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CHRONOMETRIC ELECTRIC CIRCUIT
Filed Oct. 4, 1940

Serial No.
359,791
2 Sheets-Sheet 1

FIG. 1

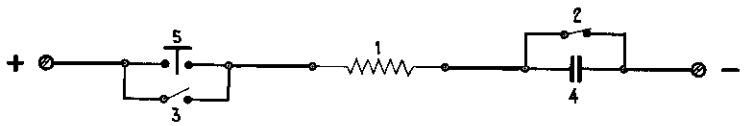


FIG. 2

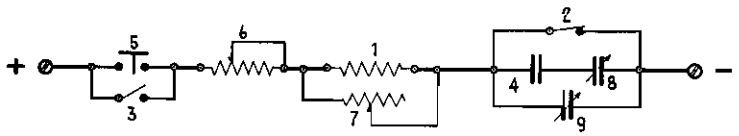
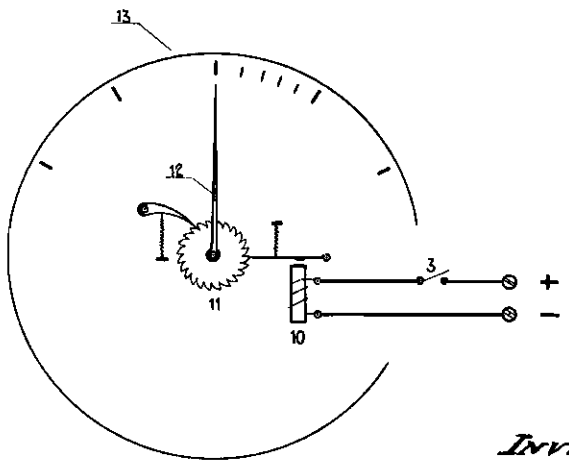


FIG. 3



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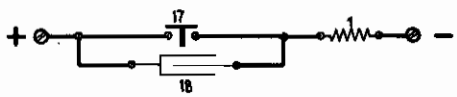

FIG. 4

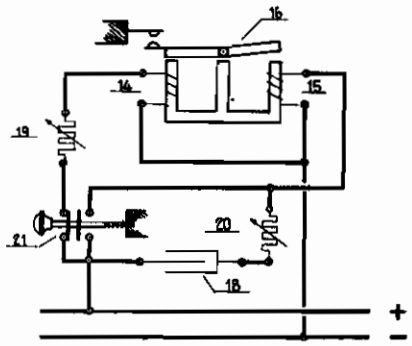

FIG. 5

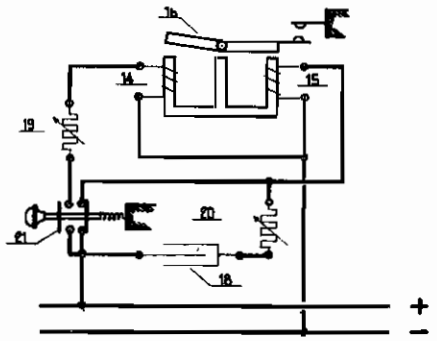

FIG. 6

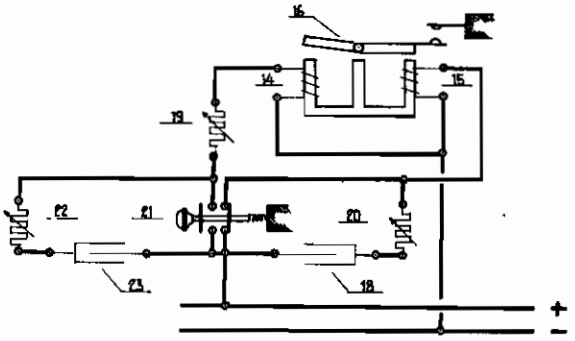

FIG. 7

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CHRONOMETRIC ELECTRIC CIRCUIT

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The present invention relates to an electric circuit, adapted to be used as a time measuring device, and which may be realized as a clock having index fingers indicating hours, minutes and seconds.

It is already known that a deferred control may be obtained by means of a condenser inserted in a relay circuit so arranged as to continue its operation by means of the discharge current, on to a commutator or contact breaker, until the intensity of such current of discharge has fallen below a certain pre-determined value.

