

D. B. MOIST & C. W. YOUNG.
 SYSTEM OF ELECTRICAL DISTRIBUTION.
 APPLICATION FILED APR. 23, 1908.

1,054,133.

Patented Feb. 25, 1913.

2 SHEETS—SHEET 1.

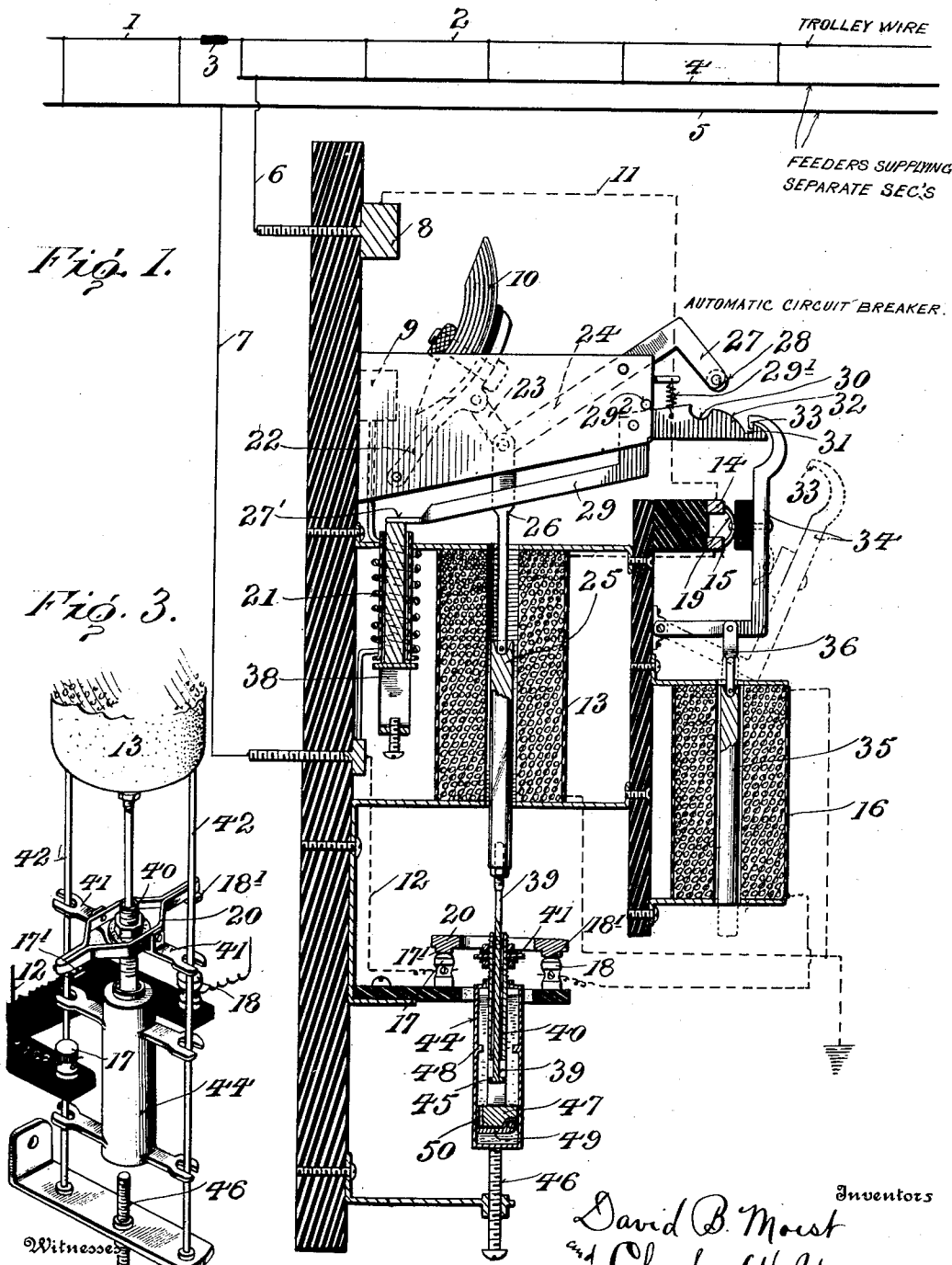
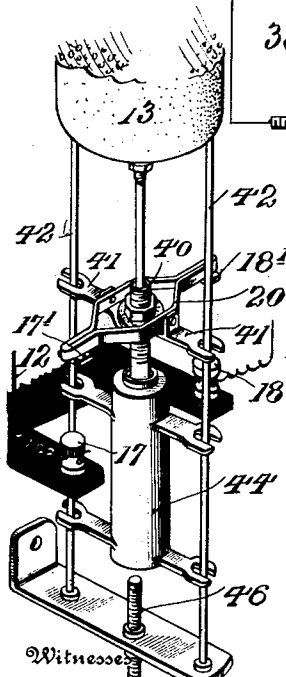


Fig. 1.

