No. 689,830. Patented Dec. 24, 1901.

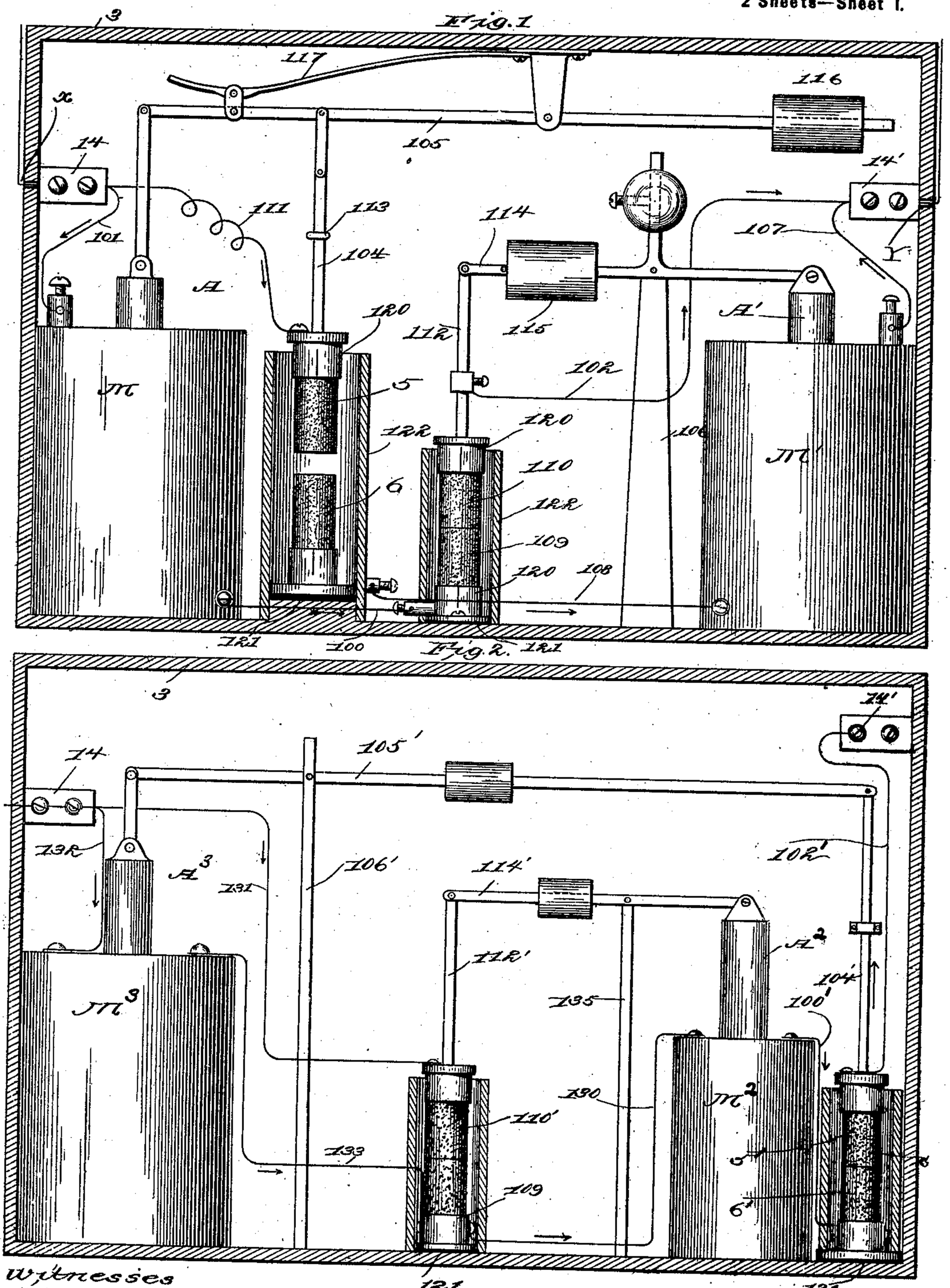
R. J. PATTERSON.

LIMITER OR INTERRUPTER FOR ELECTRIC CIRCUITS.

(Application filed Dec. 29, 1900.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1



Witnesses
W. C. Linsley.
John L. McGarrigle.

Inventor
Ralph J. Patterson.
by Shumby Gregory.
Atty's.

