

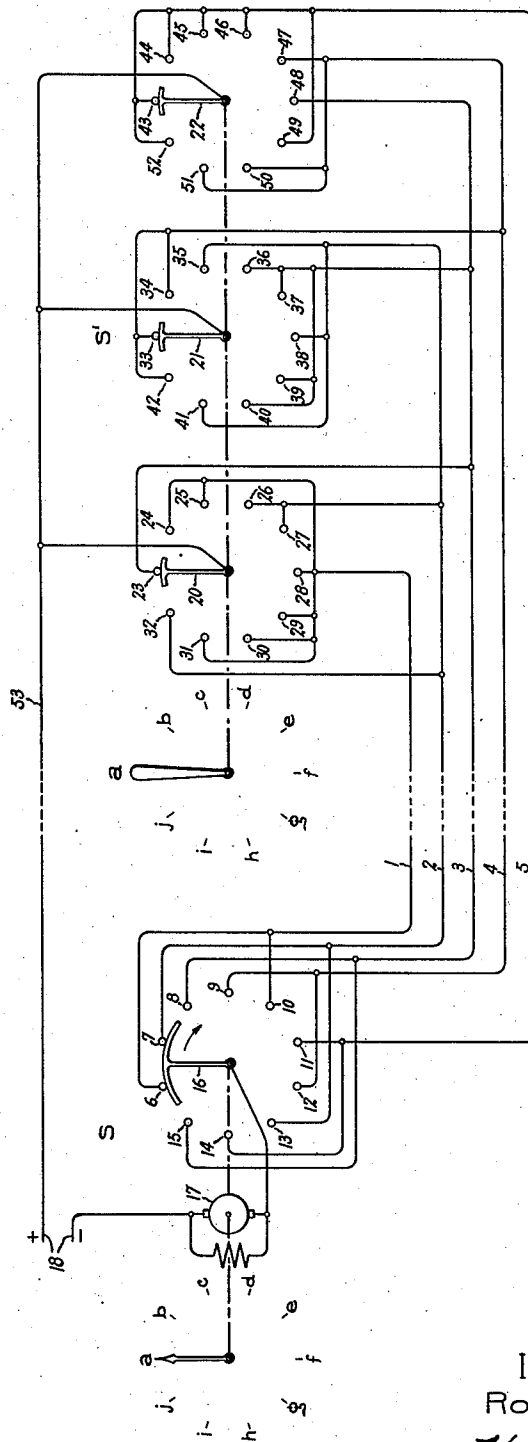
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REMOTE CONTROL SYSTEM

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REMOTE-CONTROL SYSTEM

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My invention relates to remote control systems and particularly to control systems of the follow-up type in which the movement of a control device at one point effects a corresponding movement of a controlled device at another point.

One object of my invention is to provide an improved remote control system of the follow-up type whereby the controlled device may be moved to a larger number of different predetermined positions than the number of control conductors interconnecting the controlled device with the controlling device.

In accordance with my invention, I provide an arrangement comprising n control conductors, where n represents four or more, and means for effecting the movement of a remote control device to different predetermined positions by selectively energizing the control conductors in different predetermined groups of $n-2$ conductors.

My invention will be better understood from the following description when taken in connection with the accompanying drawing, the single figure of which diagrammatically illustrates a remote control system embodying my invention, and its scope will be pointed out in the appended claims.

In the accompanying drawing, I have illustrated my invention in connection with an arrangement for controlling a motor-driven multi-position switch S at a remote station over five control conductors 1 to 5, inclusive, so that the switch S can be moved to any one of ten different stopping positions a to j , inclusive, by moving a control switch S' at the controlling station to a corresponding position. As shown, the multi-position switch S is provided with a bank of ten stationary contacts 6 to 15, inclusive, arranged in a circle so as to be engaged successively by a movable contact member 16 which is driven in a clockwise direction by a motor 17. The movable contact member 16 is so designed that it is always in engagement with at least two adjacent stationary contacts and is just wide enough to bridge three adjacent stationary contacts. For example, during the movement of the movable contacts from position a to position c , just as the movable contact 16 starts to disengage the stationary contact 6, it engages stationary contact 8; then after it disengages stationary contact 6, it remains in engagement with only stationary contacts 7 and 8 until just before it disengages contact 7 when it moves into engagement with contact 9. The motor 17 is connected in series between the movable contact member

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16 and one terminal of a suitable source of control current, such as the negative terminal of a direct current supply circuit 18.

