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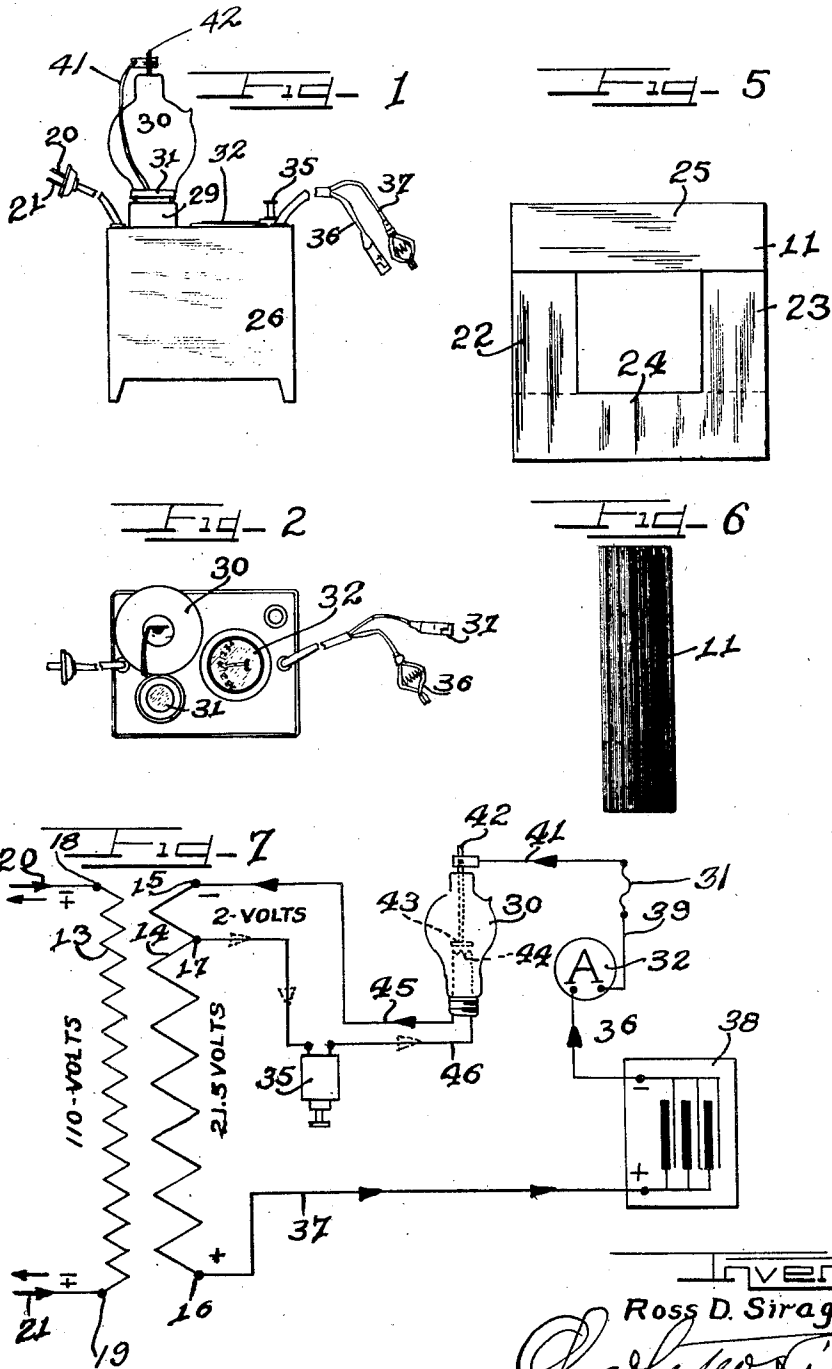
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1,802,483

