A. B. REYNDERS.

TIME LIMIT RELAY.

APPLICATION FILED OCT. 20, 1904.

995,184. Patented June 13, 1911.

2 SHEETS—SHEET 1.

Fig. 1.

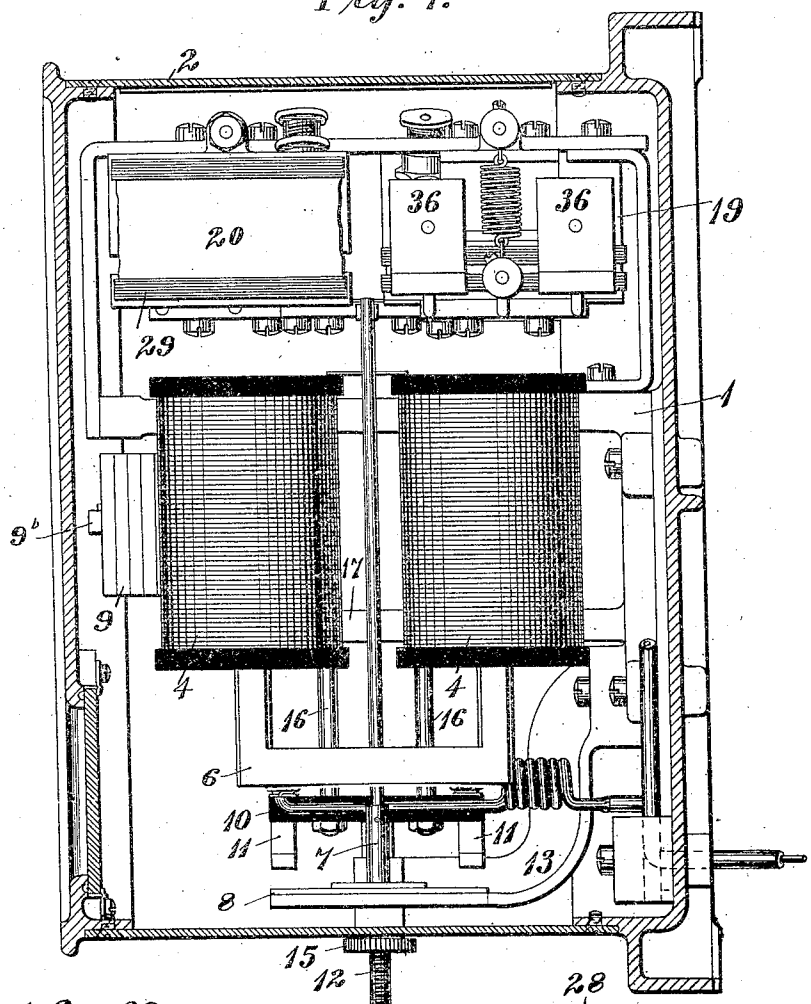
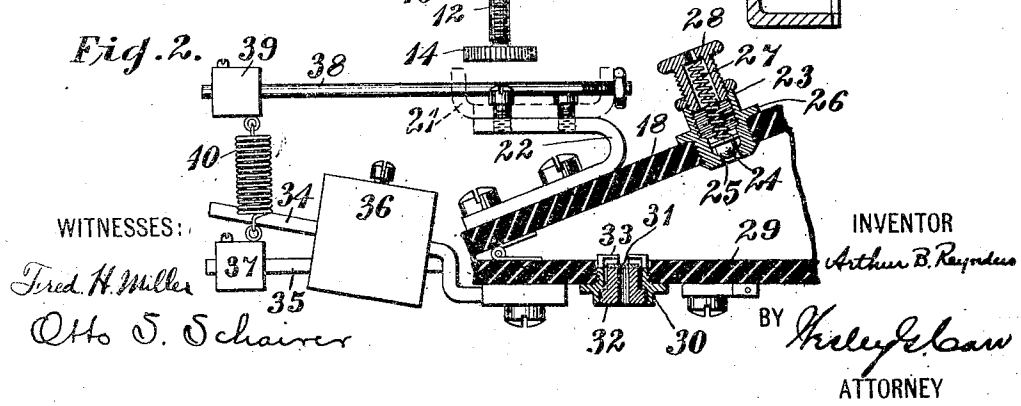


Fig. 2.



