 to one terminal of a relay coil 17, the other terminal of which is connected by a conductor 18 to a wiper 12.

The circuit for setting up the other frequency channel of the illustrated system includes a contact element 13 which makes contact with the peripheral portion of the disc 4. This element is connected by way of a conductor 14, and the movable arm and lower fixed contact element of a switch 15 to ground.

The movable arms of the switches 8 and 15, when at rest, are in contact with the upper fixed contact elements of those switches.

There is provided for the operation of the switch 8 a cam disc 20, having a cam portion 21, which, when the disc is rotated, engages the arm of the switch 8 and moves it into contact with the lower fixed contact element. The cam disc is provided with a lug 22 on its periphery, which is engaged by a push button 23 when it is desired to close the switch 8.

A similar cam disc 24 is provided for the switch 15. It has a cam 25, a lug 26 and push button 27, and operates the switch 15 in the same manner as the operation of switch 8 by the disc 20.

In the system as illustrated, the disc 4 is positioned so that its cutout portion 5 is under the contact element 6 and the associated communication apparatus is thus tuned to the channel controlled by the push button 23. If it is desired to select the channel associated with the push button 27, that button is pressed. This rotates disc 24 and closes switch 15 with respect to its lower fixed contact element. A circuit is now complete through switch 15, ground, battery 2, conductor 37, relay coil 17, conductor 18, contact wiper 12, disc 4, contact element 13, and conductor 14. The energization of relay coil 17 raises the movable arm of switch 10 into contact with element 9. This energizes the motor 1. The motor consequently turns the shaft 3 until the cutout portion of the disc 4 moves under the contact element 13, whereupon the circuit is broken and the motor is deenergized.

When the push button 23 was pressed to initiate the action described above, it was necessary that the cam disc remain in the position to which it was rotated, until the operation of the disc 4 brought the cutout portion 5 under the switch 6. But once that action is completed, it is equally necessary that the cam disc 24 be returned to its initial position in order that the switch 15 might open. This action is accomplished, in accordance with the invention by mechanism which will now be described.

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The cam discs 20 and 24 are free to rotate on the shaft 28 which extends through both of them. But keyed on the shaft 28 and positioned along side discs 20 and 24, respectively, are positioning discs 29 and 30. Each of these discs has a segment removed from its periphery as shown at 31 and 32. Extending from the side of the disc 20 into the recess 31 is a pin 33. A similar pin 34 extends from the side of the disc 24 into the recess 32.

Keyed to the same shaft 28 is a cam disc 35 provided on its peripheral edge with an extended cam segment 36. This segment is so dimensioned as to close an adjacent switch 40 when the disc 35 is rotated. The switch 40 is of the type which opens when released and must be held in a closed position.

Also keyed to the shaft 28 is a crank arm 41, to the end of which is pivotally secured a member 42 which forms an armature moving within a solenoid 43.

Mounted on the shaft 3 for rotation therewith is a conductive disc 44 having an extending contact element 45 on its periphery. Positioned adjacent the periphery of the disc 44 in such positions as to make contact with element 45 are two contact elements 46 and 47. The element 46 is connected by a conductor 48 to contact element 6 and is so located as to make contact with element 45 when the cutout 5 is under the element 6. Contact element 47 is connected to contact element 13 by a conductor 49. The element 47 is so positioned that it makes contact with element 45 when the cutout 5 is under element 13.

The movable arm of the switch 40 is connected to one terminal of the solenoid 43 by a conductor 50. The remaining terminal of the solenoid is connected to ground and to one terminal of the battery 2 by a conductor 51. The remaining terminal of the battery 2 is connected to one terminal of the relay coil 17 and to the movable arm of switch 10 by conductor 37. The lower fixed contact element 53 is connected to the fixed contact element of switch 40 by a conductor 54.

Positioned in wiping contact with the disc 44 is a wiping contact element 55. This element wipes the disc 44 throughout its rotation. It is connected to the lower fixed contact element 58 of a single-pole double-throw switch 57 by a conductor 56. The upper fixed contact element 60 of this switch is open circuited. The movable element is connected to the conductor 51 by a conductor 59.

