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R. J. WISE

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ELECTRICAL TIMING DEVICE

Filed Aug. 27, 1929

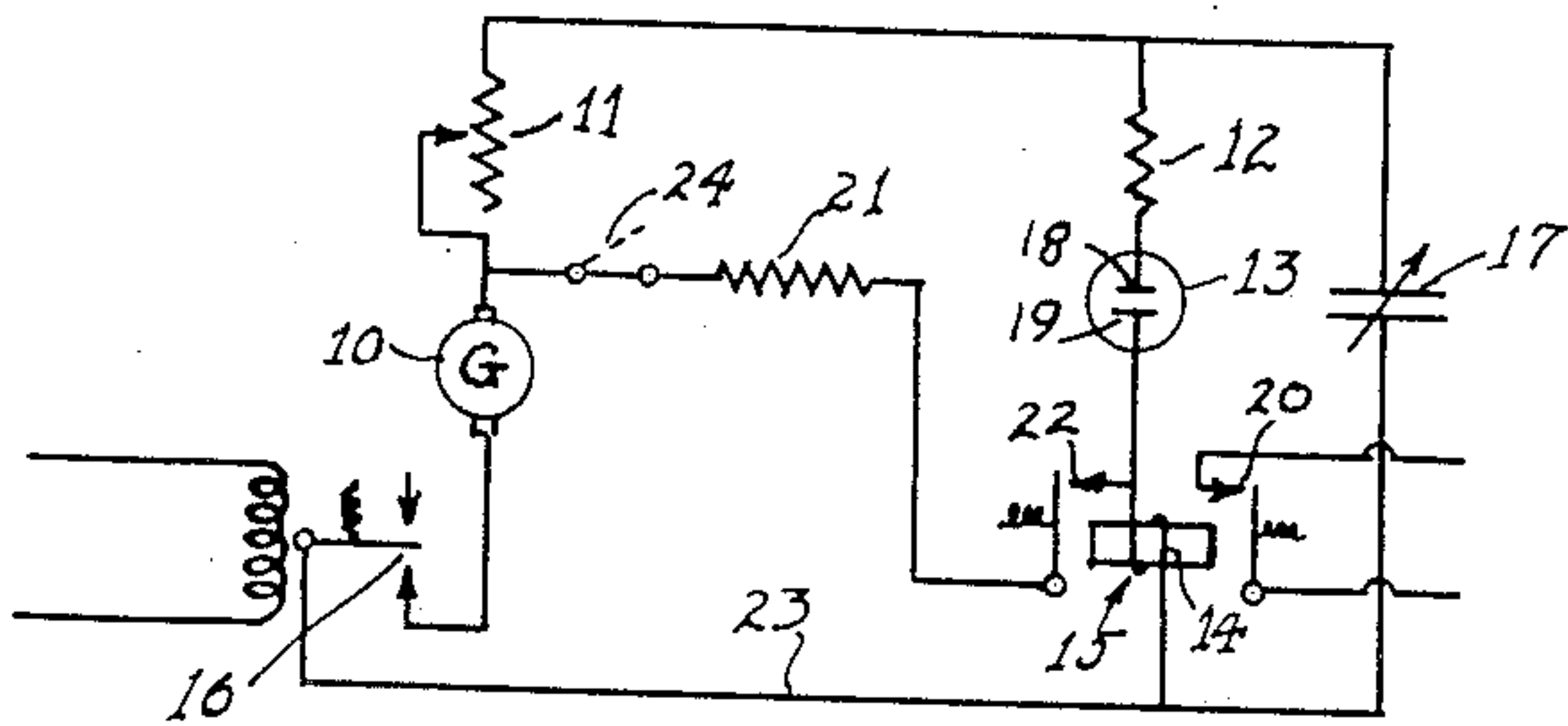


Fig. 1

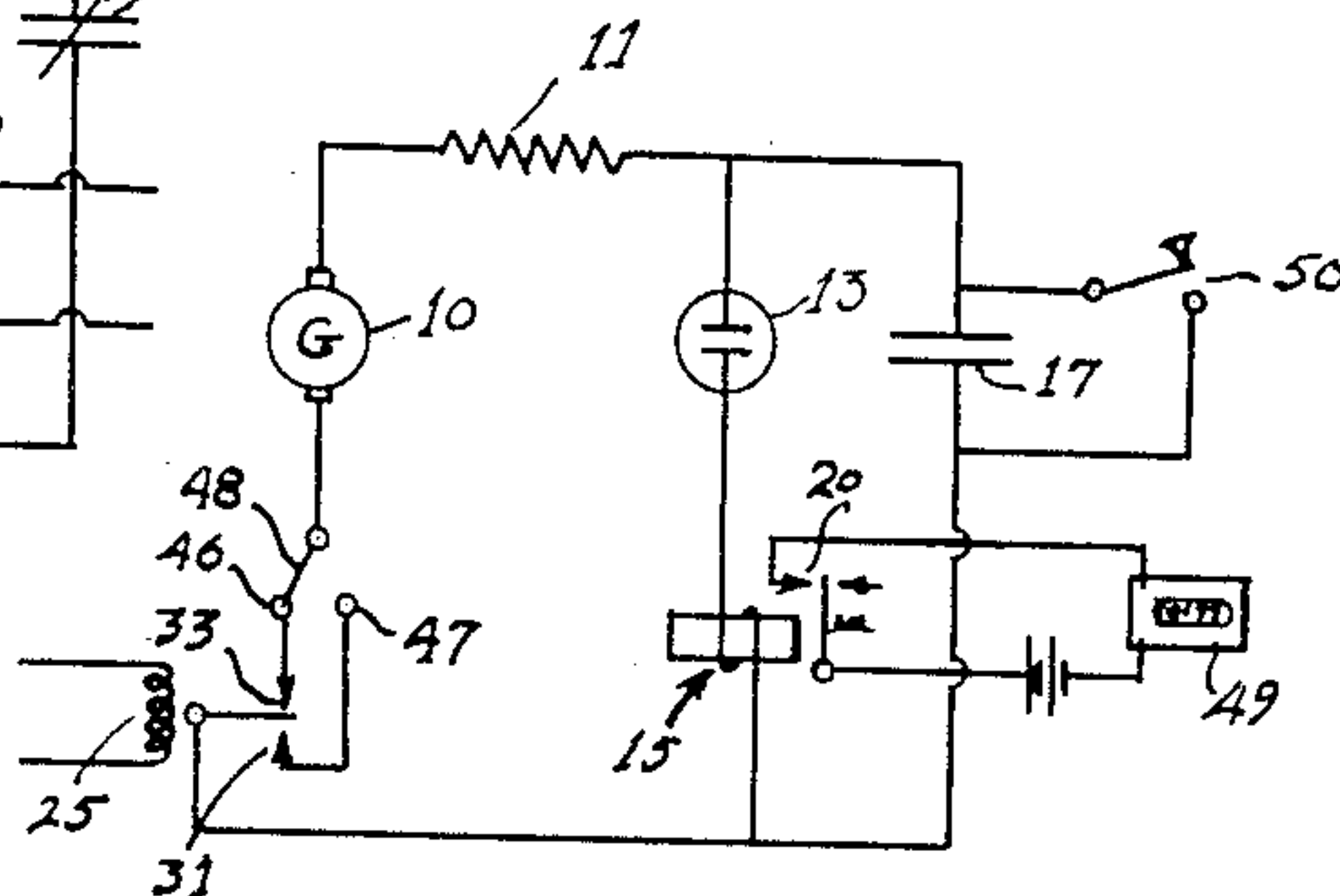


Fig. 4