Fig. 3.



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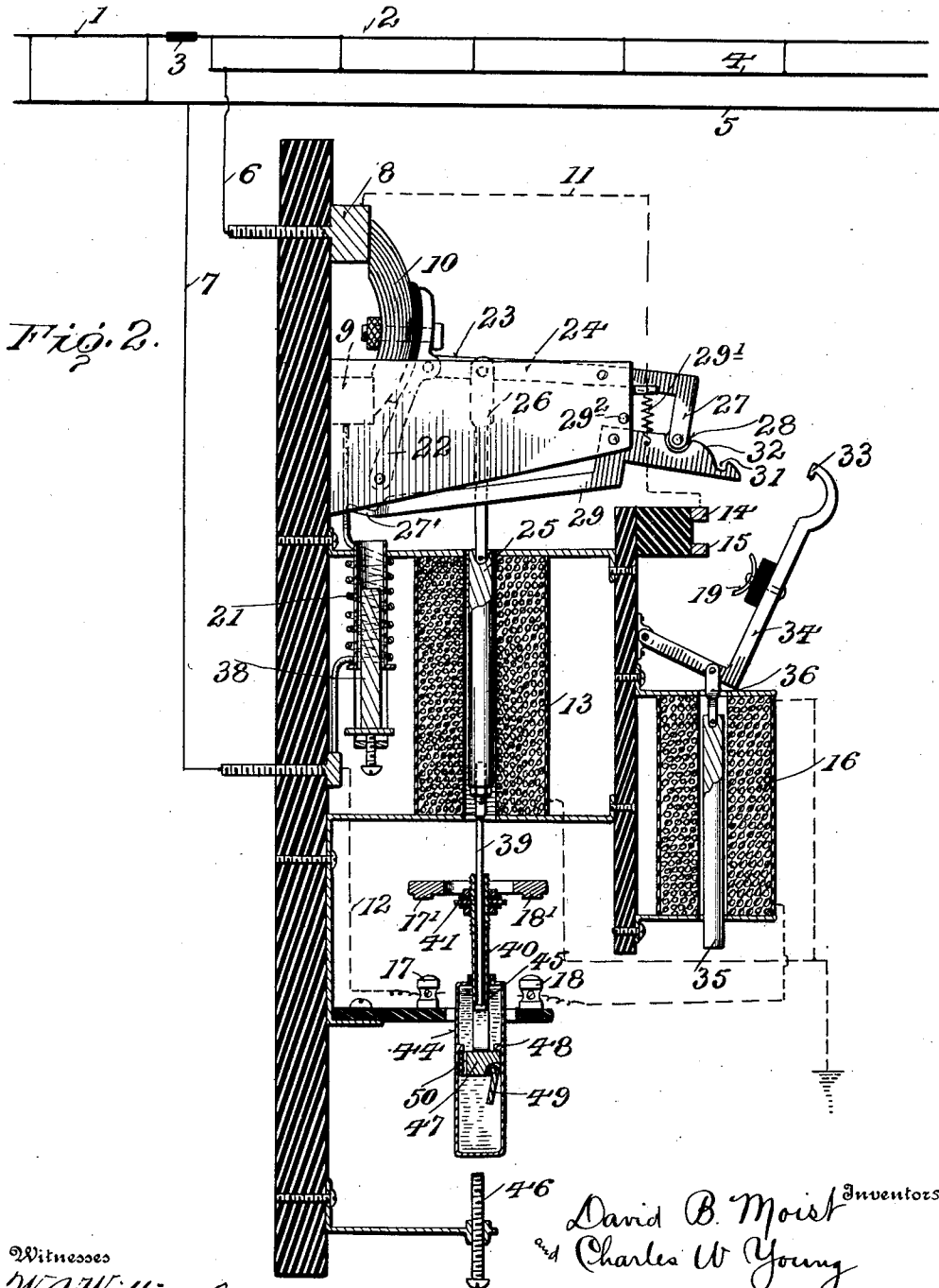
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Witnesses
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UNITED STATES PATENT OFFICE.

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SYSTEM OF ELECTRICAL DISTRIBUTION.