CURRENT CONTROLLING DEVICE

Filed Nov. 3, 1924

2 Sheets-Sheet 1



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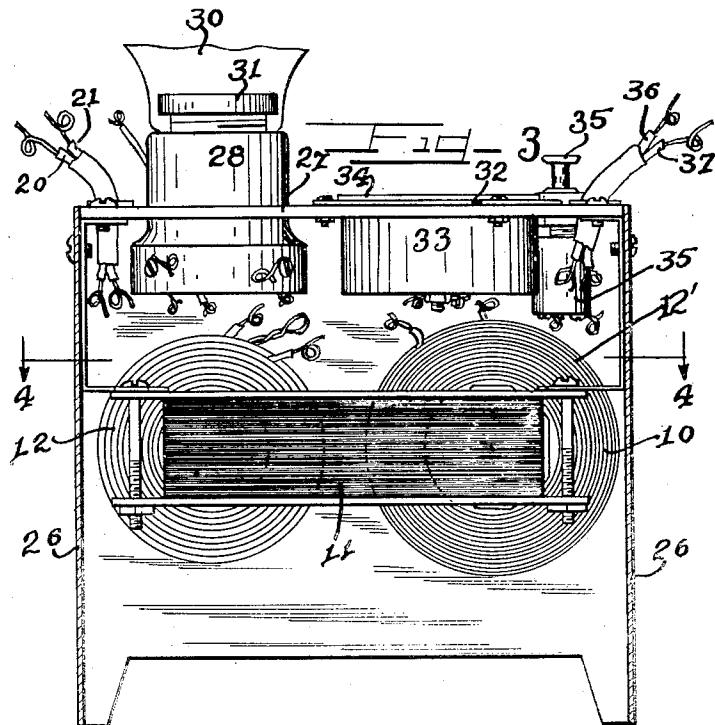
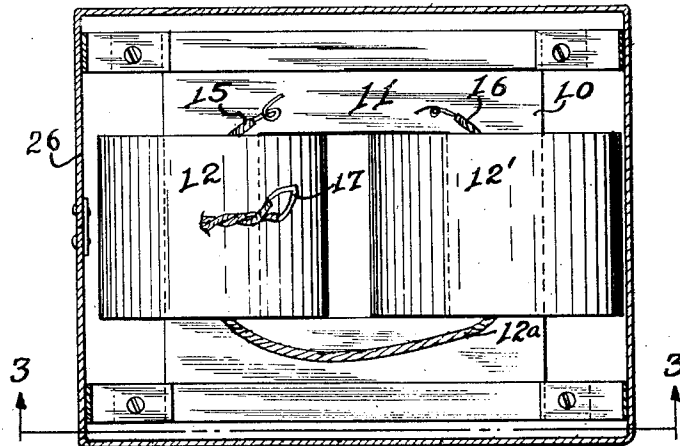


Fig. 4



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UNITED STATES PATENT OFFICE

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CURRENT-CONTROLLING DEVICE

Application filed November 3, 1924. Serial No. 747,578.

This invention relates to a method of and apparatus for controlling electric current.

One of the objects of the invention is to provide a method of operation whereby an electric current, having been initiated by suitable means in a suitable circuit will automatically cease to flow upon occurrence of a changed condition in the circuit, without the intervention of any mechanically movable parts.

Another object is to provide a method of charging storage batteries whereby the counter-electromotive force of the battery will automatically oppose electronic flow in a charging circuit to an extent that will cause substantial opening of said charging circuit and stop the flow of current therein upon the establishment of a predetermined condition, for instance, when the battery approaches a fully charged condition.

Another object is the provision of a charging circuit having therein an electronic tube, provided with plate and filament elements in series in said circuit, and a push button switch to control a circuit to momentarily heat said filament and thereby initiate current flow in the charging circuit.

A further object is to provide improved apparatus for carrying the invention into effect.

Other objects, advantages and benefits will hereinafter appear to persons skilled in the art from a consideration of the following description when taken in conjunction with the drawings, wherein:—

Figure 1 is an elevation of a current rectifying device embodying the invention.

Figure 2 is a plan view of the device.

Figure 3 is an enlarged sectional view taken through a vertical plane substantially on line 3—3 of Figure 4.

Figure 4 is a similar view taken through a horizontal plane on line 4—4 of Figure 3.

Figure 5 is a plan view of a transformer core.

Figure 6 is an end view thereof.

Figure 7 is a diagram of circuits.

In all the views, the same reference characters indicate similar parts.

In the drawings, I have shown an appara-

tus well adapted for carrying the invention into effect, wherein 10 is a transformer having a rectangular core 11 of peculiar formation and overlying coils 12, 12'. In the particular embodiment the primary coil 13, shown in the diagram of circuits in Figure 7, is wound next to the core and secondary coils are, in Fig. 3, shown to be on the outside thereof. In Figure 4, the terminals of the secondary circuit of the transformer and conducting wires are shown corresponding with the terminals and wires shown in Figure 7. The terminal 15 is connected to one end of the secondary coil and the terminal 16 to the other end thereof. The coils are connected together at 12a as a single coil designated by numeral 14 in Figure 7. A tap 17 is connected to an intermediate point of the coil and between the tap terminal 17 and the terminal 15 there is impressed in operation about two volts, and between the tap terminal 17 and the terminal 16 there is impressed in operation about 21.5 volts, and there is a fall of potential of 23.5 volts between the terminals 15 and 16. The terminals 18 and 19, of the primary coil 13, are connected to the service wires 20—21.

The core of the transformer is built up of laminae, each of U-shaped formation consisting of the legs 22, 23 and the yoke 24. At the end of the legs 22 and 23, and in a horizontal plane therewith, is a straight bridging piece 25. The next U-shaped piece, or lamina, to be placed upon the core is reversed in position so that its straight piece 25 will come in the position that the yoke 24 occupies in the preceding lamina as shown in Fig. 5. By this means of building up the transformer core, the core pieces can be placed inside of the coils after the coils have been wound, and the full cross-sectional area of the core may be maintained throughout. When pressure is applied to bind the laminae forming the core together, the parts will remain in the positions in which they were initially placed.

