July 16, 1929. T. F. BURKE 1,720,662

ELECTRIC WELDING

Filed Jan. 20, 1926

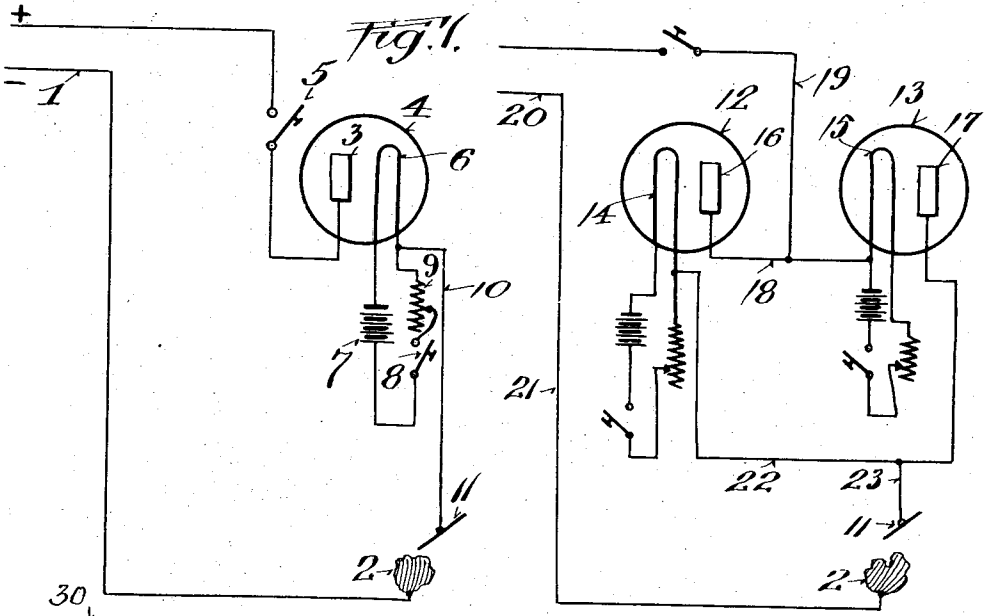


Fig. 1.

Fig. 2.

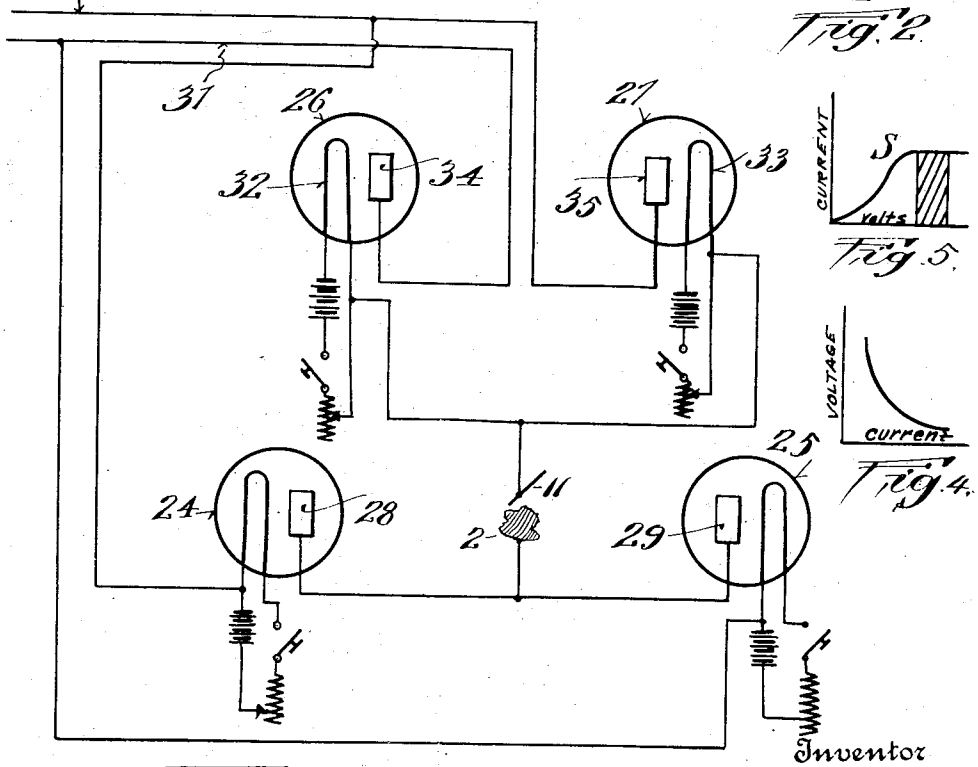


Fig. 3.

