E. H. ROLLINSON.

ELECTRICAL TIMING DEVICE.

APPLICATION FILED NOV. 27, 1915.

1,231,200.

Patented June 26, 1917.

2 SHEETS—SHEET 1.

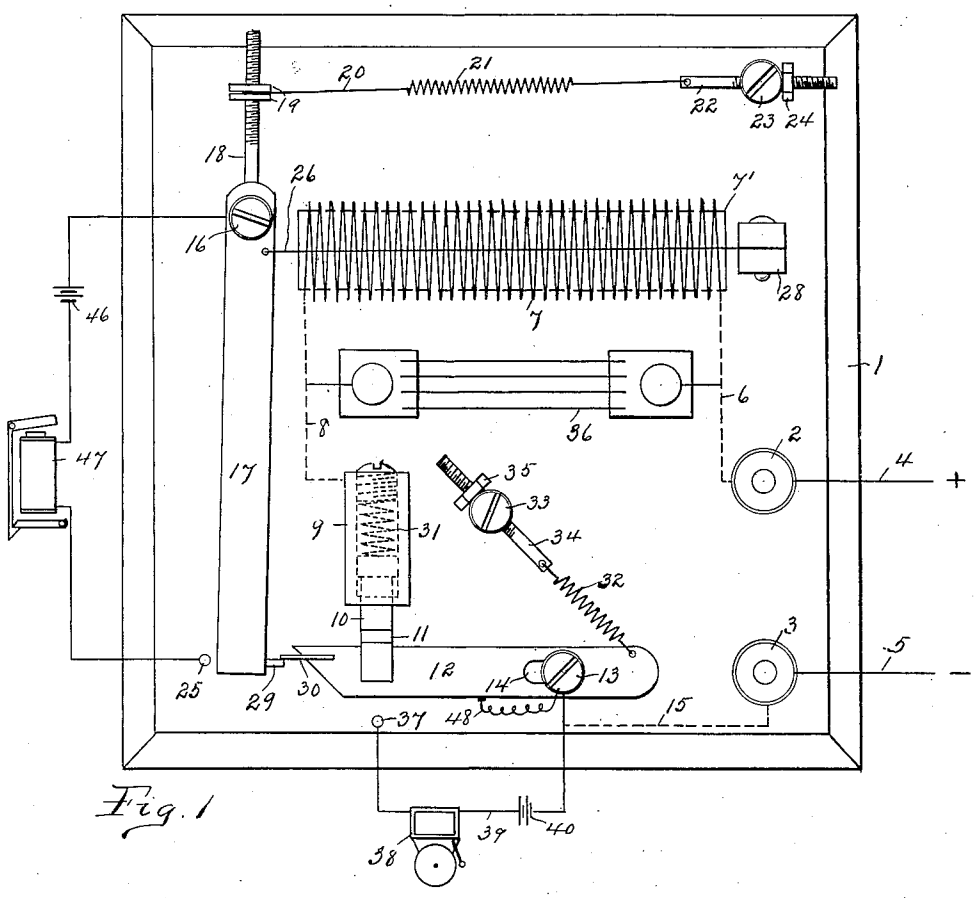


Fig. 1

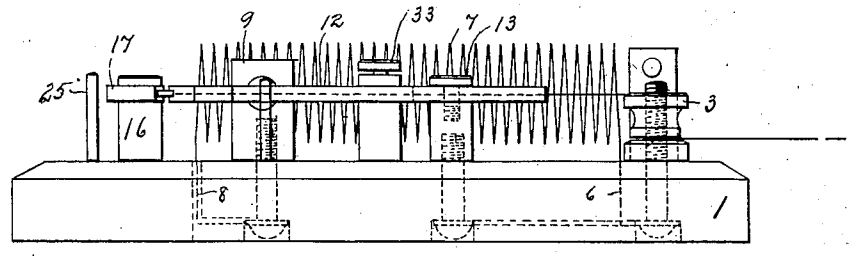


Fig. 2.

