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RPM COUNTER FOR INTERNAL COMBUSTION ENGINES

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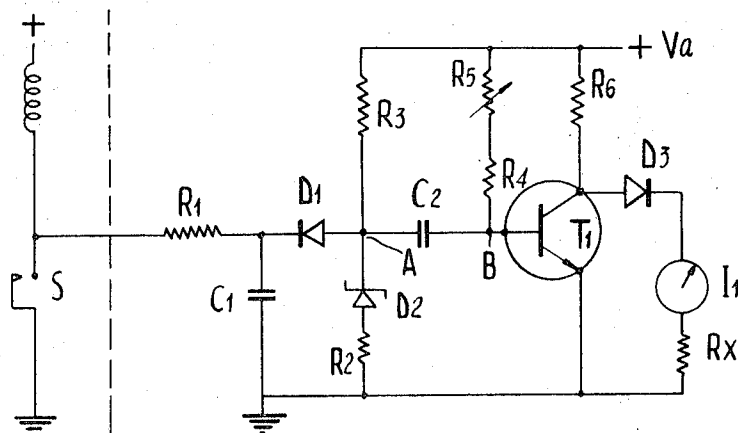


Fig. 1

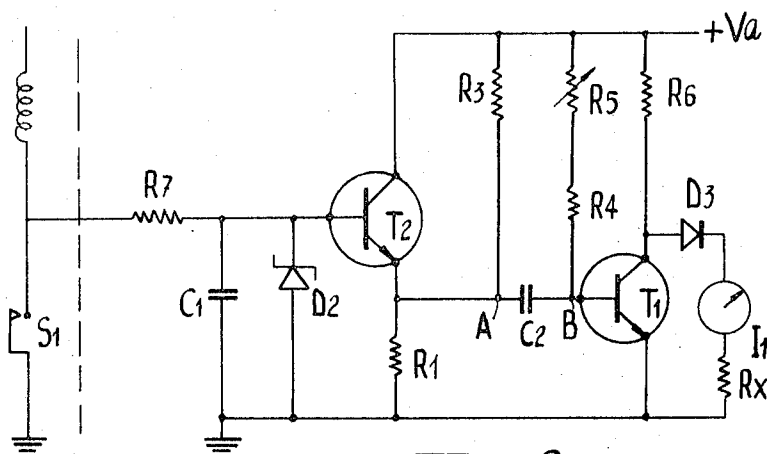


Fig. 2

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RPM COUNTER FOR INTERNAL COMBUSTION ENGINES

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4 Claims

ABSTRACT OF THE DISCLOSURE

An RPM counter for internal combustion engines which measures the interruption frequency of an external breaker switch including a meter, a power supply, a transistor and a compensating unit for changes in battery voltage which includes a capacitor, a Zener diode and a diode, with interposed resistances in the circuit.

The present invention relates to an analogic pulse counter device, particularly for use as a speed indicator for internal combustion engines or speedometer for motor cars.

At present, there are already known electronic counters for use as instruments or meters on motor cars or the like, particularly for use as engine speed indicator or speedometer. Known counters usually contemplate the use of a monostable circuit necessarily requiring the use of various components. Obviously, this would affect the costs and circuit complexity.

In order to overcome such a drawback, the present invention provides an analogic pulse counter device, particularly for the aforesaid applications, which is extremely simple, practical and thus economical, particularly by employing one transistor only. The analogic pulse counter device according to the invention essentially comprises a measuring instrument connected between the collector and emitter of a transistor, the base of which is connected through a suitable component network to a terminal of a switch or breaker, so that the current, as indicated by the instrument, is proportional to interruption frequency, circuitry being provided for rendering the instrument indication, within determined limits, independent of supply voltage.

The present invention will be better understood from the following detailed disclosure, given by way of example and therefore not in a limiting sense, particular reference being had to the accompanying drawings in which:

FIG. 1 is an electric diagram for an analogic pulse counter device according to the invention; and

FIG. 2 shows a modified embodiment contemplating the use of two transistors.

