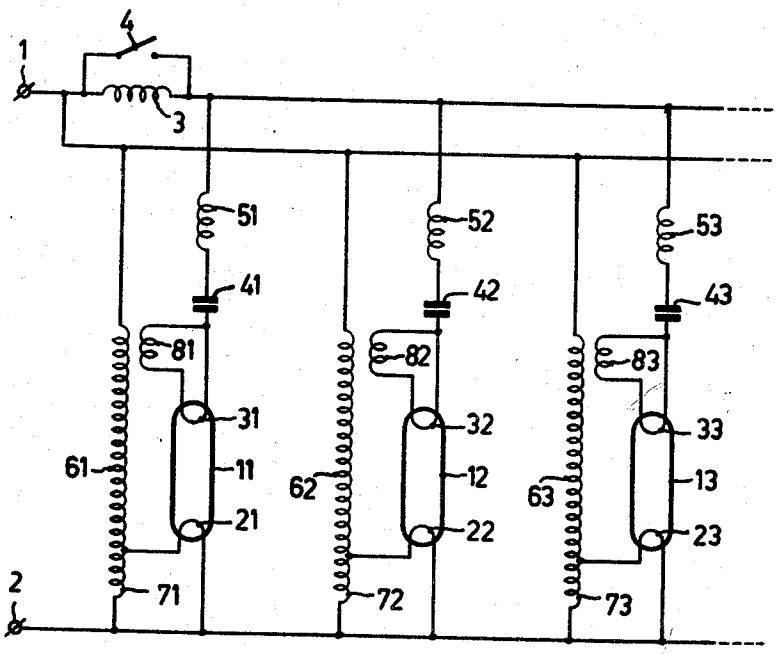
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DEVICE FOR ADJUSTING THE POWER CONSUMPTION OF GASEOUS AND/OR VAPOUR-DISCHARGE LAMPS

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# DEVICE FOR ADJUSTING THE POWER CONSUMPTION OF GASEOUS AND/OR VAPOUR-DISCHARGE LAMPS

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This invention relates to devices for adjusting the power consumption of gaseous and/or vapour-discharge lamps to the normal value and at least one lower value.

Such an arrangement usually has to satisfy the requirement that the lamps can be ignited in either condition. If the arrangement includes more than one lamp, igniting difficulties are liable to occur because the lamp or lamps first ignited may detrimentally effect the ignition of the following lamps in one condition or even in both conditions.

An object of the invention is to provide a simple device in which such difficulties do not occur.

According to the invention, at least two lamps substantially identical in electrical characteristics are present, each lamp being connected in series with an associated capacitance and an associated inductance and also in series with at least one common inductance, adjustable to the maximum impedance and a lower impedance. In addition, to the connecting terminals of the device there is supplied an alternating current, the reactances being so chosen that the device always consumes a leading current at the frequency of the supply current source for which it is intended.

In the said device the full supply voltage for which the lamps are designed is set up across each lamp not yet ignited in the condition of lowest power consumption, that is to say when the common inductance is adjusted to the lowest value, so that igniting difficulties cannot occur in this condition.

For any other adjustment of the common series-inductance, the full supply voltage is set up across the lamp first ignited, but a voltage exceeding the supply voltage and increasing with the number of the lamps already burning is set up across each subsequent lamp.

The values of the associated capacitances and associated inductances are preferably so chosen that the lamps consume the desired lowest power when the common inductance has been made inactive.

The maximum value of the common inductance is preferably such that the lamps consume the normal power for this value.

In order that the invention may be readily carried into effect, one embodiment thereof will now be described in detail, by way of example, with reference to the accompanying diagrammatic drawing.

The device shown has two connecting terminals 1 and 2 for connection to an alternating-current source of suitable voltage and frequency.

The device comprises a series of gaseous-discharge lamps 11, 12 and 13, for example, low-pressure mercury-vapour discharge tubes having a coating on the inner wall of the discharge vessel which fluoresces substantially in the range of visible wave-lengths by the action of the radiation produced. The lamps are connected to the terminals 1 and 2 in series with associated capacitances 41, 42, 43 and inductances 51, 52, 53 and also in series with an inductance 3 which is common to all the lamp circuits.

