

H. P. BALL & G. WRIGHT.
CIRCUIT CONTROLLER.
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1,098,778.

Patented June 2, 1914.

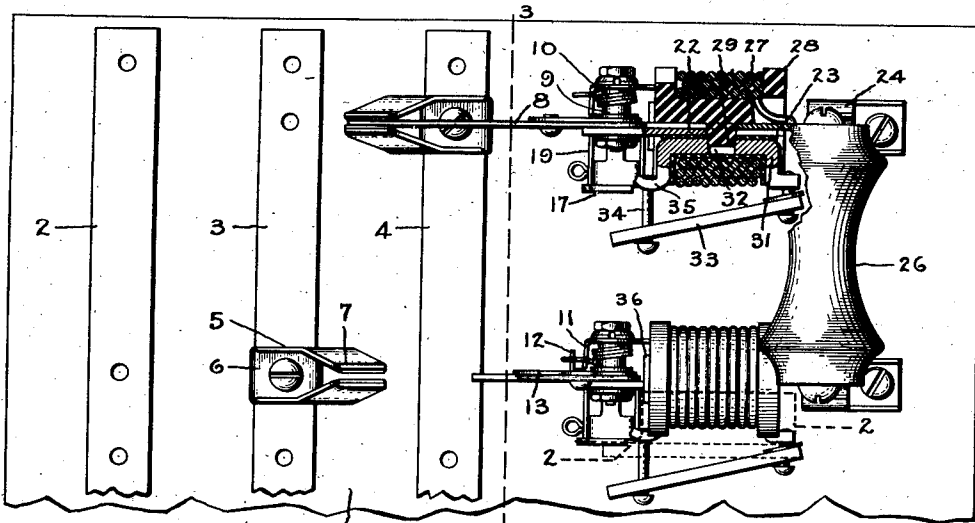


Fig. 1

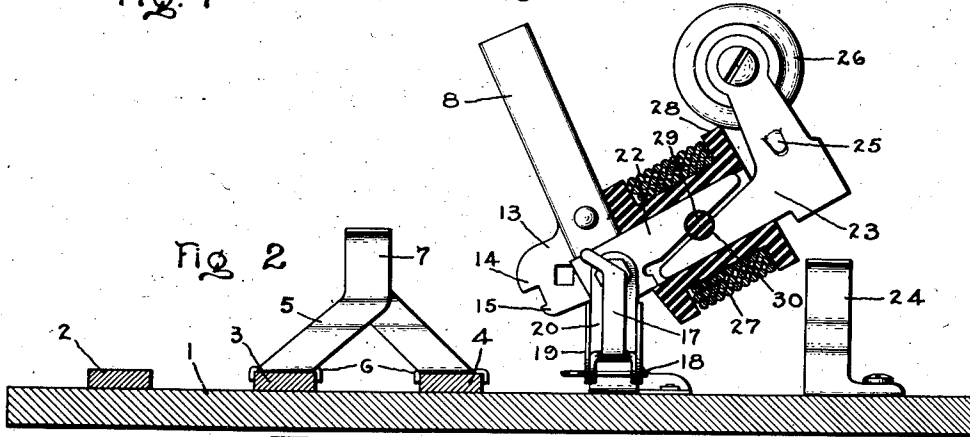


Fig. 2

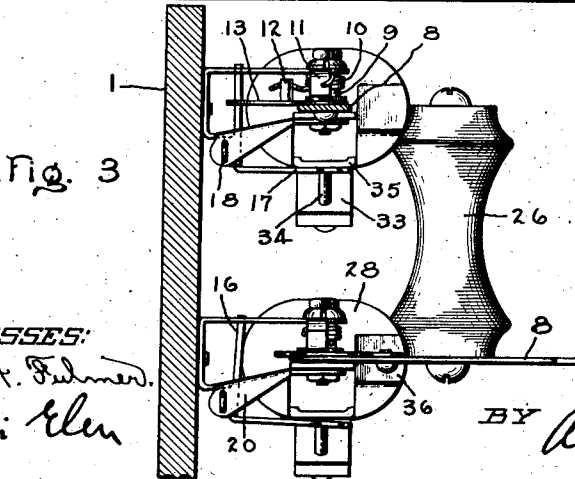


Fig. 3

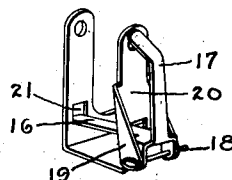


Fig. 4

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UNITED STATES PATENT OFFICE.

