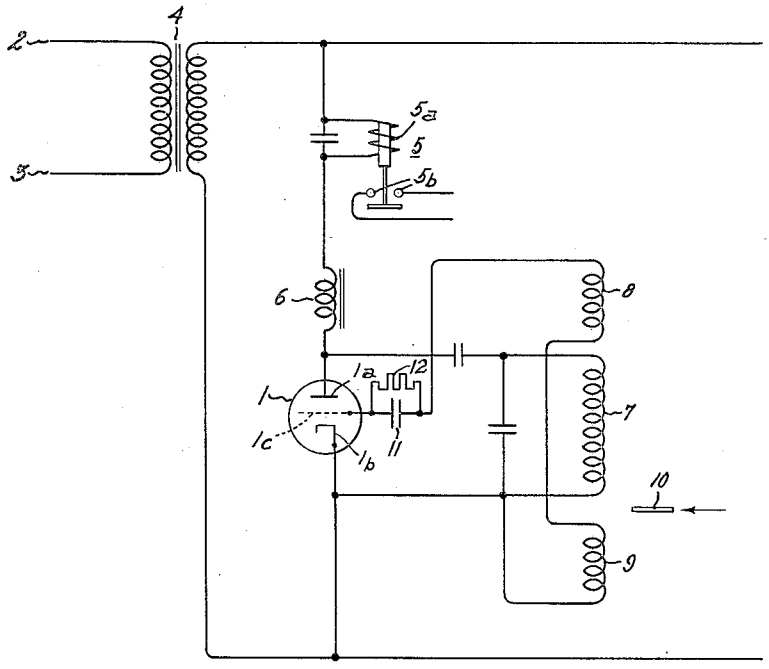
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VANE CONTROLLED OSCILLATOR

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VANE CONTROLLED OSCILLATOR

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1 Claim. (Cl. 250—36)

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This invention relates to control apparatus and it has for an object the provision of a simple, reliable, inexpensive and improved device of this character.

Another object of the invention is the provision of improved apparatus for enabling an electro valve oscillator to control an electroresponsive device such as a relay of the character in which operation of the relay is effected by movement of a magnetic vane between two coils. A further and more specific object of the invention is the provision of improved apparatus of this character utilizing a single electric valve in which the relay drops out when the vane is moved to a position between two index coils and in which the operation is "fail safe." By "fail safe" is meant that if the valve burns out or for any reason becomes nonconducting the relay is operated to the same position as it is when the vane is moved to the position between the index coils, i. e., it is dropped out.

A still further object of the invention is the provision of apparatus of the character described in which drop out of the relay is effected without necessarily varying the tuning of the electric valve circuits.

For a better and more complete understanding of the invention reference should now be had to the following specification and to the accompanying drawing of which the single figure is a simple diagrammatical illustration of an embodiment of the invention. The invention has general application to electrical control systems for various purposes. It is especially applicable to installations such as weighing devices, float controlled devices and limit or flag switch controlled devices in which a movable member or element is provided and in which a control operation is to be affected in accordance with the movement or position of this element. The control operation may be initiated, modified in some manner or terminated upon the arrival of the element at a predetermined position with respect to another element which may be either movable or stationary.

In carrying the invention into effect in one form thereof, an oscillator electric valve is provided having an input circuit and an output circuit. The operating coil of an electroresponsive device such for example as a relay is connected in the output circuit of the oscillator valve. A balanced feedback from the output circuit to the input circuit is provided. In this feedback is included a coupling which tends to generate oscillations in the oscillator valve circuits. A

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second coupling is provided which tends to prevent the oscillations. Normally these two feedback couplings balance each other and the circuit is nonoscillatory. Means are provided for rendering ineffective the coupling which inhibits oscillations thereby deenergizing the relay coil and causing the relay to drop out.

Referring now to the drawing an electric valve 1 is supplied with alternating voltage from a suitable source which is represented by the two supply lines 2 and 3 to which the valve is connected through a suitable transformer 4.

The valve is provided with an anode 1a, a cathode 1b and a control grid 1c. As shown the output circuit of the valve is connected across the secondary winding of the transformer and the operating coil 5a of an electroresponsive device 5 such as a relay is included in the circuit. The relay is illustrated as having normally open contacts 5b. A choke coil 6 of suitable dimension is connected in the output circuit.

