

Sept. 29, 1931.

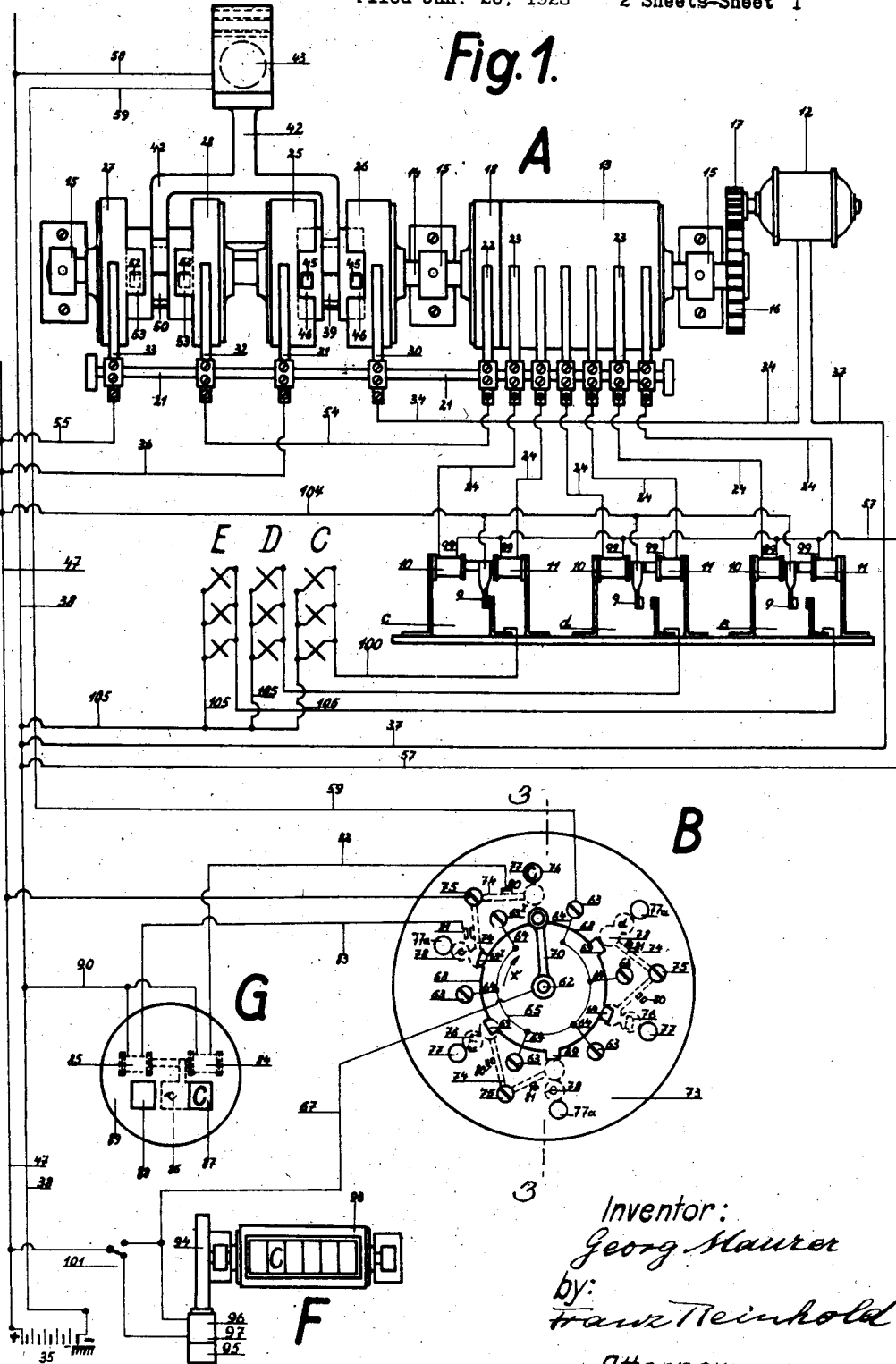
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1,824,828

SYSTEM FOR CONTROLLING ELECTRIC SWITCHES

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Fig. 1.