The lamps include thermionic electrodes 21, 22, 23 and 31, 32, 33 which are heated to and maintained at the



emission temperature by means of heating-current transformers having their primary windings 61, 62, 63 connected to the terminals 1 and 2. The electrodes 21, 22, 23 are connected to secondary windings 71, 72, 73, consisting of tapped portions of the primary windings, while the electrodes 31, 32, 33 are supplied by secondary windings 81, 82, 83, which are electrically insulated from the primary windings.

The lamps are stabilized capacitively, that is to say, the capacitance in each lamp circuit is higher than the inductance. It therefore follows that, if the common inductance 3 is short-circuited by means of a switch 4 in shunt therewith, or its impedance is reduced in some other way, the sum of the inductances in each lamp circuit becomes smaller, resulting in an increased value of the capacitance not compensated and hence in a reduction of the power consumption and of the light output of the lamps which is substantially proportional thereto within determinned limits. The lamps have their maximum power consumption for the maximum value of inductance 3 and their minimum power consumption for the minimum value thereof.

In the closed condition of switch 4, the full supply voltage is applied across each lamp not yet ignited so that ignition difficulties resulting from the mutual influence the lamps exert on one another cannot occur in this condition.

If the switch 4 is open, the first lamp to be heated to its ignition point is ignited at the full supply voltage. Its discharge current passes through inductance 3 and produces therein a voltage drop which is approximately in phase with the supply voltage. Consequently, the voltage set up across each lamp not yet ignited exceeds the supply voltage by the value of the said voltage drop. The increased voltage causes ignition of a second lamp. The discharge current flowing in the second lamp also flows in the common inductance 3, and further increases the voltage drop across the common inductance 3, and hence the voltage applied across each lamp not ignited.

In the open condition of switch 4, and also for values of the common inductance 3 higher than zero, all the lamps are ignited at a voltage at least equal to the supply voltage for which they are designed. In this condition, mutual influencing of the lamps occurs, it is true, but only in a favourable sense. Despite the increased igniting voltage, the lamps do not run the risk of being ignited before their electrodes are heated up sufficiently, since the electrodes of the lamps ignited later have been heated up for a longer period.

In a specific case, the supply voltage was 250 volts at a frequency of 50 c./s. and 11 fluorescent lamps were employed each normally consuming 40 watts. Each of the capacitances 41, 42, 43 . . . had a reactance value of 935 ohms, each of the inductances 51, 52, 53 . . . a reactance value of 33.3 ohms and the common inductance 3 was 34.4 ohms.

Each lamp had a power consumption of 40 watts with switch 4 open, and of 20 watts with switch 4 closed, and emitted a corresponding amount of light.

If each lamp consumes the maximum power of 40 watts, the voltage drop across the common inductance 3 is approximately 170 volts and the component thereof which is in phase with the supply voltage is approximately 140 volts, so that the increase in igniting voltage produced by each burning lamp was approximately 13 volts.

What is claimed is:

1. A circuit for operating a plurality of gaseous discharge devices, comprising input means for a source of alternating current of a given frequency, adjustable reactance means having a first and second value of reactance at said given frequency, a first circuit comprising the

series connection of a first gaseous discharge tube and a first reactance means of a type opposite to that of said adjustable reactance means, a second circuit comprising the series connection of a second gaseous discharge tube and a second reactance means of a type similar to that of said first reactance means, and means for connecting said adjustable reactance means in series with said input means and each of said first and second series circuits, said first and second reactance values of said adjustable reactance means having values relative to the reactance values of said first and second reactance means at which said circuit exhibits a net reactance which is less than the reactance value of either of said first and second reactance means alone for each of said first and second reactance values at said given frequency.

2. A circuit for operating a plurality of gaseous discharge devices, comprising input means for a source of alternating current of a given frequency, adjustable reactance means having a first and second value of reactance at said given frequency, a first circuit comprising the series connection of a first gaseous discharge tube and a first reactance means of a type opposite to that of said adjustable reactance means, a second circuit comprising the series connection of a second gaseous discharge tube and a second reactance means of a type similar to that of said first reactance means, and means for connecting said adjustable reactance means in series with said input means and each of said first and second series circuits, said first and second reactance values of said adjustable reactance means having values relative to the reactance values of said first and second reactance means at which said circuit exhibits a net reactance of the same type as that of said first and second reactance means for each of said first and second reactance values at said given frequency.