A casing 26, made preferably of non-magnetic material, such, for example, as aluminum, is placed around the devices forming the rectifier and, being non-magnetic, is therefore not vibratorily responsive to the vary-

ing magnetic changes that take place inside of the casing. The casing will not therefore vibrate with the magnetic impulses and, therefore, the device is substantially noiseless.

A plate 27 of insulating material is mounted in the upper end of the casing 26 for the purpose of supporting the sockets 28 and 29 for the rectifying tube 30 and the fuse 31, respectively. An ammeter 32 is mounted upon the face plate 27 with its supported part 33 below the plate within the casing and a rim 34 thereabove. A push button switch 35 for momentarily closing the filament-heating circuit is also supported upon the plate. Wires 36 and 37 are the lead wires to be connected to the storage battery 38 to be charged.

Now referring to the diagram, the ammeter 32 is connected by wire 39 to a terminal of the safety fuse 31 which is connected by the wire 41 to the tube terminal 42 of the tube 30. The electron plate 43 is shown within the tube and the filament 44 is connected by wire 45 to the terminal 15 of the secondary coil of the transformer. Wire 46 connects the other terminal of the filament to the terminal 17 which is a tap from the coil 14 of the transformer.

The operation of the device is substantially as follows:

The transformer has a primary coil having a fall of potential of 110 volts and a secondary coil, for example of 23.5 volts stepped down from the 110 volts.

An electron tube 30, of the ionization type, is used in the secondary circuit, as shown. Any tube of this character that ionizes, has a definite current requirement to keep up the ionization or the flow of electrons between its enclosed elements. In the particular case, the current required as a minimum for this purpose is 1.6 amperes, that is, with one side of the filament disconnected by the push button switch 35, a current load of 1.6 amperes through the tube will be just enough to continue the flow of electrons in the tube and maintain it in operation. When the current goes below 1.6 amperes the ionizing effect of the tube, or the flow of electrons between the plate and filament will immediately cease and the circuit will, substantially, be opened as a result of this action, and no current will flow from the source of supply to the battery, or vice versa, as before, until the filament is again heated by an outside agency. When the push button switch is closed by pressure upon one element of the switch, the charging current, with the filament in an incandescent state, will amount to about 3.75 amperes. The push button switch is closed only for a few seconds, and then opened, or until the filament becomes sufficiently heated to start the flow of electrons between the elements of the tube and the consequent flow of current in the charging circuit is established. After

this effect has been produced, the push button switch is opened and the current will continue to flow as before, but the resistance will increase to some extent and the result is that a current of 3.25 amperes will now flow through the battery. A current of 3.25 amperes will continue to flow from the source of current, or from the secondary coil of the transformer through the battery until the counter-electromotive force of the battery, as a result of being charged, is of such value that it will reduce the current flowing through the charging circuit to less than 1.6 amperes, whereupon the battery will be substantially fully charged and the circuit will be thereby opened by the cessation of the flow of electrons between the elements of the tube. This cessation of the flow of current to the battery will occur at a predetermined time and will be automatically performed, without requiring any mechanical movement of any parts of the device.

I have found from actual experiment, that the electron tube 30 will function as above, when the filament 44 has been initially heated to the proper degree and thereafter the initial heating agent withdrawn, until the current flowing through the tube is of such low value that it is unable any longer to engender the flow of electrons between the elements of the tube, whereupon the charging circuit will be, thereby, opened.

I will not make any attempt to explain the theory upon which the rectifying tube acts in the manner described. It is sufficient to say that the results described are accomplished in the manner stated.

I have herein shown a single embodiment of my invention for the purpose of clear disclosure, but it is manifest that many changes may be made in the arrangement, configuration and proportioning of the devices disclosed are within the scope and spirit of the appended claims.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In combination, a thermionic rectifying valve having a heating element, a storage battery, a charging circuit including said valve and said battery in series circuit relation, means for temporarily energizing said heater element to initiate charging action of said valve, said valve being adapted to sustain charging action while the current there-through is above a predetermined value, means for impressing on said charging circuit an alternating voltage of such value that charging action is automatically stopped by said valve when the counter voltage of said battery increases to its fully charged value.

2. In combination, a source of alternating voltage, a thermionic rectifying valve having a heating element, a storage battery to be charged from said source by means of said

rectifier, means for temporarily energizing
said heater element to start the charging of
said battery, said valve having the character-
istic of thereafter continuing rectification as
5 long as the current therethrough is above a
predetermined value, and means for impress-
ing an alternating voltage on said valve and
battery of such a value in respect to said char-
acteristic that rectification is automatically
10 stopped by said valve when the counter volt-
age of the battery attains its fully charged
value.

In testimony whereof I have hereunto sub-
scribed my name.

ROSS D. SIRAGUSA.