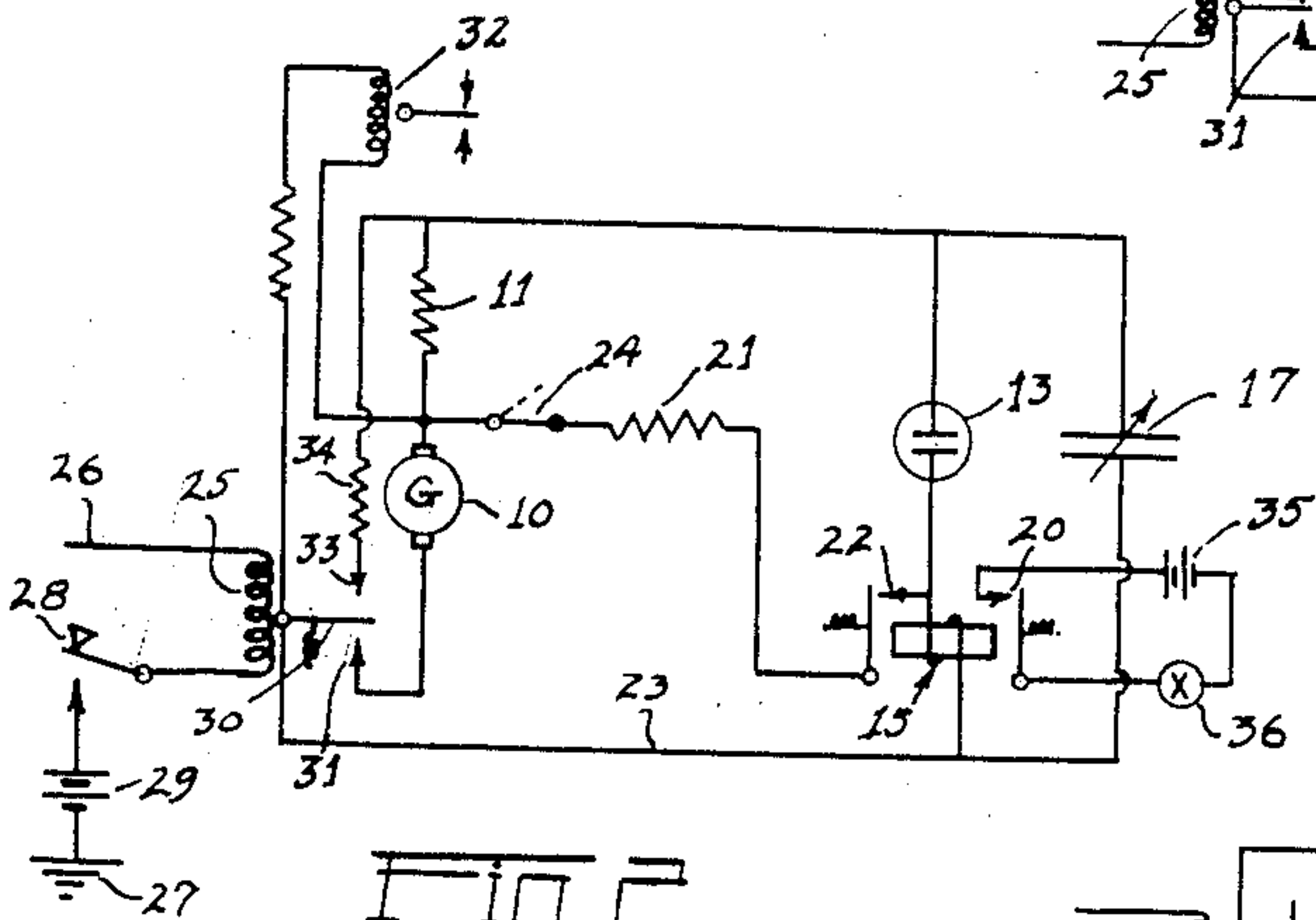


Fig. 2

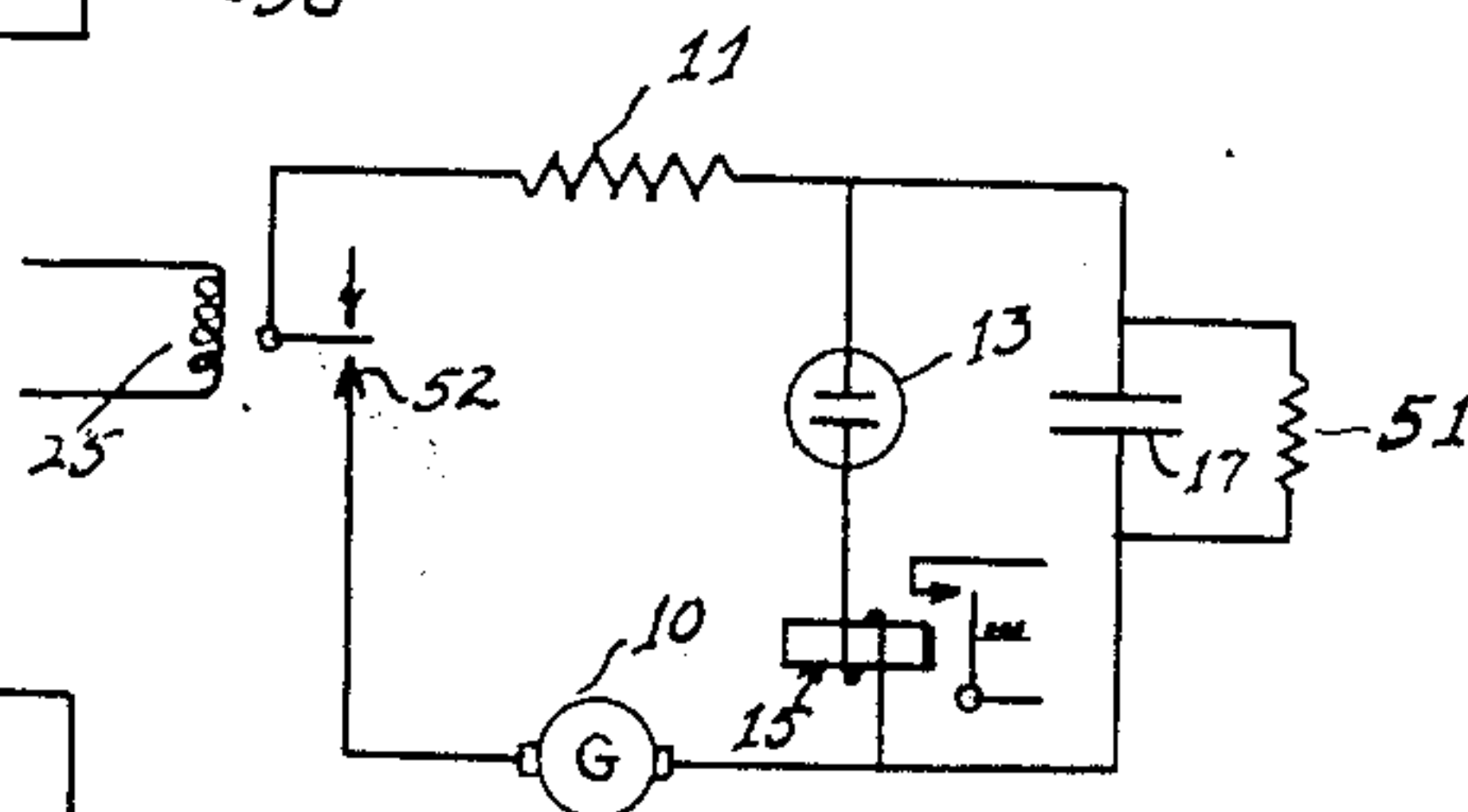


Fig. 5

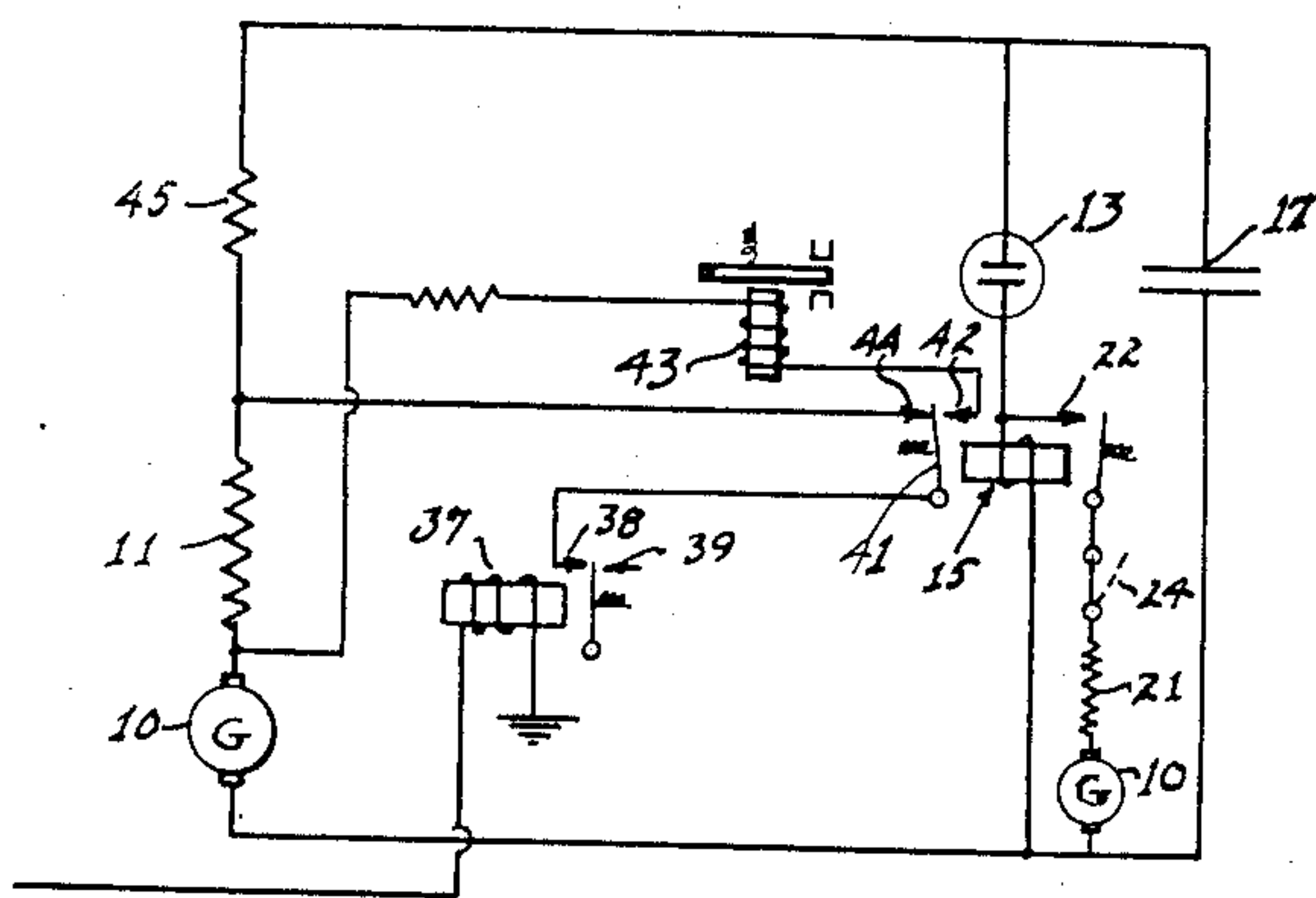


Fig. 3

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ELECTRICAL TIMING DEVICE

Application filed August 27, 1929. Serial No. 388,737.