Fig. 5.

Fig. 4.

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ELECTRIC WELDING.

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This invention relates to electric welding and particularly to the means in connection with electric welding for keeping the current constant.

It is a known characteristic of welding for example that when the arc is made a decrease in the voltage causes an increase in the current and an increase of the current causes a decrease in the voltage as shown by the curve of Figure 5. So without some means of regulation, the arc will, as commonly expressed in the art, "run away with itself" blowing a fuse or circuit breaker or possibly doing some damage. Attempts have been made to regulate this characteristic or overcome it by such means as resistance in series or by special generators and other means, all of which have draw backs or objections.

The present invention has for its object to provide novel means for maintaining constant current for the weldings to limit the current flow within the working range regardless of the voltage; to provide for a substantially constant current in use; to employ thermionic regulating means; to enable the invention to be utilized in connection with a source of direct current supply and with a source of alternating current supply; to provide means for causing the polarity of the electrode and the work to remain constant; to secure simplicity of construction and operation; and to obtain other advantages and results as may be brought out in the following description.

Referring to the accompanying drawings, in which like numerals of reference indicate the same parts throughout the several views:

Figure 1 is an electric diagram of an embodiment of my invention wherein the power is derived from a source of direct current;

Figure 2 is a similar diagram wherein the power is derived from a source of alternating current;

Figure 3 is a similar alternating current diagram wherein means are employed for maintaining the polarity of the electrode and work constant;

Figure 4 is a curve showing relation of voltage and current in an uncontrolled arc, and

Figure 5 is a curve of current and plate potential at a given filament temperature of a thermionic tube.

In the specific embodiment of the invention illustrated in said drawings, the reference numeral 1 indicates wires from the source of direct current, one of said wires making electric connection with the work 2. The other of said wires is in electric connection with the plate 3 of a thermionic tube 4. Any suitable switch 5 is included in series with one of these wires for opening and closing the circuit.

The thermionic tube 4 also includes a filament 6 preferably lighted from a battery 7 and having the battery current controlled by a suitable switch 8 and rheostat 9 in series with the filament. Connected to one side of the filament circuit is a wire 10 in electric connection with an electrode or welding tool 11 from which the arc is to be made to the work. Since a thermionic tube is a one way valve, in which current flows from the positive element or plate, to the negative element or filament, it is necessary to make proper connection with the source of electric supply to obtain this necessary polarity.

In operation, it will be observed that current enters from the source of supply passing to the plate, from thence to the filament, thence to the electrode or tool, forms the arc with the work and returns to the source of supply. It may here be noted that a thermionic tube is characterized by the fact that for a given filament temperature only a specified maximum current can be drawn within certain ranges of plate potential, and that maximum is substantially constant. By reference to Figure 5, it is to be noted that the current and potential of a tube are plotted for a given temperature of the filament. For an initial period the current and potential increase substantially in proportion until the point of saturation, S, is reached after which increase of potential has practically no effect in increasing the current. And conversely, by decreasing the potential in any of the area above point S there will be substantially no decrease in the current. In using my invention I operate the tube above the point of saturation, preferably employing a voltage well above the point of saturation. As a result, therefore, when the arc is made with the work, the decrease in voltage resulting therefrom cannot effect any increase of current because of the above described tube characteristic maintaining the current substantially constant. The tube accordingly prevents the arc from "running away with itself".

Where the source of current supply is alternating, the arrangement shown in Figure 2 is preferably employed. In said view, are shown a pair of thermionic tubes 12, 13 having filaments 14, 15 respectively and plates 16, 17. The plate 16 of one tube is connected with the filament 15 of the other tube, as by wire 18, which is in connection with the source of alternating current supply through wire 19. As in the previously described construction, the other wire 20 from the source of current supply is connected, as by wire 21, to do work 2.

Connection, as by wire 22, is made from the filament 14 of the first tube, and this to the plate 17 of the second tube, and this connecting wire is joined, as by wire 23, to the tool 11. It will be observed by the construction shown, one half-wave of the alternating current will flow through the one tube to the tool while the other half-wave will flow through the other tube thereby delivering a substantially constant current to the tool. As described above the tubes in this instance also are operated above their points of saturation and accordingly prevent the arm from "running away with itself".