In FIG. 1 there is schematically shown at S a switch or breaker of any desired type, generally at the outside of the actual device and forming part of the system, the interruption frequency of which is to be measured. For example, S may be the usual breaker of the ignition system for an internal combustion engine, the revolutions of which are to be measured. S has a terminal connected to the positive pole V_a through a reactance, the other terminal being grounded. According to the invention, the base of a transistor T1 is connected in series, through a capacitor C2, a diode D1 and a resistor R1, to that terminal of breaker switch S which is connected to the positive pole. The common point of R1 and D1 is grounded through a capacitor C1, whereas the common point of D1 and C2 (indicated by A) is grounded through a diode D2 (preferably a Zener diode) and a resistor R2 series connected.

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Point A is also connected to the positive pole ($+V_a$) through a resistor R3. Base of transistor T1 (indicated by B) is series connected to $+V_a$ through a resistor R4 and a rheostat R5. Finally the collector of transistor T1 is connected to $+V_a$ through a resistor R6 and to a milliammeter I1 through a diode D3, the other terminal of milliammeter I1 being grounded. The emitter of transistor T1 is grounded.

The operation of the circuit according to the invention can be described as follows:

Set R1-C1 filters any oscillations or disturbances in the inlet circuit; diode D1 cuts off when the input goes positive and allows capacitor C2 to charge at the voltage as determined by Zener D2 (temporarily omitting to consider R2, the function of which will be described in the following. When S1 closes, D1 is rendered conducting and voltage of point D lowers to the same extent as A, cutting off T1. Capacitor C2 discharges through R4 and R5 to bring T1 back to a conducting state. Rheostat R5 permits the calibration of the current flowing through I1, adjusting the cutoff time for T1 and thus compensating for the tolerances of the various components. When T1 is cut off, a current limited to R6 flows through I1. With T1 saturated, diode D3 prevents a current from flowing through I1 due to saturation voltage of T1.

In some applications, supply voltage $+V_a$ is not stabilized (for example, V_a may be a motor car battery voltage). According to the invention provision is made so that the reading of I1 is independent of $+V_a$. To this end, in order to stabilize $+V_a$ voltage there could be provided, for example, a Zener diode, but this would involve a power dissipation. According to the invention, the indication of I1 is made independent of V_a by a suitable compensation or equalizing system. Should the voltage sweep of points A and B, and hence base of T1, be constant and independent of V_a , it could be readily verified that the average current of I1 for a given pulse frequency would be proportional to V_a . The provision of R1, besides being necessary in many circumstances for filtering the input signal, makes the voltage jump at A dependent on V_a (the sweep is between the voltage of Zener D2 and dividing voltage R1 and R3). The higher V_a the smaller the sweep of A, hence decreasing the period of time at which T1 is cut off and accordingly decreasing the average current in I1. Therefore, a compensation or equalizing phenomenon is provided. For increasing values of R1, the average current in I1 is initially increasing with V_a , then becoming independent of V_a and hence decreasing as V_a increases. Therefore, for given values of the other components there would exist an optimum value for R1.

Owing to circuit input impedance and signal filtering easiness, it might be required to increase the value of R1 with respect to the optimum value which renders the average rate of I1 independent of V_a . In this case, there will be a supercompensation which can be corrected by adding a suitable resistor R2 in series with Zener D2. As V_a increases (i.e., R2), the voltage jump of point A increases and hence the average current in I1 increases. Thus, a substantial freedom in circuit proportioning is obtained, while maintaining a considerable independence of V_a in I1 current rate, without it being required to directly stabilize the supply voltage.

