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MACHINE REGULATING MEANS

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Fig. 1

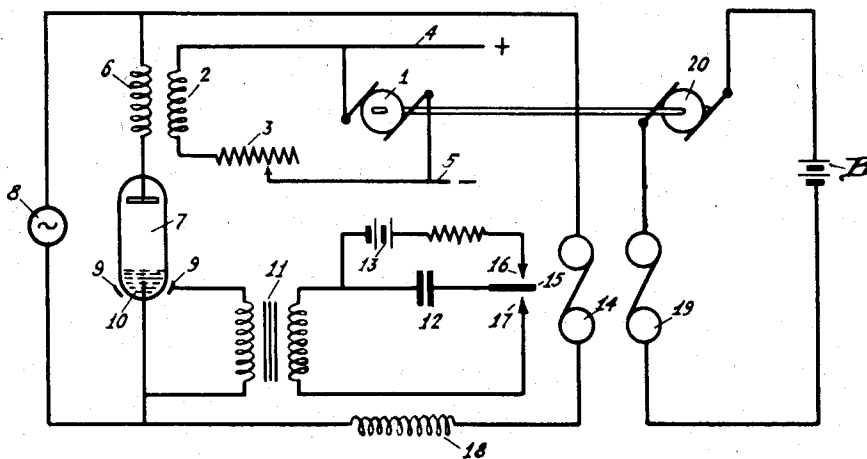
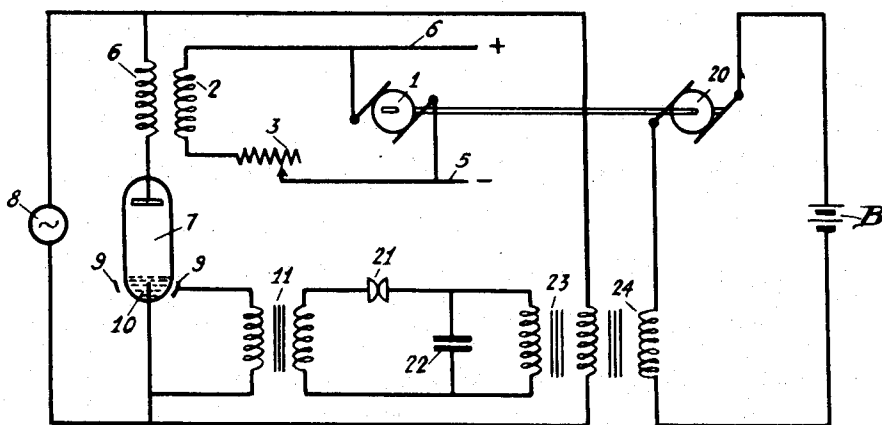


Fig. 2



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MACHINE REGULATING MEANS

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It is known from the prior art that the speed of motors may be regulated by the aid of vapor discharge tubes whose discharge is dependent upon a regulating quantity such as the potential of a tachometer machine.

In systems of this kind it is necessary that the igniting or striking of the discharge tube should be effected in dependence upon the phase and the amplitude of the igniting potential at instants defined with extremely great accuracy, especially in the case of high-speed regulators or governors. The systems heretofore known do not measure up to requirements to an extent needed in practice.

The present invention consists in a particular form of construction of the igniting circuit of such a discharge tube whereby a very accurate inter-dependence of the ignition process and the regulating function or quantity is insured. For this object an ignition potential rising at a rapid rate is employed, indeed, the rise thereof is considerably steeper than that of the potential of the tube resulting in the discharge current.

To obtain such a steep rise in the ignition potential, various means may be used. Since ordinarily the discharge current source serves simultaneously for the supply also of the ignition potential, means must be provided in the ignition circuit to the end that the usually sinuous rise of this potential is changed into a potential wave presenting steep rises in peaks. This end can be attained in one way by the aid of a vibrator relay in whose working circuit, suitably by means of the charges and discharges of a condenser, the necessary peaked nature of the ignition potential wave is produced. Another means to the same end consists in the insertion of a spark-gap in the ignition circuit.

A more specific and detailed explanation of the circuits in question will be found in the following specification when read in connection with the drawings in which:

Figure 1 shows diagrammatically the use of a vibrating relay device for obtaining the necessary steep rise in the ignition potential; and

Figure 2 illustrates diagrammatically an-

other form of the invention in which a spark gap is utilized.