1,054,133.

Specification of Letters Patent.

Patented Feb. 25, 1913.

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To all whom it may concern:

Be it known that we, DAVID B. MOIST and CHARLES W. YOUNG, of the city of Harrisburg, in the county of Dauphin and State of Pennsylvania, have invented certain new and useful Improvements in Systems of Electrical Distribution, of which the following is a specification.

Our invention relates to systems of electrical distribution and has for its object the provision of automatic means for connecting sections so that the connection will be maintained so long as there is current on the individual sections and that the connection will be broken on injury to any section. The desirability of employing sections in systems of distribution is obvious, since they prevent an injury to any part of the system from putting the whole system out of operation. It is well recognized, however, that the provision of separate sections prevents the most effective distribution of loads and is therefore objectionable. In practice it is frequently the case with unconnected sections that the peak loads on adjacent sections come at different times so that one section may be carrying a very heavy load and the adjacent section scarcely any. The connection of the sections results in a higher voltage average and less transmission loss. It is to be borne in mind however, that the object of dividing a system into sections is to prevent any trouble such as a ground or short circuit on any one section from interrupting the service on the rest of the system. Hence any apparatus designed to interconnect the different sections must not destroy the advantage gained by having the sections separate. To this end the connection must be arranged to be closed only when the sections concerned are in normal condition and to be maintained closed only so long as this condition persists in them. Our invention one embodiment of which is shown herein secures these results.

For the illustration of our invention we have chosen a system for feeding trolley sections. It will be understood however, that this is but one of many possible embodiments and is illustrative.

Referring to the drawings, Figure 1 is a diagrammatic view of our invention applied to a system of the nature stated. Fig. 2 is a side elevation of the apparatus partly in section we have found most effective for connecting sections. Fig. 3 is a detail per-

spective view of the dash pot and switching devices adjacent thereto.

1 and 2 are stretches of the trolley wire insulated from each other by insulation 3. 60

4 and 5 represent separate feeder sections to which current is furnished from a source or sources of electricity in any usual way. A connection between these feeders is provided. This connection comprises conductors 6, 7, contacts 8, 9 and a switch contact 10, which is adapted to close or open a gap in the connection. The connection above described is controlled by circuits including conductors 11 and 12. The circuit 11 receives current from section 4. The circuit 12 receives current from section 5. The windings of an electro-magnet 13 are included in the circuit 11, and in this circuit there is a gap between the contacts 14 and 15. In the circuit 12 are the windings of an electro-magnet 16, and in this circuit there is a gap between the contacts 17 and 18. The switch contacts 14 and 15 are arranged to be bridged by a switch contact 19 under the control of the electro-magnet 16. The contacts 17 and 18 are adapted to be bridged by switch-contacts 17' and 18' carried by the yoke 20 controlled by the electro-magnet 13. The detailed construction of these parts as herein illustrated will be more fully set forth hereinafter. A strip coil 21 such as is commonly used in well-known commercial forms of circuit breakers is employed to break the connection between sections when conditions are such as to require their disconnection. This trip coil may be adjusted to operate when the current reaches a predetermined number of amperes.

The switch contact 10, as in well-known forms of circuit breakers, is carried by a pivoted arm 22. This arm is adapted to be operated by toggle lever arms 23, 24 pivoted to each other, to the arm 22 and to the frame and connected with the movable core 25 of the electro-magnet 13 by a link 26. The lever arm 24 is provided with an angular extension 27 at the end of which is an anti-friction roller 28. With this extension is adapted to coast a lever 29 one end of which is forced up by a spring 29' against a stop 29² and is of peculiar conformation whereby it is adapted to act to retain the main switch in closed position. To this end it is provided with an open ended slot 30 conformed in general to the shape of the roller, the relation of the parts being such

that the connection will be held closed against the action of gravity, until the lever 29 is tripped in the manner to be hereinafter described or mechanically. The end of this lever is also provided with a catch 31 and a cam surface 32. The catch is itself provided with a cam surface on which is adapted to ride the lower end of a projection 33 on a lever 34 pivoted to the frame and controlled by the movable core 35 of the electro-magnet 16 by means of a link 36. This lever 34 carries the switch contact 19 which is adapted to bridge the gap between contacts 14 and 15 already mentioned. The action of the latch will be more fully explained shortly, but it may be said at this time that it retains the switch contact 19 in position against the contacts 14 and 15, until the switch contact 10 is almost ready to close the connection between the sections, which action is completed by the momentum of the parts with the aid of a slight arc at the contacts 14 and 15. The inner end 27' of the lever 29 is arranged above the armature 38 of the trip coil 21 so that the operation of the latter on excess of current will release the arms of the toggle and permit the connection to be broken through the action of gravity.

