

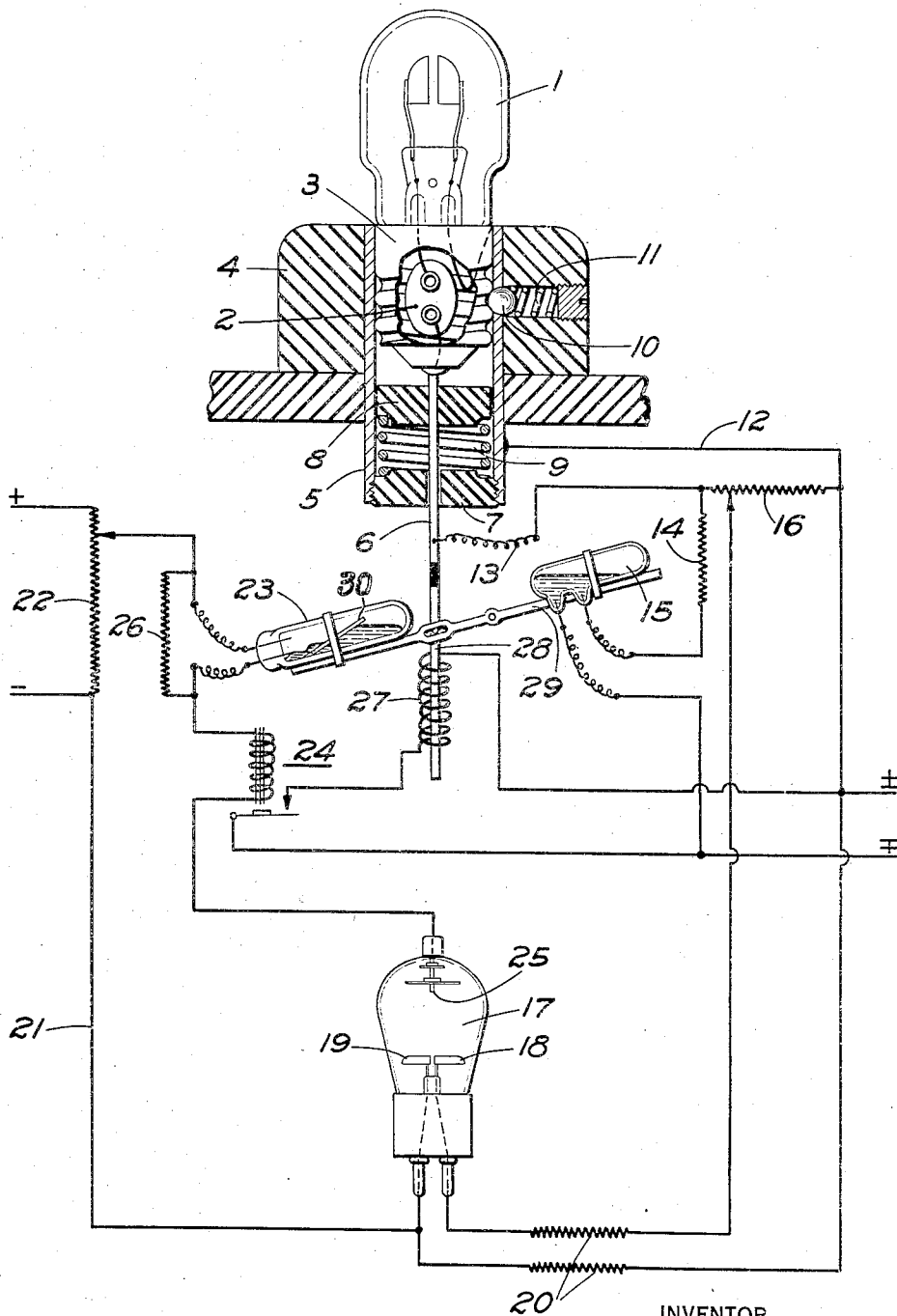
Dec. 21, 1937.

T. J. RADCLIFFE

2,103,040

MANUFACTURE OF RESISTANCE BODIES

Filed Dec. 30, 1935



INVENTOR
Thomas J. Radcliffe
BY *John A. Brown*
ATTORNEY

UNITED STATES PATENT OFFICE

2,103,040

MANUFACTURE OF RESISTANCE BODIES

Thomas J. Radcliffe, Belleville, N. J., assignor
to General Electric Vapor Lamp Company,
Hoboken, N. J., a corporation of New Jersey

Application December 30, 1935, Serial No. 56,797

2 Claims. (Cl. 201—63)

The present invention relates to electric resistances, and particularly to resistances of the type used in connection with electric discharge devices of various types.

A particular object of the invention is to provide a resistance having a precisely adjusted value. Another object of the invention is to provide a novel apparatus for accurately adjusting the impedance of a resistance unit. Still another object of my invention is to produce an electric gaseous discharge which will operate with a uniform wattage. Still other objects and advantages will appear from the following detailed specification or from an inspection of the accompanying drawing.