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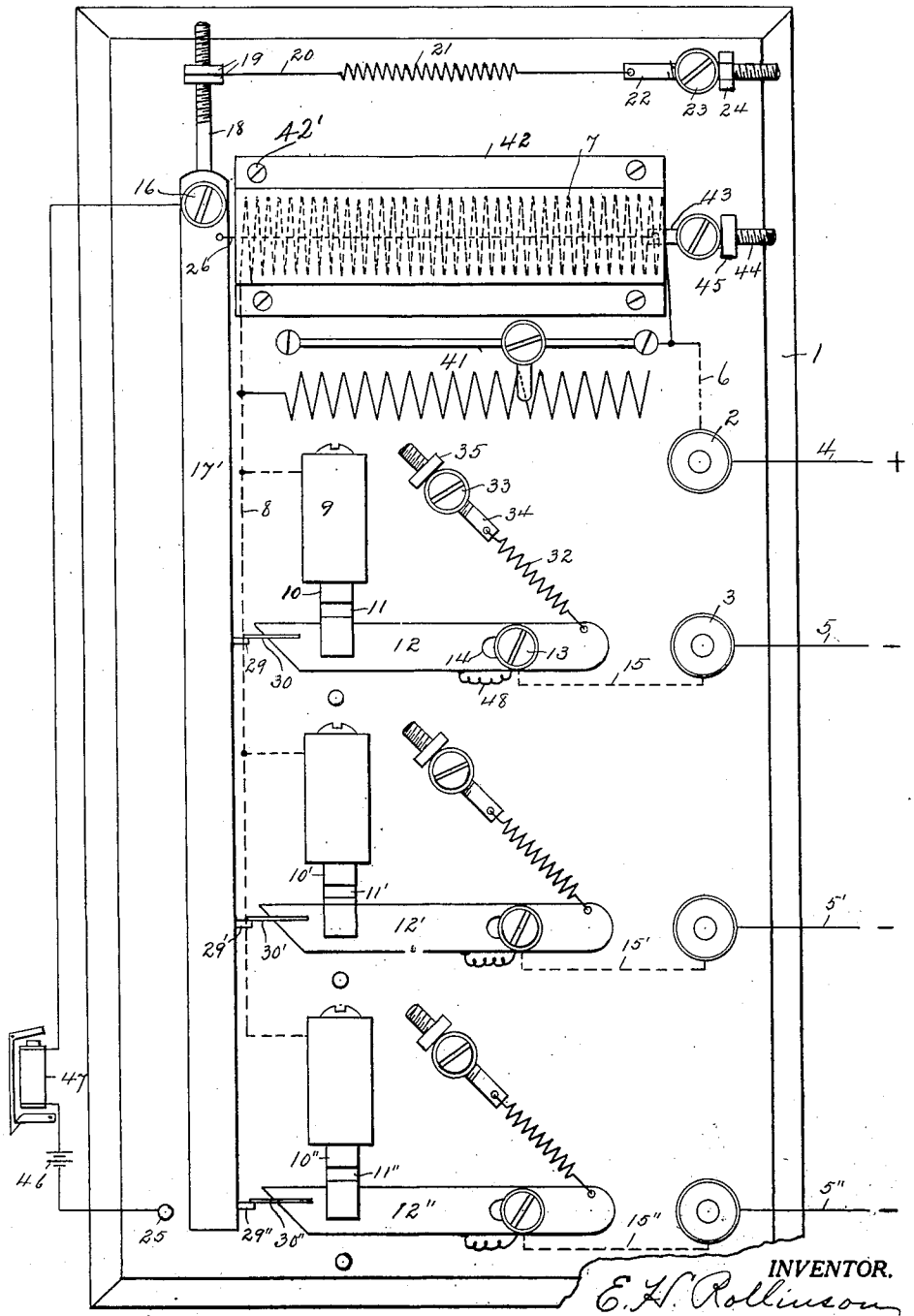


Fig. 3.