HENRY P. BALL, OF PITTSFIELD, MASSACHUSETTS, AND GILBERT WRIGHT, OF SCHENECTADY, NEW YORK, ASSIGNORS TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

CIRCUIT-CONTROLLER.

1,098,778.

Specification of Letters Patent.

Patented June 2, 1914.

Application filed December 22, 1908. Serial No. 468,834.

To all whom it may concern:

Be it known that we, HENRY P. BALL, a citizen of the United States, residing at Pittsfield, county of Berkshire, State of Massachusetts, and GILBERT WRIGHT, a citizen of the United States, residing in the city and county of Schenectady, State of New York, have invented certain new and useful Improvements in Circuit-Controllers, of which the following is a specification.

Our invention relates to devices for controlling electric circuits and more particularly to automatic circuit breakers which are non-closable on overload and are especially adapted to be used in place of fuses on panel boards and switch boards.

The main and branch circuits controlled by small switch boards and by the panel boards commonly used for the lighting circuits in buildings are generally protected by means of fuses, which are objectionable on account of the difficulty in calibrating a fuse and the expense and trouble of replacing a fuse each time an overload occurs upon any of the circuits.

The object of our invention is to overcome the difficulties met with in the use of fuses, and to provide a simple, cheap and efficient circuit controller which occupies a minimum space on the panel or switch board, is non-closable on overload, will automatically open the circuit upon occurrence of overload, has a very light and easily movable contact for breaking the circuit, can be used without change or modification to connect branch circuits to either side of a three-wire system and which is in general an improved form of simple and reliable circuit breaker, well adapted for use on panel boards and similar small switch boards.

In carrying out our invention, the circuit is controlled by means of a light and easily movable contact arm or blade biased to open the circuit and normally held in circuit closing position by some form of latch. The switch blade is connected in series with the contact and a tripping coil mounted on the switch blade has an armature which engages the latch and thereby automatically opens the circuit upon the occurrence of an overload. The parts are preferably so mounted that the circuit breaker is closed

by moving the switch arm in a direction to open the switch and after the circuit breaker has been latched in the closed position, the switch arm is moved back and closes the circuit. If an overload exists when the switch finally closes the circuit, the circuit breaker is automatically tripped and opens the circuit. The switch arm is rendered unusually short and compact by making it of two parts which are bound or clamped together by the overload coil and are connected to opposite ends of the overload coil so that the switch arm is very little longer than the overload coil. Contact clips of a special form are used to cooperate with the movable contact and are so proportioned that a standard form of circuit controller can be used to connect branch circuits to either side of a three-wire system, the only change that is required being a change in the position of the contact clips.

Our invention will best be understood in connection with the accompanying drawing, which is an illustration of one of the various forms in which it may be embodied and in which—

Figure 1 is a plan view of a portion of a panel board with our circuit controller mounted thereon, the lower side of the circuit being open; Fig. 2 a side view of the circuit controller shown in Fig. 1, with one of the overload coils shown in section along the line 2—2; Fig. 3 a sectional view on the line 3—3 of Fig. 1; and Fig. 4 a perspective view showing a detail of the device.

In the specific form of device shown in the drawings, the parts are mounted on a base or panel board 1, which is made of marble or any suitable insulating material and carries the three parallel conductors or bus bars 2, 3 and 4, of a three-wire system. On these conductors are mounted contact clips 5, which, as shown in Fig. 2, are each provided with a base 6 shaped to engage one of the conductors or bus bars and to be held thereon by means of a set screw, and also provided with contacting surfaces 7 which are out of alinement with the base 6 and when in position on the bus bars project, as shown in Figs. 1 and 2, to such an extent that the contacting surfaces of the clip secured to one conductor or bus bar are mid-

way between that conductor and the adjacent conductor. Two clips may therefore be mounted on two parallel bus bars, as shown in Fig. 1, in such a manner that the contacting surfaces of both clips are midway between the two conductors. The contact clips can be mounted to project on either side of the conductor, and by mounting the clips on the neutral conductor in proper relation to the clips on the outside conductors, a branch circuit can be connected to either side of the three-wire system. In the arrangement shown in Fig. 1 the branch circuit is connected to the right hand side of the system, but a circuit controller mounted on the left of the conductor could obviously be connected to the left hand side of the system by arranging the contact clips on the neutral and on the left hand outside conductor.

