A. AICHELE.

MAXIMUM TIME RELAY.

APPLICATION FILED NOV. 17, 1915.

1,301,991.

Patented Apr. 29, 1919.

2 SHEETS—SHEET 1.

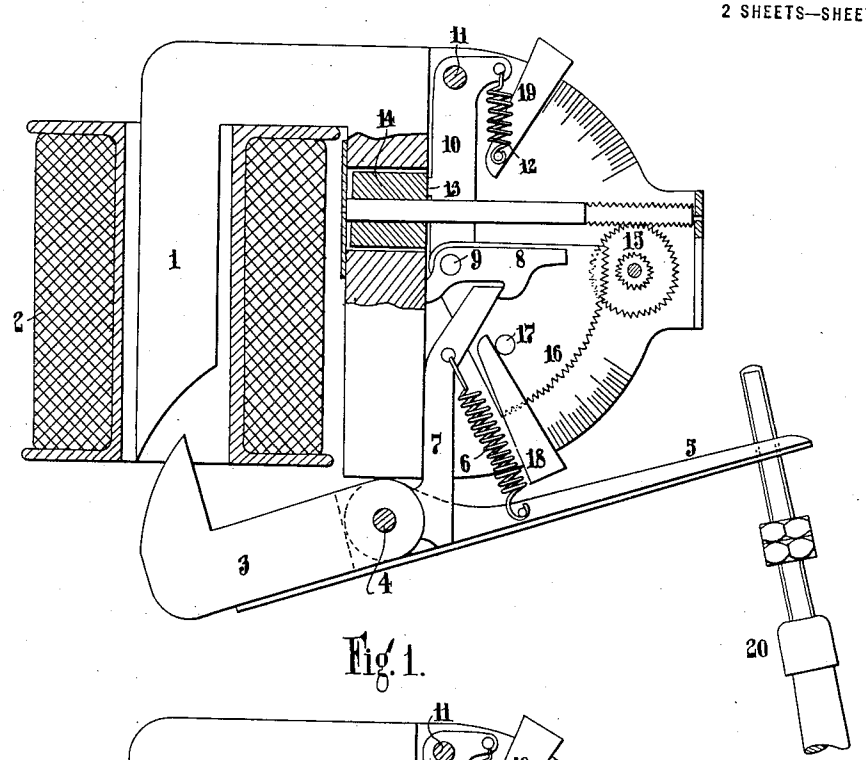


Fig. 1.

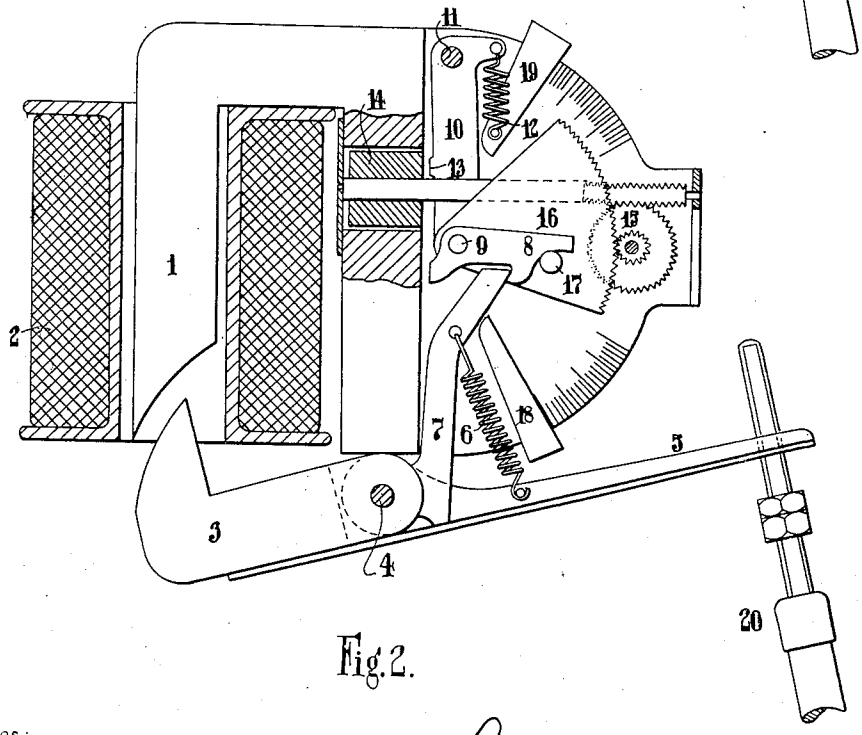


Fig. 2.