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UNITED STATES PATENT OFFICE.

EARL HOYT ROLLINSON, OF LYONS FARMS, NEW JERSEY.

ELECTRICAL TIMING DEVICE.

1,231,200. Specification of Letters Patent. Patented June 26, 1917.

Application filed November 27, 1915. Serial No. 63,705.

To all whom it may concern:

Be it known that I, EARL HOYT ROLLINSON, a citizen of the United States, and residing in Lyons Farms, county of Union, and State of New Jersey, have invented certain new and useful Improvements in an Electrical Timing Device, of which the following is a specification.

Hot wire circuit breakers are old in the art, but in all cases the hot wire element of such circuit breakers carries either the main current or a shunted current, with the result that the alternate heating and cooling of the wire oxidizes or sets up a molecular fatigue therein, and otherwise so deteriorates the wire itself as to reduce its capacity and reliability. Frequently the current is of such strength that it completely destroys the effect of the wire as a tension device for holding the circuit closed. The device of my invention embodies several novel features. The current through the circuit breaker may be either current from the main circuit or from a shunted circuit, but in no case does any portion of the operating current pass through the hot wire; it depends entirely for its operation upon heat generated in a heating coil which is located either in a main circuit or a shunted circuit through the device. The time element is of the greatest importance in devices of this character, and when properly calibrated the device will carry either a heavy, steady, strong current for a predetermined period before the breaker is operated, or it may be calibrated for a current of gradually increasing strength for a predetermined period before the circuit breaker opens.

In carrying out my invention I make use of a structure substantially as illustrated in the accompanying drawings, wherein—

Figure 1, illustrates a vertical plan view of my device with a single circuit breaker closed.

Fig. 2, is a bottom end elevation of the device.

Fig. 3, is a view similar to Fig. 1, but illustrating the device as applied to a plurality of branch circuits in parallel from the main circuit.

Similar numerals of reference refer to like parts throughout the specification and drawings.

The various parts of the timing device are mounted upon an insulating slab or board 1, which may be of marble, slate, fiber, or any desired or preferred insulating material. The two binding posts 2 and 3, are conveniently secured to the face of the board and are connected by the wires 4 and 5, with the circuit to be broken. The wire 6 leads from the binding post 2, to the heating coil 7, which is suitably mounted upon the face of the board 1; thence the wire 8 leads to a standard 9, rigidly secured to the board 1, in which the spring actuated carbon brush or contact 10 is located. Bearing upon the face of the brush 10, is a corresponding brush or contact 11, carried by the oscillating and sliding lever 12,—the latter being pivoted upon the post 13 in such a manner that the lever 12 may slide the length of the slot 14 for a purpose hereinafter to be described. The circuit then continues through the wire 15 to the binding post 3, and thence by way of the wire 5, to the return circuit.

Pivoted upon the post 16 is a pendulum lever 17, having the upper screw-threaded extension 18, upon which are mounted a pair of leverage adjusting nuts 19. Between these nuts is secured a wire 20, of special composition, a portion of which is coiled into a contractile spring 21, and secured to the adjusting screw 22, which latter is mounted in the post 23. The adjustment of the tension of the wire 20 and its spring 21, is afforded by means of the nut 24, upon the screw 22. When the spring 21 is under proper tension, the tendency of the pendulum lever 17 is to swing to the left as shown in the figure to bear upon the stop post 25. This tendency, however, is restrained by means of a so called hot wire 26, secured to the lever 17 at a point in close proximity to the post 16, and extending axially through the coil 7, to an adjusting standard 28 secured to the board 1 at the opposite end of the coil 7. This wire 26, is drawn taut and its end permanently secured between the jaws of the standard 28, and its tension is such as to pull the lever 17 into the position indicated in Fig. 1, in which position the steel stop point 29 is in position to engage the corresponding silver stop plate 30, which latter is secured in the free end of the lever 12, the parts being so arranged that when in the position indicated in Fig. 1, the spring 31 within the standard 9, is put under compression by the carbon brush 11 bearing upon the carbon brush 10. The lever 12

extends to the right of its pivot post 13, and is connected by the adjustable spring 32 to the post 33, by means of the adjusting screw 34; the tension of the spring 32 being adjusted by means of the adjusting nut 35.

