

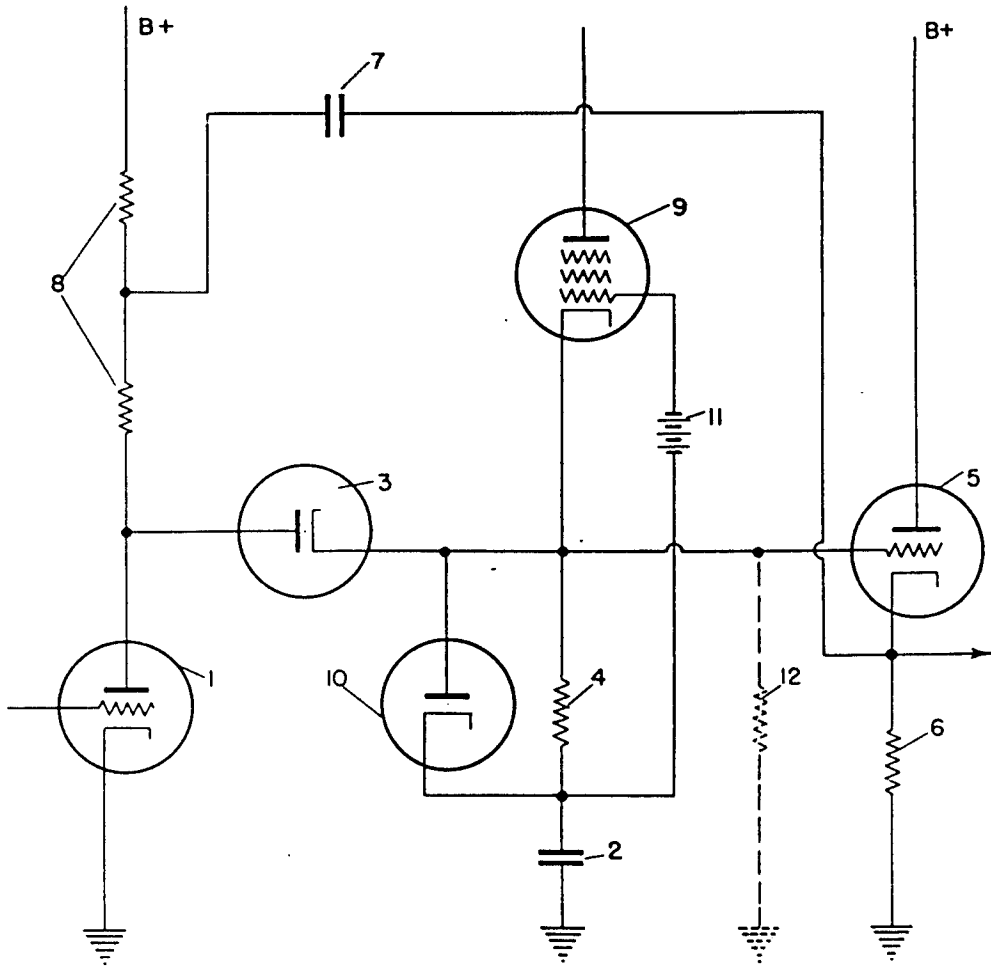
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CONDENSER CHARGE REGULATION

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CONDENSER CHARGE REGULATION

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Original application March 31, 1949, Serial No.
84,666. Divided and this application May 18,
1950, Serial No. 162,771

1 Claim. (Cl. 320-1)

(Granted under the act of March 3, 1883, as
amended April 30, 1928; 370 O. G. 757)

1
The invention described herein may be manu-
factured and used by or for the Government of
the United States for governmental purposes
without the payment of any royalty thereon in
accordance with the provisions of the act of
March 3, 1883 (22 Stat. 625), as amended by the
act of April 30, 1928 (45 Stat. 467, 35 U. S. C.,
1946 Ed. Sec. 45).

This invention relates to the storage of energy
in electrostatic condensers. In particular it re-
lates to methods of storing regulated quantities
of energy in condensers and of compensating for
the conductivity of the insulation in the circuit
to which the condenser is connected, thus pre-
venting rapid leakage of current from the
charged condenser. This application for patent
is a division of pending application Serial No.
84,666 for patent on Electric Line Fault Locaters
including only Figure 3 thereof.

An object of this invention is to delay the dis-
charge of condensers in electric circuits after the
condensers have been charged. A related object
is to compensate for the inevitable conductivity
which is characteristic of even the best of insula-
tors in connection with charged condensers, and
to decrease the so-called leakage current through
or over the circuit insulation from charged con-
densers connected to the circuits. Another ob-
ject is to permit the use of relatively poor insula-
tion in condenser circuits while holding the con-
denser leakage discharge rate to a value that
would otherwise be possible only with much bet-
ter insulation.

