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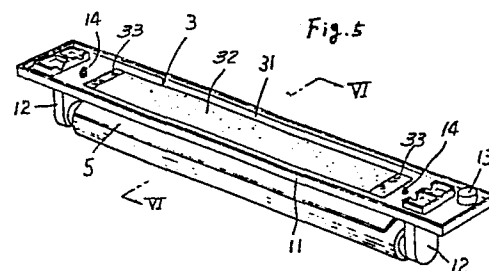
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54 **Ballast stabilizer for discharge lamps and lighting circuit using the same.**

57 A ballast stabilizer for a fluorescent discharge lamp (1) is made of an electrically resistive material layer (32) disposed on a base plate (31). The base plate (31) may be of insulating material and form part of the appliance body (11), particularly the lamp holder. Such a ballast stabilizer has a comparatively large area with the result that heat dissipation during operation of the lamp is improved and temperature rise is held at a minimum. At the same time, the ballast stabilizer requires practically no extra space and can be produced at low cost.



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Ballast Stabilizer for Discharge Lamps
and Lighting Circuit Using the Same

This invention relates to a ballast stabilizer for discharge lamps and to a lighting circuit using said ballast stabilizer.

To light a fluorescent lamp in a stabilized manner,
5 it is necessary to install in the lamp power supply circuit a ballast stabilizer which limits the discharge current to its specified value or less.

Conventional ballast stabilizers of this type are mostly in the form of choke coils, which are bulky and
10 heavy and which cause so high a rise in temperature owing to their heat generation during the lighting of the lamp

that it is necessary to provide a sufficient space for heat dissipation between the choke coil and other parts, limiting the place available in the fluorescent lamp appliance for installing the ballast
5 stabilizer, thus resulting in the disadvantage of imposing various restrictions on the engineering and aesthetic desing of the fluorescent lamp appliance.

Besides the aforesaid type of ballast stabilizers, use has heretofore been made of incandescent lamps or
10 resistance wires; in each case, however, it is necessary to add thereto a discharge starting circuit comprising such electronic parts as expensive transistors, resulting in an increase in cost. Moreover, in the case of the former, the fluorescent lamp appliance must of necessity
15 be used with an incandescent lamp, while in the case of the latter since ballast stabilizer is in the form of a mere resistance wire, it is difficult to handle and is inconvenient for the maker to build it into the appliance.

This invention has been accomplished to overcome the
20 drawbacks described above and will now be described with reference to the drawings showing embodiments thereof.

In the drawings,

Fig. 1 is a circuit diagram for a discharge lamp lighting circuit according to a first form of this invention;

5 Fig. 2 is a perspective view showing an example of a ballast stabilizer used in said lighting circuit;

Fig. 3 is a section taken along the line III-III in Fig. 2;

Fig. 4 is a perspective view of a fluorescent lamp
10 appliance using the lighting circuit of Fig. 1;

Fig. 5 is a perspective view looking at said appliance from a different position;

Fig. 6 is an enlarged section taken along the line VI-VI in Fig. 5;

15 Fig. 7 is a sectional view of a fluorescent lamp appliance wherein an auxiliary electrode is fabricated to serve as a reflector hood; and

Fig. 8 is a circuit diagram for a discharge lamp lighting circuit according to a second form of the
20 invention.

The numeral 1 denotes a fluorescent discharge lamp (hereinafter referred to briefly as the fluorescent lamp) having one electrode F_1 connected to one pole of an AC power source 4 through the secondary winding 2_1 of an

autotransformer 2 connected in series with a ballast stabilizer 3, the other electrode F_2 being connected to the other pole of the AC power source 4. The terminal a of the secondary winding 2_2 of the autotransformer 2 is :
5 connected to an auxiliary electrode 5 disposed in contact with or close to the outer wall surface of the fluorescent lamp 1. Further, the fluorescent lamp 1 has a glow lamp 6 connected in parallel therewith.

The aforesaid ballast stabilizer 3 is constructed
10 as follows.

A base plate 31 made of an insulating material, such as glass, epoxy resin or Bakelite, has an electrically resistive material, such as carbon type resistive paint, applied thereto as by printing, spraying or other means,
15 said electrically resistive material being hardened by heating to form an electrically resistive material layer 32. In this case, the electrically resistive material is applied to the base plate 31 everywhere except its opposite end portions, to which an electrically conductive material,
20 such as silver, is applied to form terminals 33, 33.

In the above case, the base plate 31 is made of a heat-resistant insulating material, but depending upon the type of the electrically resistive material, it may be applied without involving heat treatment, in which case
25 it is not always necessary to form the base plate 31 of an

insulating material which withstands such heat treatment temperature. The base plate 31 is a flat plate, but it may be a curved plate, of course.