The slot 14, in the lever 12, permits a lateral sliding movement of said lever to the extent of the slot so that in again setting the device, after once being tripped, it is unnecessary to touch the lever 17; the lever 12 may be slid to the right to the extent of the slot 14, pressed upwardly with the carbon brush 11, depressing the brush 10 against the spring 31, and then slid to the left with the stop plate 30 above the stop pin 29.

It will be noted that the general direction of the screw 34 and spring 31, is diagonal to the general direction of the lever 12,—this is so designed to permit the spring 32 not only to create in the lever 12, an anti-clockwise tendency, but also to keep the lever 12 with its slot 14, bearing close upon the standard 13, with the stop plate 30 and the stop pin 29 in engagement.

In some cases I may introduce a shunt 36 between the wire 6 and the wire 8, so that only a portion of the current from the wire 4 will pass through the heating coil 7, the main body of the current passing through the shunt 36. This shunt may be of any type of shunt now on the market—the Weston type being the one illustrated.

The stop post 37 is provided to limit the movement of the lever 12 and its normal distance from the lever 12, as shown in Fig. 1, is such that when the lever 12 rests upon it, the contact between the faces of the brushes 10 and 11 will be completely broken.

In order to indicate the breaking of the circuit I may lead a wire from the stop post 37 to an ordinary electric bell 38, located at any convenient point; the circuit being completed by the wire 39, through the battery 40, to the post 13.

The operation of the device is as follows: Let it be assumed that a current is passing through the device by way of the wire 4, coil 7, and shunt 36, wire 8, standard 9, brushes 10 and 11, lever 12, wire 15 to the binding post 3 and wire 5. If the current passing through the circuit is normal, its heating effect upon the coil 7 will be insufficient to affect the hot wire 26 sufficiently to permit the spring 21 to break the engagement between the stop plate 29 and the stop pin 30. If, however, the device is calibrated for the specific purpose, then a rise of current strength in this circuit will gradually increase the heating effect of the coil 7, and its temperature will be radiated to the wire 26, which, of course, will expand and permit the spring 21 to throw the lever 17 against the stop post 25, the spring 32 will then oscillate the lever 12 upon its pivot and thereby break the circuit at the two brushes 10 and 11. Simultaneously with the contact of the lever 12 with the stop post 37, the circuit through the bell 38 is closed and the ringing of the bell will indicate the breaking of the circuit and the trouble may be located immediately.

Again there are cases where the device would be used in a circuit where the current is of uniform strength; in this case the coil 7 will only heat gradually, but it can be so adjusted or selected that the current must continue for a predetermined period before sufficient heat will be generated to expand the wire 26 sufficiently to permit the device to operate, and it is this particular function of the device which gives it the name of a timing electric circuit breaker. The wires 26 and 20 should be selected of some special composition having a high coefficient of heat expansion so that the wire 26 may be affected by the radiation of heat within the coil 7. It will be noted that the wire passes through the axis of the helix or coil 7, so that it is completely air insulated from the coil. The circulation of the air through this open coil materially adds to the effectiveness of the device, for the reason that, being selected of material having a high coefficient of heat expansion, slight changes in the temperature might affect it. These slight changes are materially modified by its air insulation from the coil 7 itself. Again, by selecting the wires 20 and 26 of the same material, atmospheric changes will affect them both in the same manner, and inasmuch as they are located on opposite sides of the fulcrum or pivot post 16, any change in one is accompanied by a corresponding change in the other. The shunt 36 and the coil 7, may be so selected that a predetermined quantity of current to produce the desired results may be made to pass through the coil 7.