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Fig. 2.

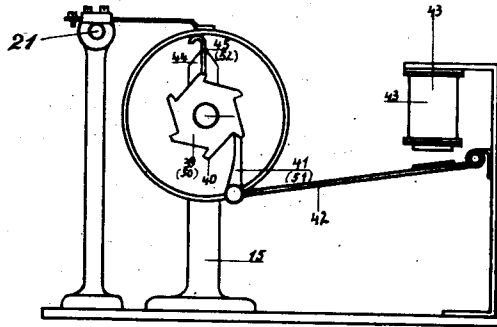


Fig. 4.

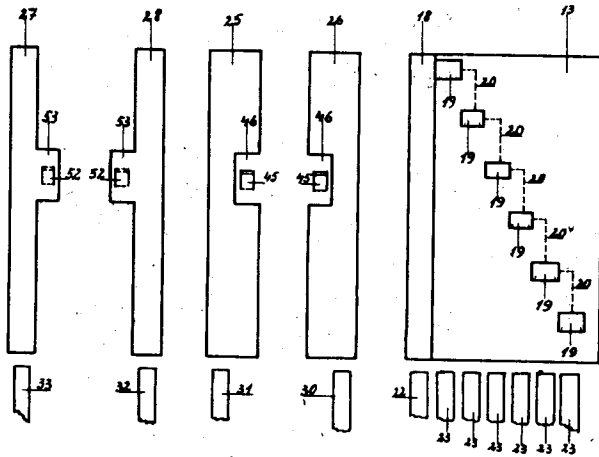
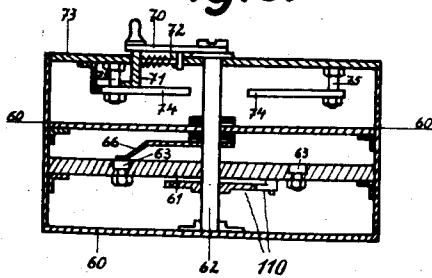


Fig. 3.



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UNITED STATES PATENT OFFICE

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SYSTEM FOR CONTROLLING ELECTRIC SWITCHES

Application filed January 20, 1928, Serial No. 248,264, and in Germany January 21, 1927.

My invention relates to improvements in systems for controlling electric switches, and the object of the improvements is to provide a system comprising a single controlling lead intermediate the controlling station and the switches for selectively operating the switches. With this object in view my invention consists in connecting the switches with an apparatus responsive to current impulses for selectively opening or closing any one or more of the said switches.

For the purpose of explaining the invention an example embodying the same has been shown in the accompanying drawings in which the same reference characters have been used in all the views to indicate corresponding parts. In said drawings,

Fig. 1 is a diagrammatical elevation showing the circuits to be controlled, the switches thereof, the apparatus responsive to current impulses and electrically connected with the said switches and the apparatus for sending current impulses thereto,

Fig. 2 is a diagrammatical elevation of the said apparatus looking from the right in Fig. 1,

Fig. 3 is an elevation partly in section taken on the line 3—3 of Fig. 1, and

Fig. 4 is a development of the parts of the apparatus shown in Fig. 1.

In the drawings I have shown a system for controlling three electric circuits C, D and E. But I wish it to be understood that the system may be constructed for controlling any number of circuits. The circuits include switches *c, d, e* the switch arms 9 of which are mounted on the armatures of electromagnets 10 and 11 adapted respectively to open and close the switches. The electromagnets are controlled by means of an apparatus A comprising an electromotor 12 adapted to be controlled by means of current impulses sent by means of an apparatus B located at a central station disposed away from the apparatus A. Thus the apparatus A controls six electromagnets 10 and 11, and it is adapted to open or close any one or more of the switches *c, d, e*, for connecting or disconnecting any one or more of the circuits C, D and E to the supply of electric energy.

