July 28, 1931. B. P. ROMAIN 1,816,748

SPEED INDICATOR

Filed Dec. 11, 1929

Fig. 1.

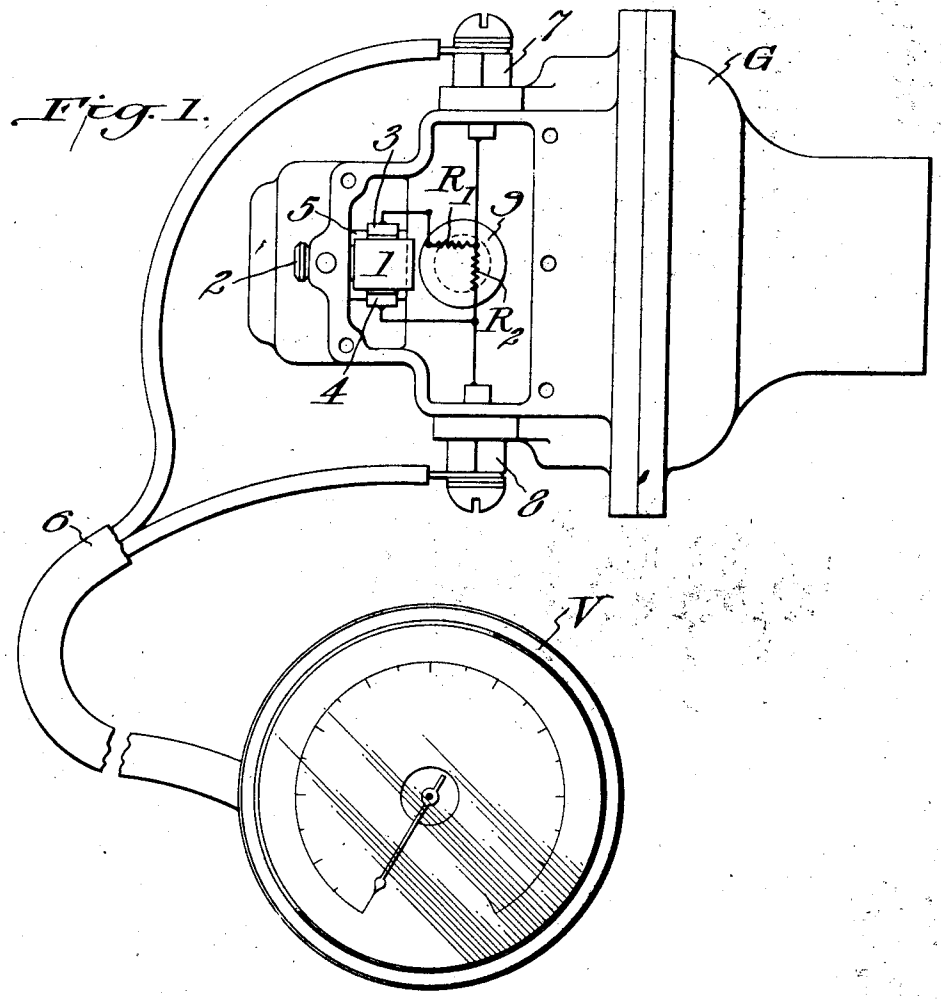
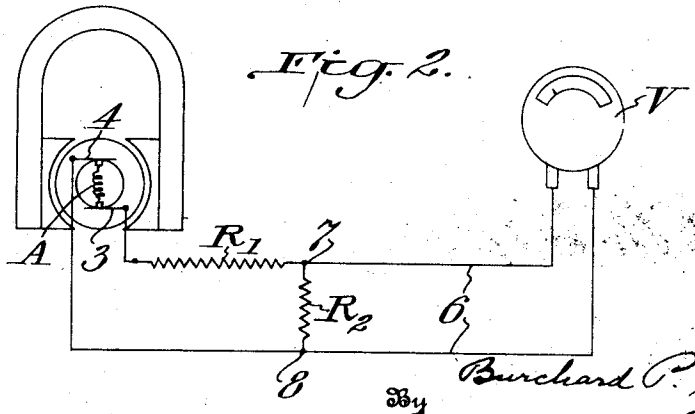


Fig. 2.



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Patented July 28, 1931 1,816,748

UNITED STATES PATENT OFFICE

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SPEED INDICATOR

Application filed December 11, 1929. Serial No. 413,386.

This invention relates to speed indicators of the type including a generator and a voltmeter, and particularly to a method of and electrical circuit for rendering the output voltage of a magneto generator substantially independent of temperature changes.

As is well known, if a magneto generator is connected to a suitable voltmeter, the generated voltage is substantially proportional to the speed of the armature, and the voltmeter may be calibrated in revolutions per minute or other convenient units. Speed indicators of this general type have been open to the objection that the terminal voltage decreases as the temperature of the magneto rises. This decrease in voltage, for any given speed, is due to two causes. In the first place, the magnetic field established by the permanent magnet decreases as the temperature increases, and, in the second place, the voltage drop in the armature winding increases due to its increased resistance at a higher temperature.