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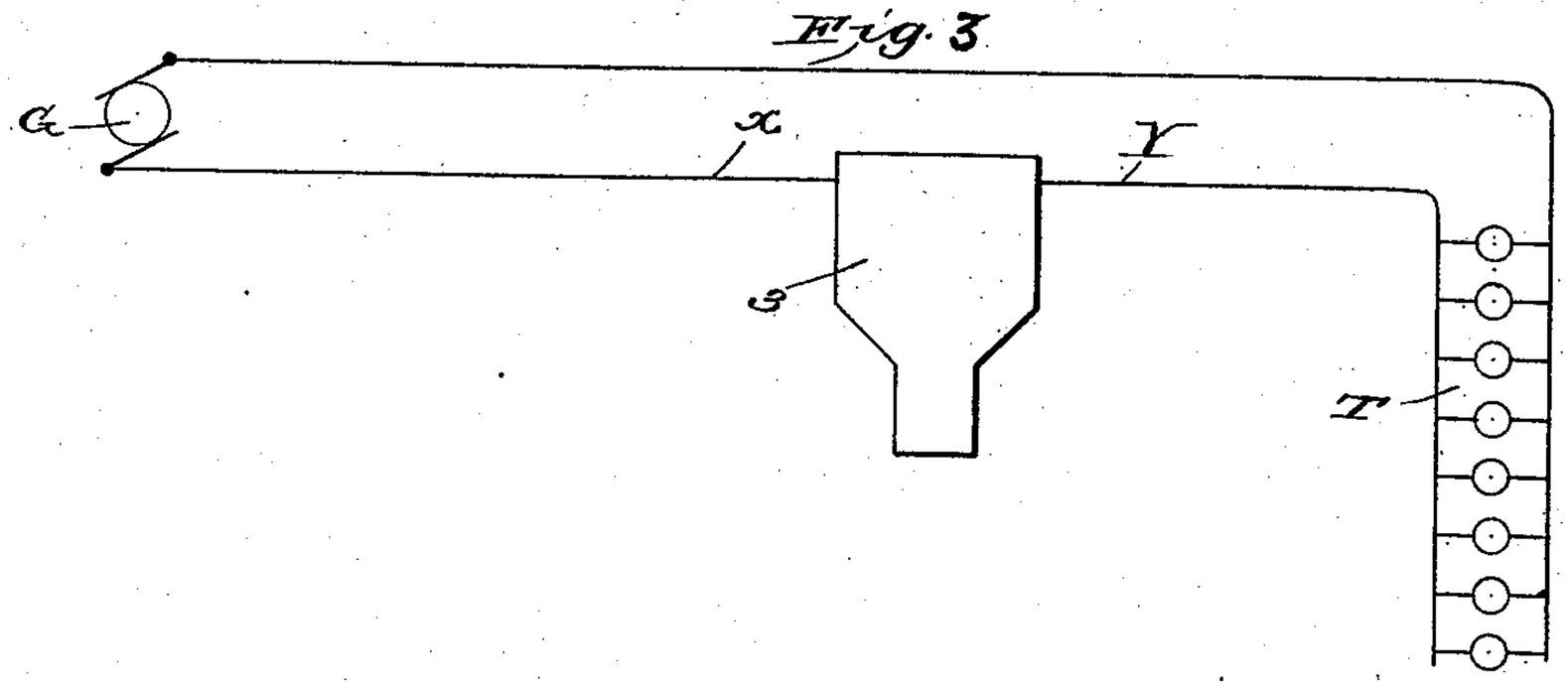
Fig. 3.



Witnesses.
W. C. Linsford.
John J. McGarrell.

Inventor.
Ralph J. Patterson,
by Crosby Gregory
atty's.

UNITED STATES PATENT OFFICE.

RALPH J. PATTERSON, OF WOBURN, MASSACHUSETTS, ASSIGNOR OF ONE-HALF TO L. R. WALLIS, OF WINCHESTER, MASSACHUSETTS.

LIMITER OR INTERRUPTER FOR ELECTRIC CIRCUITS.

SPECIFICATION forming part of Letters Patent No. 689,830, dated December 24, 1901.

Application filed December 29, 1900. Serial No. 41,451. (No model.)

To all whom it may concern:

Be it known that I, RALPH J. PATTERSON, a citizen of the United States, and a resident of Woburn, county of Middlesex, and State of Massachusetts, have invented an Improvement in Limiters or Interrupters for Electric Circuits, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

In electric-light plants where electricity is furnished to several individual consumers for lighting purposes at a cost based upon the average or maximum number of lights used at any given time by any individual consumer it is of great advantage to have some means of indicating if any one patron is using more lamps than his contract calls for. Various devices have been devised for giving such indication, such devices including a magnet which is normally inoperative, but which is rendered active or operative when a greater number of lights or lamps than is permitted is being used, such magnet when operative or active operating to automatically break the circuit, so as to extinguish the lights, suitable means being provided to reëstablish the circuit again. In indicators of this character, however, the separating of contacts to completely open or break a circuit carrying a large current is very destructive to the instrument, and, furthermore, the complete extinguishing of the lights is an annoyance to the patron.