The controlling apparatus A comprises a drum 13 fixed to a rotary shaft 14 mounted in bearings 15 and carrying a gear wheel 16 meshing with a pinion 17 keyed to the shaft of the electromotor 12. The wall of the drum 13 is made from insulating material, and it is provided at its left hand end with a ring 18 of copper or other conductive material, and with six contacts 19 connected with the ring 18 by leads 20. On a rod 21 disposed parallel to the shaft 14 a switch arm 22 and six switch arms 23 are mounted, which arms are insulated from the rod 21 and from one another and bear on the circumference of the drum 13 in position for engagement respectively with the ring 18 and the contacts 19. The switch arms 23 are connected by leads 24 with one of the electromagnets 10 and 11.

To the shaft 14 pairs of drums 25, 26 and 27, 28 are fixed, which are insulated from the shaft 14 and carry metallic circumferential walls. The said metallic walls are engaged by switch arms 30, 31, 32, 33 mounted on and insulated from the rod 21. The switch arm 30 is connected by a lead 34 with the electromotor 12, and the switch arm 31 is connected by a lead 36 with a lead 47 connected with the positive terminal of a source of electric energy 35. The electromotor is further connected by a lead 37 with a lead 38 connected with the earth or the negative terminal of the source of electric energy 35. Thus the drums 25 and 26 control the supply of current to the electromotor 12.

Between the drums 25 and 26 a ratchet disk 39 is rotatably mounted on the shaft 14, which is formed with six ratchet teeth 40 engaged by a pawl 41 carried by the armature 42 of an electromagnet 43. At opposite sides the said disk carries lugs 44 provided with brushes or contact springs 45 adapted for engagement with the inner faces of the metallic walls of the drums 25 and 26 and electrically connected with each other. Normally the said brushes are out of contact with the said circumferential wall which for this purpose are provided with recesses 46. When the brushes make contact with the walls of the drums 25 and 26 a circuit is closed from the positive terminal of the source of elec-

tric energy 35 through the leads 47, 36, the switch arm 31, the drum 25, the brushes 45, the drum 26, the switch arm 30, the lead 34, the electromotor 12, leads 37, 38, and the negative pole of the source of electric energy 35, so that the electromotor 12 rotates the shaft 14 and the parts carried thereby.

Between the drums 27 and 28 a ratchet disk 50 is loosely mounted on the shaft 14, which disk is likewise provided with six ratchet teeth corresponding in position to the ratchet teeth 40 of the disk 39 and engaged by a pawl 51 carried by the armature 42 of the electromagnet 43. The said disk likewise carries a pair of brushes or contact springs 52 adapted for engagement with the inner faces of the metallic walls of the drums 27 and 28. As distinguished from the brushes 45, the brushes 52 are normally in contact with the drums 27 and 28, and they are brought out of contact therewith upon rotation of the drums, the said drums being provided for this purpose each with an axial projection 53. The switch arm 32 is connected by a lead 54 with the switch arm 22, and the switch arm 33 is connected by a lead 55 with the lead 47 and the positive pole of the source of electric energy 35. Thus the disks 27, 28 and the switch arms 32, 33 are adapted to close the circuits of the electromagnets 10 and 11 as follows: from the positive terminal of the source of electric energy 35 through the leads 47, 55, switch arm 33, drum 27, brushes 52, drum 28, switch arm 32, lead 54, switch arm 22, ring 18, lead 20, one of contacts 19, switch arm 23, lead 24, electromagnet 10 or 11, leads 99 and 57, to the lead 38 and the ground or negative pole of the source of electric energy 35.

The electromagnet 43 is connected by leads 58 and 59 respectively with the negative terminal of the source of electric energy 35 and with the apparatus B located at the central station and adapted to supply current impulses to the electromagnet 43.

