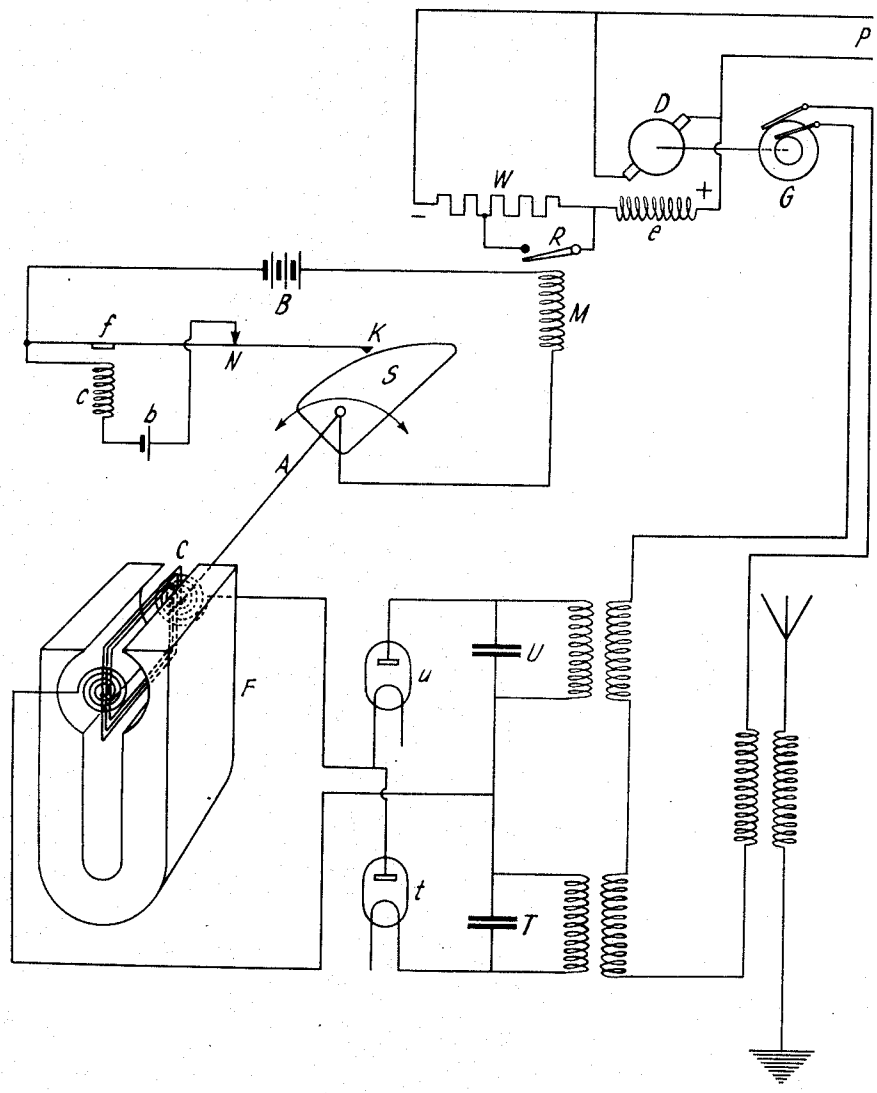
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SPEED CONTROL MEANS FOR HIGH FREQUENCY GENERATORS

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SPEED-CONTROL MEANS FOR HIGH-FREQUENCY GENERATORS.

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My invention relates to speed regulating means and especially to speed regulators working on the "Tirrell" principle.

An object of my invention is to provide a speed control means having a vibrating contact adapted to shunt a control resistance for rapid successive periods of varying length.

Another object of my invention is to provide a vibrating speed regulator in which the vibrations are under the control of a resonant circuit.

Another object of my invention is to provide a vibrating relay actuated in response to the movements of a primary vibrating relay, the vibratory currents from which are controlled by movements of a cam, actuated by speed responsive means.

In the art of the regulation of high frequency alternators it has been found essential to maintain the speed at a constant value with very great accuracy. This has been found difficult to do under the many varying requirements of high frequency alternator service.

My invention provides a simple means of applying the "Tirrell" principle of the vibratory field control to the regulation of the speed of the motor driving a high frequency generator.