The circuit is automatically controlled by means of a circuit breaker with movable contact 8 made in the form of contact blades which cooperate with the contact clips 5 and are carried on the pivots 9 mounted parallel to the conductors or bus bars 2, 3 and 4. Each movable contact 8 is biased to open the circuit by means of a coil spring 10, which surrounds the pivot 9 and has projecting parallel ends which are separated by a stationary lug or abutment 11 and also by a lug or abutment 12 carried on the blade. These lugs are in such relation to each other that when the contact 8 is in the circuit opening position of the lower contact blade of Fig. 3, the two lugs are in alignment and the spring is not under strain, but when the contact 8 is in the circuit closing position of the upper contact 8 of Fig. 3, the ends of the spring and the lugs are separated, as shown, and the spring is put under strain.

Each movable contact is stopped in position in the contact clips and is latched closed in any suitable manner, and in the preferred construction each contact is provided with a blade 13 which carries a lug 14 for stopping the contact in proper position with its ends between the contacting surface of the contact clip 7 and also with a restraining lug 15 for holding the contact in circuit closing position against the strain exerted by the spring 10. The movable contact may be prevented from going through the contact clip 5 by any suitable stop which engages the lug 14, but in the preferred construction a pivoted latch 16, which is mounted to move in a plane transverse to the plane of movement of the contact blade 8, acts both as a stop to prevent oversetting of the contact 8 and also as a latch to hold the contact closed against the tension of its spring. The latch 16 is provided with a resilient actuating arm 17 at right angles to the latch and is mounted upon a pivot 18 carried upon wings 19 which are bent up from one side of a U-shaped

support 20, firmly secured to the base or panel 1 and carrying at its upper ends the pivot 9 on which movable contact 8 is mounted. The latch 16 extends through a slot in the side of the support 20 adjacent the pivot and its free end extends through a guide slot 21 in the opposite side of the U-shaped support 20, the guide slot preventing transverse movement of the free end of the latch, so that any strain exerted upon the latch by the contact 8 is resisted by the pivot and also by the guide for the free end of the latch. The parts are so proportioned that the lug 14 cannot be carried past the latch in any position of the latch, while when the latch is in its lowermost position the restraining lug 15 is released and the movable contact is free to respond to the bias of the spring 10 and to open the circuit. The latch 16 therefore acts both as a stop to prevent oversetting of the contact 8 and also as a latch which normally holds the circuit closed and is movable out of engagement with the restraining lug 15 to release the movable contact and thereby open the circuit upon the occurrence of overload.

The circuit breaker comprising the contact 8 and latch 16 is closed by means of a switch arm, connected in series with the contact 8 and arranged to move the contact 8 into circuit closing position. The switch arm is preferably made as short as possible in order to minimize the space required on the switch board and in the preferred construction the switch arm which is made of two parts or members comprises a movable member 22 mounted on the pivot 9, and a contact blade or member 23, insulated from the movable member 22 and cooperating with a contact clip 24 which corresponds to the contact clip 5 with which the movable contact 8 cooperates. The contact blade 23 is preferably provided with a projection or stop 25 which engages the end of the contact clip 24 and prevents the contact blade going beyond a predetermined position in the contact clip. There are two contact blades or members 23 connected by means of a handle 26 of any suitable insulating material, so that the two switch blades on the two sides of the circuit are fastened together and operate as one device. The two parts of each switch arm are electrically connected and also mechanically bound together by an overload or trip coil for actuating the latch 16 and mounted on the switch arm to encircle both parts or members of the switch arm and to clamp them rigidly to each other. In the preferred construction, the member 22 and the contact blade 23 are rigidly held in proper relation to each other by means of an insulating spool 28 provided with a longitudinal groove which fits snugly over the two members of the switch arm and has in the bot-

