Sept. 12, 1933. W. H. EDWARDS ET AL 1,926,144

TIME CONTROLLED APPARATUS

Filed June 14, 1929 2 Sheets-Sheet 1

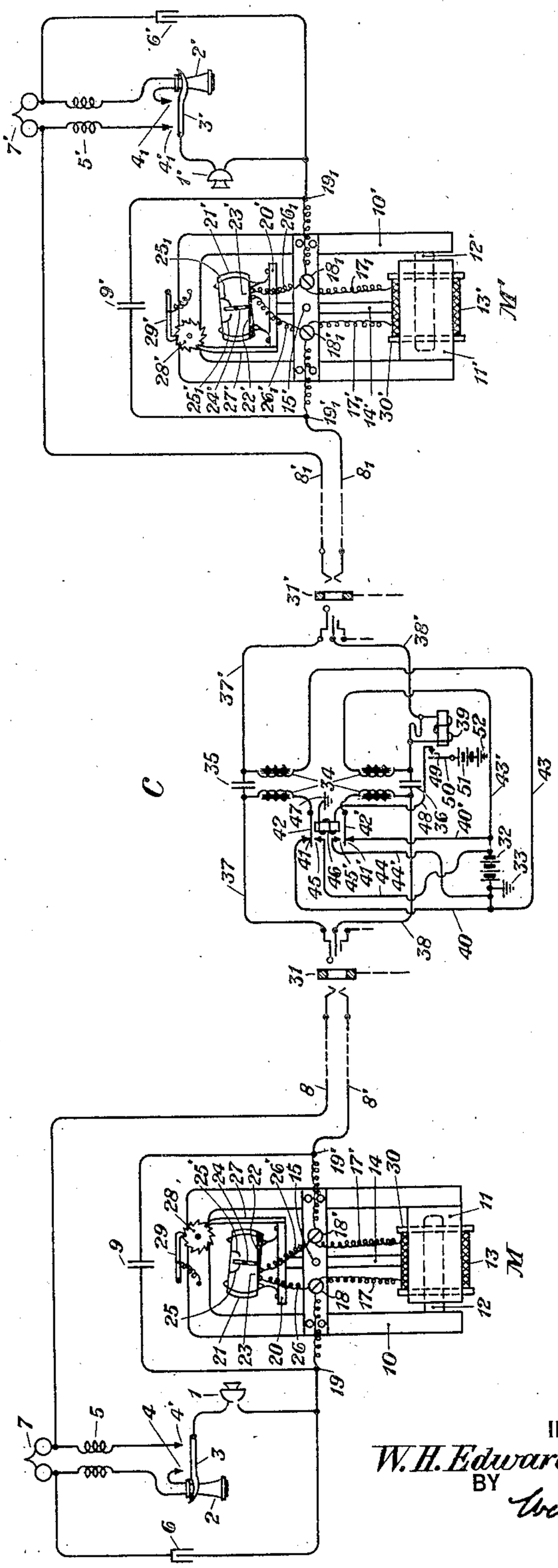

Fig. 1

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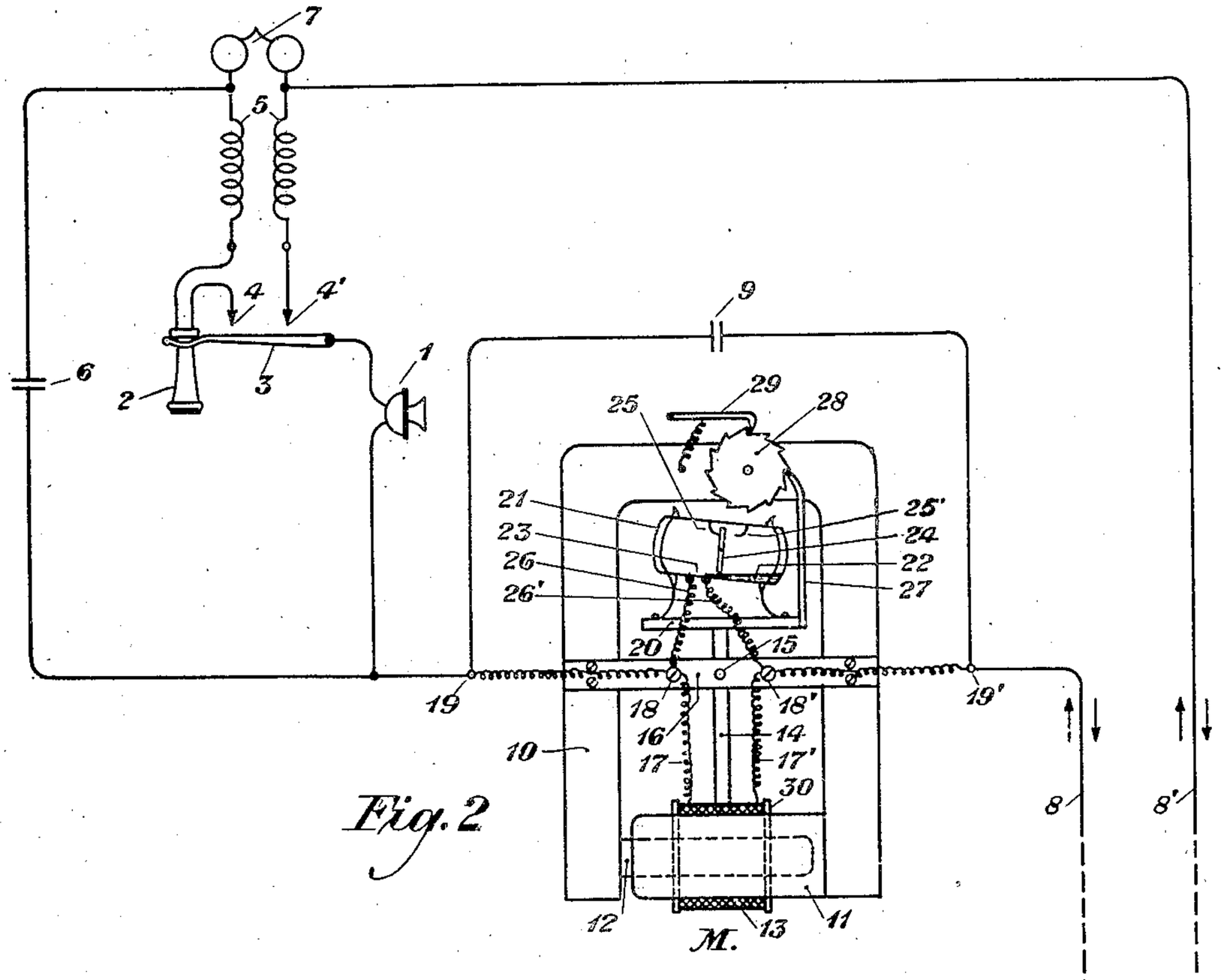

Fig. 2

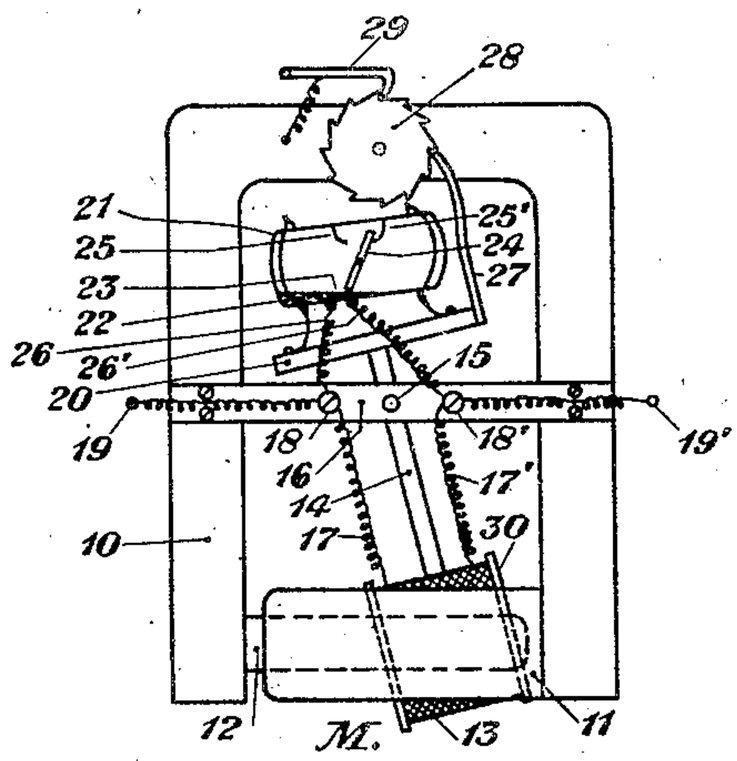

Fig. 3

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1,926,144

TIME CONTROLLED APPARATUS

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Application June 14, 1929. Serial No. 370,959

5 Claims. (Cl. 171—272)

This invention relates to timing devices, and more particularly to automatic time measuring devices which are adapted to be located at the subscriber's stations of a telephone system, the device at each station being adapted to be operated automatically at predetermined intervals of time by a constant direct current in the line to measure the length of time the telephone is in use.