It goes without saying that the size of the ballast
5 stabilizer 3 is such that it can be received in the
fluorescent lamp appliance. Thus, the length and width
of the base plate 31 are so determined that it can be
housed in the appliance. The type and amount of the
electrically resistive material to be applied to the
10 base plate 31 are suitably selected to provide the
specified value of electric resistance.

In addition, the way the electrically resistive
material layer 32 is formed on the base plate 31 is not
limited to the methods mentioned above; for example,
15 vapor deposition and other means may be used.

The autotransformer 2 should have a satisfactory
operating characteristic in the high frequency band;
usually, it has a size of about 2 cm³. For example, Model
SF-2A manufactured by Nippon Electric Company, Ltd., which
20 has said size, is used.

In operation when the AC power source 4 is turned on,
the glow lamp 6 is energized by one pole of the AC power
source 4 through the primary winding 2₁ of the autotrans-
former 2, and one electrode F₁ of the fluorescent lamp 1
25 on one hand and by the other pole of the AC power source

through the other electrode F_2 of the fluorescent lamp 1 on the other hand, so that the glow discharge in the glow lamp 6 is started. As a result, the electrodes F_1 and F_2 of the fluorescent lamp 1 are preheated, and the
5 subsequent ceasing of the glow discharge causes a transient current to flow through the primary winding 2_1 of the autotransformer 2, so that a stepped-up high voltage is produced in the secondary winding 2_2 . Since this high voltage is applied between one pole F_1 of the fluorescent
10 lamp 1 and the auxiliary electrode 5, the discharge is started between the two electrodes F_1 and F_2 , producing a discharge current flowing through the ballast stabilizer 3.

An experiment on lighting will now be described.
15 In this case, the ballast stabilizer 3 was constructed by applying a carbon type resistive paint to a 3-cm wide and 58-cm long base plate 31 of epoxy resin everywhere except the opposite end portions each of which measures 2 cm, applying a silver paint to the opposite end
20 portions to provide terminals 33, 33, and heating these paints at 150°C for 4 hours to harden them, the resulting resistance being about 180Ω . A 20-watt fluorescent lamp 1 and a 100-V AC power source were used. When the power source was turned on, a discharge current of about 330 mA flowed
25 through said ballast stabilizer 3. The ballast stabilizer

3 never became heated so much as to exceed 60°C. The stability of the discharge current during lighting was as good as when the conventional ballast stabilizer was used.

5 In the fluorescent lamp lighting circuit described above, the glow lamp 6 may be replaced by a negative-resistance element (e.g., one manufactured by Mitsubishi Electric Corporation) while retaining the same result as described above.

10 Figs. 4-6 show an example of a fluorescent lamp appliance using the aforesaid lighting circuit, wherein the appliance body 11 is formed of a plate with its end edges bent upward. Although the ballast stabilizer 3 has been described as being formed by providing the
15 electrically resistive material layer 32 on the base plate 31 which is separate from the appliance body 11, it is possible to use the appliance body 11 itself as a base plate and form the electrically resisting material layer 32 thereon. If the appliance body 11 is an electrically
20 conductive plate, this invention may be embodied by forming an insulating layer of enamel or the like on the upper surface of the plate and superposing an electrically resistive material layer 32 on said insulating layer. The auxiliary electrode 5 is in the form of an aluminum
25 plate disposed between the appliance body 11 and the

fluorescent lamp 1. If said auxiliary electrode 5 is widened, it may serve as a reflector hood, as shown in Fig. 7. In addition, 12, 12 denote the sockets of the discharge lamp 1; 13 denotes the socket of the glow lamp; 14, 14 denote set screws for attaching the auxiliary electrode 5 to the appliance body 11; and 15, 15 denote coil springs interposed between the appliance body 11 and the auxiliary electrode 5.

Fig. 8 shows a lighting circuit using said ballast stabilizer 3 according to another embodiment of the invention, wherein one electrode F_1 of a fluorescent lamp 1 is connected to one pole of an AC power source 4, while the other electrode F_2 is connected to the other pole of said AC power source 4 through a triac 25, which is a switching element, and the ballast stabilizer 3 connected in series with the latter. The numeral 22 denotes a step-up autotransformer with its primary winding 22_1 connected to the AC power source 4 through the ballast stabilizer 3 and its secondary winding 22_2 having its output terminal b connected to the electrode F_2 of the fluorescent lamp 1 through a series combination of resistors R_1 and F_2 . The numeral 26 denotes a diac connected between the junction between the resistors R_1 and R_2 and the gate of the triac 25. The numeral 27 denotes a preheating transformer with its primary winding 27_1 connected to the

AC power source 4 through said ballast stabilizer 23 and its secondary windings 27_2 , 27_2 connected to the electrodes F_1 and F_2 of the fluorescent lamp 1, respectively.