The manner in which the radiation of heat within the coil 7 is governed, is as follows: The coil 7 may be wound upon a tubular core 7', of any material suitable for the purpose,—various materials are used to produce various degrees of heating effects; for example, if the bare coil is used without any supporting core, radiation would be comparatively immediate, and very quickly expand the wire 26. If some rapidly conducting material, as a thin tubular core made of aluminum or copper were used, then the effect upon the wire 26 would be retarded and the degree of retardation may be regulated by the relative thickness of the aluminum or copper core. On the other hand, if still greater retardation of the heating effect of the coil is desired, the core may be made of porcelain or clay compound of sufficient thickness to produce the desired effects. This retardation is due to the fact

that the intervening air-gap affords a free circulation of air around the wire 26, and since the cores have a considerable more area for the radiation of heat, their interposition effects a ready means for very nicely and definitely timing the instant of tripping.

In Fig. 3, I have shown the device as arranged for use in a plurality of parallel branch circuits, and while I have shown three of such branch circuits I do not desire to limit myself to that number, as any number of such circuits may be provided for by the device. In this case the board 1 is sufficiently extended to carry all of the apparatus used. The circuit breaking elements are substantial duplicates of the device shown in Fig. 1, and a description of them will suffice as for a description of the corresponding elements in Fig. 3. The lever 17′, however, is made of sufficient length to carry the corresponding stops 29—29′—29″, for engagement with the corresponding stop plates 30—30′—30″. The circuit may be assumed to enter the device through the wire 4, by way of the binding post 2, thence by the variable resistance 41, to the wire 8, to the several standards 9—9′—9″; thence by way of the brushes 10—11, 10′—11′, 10″—11″, to the levers 12—12′—12″, wires 15—15′—15″, and return wires 5—5′—5″, to the various apparatus in the branch circuits to be operated by the current. The amount of resistance in the variable resistance 41, to the passage of the current will determine the amount of current passing through the coil 7, and this may be regulated for the proper time element for operating the device.

In Fig. 3, I have shown the coil 7 as inclosed within a cover plate 42, which latter is secured to the base or slab 1, by means of the screws 42′.

In Fig. 3, I have shown a variable resistance 41 where I have shown a shunt 36 in Fig. 1. It is to be understood that the substitution of the one for the other may be made in any case. The shunt is used where the time element is intended to be fixed, and the variable resistance 41 is used where the time element may be varied. In Fig. 3, I have also shown the ordinary adjustable wire connection 43, for adjusting the tension of the wire 26; this consists merely of a post with the adjusting screw 44 and the adjusting nut 45, the wire 26 being connected to the pendulum lever 17′, and passing through the axis of the coil 7, and connected to the end of the adjusting screw 44.

In some cases it may be desirable to make a more positive connection between the lever 12, and its supporting post 13, than the sliding connection shown. Occasions may arise where this metallic connection would offer, at times, too great a resistance; in order to overcome this I may connect the lever 12 directly with the post 13, by means of a pigtail connector 48, soldered to the side of the lever 12 and to the post 13. This, and other minor details of construction would readily suggest themselves to persons skilled in the art and need no further explanation.

In Fig. 1, I have shown an additional form of signal device. In this case I lead a wire from the post 16, through a battery 46, to some one of the well known forms of indicators or annunciators as 47, thence to the post 25. In this case, whenever the wire 26 expands sufficiently to bring the pendulum lever 17 in contact with the post 25, the circuit through the annunciator will be established and the drop will fall, but the main circuit through the coil 7 having been broken by the separation of the stops 29 and 30, and the brushes 10 and 11, the coil 7 will immediately cool and the wire 26 will immediately contract and draw the pendulum lever 17 away from the stop 25, and thereby break the annunciator circuit. This is as it should be, for when the drop of the annunciator falls there is no necessity for further current to pass and thus the battery current is not wasted. I have illustrated a similar annunciator 47, in connection with Fig. 3, and its operation will be readily understood from the foregoing.