It is the object of my invention to provide a device for indicating when the maximum number of lamps is being exceeded by any one patron or consumer by causing the lamps to flicker or wink instead of being completely extinguished, and this I accomplish by providing mechanism which is situated entirely in series with the translating devices and which is so constructed as to be set in operation by an excessive current or a current above the amount necessary to furnish a predetermined number of lights, the said mechanism operating to intermittingly introduce a resistance into the circuit at periods of short duration, the introduction of such resistance causing the current to fluctuate rapidly, and consequently causing the lamps to wink or flicker, and such operation continues during the duration of the overload or other abnormal conditions which caused the excessive current, so that so long as the abnormal conditions continue the rapid fluctuations of the current continue and the lamps will be caused to flicker.

My device is so constructed that the circuit is never completely broken, and consequently the lamps are never completely extinguished.

One form of apparatus which embodies my invention comprises two switch points or contacts, which are preferably carbon contacts and which are placed in one side of the main circuit and in series with the translating devices, combined with means for intermittingly forming an arc between said contacts when the working current becomes excessive or exceeds a certain predetermined amount, the entire working current flowing through said contacts during the formation of the arc and the arc, therefore, operating to introduce resistance into the line without completely opening the circuit. The control of the contacts for the formation of the arc may be accomplished by means of a magnet, which is normally ineffective, but which is rendered effective or operative when the current in the working circuit becomes excessive or exceeds a certain predetermined amount. I have also combined with my arcing contacts a mechanism whereby the magnet controlling said contacts is intermittently rendered operative, thus forming a series of arcs between said contacts in rapid succession, the formation of such series of arcs causing the lamps in the circuit to wink or flicker, as will be obvious.

In the preferred embodiment of my invention the indicator or interrupter will include two contact-plates, which are in series with the translating devices, the said contact-plates being connected by parallel circuits or circuits in multiple arc, each of said circuits including a pair of contacts and the coils of a magnet, and the contacts of one of said pairs preferably will be of carbon, so that as they are separated an arc will be formed between the same. The magnets and the contacts are so arranged that when the current becomes excessive the magnets are alternately energized and the pairs of contacts are

alternately opened and closed, the opening of the carbon contacts causing the formation of an arc, as will be obvious, and such alternate opening and closing of the contacts continues during the existence of the abnormal conditions which cause the excessive current.

Referring to the drawings, Figure 1 shows one form of my apparatus. Fig. 2 shows a modification thereof, and Fig. 3 is a diagram illustrating the position of my interrupter or indicator in the circuit.