According to the present invention, use is also made of the condenser, but the circuit is so arranged that the relay operating the commutator or contact breaker to be controlled, operates during the charging of the condenser until the charging current, depending from a constant tension, falls below a certain predetermined value; the system of time-delay control so obtained being used in conjunction with means adapted to repeat periodically the operation at pre-determined intervals of time, always equal to each other.

The invention comprises essentially an electric circuit in which are inserted two or more contacts controlling a relay of normal type, a condenser traversed by a current of sufficient intensity for maintaining attracted said relay during a predetermined time, said relay being inserted on a key adapted to open one of the contacts for starting the charge of the condenser, and adapted to close the other contact which re-establishes the circuit in place of the key.

The invention comprises also the feeding with alternate current, and devices for disposing the antagonistic force of the relay, so as to withdraw it from the action of the stationary current, for the purpose of effecting the attraction of the relay only during the transitory period of the current, and in order to cause the device to be independent from the variations of the tension.

Lastly, the electric circuit according to the invention, provides essentially the driving element for the measure of time, operating on the principle of the time variation of the charging current of a condenser in the time, assuming the time in which the charging current falls to the minimum to maintain the relay attracted as unit of measure.

The device according to the invention is shown schematically in various forms of realization and by way of example in the attached drawing, in which:

Fig. 1 shows an electric circuit comprising a relay, two contacts, a condenser and a key.

Fig. 2 shows a complete circuit for effecting the calibration of the time of operation of the device.

Fig. 3 shows a circuit similar to an ordinary rotating telephone circuit finder.

Fig. 4 shows a circuit in which a relay is attracted immediately on insertion, and remains attracted for a given time after having been switched off. (Time-delay dropout relay).

Fig. 5 shows a circuit similar to that shown in Fig. 4, predisposed so as to compensate eventual variations of tension of the feeding current.

Fig. 6 shows a circuit similar to that shown in Fig. 5, comprising a time-delay relay which is energized after a determined time from its insertion, said activated condition ceasing immediately upon its disconnection. (Time-delay pickup relay.)

Fig. 7 shows a circuit similar to those illustrated on Figs. 5 and 6, but provided with a time-delay relay retarding its action both on its insertion and on switching off. (Time-delay pickup and dropout relay.)

In Fig. 1, 1 indicates a relay of ordinary type, which actuates, when is energized, two contacts 2 and 3, shown in the figure in a de-energized position, 4 is a condenser having such a capacity that when the circuit is fed with constant tension, it is traversed by a charging current which is sufficient to maintain attracted the relay 1 for a certain time.

The operation of the device shown in Fig. 1 is as follows:

On pushing momentarily the key 5, the relay 1 becomes inserted and is thereby energized, for operating its two contacts 2 and 3. The contact 2 opens, starting thereupon the charge of condenser 4; the contact 3 closes, thus maintaining closed the circuit in place of key 5 which reopens immediately.

When condenser 4 has been charged until the charging current has dropped below the necessary minimum value for keeping attracted relay 1, this latter ceases its action on the contacts 2 and 3; contact 3 opens thereby switching off the circuit of the device, contact 2 closes, thereby discharging condenser 4 and predisposing it for the subsequent operation.

By selecting suitably the electrical characteristics of relay 1 and of condenser 4, the time in which relay 1 is maintained attracted is constant for a given tension, and consequently the complex may be used as a time measuring device.

The circuit shown in Fig. 1 may be completed

by the addition of adjustable resistances 6, 7 and of condensers 8 and 9, as shown in Fig. 2. The calibration of the operating time of the complex may be effected either by operating on the adjustable resistances 6 and 7, or on the variable condensers 8 and 9. All the variable elements 6, 7, 8 and 9 above mentioned, may in their turn be replaced with inductances, both constant or variable, with or without iron core, and connected to them either in series or in parallel.

If from the circuit shown in Fig. 1, the contact 3 is excluded, and the key 5 is maintained permanently closed, the circuit of relay 1 will close and open at constant intervals of time, equal to the time of operation of the complex.

By applying in the last mentioned case, the contact 3 of the relay 1 in the circuit illustrated in Fig. 3, which is similar to an ordinary telephone circuit finder, the toothed wheel 11 will advance through a tooth at every insertion of relay 1 and consequently of the servomotor 10.