Another object is to provide means for charg-
ing a condenser at a predetermined rate and re-
lating the condenser charge to the length of time
used in charging, and by delaying the condenser
discharge to increase the accuracy of indication
in comparison with the accuracy that would be
had without leakage compensation.

What constitutes my present invention is set
forth in the following specification in reference
to the accompanying drawing and is succinctly
defined in the appended claim.

Referring to the drawing, a thermionic vacuum
tube 1 in response to any appropriate control
voltage applied to the grid thereof regulates the
rate of charging a condenser 2. In a typical prac-
tical situation, the grid of tube 1 is normally at
zero bias so the plate thereof is virtually at
ground potential. When a voltage is applied be-
tween the grid and cathode of tube 1, a voltage
appears between the plate and cathode thereof.

This voltage is applied to condenser 2 through
a diode 3. Condenser 2 receives a charge at a

2
rate proportional to the quotient of voltage of
tube 1 minus the condenser voltage, divided
by the resultant resistance of a resistor 4 in the
circuit of condenser 2 and other circuit elements
associated therewith. This proportionality of
rate of charging departs from linearity if no
compensation is applied.

Compensation to produce linearity is accom-
plished by using a second triode 5 with a cathode
resistor 6 and a connection to the plate circuit
of tube 1 through a condenser 7. A tapped re-
sistor 8 is inserted in the plate lead of tube 1
for providing the appropriate division of voltage
for condenser 7. This system of producing lin-
earity in condenser charging rate is known in the
related arts. Resistor 8 and condenser 2 are,
when practicable, temperature compensated.

In the practical use of this circuit it is impor-
tant that the rate of discharge of condenser 2
through leakage paths be decreased in order to
give as much time as practicable for recording the
condenser voltage as substantially the voltage to
which the condenser had been charged. The
delay in discharge is accomplished by an amplify-
ing tube 9 and a diode 10 connected as shown to
resistor 4. When condenser 2 is being charged
by the action of tube 1, the cathode of diode 3 is
positive with respect to ground, making the up-
per end of resistor 4 positive with respect to its
lower end, and the upper terminal of condenser
2 positive with respect to ground. Diode 10 in
parallel with resistor 4 permits current to flow in
charging condenser 2 without such current being
opposed by a severe voltage drop through resis-
tor 4.

In discharging condenser 2, diode 10 is non-
conducting so that the discharge current from
condenser 2, makes the lower end of resistor 4
positive relative to the upper end.

Amplifier tube 9 is biased by a biasing battery
11 to zero plate current when condenser 2 is not
discharging. When condenser 2 is discharging,
the development of a difference of potential
across resistor 4 makes the control grid of am-
plifier tube 9 sufficiently positive relative to the
cathode thereof to permit the flow of plate cur-
rent.

Plate current flow in tube 9 increases the po-
tential of the upper end of resistor 4 relative to
ground and so retards the escape of current from
condenser 2. Expressed in another way, it may
be said that tube 9 provides a current to ground
in the leakage path normally followed by the cur-
rent being discharged from condenser 2. The
leakage path is represented by a resistor 12,

shown as a broken line, across which in effect, the plate current of tube 9 develops a voltage which would be the same as that which would be produced by the current that would be flowing if the voltage on condenser 2 were much higher than it actually is. This opposes the flow of current from condenser 2 and, in consequence, delays the discharge thereof.

The circuit shown in the drawing comprises, as described above, three functional groups, the controlling amplifier, tube 1, the amplifier 5 for overcoming inherent non-linearity in the performance of the circuit and means, tube 9 and associated parts for delaying the leakage discharge of condenser 2. The circuit as a whole is a novel combination of three functional groups, one of which is novel in itself.

I claim:

An electric circuit for storing measurable quantities of electric energy comprising a first triode including a plate, cathode, and control grid, the plate of which is connected through a first resistor to a source of positive electrical potential, a condenser connected in series with a second resistor, a first diode and the plate-cathode path of said first triode, one terminal of said condenser being connected to the cathode of said first triode, the plate of said first diode being connected to the plate of said first triode, a second diode connected in shunt with said second

resistor, the cathode of said second diode being connected to the junction of said second resistor and said condenser, a second triode including a plate, cathode and control electrode, the plate of said second triode being connected to a source of positive electrical potential, the cathode of said second triode being connected to ground through a load resistor, the control grid of said second triode being connected to the junction of said second resistor and said first and second diodes, a connection between the cathode of said second triode and a tap on the mid-portion of said first resistor, an electrical discharge device having at least a plate, cathode, and control grid, a connection from the control grid of said electrical discharge device to the junction of said second resistor and said first and second diodes, and means to normally bias the control grid of said electrical discharge device negatively.

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REFERENCES CITED

The following references are of record in the file of this patent:

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