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2 SHEETS—SHEET 2

Fig. 4.

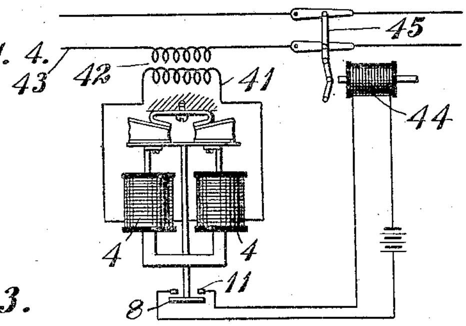

Fig. 3.

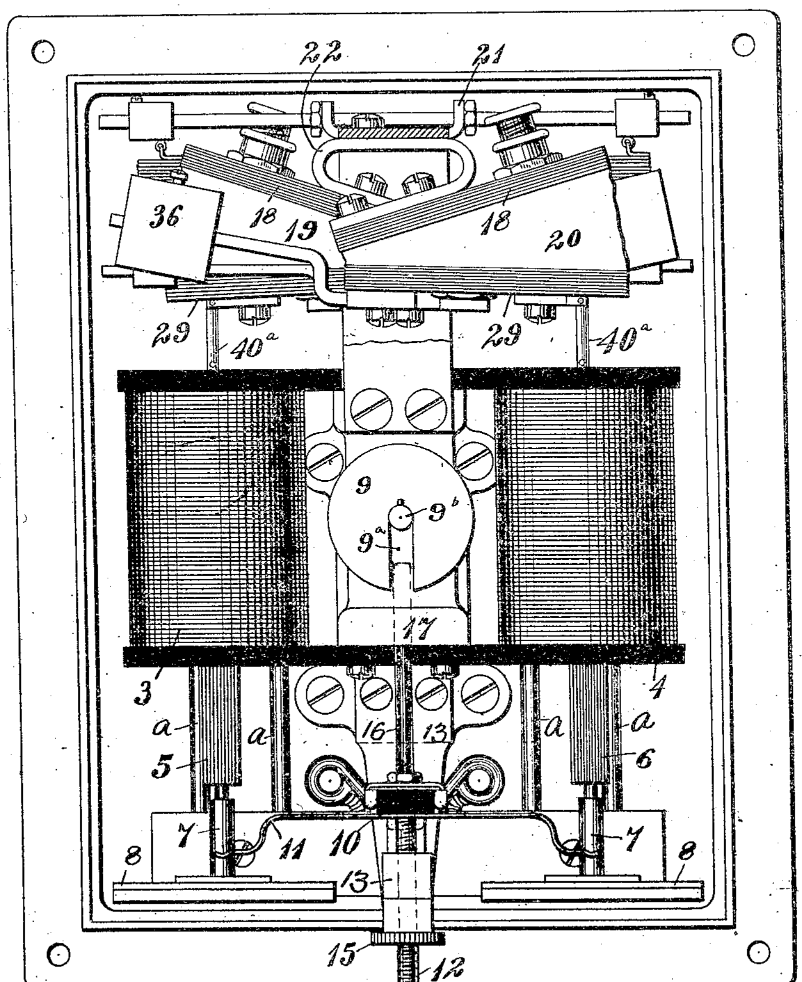

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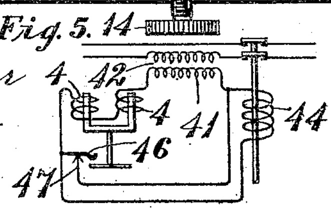
Fig. 5.



