

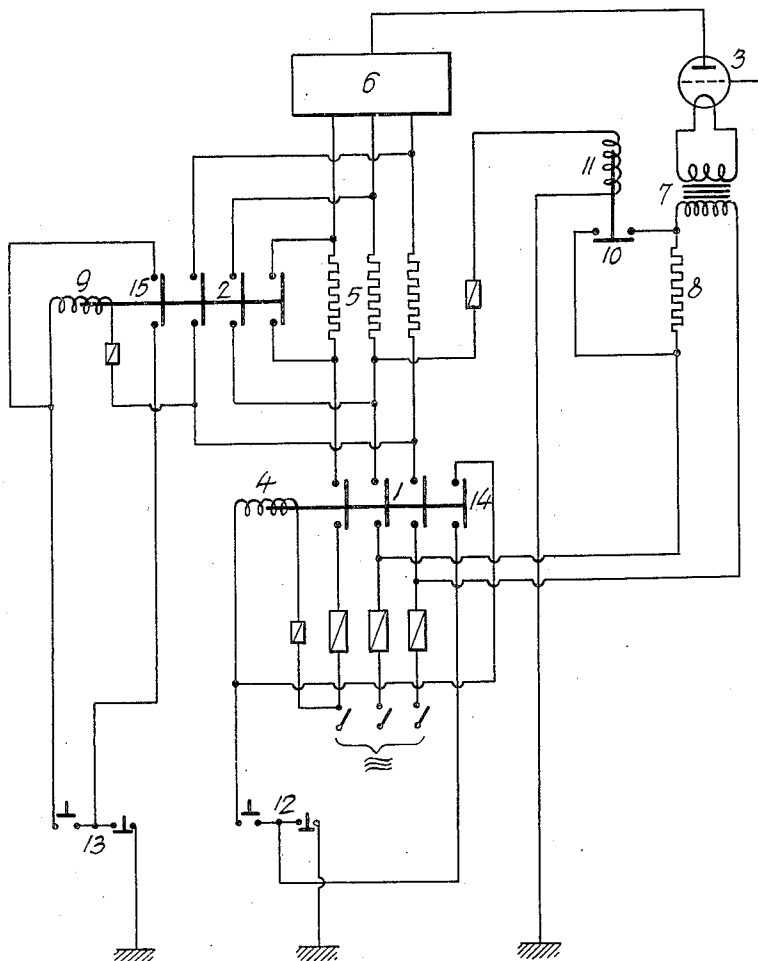
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ELECTRIC CIRCUITS

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ELECTRIC CIRCUITS

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1 Claim. (Cl. 315—93)

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In the arrangements, in which the electron tube functions as oscillator or amplifier, the magnitude of the output delivered depends, among other factors, also on the emission current of the cathode. If the electron tube should already operate in the saturated region of the characteristic, it is not possible to obtain a higher emission current. Although, by overheating the cathode this can be achieved, it will be at the cost of shortening the life of the cathode.

When operating only for a short time and intermittently, in the arrangements as hitherto used the electron tube is mostly heated continuously to a heating voltage, at which the cathode delivers the emission current required during operation. The result of this is, that the time, during which the electron tube can be kept in use, amounts to only a small fraction of the actual life of the cathode.

It is not possible to switch the heating on to the electron tube only at the moment, in which a high voltage is applied to the anode, as it takes a certain amount of time to heat up the cathode and, with the majority of the larger electron tubes, cannot be done intermittently and suddenly. In those cases, in which it is a question of a periodic and rapidly recurring initiation of a temporary mode of operation of the arrangement, as, for instance, with oscillators for metallurgical purposes, a rapid heating up and extinction of the cathode would result in its early destruction.