Where it is also desired to send the current through the arc in the same direction at all times, the construction shown in Figure 3 may be employed. In said view, I have shown four thermionic tubes, two of which, numbered 24, 25 are between the source of current supply and the work 2 whereas two others 26 and 27 are between the tool 11 and the source of supply. In the arrangement shown in this view the plates 28, 29 of the first pair are connected together and to the work whereas the filaments are in separate communication with the two wires 30, 31 of the source of supply. Conversely, the filaments 32, 33 of the other pair of tubes are joined together and to the tool 11, whereas the plates 34, 35 of those two tubes are separately connected to the wires 30, 31 of the source of supply. In this instance, therefore, there will not only be a control of the current as in the previous cases, but a rectification with direction of the flow of current.

Obviously detail changes and modifications may be made in the construction and operation of my improvements in arc welding, without departing from the spirit or scope of the invention, and I do not wish to be understood as limiting myself to the exact structure shown or described except as set forth in the following claims when construed in the light of the prior art.

While I have shown and described my invention as specifically applied to arc welding, I wish it to be understood that I do not desire to be limited or restricted in this respect, as the invention may be equally well applied to any other form of welding where it is desirable or advantageous for maintaining constant or controlling the current supply from which is derived the welding heat.

Having thus described my invention, I claim:

1. In combination with a source of current supply having substantially fixed voltage, and means for producing an electric weld, of thermionic means saturating at a lower voltage than that of the current supply for regulating the flow of current through said weld.

2. In combination with a source of alternating current supply having substantially fixed voltage, and means for producing an electric weld, of thermionic means saturating at a lower voltage than that of the current supply for regulating the flow of current through said weld, said thermionic means also rectifying the alternating current.

3. In combination with a source of current supply, a thermionic device for producing an electric weld having plate and filament, said device saturating at a lower voltage than that of the current supply for regulating the flow of current through said weld, said plate being connected to one side of the source of current supply, and the other side of said source of current supply being connected to the work and means for producing an arc connected to said filament.

4. In combination with a source of current supply, an electric weld producing means in series with a thermionic device saturating at a lower voltage than that of the current supply for regulating the flow of current through said weld producing means and having plate and filament adapted to be operated to cause the plate current to remain substantially constant with plate voltage variations.

5. In combination with a weld producing means, a thermionic device saturating at a lower voltage than that of the current supply for regulating the flow of current through said weld producing means and having plate and filament, said weld producing means, plate and filament being electrically in series.

6. In combination with a source of alternating current supply, and means for producing an electric arc, of thermionic devices saturating at lower voltages than that of the current supply for regulating the flow of current through said electric arc, said devices having anodes and cathodes for regulating and rectifying said current by utilizing the operating characteristics of said thermionic devices to obtain substantially constant plate current with plate voltage variations.

7. A combination with a source of alternating current supply, and means for producing an electric weld, of thermionic means

saturating at a lower voltage than that of the current supply for regulating the flow of current through said weld, having plate and filament for regulating, rectifying and directing the flow of current through said weld.

8. In combination with a weld producing tool and work to which a weld is to be formed from the tool of thermionic devices, saturating at a lower voltage than that of the current supply for regulating the flow of current through said weld, for simultaneously rectifying alternating current supply thereto and to maintain the current flow in the weld substantially constant with fluctuating potential while maintaining the tool at constant polarity.

9. In combination with a weld producing tool and work to which the weld is to be formed from the tool, a pair of thermionic devices each of which saturates at a lower voltage than that of the current supply for regulating the flow of current through said weld having plates connected to said work and filaments connected to the opposite sides of a source of current supply and a pair of thermionic devices having filaments connected to said tool and having plates connected to the opposite sides of the source of current supply.

10. In combination with a weld producing tool, of thermionic devices saturating at lower voltages than that of the current supply for regulating the flow of current through the weld producing tool, said devices having a plurality of electrodes, one of said electrodes to operate as a plate electrode and to coact with the other of said electrodes which is adapted to act as a filament so that said devices are characterized by the fact that at and above a predetermined voltage on the plate electrodes the thermionic plate currents are constant whereby there is a substantial current flow in the weld with fluctuating plate potentials.

In testimony whereof I have hereunto set my hand on this 7th day of January, A. D. 1926.

THOMAS F. BURKE.