In the telephone metering systems heretofore proposed, in which the meter was located at the subscriber's station, it was found necessary in order that the meter be operated automatically at predetermined intervals of time, to vary the line current periodically during the conversation. It is obvious that any artificial or abnormal variation of the line current will introduce objectionable disturbances in the talking circuit. Consequently, expensive apparatus had to be installed in order to eliminate these disturbing effects.

It is an object of this invention to provide a telephone metering system which includes a meter located at the subscriber's station and capable of being operated automatically at definite time intervals by the normal direct current present in the line.

A better understanding of the invention may be had from the detailed description hereinafter following.

Figure 1 of the drawings represents diagrammatically a telephone system illustrating one embodiment of the invention; Fig. 2 is an enlarged view of one of the stations of Fig. 1; Fig. 3 shows diagrammatically the same embodiment of the meter in its operated condition.

In Fig. 1, two subscribers' stations A and B are shown with subscriber's loops extending to the central office and terminating in the jacks 31 and 31'. As shown, A represents the station of the calling subscriber and B that of the called subscriber. Substation A comprises the usual transmitter 1, the receiver 2, the receiver hook 3, the contacts 4 and 4', the induction coil 5, the condenser 6, the ringer 7, and the line conductors 8 and 8'. In addition, there is located at the substation a meter M connected in series with the substation circuit with a by-pass condenser 9 provided to permit the voice signals to pass therethrough rather than through the meter winding.

The meter M, as shown, includes a permanent magnet 10 having adjacent or overlying, parallel disposed pole pieces 11 and 12, 11 being the outer pole piece and 12 being the inner. An armature of the moving coil type, having the coil 13 and the supporting member 14, is pivoted at 15 on the bar 16. The coil 13 is positioned within the outer pole piece 11 and surrounds the inner pole piece 12. The winding of the coil 13 is connected in series with the substation circuit through the leads 17 and 17', the connecting posts 18 and 18', and the meter terminals 19 and 19'. On the upper end of the supporting member 14 is positioned the cross-bar 20 upon which is mounted a mercury switch. This mercury switch includes a receptacle 21, the mercury 22, the contacts 23, the pivoted vane 24 and the vane stops 25 and 25'. The contacts 23 are connected through leads 26 and 26' to the connecting posts 18 and 18', respectively. There is also mounted on the cross-bar 20 a pawl 27 which, when it is moved upward, operates a ratchet wheel 28. A holding pawl 29 is provided to hold the ratchet wheel in its operated position.

The arrangement at substation B is the same as that shown at substation A, as described above.

When battery is applied to the device so that the current flows in the direction indicated by the solid arrows in Fig. 2—that is, from meter terminal 19 through connecting post 18, lead 17, the winding of coil 13, lead 17' and connecting post 18' to meter terminal 19'—the coil is energized in such a way that it is held in its normal position as shown in Fig. 2, the shunt circuit, which includes contacts 23 and leads 26 and 26', remains open and no registration occurs. When battery is applied to the device so that the current flows in the direction indicated by the dotted arrows in Fig. 2, that is, in the opposite direction registration begins. With this direction of current flow through the coil 13, said coil moves away from its normal position shown in Figs. 1 and 2 through the magnetic field to the position shown in Fig. 3. This movement of the coil, through the supporting member 14 and the cross-bar 20, causes the pawl 27 to operate the ratchet wheel 28 one step and tilts the receptacle 21 to a position as shown in Fig. 3. The vane 24, due to the position of the vane stop 25', swings out and permits the mercury to flow rapidly to the other side of the receptacle 21, as shown in Fig. 3. The mercury in this position completes the connection between the contacts 23 and closes the shunt circuit around the coil 13. The coil is deenergized and is restored to its normal position, as shown in Figs. 1 and 2, by the force of gravity. The receptacle 21 is tilted back to its previous position and the mercury tends to flow back to its normal position. However, this time the vane 24, due to the position of the stop 25, presents a restricted opening to the passage of mercury and hence retards the flow thereof and creates a definite time interval during which the shunt circuit is closed and the coil deenergized. When the mercury finally restores to the other side of the receptacle, the connection between the contacts 23 is broken and the shunt circuit is opened. The coil is again energized in such a way that it again moves to the position shown in Fig. 3 and causes the ratchet

wheel to be operated another step and the receptacle to be tilted as before. This cycle is repeated at definite time intervals as long as the connection between the subscribers is maintained and the time of each conversation is recorded without any substantial, artificial or abnormal variation of the line current.