The apparatus B for sending current impulses to the apparatus A is shown in Figs. 1 and 3. As shown, the said apparatus consists of a casing 60 provided with a partition wall 61 of insulating material and having a shaft 62 mounted therein. To the partition wall 61 six contacts 63 are fixed which are connected by leads 64, 65, and 59 with electromagnet 43. To the shaft 62 a switch arm 66 is secured, which is insulated from the said shaft, and which is adapted, when rotating the shaft, to engage the contacts 63. The arm 66 is connected by a lead 67 with the lead 47 and the positive terminal of the source of electric energy. The front wall 73 of the casing 60 is provided with a circular hole 68, and it is formed at its inner margin with six notches 69. In front of the said hole 68 an arm 70 is secured to the shaft 62, and in a slot of the said arm a slide 71 is radially

h is adapted to be forced by a engagement with the notches the inner face of the front wall 73 bell crank levers 74 are rockingly mounted on pins 75, and the arms of the said bell crank levers are in position for engagement with the slide 71 engaging in the notches 69. At one of their arms the said bell crank levers carry plates 76 having indications C, D, E representing the circuits C, D, E thereon, and when rocking the bell crank levers with the said plates outwardly, the said indications are displayed through peep holes 77 made in the wall 73. Similar disks 78 are provided at the other arms of the bell crank levers, and the said disks are provided with indications *c, d, e* corresponding to the circuits C, D, E. The indications provided on the plates 76 and displayed through the peep holes 77 indicate that the corresponding circuits are connected with the source of electric energy, while the indications made on the plates 78 and adapted to be displayed through similar peep holes 77*a* indicate that the said circuits are disconnected from the source of electric energy.

The arms of each of the bell crank levers are adapted to make contact with terminals 80 and 81 connected by leads 82 and 83 with electromagnets 84 and 85 the armatures of which are connected with a plate 86 carrying indications such as C adapted to be displayed through either one of peep holes 87 and 88 made in a disk 89; the said disk and electromagnets being located in a room away from the apparatus B. The electromagnets 84 and 85 are connected by a lead 90 with the lead 38 and the ground or negative pole of the source of electric energy 35. It will be understood that an apparatus such as 89 is provided for each of the bell crank levers 74. When the arm 70 has been set with its slide 71 in engagement with one of the notches 69, the corresponding bell crank lever 74 is rocked into position for displaying the disk 76 or 78 with the indication printed thereon through the corresponding peep hole 77 or 77*a*, and further, the circuit of one of the electromagnets 84 or 85 is closed for shifting the plate 86 into position for displaying the letter C through one of the peep holes 87 or 88 thus indicating the position of the arm 70.

The apparatus B is further connected with means for examining the operation of the system. When operating the apparatus B in the manner to be described hereafter no current impulse is sent to the apparatus A if the circuit of the electromagnet 43 is broken. In such cases the synchronism between the apparatus B and A is disturbed. Therefore, in order to indicate that a current impulse is sent, an indicating apparatus F is provided, which consists of a drum 93 provided with six fields carrying indications such as C, D, E, corresponding to the circuits C, D, E, the said

indications being displaced with relation to one another circumferentially of the drum. The axis of the drum carries a ratchet wheel 94 engaged by a pawl 95 connected with the armature 96 of an electromagnet 97 included in the lead 67. Thus, whenever a current impulse is sent through the leads 67 and 65, 59 to the electromagnet 43 the drum 93 is advanced one step through the intermediary of the electromagnet 97 and the pawl and ratchet mechanism 94, 95, so that the corresponding indication is displayed through the peep hole of the apparatus F. In the figures the circuit C is shown to be connected to the source of electric energy, and accordingly the switch 9 of the said circuit is closed, and the letter C is displayed by the apparatus B, F and G. The lead 67 includes a switch 101 for disconnecting the apparatus F from the system.