The interrupter is designated generally by 3, and it comprises a suitable casing, which may be of any appropriate shape suited to support the operative parts of the device hereinafter described. The said indicator is placed in one side of the working circuit between the generator G and the translating devices T, as illustrated in Fig. 3, and in series only with said translating devices. Referring to the embodiment of my invention in Fig. 1, it will be seen that the said device includes the contact-plates 14 14′, which are connected with the same side of the circuit at X and Y, respectively, the said contact-plates 14 14′ therefore being in series with the translating devices. In the form of my invention shown in Fig. 1 the said contact-plates 14 14′ are connected by two circuits, which are in parallel or in multiple arc, each of said circuits being, it is obvious, in series with the translating devices. The circuit through which the current normally flows, and which I will hereinafter refer to as the "main multiple circuit," comprises the wire 101 and the coils of the magnet M, which magnet is supported in any suitable way in the casing, the wire 100, the fixed contact 109, movable contact 110, and wire 102. The other circuit between the contacts 14 14′, and which for convenience I will hereinafter term the "auxiliary multiple circuit," includes the wire 111, the movable contact 5 and fixed contact 6 of the arcing contacts, the wire 108, the coils of the magnet M′, and the wire 107. In this embodiment of my invention the contacts in the main multiple circuit or that which includes the coils of the magnet M are controlled by the magnet M′, while the contacts 5 and 6 or the arcing contacts are in turn controlled by the magnet M, this being accomplished as follows: The contacts 109 110 may be of any suitable material, and the contact 109 is mounted in any suitable base or socket piece 120, while the contact 110 is similarly mounted in a corresponding holder or socket piece 120, which is supported by the stem 112, said stem being mechanically connected to, but electrically insulated from, the weighted lever 114, which lever is pivotally mounted in any suitable way upon the standard 106. One end of the lever has attached thereto the armature A′ of the magnet M′, and as the said magnet is shown in the form of a solenoid the armature A′ will be the core of the solenoid. An adjustable weight 115, mounted upon the lever 114, serves to balance the same. The arcing contacts 5 and 6 are preferably of carbon or some similar material and they are suitably carried by holders 120, the holder 120 for the movable contact 5 being connected to the wire 111 and being supported from the stem 104, which passes through the guide 113 and is connected to the pivoted lever 105. One end of said lever is connected to the armature A of the magnet M in some suitable way, and preferably the said lever will be balanced by means of the adjustable counterweight 116 and the leaf-spring 117, the said counterweight and leaf-spring being so adjusted as to normally hold the contacts 5 and 6 separated, as illustrated. The operation of the device is as follows, it being assumed that said device is set for, say, ten lamps, in which case the weight 116 will be so adjusted upon the lever 105 that the magnetic attraction on the armature A, caused by a current sufficient for ten lamps or less, would be insufficient to overcome the weight 116 and spring 117. Under normal conditions therefore the contacts 5 and 6 in the auxiliary multiple-arc circuit will be open and the entire working current will pass through the main multiple circuit, including the magnet or solenoid M and the normally closed contacts 109 110. When, however, an excessive current is generated—such, for instance, as would be occasioned by turning on one extra lamp—the magnet M is sufficiently energized to attract the armature A, and thereby close the normally open or arcing contacts 5 and 6, thus dividing the working current between the two multiple circuits between the contact-plates 14 14′. As soon as the contacts 5 and 6 are closed the magnet M′ will be energized and the contacts 109 110 separated, thereby breaking the main multiple circuit including the magnet M, whereby said magnet becomes deenergized. The weight 116 and the spring 117 will then operate to separate the arching contacts 5 and 6, and inasmuch as the full current is now passing through the auxiliary multiple circuit including said contacts an arc will be formed between the same, which arc has the effect of introducing a variable resistance into the line. Inasmuch as the said contacts are in series with the load or translating devices the introduction of this resistance into the auxiliary multiple circuit renders the magnet M′ sufficiently ineffective so that the contacts 109 110 in the main multiple circuit come together again, thus energizing magnet M, the said magnet when energized closing the contacts 5 and 6 in the auxiliary circuit, as will be evident, and destroying the arc between said contacts. This operation is rapidly repeated, the repetition continuing so long as the abnormal conditions which cause the excessive current to continue, so that the result of the excessive current is to cause the formation of a rapid succession of arcs between the arcing contacts 5 and 6 and a consequent rapid fluctuation of the cur-

rent in the main circuit, such fluctuation of the current causing the lamps to flicker or wink, and thus indicating to the consumer that he has exceeded his limit. By simply turning off the extra lamps the current is reduced to its normal amount, when the device ceases its operation as an indicator or interrupter.

The device shown in Fig. 2 is substantially the same as that illustrated in Fig. 1, except that in each of the main and auxiliary multiple circuits the contacts are normally closed. The main multiple circuit between the contact-plates 14 14′ in Fig. 2 includes the wire 131, the movable contact 110′, fixed contact 109′, the wire 130, the coils of the magnet M^2, the wire 100′, the arcing contacts 6′ 5′, and the wire 102′. The auxiliary multiple circuit includes the wire 132, the coils of the magnet M^3, wire 133, the fixed contact 109′, wire 130, coils of the magnet M^2, the arcing contacts 5′ 6′, and the wire 102′. In this embodiment of my invention the armature A^3 of the magnet M^3 is mounted upon the lever 105′, which in turn is connected to the movable arcing contact 5′ by the rod 104′, the lever 105′ being suitably pivoted upon the standard 106′. The armature A^2 of the magnet M^2 is connected to the lever 114′, to which lever the movable contact 110′ is connected, the lever 114′ being supported upon any suitable standard 135. The contacts 110′ 109′ may be of any suitable material, while the arcing contacts 5′ 6′ will preferably be of carbon, as in Fig. 1. In the operation of this form of my invention the working current passes through both the main and the auxiliary multiple circuits; but because of the resistance of the coils of the magnet M^3 the larger portion of the current passes through the main multiple circuit, comprising the wire 131 and contacts 110′ 109′ and the coils of the magnet M^2. The said magnet M^2 is so adjusted that the normal working current has no effect upon the armature A^2, but when an excessive current is being generated the said armature A^2 is attracted and the contacts 110′ 109′ are separated, thus breaking the main multiple circuit. The current then passes entirely through the auxiliary multiple circuit. The magnet M^3 will be so adjusted that this current will energize the same sufficiently so as to slightly separate the arcing contacts 5′ 6′, thereby establishing an arc between the same. The forming of an arc throws sufficient resistance into the line so as to cut down the current and deënergize the magnet M^2 sufficiently to allow the contacts in the main multiple circuit to close, thereby deënergizing in turn magnet M^3 and allowing the arcing contacts 5′ 6′ to close together. This operation is repeated rapidly so long as the abnormal conditions last—that is, so long as the conditions of the load, &c., are such as to normally generate an excessive current—and the rapid succession of arcs between the arcing contacts causes the current to fluctuate rapidly, as in the embodiment of my invention shown in Fig. 1, thus causing the lamps in the circuit to wink or flicker. The extent to which the arcing contacts are separated, and consequently the length of the arc produced, will vary somewhat according to the strength of the excessive current, and as the amount of resistance which is thrown into the line depends upon the length of the arc produced it will be obvious that the resistance employed is a variable resistance, and my device hence has the function of alternately throwing a variable resistance into and out of the circuit in rapid succession, thereby causing the current to rapidly fluctuate during the time that the overload or other abnormal condition continues, the fluctuation being variable, due to the variable resistance.