3. A circuit for operating a plurality of gaseous discharge tubes, comprising an adjustable inductance means having a first and second value of inductance, a first series circuit comprising a first gaseous discharge tube and a first capacitance means connected in series therewith, a second series circuit comprising a second gaseous discharge tube and second capacitance means connected in series, input means for a source of electric energy of a given frequency, and means for connecting said adjustable inductance means in series with said input means and each of said first and second series circuits, said first and second inductance values of said adjustable inductance means having values relative to the capacitance value of said capacitance means such that said circuit exhibits a net capacitive reactance for each of said first and second inductance values at said given frequency.

4. A circuit for operating a plurality of gaseous discharge tubes, comprising an adjustable inductance means having a first and second value of inductance, a first circuit comprising the series connection of a first gaseous discharge tube, a first capacitance means and a first inductance means, a second circuit comprising the series connection of a second gaseous discharge tube, a second capacitance means and a second inductance means, input means for a source of alternating current of a given frequency, and means for connecting said adjustable inductance means in series with said input means and each of said first and second series circuits, said first and second inductance values of said adjustable inductance means having values relative to the values of said series circuit inductance and capacitance means such that said circuit exhibits a net capacitive reactance for each of said first and second inductance values at said given frequency.

5. Apparatus as described in claim 4 wherein said adjustable inductance means comprises a fixed inductance element and a switch connected in parallel with a portion of said inductance element.

6. A circuit for operating a plurality of gas discharge tubes, comprising an adjustable inductance means, a plurality of gas discharge tubes having first and second electrodes for establishing a discharge current path in said tubes, an individual inductance element and an individual capacitance element connected in series circuit with each of said discharge tube current paths, means connecting each of said series circuits comprising said gas tube, said inductance element and said capacitance element in parallel circuit arrangement with each other, input terminals for a source of alternating current of a given frequency, and means for connecting said adjustable inductance means in series circuit with said input terminals and said parallel circuit arrangement, said adjustable inductance means having a first and second value of inductance relative to the inductance and capacitance values of said series circuit elements such that said circuit exhibits a net capacitive reactance for each of said first and second inductance values at said given frequency, whereby said circuit draws a leading current from said alternating current source.

7. Apparatus as described in claim 6 wherein said adjustable inductance means comprises an inductance element and a switch connected in parallel therewith.

8. Apparatus for adjusting the power consumed in a plurality of gas discharge tubes to a first value and to a second lower value, comprising an adjustable inductance element having first and second values of inductance corresponding to said first and second values of power, respectively, at least two discharge tubes having substantially identical electrical characteristics, a capacitance element and inductance element for each of said discharge tubes, means for connecting each of said tubes in series circuit arrangement with an associated capacitance element and inductance element, input means for a source of alternating current of a given frequency, and means for connecting said adjustable inductance means in series circuit with said input means and each of said series circuit arrangements, said first and second inductance values of said adjustable inductance having values relative to the values of said associated capacitance and inductance elements such that said circuit draws a leading current from said alternating current source at said given frequency.

9. Apparatus as described in claim 8 wherein said adjustable inductance comprises an inductance element and a switch connected in parallel therewith for selectively short circuiting said inductance element, said associated capacitance and inductance elements having values of capacitance and inductance, respectively, such that said discharge tubes consume said lower value of power when said switch short circuits said inductance element.

10. Apparatus as described in claim 8 wherein said second value of inductance is lower than said first value of inductance of said adjustable inductance element, said capacitance element having a capacitance value relative to said adjustable and associated inductance elements such that said circuit exhibits a net capacitive reactance for each of said first and second inductance values at said given frequency, whereby the net reactive impedance of each series combination of adjustable inductance and associated inductance and capacitance elements has a high value for said second value of inductance and a low value for said first value of inductance.


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