tom a cylindrical key or projection 29 which fits into corresponding recesses or key ways 30 in both the movable member 22 and the contact blade 23. As a result of this construction, as shown in Fig. 2, the movable member and the contact member are clamped to each other in the longitudinal groove and are immovably held when the parts are assembled, the cylindrical key 29 entering the recesses 30 and locking the two members against longitudinal displacement while the walls of the groove in the spool 28 prevent lateral displacement. After the parts of the switch blade are placed in position in the groove in the insulating spool 28 they are held in the groove by any suitable means, preferably a bow shaped yoke of iron placed on top of the two members and separated from them by a thin sheet of insulation. The yoke has a recess 32 which fits over the end of the key 29, and thereby positions the yoke in the groove. In manufacturing the switch the two members of the switch arm are laid in the groove in the spool 28 and the yoke 31 is then placed on top of them, after which the coil 27 is wound on the spool, whereby the yoke and members of the switch are firmly bound in place in the groove. On the outer ends of the yoke an armature 33 is loosely mounted on guide pins 34 and is so arranged that the end of the armature strikes the arm 17 when the armature is lifted, thereby moving the latch 16 out of engagement with the lug 15 and permitting the movable contact 8 to open the circuit. One end of the yoke 31 is provided with a curved tip 35, so proportioned that when the switch arm is swung about the pivot to force the contacts 8 into the clips 5, the curved tip 35 engages the end of the spring arm 17 and moves it in a direction to throw the latch 16 into latching position, thereby exerting a spring pressure on the latch to throw it into a closed position and avoiding the uncertainty of action which is encountered when the closing of the latch is dependent upon gravity. The insulating spool 28 is provided with a wearing plate 36 placed in a position to receive the impact of the movable contact 8 when the switch opens and thereby prevent the blow of the movable contact from injuring the insulating spool.

The operation of the device is as follows: When the parts are in the position shown in Fig. 2, both the switch and the circuit breaker are open. If it is desired to close the circuit the handle 26 is moved in a counter-clockwise direction about the pivot 9 thereby forcing the movable contact 8 between the contacting surfaces 7 of the clips 5. As the switch arm swings into position to force the contact 8 into the clips 5, the curved tip 35 of the yoke 31 presses down upon the outer end of the spring arm

17 and thereby exerts a spring pressure on the latch 16 which holds it in yielding engagement with the plate 13 and throws it into latching position behind the lug 15 as soon as the movable contact 8 is fairly between the contacting surface 7 and the clips 5. If an attempt is made to throw the movable contact farther and cause it to pass through the clips 5 the lug 14 engages the latch 16 and effectively stops further movement of the contact 8. The latch 16 springing into position behind the restraining lug 15 latches the circuit breaker closed and the switch arm is then moved in a clockwise direction until the contacts 23 engage the contact clips 24, thereby closing the circuit through the circuit breaker. If an overload exists upon the circuit when the switch is closed an abnormal current will flow through the contact 23, around through the tripping coil 27 into the movable member 22 and thence through the movable contact 8 to the contact clips 5. This abnormal current sets up a strong magnetic field which lifts the armature 33 and causes it to deliver a blow on the end of the spring arm 17, thereby throwing the latch 16 out of engagement with the restraining lug 15 and permitting the movable contact 8 to move out of the contact clips 5 under the influence of the spring 10.

Since the movable contact 8 is in the form of a light blade and is freely movable about the pivot 9, the circuit is opened very quickly and with a minimum of sparking. The movable contacts 8 are in duplicate and each is provided with its own tripping magnet and latch identical in construction. The device is then a double pole circuit breaker and protects both sides of the circuit.

Our invention may be embodied in many other forms than that shown and described and we do not, therefore, wish to be restricted to the precise arrangement disclosed, and intend to cover by the appended claims all changes and modifications which are within the spirit and scope of our invention.

What we claim as new and desire to secure by Letters Patent of the United States, is—

1. In a circuit controller, the combination with an automatic circuit breaker comprising cooperating contacts biased to separate, and latching means for holding said contacts into engagement, of a switch in series with said circuit breaker and by means of which said circuit breaker is closed, and means whereby said switch yieldingly forces said latching means into latching position during the closing of said circuit breaker.

2. In a circuit controlling device, the combination with a circuit breaker comprising cooperating contacts biased to separate, one

of said contacts being pivoted, and latching means for holding said contacts in engagement, of a switch in series with said circuit breaker comprising a switch blade mounted
5 on the same pivot as said pivoted contact of said circuit breaker and by means of which the circuit breaker is closed, and means on said switch blade for cooperating with said latching means to yieldingly force said
10 latching means into latching position as said circuit breaker is closed by said switch blade.