For sake of completeness and by mere way of example, some indications will now be given for possible values for the circuit components as provided for a voltage V_a between 12 and 16 v.: R1=0.680K ohm; C1=0.47 microfarad; R2=0.470K ohm; R3=3.9K ohm; C2=0.33 microfarad; R4=8.2K ohm; R5=20K ohm; R6=0.360K ohm; D1=BAY 18; D2=BZY88/C6V8; D3=BA170; and T1=2N3415. I1 may be a milliammeter having an in-

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ternal resistance of 160 and 12 ma. at full scale value; R_x is a thermistance which can be series added to I1 where thermal compensation of the instrument is desired.

The values, as above indicated by way of example, can be adapted, for instance, for carrying out a device according to the invention for an application as a motor car speed indicator.

FIG. 2 shows a possible modified embodiment of the invention. In this diagram, diode D1 is substantially replaced by a transistor T2, the emitter of which is grounded by an equalizing resistor R1. As input resistance, there is instead provided a resistor R7 the value of which can be very high.

Obviously, the embodiments can be varied according to the different applications and components being used; however, all of them are to be understood as within the scope of the present invention.

What is claimed is:

1. In a pulse counter for measuring the interruption frequency of the breaker switch of the ignition system of the engine whose speed is being measured (S-S1), a supply battery having a positive first pole (+Va) and a grounded second pole;

a first resistor (R6), a first diode (D3), and a meter (I1) being serially connected, in the order of recitation, between said first and second poles;

a first transistor (T1) having a base, an emitter connected to the second pole, and a collector;

a second resistance (R4, R5) interconnecting said base and said first pole;

said collector being connected to the circuit point between said first resistance and said first diode;

the improvement comprising:

a compensating unit for changes in battery voltage; a first capacitor (C2) having one electrode connected to said transistor base;

said compensating unit including a third resistance (R3) and a Zener diode (D2);

a second diode (D1);

and a fourth resistance (R1);

said third resistor (R3) by one of its terminals being directly connected to said first pole, and connected by its other terminal through the Zener diode (D2) to said second pole;

the other electrode of said first capacitor being connected to the terminal of the third resistance (R3) which is adjacent the Zener diode (D2) and also connected to one electrode of second diode (D1), the other electrode of said second diode being connected to one terminal of the fourth resistance (R1), the other terminal of said fourth resistance being connected to one terminal of said breaker switch.

2. In the pulse counter of claim 1, a filtering capacitor (C1) interposed in series between said other electrode of said second diode and said second pole.

3. In a pulse counter for measuring the interruption frequency of the breaker switch the ignition system of

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the engine whose speed is being measured (S-S1), a supply battery having a positive first pole (+Va) and a grounded second pole;

a first resistor (R6), a first diode (D3), and a meter (I1) being serially connected, in the order of recitation, between said first and second poles;

a first transistor (T1) having a base, an emitter connected to the second pole, and a collector;

a second resistance (R4, R5) interconnecting said base and said first pole;

said collector being connected to a circuit point between said first resistance and said first diode;

the improvement comprising:

a compensating unit for changes in battery voltage;

a first capacitor (C2) having one electrode connected to said transistor base;

said compensating unit including a third resistance (R3) and a Zener diode (D2);

and a fourth resistance (R1);

said third resistance (R3) by one of its terminals being directly connected to said first pole, and connected by its other terminal through said fourth resistance (R1) to said second pole;

a second transistor (T2);

the other electrode of said first capacitor (C2) being connected to that terminal of the third resistance (R3) which is adjacent the fourth resistance (R1) and also connected to the emitter of said second transistor;

the collector of said second transistor being connected to said first pole, and the base of said second transistor being connected to one electrode of said Zener diode, the other electrode of said Zener diode being connected to said second pole;

a fifth resistor (R7);

that electrode of said Zener diode (D2) adjacent the base of said second transistor (T2) being connected to one terminal of said fifth resistor and the other terminal of said fifth resistor being connected to one terminal of said breaker switch.

4. In the pulse counter of claim 3, a filtering capacitor (C1) with one electrode connected to the electrode of the Zener diode (D2) adjacent the base of the second transistor (T2), the other electrode of said filtering capacitor being connected to said second pole.

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U.S. Cl. X.R.

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