In selecting what I consider the best material of which to make the two stops 29 and 30, I have chosen steel of cylindrical form for the stop 29, and a flat silver plate for the stop 30, for the reason that these two metals offer the least frictional resistance to each other, and inasmuch as the device is very delicately adjusted the frictional resistance between these two points should be as slight as possible. I have described the heat retarding element 7′, as of aluminum, copper, porcelain, or clay composition,—I do not intend by this to limit myself to these substances as it is only a matter of experiment to determine which of these, or which of any other of the numerous substances which might be used, can be selected for the purpose. In practice the well known Leonard porcelain resistance tube having a standard resistance of 5 ohms answers very well for many of the purposes to which the device can be put.

While I have shown in Fig. 1, a shunt 36, which carries the major portion of the current, and in Fig. 3, the variable resistance 41, for the same purpose, yet it is quite obvious that both these devices may be combined in the same instrument. They are solely for the purpose of adjusting the current which passes through the heating coil 7.

In Fig. 1, I have shown two forms of indicators, one an audible signal as the bell 38, and the other as a visual indicator as the drop annunciator 47. I do not wish by this to be considered as limiting myself to a

single one of these devices upon a single instrument, as both may be used at the same time. For example, the bell may be used in dark places where a visual signal could not be seen, and where several of the devices are utilized in several separate circuits the bell would indicate that some one of the circuits has been broken and that some of the apparatus may be out of order, while the visual signal would indicate to the eye at a glance, the particular instrument which needed attention. The device is completely self acting and is self supervised, and in actual operation may be adjusted to either a slight or a very considerable variation in current. It may be adjusted by means of the variable resistance 41, or the proper selection of a shunt 36, or the proper selection of a core 7' for any of the varied demands made upon a circuit breaker of the character described. It finds its most extended use in connection with fire alarms and telephone systems.

In practice the plane of the board 1 is vertical so that the pendulum lever 17, may hang vertically downward so that gravity will have little if any effect in varying the delicacy of the device.

While I have shown and described two forms of my invention yet I do not consider that they are modifications in the strict sense of the word; they are only forms of the same invention designed for different purposes, and while the forms shown and described exhibit my preferred construction, I do not desire to be considered as limiting myself to them alone. The principal feature of the invention resides in the fact that the operating wire or element, does not at any time carry any current and is therefore unaffected by the comparatively slight variations in temperature to which it is subjected in use.

I claim:

1. In a timing circuit breaker, the combination of an electrical circuit, a heating coil in said circuit, a device for holding said circuit breaker closed including an expansible metallic member within and free from contact with said heating coil and actuated by the heat radiated therefrom to release said device and open said circuit breaker.

2. In a timing cut-out for electric circuits, the combination of an electric circuit, a heating coil and a circuit breaker in series in said circuit, a spring actuated pivoted lever having a stop device for holding said circuit breaker closed, an expansible metallic element free from contact with but actuated by the heat generated in and radiated from said coil to release said circuit breaker and thereby open the circuit.

3. In a circuit breaker, the combination of an electric circuit, a heating coil in said circuit, and a pivoted spring actuated circuit breaker in said circuit, an expansible metallic member disconnected from said circuit free from contact with said coil and actuated by radiant heat therefrom for releasing said circuit breaker to open said circuit.

4. In a circuit breaker, the combination of an electric circuit, a heating coil and a circuit breaker in series in said circuit, a tripping device for releasing said circuit breaker, an expansible metallic element free from contact with and actuated by radiant heat from said heating coil for releasing said tripping device to open said circuit.