This invention relates to an electrical timing device and more particularly to a device for operating an instrument such as a telegraph relay in response to a predetermined time interval of current flow.

The invention is especially adaptable to the operation of a call signal at a distant station of a telegraph system employing simplex printers where it is desirable, in order to save wear on the printing machines, eliminate noise and conserve on the current consumption of the machines, to maintain the driving motors idle when the circuit is not in operation, but to have the printing unit quickly available when it is desired to transmit thereto.

In a patent to Rothermel and Hewitt, No. 1,803,304, granted April 28, 1931, there is described a call system for a simplex telegraph system, in which the call signal is operated by a single open circuit condition of the line, the call signal responding irrespective of the length of time the open circuit condition is maintained. While this system has proven highly satisfactory, there are certain installations in which so called concentration units are employed, to which the system is not well adapted since there is an open circuit condition of the line of from one to two seconds, produced when the concentration operator detaches the plug from the line jack, which causes a false call signal to be established.

This difficulty has been overcome in a system disclosed in another copending application of W. B. Blanton, filed August 3, 1929, Serial No. 383,235, in which the signal is made responsive to an open circuit condition of short duration but is immediately discontinued, if the open circuit condition continues, as for instance, for a period exceeding about one third of a second.

It is one of the objects of my invention to overcome this same difficulty by providing a call signal which does not respond to an open circuit condition of short duration but only to one of prolonged duration, as for instance, several seconds.

Another object is to provide apparatus for causing the sounder or the recording or print-

ing apparatus at a distant station, which is normally inactive, to respond when it is desired to transmit to said station.

Other objects are to provide an apparatus, which will cause a time interval to elapse between the operation of a control contact and the operation of an electrical instrument in response thereto; to obtain an intermittent operation of an electrical device in response to a continuous current flow or to an intermittent current flow of different periodicity; and to provide an apparatus responsive to a predetermined accumulated time of applied potential.

Other objects and advantages will herein-after appear.

In accordance with my invention I employ a condenser having a slow charging rate in connection with a gaseous conduction device having a definite breakdown potential, the condenser being bridged across the gaseous conduction device so that after a predetermined period of current flow the condenser accumulates a charge equal to the breakdown potential of the gaseous conduction tube and discharges therethrough, the discharge continuing until the charge is reduced to the lower limit of the operating voltage of the tube, at which time the discharge is discontinued abruptly. A relay, call signal, counting mechanism or other form of electrically operated device may be connected in series with the gaseous conduction device so as to be operated when the discharge occurs and a locking circuit may be provided for the electrical device to continue the operation thereof after the discharge has ceased.

The charging current may be applied continually or intermittently. In the latter case the condenser acquires its charge over the accumulated time of current flow thereto.

In the preferred embodiment of the invention I employ the timing device in a telegraph system for operating a call signal at a distant station in response to a prolonged pulse of definite polarity or to a prolonged open circuit condition of the line, to call the attendant and/or to cause a normally inactive sounder or recording device to respond to the transmitting signals.

The invention will be more fully understood by reference to the accompanying drawings in which:

Figure 1 is a circuit diagram embodying the invention, illustrating an arrangement for obtaining a delayed operation of an electrical apparatus in response to the operation of a circuit closing contact;

Figure 2 is a circuit diagram showing the invention applied to a simplex telegraph system for operating a call signal;

Figure 3 is a circuit diagram of the invention applied to a sounder silencer;

Figure 4 is a circuit diagram showing an arrangement for obtaining the accumulative effect of an intermittent current; and

Figure 5 illustrates an arrangement for regulating the rate of charging of the timing condenser.

Referring to Figure 1, I have shown a circuit having, in series, a generator 10, a high resistance 11, a resistance 12, a gaseous conduction device 13, the winding 14 of a relay 15, and a switch 16. A condenser 17 is bridged across the resistance 12, gaseous conduction device 13 and relay 15.

The gaseous conduction device 13 may consist of a pair of opposed closely spaced electrodes 18 and 19 contained within a sealed envelope filled with one of the monatomic gases such as neon, argon or helium or mixtures thereof, the pressure of the gas and spacing of the electrodes being such that the device will have a definite starting or breakdown potential, preferably of from 100 to 200 volts, and a considerably lower operating voltage.