The motor 1 to be regulated or controlled has connected a regulating circuit 2, 3 in parallel to its armature circuit 4, 5, the current flowing through said regulating circuit to be acted upon in dependence upon the speed of the motor by the main discharge circuit of a mercury-vapor tube 7, said action being effected inductively through the coupling 2, 6. The discharge tube 7 is fed from an alternating current source 8. The tube is started or ignited by the aid of an ignition ring 9 being externally laid around the discharge vessel and being associated with the cathode 10 by way of a transformer 11, ignition being accomplished by the rapid alternate charging of a condenser 12 from a battery 13 followed by discharges by way of the primary winding of the ignition (spark) inductor 11. The circuit closing and opening to insure charging and discharging is effected by means of a relay 14 connected with the alternating current source 8, the keeper 15 of said relay being alternately connected with the two contacts 16 and 17, respectively. 14 is connected with 8 most suitably by way of a super-saturated choke-coil 18. This is done for the purpose of producing in this circuit a steep overtone or harmonic whereby the travelling times of the relay 14, 19 are shortened. The relay is provided with another winding 19 connected with a battery B in the circuit of a tachometer machine 20 being in mechanical coupling relation with motor 1 to be controlled.

The operation of the scheme is as follows: Whenever the motor 1 is running at the normal rate of speed, ignition of tube 7 by way of 14, 15, 11 is always effected at a certain value of the alternating current connected thereto. As a result, upon each ignition, a potential is induced in the winding 2 of the circuit to be regulated, said potential being so chosen that nothing is altered, for the time being, in the normal speed of the motor. But when, say, owing to load fluctuations the speed of the motor undergoes variations, there are simultaneously caused variations in the current flowing through coil 19 of

the vibratory relay, and this influences the biasing magnetization of the relay with the result that a shift occurs in the limit at which the latter is caused to respond. As a consequence, the change-over of the keeper 15 and thereby the ignition at 9 no longer takes place at the same potential acting at 7 as previously, but either earlier or later, as the case may be. The result is that the amplitude and the starting point of the discharge current flowing in 6 is altered, so that also the action upon the regulating circuit of 1 by way of 2 is altered in this sense that the change in speed caused by load fluctuations or the like is counteracted.

In the arrangement shown in Figure 2 a spark gap is used instead of a vibratory relay. For this purpose, a transformer 23 is connected in parallel to the discharge circuit, whose secondary is connected with a condenser 22 which is discharged through or across a spark gap 21. These charges and discharges are dependent as to phase and amplitude upon the regulating function or quantity, that is to say, upon the potential of the tachometer machine 20, the latter for this object influencing the biasing magnetization of the transformer by means of an auxiliary winding 24. The other parts in Figure 2 correspond to those in Figure 1.

The regulation of the ignition time may be insured also in some other way than hereinbefore suggested, for instance, by varying the length of the spark gap or by shifting the phase of the ignition potential in relation to the current to be regulated.

The regulating or controlling functions in schemes of the kind hereinbefore disclosed as to their action are otherwise the same as in the well-known high-speed governors.

Having thus described my invention, what I desire to protect by Letters Patent is as follows:

1. A speed regulating system for electric motors comprising, a regulating circuit in parallel with the motor armature, means comprising a mercury vapor tube and a current source for affecting said regulating circuit and means controlled by the speed of said motor for controlling the action of said mercury vapor tube.

2. In an electric motor speed regulating system, a regulating circuit in parallel with the motor armature, a mercury vapor tube circuit inductively coupled to said regulating circuit, a source of alternating current in parallel with said tube circuit, an igniting circuit associated with said tube, means comprising a relay device in series with said alternating current source for periodically igniting said tube, a speed responsive device associated with said motor and means controlled thereby for affecting said relay device in accordance with the motor speed.

3. A speed regulator for electric motors

comprising a regulating circuit connected with the motor armature, a discharge tube in series with a circuit inductively coupled to said regulator circuit, and a source of alternating current for energizing said tube, an igniting circuit associated with said tube and means comprising a polarized relay circuit for affecting said igniting circuit periodically and a motor speed responsive device for affecting said relay circuit in accordance with the motor speed.