By means of my invention I shunt a portion of the motor field resistance by means of a vibrated contactor relay. The movements of the relay are controlled by current from a vibrator interruptor producing a convenient low frequency and means consisting of a pivoted cam cooperating with the vibrating member whereby the ratio between on periods and off periods in the current output from the vibrating contact is controlled.

By this device I am enabled to obtain very sensitive and accurate speed regulation of the driving motor by means having a very much shorter natural period than the natural period of oscillation about an average value of the motor speed. By this means I obtain much closer speed regulation and freedom from hunting and speed rate oscillations.

Other objects and structural details of my invention will be apparent from the following description when read in connection with the accompanying drawings, wherein:

The single figure is a diagrammatic representation of circuits and apparatus embodying a preferred form of my invention:

Referring to the drawing I provide a motor D having a field winding *e* and driving a high frequency generator G. A power supply *p* is provided for the motor D. A field resistance W is connected in series with the motor field winding *e* for control and regulating purposes. A portion of this resistance W is shunted by the contact R of the relay M. The coil of relay M is supplied by current from a source B in series with a contact K which cooperates with a movable cam S. The contact K is mounted upon a vibrator armature N which is driven by the usual magnet *c*, armature *f* and battery *b*. The contact K is preferably elastically mounted upon the vibrator armature N in order that it may have a minimum effect upon the natural frequency of the vibrator and in order that changes in the position of impact with the cam S may produce as little effect upon the frequency as possible.

The cam S is mounted on a spindle A and preferably weighted so as to assume, by the influence of gravitation, a median position. The position of this cam is then controlled by the deviation of the speed of the alternator from its proper value. The device for producing this deviation may conveniently assume the form of resonant circuits and rectifiers, connected to the output of the radio frequency generator, and supplying an electro-magnetic rotatable device in such manner that an increase in speed will move the cam in one direction and a decrease in speed in the reverse direction.

This device may conveniently assume the form of a coil C also mounted upon the spindle A and within the field of a magnet F. A pair of resonant circuits U and T may be coupled to the output circuit of the generator G, and tuned, one slightly above, and one slightly below, the desired frequency. Rectifiers *u* and *t* are then provided and

connected to the resonant circuits, as indicated, with the coil C in a portion of the common circuit.

In the operation of the above described device of my invention the motor D drives the generator G, the output from which may be supplied to a suitable transmitting circuit. The value of the resistance W is then adjusted to such a magnitude that the motor D tends to run at a speed slightly below that required to produce the desired frequency from the generator G. The vibrator N may then be set into operation, whereupon the contact K will be caused to vibrate against the cam S making contact therewith for definite periods, at a definite frequency. Contact of the contactor K with the cam S closes the circuit through source B and coil M, causing an opening of the contacts R of the relay M, thereby inserting additional resistance in the field winding *e* of the motor D and causing its speed to tend to increase. The contacts R then close and open at a frequency corresponding to the frequency of the vibrator N and remain open for a length of time determined by the time the contact K touches the cam S. The increase in speed of the motor D is then determined by the portion of the total time during which the contacts R are open.

The disk S being pivoted, and of the shape shown in the drawing, a movement to the left will bring a higher portion of the disk under the contact K and result in the contact K touching the disk S for a longer portion of each vibration period, while a movement of the cam S to the right will result in a lower portion of the cam coming under the contact K, and in the circuit of source B being closed for a smaller portion of each vibration period. A full movement of the cam S to the right may open the circuit at K completely and a full movement of the cam S to the left may close the circuit fully at K, thus holding the contacts R steadily closed, or steadily open, and producing a maximum decrease or increase of the speed of the motor D.

The disk S may conveniently be moved by current in the coil C coacting with the field of the magnet F. This current is conveniently supplied from the output of generator G through the resonant circuits U and T. A decrease in speed of the generator will result in the frequency approaching more nearly to the frequency to which the circuit U is tuned and thereby cause an increase in oscillatory current therein. The frequency simultaneously recedes from the natural frequency of the circuit T and such current as may have been flowing therein tends to decrease. The flow of vibratory current in curcuit U causes current to flow through the rectifier *u* and through the coil C in a direction which may be caused to move the disk S towards the left, thereby causing contact K to touch for a longer period of time in each vibration, holding the contacts R of the relay M open for a longer proportionate integrated time, thus inserting a greater effective resistance into the field *e* of the motor D and causing an increase in motor speed.