It is a characteristic of negative glow tubes of this nature, when the electrodes are thoroughly degasified and cleaned and pure gas employed, to have an extremely uniform starting or breakdown potential over a long period of time, particularly when operated at low current discharges, and after the discharge has been initiated therethrough, to continue to conduct current until the voltage has decreased considerably below the value required to start the discharge.

The voltage delivered by the generator 10 through the resistance 11 is below the starting or operating voltage of the tube 13 so that upon closing the switch 16 no discharge will occur therethrough. The condenser 17, however, gradually assimilates a charge over an interval of time depending upon the capacity of the condenser and the value of the resistance 11, until it reaches the breakdown potential of the tube 13. The condenser then discharges through the tube and energizes the winding of the relay 15. The discharge continues until the voltage has decreased to the lower limit of the operating voltage of the tube and is then abruptly discontinued. The rate of discharge may be regulated by the resistance 12.

The relay contacts 20 are thus closed during the discharge period of the condenser to establish a circuit which may be employed for any useful purpose. If it is desired to maintain the relay contacts closed after the discharge ceases, a locking circuit for the relay may be provided from the generator 10 through a resistance 21, a second contact 22, of the relay 15, winding 14 and back to the generator, by way of conductor 23. The locking circuit will thus be established during the discharge by closing of the contact 22 and is broken manually by the switch 24.

It will be appreciated that the condenser 17 will charge up and discharge periodically through the tube 13, and if the locking circuit be omitted, the discharge will produce an intermittent operation of the relay 15. Due to the uniform electrical characteristic of the discharge tube, the time rate of charging and discharging may be made very uniform.

Either the resistance 11 or the condenser 17, or both may be variable to permit the rate of charging to be regulated so as to obtain the desired time interval between the closing of the switch 16 and the operation of the relay 15. The switch 16 is shown as electro-magnetically operated and may constitute the contacts of a relay operated by a telegraph signal, as for instance, to operate a call system.

In Figure 2, I have illustrated, such a call system applied to a simple telegraph circuit including a receiving or line relay 25 connected to the line 26 and to the ground 27 through a transmitting key 28 and a source of potential 29. The line relay 25 may be employed to directly operate the sounder or recording device, but as shown, the relay tongue 30 and back contact 31 are connected through the generator 10 with the winding of a second relay 32, which may operate the sounder, recorder, repeating or other apparatus.

The timing device, including the high resistance 11, tube 13, condenser 17, relay 15 and the locking circuit therefor, are electrically connected with relation to the generator 10 exactly as described in connection with Figure 1. The front contact 33 of the relay 25 is connected through a low resistance 34 to the side of the condenser 17 opposite that to which the relay tongue 30 is connected.

The contact 20 controls a call signal circuit including a battery 35 and a signal device 36, which may be either visible or audible.

The operation of the call system is as follows:

When the line is idle and no signals are being transmitted the relay tongue 30 rests against the front contact 33 and the circuit to the generator 10 is open, the condenser 17 at the same time being short circuited through the low resistance 34.

When signals are transmitted the relay tongue alternately engages the front and back contacts 31 and 33. Upon contact with the back contact the circuit to the relay 32 is closed and at the same time charging current is delivered to the condenser 17. However, the relay tongue does not remain on its back contact for a sufficient period to charge the condenser to the breakdown potential of the tube 13 and on its return to the front contact, the condenser discharges through the resistance 34. Therefore, the condenser does not accumulate any appreciable charge during the normal transmission of signals.

If, however, the transmitting operator desires to call the attendant at the distant station he holds the line open for a prolonged interval, say from fifteen to twenty seconds, so as to retain the relay tongue on its back contact 31 for a period sufficient to charge the condenser to the breakdown potential of the tube, at which time a discharge occurs through the tube and effects the operation of the call signal 36 through the relay 15. The relay 15 is locked up until manually released by the opening of the switch 24.

In duplex, quadruplex or single line repeater sets, etc. it is often desirable that the sounder at the repeating station remain silent except when it is necessary to call the attendant as for testing of the circuit or for the reception of a message, and in Figure 3 there is illustrated a system for automatically closing local circuits at the repeating station, in response to a prolonged open condition of the line, for causing the sounder to respond to subsequent signals made at the calling station.

A leak relay 37, having a front contact 38 and a back contact 39, is connected between the line and the ground to respond to the signals transmitted from the calling station.