A balanced feedback is provided between the output and input circuits. This feedback in this case comprises two inductive couplings which is provided by a coil 7 connected across the anode and cathode of the valve and two index coils 8 and 9. Other forms of feedback coupling such as resistive or capacitative couplings may be used.

These two index coils are connected in series relationship with each other in the input circuit between the cathode and grid. They are mounted in spaced apart relationship on any suitable supporting means which may be movable or stationary.

In the space between the index coils 8 and 9 is mounted the coil 7 which is connected between the cathode and the anode of the valve and is thus effectively connected with the output circuit. Coil 7 is mounted in inductive relationship with the index coils 8 and 9.

The coupling between the coils 7 and 8 is in such a direction as to initiate and support oscillation of the valve. On the other hand the coil 9 is connected in opposition to the coil 8 and the coupling between it and the coil 7 tends to inhibit oscillations. These feedback couplings balance each other and normally the valve is not oscillating. When the valve 1 is oscillating, the capacitor 11 in the grid circuit is charged by grid rectification. The polarity of the charge on the capacitor is negative at the grid. This negative bias voltage on the grid reduces the plate current to a very low value. During the condition of non-oscillation, the charge on the capaci-

tor leaks off through the grid leak resistor, thereby decreasing the negative bias on the grid and increasing the plate current to a relatively large value.

The coupling between coils 7 and 9 is interrupted by means of a vane member 10. This vane may be made of a suitable electrically conducting material such as copper. When this vane is interposed between these two windings they are electrically isolated from each other.

In a practical embodiment of the invention the valve 1 and coils 7, 8, and 9 or the vane, or both may move. The control is responsive to the relative positions of the coils and the vane. In one application which has large use, the vane is carried on the moving element of an indicating device such as the needle of a meter, and it is required that a controlling operation be effected when the needle reaches a predetermined position. For example, the meter may be measuring and indicating furnace temperatures, and it may be required that the current supply be discontinued at a predetermined maximum value which is represented by the position of the coils.

With the foregoing understanding of the elements and their organization the operation will readily be understood.

With the vane withdrawn from the space between the coils, the oscillation "turn off" coupling between the coils 7 and 9 balances the oscillation "turn on" coupling between the coils 7 and 8. Consequently the valve is not oscillating, the anode current is large, and the relay 5 is picked up and its contacts closed.

Assuming the coils 7, 8, and 9 to be stationary and the vane to be mounted on the needle of a furnace temperature indicating instrument, the vane will move into the space between the coils 7 and 9 as the furnace temperature rises to the maximum permissible value as determined by the position of the coils. This isolates coils 7 and 9 from each other and destroys the oscillation turn off coupling between them. As a result the oscillation "turn on" coupling between coils 7 and 8 becomes fully effective and the valve 1 generates radio frequency oscillations which are sustained by the feedback through the inductive coupling of coils 7 and 8.

In consequence of the oscillations, the D. C. component of the anode current decreases, thereby deenergizing the relay 5. In response to deenergization, the relay 5 drops out and opens its normally open contacts thereby to effect a controlling operation such as to discontinue the supply of current to the furnace.

It will be noted that the valve control system fails safe. If the valve 1 burns out or becomes non-conducting for any reason, the relay 5 becomes deenergized and drops out. In other words the relay is operated to the position to which it is operated when the vane reaches the limiting or turn off position between the coils 7 and 8.

Although in accordance with the provisions of the patent statutes this invention is described as embodied in concrete form and the principle thereof has been described together with the best mode in which it is now contemplated applying that principle. It will be understood that the apparatus shown and described is merely illustrative and that the invention is not limited thereto, since alterations and modifications will readily suggest themselves to persons skilled in the art without departing from the true spirit of the invention or from the scope of the annexed claim.

What I claim as new and desire to secure by Letters Patent of the United States is:

In a control system, an oscillator comprising an electric valve having an anode, a cathode and a control grid, means to apply operating voltage between said anode and said cathode, a first inductance coil and a first capacitor in parallel therewith connected in series with a second capacitor between said anode and said cathode, second and third inductance coils and a third capacitor connected in series between said control grid and said cathode, said first and second coils being arranged in regenerative feedback mutually inductive relation thereby tending to cause electrical oscillations, said first and third coils being arranged in degenerative feedback mutually inductive relation thereby tending to prevent such oscillations, means for varying the mutual inductance between said first and third coils to cause or prevent such oscillations selectively, and a grid-leak resistor effectively connected between said control grid and said cathode whereby said valve is self-biasing and conducts less current when oscillating than when not oscillating.

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