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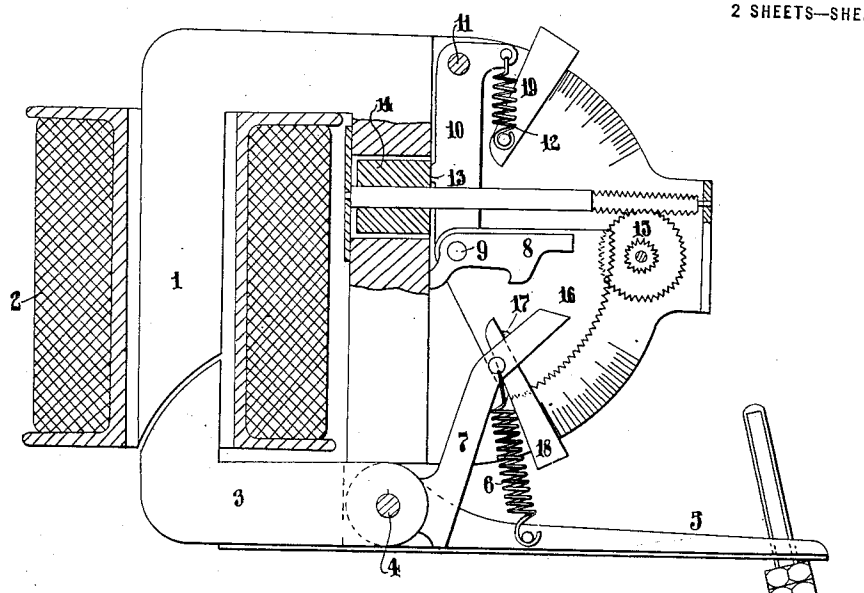


Fig. 3.

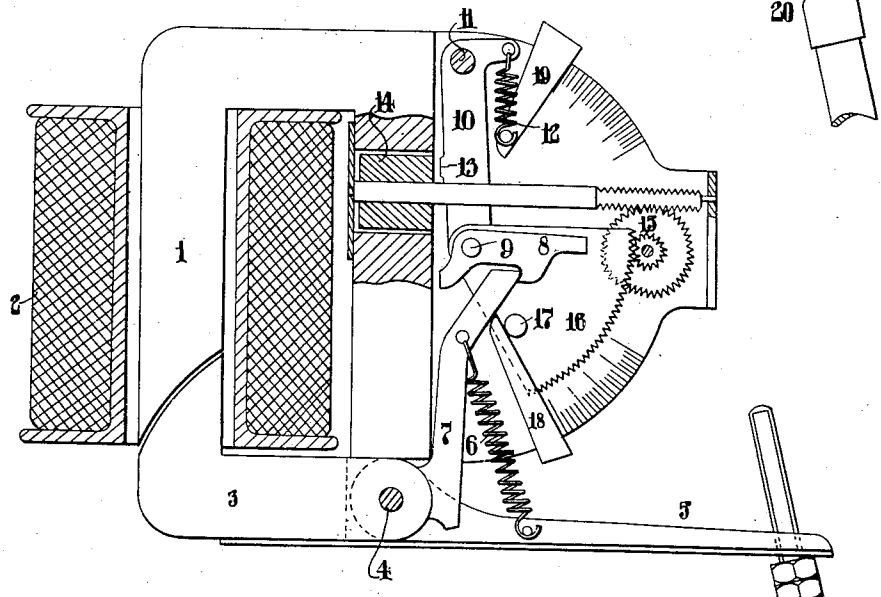


Fig. 4.

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UNITED STATES PATENT OFFICE.

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MAXIMUM-TIME RELAY.