The relay coil 17 operates switches 10 and 57. They are in the position corresponding to the unenergized state of coil 17 as shown.

In considering the operation of the repositioning device, let it be assumed that the push button 27 is pushed in. This closes switch 15 in its lower position and completes the tuning circuit as described above.

By virtue of the pin 34, rotation of the disc 24 also rotates the positioning disc 30 and with it the shaft 28 and the disc 35. Rotation of the disc 35 will cause the cam element 36 to close switch 40 but by virtue of the relative angular positioning of elements 36 and 25, this closure will not occur until after the switch 15 has been closed. This delay in the closure of switch 40 is necessary in order to allow time for relay 17 to operate as will be explained.

By the time switch 40 closes, the relay 17 will have become energized due to the closure of the switch 15 and the switches 10 and 57 will have been actuated so that the movable arms will be in their upper positions in contact with fixed contact elements 9 and 60.

When switch 40 closes, the circuit composed of conductor 50, solenoid 43, conductor 51, battery 2, conductor 37, fixed contact 53 and the movable arm of switch 10, and conductor 54, will be open at switch 10 and the solenoid will not as yet be energized. Had it not been for the delay in actuating switch 40 and had relay 17 not as yet been energized, the circuit would have been completed through switch 10 and repositioning of shaft 28 would

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occur and would open switch 15 before tuning had been accomplished.

With the delay, however, the circuit just described will not be completed until disc 4 has been rotated so that the cutout 5 is under the contact element 13. This interrupts the energizing circuit for relay 17 and the switches 10 and 57 take the positions shown. The circuit through solenoid 43 is now completed and the armature 42 is pulled to the right opening switch 40. This opens the switches 15 and 40 and returns disc 24 to its original position.

In order to indicate to the user the channel upon which the communication device is set up, there is provided an indicating arrangement including a separate indicating light for each channel and means to light the light of the channel to which the set is tuned.

There are shown in Fig. 1 a light 60 positioned adjacent disc 20 and a light 61 adjacent disc 24. The light 60 is connected to the upper contact element of switch 8 by a conductor 62 and to the conductor 37 by a conductor 63. The light 61 is connected to the upper contact element of switch 15 by a conductor 64 and to the conductor 63 by a conductor 65.

In the arrangement illustrated in Fig. 1 the light 60 is lighted through the circuit including conductor 62, switch 8, conductors 7 and 48, contact element 46, contact element 45, disc 44, wiper element 55, contact element 58, the movable arm of switch 57, conductor 59, conductor 51, battery 2, conductor 37, conductor 63 and light 60. The lighting circuit for the light 61 is interrupted at contact element 47.

An enlarged view of a disc, such as the disc 20, is shown in Fig. 2. The switch 8 is illustrated as being of the conventional microswitch type.

Fig. 3 shows an enlarged view of a cam disc of the type of disc 35 of Fig. 1.

The embodiment described above, while completely and satisfactorily operative for its intended purpose, does offer the possibility that a careless operator might push in one of the buttons to less than the full extent of its intended travel. If this is done the switches 8 or 15 could be momentarily actuated without detenting or causing the relay 17 to be energized. There is shown in Fig. 4 an arrangement using a modified form of cam disc for eliminating this possibility.

In the arrangement of Fig. 4 there are utilized a pair of cam discs 70 and 71 which coact with a pair of microswitches 72 and 73. The discs are similar to the discs 20 and 24 and the switches are similar to the switches 8 and 15 of Fig. 1, except that the cam elements 74 and 75 of the discs normally are in contact with and pressing down the movable arms of the switches when the discs are at rest in their unactuated positions. In this condition the switches have the same relationship with their associated fixed contacts as are shown for switches 8 and 15 in Fig. 1.

There is also positioned on shaft 28 a cam disc 76 having a cam 93 and having associated with it a switch 77. The latter switch operates in the circuit of Fig. 1 in the same manner as switch 40 of that figure. The cam 93 of disc 76 is in pressing-down contact with the movable arm of switch 77 when the disc is in its rest position and the switch is open in this condition.