The invention consists in the new and novel combination of elements, as hereinafter set forth and claimed.

Resistances of paper impregnated with carbon or the like are used for many purposes, especially where a relatively high resistance is desired. Thus in the manufacture of cathode glow lamps and the like it is customary to enclose a series resistance of this type within the base to ballast the discharge. These paper resistances are ordinarily impregnated with resin to increase their mechanical strength and to seal them against moisture in order to keep their resistance constant. Such resistances are very satisfactory in operation, but are subject to large variation in the resistance obtainable with a given geometry. This variation is, of course, partly due to the fact that it is difficult to uniformly impregnate the paper with the carbon. I have likewise found that the degree of penetration of the resin coating also materially affects the value of the resistance. Thus in some cases the heat ordinarily employed to affix a base to an electric gaseous discharge device has been found to affect the value of a resistance enclosed within said base through the heating of said resin coating. For all of these reasons it has been difficult to make these devices conform to their rated wattage.

I have now discovered that the resistance of these impregnated resistors can be accurately adjusted by first producing the resistor with a value somewhat less than that desired, and then increasing the resistance thereof to the exact desired value by heating the resistor above its normal operating temperature to cause the resin to further infiltrate into the fibers. This novel process is preferably carried out in a novel apparatus of my invention, wherein a current larger than said resistor is rated to carry is passed

therethrough to heat it until its resistance has increased to a predetermined value, whereupon the flow of this current is automatically interrupted. In this novel apparatus provision is also made to prevent the initially high cold resistance of the carbon from interrupting the flow of the heating current. As a further refinement where this apparatus is used to adjust the value of a resistance within a cathode glow lamp, for example, this lamp is automatically ejected as soon as the operation is complete. By thus adjusting the resistance after it has been assembled with a lamp the wattage of the lamp is accurately adjusted to any desired value.

For the purpose of illustrating my invention I have shown in the accompanying drawing a schematic diagram of a preferred embodiment thereof which is especially adapted to handle completely assembled cathode glow lamps having a paper resistor incorporated in the base thereof.

In this drawing 1 represents a cathode glow lamp having a resistance 2 of resin coated, carbon impregnated paper housed within the base 3 thereof in a conventional manner. A special socket is provided for this lamp consisting of an insulating member 4 having a smooth metal tube 5 passing therethrough in which the sleeve of the base 3 freely slides. The tip of a base 3 which is positioned within said tube 5 engages a plunger 6 which passes through an insulating bushing 7 at the lower end of said tube. Near its upper end said plunger carries an insulating flange 8, and a spring 9 which is confined between the bushing 7 and said flange tends to move said plunger upwardly to eject the lamp from the tube 5. A ball detent 10 in the wall of the tube 5 is adapted to engage the thread on the base 2, the spring 11 which holds this ball being just strong enough to overcome the ejecting force of the spring 9. Said tube 5 is electrically connected by the wire 12 to one side of a suitable current source, which is here shown as alternating, although direct current may be used if desired, this source ordinarily having a potential considerably in excess of the rated voltage of the lamp 1. Thus where this lamp is intended for operation on 115 volts a 230 volt source is ordinarily employed. The plunger 6 is connected through a suitable flexible conductor 13, resistance 14, and mercury switch 15 to the opposite side of said alternating current source. A potentiometer 16 having a resistance of the order of a megohm is connected between the wire 12 and conductor 13.

A relay tube 17 of the type disclosed in U. S. 55

Patent No. 1,965,589, granted July 10, 1934 to Ted E. Foulke, has its control electrodes 18 and 19 connected through the similar resistances 20, of the order of 100,000 ohms, to said potentiometer 16, the movable tap on said potentiometer being so adjusted that the gap between the electrodes 18 and 19 does not break down until the resistance 2 has increased to the desired value, as evidenced by the increase in IR drop therein, to which the potential across the potentiometer 16 is responsive. The electrode 19 of said relay tube is likewise connected by the lead 21 to the negative side of a suitable direct current source of say 110 volts. A potentiometer 22 is connected across said source, and from a suitable point on this potentiometer a connection is made through the mercury switch 23 and the coil of relay 24 to the anode 25 of the relay tube 17. The potential tapped off from the potentiometer 22 is so chosen as to break down the gap between the electrodes 19 and 25 only after the gas has been ionized by a discharge between the electrodes 18 and 19. The switch 23, which is only schematically illustrated, is of a quick opening, delayed closing type which is now well known, in which the mercury flows over a baffle 30 in opening the circuit, but has to flow through a restricted orifice therein in order to close the circuit through the switch. As used in practice this switch delays the closing by about 10 seconds. A high resistance 26, of the order of a megohm, is preferably connected across the terminals of the switch 23 in order to avoid the building up of abnormal potentials by static while the switch is open.

The contacts of the relay 24 are connected in series with the solenoid coil 27 across the alternating current source. The core 28 of said solenoid is an extension of the plunger 6, but is preferably insulated therefrom. A pivoted support 29 is connected with a slot and pin connection to the core 28 so as to be tilted when said core and plunger are actuated by the coil 27. The switches 15 and 23 are mounted on this support in such position that both these switches move to the circuit closing position when a lamp 1 is in the socket and to the circuit opening position when the lamp is ejected therefrom.