An object of the present invention is to provide a speed indicator in which the terminal voltage is substantially independent of the temperature of the magneto. Further objects of the invention are to provide a method of and circuit arrangements for rendering the terminal voltage of the generator substantially independent of those changes in generated voltage which arise from the varying temperature of the magneto.

More specifically, an object of the invention is to provide a speed indicator including a magneto which has shunted across the terminals thereof a resistance whose effective value increases with temperature at such a rate that the terminal voltage is substantially independent of temperature changes.

These and other objects of the invention will be apparent from the following specification, when taken with the accompanying drawings, in which:

Fig. 1 is a plan view of a speed indicator, the cover plate of the generator being omitted and the circuit elements embodying the present invention being shown diagrammatically;

Fig. 2 is a diagrammatic illustration of the circuits and general arrangement of the speedometer.

In Fig. 1, the reference character G indicates a magneto generator of the form described in the copending application of Edward F. Weston, Ser. No. 366,488, filed May 27, 1929.

As described in the said application, the generator includes a brush holder 1 pivotally mounted on the pin 2 and carrying brushes 3, 4, that contact with a commutator 5. By means of a flexible cable 6, the terminals 7, 8, of the generator are connected with a voltmeter V.

In accordance with the present invention, a spool or form 9 is mounted between the terminals and carries a pair of resistors R_1, R_2 that are, respectively, in series with the armature winding A and in shunt across the generator terminals. The resistor R_1 is formed of material such as manganin having a small resistance temperature coefficient and the resistor R_2 is formed of a material, such as copper or nickel, having a high resistance temperature coefficient.

When the temperature increases, the weakening of the magnetic field and the increased resistance of the armature winding A tend to decrease the terminal voltage, but the increased resistance of the resistor R_2 decreases the current through it and hence decreases the resistance drop in armature winding A and resistor R_1 due to that portion of the total magneto current which flows through the shunt resistor R_2. The values of the various resistances in the circuit may be so chosen that substantially perfect temperature compensation can be secured. If the armature winding A has a materially lower resistance temperature coefficient than the shunt resistor R_2, it is possible to omit the series resistor R_1. In general, however, greater freedom of design is possible when the series circuit between the generator terminals includes a resistor R_1 in addition to the resistance provided by the armature winding.

In one particular case, and for use with a voltmeter having a total resistance of 900

ohms, and giving a full scale deflection with 4.5 volts applied across its terminals, the resistances included in the generator elements were:

	Ohms
R_1, manganin resistor	106
R_2, nickel wire, at 20° C.	900
A, copper wire, at 20° C.	44
Resistance temperature coefficient of shunt R_2, per degree C	0.00461

The scale of the voltmeter V was graduated from zero to 1250 revolutions per minute, and at 1250 R. P. M., the open circuit voltage generated by the armature was 6 volts. A test of this speed indicator showed an error of but 0.25% for a temperature variation from −35° C. to +45° C., i. e., a total temperature change of 80° C. A similar magneto without the temperature compensating resistors R_1 and R_2 would show an error of approximately 2.2% for the same temperature change.

It will be apparent that the invention is not limited to the particular values given in the above example, or to the provision of compensating resistors that suppress temperature variations of any particular range. The invention may be employed with either alternating or direct current magnetos, and the physical and electrical design of the magneto may be quite different from that embodied in the magneto which is shown in Fig. 1.

I claim:

1. In a speed indicator of the type including a generator and a voltmeter, a generator comprising a permanent magnet, an armature revoluble in the field established by said magnet, a winding on said armature, a pair of terminals for said generator, circuit elements including brushes for connecting said winding between said terminals, and a resistor shunted across said terminals, the resistance-temperture coefficient of said resistor being higher than the resistance-temperature coefficient of the generator series circuit between said terminals.

2. The invention as set forth in claim 1, wherein the generator series circuit between said terminals includes a resistor in series with the armature winding, the resistance-temperature coefficient of said series resistor being lower than that of said shunt resistor.

3. The invention as set forth in claim 1, wherein the armature winding is formed of copper wire, and the generator series circuit between said terminals includes a resistor having a substantially zero resistance-temperature coefficient.

4. A generator comprising the combination with means establishing a magnetic field, an armature revoluble in said field, a winding on said armature, and generator output terminals, of means rendering the voltage across said terminals substantially independent of changes in the temperature of said generators; said last-mentioned means comprising a resistor serially connected between said armature winding and said terminals, and a second resistor connected between said terminals, said second resistor having a higher temperature-resistance coefficient than that of the armature winding circuit between said terminals.

5. The invention as set forth in claim 4, wherein said armature winding comprises copper wire, said first resistor is a manganin wire having an approximately zero temperature-resistance coefficient, and said second resistor is a nickel wire.

In testimony whereof, I affix my signature.

BURCHARD P. ROMAIN.