(No Model.) 2 Sheets—Sheet 1.

R. CALLENDER.

ELECTRICAL CIRCUIT CONTROLLER.

No. 515,109. Patented Feb. 20, 1894.

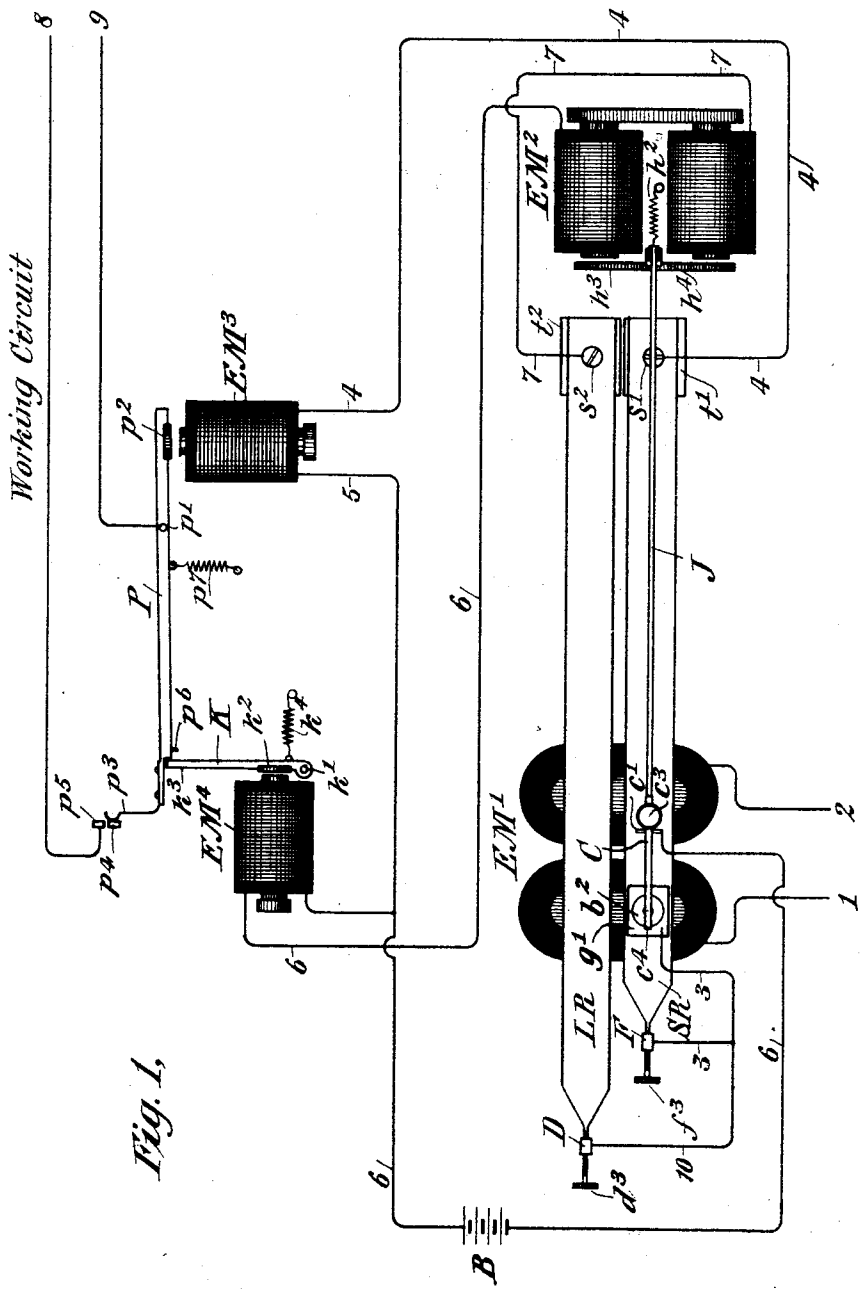

Fig. 1.

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(No Model.) 2 Sheets—Sheet 2.

