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INCANDESCENT LAMP SYSTEM

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FIG. 1

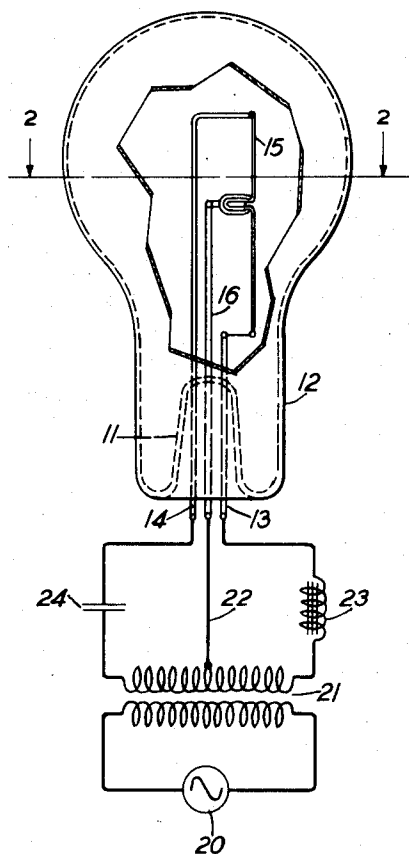


FIG. 2

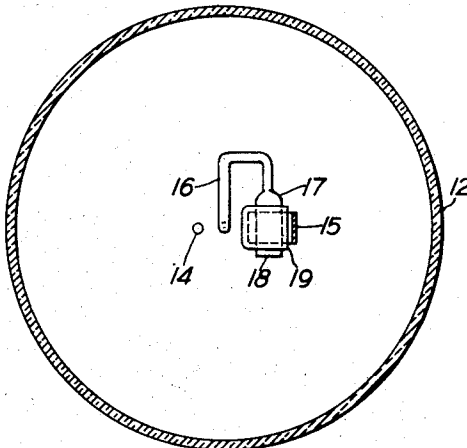


FIG. 3

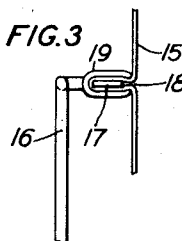
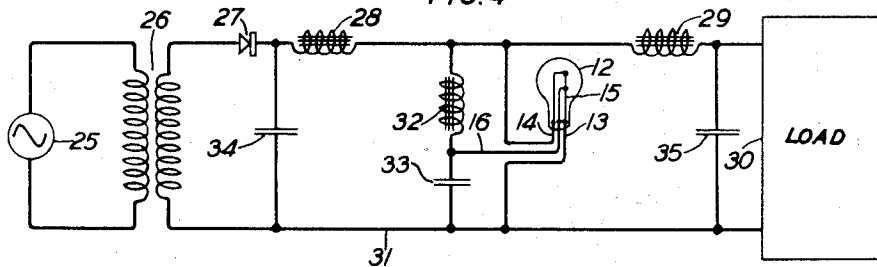


FIG. 4



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INCANDESCENT LAMP SYSTEM

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4 Claims. (Cl. 176—10)

This invention relates to systems for operating incandescent lamps and particularly to a system for operating incandescent electric lamps on rectified alternating current.

5 The object of this invention is to minimize the variation in the light emitted by an electric incandescent lamp operated on rectified alternating current due to the residual ripple in the rectified current.

10 A feature of the invention resides in the use of an electric incandescent lamp having a filament tapped at a central point.

Another feature of the invention resides in the connection of the filament of the lamp in shunt with the filter of the rectifier.

15 Another feature of the invention resides in the provision of means for supplying components of the ripple current approximately in phase opposition to the two sections of the filament.

20 A further feature of the invention is the provision of a series resonant circuit, resonant at the fundamental frequency of the ripple current, for supplying currents in phase opposition to the sections of the filament.