5. In an electric circuit breaker, the combination of an electric circuit, a heating coil and a spring actuated circuit breaker in said circuit, a pivoted lever having a stop thereon for engagement with an element of said circuit breaker to hold the same closed, an expansible wire within but free from contact with said heating coil connected to said lever and actuated by radiant heat from said coil to permit said lever to release said circuit breaker and thereby open said circuit.

6. In a timing circuit breaker, the combination of an electrical circuit, a heating coil in said circuit, a device for holding said circuit breaker closed including an expansible wire within but free from contact with said heating coil and actuated by the radiant heat therefrom to release said device and open said circuit breaker, and means for adjusting the current strength in said coil.

7. In a timing cut-out for electric circuits, the combination of an electric circuit, a heating coil and a circuit breaker in series in said circuit, a spring actuated pivoted lever having a stop device for holding said circuit breaker closed, an expansible wire free from contact with said heating coil and actuated by the heat generated in said coil and radiated through the intervening air-gap to said element to release said circuit breaker and thereby open the circuit, and means for adjusting the current strength in said coil.

8. In a circuit breaker, the combination of an electric circuit, a heating coil in said circuit, and a pivoted spring actuated circuit breaker in said circuit, an expansible wire disconnected from said circuit and free from contact with said coil but actuated by radiant heat therefrom for releasing said circuit breaker to open said circuit, and means for adjusting the current strength in said coil.

9. In a circuit breaker, the combination of an electric circuit, a heating coil and a circuit breaker in series in said circuit, a tripping device for releasing said circuit breaker, an expansible wire separated by

an intervening air-gap from and actuated by radiant heat from said heating coil for releasing said tripping device to open said circuit, and means for adjusting the current strength in said coil.

10. In an electric circuit breaker, the combination of an electric circuit, a heating coil and a spring actuated circuit breaker in said circuit, a pivoted lever having a stop thereon for engagement with an element of said circuit breaker to hold the same closed, an expansible wire within but separated by an intervening air-gap from said heating coil connected to said lever and actuated by radiant heat from said coil to permit said lever to release said circuit breaker and thereby open said circuit, and means for adjusting the current strength in said coil.

11. In a timing circuit breaker, the combination of an electrical circuit, a heating coil in said circuit, a device for holding said circuit breaker closed including an expansible wire within but separated by an intervening air-gap from said heating coil and actuated by the heat radiated therefrom across said air-gap to release said device and open said circuit breaker, and means for regulating the heat radiated by said coil upon said expansible wire.

12. In a timing cut-out for electric circuits, the combination of an electric circuit, a heating coil and a circuit breaker in series in said circuit, a spring actuated pivoted lever having a stop device for holding said circuit breaker closed, an expansible wire separated by an intervening air-gap from and actuated by the heat generated in said coil and radiated across said air-gap to release said circuit breaker and thereby open the circuit, and means for regulating the heat from said coil to expand said wire in a predetermined time to operate said circuit breaker.

13. In a circuit breaker, the combination of an electric circuit, a heating coil in said circuit and a pivoted spring actuated circuit breaker in said circuit, an expansible wire disconnected from said circuit and separated by an intervening air-gap and actuated by radiant heat from said heating coil for releasing said circuit breaker to open said circuit, and means for regulating the heat radiant from said coil to expand said wire in a predetermined time to operate said circuit breaker.

14. In a timing circuit breaker, the combination of a main line circuit and a plurality of branch line circuits connected with said main line circuit, a heating coil in said main line circuit, and a circuit breaker in each of the branch line circuits, thermally actuated means separated from said coil by an intervening air-gap for normally holding said breakers closed and simultaneously opening all of said circuit breakers, operated by the generation of a predetermined quantity of heat in said heating coil and radiated across said air-gap to said thermally actuated means.