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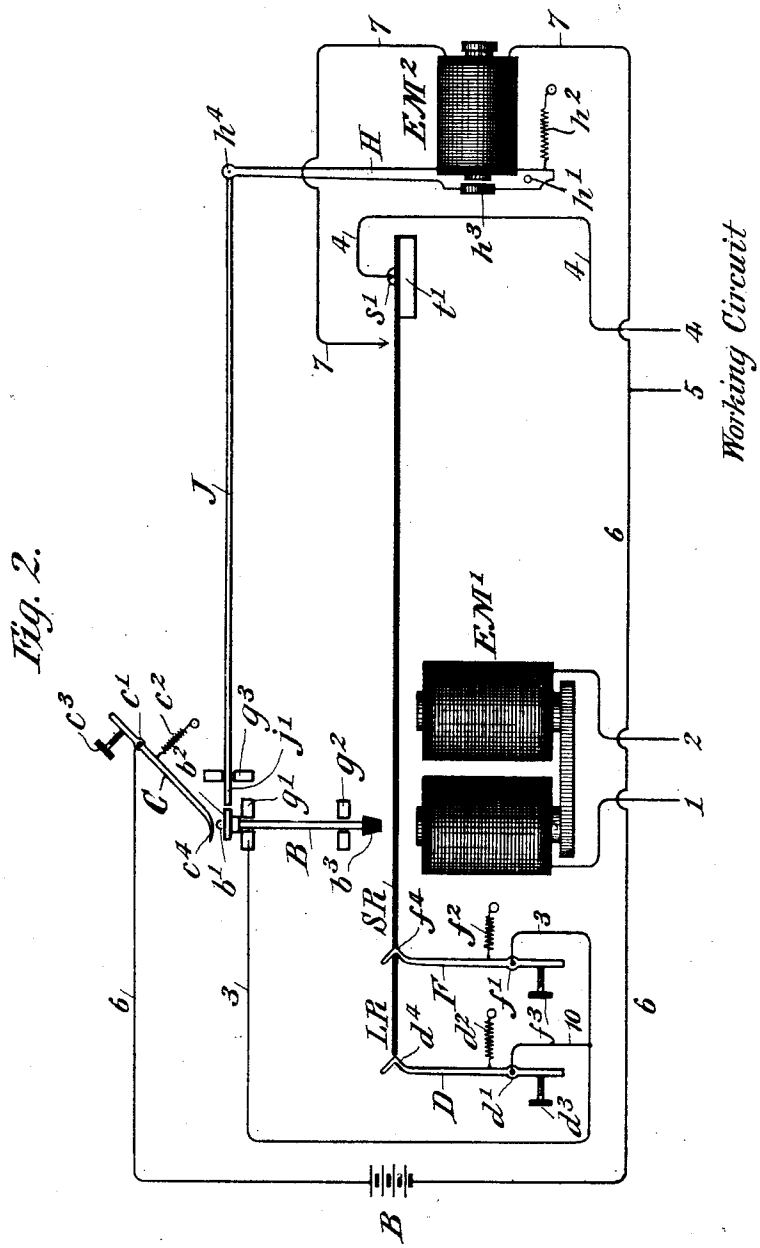
Fig. 2.



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UNITED STATES PATENT OFFICE.

ROMAINE CALLENDER, OF BRANTFORD, CANADA.

ELECTRICAL-CIRCUIT CONTROLLER.

SPECIFICATION forming part of Letters Patent No. 515,109, dated February 20, 1894.

Application filed November 2, 1893. Serial No. 489,877. (No model.)

To all whom it may concern:

Be it known that I, ROMAINE CALLENDER, a subject of the Queen of Great Britain, residing at Brantford, in the Province of Ontario, Dominion of Canada, have made a new and useful invention in Electrical-Circuit Controllers, of which the following is a specification.

The present invention is directed to improvements in that class of circuit controllers employing a time element for controlling the length of time that an electrical circuit shall remain active or inactive or for regulating the interval of time that shall elapse between the taking of an initiatory step for opening or closing an electrical circuit and the automatic completion of the act that was initiated. It is more particularly directed to improvements in that form of apparatus described in my prior application, filed April 24, 1893, and bearing Serial No. 471,559. In that specification I describe the means whereby a vibratory reed armature is caused to close a local circuit and to open it again after any pre-determined interval of time. I also describe an arrangement of circuits by which a secondary circuit is closed after some definite time interval following the taking of an initiatory step to close said secondary circuit, and I also show an arrangement of parts by which the secondary circuit is ruptured immediately after it has been closed. In practice I find that unless the auxiliary switch is perfectly adjusted, its operation is not absolutely certain. Owing to the fact that the secondary circuit is only closed for a very brief interval of time, the current flowing through the coils of the auxiliary switch electro-magnet does not always effect the complete movement of the armature and lever of said auxiliary switch. To render this form of apparatus positive under any usual conditions, I have devised the improvement hereinafter described and have illustrated it in the two sheets of drawings attached.

Figure 1 is a diagrammatic plan view showing the two reed armatures with which my new form of apparatus is provided. Fig. 2 is a diagrammatic side elevational view of the apparatus.