While I have shown the movable contact member 16 as being one continuous contact, it is evident that it may be two separate contacts so spaced as to engage different stationary contacts in each position of the switch and so designed that, as the switch is moved from one position to the next, each movable contact momentarily bridges the space between the two adjacent stationary contacts.

Since in each stopping position of the switch S the motor 17 is energized to move the switch to its next position when either of the stationary contacts being engaged by the movable contact member 16 is connected to the positive side of the supply circuit 18, in order to effect the movement of the switches to any desired stopping position it is necessary to connect the stationary contacts 6 to 15, inclusive, of the switch S to the positive terminal of the supply circuit 18 so that at least one of the stationary contacts engaged by the movable contact member 16 in each stopping position except the desired stopping position is connected to the positive terminal of the supply circuit 18.

In the particular arrangement shown in the drawing, this result is accomplished by connecting the stationary contacts 6 to 15, inclusive, of the switch S to the control conductors 1 to 5, inclusive, in such a manner that, when the control conductors are connected to the positive terminal of the supply circuit 18 in different groups of three, there is for each group of three energized control conductors a different stopping position of the switch S in which both of the contacts engaged by the movable contact member 16 are disconnected from the positive terminal of the supply circuit 18. For selectively effecting at the controlling station the connection of the control conductors 1 to 5, inclusive, to the positive terminal of the supply circuit 18 in the desired groups of three, I have shown the manually operable control ling switch S' as having ten positions a to j , inclusive, which correspond to the positions a to j , inclusive, of the controlled switch S . In order to simplify the disclosure, the controlling switch S' is shown as having three movable contacts 20, 21 and 22, which when rotated in a clockwise direction from the position shown respectively are arranged to engage successively the ten stationary contacts 23 to 32, inclusive, 33 to 42, inclusive, and 43 to 52, inclusive. The movable contacts 20, 21 and 22 are

connected to a common conductor 53 which extends to the positive terminal of the control circuit 18.

As shown, the control conductors 1 to 5, inclusive, are connected to the stationary contacts of the switches S and S' as follows:

Conductor	Contacts of switch S	Contacts of switch S'
1-----	6, 10-----	24, 25, 28, 29, 30, 31.
2-----	7, 13-----	26, 27, 32, 35, 38, 41.
3-----	8, 15-----	23, 36, 37, 39, 40, 48.
4-----	9, 12-----	33, 34, 42, 47, 50, 51.
5-----	11, 14-----	43, 44, 45, 46, 49, 52.

so that in order to stop the switch S in any given position the pair of control conductors indicated in the following table has to be deenergized:

Stopping position of switch S	Stationary contacts engaged by movable contact 16	Control conductors deenergized
a-----	6, 7-----	1, 2.
b-----	7, 8-----	2, 3.
c-----	8, 9-----	3, 4.
d-----	9, 10-----	4, 1.
e-----	10, 11-----	1, 5.
f-----	11, 12-----	5, 4.
g-----	12, 13-----	4, 2.
h-----	13, 14-----	2, 5.
i-----	14, 15-----	5, 3.
j-----	15, 6-----	3, 1.

Also it will be seen from the following table that in each of the ten positions of the controlling switch S' the connections of the stationary contacts are such that a different group of three control conductors is energized by being connected to the positive terminal of the control circuit 18 and a different pair of control conductors is deenergized:

Position of switch S'	Control conductors deenergized	Control conductors energized
a-----	1, 2-----	3, 4, 5.
b-----	2, 3-----	1, 4, 5.
c-----	3, 4-----	1, 2, 5.
d-----	4, 1-----	2, 3, 5.
e-----	1, 5-----	2, 3, 4.
f-----	5, 4-----	1, 2, 3.
g-----	4, 2-----	1, 3, 5.
h-----	2, 5-----	1, 3, 4.
i-----	5, 3-----	1, 2, 4.
j-----	3, 1-----	2, 4, 5.