25 Many optical systems require a light source of very constant intensity which has commonly taken the form of an electric incandescent lamp operated by current from a storage battery. Because of the well known disadvantages of a storage battery and the wide distribution of alternating current supplies, in recent developments, the storage battery has been replaced by a rectifier and filter operated by alternating current. It has been found, however, that, unless a rather elaborate filter is employed, a varying component is superimposed on the steady current supplied to the lamp. When a very constant source of light is essential, the variation in the light due to this varying component may be of sufficient magnitude to render unsatisfactory the results obtained.

In accordance with the present invention a rectifier and filter supplies rectified alternating current to an incandescent lamp and any other desired apparatus. The filament of the incandescent lamp is connected in shunt to a section of the filter. An inductor and a capacitor in series are also connected in shunt to the filament of the lamp. The value of the inductance and capacitance is chosen so that the inductor and capacitor form a series resonant circuit resonant at the fundamental frequency of the ripple component of the rectified current. The junction of the inductor and capacitor is connected to the midpoint of the filament of the

lamp so that the ripple currents flowing in the sections of the filament are approximately in phase opposition.

For certain uses, the filament of a lamp of this character must be imaged on a small area. 60 As a result, the tap in the center of the filament must be so made that a dark spot is not caused at the tap, and equal portions of the halves of the filament may be imaged on the area. In a preferred form of lamp, a flat ribbon-like filament is vertically supported in the usual glass envelope. A loop at the center of the filament is formed around a flattened leading-in wire. A resilient, nearly circular spring retains the filament around the leading-in wire, and exerts 70 tension on the two sections of the filament to cause the ends of the sections to be closely adjacent.

While this invention is disclosed as embodied in an incandescent lamp system, it will be apparent to one skilled in the art, that the invention is of wide application. The invention may readily be applied to any element which, when heated by a periodically varying current, emits or causes the emission of radiant energy. The invention is 80 thus applicable to the ordinary thermionic vacuum tube having a filament which, when heated by a varying current, emits electrons. The invention is also peculiarly applicable to the so-called heater-type vacuum tube in which an element heated by a varying current causes the emission of electrons from an indirectly-heated cathode. The invention is also applicable to heated elements, such as the known Nernst glower, which radiate energy when heated by a 90 varying current, but are not necessarily enclosed in an evacuated envelope.

Fig. 1 diagrammatically represents a simplified system embodying a form of the invention.

Fig. 2 represents a sectional view of the lamp 95 shown in Fig. 1 along the plane of the line 2—2.

Fig. 3 is a detail view of the clamp at the center of the filament of the lamp.

Fig. 4 diagrammatically represents a preferred form of the invention.

In Fig. 1 a foot-tube 11 is mounted in an evacuated envelope 12. Leading-in wires 13 and 14 sealed in the foot-tube 11 support a flat filament 15 in a vertical position. The leading-in wires 13 and 14 may be arranged in the usual way to exert 105 a moderate spring tension on the ends of the filament 15. A leading-in wire 16 sealed in the foot-tube 11 is bent horizontally to form a center support for the filament 15. As shown in Fig. 2, the leading-in wire 16 is bent so that the outer end 110

is at right angles to the longitudinal axis of the filament 15. A portion 17 of the outer end of the leading-in wire 16 is flattened in a plane normal to the plane of the filament 15, and the edge 18 of the flattened portion 17 may be tapered. The filament 15 is wrapped around the flattened portion 17 of the leading-in wire 16 and is retained by a resilient clamp 19.

As shown in Fig. 3, the edges of the clamp 19 in contact with the filament 15 may be tapered to a thin edge. The clamp 19 is composed of some material, such as molybdenum, which does not lose its resilience when heated. When the filament 15 is heated, the clamp 19 holds the filament 15 taut and straight and draws the two sections of the filament 15 together so that the dark area in the center of the filament is materially reduced.

In Fig. 1, current from a source of alternating current 20 is applied to the primary winding of a transformer 21. A central tap on the secondary winding of the transformer 21 is connected by wire 22 to the leading-in wire 16. An outer end of the secondary winding of transformer 21 is connected through an inductor 23 to the leading-in wire 13. The other end of the secondary winding of transformer 21 is connected through a capacitor 24 to the leading-in wire 14.