Referring now to Fig. 1 of the drawings:—E M′ is the controlling electro-magnet included in the controlling circuit 1, 2. L R and S R are vibratory reed armatures of different lengths secured to the supports t^2 and t' by the screws s^2 and s' and adapted to be put into motion by one or more closures of the controlling circuit through the electro-magnet E M′. These reed armatures, when put in motion, have different periods of natural activity; the shorter reed terminating its vibrations while the longer reed is still in motion. D and F are yielding contact levers normally resting against the metallic ends of the reeds L R and S R, and d^3 and f^3 are adjustments for regulating said contact levers. g' is a guide, and b^2 is the head of a plunger adapted to move up and down in said guide as shown more clearly in Fig. 2. J is a locking slide bar, the point j' of which is adapted to pass under the head b^2 of the plunger B and hold said plunger in its uppermost position. g^3 is a guide through which passes the point j' of the locking slide bar J. C is a contact lever adapted to make electrical connection with the contact point b' on the head of the plunger B when said plunger is in its uppermost position. c' is the pivot of the contact lever C, and c^2 and c^3 are the retractile spring and check adjustment for regulating the normal position of said lever. E M² is the automatic release electro-magnet for withdrawing the locking slide bar J after its point j' has been allowed to pass under the head b^2 of the plunger B. h^3 is an armature secured to the lever H of the releasing electro-magnet E M². E M³ and E M⁴ are operating and releasing electro-magnets of an auxiliary switch. P is a lever pivoted at p' and carrying the armature p^2 and contact spring p^3. p^5 is a contact plate adapted to close a working circuit through conductors 8 and 9 when the contact spring p^3 is in electrical connection with said contact plate p^5. K is a locking lever for maintaining the spring p^3 of the lever P in its uppermost position when the end k^3 of the locking lever K is allowed to fall back against the limit pin p^6. k' is the pivot of the locking lever K. k^2 is the armature of said lever and k^4 is a retractile spring for bringing the lever K into its locking position. p^7 is an additional retractile spring for bringing the lever P into its normal position after the releasing lever K has been withdrawn from its

locking position under the influence of electro-magnet E M⁴. B is the local battery and 6, 5 and 4 are conductors running from it to the contact lever C, auxiliary switch electro-magnets E M³ and E M⁴ and to the screws s' and s^2 of the vibratory reeds L R and S R by way of releasing electro-magnet E M² and conductor 7.

Referring now to Fig. 2, B is the plunger adapted to move freely in the guides g' and g^2. b^3 is an insulating foot secured to the lower end of the plunger B. d' and f' are the pivots of the yielding contact levers D and F, and d^2 and f^2 are retractile springs for holding the contact points d^4 and f^4 of the levers D and F against the front ends of the vibratory reed armatures L R and S R.