Similarly an increase in speed of the generator G will cause the frequency to approach the natural frequency of circuit T and recede from that of circuit U thereby causing current to flow through rectifier *t* which sends a current through coil C in the reverse direction from that furnished by rectifier *u*, moves the disk S to the right and by a similar sequence of events causing a slowing down of the motor D.

By this means I am enabled to obtain a very accurate speed regulation of the motor D by apparatus based upon the Tirrell principle.

While I have shown but one embodiment of my invention in the foregoing drawings and descriptions it is capable of various modifications therefrom without departing from the spirit thereof, and it is desired therefore that only such limitations shall be imposed thereon as are required by the prior art or indicated by the appended claims.

I claim as my invention:

1. A speed regulating means comprising a motor field resistance, a shunting relay connected thereto, means for actuating said shunting means comprising a current source and vibratory and adjustable contacts, means for adjusting said adjustable contact comprising a rotatable cam, and speed responsive means actuating said cam, comprising means for producing a magnetic field, a coil mounted therein and connected to said cam, and means for electrically energizing said coil with a current in one direction or the reverse according as the regulated speed departs above or below its regulated value.

2. In a speed regulating device, a field resistance, a relay for cutting said resistance into and out of circuit, a vibrator for actuating said relay, a cam for varying the relative opening and closing periods of the contact of said vibrator, whereby the period of insertion of the field resistance is varied, and means for adjusting the position of said cam in accordance with the speed of the controlled device.

3. In a speed regulating device, a field resistance, a relay for cutting said resistance into and out of circuit, a vibrator for actuating said relay, a cam for varying the relative opening and closing periods of the contact of said vibrator, whereby the period of insertion of the field resistance is varied, and means comprising a coil associated with

the controlled device and adapted to adjust the position of said cam in accordance with the speed of the controlled device.

4. A speed regulating device comprising a generator of alternating current and a motor for driving the generator, means for varying the speed of said motor, means for actuating said speed varying means and means for controlling said actuating means comprising a pair of oscillatory circuits associated with the output of the generator and tuned respectively below and above the desired generator frequency, means for rectifying the currents of each of said oscillatory circuits, and a coil connected to said rectifying means adapted to vary said controlling means.

5. A speed regulating device comprising a generator of alternating current and a motor for driving the generator, a field resistance for said motor, a relay for cutting said resistance into and out of circuit, a vibrator for actuating said relay, a cam for varying the relative opening and closing periods of the contacts of said vibrator, whereby the period of insertion of the field resistance is varied, and means comprising a pair of oscillatory circuits associated with the output of the generator and tuned respectively below and above the desired generator frequency for adjusting the position of said cam in accordance with the speed of the controlled device.

6. A device of the kind described comprising a motor generator set, a variable field for said motor, means comprising an adjustable contact device for varying said field, and means in the output circuit of said generator comprising two tuned circuits and rectifying devices connected thereto for controlling said adjustable contact whereby the frequency of said generator may be controlled.

7. In a device for maintaining the frequency of a motor driven generator, a contact comprising a vibrating portion and a rotating portion, means for periodically vibrating the first named portion, a pair of resonant circuits detuned with respect to one another and coupled to the output circuit of said generator, rectifying means coupled to said resonant circuits, and means controlled thereby for rotating said rotating portion in accordance with changes in the regulated speed.

8. In a speed regulating device, a contact comprising a vibrating portion, a rotating cam cooperating therewith, means for periodically vibrating said vibrating portion, and means comprising a magnetic field and coil mounted therein and connected to said cam for rotating said cam in accordance with changes in the regulated speed.

9. In a device for maintaining constant the frequency of a motor driven generator, a contact device comprising a vibrating arm and a rotating cam, a magnetic field and a coil mounted therein and connected to said cam, means comprising a pair of resonant circuits coupled to the output circuit of said generator to be governed, rectifying means coupled to said resonant circuits for energizing said coil in accordance with changes in the frequency of the governing generator whereby said cam may be rotated.

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