4. A speed regulating system for electric motors comprising a regulating circuit in parallel with the motor armature circuit, a mercury vapor tube circuit inductively coupled to said regulating circuit, an alternating current source for energizing said tube, an igniting circuit associated therewith comprising a condenser device and a relay adapted to periodically charge and discharge said condenser device and means comprising said alternating current source for operating said relay, a speed responsive device associated with the motor to be controlled and means controlled thereby for affecting said relay in accordance with the motor speed.

5. In a speed control device the combination with a control circuit, of means for energizing said control circuit, including a discharge tube and a source of alternating current connected in parallel, said discharge tube normally producing a potential which varies substantially as a sine wave and of means for causing said discharge tube to produce a potential which varies as a distorted sine wave.

6. A device, as claimed in claim 5, in which said last named means comprises an ignition circuit associated with the cathode of said discharge tube on the one hand and with the device to be controlled on the other hand.

7. The combination claimed in claim 5, in which the last named means includes an ignition circuit adapted to be connected through a vibratory relay to a source of potential, said circuit being connected with the cathode of said discharge tube on the one hand and with the device, the speed of which is to be regulated, on the other hand.

8. A device, as claimed in claim 5, in which the means for causing said discharge tube to produce a potential, which varies as a distorted sine wave, includes an ignition circuit comprising a transformer having its primary winding adapted to be connected to a source of potential, and its secondary winding connected to the cathode of said discharge tube, a relay circuit connected in parallel with said discharge tube and coupled to said ignition circuit, and a second relay circuit coupled to said last named circuit and to the device to be controlled.

9. A device, as claimed in claim 5, in which said last named means includes an ignition circuit including a source of potential, a charging condenser and the armature of a

relay, means for connecting said circuit to the cathode of said discharge tube, and a relay winding associated with said armature and with the device to be controlled.

6 10. In an arrangement for regulating the speed of rotation of an electric device, the combination with a control circuit connected with said device, means for energizing said control circuit including a discharge tube in
10 parallel with a source of alternating current, said discharge tube normally producing a potential which varies substantially as a sine wave, and of means for altering the character of said sine wave in accordance with varia-
15 tions in speed of the device to be controlled including an ignition circuit comprising a condenser and a circuit for charging said condenser, means for coupling said ignition circuit to said discharge tube and a relay opera-
20 tively interposed between the charging circuit and the device to be controlled.

11. A device, as claimed in claim 5, in which said last named means includes an ignition circuit coupled to said discharge tube, said
25 ignition circuit having a condenser and a spark gap and means for charging said condenser including a transformer having one winding connected with a source of potential which varies in accordance with the speed of
30 the device to be controlled and a second winding connected with said ignition circuit.

12. A speed regulating system for electric motors comprising a control circuit including an inductance in parallel with the armature
35 circuit of said motor, a source of potential, a discharge tube in series with said source of potential, an inductance in series with said discharge tube, said inductance being coupled to the inductance in said control circuit, a
40 condenser and an ignition circuit including a transformer having one winding connected to said discharge tube and another winding adapted to be connected in series with said condenser, means for charging said condenser including a relay winding connected in
45 parallel with said source of potential and a source of direct current potential, an armature adapted to be actuated by said winding to connect said condenser in series with said
50 direct current source of potential, a saturated inductance in series with said relay circuit, a second relay circuit associated with said first named circuit, and means for energizing said second relay circuit including a source
55 of potential which varies in accordance with the speed of the motor to be controlled.

13. A speed regulating device for electric motors comprising a control circuit including an inductance connected in parallel with the
60 armature winding of said motor, an energizing circuit therefore including a discharge tube connected in series with an alternating current source, an inductance connected with said discharge tube, and coupled to said in-
65 ductance in said control circuit, a charging

condenser, a spark gap, an ignition circuit for said discharge tube including a transformer having a winding connected with said tube and a second winding connected in series with said charging condenser through said
70 spark gap, means for charging said condenser including a transformer having one winding connected in series with said condenser and another winding connected in series with said
75 source and means for varying the potential charge of said condenser including a source of potential varying in accordance with the speed of rotation of said device to be controlled and means for connecting said source with a third winding in said transformer. 80

In testimony whereof I affix my signature.
HANS SCHUCHMANN.

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