1,301,991. Specification of Letters Patent. Patented Apr. 29, 1919.

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To all whom it may concern:

Be it known that I, ALBERT AICHELE, a citizen of the Swiss Republic, and residing at Wiesenstrasse 10, in Baden, Switzerland, have invented certain new and useful Improvements in or Relating to Maximum-Time Relays, of which the following is a specification.

This invention relates to maximum time relays.

Heretofore with maximum time relays in which the armature of the overload electromagnet coil operated the circuit breaker the armature has been attracted in opposition to the force of a spring, which is stressed according to the strength of the overload current and remains stressed during the attraction of the magnet until the magnet becomes deënergized owing to the operation of the circuit breaker. The electromagnet armature can therefore only perform the work which is equal to the difference between its attractive force and the force required for stressing the spring. Since the force of the spring must be appreciable, a considerable portion of the attractive force is lost in stressing the spring.

The object of the present invention is to provide a relay free of these disadvantages.

The invention primarily consists therefore in a maximum time relay in which in the case of a feeble overload current lasting over a predetermined time period the armature of the overload coil operates the circuit breaker with full force, *i. e.*, without a counter spring action.

The invention also consists in a maximum time relay in which a feeble overload current produces only a partial attraction of the electromagnet armature for the first part of the action, a movable member normally resting in a predetermined position being adapted to be moved into gear with a time mechanism by the said partial attraction and to trip-release after a predetermined time interval connective mechanism between the armature and the mounting of the movable member in such a way that as long as the feeble overload current continues, a counter spring on the electromagnet armature will be stressed, but the stressing of the counter spring will cease simultaneously with the tripping of the connective mechanism, whereby the force of the spring no longer acts in opposition to the full attraction of the armature and the cut-out is effected with full power.

The invention also consists in the improved maximum time limit relays herein described.

In the accompanying diagrammatic drawings a construction of the maximum time limit relay is shown in four different positions.

Figure 1 shows the parts in their normal position;

Fig. 2 shows the parts after the magnet armature has been partly attracted and the time gearing moved almost to the end of its travel;

Fig. 3 shows the armature completely attracted and the circuit breaker operated;

Fig. 4 represents the action of the mechanism on a very great overload or short-circuit.

In the form shown in Fig. 1 by way of example, the electromagnet core 1, with overload coil 2 has an armature 3 that can pivot on the fixed axle 4. This armature has an extension 5 for operating the circuit breaker by way of the rod 20, and is connected by a particularly powerful spring 6 to a pawl 7 that is likewise pivoted on the axle 4. The pawl 7 bears against a nose piece 8, pivoted at 9 in the free end of the bell crank lever 10, movable about the fixed axle 11. The pawl 7 is trip-released from the nose-piece 8, by time mechanism as explained hereinafter. The parts 6, 7 and 8 constitute the connective mechanism between the armature 3 and the lever 10 on which the movable member 16 is mounted. The other arm of the lever 10 is engaged by the counter spring 12 of the electromagnet armature 3 which in the deënergized position presses the lever 10 against a suitable stop.

The reducing gear is independently driven by any well known means at uniform speed, but precise uniformity of speed is not important. In the drawings the means shown for driving the time mechanism is an asynchronous motor, of which the rotor 14 is in the field of the electromagnet, being lodged in an air gap of the core 1. A small shoulder 13 on the lever 10 presses against and brakes the rotor 14, thereby preventing the time mechanism from running idly while the current is within its normal value.

The movable member illustrated is in the form of a sector 16 rotatable about the axle 9 and is brought into engagement with the gear 15 only when by the operation of the relay, the lever 10 is rotated on the axle 11. The sector 16 has a stop-pin 17 which in the normal position bears against the fixed pointer 18. By means of the latter the time of the trip release of the pawl 7 from the nose piece 8 can be regulated by hand. For the purpose of adjusting the strength of the releasing current the spring 12 may be stressed more or less by means of the piece 19.