In order to make an intermittent heating of the filament possible, the filament resistance would have to be made so great that the switching in current does not exceed a certain maximum value. Now, for this purpose it is proposed according to the invention to heat the filament to a temperature, at which the filament resistance already reaches a value which prevents the occurrence of dangerous currents. This resistance is reached at a considerably lower temperature than the normal temperature of the filament. Consequently, the vaporisation of the filament material is less great in these intermediate periods and therefore the life of the filament correspondingly greater. On the other hand, it becomes possible to overheat the cathode during short working periods, without reducing its total life, as an increased filament vaporisation lasting only a short time during the working periods is compensated by a reduced vaporisation during the inoperative periods. It is clear, that this arrangement will have all the

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more importance, the shorter the operative periods and the longer the inoperative periods.

In its practical embodiment the whole arrangement will be somewhat as follows. The electron tube is heated to a lower voltage than when in operation, for instance to 90% of the working voltage, whereby the filament vaporisation is kept down to about 50%. At the commencement of the working period the cathode is overheated intermittently to a higher voltage than the normal working voltage, for instance to 110% of the latter, whereby the filament vaporisation and the emission current are increased by about 50%. If the duration of the operative period to that of the inoperative period be, say, 1:1, there will be no shortening of the life and the output delivered will be about 50% higher.

To take another case, the electron tube is heated to, say, only 80% of the normal heating voltage and is thereupon additionally heated during the operation up to the full normal heating voltage. In this case there will be no increase in the delivered output, but the life of the electron tube is increased in accordance with the ratio of the operative period to the inoperative period.

The ratio of the underheating to the overheating of the filament can of course be optionally adjusted according to the desired life and the output to suit given operative conditions.

In the accompanying drawing an example is shown of the diagram of connections of an arrangement for carrying the mode of operation according to the invention into effect.

This arrangement consists substantially of two switching devices 1, 2, one of which, 1, closes the circuit, by means of which the electron tube 3 has the lower anode voltage applied to it, whilst the other, 2, then enables the actual, either normal or increased operative anode voltage to be applied. The first switching device 1 is built into current lead of a three-phase current generator and is actuated by means of a solenoid 4. The circuit closed thereby leads, for instance, through resistances 5 to the rectifier 6 feeding the anode of the electron tube 3.

The cathode of this electron tube 3 is heated by the secondary current of the transformer 7, the primary side of which is fed by one phase of the three-phase generator. In the primary side of this transformer there is also a resistance 8. By these two resistances, 5 and 8, the circuit is kept at the low voltage, even during the

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inoperative periods. When this voltage is to be raised to the useful operative voltage, the two resistances are short-circuited.

For this purpose there is provided at the resistances 5 the switching device 2 which is built into bridging leads and is in this case again actuated by a solenoid 9, whilst the short-circuiting of the resistance 8 is effected by a switch 10 by means of the solenoid 11. The resistances 5, 8 can, of course, be replaced by inductances or self-acting inductions, such as autotransformers, choking coils and the like.

For facilitating the operation and manipulation of the whole arrangement special press-button switches 12, 13 are provided, by means of which the two switching devices 1, 2 are, on the one hand, operated and, on the other hand, held in the operative position as long as desired. On the starting button of the double switch 12 being depressed, the solenoid 4 of the switching device 1 is energized and, similarly, on the starting button of the double switch 13 being depressed, the corresponding solenoid 9 of the switching device 2 is energized. For holding the two switching devices in their operative position, there is connected to each of them a further switch stage, 14 and 15 respectively, which, when the circuits of the respective solenoids have once been connected up, keeps them closed. For interrupting these holding circuits, each of the double switches, 12 and 13, is provided with a circuit-breaking button.

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I claim:

In a thermionic vacuum tube oscillator circuit for high frequency heating in metallurgical apparatus wherein the heated vacuum tubes are subject only to intermittent loads, conductors forming a supply circuit for the plate of each vacuum tube, resistances in the conductors forming the plate supply circuit for varying the plate to cathode voltage, a shunt circuit around each resistance, a relay having a pair of contacts in each shunt circuit, conductors forming a cathode supply circuit connected to said plate supply circuit, an impedance connected in at least one of said cathode supply conductors, a shunt circuit around said latter impedance, a second relay having its load contacts connected in said latter shunt circuit, and a primary circuit for said latter relay including one pair of load contacts of the first relay.

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