The time relay circuit includes the generator 10 and high resistance 11 in series with the condenser 17 and the gaseous discharge tube 13 and relay 15 bridged across the terminals of the condenser. The contact 22 of the relay controls a locking circuit for the relay 15 through a second generator 40, resistance 21 and manual switch 24. The contact tongue 41 of the relay 15, when in engagement with the front contact 42, completes a circuit for a sounder or other receiving apparatus 43, from the generator 10, through the contacts of the leak relay 37. The back contact 44 of the relay 15 completes a short circuit of the high resistance 11 and generator 10, when the leak relay armature is on the front contact.

The operation of the system is as follows: During the period when the line is idle, and the contact 38 closed by the steady line current, the condenser 17 is discharged through the low resistance 45, contacts 44 and 38 of relays 15 and 37. The generator is short

circuited through the same contacts and no charging of the condenser occurs. If signals are transmitted, the relay 37 responds thereto but since the contact 42 of relay 15 is open the sounder does not operate. When the armature of the leak relay 37 is on the back contact, the condenser tends to charge up but since this position is not maintained for a sufficiently long period to discharge through the tube 13 the relay 15 remains unenergized. Each time the armature re-engages the front contact 38 the condenser discharges. If the transmitting operator desires to call the repeater station he holds the line open for a prolonged period, thus maintaining the armature of the leak relay on its back contact for a sufficient period to charge up the condenser 17 to enable it to discharge through the tube 13 and relay 15 whereupon the contact 22 is closed to complete the relay locking circuit and contact 42 is closed to complete the sounder circuit. The sounder 43 will then respond to the line signals until its circuit is broken by opening of the switch 24 and de-energizing the relay 15.

In Figure 4 I have shown an arrangement adapted to respond to the accumulated time during which the relay tongue remains on either of its contacts, to operate the relay 15. The contacts 31 and 33 of the relay 25 are connected to two switch contacts 46 and 47 adapted to be selectively engaged by a switch arm 48. The contact 20 of relay 15 may control the circuit to a counting device 49. A key 50 is bridged across the plates of the condenser 17.

With the switch arm 48 on contact 46, for instance, the condenser 17 will acquire a charge each time the relay tongue engages the relay contacts 33, and since no discharge path is provided for the current in either position of the relay, other than through the tube 13, the condenser will gradually acquire a charge of sufficient voltage to break down the resistance of the tube and discharge there-through, thus causing a momentary flow of current through the relay 15 whereby the counting mechanism 49 will be operated.

Since the accumulated time required to charge the condenser is constant, irrespective of the length or frequency of the individual time intervals of which it is composed, the total interval between successive discharges will give a measurement of the proportion of the time the tongue rests on each of its contacts.

This embodiment is useful in determining the natural bias of a relay. For instance, if current reversals of uniform periodicity are impressed upon the winding of a polar relay the relay tongue should rest for exactly equal intervals upon each of the contacts. Due to a natural bias of the relay tongue in one direction, however, the period of engagement with one contact may be slightly greater than

that with the opposite contact. By utilizing the relay to be tested in place of the relay 25 and placing the switch arm 48 first on contact 46 and measuring the time required for the discharge to occur and then repeating the measurement with the switch arm on the contact 47 the direction of the bias may be readily determined, since the bias causes the contact tongue to hold-over on one contact slightly longer than on the other, and thereby, increases the charging rate of the condenser in one position of the switch 48. The condenser 17 should be completely discharged before each measurement, by closing the switch 50.

In Figure 5 a leak resistance 51 has been placed in shunt to the condenser 17 to permit the charge to leak off slowly and thus prolong the charging period of the condenser. If the leakage rate is made just equal to the charging rate for the average condition of operation of the relay 25 in response to telegraph signals, the condenser will never acquire sufficient charge to operate the tube 13. However, if for any reason the relay tongue remains on contact 52 for a greater proportion of the time, the condenser will charge up and discharge through the tube 13 to operate the relay 15 and thus indicate the existence of such condition.

Various other applications of the invention will occur to those skilled in the art and I desire to include, within the scope of my invention, all such modifications as come within the terms of the appended claims.

What is claimed is:

1. A telegraph call system comprising a relay responsive to line conditions, a condenser, means for charging said condenser in one position of said relay, means for discharging said condenser in the other position of said relay, and means for providing a second discharge path for said condenser when the charge thereon exceeds a predetermined voltage.

2. A telegraph call system comprising a relay responsive to line conditions, a condenser, means for charging said condenser in one position of said relay, means for discharging said condenser in the other position of said relay, a gaseous discharge device having a definite break down voltage and a lower operating voltage connected across said condenser to provide a discharge path when the charge on the condenser equals said breakdown voltage.

3. A telegraph call system comprising a relay responsive to line conditions, a condenser, means for charging said condenser in one position of said relay, means for discharging said condenser in other position of said relay, a gaseous discharge device having a definite breakdown potential and a lower operating potential connected across said condenser to provide a discharge path when the charge on

the condenser equals said breakdown potential, and means for regulating the rate of charging of said condenser.