In the case of a moderate excess current, the mode of operation is as follows:—

Armature 3 is attracted and presses (in opposition to the force of the counter spring 12) by means of the spring 6 and pawl 7 the nose piece 8 toward the right until the sector 16 has engaged the pinion 15. At the same time this releases the braking stop 13 of the lever 10 from the rotor 14 which begins to revolve and thus moves the toothed sector 16 upwardly on its axle 9. After a certain period of time the parts arrive at the position shown in Fig. 2 and the pin 17 lifts the nose piece 8 and trip releases the pawl 7. The connection of the armature 3 to its counter spring 12 is now broken, and this armature can now be attracted freely into its end position. In this operation the extension 5 strikes the switch-operating rod 20 and thus releases with full force the main switch. At the same time the spring 12 pulls the lever 10 back into its initial position, thereby uncoupling again the time mechanism 15, 16 and braking the rotor 14. The sector 16 and the nose 8 are caused by their own weight to drop into their initial positions, the parts then being in the position shown in Fig. 3. After the winding 2 has become deënergized the armature 3 also drops, and thus causes a fresh engagement of the pawl 7 with the nose 8, as shown in Fig. 1.

If the moderate excess current ceases before the toothed sector has been driven by the time mechanism into the position shown in Fig. 2, the armature 3, pawl 7, nose-piece 8 and lever 10 resume their normal positions, as shown in Fig. 1; the toothed sector 16 being thereby withdrawn from engagement with the gear 15, then drops into its normal position, as shown in Fig. 1.

In the operation of the relay described, the spring 6 does not come into action as a spring, and the mechanism acts as though the pawl 7 were made in one piece with the armature extension 5.

In the case of high excess currents during short circuiting, the spring 6 permits the end of the pawl 7 to move out of engagement with the nose piece 8. The attractive force of the electromagnet becomes so great in the case of such currents that, overcoming the force of the spring 6, it attracts the armature 3 immediately into its end position, the parts 7, 8, 9, 10 and 16 being undisturbed, and knocks down the switch rod 20 by means of the extension 5.

The parts are then in the position shown in Fig. 4. In this case the electromagnet has completely attracted its armature 3 and, while stressing the spring 6, the pawl 7 rotates slightly about its pivot 4 due to the constraint of the nose piece 8, whereby the heel of the pawl is lifted clear from its bearing surface on the lever 5, as shown in Fig. 4. The pawl 7 during this movement of the armature remains undisturbed in relation to the fixed part of the apparatus.

In the time relay as shown, the releasing time is independent of the strength of the current because the time mechanism motor is an asynchronous motor which will run practically idle until the pin 17 strikes the nose 8.

It will be understood that the above described construction is given by way of example only and may be modified. It is also to be understood that instead of operating the time relay in such a manner that the releasing time is independent of the strength of the current, the arrangement may be modified for the time to be dependent upon that current.

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

1. In a maximum time limit relay circuit breaker, the combination of an electromagnet, a movable armature, a counter spring normally acting on the armature, connective mechanism between the armature and the counter spring comprising a pair of trip elements, a time mechanism, means for driving the time mechanism, and a movable member mounted on an element of the connective mechanism and which a small movement of the armature moves into driving contact with the time mechanism, and after a predetermined time releases the trip elements and thereby releases the armature from the influence of the counter spring.

2. In a maximum time limit relay circuit breaker, the combination of an electromagnet, a movable armature, a counter spring normally acting on the armature, connective mechanism between the armature and the counter spring comprising a pair of trip elements, a time mechanism, means for driving the time mechanism, and a movable member mounted on an element of the connective mechanism and which a small movement of the armature moves into driving contact with the time mechanism and after a predetermined time releases the trip elements and thereby releases the armature from the influence of the counter spring, and

braking means carried by the connective mechanism for normally preventing the idle running of the time mechanism.

3. In a maximum time limit relay circuit breaker, the combination of an electromagnet, a movable armature, a counter spring normally acting on the armature, connective mechanism between the armature and the counter spring comprising a pair of trip elements, a time mechanism, means for driving the time mechanism, an asynchronous motor having its rotor in the magnetic field of the electromagnet, and a movable member mounted on an element of the connective mechanism and which a small movement of the armature moves into driving contact with the time mechanism and after a predetermined time releases the trip elements and thereby releases the armature from the influence of the counter spring.