The disc 76 is not keyed to the shaft but has a pin 78 protruding from its side and, as more clearly shown in Fig. 6, lying in a segmental peripheral recess 79 formed in a positioning disc 80 which lies along side disc 76 and is keyed to the shaft 28.

The disc 70, which is identical to the disc 71, is shown in an enlarged view in Fig. 5. This disc is not keyed to the shaft 28, but has alongside it a smaller positioning disc 81 which is keyed to the shaft and which is provided with a segmental peripheral recess 82 into which protrudes a pin 83 extending from the side of disc 70. A similar small disc 84 coacts with cam disc 71.

The purpose of the lost motion relationship provided between cam discs 20, 24, 70 and 71 and their associated small discs 29, 30, 81 and 84, is to allow one of the cam discs to be rotated by its associated push button without moving the other.

In the operation of the arrangement of Fig. 4, let it be assumed that the push button associated with cam disc 71 is pushed. Since the movable arm switch 73 is already at the end of the cam 75 when the disc is at rest, it only takes a small movement of the push button to move the cam off it and thus to allow it to rise. This will position the movable arm in contact with the element corresponding to the lower fixed contact of the switch 15 of Fig. 1, but which in this case would be in an upper position. This will ground the conductor 14 and the operation of the circuit of Fig. 1 will proceed as has been described above.

The movement of the shaft 28 resulting from actuation of the push button will rotate cam disc 76, but only after the pin 78 has been moved across the recess 79 and has engaged its left-hand edge. This allows the relay coil 17 to have been energized before the switch 77 is closed by having the cam of disc 76 moved off of it.

There is also keyed to the shaft 28 a cam disc 85 which is shown more clearly in Fig. 7. This disc has formed in its periphery a segmental recess 86. This recess has a sloping right-hand wall 87. Associated with this disc is a lever 88, pivotally secured to some fixed support at 89. The lever is biased upwardly by a spring 90 secured at one end to the lever and at the other end to a fixed support 91. The end of the lever is provided with a roller follower 92 which rides up into the recess 86.

In the operation of the arrangement of Fig. 4, when the member 42 is pulled to the right by solenoid 43, as the tuning action is completed, the shaft 28 will be rotated in a counter-clockwise direction and the disc 71 will also be rotated. This will reposition the cam 75 to its illustrated position.

The small disc 80 will also be rotated and, after this disc has been rotated until the pin 78 is again in contact with the right-hand face of the recess 79, the disc 76 will be rotated until the switch 40 opens. Ideally this should bring the cam 93 to its illustrated relationship with switch 77. In practice, however, rotation of the shaft 28 may cease before this relationship is completely achieved.

It will be noted that the cam 93 has a hump 92 at its engaging edge, over which the roller of the movable arm of switch 77 must ride. The disc 85 and its associated arm 88 is provided to insure that the arm of switch 77 does ride over the hump on the repositioning action. The sloping surface 87 is so angularly positioned that the roller 94 is riding up the slope as the arm of switch 77 goes over the hump. This insures that the disc will not cease its rotation until the roller of switch 77 has moved over the hump.

The reason for having the repositioning movement of disc 76 follow that of discs 70 and 71 is to insure that the latter will be repositioned before the switch 77 is opened.

The function of disc 85 can be incorporated on disc 76, if desired.

What is claimed is:

1. The combination comprising, a first shaft, a second shaft, means driving said second shaft, a plurality of electrical circuits, each adapted to energize said driving means when completed, means actuated by the rotation of said second shaft to interrupt each of said circuits only when said shaft occupies a unique position, a switch in each of said circuits, separate means at said first shaft for closing each of said switches, means operated by the actuation of each of said switch closing means to rotate said first shaft and means actuated by the said interruption of the one of said circuits which includes said closed switch to reposition said first shaft, said repositioning means

comprising a normally incomplete electrical circuit and means actuated by said second shaft to complete the last named electrical circuit coincident with the said interruption.