The core 25 is provided with an extension 39 which may suitably be made adjustable with respect thereto. On this extension is located a slidable sleeve 40 provided with extensions 41 coacting with guides 42 and carrying the pivoted yoke 20 on which are the contacts 17' and 18'. The sleeve and yoke are suitably made adjustable with respect to each other, as by being relatively screw-threaded as shown. The lower end of the extension 39 works in a dash pot 44 and is provided with extensions 45 coacting with the said sleeve 40 above mentioned. A screw 46 constituting an adjustable stop for the dash pot is provided. The sleeve 40 is provided with a piston 47 which, as the armature moves up, is adapted to coact with a projection 48 in the dash pot so as to carry the dash pot with it. In operation the extension 39 first picks up the sleeve and thereafter the sleeve picks up the dash pot. This piston carries a hinged valve 49 controlling holes 50 in said piston. The space in the dash pot is filled with oil. When the piston moves up the valve swings downward and the oil does not sensibly retard the upward motion. When the parts move downward however, after the contact 10 is clear of the contacts 8 and 9 and the movement of the dash pot has been arrested by the stop 46, the valve closes and the yoke bearing the contacts descends slowly owing to the resistance of the oil in the dash pot.

The function of the dash pot is to delay the closing of the circuit 12 at the contacts 17 and 18, in case the trip coil causes the

opening of the connection. This delay has been found desirable because it gives the switch board tender at the power station a better chance to locate the trouble without interference from the attempted operation of the parts

The operation of our invention is as follows: Assuming the connection between the separate feeder sections to be open and the parts to be in the position shown in Fig. 1, if the feeder sections be energized the connection between the sections will be closed automatically in the following manner. Current will flow from section 5 through circuit 12 to the negative side of the circuit as shown to ground. It will thus energize the controlling magnet 16 which will force up its core and close circuit 11 by causing switch contact 19 to bridge contacts 14 and 15. Just before this action takes place the projection 33 acts upon the nose of the catch 31 to depress the end of the lever 29 and become engaged with said catch. On the completion of the circuit 11, current flows from section 4 through said circuit energizing electro-magnet 13 and causing the core thereof to move upward. This movement continues but a short distance before the head on the extension 39 picks up the sleeve 40 and the latter carrying with it the contacts 17' and 18' begins to move upward. This of course, breaks the circuit 12 but does not at once break the circuit 11 for the reason that this circuit is held closed by the coaction of the catch 31 and the projection 33. Continued motion of the armature causes the roller 28 on the end of the angular extension 27 of the lever 24 to act upon the cam surface 32 depressing the end of the lever 29 and releasing the lever 34 so that it breaks the circuit 11. The momentum of the parts and the slight arc at the contacts 14 and 15 are however sufficient to carry the switch contact 10 into the closed position. Shortly before this position is reached the piston 47 picks up the dash pot by coacting with projection 48. This motion also results in locking the angular extension 27 of the lever arm 24 by the coaction of the open-ended slot 30 and the anti-friction roller 28. It will be seen that this action cannot occur unless both sections are energized and consequently that if either is short circuited or otherwise abnormal the connection between the sections will remain open.

Assuming the sections to be closed, it will be noted that this condition persists until the trip coil acts to release the lever 29 from its coaction with the angular extension 27 of the toggle lever arm 24. This will occur whenever the current becomes too heavy and this is the case whenever either section is compelled to carry the current for both.

It will be noted that when the connection

between sections is closed both the circuits 11 and 12 are open. It will also be noted that each of the circuits which jointly control the connection of the sections controls the other.

Our system may be regarded as comprising a plurality of circuit closers each of which controls the circuit of the other and one of which serves to connect the sections.

One of the principal advantages of our invention is the fact that continuous current is not required to operate it, the circuits of the electromagnets connected to the separate sections being normally open, *i. e.*, being open when the connection between the sections is closed. This is a distinct advantage since the necessity of wasting even a small amount of current all the time means in the long run a considerable expense.

Having described our invention, what we claim as new and desire to secure by Letters Patent is—

1. In a system of electrical distribution, separate sections, a connection between said sections, a plurality of magnet windings receiving current from separate sections, the circuit of each magnet winding having a normally open break therein and each magnet winding controlling the break in the circuit of one of the others, and means controlled by the conjoint action of the said magnet windings for closing the gap in the connection, when said sections are energized.