In Fig. 4 I have shown a development of the drums 13, 25, 26, 27 and 28. The contacts 19 are displaced from each other at angles of 60°, and they are smaller in breadth than the recess 46 and projections 53.

The operation of the apparatus is as follows:

It may be assumed that none of the circuits C, D and E is connected to the source of electric energy 35, and that the slide 71 of the arm 70 of the apparatus B engages in the notch 69¹. If it is desired to supply current to the circuit C the arm 70 is turned through an angle of 60° in the direction of the arrow α and into the position shown in Fig. 1. Thereby the switch arm 66 slides over the contact 63¹, so that a current impulse is sent as follows: Arm 66, contact 63¹, leads 64, 65, 59, electromagnet 43, leads 58, 38, ground, source of electric energy 35, leads 47, 67, apparatus F, and back to arm 66. Thus the electromagnet 43 is temporarily energized thus advancing the ratchet wheels 39 and 50 one step. The brushes 52 leave the drums 27 and 28 thus breaking the circuit 54, 55, and the brushes 45 are thrown into engagement with the inner faces of the drums 25, 26, thus closing the aforesaid circuit of the electromotor 12. The electromotor rotates the shaft 14 and the parts carried thereby, until the drums 25 and 26 have been turned so far that the brushes 45 are again in the recesses 46 and the motor circuit is interrupted. Further, the drums 27 and 28 have been rotated through the same angle of 60°, so that the projecting portions thereof are again in contact with the brushes 52. Finally the drum 13 has been rotated through an angle of 60°, so that the second contact arm 23 slides over the corresponding contact 19. Thus the circuit including the said contact arm 23 is closed as follows: Positive pole of the source of electric energy 35, leads 47, 55, switch arm 33, drum 27, brushes 52, drum 28, switch arm 32, leads 54, switch arm 22, ring 18, lead 20, second contact 19,

switch arm 23, lead 24, electromagnet 11 of switch a , leads 57, 38, ground or negative pole of source 35. Therefore, the switch arm 9 of the switch c is shifted to the right for closing the circuit C, the said circuit being made as follows: positive pole of the source of electric energy 35, leads 47, 104, switch arm 9, lead 100, lamps C, leads 105, 38, ground. Immediately after the electromagnet 11 has been energized the circuit thereof is again interrupted, the drum 13 being arrested only after the contact 19 has passed the arm 23, as is indicated in Fig. 4. The motor is now arrested its circuit being interrupted between the brushes 39 and the drums 25, 26.

By the operation of the arm 70 the bell crank lever 74 carrying the letter C is rocked into the position shown in Fig. 1, and the said letter C is displayed through the peep hole 77 thus indicating that the circuit C has been closed. Further, the circuit of the electromagnet 84 is closed at 80, so that the letter C is likewise displayed through the peep hole 87 of the apparatus 89. The current impulse sent by the arm 66 making contact with the first one of the contacts 63 has temporarily energized the electromagnet 97, so that the letter C appears in the second field of the drum 93 thus indicating that the impulse has been sent to the electromagnet 42.

If it is desired to close another one of the circuits C, D, E, for example the circuit E, while the circuits C and D are not to be closed, the arm 70 is immediately turned from the aforesaid initial position in the direction of the arrow α through an angle of 300° and into position with the slide 71 in engagement with the notch 69 corresponding to the letter E. Thereby the arm 66 sends five current impulses by successively sliding on the contacts 63, and the disks 39 and 50 carrying the brushes 45 and 52 are rotated through an angle of 300°. Now the motor 12 is operated in the same way as has been described above, the motor circuit being closed by the brushes 45 engaging the inner faces of the drums 25, 26. Further, the drum 13 is rotated through an angle of 300°, until the recesses 46 of the drums 25, 26 are again in the positions corresponding to the brushes 45. By the rotation of the drum 13 the contact arms 23 successively slide on the contacts 19. But the circuits of the electromagnets 10, 11 including the second, third and fourth contact arm 23 are not closed, because they are held open by the brushes 52 being out of contact with the drums 27 and 28. Only after the projecting parts of the said drums have made contact with the brushes 52 and 53, that is when the fifth contact arm 23 rides on its contact 19, the circuit including the said fifth contact arm is closed, so that the electromagnet 11 of the switch e is energized

and the circuit E is closed by the said switch e.