The current flowing from the secondary winding of transformer 21 through inductor 23, leading-in wire 13, lower half of filament 15, leading-in wire 16 and wire 22 may be arranged to lag behind the electromotive force in the secondary winding of transformer 21 by substantially 45 electrical degrees. The current flowing from the secondary winding of transformer 21 through capacitor 24, leading-in wire 14, upper half of filament 15, leading-in wire 16, and wire 22 may be arranged to lead ahead of the electromotive force in the secondary winding of transformer 21 by substantially 45 electrical degrees. Thus, when one half of the filament 15 is emitting the maximum amount of light, the other half of the filament is emitting the minimum amount of light. The total light emitted by equal lengths of the filament 15 above and below the connection with leading-in wire 16 will thus be nearly constant.

In Fig. 4 current from a source of alternating current 25 is supplied to the primary winding of a transformer 26. Current from the secondary winding of the transformer 26 flows through rectifier 27, inductors 28 and 29 to a load 30, returning to the secondary winding of the transformer 26 through wire 31. The load 30 may, for example, be the filaments of a thermionic amplifier. The rectified current flowing to the load 30 will be smoothed by the filter formed by inductors 28 and 29, and the capacitors 34 and 35, but may contain a substantial ripple component.

Current from the secondary winding of the transformer 26 flows through rectifier 27, inductor 28, leading-in wire 14, filament 15 of lamp 12, leading-in wire 13 and wire 31. The shunt path formed by the filament 15 of the lamp 12 will assist in reducing the ripple component in the current flowing in the load 30. The ripple component remaining in the current flowing in

the filament 15 will, however, tend to cause the light emitted by the lamp 12 to vary.

An inductor 32 and capacitor 33 in serial relation are connected in parallel relation to the filament 15. The inductance of the inductor 32 and the capacitance of the capacitor 33 are so chosen that the combination forms a series resonant circuit for the ripple component. The ripple component flowing in the load 30 is materially reduced by this resonant circuit which forms a low impedance shunt for the ripple component.

The junction of the inductor 32 and the capacitor 33 is joined by leading-in wire 16 to the center of the filament 15 of the lamp 12. The ripple components flowing in the two sections of the filament 15 will be in quadrature, as hereinabove described in connection with Fig. 1. The light emitted by the lamp 12 will thus be substantially constant due to the reduction in the ripple component due to the resonant shunt, and the out-of-phase relation of the ripple components flowing in the two sections of the filament 15.

What is claimed is:

1. In combination, a rectifier energized by alternating current, an electric incandescent lamp energized by the output of said rectifier, a resonant circuit comprising a capacitor and an inductor in serial relation in shunt with the filament of said lamp said circuit being resonant to the fundamental frequency of the unrectified component in the output of said rectifier and a connection from the midpoint of said filament to the junction of said capacitor and said inductor.

2. In combination, a rectifier energized by alternating current, a filter on the output of said rectifier including inductive series elements, capacitive shunt elements and a resonant shunt element comprising a capacitor and an inductor in serial relation said shunt element being resonant to the fundamental frequency of the unrectified component in the output of said filter, an electric incandescent lamp having its filament in parallel relation to said resonant shunt element, and a connection from the midpoint of said filament to the junction of said capacitor and said inductor.

3. In combination, a rectifier energized by periodically varying current, a radiant element heated by the output of said rectifier, an inductor and a capacitor in serial relation connected in parallel relation with said radiant element, and a connection from the junction of said capacitor and said inductor to a point intermediate the ends of said radiant element.

4. In combination, a rectifier energized by periodically varying current, a radiant element connected to the output of said rectifier, an inductor and a capacitor in serial relation connected in parallel relation with said radiant element, said inductor and said capacitor being resonant to the fundamental frequency of the unrectified component in the output of said rectifier and a connection from the junction of said capacitor and said inductor to a point intermediate the ends of said radiant element.

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