Sept. 15, 1970 P. C. WEBB 3,529,207

FLUORESCENT LAMP CONTROL

Filed April 18, 1968

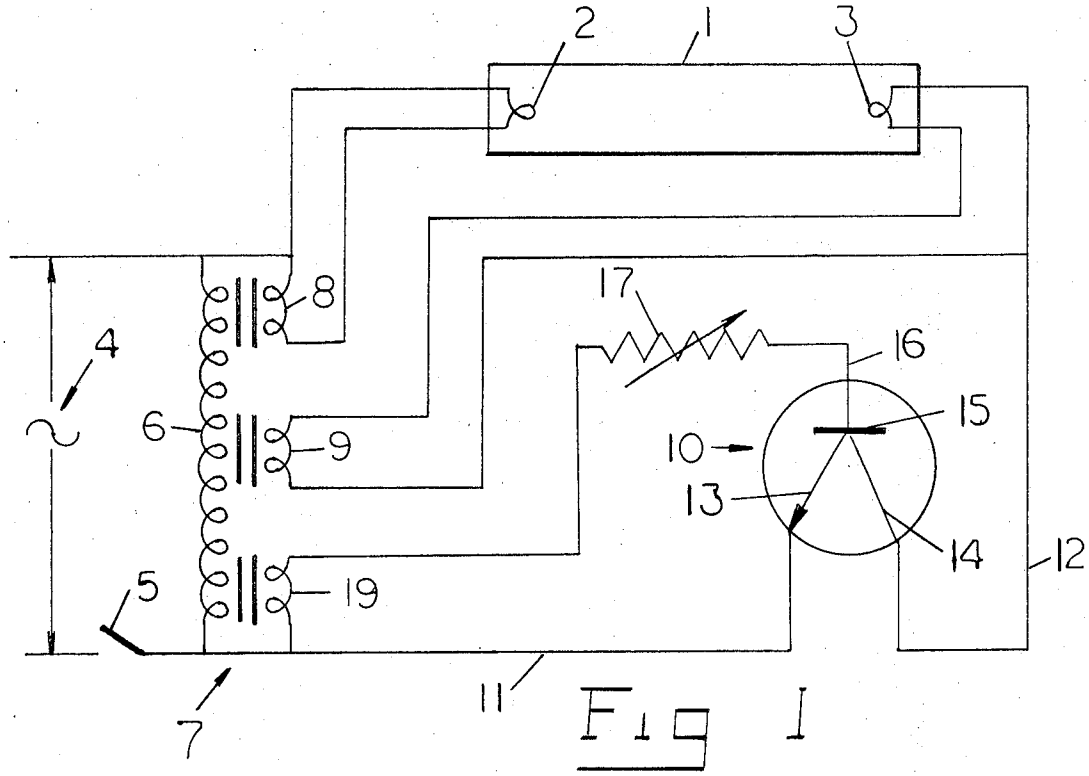


Fig 1

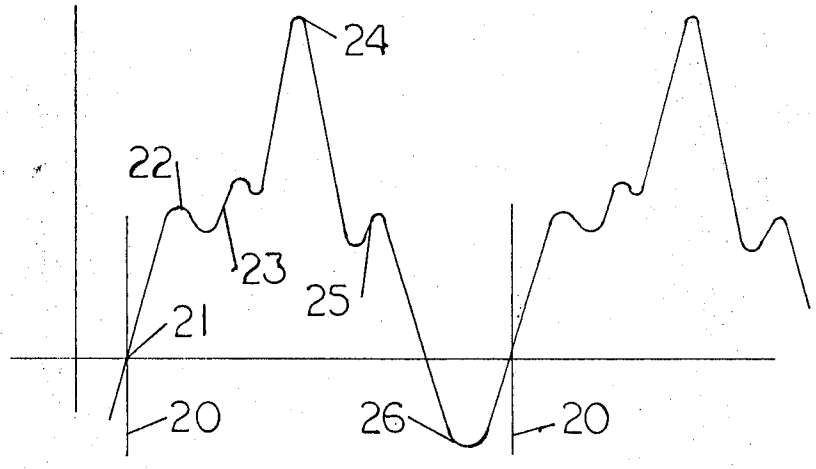


Fig 2

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United States Patent Office 3,529,207
Patented Sept. 15, 1970

3,529,207

FLUORESCENT LAMP CONTROL

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Filed Apr. 18, 1968, Ser. No. 722,440
Int. Cl. H05b 39/00
U.S. Cl. 315—94 6 Claims

ABSTRACT OF THE DISCLOSURE

A fluorescent lamp having heated filaments energized by separate coils which are in turn energized at different potentials from a power supply transformer, a transistor connected in series in a regulating conductor of one filament with the emitter connected to the power source and the collector of the transistor connected to the filament, and a control resistor connected between the base of the transistor the same side of the power supply as the regulating conductor through a biasing coil in the transformer.

OUTLINE OF INVENTION

The transistor is substituted for the usual current limiting ballast of fluorescent lights. A biasing connection to a control terminal of the transistor automatically regulates the transistor to pass the necessary high starting voltage to the lamp, and reduce the operating current and voltage in the lamp, when the internal resistance of the lamp is reduced as the lamp starts. The biasing connection to the transistor includes a resistor, which may be variable and used as a brightness control for the lamp, and a secondary coil of the power supply transformer of the lamp.