2. In a system of electrical distribution, separate sections, a connection between said sections, means for locking the connection closed, releasing means therefor, electromagnetic devices connected to separate sections acting conjointly to close the connection between the sections when the sections are energized.

3. In a system of electrical distribution, separate sections, a connection between said sections, a circuit breaker governing said connection and having its operating winding connected to one of said sections and having a normally open break in the circuit of said winding, and electromagnetic means for opening and closing said break connected to another of said sections.

4. In a system of electrical distribution, separate sections, a connection between said sections, circuits individually connected to individual sections, each of said circuits having a normally open break therein, a magnet winding in each of said circuits adapted and arranged to control a break in another of said circuits, and a switch controlled by one of said magnet windings for making the connection between the sections.

5. In a system of electrical distribution, separate sections, a connection between said sections, normally open circuits individually connected to individual sections, a magnet winding in each of said circuits adapted

and arranged to control a break in another of said circuits, a switch controlled by one of said magnet windings for making the connection between the sections, means for locking the switch closed and a trip coil for releasing the locking means.

6. In a system of electrical distribution, separate sections, a connection between said sections, a circuit breaker governing the connection between the sections and having its operating winding connected to one section, said winding having a normally open break in its circuit, an auxiliary electromagnet connected to another section and constituting the sole means for closing the break in the circuit of said operating winding.

7. In a system of electrical distribution, separate sections, a connection between said sections, two circuits normally open each receiving current when closed from one of said separate sections, electromagnetic means in one of said circuits to close a break in the other of said circuits, and electromagnetic means in that other circuit to close the connection between the sections.

8. In a system of electrical distribution, separate sections, a connection between said sections, automatic switches each receiving current from one of said sections, the circuit of one of said switches being closed when the connection between the sections is open, and the circuit of the other of said switches being open when the connection between the sections is open and said closed circuit dead, and the automatic switch in the closed circuit on the energization thereof closing the open circuit and thereby closing the connection between the sections.

9. In a system of electrical distribution, separate sections, a connection between said sections, a circuit breaker governing the connection between the sections and having its operating winding connected to one of said sections, said operating winding having a normally open circuit, means to lock the circuit breaker in closed position, automatic releasing means for said locking means, and additional electromagnetic devices to assist in resetting said circuit breaker, said additional electromagnetic devices being connected to another section.

10. In a system of electrical distribution, separate sections, a connection between said sections, comprising a switch contact, electromagnetic means comprising magnet windings connected respectively to the separate sections, one of said windings having a normally open circuit being adapted and arranged to close the said switch contact, and switch contacts in the connections between individual magnet windings and their respective sections and controlled by other of said electromagnetic means.

11. In a system of electrical distribution, separate sections, a connection between said

sections, a circuit connected to one of said sections, an electro-magnet in said circuit, a switch contact, an armature carrying said contact adapted to be moved by said electro-magnet and arranged to close the connection between the sections when the said circuit is energized, a second circuit controlled by the first circuit and connected to another section, an electro-magnet in said second circuit, a switch contact, an arm carrying said contact and adapted to be moved by said second electro-magnet to control said first circuit, and a latch adapted to coact with said arm to delay the opening of the first circuit after the second circuit is broken to insure the closing of the connection between the sections, and adapted to coact with said armature to lock this connection closed.

12. In a system of electrical distribution, separate sections, a connection between said sections, a circuit connected to one of said sections, an electro-magnet in said circuit, a switch contact, an armature carrying said contact adapted to be moved by said electro-magnet and arranged to close the connection between the sections when the said circuit is energized, a second circuit controlled by the first circuit and connected to another section, an electro-magnet in said second circuit, a switch contact, an arm carrying said contact and adapted to be moved by said second electro-magnet to control said first circuit, a latch adapted to coact with said arm to delay the opening of the first circuit after the second circuit is broken to insure the closing of the connection between the sections, and adapted to coact with said armature to lock this connection closed, and a trip-coil in said connection between the sections adapted to operate the latch to release the connection when circuit conditions in the connection sections becomes abnormal.

13. In a system of electrical distribution, separate sections, a connection between said sections, a circuit closer for said connection provided with an extension, a second circuit closer controlling the circuit of the first circuit closer, and having its circuit controlled by the first circuit closer, a pivoted latch lever one end of which is provided with a catch to hold the second circuit closer closed during a part of the closing movement of the first circuit closer, a cam surface adapted to be acted upon by the extension to release the second circuit closer, and a slot to cooperate with said extension with which the first circuit closer is provided to lock the same closed, and a trip coil in the connection between the sections located adjacent the other end of the latch lever to actuate the same to unlock the first circuit closer, when current conditions in the connected sections become abnormal.

