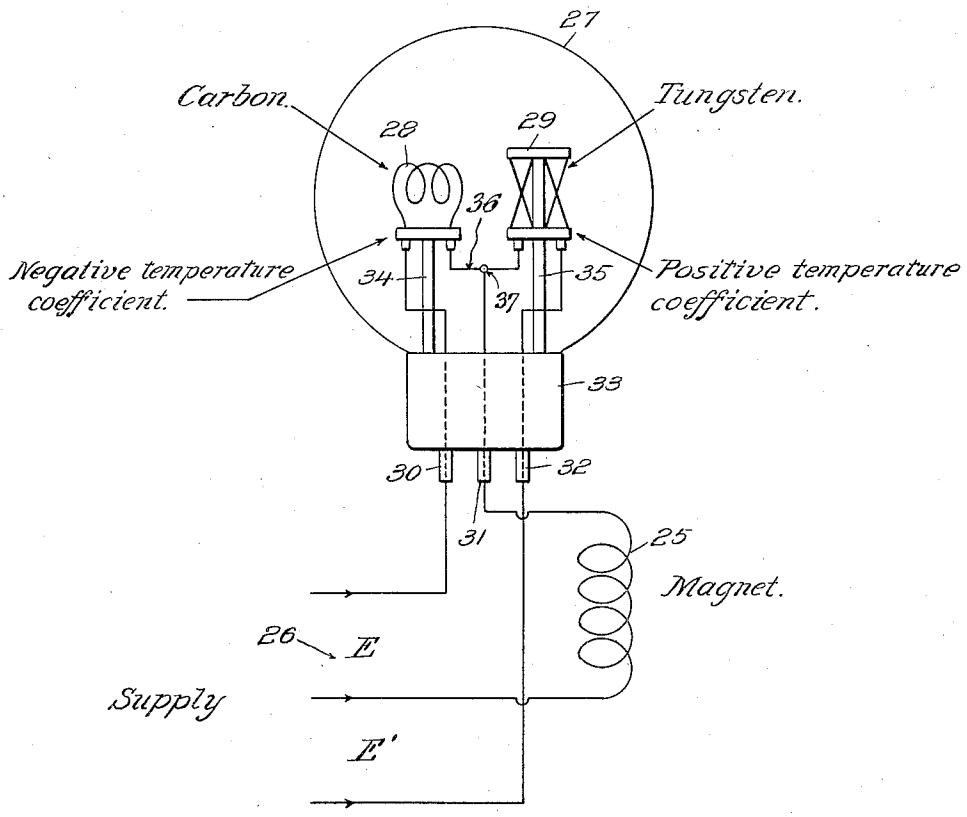
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CIRCUIT CONTROLLER

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CIRCUIT CONTROLLER

Original application filed December 27, 1929, Serial No. 416,877. Divided and this application filed March 21, 1931. Serial No. 524,394.

My invention relates broadly to current regulators and more particularly to an electrical system in which the characteristics of the current may be controlled in predetermined relation to a definite time interval.

This application is a division of my application Serial No. 416,877, filed December 27, 1929 for slow electromagnet.

One of the objects of my invention is to provide a device which may be connected in an electrical circuit in series between the current supply and the load for regulating the current supplied to the load according to the temperature coefficient of resistance of the device.

Another object of my invention is to provide a current regulator consisting of an evacuated or gas filled vessel having a pair of filaments connected in series and connected to terminals brought out of the vessel, the filaments each having different temperature coefficients of resistance and adapted to mutually control the characteristics of the current supplied to a load through circuits including said filaments.

Still another object of my invention is to provide a circuit controller in the form of a detachable device adapted to be inserted in circuit between a supply source and a load for controlling by the differential operation, the characteristics of the current supplied to the load.

A further object of my invention is to provide a construction of current regulator including independent elements each having different temperature coefficients of resistance connected with circuit terminals adapted to make contact with circuits leading to a load.

Other and further objects of my invention reside in the construction of an electrical control device as set forth more fully in the specification hereinafter following by reference to the accompanying drawing which diagrammatically illustrates the circuit controller of my invention.

My invention has many applications as a circuit controller and particularly as a device for producing predetermined operation of an electromagnet in which it may be desired to produce a magnetic condition at a predetermined time after the application of current to a control circuit or wherein it may be desirable to have the electromagnet lose its magnetic characteristics after a predetermined time interval.