It will be understood that after closing one circuit C, D or E any other circuit may be closed by turning the arm 70 into position with its slide 71 in engagement with the corresponding notch 69, and that when thus closing a second circuit the first one is not interrupted. Further, the circuits may be closed in any desired succession.

For interrupting the circuits the apparatus is operated in the same way, the arm 70 being set into position with its slide 71 in engagement with the notch 69 corresponding to the electromagnet 10 of the circuit to be interrupted.

Suitable means such as a pawl and ratchet mechanism 110 are provided for preventing movement of the arm 70 opposite to the arrow *a*.

I claim:

1. A system for controlling electric switches, comprising a rotary member carrying circumferentially displaced contacts, switch members in position for engagement with said contacts, current consumers each connected with one only of said switch members, an electromotor for rotating said rotary member, a normally open switch included in the motor circuit and having one member movable with said rotary member and the other member movable independently thereof, a normally closed switch included in the circuits of said consumers and having one member movable with said rotary member and the other one movable independently thereof, circuits for supplying electric current to said motor and to said current consumers, electric means responsive to current impulses for moving said independently movable switch members respectively into circuit making and breaking positions.

2. A system for controlling electric switches, comprising a rotary member carrying circumferentially displaced contacts, switch members in position for engagement with said contacts, current consumers each connected with one only of said switch members, an electromotor for rotating said rotary drum, a normally open switch included in the motor circuit and comprising a switch member having a wall formed with a conductive and a non-conductive portion and movable with said rotary member and a switch member movable independently of said rotary member and normally engaging said non-conductive portion, a switch included in the circuits of the current consumers and comprising a switch member movable with said rotary member and having a wall formed with a conductive portion and a non-conductive portion and a switch member movable independently of said rotary member and normally engaging said conductive portion, pawl and ratchet mechanisms for

moving said switch members, an electromagnet common to both pawl and ratchet mechanisms for moving said independently movable switch members, and means to send current impulses to said electromagnet.

3. A system for controlling electric switches, comprising a rotary member carrying circumferentially displaced contacts, switch members in position for engagement with said contacts, current consumers each connected with one only of said switch members, an electromotor for rotating said rotary member, a normally open switch included in the motor circuit and having one switch member movable with said rotary member and the other switch member movable independently thereof, circuits for supplying electric current to said motor and switch and to said current consumers, electric means responsive to current impulses for moving said independently movable switch member into position for closing said motor circuit, automatic means operative while said motor circuit is closed for breaking the circuits of said current consumers, and a controller movable in one direction only for sending current impulses to said electric means, said controller having contacts equal in number to the contacts of said rotary member.

4. A system for controlling electric switches, comprising a rotary member carrying circumferentially displaced contacts, switch members in position for engagement with said contacts, current consumers each connected with one only of said switch members, an electromotor for rotating said rotary member, a normally open switch included in the motor circuit and having one switch member movable with said rotary member and the other switch member movable independently thereof, circuits for supplying electric current to said motor and switch and to said current consumers, electric means responsive to current impulses for moving said independently movable switch member into position for closing said motor circuit, automatic means operative while said motor circuit is closed for breaking the circuits of said current consumers, a controller movable in one direction only for sending current impulses to said electric means, and mechanical means operatively connected with said controller carrying indications representing the current consumers.

5. A system for controlling electric switches, comprising switches, a controlling apparatus responsive to current impulses and connected with said switches, and an apparatus for sending current impulses to said controlling apparatus comprising contacts electrically connected with said controlling apparatus and provided one for each of the switches, rockable signals one for each of said switches, a contact making arm adapted to be successively moved into engagement

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with said contacts, a source of electric energy connected with said contact making arm and controlling apparatus, and means on said arm for rocking said signals into signalling positions.