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UNITED STATES PATENT OFFICE.

ARTHUR B. REYNDERS, OF WILKINSBURG, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

TIME-LIMIT RELAY.

995,184. Specification of Letters Patent. **Patented June 13, 1911.**

Application filed October 20, 1904. Serial No. 229,349.

To all whom it may concern:

Be it known that I, ARTHUR B. REYNDERS, a citizen of the United States, and a resident of Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Time-Limit Relays, of which the following is a specification.

My invention relates to time limit devices which are interposed between main circuits and the tripping coils of automatic breakers for such circuits in order to avoid operation of the breakers by reason of momentary current fluctuations.

My invention has for its object to provide a device of the character indicated which shall have a time period between the beginning of a flow of current that exceeds a predetermined amount and the instant when the circuit-breaker is tripped that is inversely proportional to the amount by which the current exceeds the predetermined amount.

My invention is illustrated in the accompanying drawings, in which—

Figure 1 is a view, in side elevation, of a device constructed in accordance therewith, the casing for the device being shown in section. Fig. 2 is an enlarged view, partially in elevation and partially in section, of some of the parts shown in Fig. 1. Fig. 3 is a view, in front elevation, of the device shown in Fig. 1, and Figs. 4 and 5 illustrate diagrammatically the circuit connections of the time limit relay comprising my invention.

Supported by a suitable framework 1, within a casing 2, are magnet coils 3 and 4, which are respectively provided with movable iron cores or armatures 5 and 6 and are connected to an external circuit by means of leads *a*. Each of the cores or armatures carries a guide stem 7, to the lower end of which is attached a contact terminal 8 in the form of a conducting plate or disk. A plurality of disks 9 having slots 9^a of such width as to receive either of the stems 7 are provided for the purpose of adjusting the weights to be lifted by the magnet windings. When not in use, the disks 9 may be supported upon a pin 9^b, as indicated in Figs. 1 and 3.

Secured to an insulating block 10, are contact strips 11, which are adapted to be engaged by the conducting disks 8 when the armatures 5 and 6 are raised. The length of the path of movement of the conducting disks 8 may be varied by raising or lowering the block 10 and its strips 11 by means of a screw 12 which is threaded into the free end of the bracket arm 13 and engages the under side of the block 10, the head 14 of the screw and a lock-nut 15 being located on the exterior of the casing 2. Guide rods 16, having their lower ends rigidly secured to the block 10 and their upper ends projecting through holes in a bracket arm 17 of the framework 2, serve to maintain the contact strips 11 rigidly in the position to which they may be adjusted by means of the screw 12.

The upper sides 18 of bellows 19 and 20 are rigidly secured to the portion 21 of the framework 1, by means of suitable brackets 22, and are provided with outlet valves 23, each of which comprises a ball 24 that is normally held to its seat 25 in a suitable tap plug 26 by means of a spring 27. The plug 26 is provided with an adjustable, perforated nut 28 for adjusting the pressure which the spring 27 exerts upon the ball 24. The lower sides 29 of the bellows are hinged to the upper sides 18 and are provided with inlet valves 30, each of which comprises a disk 31 mounted between the perforated ends of hollow tap plugs 32 and 33. The lower sides of the bellows also carry arms 34 and 35, which are respectively provided with weights 36 and nuts 37 that are adjustable in position thereon. The weights 36 are provided for the purpose of counterbalancing or partially counterbalancing the weights of the lower sides of the bellows. Rods 38 are rigidly secured to the portion 21 of the framework 1 and their projecting free portions are provided with nuts 39 that are adjustable in position thereon. Springs 40 have their respective ends secured to the adjustable nuts 37 and 39. The lower sides of the bellows 19 and 20 are also connected with the magnet cores 5 and 6, respectively, by means of rods 40^a, so that when the cores are raised, as a result of the energizing of the magnet windings 3 and 4, the raising of the magnet cores may be retarded. As the cores 5 and 6 are drawn into the coils 3 and 4, a better magnetic circuit is established and the pull upon the cores increases. In order that the motions of the cores may be uniform and also in order that the time period