On closing key 5 for a time t (Fig. 3) the displacement of index finger 12, integral with the wheel 11 records on dial 13, the measure of the time t.

By calibrating the time interval of the chronometric circuit for the time of one second, providing wheel 11 with sixty teeth, and connecting mechanically index finger 12 with another two index fingers with successively reduced angular movements from 60 to 1 (using ordinary clock gearings) a clock is realized, having hours, minutes and seconds index fingers. In this case, the clock setter or adjustment device may be provided by using one or more of the variable elements above described, shown in Fig. 2.

In order to cause the time of operation of the device to be independent, within certain limits, from the tension of the feeding current, it is sufficient to substitute the usual antagonistic spring of relay 1, with an electromagnetic force, proportional to the tension of the feed current, as shown by way of example in Fig. 5, which shows the relay 1, formed as an E shaped core provided with two windings 14 and 15, the moveable anchor 16 being balanced on a pivot between two core expansions as hereinafter described.

By replacing the dial 13 with a series of contacts, and the index finger 12 with a sliding brush operating with said contacts, the time registration may be effected through suitable electric devices, such as lamps, relays and the like.

By applying on the relay 1 more contacts (besides the contacts 2 and 3), it is possible to insert, during the operation of the chronometric circuit, any other circuit or electric apparatus, so as to obtain the chronometric registration in other ways. By means of such auxiliary contacts and relays, it is possible to insert a plurality of chronometric circuits in series, calibrated either to give equal times or, to provide times different one from the other.

The preceding description of the arrangements of circuits according to the invention, applies also when the circuit shown in fig. 1 is fed with alternating current, provided that use is made of suitable appliances.

Fig. 4 shows schematically a circuit so arranged that the relay provided in it is attracted immediately upon its insertion, and continues to be attracted for a determined time after having been switched off (Time-delay dropout relay). In such circuit, the relay 1 is energized immediately on closing key 17, while condenser 19 is short circuited by said contact key 17, and is thereupon discharged. When the circuit is disconnected, through the opening of contact key 17, the relay 1 continues to be traversed by the feeding current, until the value of said charging condenser current falls below a certain determined value.

Fig. 5 shows schematically a circuit similar to that shown in fig. 4, but provided with means adapted to compensate eventual variations of tension of the feeding current. These means, as above mentioned, consist in forming the relay on an E shaped core, comprising two windings 14 and 15, and on oscillating anchor 16 pivoted between said core windings, one of which may be inserted as the relay 1 shown in fig. 4, and the other may be shunted from the feed current with an adjustable resistance connected in series, thus acting as an antagonistic force.

With the arrangement just described, both the active force of the relay, depending from the charging current of condenser 18, and the antagonistic force which causes it to be disconnected, when said force decreases, are proportional to the tension of the current, i.e., they vary similarly as the variations of the latter, and consequently the operation of the device depends solely from the electric characteristics of the circuit, and so remains practically constant even during eventual variations of the current tension.

In the circuit shown in fig. 5, the rheostats 19 and 20 are used for adjusting, within certain limits, the time of the circuit.

Fig. 6 shows a circuit similar to that shown in fig. 5, with which however the opposite effect is obtained, i.e., a retardation of the activation of the relay (time-delay pickup relay). In this circuit, winding 14 is the active one, while winding 15 provides the antagonistic force; these two windings are so dimensioned that on pressing the key 21, the winding 14 is inserted, but the force produced by it is not sufficient for attracting immediately the movable anchor 16, and consequently a time t has to pass between said insertion and the actual attraction of anchor 16, after which the current charge of condenser 18, drops to such a low value, that the current traversing the winding 15 falls below and is overcome by that traversing the winding 14. Also in this case the time-delay depends on the values of condenser 18 and resistances 19 and 20.

The relay shown in fig. 6 has a quick return, viz; as soon as key 21 is released, the moveable balancer 16 is immediately attracted again by the winding 15.

The circuit shown in fig. 7 is a time-delay pickup and dropout relay. In fact, in this circuit, on pressing the key 21, the operation above described for the circuit of fig. 6 is obtained, and on releasing said key 21, the operation described for the circuit of fig. 5 is obtained. The two time-delays depend on the values of the condensers 18 and 23 and of the resistances 19, 20 and 22.

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