14. In a system of electrical distribution,

separate sections, two electro-magnets, circuits therefor, switch contacts adapted to connect said sections and to close breaks in said circuits, movable elements controlled by said electro-magnets and carrying said switch contacts, a latch lever having latching means to latch one of said movable elements, locking means and releasing means to cooperate with another movable element, the releasing means being nearer the movable element with which it cooperates than is the locking means, the magnet controlling the movable element which cooperates with the latching means of the latch lever having its circuit closed when the connection between the sections is open, whereby the latch lever first latches the last named movable element and then releases it and locks the other.

15. In a system of electrical distribution, separate sections, a connection between the sections, a plurality of circuit closers each controlling the circuit of the other and one of them controlling the connection between the sections, devices for holding closed the circuit of one of the circuit closers after the circuit of the other is broken, means comprising a lost motion connection for subsequently releasing said devices, and means for retarding the closing of the circuit of the closer whose circuit is not thus held closed.

16. In a system of electrical distribution, separate sections, a connection between the sections, a plurality of circuit closers each controlling the circuit of the other and one of them controlling the connection between the sections, an armature for said last mentioned circuit closer, a switch contact governing the circuit of another of the circuit closers, means carried by the armature below said contact to raise and lower the same, and a downwardly acting dash pot to retard the closing of the circuit of said other circuit closer.

17. In a system of electrical distribution, separate sections, a connection between the sections, a plurality of circuit closers each controlling the circuit of the other and one of them controlling the connection between the sections, an armature for said last mentioned circuit closer, a switch contact governing the circuit of another of the circuit closers, a movable dash pot one of the elements of which carries the switch contact to retard the closing of the circuit of said other circuit closer, and an adjustable stop for said dash pot.

18. In a system of electrical distribution, separate sections, a connection between the sections, a plurality of circuit closers each controlling the circuit of the other and one of them controlling the connection between the sections, an armature for said last mentioned circuit closer, a sleeve slidable on said

armature, a switch contact carried by said sleeve and governing the circuit of the second circuit closer, a dash pot slidable on said sleeve, projections on said armature and dash pot whereby the armature picks up successively the sleeve and the dash pot, and means for arresting the return movement of the dash pot.

19. In a system of electrical distribution, separate sections, a connection between said sections, circuits individually connected to individual sections, a magnet winding in each circuit, switch contacts adapted to bridge a gap in one of said circuits, a support for said contacts controlled by the magnet winding in the other circuit, said support being provided with a catch, switch contacts adapted to bridge a gap in the circuit of the last named magnet winding, a support for said switch contacts controlled by the magnet winding in the other circuit, switch contacts adapted to bridge a gap in the connection between the two sections and operated by said last named magnet, releasing and locking means also operated by said last named magnet, and a latch lever provided with a catch to cooperate with that of said first mentioned support, a cam surface and a locking slot to cooperate with said locking means.

20. In a system of electrical distribution, separate sections, a connection between said sections, circuits individually connected to individual sections, an electro-magnet in one of said circuits, switch contacts operated by said magnet to close the connection between the sections, switch contacts also operated by said electro-magnet to control the other

circuit, an electro-magnet in the other circuit, switch contacts adapted to form a part of the circuit of the first named magnet, a pivoted support on which said switch contacts are mounted adapted to be operated by the magnet in the second circuit, a latch lever pivoted for co-action with said pivoted support, and provided with a catch, a cam surface and an open ended locking slot, and a releasing and locking lever controlled by the electro-magnet in the first circuit and located and adapted for successive cooperation with the cam surface and the locking slot of the latch lever to release the pivoted support and then lock the connection between the sections closed.

21. In a system of electrical distribution, separate sections, electromagnets connected to separate sections, armatures for said electromagnets, main contacts for completing the connection actuated by one of said armatures, means for locking said connection closed, a movable arm, operative connections between another of said armatures and said arm, contacts carried by said arm to bridge a gap in the circuit of the electromagnet whose armature actuates the main contacts, a latch for said arm, and devices for releasing said latch operated by the armature actuating the main contacts.

Signed by us at Harrisburg, Pennsylvania this 6th day of April 1908.

DAVID B. MOIST.
CHARLES W. YOUNG.

Witnesses:

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