5 6. A system for controlling switches, comprising switches, two electromagnets for each of said switches respectively adapted to set the same into circuit breaking and circuit
10 closing positions, a controlling apparatus electrically connected with said electromagnets and responsive to current impulses, and an apparatus for sending current impulses comprising contacts connected with said controlling apparatus and provided one for each
15 of said electromagnets, a contact making arm adapted to be successively moved into engagement with said contacts, a source of electric energy connected with said contact making arm and controlling apparatus, rockable
20 arms one for each of said switches and each carrying two signals in positions corresponding to the contacts cooperating with the electromagnets of the switches, and means on said
25 contact making arm adapted to rock said signal carrying arms with their signals into and out of signalling positions.

7. A system for controlling electric switches, comprising a rotary member carrying
30 circumferentially displaced contacts, switch members in position for engagement with said contacts, current consumers each connected with one only of said switch members, an electromotor for rotating said rotary
35 member, a normally open switch included in the motor circuit and having one switch member movable with said rotary member and the other switch member movable independently thereof, circuits for supplying electric current to said motor and switch and to said current
40 consumers, electric means responsive to current impulses for moving said independently movable switch member into position for closing said motor circuit, means for sending current impulses to said electric means, a single circuit connecting said electric means
45 and means for sending current impulses, and automatic means controlled by said electromotor and operative while said motor circuit is closed for breaking the circuits of said current consumers.

8. A system for controlling electric switches, comprising a rotary member carrying
55 circumferentially displaced contacts, switch members in position for engagement with said contacts, current consumers each connected with one only of said switch members, an electromotor for rotating said rotary member, a normally open switch included in the motor circuit and having one switch member
60 movable with said rotary member and the other switch member movable independently thereof, circuits for supplying electric current to said motor and switch and to said current consumers, electric means responsive

to current impulses for moving said independently movable switch member into position for closing said motor circuit, a switch comprising a plurality of switch contacts, a
70 single circuit connected with all the said contacts and with said electric means, and automatic means controlled by said electromotor and operative while said motor circuit is closed for breaking the circuits of said current consumers.

9. A system for controlling electric switches, comprising a rotary member carrying
75 circumferentially displaced contacts, switch members in position for engagement with said contacts, current consumers each connected with one only of said switch members, an electromotor for rotating said rotary member, a normally open switch included in the motor circuit and having one member
80 movable with said rotary member and the other member movable independently thereof, a normally closed switch included in the circuits of said consumers and having one member movable with said rotary member and the other one movable independently
85 thereof, circuits for supplying electric current to said motor and to said current consumers, electric means responsive to current impulses for moving said independently movable switch members respectively into
90 circuit making and breaking positions, a switch having a plurality of switch contacts, and a single circuit connected with all of the said contacts and with the said electric means.

10. A system for controlling electric switches, comprising a rotary member carrying
100 circumferentially displaced contacts, switch members in position for engagement with said contacts, current consumers each connected with one only of said switch members, an electromotor for rotating said rotary member, a normally open switch included in the motor circuit comprising a switch member rotatable with said rotary member and
105 having a circuit making and a circuit breaking portion and a brush movable independently of said rotary member and adapted to be moved through said contact making and breaking portions, electric means responsive to current impulses for moving said brush
110 from contact breaking position into contact making position, means remote from said rotary member and electromotor for sending current impulses to said electric means, a single circuit connecting said electric means
115 and means for sending current impulses, and automatic means controlled by said electromotor and operative while the motor circuit is closed for breaking the circuits of said current consumers.