In the use and operation of this device, with the plunger 6 in its elevated position under the action of the spring 9, and both switches 15 and 23 accordingly open, a lamp 1 has its base 3 inserted within the tube 5 and is forced downwardly therein against the plunger 6, causing the latter to recede, whereby the switches 15 and 23 are moved to the circuit closing position. The base 3 is thereupon yieldably held in the desired position by the spring ball detent 10. As soon as the switch 15 is moved to this position the circuit therethrough is closed, and current thereupon flows from the alternating current source through the lead 12, tube 5, thence through the lamp 1 and the ballast resistance 2 to the tip of the base 3, through plunger 6, lead 13, and switch 15 back to the other side of said source, the current being limited by the resistance 14 to a value of the order of four or five times the normal operating current of the lamp 1. Thus in adjusting the resistance of a $\frac{1}{4}$ watt lamp a resistance of the order of 6000 ohms is used in practice for the resistance 14. A definite fraction of the sum of the voltage drop across the electrodes of the lamp 1 plus the drop in the ballast resistance 2 is thereupon impressed between the electrodes 18 and 19 through the potentiometer 16. As the current flows through

the resistance 2 the latter is heated to a temperature considerably above that which it will ever attain during normal operation of the lamp 1, causing the resin with which said resistance is coated to melt and to infiltrate into said resistance. The value of said resistance is thereby increased, and the voltage drop across the potentiometer 16 increases as a result thereof, until eventually the portion of said voltage which is impressed between the electrodes 18 and 19 is sufficient to ionize the gas therebetween, whereupon a glow discharge which is limited by the resistances 20 occurs between said electrodes. By suitable adjustment of the tap on the potentiometer 16 this discharge can, of course, be made to occur at any desired value of the resistance 2. This discharge ionizes the gas between the electrodes 19 and 25, whereupon current flows, provided the circuit through the switch 23 is closed, from the positive tap on the potentiometer 22, through the switch 23, the magnet coil of relay 24, to anode 25, thence through the gas of the tube 17 to the cathode 19, returning through conductor 21 to the negative side of the direct current source. The contacts of the relay 24 are thereupon closed, energizing the solenoid coil 27, whereupon the core 27 is pulled upwardly, along with the connected plunger 6 and pivoted support 29. The additional force thus exerted by the plunger 6 overcomes the resistance of the ball detent 10, whereby the lamp 1 is ejected from the tube 5, and at the same time the switches 15 and 23 are moved to the open circuit position. The parts are then maintained in this position by the spring 9 until another lamp 1 is inserted in the socket, whereupon the previously recited cycle is repeated.

Due to the negative temperature characteristic of carbon it sometimes happens that the cold resistance of the resistance 2 is as high as that of the hot value for which the device is adjusted. If it were not for the switch 23 this would cause the apparatus to function immediately to eject the lamp 1 therefrom. Through the use of the delayed closing switch 23, however, response of the apparatus is delayed until the resistance 2 has been heated at least to its normal operating temperature, so that the apparatus functions only on the hot value of the resistance 2. While the location of the time delay switch in the direct current circuit of the relay tube 17 is preferred it is, of course, obvious that it may be included in any other circuit which will prevent energization of the solenoid coil 27 during the initial heating period of the resistance 2, as directly in said solenoid circuit or in the circuit between the relay tube 17 and the potentiometer 16, for example.

Where it is desired the switch 15 can be omitted, the function thereof then being performed by the making and breaking of the circuit at the lamp 1 as said lamp is inserted in and ejected from its socket. Likewise where desired the automatic ejecting feature can be eliminated, the switches 15 and 23 then being manually moved to circuit closing position after the lamp 1 has been inserted in the socket. In this case, the switch 15 is, of course, essential to the proper operation of the device.

While I have illustrated my invention by reference to a particular embodiment thereof it is obvious that various changes, substitutions and omissions, within the scope of the appended claims, may be made therein without departing from the spirit of my invention.

I claim as my invention:—

1. In apparatus for adjusting the value of a resistance which is subject to permanent change upon the application of heat, in combination, means to pass a heating current through said resistance, means responsive to the voltage drop across said resistance to interrupt the flow of said current when said resistance has attained a predetermined value, and means to prevent the operation of said interrupting means during the initial heating of said resistance.

10 2. In apparatus for adjusting the self-contained ballast resistance of an electric gaseous discharge device, said resistance being of a type which is subject to permanent change upon the

application of heat, in combination, socket means to retain said device, means associated with said socket to pass current through said device to heat said resistance to a temperature in excess of that attained during normal operation of said device, 5 means responsive to the voltage drop in said resistance to interrupt said current and to eject said lamp from said socket when said resistance has attained a predetermined value, and means to delay the operation of said last mentioned means 10 until said resistance has been heated for a predetermined time.

THOMAS J. RADCLIFFE.