required to bring the conducting disks 8 into engagement with the contact strips 11 may be substantially inversely proportional to the current in the magnet windings 3 and 4, it is necessary to provide means for neutralizing or counterbalancing the increasing pull upon the magnet cores. This means comprises the springs 40 and the adjustable nuts 37 and 39, it being possible, by adjusting the positions of the said nuts upon their respective arms, to so adjust the springs 40 that the tension upon them increases substantially as the pull upon the magnet cores increases.

In Fig. 4, I have shown the connections with a single-phase circuit of a single pair of magnet windings such as appear in the foregoing figures, it of course being understood that while the device shown in the previous figures is for use in connection with either two or three phase circuits, it may be modified, without affecting the scope of my invention, for employment in connection with single-phase circuits or circuits of any other number of phases. As here shown, the magnet coils 4 are supplied with energy from the secondary winding 41 of a series transformer 42. The conducting disk 8 is brought into engagement with the contact strips 11 when more than a predetermined amount of current is supplied continuously over the main circuit conductor 43, thereby completing a battery circuit to the tripping magnet winding 44 of a circuit-breaker 45.

In Fig. 5, a modification of the circuit connections of Fig. 4 is shown, in which the energy for tripping the circuit-breaker is derived from the main circuit. Magnet windings 4 are connected in series with the secondary winding 41 of a series transformer 42, and under ordinary conditions, a circuit is completed through a finger 46 and a terminal 47. When more than a predetermined amount of current is supplied continuously through the circuit conductor 43, the raising of the magnet core causes the finger 46 to disengage the terminal 47, the circuit-breaker tripping coil 44 being then energized.

I claim as my invention:

1. The combination with a magnet winding and a movable core therefor, of a bellows having a movable side connected to said core, arms carried by the movable side of said bellows upon which an adjustable counterweight and an adjustable nut are respectively mounted, a stationary arm, an adjustable nut carried thereby, and a spring connected between said nuts.

2. The combination with a magnet winding and a movable core therefor, of contact terminals carried by said core, stationary contact terminals, a bellows having a movable side connected to said core, arms carried by the movable side of said bellows upon which an adjustable counterweight and an adjustable nut are respectively mounted, a stationary arm, an adjustable nut carried thereby, and a spring connected between said nuts.

3. The combination with a magnet winding and a movable core or armature therefor, of a bellows connected to said movable core or armature and having one side provided with an inlet valve and its other side provided with an escape valve, each of said valves being automatically opened and closed.

4. The combination with a magnet winding and a movable core or armature therefor, of a bellows having automatic inlet and escape valves in its respective sides and connected to said core for retarding the movement thereof, and a spring for causing the movement of the core or armature to be substantially uniform.

5. The combination with a magnet winding and a movable core or armature therefor, of a bellows having a hinge-supported side connected to said core or armature and provided with laterally projecting arms, a counterbalancing weight upon one of said arms, and a spring opposing movement of the other arm and adjustable longitudinally thereof to vary the leverage exerted by said core or armature.

6. The combination with a magnet winding and a movable core or armature therefor, of a bellows having automatic inlet and escape valves in its respective sides and connected to said core or armature for retarding the movement thereof, and a spring the tension upon which varies substantially as the magnetic pull upon the said core or armature varies.

7. The combination with a magnet winding and a movable core or armature therefor, of a bellows having a hinge-supported side to which said core or armature is connected, means for counterbalancing the weight of said hinge-supported side, and a spring acting in opposition to the pull exerted by said magnet winding and laterally adjustable with reference to the hinge in order to vary the degree of opposition to said pull.

In testimony whereof, I have hereunto subscribed my name this 18th day of October, 1904.

ARTHUR B. REYNDERS.

Witnesses:

BIRNEY HINES,

C. A. HEPP.