4. A telegraph call system comprising a relay responsive to line conditions, a condenser, means for charging said condenser in one position of said relay, means for discharging said condenser in the other position of said relay, a gaseous discharge device having a definite breakdown potential and a lower operating potential connected across said condenser to provide a discharge path when the charge on the condenser equals said breakdown potential, a relay in series with said gaseous discharge device, a call signal circuit closed by said relay when said condenser discharges through said gaseous discharge device and means for maintaining said call circuit closed after the discharge through the device ceases.

5. In a telegraph system, a receiving relay, a receiving instrument, a circuit for said receiving instrument, a condenser, a gaseous conduction tube bridged across said condenser, a leakage path around said tube, said receiving relay in one position rendering said leakage path ineffective, and permitting said condenser to charge at a slow rate, means for causing said condenser to discharge through said tube after it has acquired a predetermined charge, and normally maintaining the circuit of said receiving instrument open, said relay being operated by the discharge current through said device to close said circuit, and render the receiving instrument responsive to the receiving relay.

6. A relay timing device comprising a condenser, means for charging said condenser at a slow rate, means for continuously discharging said condenser at a rate less than the charging rate, a gaseous conduction device connected across the terminals of said condenser and a relay in series with said gaseous conduction device and condenser, said condenser after it has acquired a predetermined charge discharging through said device and energizing said relay.

7. A relay timing device comprising a condenser, means responsive to current of one polarity for charging said condenser at a slow rate, said condenser being non-responsive to the accumulative effect of spaced impulses of said polarity, a gaseous conduction device connected across the terminals of said condenser and a relay in series with said gaseous conduction device, said condenser, after it has acquired a predetermined charge discharging through said device and energizing said relay, and a locking circuit for said relay for maintaining the same energized after said discharge has ceased.

8. A relay timing device comprising a condenser, means for charging said condenser at a slow rate, a gaseous conduction device connected across the terminals of said condenser and a relay in series with said gaseous con-

duction device, said condenser, after it has acquired a predetermined charge discharging through said device and energizing said relay, and means for controlling the rate of discharge through said device.

5 9. A telegraph system comprising a relay responsive to line signals of marking and spacing character, a condenser arranged to be charged during the reception of a signal of one character and to be discharged during the reception of a signal of the other character and circuit closing means controlled by the discharge current of said condenser, after the condenser has acquired a predetermined charge.

10 10. A telegraph system comprising a line circuit, a source of line signals of marking and spacing character, a condenser associated with said circuit and arranged to be charged during the period of a signal of one character and to be discharged during the period of a signal of the opposite character and means in shunt to said condenser having a normally high resistance and a definite "break down" voltage to provide a discharge path for the condenser after it has acquired a predetermined potential and circuit controlled means in said discharge path.

15 11. A telegraph system comprising a line circuit, a source of line signals of marking and spacing character, a condenser associated with said circuit and arranged to be charged during the period of a signal of one character and to be discharged during the period of a signal of the opposite character and means in shunt to said condenser having a normally high resistance and a definite "break down" voltage to provide a discharge path for the condenser after it has acquired a predetermined potential, the capacity of said condenser and the charging rate thereof being so proportioned that the condenser will not attain said "break down" voltage in response to ordinary telegraph signals of mixed marking and spacing character.

20 12. A telegraph system comprising a line circuit, a source of signals of marking and spacing character, a condenser associated with said circuit and arranged to be charged during the period of a signal of spacing character and to be discharged during the period of a signal of marking character, a glow discharge tube in shunt to said condenser to provide a discharge path for the condenser after it has acquired a predetermined potential, the capacity of the condenser and the charging rate thereof being so proportioned that the condenser will not attain the "break down" voltage of the glow tube in response to ordinary telegraph signals of mixed marking and spacing character and circuit controlled means in said discharge path.

25 13. A telegraph system comprising a line circuit, a source of signals of marking and spacing character, a condenser associated

with the circuit, a glow tube in shunt to the condenser, means for charging the condenser in response to signals of a definite character, said condenser in response to ordinary telegraph signals of mixed marking and spacing character being restricted to a potential below the "break down" voltage of the glow tube and being chargeable to a potential above said "break down" voltage in response to prolonged signals of said definite character.

30 14. In a telegraph system, a line, a relay responsive to line signals of marking and spacing character, a receiving instrument normally disassociated from the line, a condenser responsive to prolonged signals of one character for acquiring a predetermined charge, said condenser being non-responsive to regular telegraph signals of mixed marking and spacing character and means actuated by the discharge current of said condenser after it has acquired said predetermined charge, for operatively associating the receiving instrument with the line.

In testimony whereof I affix my signature.

RALEIGH J. WISE.

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