11. A system for controlling electric switches, comprising a rotary member carrying
120 circumferentially displaced contacts, switch members in position for engagement with said contacts, current consumers each

connected with one only of said switch members, an electromotor for rotating said rotary member, a normally open switch included in the motor circuit comprising a pair of switch members having conductive portions and movable with said rotary member and each provided with a recess and a switch member movable independently of said rotary member and normally engaging in said recesses, electric means responsive to current impulses for moving said independently movable switch member from said recesses on said conductive portions, means remote from said rotary member and electromotor for sending current impulses to said electric means, a single circuit connecting said electric means and means for sending current impulses, and automatic means controlled by said electromotor and operative while said motor circuit is closed for breaking said circuits of the consumers.

12. A system for controlling electric switches, comprising a rotary member carrying circumferentially displaced contacts, switch members in position for engagement with said contacts, current consumers each connected with one only of said switch members, an electromotor for rotating said rotary member, a normally open switch included in the motor circuit comprising a pair of switch members having conductive walls formed each with a recess and movable with said rotary drum and a switch member movable independently of said rotary member and adapted to connect said conductive walls and normally engaging in said recesses, pawl and ratchet mechanism for moving said independently movable switch member, an electromagnet for moving said independently movable switch member from the recesses into position for engagement with said conductive walls, means remote from said rotary member and electromotor for sending current impulses to said electromagnet, a single circuit connecting said electrical means and means for sending current impulses, and automatic means controlled by said electromotor and operative while said independently movable switch member connects said conductive walls for interrupting the circuits of said current consumers.

13. A system for controlling electric switches, comprising a rotary member carrying circumferentially displaced contacts, switch members in position for engagement with said contacts, current consumers each connected with one only of said switch members, an electromotor for rotating said rotary member, a normally open switch included in the motor circuit and having one switch member movable with said rotary member and the other switch member movable independently thereof, circuits for supplying electric current to said motor and

electric means responsive to current impulses for moving said independently movable switch member into position for closing said motor circuit, means remote from said rotary member and electromotor for sending current impulses to said electric means, a single circuit connecting said electric means and means for sending current impulses, automatic means controlled by said electromotor and operative while said motor circuit is closed for breaking the circuits of said current consumers, and a controller remote from said rotary member and electromotor and movable in one direction only for sending current impulses to said electric means.

14. A system for controlling electric switches, comprising a rotary member carrying circumferentially displaced contacts, switch members in position for engagement with said contacts, current consumers each connected with one only of said switch members, an electromotor for rotating said rotary member, a normally open switch included in the motor circuit and having one switch member movable with said rotary member and the other switch member movable independently thereof, circuits for supplying electric current to said motor and switch and to said current consumers, electric means responsive to current impulses for moving said independently movable switch member into position for closing said motor circuit, means remote from said rotary member and electromotor for sending current impulses to said electric means, a single circuit connecting said electric means and means for sending current impulses, automatic means controlled by said electromotor and operative while said motor circuit is closed for breaking the circuits of said current consumers, a controller movable in one direction only for sending similar current impulses to said electric means, and means electrically connected with said controller for indicating the position of said rotary drum.

15. A system for controlling electric switches, comprising a rotary member carrying circumferentially displaced contacts, switch members in position for engagement with said contacts, current consumers each connected with one only of said switch members, an electromotor for rotating said rotary member, a normally open switch included in the motor circuit and having one switch member movable with said rotary member and the other switch member movable independently thereof, circuits for supplying electric current to said motor and switch and to said current consumers, electric means responsive to current impulses for moving said independently movable switch member into position for closing said motor circuit, means remote from said rotary member and electromotor for sending current impulses to said electric means, a single circuit connecting

said electric means and means for sending
current impulses, automatic means controlled
by said electromotor and operative while said
motor circuit is closed for breaking the cir-
5 cuits of said current consumers, a controller
movable in one direction only for sending
similar current impulses to said electric
means, and electric means included in the cir-
10 cuit connecting the controller with said elec-
tromagnet for indicating the current im-
pulses.

In testimony whereof I hereunto affix my
signature.

GEORG MAURER.

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