2. The combination comprising, a first shaft, a second shaft, means driving said second shaft, a plurality of electrical circuits, each adapted to energize said driving means when completed, means actuated by the rotation of said second shaft to interrupt each of said circuits only when said shaft occupies a unique position, a switch in each of said circuits, separate means at said first shaft for closing each of said switches, means operated by the actuation of each of said switch closing means to rotate said first shaft from a first to a second position and means actuated by the said interruption of the one of said circuits which includes said closed switch to reposition said first shaft to said first position, said repositioning means comprising an electrical circuit, means actuated by the rotation of said first shaft to break the last named circuit when said shaft is in said first position and means actuated by the rotation of said second shaft to break the last named circuit except during said interruption.

3. The combination comprising, a first shaft, a second shaft, means driving said second shaft, a plurality of electrical circuits, each adapted to energize said driving means when completed, means actuated by the rotation of said second shaft to interrupt each of said circuits only when said shaft occupies a unique position, a switch in each of said circuits, separate means at said first shaft for closing each of said switches, means operated by the actuation of each of said switch closing means to rotate said first shaft from a first to a second position and means actuated by the said interruption of the one of said circuits which includes said closed switch to reposition said first shaft to said first position, said repositioning means comprising a solenoid acting on said shaft and an energizing circuit therefor, means actuated by the rotation of said first shaft to break said solenoid energizing circuit when said shaft is in said first position and means actuated by the rotation of said second shaft to break said solenoid energizing circuit except during said interruption.

4. The combination comprising, a first shaft, a second shaft, means driving said second shaft, a plurality of electrical circuits each adapted to energize said driving means when completed, means actuated by the rotation of said second shaft to interrupt each of said circuits only when said shaft occupies a unique position, a normally open switch in each of said circuits, a separate rotatable switch actuating means carried by said shaft for each of said switches, each of said switch actuating means coacting with said first shaft to rotate said shaft from a first to a second position when it is operated to actuate and close the one of said switches associated therewith, and means actuated by the said interruption of any of said circuits, the said switch of which has been closed, to reposition said shaft to said first position, said repositioning means including a solenoid, a solenoid energizing circuit, comprising a normally open switch at said first shaft, means carried by said first shaft and operative when said first shaft is rotated to said second position to close said switch and means actuated when said driving means is deenergized to complete said solenoid energizing circuit.

5. The combination comprising, a first shaft, a second shaft, means driving said second shaft, a plurality of electrical circuits each adapted to energize said driving means when completed, means actuated by the rotation of said second shaft to interrupt each of said circuits only when said shaft occupies a unique position, a normally open switch in each of said circuits, a separate rotatable switch actuating means carried by said shaft for each of said switches, each of said switch actuating means coacting with said first shaft to rotate said shaft from a first to a second position when it is operated to actuate and to close the one of said switches associated therewith at a point

in the rotation of said first shaft prior to said second position, and means actuated by the said interruption of any of the circuits, the said switch of which has been closed, to reposition said shaft to said first position, said repositioning means including a solenoid, a solenoid energizing circuit, comprising a normally open switch at said first shaft, means carried by said first shaft and operative when said first shaft is rotated to said second position to close said switch and means actuated when said driving means is deenergized to complete said solenoid energizing circuit.

6. The combination comprising, a first shaft, a second shaft, means driving said second shaft, a plurality of electrical circuits each adapted to energize said driving means when completed, a relay actuated switch common to said energizing circuits, means actuated by the rotation of said second shaft to interrupt each of said circuits only when said shaft occupies a unique position, a normally open switch in each of said circuits, a separate rotatable switch actuating means carried by said shaft for each of said switches, each of said switch actuating means coacting with said first shaft to rotate said shaft from a first to a second position when it is operated to actuate and to close the one of said switches associated therewith at a point in the rotation of said first shaft prior to said second position, and means actuated by the said interruption of any of said circuits, the said switch of which has been closed, to reposition said shaft to said first position, said repositioning means including a solenoid, a solenoid energizing circuit, comprising a normally open switch at said first shaft, means carried by said first shaft and operative when said first shaft is rotated to said second position to close said switch and means actuated when said driving means is deenergized to complete said solenoid energizing circuit.