In the drawing I have shown a single winding electromagnet at 25 connected in circuit with a voltage supply source 26 and in series with an incandescent lamp device having an evacuated or gas filled vessel 27 which is arranged to act differentially for controlling the current through the single winding electromagnet 25. The incandescent lamp device 27 includes a carbon filament 28 having a negative temperature coefficient of resistance and the tungsten filament 29 which has a positive temperature coefficient of resistance connected in the manner shown to the three wire supply circuit connecting to source 26. The incandescent lamp device 27 is provided with terminals 30, 31 and 32 projecting from the base portion 33. The carbon filament 28 is supported within the evacuated or gas filled vessel 27 on the vertically disposed support 34. The tungsten filament 29 is suitably mounted within the evacuated or gas filled vessel 27 on the support 35. A conductor 36 serves to interconnect the carbon filament 28 and the tungsten filament 29 in series relation. A tap 37 is taken from a point 37 intermediate the ends of conductor 36 and connected to the terminal 31 as shown. The base 33 is fitted into any suitable socket whereby contacts 30, 31 and 32 connect with the supply circuit 26 and the electromagnet 25 as shown.

With equal full rated voltage applied simultaneously at E and E′ the filaments being equal in resistance when hot, a momen-

tary current will flow in the center leg through electromagnet 25. The total duration of this current will be the heating time of both filaments. It will start as a maximum and taper off to zero as the carbon filament comes, relatively slowly, up to the full operating temperature.

With equal voltages, and the filaments equal in resistance when cold, the current through electromagnet 25 will be zero until the filaments begin to heat. As the tungsten filament heats the current in its leg of the circuit will decrease and as the carbon heats the current in its leg will increase. The resultant difference flowing through electromagnet 25 will rise over a period of time and reach a constant value when both filaments are up to full voltage.

With constant applied voltage, and the filaments equal in resistance when partly heated, the current in electromagnet 25 will start at a high value and decrease to zero by the time both filaments are up to the temperature corresponding to equal resistance. After this point is passed the current through electromagnet 25 will increase again but the direction of energy flow through electromagnet 25 will be the reverse of what it was at the start. The times again will be the heating time of the filaments.

By connecting a magnet in the neutral circuit as indicated it can be made to function as follows:

1. Pick up its core momentarily while the filaments are heating and drop it again.

2. Pick up its core after the filaments have heated to a certain point after a certain time has elapsed and hold it.

3. Pick up its core as soon as current is applied to the filaments, drop it as they heat to a certain point, and pick it up again as they heat further.

4. If the magnet is polarized it can be made to operate in one direction under condition (3) at the start and to reverse its direction after the point of equal resistance is passed.

In the first described condition, advantage can be taken of the differential heating of filaments or other elements to obtain a magnetic action after a period of time has elapsed and yet have current flowing in the magnet only for a relatively short time. By varying the heating elements as to materials and resistance and the voltage and currents the time element of the combination may be varied over a wide range. For instance for high coefficient materials nickel, copper or aluminum may be used. For medium and zero coefficient materials nickel-copper alloys, and for negative coefficient carbon or boron.

Assume a direct current supply with the device of my invention connected in circuit with the upper supply line, positive, connected to the carbon filament and the lower supply line, negative, to the tungsten. With the value of resistance and current given in the table below it will be seen that the current flow through the magnet 25 will be 8 amperes flowing upward when cold, zero when the resistances equalize, and 3 amperes flowing downward when hot.

	Carbon		Tungsten		Difference, amperes
	Ohms	Amperes	Ohms	Amperes	
Cold	5	2	1	10	−8
Equal resistance	3.75	2.66	3.75	2.66	0
Hot	2.5	4	10	1	+3

The device of my invention may be applied to direct or alternating current circuits. When applied to alternating current circuits it may be utilized for inductive and magnetic effects as set forth in my application Serial No. 416,877, filed December 27, 1929.

While I have illustrated the winding of an electromagnet it should be understood that the device may be a motor, a measuring device, a lamp or some other form of load other than an electromagnet.

While I have described my invention in one of its preferred embodiments I desire that it be understood that modifications may be made and that no limitations upon my invention are intended other than are imposed by the scope of the appended claims.

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

1. A circuit controller comprising an evacuated envelope having a base, terminals extending from said base and a pair of filaments disposed within said envelope, a conductor electrically connecting said filaments in series, said filaments having their remote ends connected with individual terminals and a connection between a point in said conductor and another of said terminals, said filaments each having different temperature coefficients of resistance.

2. A circuit controller comprising an evacuated envelope, a base connected therewith, terminals carried by said base, independent filaments supported within said envelope in predetermined relation to said base, one of said filaments comprising a carbon filament and another of said filaments comprising a tungsten filament, a series circuit extending between two of the terminals and said filaments, and a connection extending from a point between said filaments and another of said terminals.

In testimony whereof I affix my signature.

ALBERT B. RYPINSKI.