3. A circuit controlling device comprising a circuit breaker, a switch arm in series
15 therewith arranged to close said circuit breaker when said switch arm is moved to open the circuit and a trip coil for said circuit breaker mounted on said switch arm.

4. A circuit controlling device comprising
20 a movable contact, a switch arm connected in series with said contact and arranged to move said contact to close the circuit when said switch arm is moved to open the circuit, a latch for holding said movable contact in
25 circuit closing position and a trip coil for said latch mounted on said switch arm.

5. In a circuit controller, the combination with a movable switch arm, of a circuit breaker connected in series with said switch
30 arm and comprising separable contacts biased to open the circuit, said contacts being closed by said switch arm when said arm is moved to open the circuit, restraining means for holding said contacts closed, and electro-
35 responsive means mounted on said switch arm to control said restraining means.

6. In a circuit controller, the combination with a movable switch arm, of a circuit breaker connected in series with said switch
40 arm and comprising separable contacts normally biased to open the circuit, said contacts being closed by said switch arm when said arm is moved to open the circuit, a latch for holding said contacts closed, a
45 coiled conductor arranged to form part of said switch arm, and an armature for said coil arranged to cooperate with said latch.

7. In a circuit controller, the combination with a movable switch arm comprising two
50 parts rigidly connected and insulated from each other, of a circuit breaker connected in series with said switch arm and comprising cooperating contacts biased to open the circuit and to be closed by said switch arm
55 as said arm is moved to open the circuit, a latch for holding said contacts closed, a coil having its winding connected between the two parts of said switch arm and an armature for said coil arranged to actuate said
60 latch.

8. In a circuit controlling device, the combination with an automatic circuit breaker comprising cooperating contacts biased to
55 separate, one of said contacts being pivoted, and a latch for holding said contacts in en-

gagement and provided with a spring arm, of a switch blade mounted on the same pivot as said pivoted contact and by means of which said circuit breaker is closed, and a
70 projection on said switch arm to engage said spring arm on said latch and thereby yieldingly force said latch toward latching position as the circuit breaker is being closed by said switch arm.

9. A circuit breaker comprising a pivoted
75 catch, a guide for the free end of said catch, a movable contact biased to open the circuit and having one lug to engage with said catch to prevent opening of the circuit and a second lug to engage said catch to limit
80 the circuit closing movement of said contact, and electroresponsive means for moving said catch out of engagement with the first lug.

10. A circuit breaker comprising a piv-
85 oted catch, a guide for the free end of said catch to prevent sidewise movement of said catch, a movable contact biased to open the circuit and shaped to engage said catch be-
90 tween its pivot and said guide during movement of said contact to close the circuit, whereby oversetting of said contact is pre-
95 vented, a lug for engaging said catch to hold said contact in circuit closing position, and electroresponsive means for moving said catch to release said contact.

11. A circuit breaker comprising a bow
shaped support having alined apertures in
opposite sides, a movable contact pivoted be-
tween the ends of said support and biased
to open the circuit, a catch pivoted to one
100 side of said support to extend through said apertures and to stop said contact in prede-
termined position to prevent oversetting of
said contact, a lug on said catch whereby
said catch holds said contact in circuit closing
105 position, and electroresponsive means for moving said catch to release said contact and thereby open the circuit.

12. In a circuit controller, the combina-
tion with a contact, of a controlling arm
110 comprising a cooperating contact, a movable member insulated from said contact, and a conducting winding arranged to clamp said member and said contact rigidly to each
115 other, said winding having its opposite ends connected to said member and to said contact respectively.

13. In a circuit controller, the combina-
tion with fixed and movable cooperating
contacts, of a movable member insulated
120 from said movable contact, and a coil mounted on said member to clamp said contact and member to each other, the opposite ends of said coil being connected to said member and to said contact respectively.

14. In a circuit controller, the combina-
tion with a contact connected to one ter-
minal of the circuit, of a circuit controlling
arm comprising a cooperating contact, a
member connected to the other terminal of
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the circuit and insulated from said cooperating contact, and a coil wound over said member and said contact to clamp them rigidly to each other and having one end connected to said member and the opposite end to said contact.