4. In a maximum time limit relay circuit breaker, the combination of an electromagnet, a movable armature, a counter spring normally acting on the armature, connective mechanism between the armature and the counter spring comprising a pair of trip elements, a time mechanism, means for driving the time mechanism, and a movable member mounted on an element of the connective mechanism and which a small movement of the armature moves into driving contact with the time mechanism and after a predetermined time releases the trip elements and thereby releases the armature from the influence of the counter spring, and an adjustable arm for controlling the time lag of the relay.

5. In a maximum time limit relay circuit breaker, the combination of an electromagnet, a movable armature, a counter spring normally acting on the armature, connective mechanism between the armature and the counter spring comprising a pair of trip elements, a time mechanism, means for driving the time mechanism, and a movable member mounted on an element of the connective mechanism and which a small movement of the armature moves into driving contact with the time mechanism and after a predetermined time releases the trip elements and thereby releases the armature from the influence of the counter spring, and an adjustable arm for controlling the strength of the counter spring.

6. A maximum time limit relay comprising an electromagnet core with two air gaps, an armature pivoted adjacent the one gap, a rotor disposed in the other gap, a winding on said core, a train of gearing, a driving connection between said rotor and said train, and the last element of the train comprising a toothed sector, a bell crank lever with a brake for the aforesaid rotor, a spring controlling said lever, a mounting on said lever for the aforesaid sector and a nose-piece or latch, a pawl pivoted on the electromagnet armature engaging said latch, a stiff spring connecting said pawl with said armature, a pin on the aforesaid sector adapted to be moved against the latch to release the pawl, an adjustable pointer for controlling the travel of the pin and an adjustable pointer for controlling the tension of the first-mentioned spring.

7. In a maximum time limit relay circuit breaker, the combination of an electromagnet, an armature, a switch connection operated thereby, a detachable connection between the counter spring and the armature, which is moved by the movement of the armature and which stresses the counter spring, when the armature is moved by the electromagnet, time mechanism, means for operating the same, a member carried by the detachable connection to engage the time mechanism and be operated thereby, when the detachable connection is moved, said member causing the release of the armature from the detachable connection after a prescribed period of movement of the said member thereby permitting the armature to be operated by the magnet, unrestrained by the counter spring to operate the switch connection.

8. In a maximum time limit relay circuit breaker the combination of an electromagnet, an armature, a switch connection operated thereby, a detachable connection between the counter spring and the armature, which is moved by the movement of the armature and which stresses the counter spring, when the armature is moved by the electromagnet, time mechanism, means for operating the same, a member carried by the detachable connection to engage the time mechanism and be operated thereby, when the detachable connection is moved, said member causing the release of the armature from the detachable connection after a prescribed period of movement of the said member, thereby permitting the armature to be operated by the magnet, unrestrained by the counter spring, to operate the switch connection, the means for operating the time mechanism consisting of a rotor in the field of the electromagnet, said rotor being held against movement normally, but released with the movement of the armature, substantially as described.

9. In combination an electromagnet, an armature, a switch connection leading from the armature, a pair of counter springs, a trip connection between one of said springs and the armature, time mechanism with means for driving the same, a member, movable with the trip mechanism and thrown thereby into engagement with the time mechanism to be operated thereby, said member when operated by the time mechanism operating the trip, the other counter

spring being connected with the armature, and a part of said trip mechanism but yielding only when high excess currents pass through the electromagnet, said spring holding the armature and a part of the trip in prescribed relation during the operation under moderate excess currents, substantially as described.

10. In combination an electromagnet, an armature therefor, a counter spring, connections between the counter spring and the armature, time mechanism, a rotor under the influence of the field of the magnet for operating the time mechanism and means for throwing out of engagement the connection between the counter spring and the mature, said means being operated by the timing mechanism and being caused to engage the same by the movement of the armature and means for restraining the rotor controlled by the said connections, substantially as described.

In testimony whereof, I have affixed my signature.

ALBERT AICHELE.

Witnesses:
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BERTHA C. GROB.