In order to prevent false registration due to the ringing current or to the flashing of the receiver hook, the mass of the armature is so selected that the moment of inertia thereof will be sufficient to provide sluggishness of action. Also, for this purpose, eddy current damping means in the form of a copper slug 30 inside the coil 13 is provided to retard the build-up and decay of the current in the coil.

As described above, only the current in the calling subscriber's line is reversed and hence only the meter at the calling subscriber's station is operated. Also, as described, this reversal occurs only after the called subscriber answers. It is to be understood, however, that the current in both subscribers' lines may be reversed and/or this reversal may be caused to occur and, hence, the meter or meters may be caused to begin operating, at any desired time during the connection, without departing from the spirit of the invention.

Although this invention has been shown and described in connection with a moving coil type of meter and with a mercury switch to create the time interval, it should be understood that it is capable of being embodied in other forms without departing from the spirit of the invention or the scope of the appended claims.

What is claimed is:

1. A timing device comprising, in combination, a pair of terminals, the circuit across which is adapted to be maintained closed at all times during the operation of said device, a magnet having overlying, parallel disposed pole pieces, a coil permanently connected in series with said terminals and adapted to move between said pole pieces, a supporting member fastened to said coil and adapted to be moved thereby, means for registering the number of times said supporting member moves through its arc of vibration, a circuit adapted to be closed to shunt said coil, and a mercury switch controlled by the movement of said supporting member for closing a shunt circuit around said coil and for keeping said shunt circuit closed a substantial and predetermined interval of time.

2. A timing register comprising, in combination, a pair of terminals, the circuit across which is adapted to be maintained closed at all times during the operation of said register, a permanent magnet one pole piece of which overlies the other, a coil permanently connected in series with said terminals and adapted to move between said pole pieces, a pivoted supporting member fastened to said coil and adapted to be moved thereby, means for registering the number of times said supporting member moves through its arc of vibration, a receptacle containing mercury adapted to be tilted by the movement of said supporting member, a circuit adapted to shunt said coil, said circuit having a pair of electrically disconnected terminals located in said receptacle, and means located in said receptacle adapted to permit said mercury to flow freely from one side of said receptacle to the other to form an electrical connection between said terminals when said supporting member is moved in one direction, and adapted to retard the flow of said mercury when said supporting member is moved in the other direction, thereby creating a substantial and predetermined time interval during which said coil is shunted.

3. A time register comprising, in combination, a pair of terminals, the circuit across which is adapted to be maintained closed at all times during the operation of said register, a permanent magnet, a coil associated with said magnet and permanently connected in series with said terminals, a supporting member adapted to move under the influence of said coil and said magnet when a voltage of predetermined polarity is impressed on said coil, means for registering the number of times said supporting member moves through its arc of vibration, a circuit adapted when closed to shunt said coil, a liquid timing device associated with said supporting member and adapted to be operated by the movement thereof, the operation of said timing device being adapted to close a shunt circuit around said coil and to keep said shunt circuit closed a substantial and predetermined interval of time, and means controlled by said timing device for repeating the initial energization of said coil and the movement of said supporting member after the expiration of said predetermined interval of time.

4. An automatic timing device comprising, in combination, a pair of terminals, the circuit across which is adapted to be maintained closed at all times during the operation of said device, a magnet, a coil associated with said magnet and permanently connected in series with said terminals, a supporting member adapted to move under the influence of said coil and said magnet when said coil is energized, means for registering the number of times said supporting member moves through its arc of vibration, a shunt circuit adapted to be closed around said coil, and a liquid time device controlled by the movement of said supporting member for closing said shunt circuit around said coil and maintaining said shunt circuit closed a substantial and predetermined interval of time.

5. A timing device comprising, in combination, a pair of terminals, the circuit across which is adapted to be maintained closed at all times during the operation of said device, a magnet, a coil permanently connected in series with said terminals and adapted, when energized, to move under the influence of said magnet, a supporting member fastened to said coil and adapted to be moved thereby, means for registering the number of times said supporting member moves through its arc of vibration, a receptacle containing a liquid and adapted to be tilted by the movement of said supporting member, a circuit adapted to shunt said coil, and means in said receptacle adapted, when said supporting member is moved in one direction, to be acted upon by said liquid in such manner that it permits said liquid to flow quickly from one side of said receptacle to the other to close said shunt circuit immediately and adapted, when said supporting member is moved in the other direction, to be acted upon by said liquid in such manner that it retards the flow of said liquid and creates a substantial and predetermined time interval during which said coil is shunted.

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