The operation of the apparatus is as follows: The controlling circuit 1, 2 runs to the point from which the apparatus is to be controlled and includes a battery or other source of electrical energy, and a Morse key or any preferred form of apparatus for making and breaking the circuit. I will presume that this circuit has just been closed and opened again, and that as a consequence, the vibratory reed armatures have been put into motion under the influence of the attraction of the controlling electro-magnet E M′. When the reeds are attracted by the closure of the circuit 1, 2 through the electro-magnet E M′ and are then allowed to fall back by the opening of said circuit, the shorter reed S R in its first upward excursion presses against the insulated foot b^3 of the plunger B and raises it to its uppermost position, thus bringing the point b' of the plunger into electrical connection with the contact end c^4 of the lever C. At this moment the point j' of the locking slide bar J is caused to pass under the head b^2 of the plunger B under the action of the retractile spring h^2 and the lever H. This locks the plunger B in its uppermost position and maintains the electrical connection between the point b' of the plunger B and the contact end c^4 of the lever C. The circuit of local battery B is thus closed but as both of the reeds are rapidly vibrating, the circuit is intermittently broken and is not operatively closed until one of the reeds ceases its vibrations. The vibratory reeds being of different lengths, have different natural periods of activity, and consequently the shorter reed S R will terminate its vibrations first, and leave the longer reed L R still in motion. When, therefore, the shorter reed S R ceases its motion a circuit is completely closed, shown in Fig. 1, as follows:—from battery B by way of conductors 6 and 5 to auxiliary switch electro-magnet E M³, thence by conductor 4 to the screw s' at the rear end of the shorter reed S R, thence through said reed to yielding contact lever F with which the front end of the reed S R is now in continuous connection, thence by conductor 3 to guide plate g', thence through the plunger B (shown more clearly in Fig. 2) point b' of said plunger, contact end c^4 of contact lever C and thence by pivot c' and conductor 6 back to the battery B. This energizes the auxiliary switch electro-magnet E M² drawing forward the armature p^2 at the end of lever P and raising the contact spring p^3 into electrical connection with the contact plate p^5 in which position it is maintained by the action of the locking lever K and retractile spring k^4, the end k^3 of said locking lever being brought against the pin p^6 of the lever P when this latter lever is moved from its normal position under the action of the electro-magnet E M³. A second local circuit 8, 9 is thus closed and it will remain closed until the longer period reed ceases its vibrations. I have simply shown the terminals of this circuit 8, 9 and have denominated the circuit as a "working circuit." I have not connected it through any apparatus, as the manner in which this may be done will be obvious. It should be noticed here that the branch conductor 6 running through the release electro-magnets E M⁴ cannot divert any noticeable proportion of the current flowing through the other part of the circuit, for the reason that the longer period reed L R (see Fig. 1) is presumed to be still vibrating and interrupting this branch of the circuit which is afterward operatively closed between the free end of the longer reed L R and the yielding lever D. Consequently the circuit passing through the local battery B is still closed, as is also the working circuit 8, 9. The longer period reed L R now terminates its vibrations, and a shunt circuit from battery B is now closed, as follows:—from battery B (Fig. 1) by way of conductor 6, release electro-magnet E M⁴, conductor 6 to the other release electro-magnet E M², thence by conductor 7 to the screw s^2 at the fixed end of the reed L R, thence through said reed to yielding contact lever D, conductors 10 and 3 to guide plate g', thence by plunger B through its point b' (see Fig. 2) through contact end c^4 of lever C and from thence by pivot c' and conductor 6 back to the battery B. The resistance of the two release electro-magnets E M⁴ and E M² is so proportioned to that of the electro-magnet E M³ that when the shunt circuit is closed through the two former electro-magnets the amount of current in the shunt or branch circuit is much greater than that now passing over the original circuit described in connection with the operation of the shorter reed S R. Consequently the electro-magnet E M³ is demagnetized proportionately, and the electro-magnets E M⁴ and E M² are operatively energized. The effect of this in the case of the electro-magnet E M⁴ is to draw forward the armature k^2 and lever and k^3 of lever K, thus allowing the contact spring p^3 to descend into the position shown in the drawings under the action of retractile spring p^7, rupturing the circuit 8, 9. The armature h^3 of the electro-magnet E M² is also drawn toward the cores of its controlling electro-magnet and by the action of the lever H on the locking slide bar J the point j' is withdrawn

from under the head b^2 of the plunger B allowing said plunger to fall into the position shown in the drawings and rupturing the circuit between the contacts b' of the plunger B and the contact end c^4 of the contact lever C. It will thus be seen that both of the reeds L R and S R were set in motion by the closure of the main controlling circuit, and that the shorter reed was utilized to close a local circuit at the termination of its vibratory period. The longer reed, it will have been noticed, was utilized to open the local circuit at the termination of its vibratory period and was also utilized to open the circuit 8, 9 controlled by the auxiliary switch. In connection with this part of the description it may be well to state that the auxiliary switch is not a vital part of my apparatus as it will be evident I may make the secondary circuit a working circuit. This is shown in Fig. 2 where the terminals 5, 4 would lead directly to the working point without the intervention of any auxiliary apparatus.

The arrangements of parts shown in Fig. 1 would be the preferred form for large currents while that shown in Fig. 2 is all that is necessary for small currents.

It will be evident that various effective combinations may be made by simply changing the relations of the several elements, and therefore I do not limit myself to the combinations shown. For instance, by including an electro-magnetic switch in the main circuit 1, 2 a local circuit could be closed instantaneously. The termination of the vibratory period of the shorter reed could then be utilized to close another secondary circuit while the termination of the vibratory period of the longer reed could be utilized to re-open one or both of the local circuits just described. It will also be evident that two independent switches could be included in the main circuit 1, 2. Both circuits would then be closed simultaneously and the vibratory period of the shorter reed could be utilized to open one of the circuits, while the vibratory period of the longer reed could be utilized to open the other local circuit.

I do not here claim broadly the method of utilizing the termination of the vibratory period of one or more reed armatures for closing one or more local circuits after a pre-determined time interval as this constitutes the subject matter of an independent application filed by me in the United States Patent Office on the 24th day of April, 1893, bearing Serial No. 471,559.

I do not limit myself to electro-magnetic means for putting the vibratory reeds into motion, as it is evident that the hand might fill this office, as a clock or any other suitable mechanical means might obviously be used.