15. In a circuit controller, the combination with a contact clip forming one terminal of the circuit, of a controlling arm comprising a cooperating contact blade, a second blade connected to the other terminal of the circuit and insulated from the first blade, and a conducting clamp with its ends connected to said blades and arranged to hold them in fixed relation to each other.

16. In a circuit controller, the combination with a contact, of a circuit controlling arm comprising a cooperating contact having a recess, a movable member insulated from said contact and having a corresponding recess, an insulating key fitted in said recesses to prevent relative movement of said contact and said member, and a winding encircling said contact and said member adjacent said key with its opposite ends connected to said member and to said contact respectively.

17. In a circuit controller, the combination with a contact, of a circuit controlling arm comprising a cooperating contact having a recess, a movable member insulated from said contact and having a corresponding recess, an insulating key fitted in said recesses to prevent longitudinal relative movement of said contact and said member, an insulating sleeve encircling said contact and said member to prevent relative lateral movement, and a winding on said sleeve with its opposite ends connected to said member and to said contact respectively.

18. In a circuit controller, the combination with a circuit breaker comprising a latch for tripping the circuit breaker to open the circuit, of a switch arm connected in series with said circuit breaker and comprising a contact, a movable member insulated from said contact, a winding encircling said member and said contact to clamp them to each other and having its opposite ends connected to said member and to said contact respectively, and a movable armature responsive to the magnetic field of said coil to actuate said latch and thereby trip said circuit breaker.

19. In a circuit controller, the combination with a circuit breaker comprising a latch for tripping the circuit breaker to open the circuit, of a switch arm connected in series with said circuit breaker and comprising a contact, a movable member insulated from said contact, a magnetic yoke adjacent said member and said contact, an armature mounted on said yoke to respond to variations in flux in said yoke and thereby actuate said latch to trip said circuit breaker, and

a winding having its ends connected to said member and to said contact and arranged to encircle said member, said contact, and said yoke to clamp them into a rigid circuit controlling arm.

20. In a circuit controller, the combination with a circuit breaker comprising a latch for tripping the circuit breaker to open the circuit, of a switch arm connected in series with said circuit breaker and comprising two adjacent members insulated from each other and having confronting recesses to form an opening through said members, a magnetic yoke mounted adjacent said members and having an opening in alignment with said recesses, an insulating spool with a longitudinal groove to receive said members and said yoke and having a projecting key fitting into said opening, a winding on said spool with its ends connected to said members, and an armature mounted on said yoke to move said latch and thereby trip said breaker.

21. In a circuit controller, the combination with a circuit breaker comprising a latch for tripping the circuit breaker to open the circuit, of a switch arm connected in series with said circuit breaker and having a transverse opening, a magnetic yoke having an opening in registry with the opening in said arm and mounted on said switch arm with its ends projecting away from said arm, an insulating sleeve with a longitudinal groove to receive said arm and yoke and a projecting key to enter both said openings, a winding on said spool encircling said arm and yoke, and an armature on said yoke to actuate said latch and thereby trip said circuit breaker.

22. In a circuit controller, the combination with a movable contact biased to open the circuit and a latch for engaging said contact to hold it in circuit closing position, of a movable switch arm for moving said contact into circuit closing position, and resilient means cooperating with said switch arm to yieldingly force said latch into latching position and set under strain by said switch arm before said arm forces said contact into circuit closing position.

23. In a circuit controller, the combination with a movable contact biased to open the circuit and a latch for engaging said contact to hold it in circuit-closing position, of a movable switch arm for moving said contact into circuit closing position, and a spring connected to said latch to force said latch into latching position and set under strain by said switch arm when said arm forces said contact into circuit closing position.

24. In a circuit controller, the combination with a movable contact biased to open the circuit and a latch for engaging said contact to hold it in circuit closing position,

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said latch having a spring arm, of a movable switch arm for moving said contact into circuit closing position and having a cam which engages said spring arm and
5 thereby forces said latch toward latching position as said contact approaches circuit closing position.

In witness whereof I, HENRY P. BALL,
have hereunto set my hand this 17th day of
10 December, 1908, and I, GILBERT WRIGHT,

have hereunto set my hand this 21st day of December, 1908.

HENRY P. BALL.
GILBERT WRIGHT.

Witnesses to Ball:

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T. P. THOMPSON.

Witnesses to Wright:

BENJAMIN B. HULL,

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