Unexpectedly, the transistor is conducting on both cycles of alternating current applied to the transistor and its biasing connection, so oppositely connected transistors are not required to provide substantially continuous energization of the lamp.

The drawings, of which there is one sheet, show a preferred form of the control circuit connected to a fluorescent lamp.

FIG. 1 is a schematic wiring diagram of the connections to a fluorescent lamp with the control elements of the invention connected thereto.

FIG. 2 is a diagrammatic view showing the wave form of the current flowing through the lamp during operation.

The diagram shows the tubular envelope **1** of a fluorescent lamp with filaments **2** and **3** in its ends. An alternating current source indicated at **4** is selectively connectable by the switch **5** to the primary **6** of a transformer indicated generally at **7**. One secondary winding **8** of the transformer is connected to one side of the power source and to filament **2**. Another secondary winding **9** is connected to the other filament **3** and is connected through a transistor **10** to the opposite side of the power source through conductors **11** and **12**.

The conductor **11** connects between the emitter **13** of the transistor and the opposite end of the primary winding **6**. The conductor **12** connects between the collector **14** of the transistor and one side of the winding **9** and the filament **3**. Together, the conductors **11** and **12** constitute a regulating conductor for filaments **3** and the lamp.

The base **15** of the transistor is connected by the conductor **16** to a resistor **17**, which may be variable. The resistor is connected by conductor **18** in series with a third coil **19**, which is connected to conductor **11** and the power source.

In operation of the lamp and its control, closing of the

switch **5** provides heater current to the filament **2** at the alternating potential of one side of the power source. The other filament **3** is supplied with an approximately equal heating current by the winding **9**. However, the potential of the filament **3** relative to the filament **2** is determined by the action of the transistor **10** and its control base **15**. Generally, the absolute potential of filament **3** will approximate the alternating potential of the opposite side of the power source from filament **2**; so that an operative potential is created between the filaments **2** and **3** considered as opposite electrodes of the lamp **1**. The alternating potential of the side of the power source connected to switch **5** acts, in conjunction with current flow through conductors **11** and **12**, to modulate and integrate the potentials and currents transmitted by the transistor, so that the resultant current through the lamp varies as is indicated graphically in FIG. 2. The current through the lamp **1** does not vary in the same sinusoidal manner as the ordinary commercial alternating current such as is applied o the primary winding **6**. Neither does the transistor act as a half wave rectifier to create intermittent voltage and current between the filaments. Instead, the current through the lamp **1** varies as shown by the graph in FIG. 2.

Considering the cycle of ordinary sixty cycle commercial current to be indicated by the lines **20** in FIG. 2, the resultant current in the lamp **1** rises from zero at **21** to an intermediate peak **22**, followed by a small fluctuation **23**. Following the fluctuation, the lamp current rises to a sharp and higher peak or positive value at **24**. The current then falls rapidly to a second low, but still positive fluctuation, indicated by the dip **25**. From this point the current decreases through zero to a negative peak **26**. The cycle is completed by a rise (decrease of negative value) to the zero starting value. This cycle of current maintains practically constant transmission or emission between the filaments **2** and **3**, and at the standard of sixty cycle commercial current provides illumination without noticeable flicker.

The following specific values or factors in the circuit provide an installation of a currently standard 40 watt F–40 type of fluorescent lamp in a 240 volt supply line. The windings **8** and **9** provide a heater voltage to the filaments **2** and **3** of 6.3 volts, which is somewhat higher than the 5 volts recommended for F–40 type lamps.

The resistor **17**. if variable, will start and operate the lamp at 10,000 ohms, with a resultant brightening of the lamp. A fixed 8,000 ohm, 10 watt resistor starts and operates the lamp satisfactory, but with the development of considerable heat or lost energy in the resistor. The transistor may be of the type identified by the designation DTS–423. Winding **19** provides a biasing voltage of 6.3 volts to the base **15** through conductors **18** and **16** to the transistor. The third winding **19**, in conjunction with resistor **17** provides a control voltage of about 7 volts between the base **15** and the emitter **13** of the transmitter.

What is claimed as new is:

1. A control for a fluorescent lamp having spaced filaments comprising,

a transformer having a primary winding adapted to be connected to a source of alternating current,

a first secondary winding in said transformer connected to one side of said primary winding and having terminals adapted to be connected to the ends of a first of said filaments,

a second secondary winding in said transformer having terminals adapted to be connected to the ends of the other of said filaments,

a transistor having base, emitter and collector terminals,

a regulating conductor connecting said second second-

ary winding to the opposite side of said primary winding from said first secondary winding,

said regulating conductor having two sections connected in series through said emitter and said collector terminals of said transistor,

and a control circuit including a resistor connected between the base of said transistor and the other side of said primary winding from said first secondary winding,

said control circuit extending through a secondary winding of said transformer.

2. A control as defined in claim 1 in which said resistor is variable.

3. A control as defined in claim 2 in which said variable resistor has both minimum and maximum resistances of finite values.

4. A control as defined in claim 1 in which said second secondary winding is connected to said regulating conductor between a terminal connection to said other of said filaments and said transistor.

5. A control as defined in claim 4 in which there is a third secondary winding in said transformer,

said third winding being connected in series with said resistor in said control circuit.

6. A control as defined in claim 5 in which said secondary windings supply voltages between 5 and 7 volts, and in which said resistor is variable between 5,000 and 10,000 ohms.

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U.S. Cl. X.R.

315—98, 105, 106, 107, 278, 272