Having thus described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. A circuit controller having two or more vibratory reed armatures adapted to be put into motion by one or more closures of a main circuit through the coils of a controlling electro-magnet, in combination with means whereby two or more local circuits are independently controlled by the reed armatures at the termination of their individual vibratory periods.

2. Two or more reed armatures having different periods of natural activity when put into motion by the closure of a circuit through a controlling electro-magnet, in combination with means whereby two or more additional circuits are independently closed by the reed armatures at the termination of their individual vibratory period.

3. A circuit controller for closing a local or secondary circuit after a pre-determined time interval and for opening it after some other pre-determined time interval, consisting of a controlling electro-magnet and two vibratory reed armatures therefor having different periods of natural activity when put into motion by the closure of a circuit through said controlling electro-magnet, together with means for causing the reed of shorter vibratory period to close a local circuit when it terminates its vibrations, and additional means for causing the reed of longer vibratory period to open said circuit at the termination of its vibratory period.

4. The combination of two independent time-controlled circuit closers of different time periods, consisting of two vibratory reed armatures having different natural periods of activity when put into motion by the closure of a circuit through a controlling electro-magnet and adapted to operate a local circuit at the termination of the vibratory period of the shorter period reed, while the termination of the vibratory period of the longer period reed is caused to reverse the condition of said local circuit.

5. A main circuit including two or more electro-magnetic switches for closing two or more secondary circuits, in combination with a circuit controller, included in the main circuit, consisting of an electro-magnet having two or more vibratory reed armatures therefor of different natural periods of activity when put into motion by the closure of the main circuit and having means whereby the individual reed armatures are caused to open the two or more secondary circuits successively as they terminate their several vibratory periods.

6. A main circuit including one or more electro-magnetic switches for closing one or more secondary circuits, in combination with a circuit controller, included in the main circuit, consisting of an electro-magnet having two vibratory reed armatures therefor of different natural periods of activity when put into motion by the closure of the main circuit and adapted to open the one or more secondary circuits after a predetermined interval of time and to automatically restore the circuit controller to its normal condition after some

other predetermined time interval: said secondary circuits being operated by the reed armatures as they terminate their individual vibratory periods.

7. A circuit controller for controlling a secondary circuit at the expiration of each of two different intervals of time consisting of two vibratory reeds having different periods of natural activity when put into motion and having circuit connections for closing the secondary circuit when the shorter period reed ceases its vibrations, and additional circuit connections for opening said secondary circuit when the longer period reed ceases its vibrations.

8. The combination in an electrical circuit controller of two vibratory reed armatures having different natural periods of activity when put into motion by the closure of a circuit through a controlling electro-magnet; the reed armature of shorter vibratory period having means for closing a circuit at the termination of its vibratory period, while the longer period reed armature is provided with means for closing an additional circuit at the termination of its vibratory period.

9. A circuit closing device included in a main electrical circuit for closing a second or local circuit at any predetermined period of time after a closure of said main circuit, consisting of an electro-magnet included in the main circuit and having two vibratory reed armatures therefor of different natural periods of activity when put into motion, together with means whereby the closure of the second or local circuit is initiated by the reed armatures whenever they are thrown into vibration but is not completely effected until the reed armature of shorter vibratory period has terminated its vibrations; in combination with means for rupturing the second or local circuit through the instrumentality of the reed armature of longer vibratory period at the termination of said vibratory period.

10. A normally open electrical circuit including an electro-magnet having two or more reed armatures, each of the reed armatures being adapted to vibrate for any predetermined length of time on a single closure of the circuit; in combination with means whereby each reed armature is caused to operate an independent local circuit at the termination of its individual vibratory period.

11. An electrical circuit controller comprising an electro-magnet and two vibratory reed armatures therefor, each of the reed armatures being adapted to vibrate for any predetermined length of time on a single closure of a circuit through said electro-magnet; in combination with means whereby a second or local circuit is closed by the reed armature of shorter period at the termination of its vibratory period, while the reed armature of longer period at the termination of its vibratory period is caused either to reverse the condition of said local circuit or to restore the circuit controller to normal condition; or both: the arrangement being such that periodic circuit closures of higher frequency than the natural vibratory period of the shorter period reed armature will not effect a closure of the second or local circuit, while the first lapse of frequency exceeding the natural vibratory period of said shorter reed armature will cause the second or local circuit to be closed.

In testimony whereof I have hereunto subscribed my name this 31st day of October, 1893.

ROMAINE CALLENDER.

Witnesses:
C. J. KINTNER,
M. M. ROBINSON.