Consequently, when the switches S and S' are not in corresponding positions, a circuit is completed between the control circuit 18 and the motor 17 to cause the motor to move the switch S to the same position that the control switch S' is in. For example, assume that the switch S is in its position a, as shown, and the control switch S' is in its position a, as shown, and the control switch S' is manually moved to its position f so that the three control conductors 1, 2 and 3 are connected to the positive terminal of the control circuit 18 and the two control conductors 4 and 5 are disconnected from the positive terminal of the control circuit 18. The connection of the control conductor 1 to the positive terminal of the source 18 by the control switch S' causes an energizing circuit for the motor 17 to be completed when the switch S is in its positions a, d and e. Similarly, the connection of conductor 2 to the positive terminal of the control source 18 causes an energizing circuit for the motor 17 to be completed in positions a and b of the switch S, and the connection of conductor

3 to the positive terminal of the control circuit 18 causes an energizing circuit to be completed for the motor 17 in the positions b and c of the switch S. Therefore, with the control switch S' in position f, the motor 17 is energized to move the switch S from its position a to its position f.

While I have shown my invention in connection with a remote control system embodying five control conductors whereby a remote control device may be moved to a maximum of ten different positions, it will be evident that my invention may be applied to effect a larger number of control operations than there are control conductors in any remote control system employing n control conductors, where n represents four or more. When only four control conductors are used, the maximum number of positions to which the controlled device can be moved is six since there are only six different combinations in which n—2 or two of the four control conductors can be simultaneously energized, whereas when six control conductors are used, the maximum number of positions to which the controlled device can be moved is increased to fifteen since there are fifteen different combinations in which n—2 or four of the six conductors can be simultaneously energized.

While I have shown the motor 17 as being directly connected in series with the movable contact 16, it will be obvious that the motor circuit could be a separate circuit controlled by a relay connected in series with the movable contact 16 in the same manner as the motor 17 is connected in the drawing.

While I have, in accordance with the Patent Statutes, shown and described my invention as applied to a particular system and as embodying various devices diagrammatically indicated, changes and modifications will be obvious to those skilled in the art, and I therefore aim in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a remote control system in which two remote points are interconnected by n control conductors and a common return conductor where n represents four or more, means at one of said points for selectively impressing a voltage between said common return conductor and a plurality of different groups of n—2 control conductors, and means at the other of said points selectively operable to different predetermined positions in response to the energization of said different groups of n—2 control conductors.

2. In a remote control system in which two points are interconnected by n control conductors where n represents four or more, a multi-position switch at one of said points having more than n stopping positions, said switch having movable contacting means engaging a different pair of stationary contacts in each stopping position, said stationary contacts being connected to said control conductors so that said movable contacting means is connected to a different pair of control conductors in each stopping position, means responsive to said movable contacting means engaging a stationary contact which is connected to an energized control conductor for effecting the movement of said switch to another of its positions, and means at the other of said points for selectively energizing said control conductors so as to energize at least one of each pair of stationary contacts engaged by said mov-

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able contacting means in all except a desired stopping position of said switch.

3. In a remote control system in which two points are interconnected by n control conductors where n represents four or more, a multi-position switch at one of said points having more than n stopping positions, said switch having movable contacting means engaging a different pair of stationary contacts in each stopping position, said stationary contacts being connected to said control conductors so that said movable contacting means is connected to a different pair of control conductors in each stopping position, means responsive to said movable contacting means engaging a stationary contact which is connected to an energized control conductor for effecting the movement of said switch to another of its positions, and means at the other of said points for selectively energizing said control conductors in different groups of $n-2$ conductors.

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4. In a remote control system in which two points are interconnected by n control conductors where n represents four or more, a multi-position switch at one of said points having more than n stopping positions, said switch having movable contacting means engaging a different pair of stationary contacts in each stopping position, said stationary contacts being connected to said control conductors so that said movable contacting means is connected to a different pair of control conductors in each stopping position, means responsive to said movable contacting means engaging a stationary contact which is connected to an energized control conductor for effecting the movement of said switch to another of its positions, and means at the other of said points for selectively energizing all of said conductors except a desired pair thereof.

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