7. The combination comprising, a first shaft, a second shaft, means driving said second shaft, a plurality of electrical circuits each adapted to energize said driving means when completed, means actuated by the rotation of said second shaft to interrupt each of said circuits only when said shaft occupies a unique position, a normally open switch in each of said circuits, a separate rotatable switch actuating means carried by said shaft for each of said switches, each of said switch actuating means coacting with said first shaft to rotate said shaft from a first to a second position when it is operated to actuate and to close the one of said switches associated therewith at a point in the rotation of said first shaft prior to said second position, and means actuated by the said interruption of any of said circuits, the said switch of which has been closed, to reposition said shaft to said first position, said repositioning means including a solenoid, a solenoid energizing circuit, comprising a normally open switch at said first shaft, means carried by said first shaft and connected thereto by a lost motion connection, the last named means being operative when said first shaft is rotated to said second position to close said switch and means actuated when said driving means is deenergized to complete said solenoid energizing circuit.

8. The combination comprising, a first shaft; a second shaft; means driving said second shaft; a plurality of electrical circuits each adapted to energize said driving means when completed; means actuated by the rotation of said second shaft to interrupt each of said circuits only when said shaft occupies a unique position; a switch in each of said circuits, said switches being biased to their closed positions; a plurality of cam discs carried by said first shaft, each of said cam discs being formed with two segments of different radii, each segment of

larger radius being normally in contact with a respective one of said switches and maintaining it in an open position; means coupling each of said cam discs to said first shaft, whereby rotation of any of said cam discs rotates said shaft; means for selectively rotating any one of said cam discs to bring the segment of smaller radius thereof opposite said respective one of said switches whereby it is closed, the operation of said rotating means moving the selected cam disc and said first shaft considerably beyond the angular position at which said switch is closed; means actuated by the said interruption of any of said circuits the said switch of which has been closed, to reposition said first shaft to its original position; said repositioning means including a solenoid, and a solenoid energizing circuit comprising a normally open switch of the same type as the first mentioned switches, and a cam disc of the same type as the first mentioned cam discs carried by said shaft and coupled thereto by a lost motion connection, the last mentioned cam disc being operative by the continued rotation of said first shaft past the point at which the closing of any of the first mentioned switches takes place, to close the last named switch; and means actuated when said driving means is deenergized to complete said solenoid energizing circuit.

9. The combination comprising, a first shaft; a second shaft; means driving said second shaft; a plurality of electrical circuits each adapted to energize said driving means when completed; means actuated by the rotation of said second shaft to interrupt each of said circuits only when said shaft occupies a unique position; a switch in each of said circuits, said switches being biased to their closed positions; a plurality of cam discs carried by said first shaft, each of said cam discs being formed with two segments of different radii, each segment of larger radius being normally in contact with a respective one of said switches and maintaining it in an open position; means coupling each of said cam discs to said first shaft, whereby rotation of any of said cam discs rotates said shaft; means for selectively rotating any one of said cam discs to bring the segment of smaller radius thereof opposite said respective one of said switches whereby it is closed, the operation of said rotating means moving the selected cam disc and said first shaft considerably beyond the angular position at which said switch is closed; means actuated by the said interruption of any of said circuits the said switch of which has been closed, to reposition said first shaft to its original position; said repositioning means including a solenoid, and a solenoid energizing circuit comprising a normally open switch of the same type as the first mentioned switches, and a cam disc of the same type as the first mentioned cam discs carried by said shaft and coupled thereto by a lost motion connection, the last mentioned cam disc being operative by the continued rotation of said first shaft past the point at which the closing of any of the first mentioned switches takes place, to close the last named switch; means actuated when said driving means is deenergized to complete said solenoid energizing circuit; and means coacting with said first shaft and resiliently biasing it for rotation in the direction opposite to its direction of rotation in response to said cam disc rotating means, the last named biasing means being effective during the operation of the switch of said repositioning means.

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