In both of the above embodiments of my invention I preferably surround the contacts by a suitable casing 122 of insulating material, such as porcelain, in order to prevent any sparks which may result from the formation of the arcs from injuring the instrument.

By the term "excessive current" as used in the above specification and in the claims I mean any current larger than the normal working current which would be required to run a certain predetermined number of lamps, and it will be understood from the above, of course, that the armature and magnets will be so constructed that such normal current will have no effect upon them.

By the term "abnormal conditions" in the specification and claims I mean those conditions which are such as to cause an excessive current when the device is not operating to throw the added resistance into the line. An example of such abnormal conditions would be when an extra light or lamp was being used, as above pointed out.

It will be obvious that various changes may be made in the structure of the device without departing from the spirit of my invention, which comprises an indicator situated entirely in series with the translating devices and which includes arcing carbons and mechanism for rapidly forming a series of arcs between said carbons whereby the current in the main circuit is made to fluctuate rapidly.

It will be obvious, further, that my device may be used for other purposes than that herein illustrated.

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

1. A main circuit including translating devices and an indicator or interrupter in said circuit and in series with the translating devices, said indicator comprising two contact-plates in series with the translating devices, two circuits in multiple arc connecting said contact-plates, each circuit including a pair of contacts and a magnet, one pair of said contacts being of carbon, whereby an excessive current alternately energizes said mag-

nets and forms a series of arcs between the carbon contacts without completely opening the circuit.

2. A main circuit including translating devices, an indicator in one side of said circuit and in series with said translating devices, said indicator comprising two circuits in multiple, each circuit being in series with the load or translating devices and including the coils of an electromagnet and a pair of contacts, the magnet in each circuit controlling one pair of said contacts, the contacts of one pair of contacts being of carbon, whereby an excessive current alternately energizes the magnets in succession and forms a series of arcs between the arcing contacts without completely opening the circuit.

3. A main circuit including translating devices, and means in series with said translating devices which, when operated upon by an excessive current intermittingly introduces resistance into the circuit at short intervals of time throughout the duration of the abnormal conditions which caused the generation of the excessive current whereby the current fluctuates rapidly so long as the abnormal conditions continue.

4. A main circuit including translating devices, and means in series with the translating devices rendered operative by an excessive current to alternately throw a variable resistance into and out of the circuit in rapid succession during the existence of the conditions which cause the excessive current, whereby the excessive current is made to fluctuate rapidly.

5. A main circuit including translating devices, a pair of arcing contacts in said circuit and in series with the translating devices and means rendered operative by an excessive current to form an intermittent arc between said contacts whereby the current is made to fluctuate without completely opening the circuit, said means being in series with the translating devices.

6. A main circuit including translating devices, arcing carbon contacts in one side of said circuit and in series with the translating devices, one of said contacts being movable, a normally inactive magnet also in series with said translating devices, said magnet being intermittently rendered active by an excessive current, the intermittent action of the magnet continuing during the existence of the conditions which caused the excessive current; and means controlled by said magnet when active and operating to vibrate the movable contact whereby during the existence of said conditions a series of arcs are formed between said contact and the current is made to rapidly fluctuate.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

RALPH J. PATTERSON.

Witnesses:

JOHN C. EDWARDS,

LOUIS C. SMITH.