15. In a timing circuit breaker, the combination of a main line circuit and a plurality of branch circuits connected therewith, a heating coil in said main line circuit and a circuit breaker in each of said branch circuits, a thermal expansion wire located in the axis of but insulated from said heating coil by an intervening air-gap, and means actuated by the generation of a predetermined quantity of heat in said coil and radiated to said wire across said air-gap for opening said circuit breakers.

16. In a timing circuit breaker, the combination of a main line circuit and a plurality of branch line circuits connected with said main line circuit, a heating coil in said main line circuit, and a circuit breaker in each of the branch line circuits, thermally actuated means separated from said coil by an intervening air-gap for normally holding said breakers closed and simultaneously opening all of said circuit breakers, operated by the generation of a predetermined quantity of heat in said heating coil and radiated therefrom across said air-gap to said thermally actuated means, and means for regulating the current strength through said coil.

17. In a timing circuit breaker, the combination of a main line circuit and a plurality of branch circuits connected therewith, a heating coil in said main line circuit and a circuit breaker in each of said branch circuits, a thermal expansion wire located in the axis of but insulated from said heating coil by an intervening air-gap, means actuated by the generation of a predetermined quantity of heat in said coil and radiated across said air-gap to said wire for opening said circuit breakers, and means for regulating the current strength passing through said heating coil.

18. In a timing circuit breaker, the combination of an electric circuit, a heating coil and a spring actuated circuit breaker in said circuit, a pivoted lever, an expansible wire connected to said lever and extending axially through said coil and rigidly secured at its opposite end, a stop pin on said lever, a stop plate upon said circuit breaker, for engagement with said pin to hold said circuit breaker closed, and a spring for swinging said lever to break the engagement of said stop pin and plate and thereby open said circuit upon the generation of heat in said coil and the consequent expansion of said wire.

19. In an electric circuit breaker, the combination of a spring pressed, sliding brush, a pivoted lever mounted to slide upon its

pivot, a brush upon said lever adapted to contact with and depress said sliding brush, and a trip device for engagement with said lever and so arranged as to require said lever to be slid upon its pivotal support and effect a wiping contact between said brushes when said circuit breaker is reset.

20. In a circuit breaker, the combination of a pair of contact brushes spring pressed together to close an electric circuit, means for effecting a direct separation of said brushes to break said circuit and for necessitating a sliding contact between said brushes to close said circuit.

21. In a timing circuit breaker, the combination of an electrical circuit, a heating coil in said circuit, a device for holding said circuit breaker closed including an expansible wire within and separated from said heating coil by an intervening air-gap and actuated by the heat radiated therefrom to release said device and open said circuit breaker, and an electric signal actuated by the opening of said circuit breaker.

22. In a timing cut-out for electric circuits, the combination of an electric circuit, a heating coil and a circuit breaker in series in said circuit, a spring actuated pivoted lever having a stop device for holding said circuit breaker closed, an expansible wire separated by an intervening air-gap from and actuated by the heat generated in and radiated from said coil to said element to cause it to expand to release said circuit breaker and thereby open the circuit, and an electric signal actuated by the opening of said circuit breaker.

23. In a circuit breaker, the combination of an electric circuit, a heating coil in said circuit and a pivoted spring actuated circuit breaker in said circuit, an expansible wire disconnected from said circuit and separated by an intervening air-gap from but actuated by radiant heat from said heating coil for releasing said circuit breaker to open said circuit, and a visual signal actuated by the opening of said circuit breaker.

24. In a circuit breaker, the combination of an electric circuit, a heating coil and a circuit breaker in series in said circuit, a tripping device for releasing said circuit breaker, an expansible wire within but separated by an intervening air-gap from and actuated by heat radiated from said heating coil across said air-gap for releasing said tripping device to open said circuit, and a visual signal and an audible signal actuated by the opening of said circuit breaker.

In testimony whereof, I have hereunto set my hand this 24 day of November, 1915.

EARL HOYT ROLLINSON.