In operation, when the AC power source 4 is turned
5 on, the preheating transformer 27 provides preheating currents flowing through the electrodes F_1 and F_2 of the fluorescent lamp 1, while the autotransformer 22 applies a stepped-up voltage, which is higher than the usual discharge voltage, to the fluorescent lamp through
10 the resistors R_1 and R_2 , so that the fluorescent lamp 1 is immediately lighted, with the discharge current flowing through the resistors R_1 and R_2 . The resulting voltage drop due to the resistor R_2 yields a trigger signal applied to the triac 25 through the diac 26, thus firing the triac
15 25. As a result, the power supply circuit to the fluorescent lamp 1 is completed, supplying the specified discharge current through the ballast stabilizer 3.

During the lighting of the fluorescent lamp 1, a current flows through the resistors R_1 and R_2 in a circuit
20 separate from the aforesaid power supply circuit; however, since said resistors R_1 and R_2 are of tens of K Ω , the power loss due to the resistors R_1 and R_2 are very small.

In the lighting circuit described above, one or both of the resistors R_1 and R_2 may be replaced by a
25 capacitor or capacitors of about 0.1 μF , and it is also

possible to replace the triac 26 by a resistor.

Thus, the lighting circuit according to the second embodiment of the invention is designed to initiate the discharge by applying a voltage higher than the usual
5 discharge voltage to the electrodes of the fluorescent lamp at the time of lighting. This means that a rapid-start type lighting circuit can be provided.

Since the ballast stabilizer of this invention is formed by forming the electrically resistive material
10 layer 32 on the base plate 31, as described above, it is in the form of a plate, light in weight and less bulky.

Further, since the ballast stabilizer 3 has the electrically resistive material layer 32 whose surface area is much larger than that of a resistance wire, the
15 characteristic of heat dissipation during heating is improved, so that its temperature rise during lighting can be reduced to a minimum.

Further, since the ballast stabilizer 3 is formed by providing the electrically resistive material layer
20 32 on the base plate 31, it can be produced with ease and at low cost.

Where said ballast stabilizer 3 or 23 is used in forming a lighting circuit, since the ballast stabilizer 3 or 23 itself is light in weight and less bulky and
25 since that space between it and an adjacent part which

is required for heat dissipation can be reduced, the discharge lamp appliance can be made light in weight and small in size and the engineering and esthetic design thereof can be diversified as well. Particularly
5 where it is used in a lighting circuit for a multi-lamp appliance, the latter can be easily designed to have a well-balanced external appearance.

The ballast stabilizers 3 and 23 can be offered at low prices, and since they are in plate form, they
10 are easy to handle and to install in discharge lamp appliances, the number of installing steps being reduced. Since they allow the use of autotransformers which can be produced at low costs, it is possible to reduce the costs of the lighting circuit and the discharge lamp
15 appliance.

Further, there is no humming sound during lighting, such as produced by a ballast stabilizer comprising a choke coil, and moreover the power factor is improved.

CLAIMS:

1. A ballast stabilizer for discharge lamps, comprising an electrically resistive material layer (32) formed on a base plate (31).
2. A ballast stabilizer for discharge lamps as set forth in claim 1, wherein said base plate (31) is made of insulating material.
3. A ballast stabilizer for discharge lamps as set forth in claim 1, wherein said base plate (31) is in the form of an electrically conductive plate having an insulating layer formed thereon, and said electrically resistive material layer (32) overlies said insulating layer.
4. A lighting circuit for discharge lamps, comprising a power supply circuit in the form of a series combination of a ballast stabilizer (3) as set forth in any of claims 1 to 3, the primary winding (2₁) of an autotransformer (2), and a discharge lamp (1), a circuit for applying the output from the secondary winding (2₂) of said autotransformer (2) to an auxiliary electrode (5) disposed in contact with or close to the outer wall surface of said discharge lamp (1), and for

cutting off preheating current to said discharge lamp
(1).

5. A lighting circuit for discharge lamps as set forth
in claim 4, wherein said electrically conductive plate
5 is a component of the discharge lamp appliance.

6. A lighting circuit for discharge lamps as set forth
in claim 4 or 5, wherein said auxiliary electrode (5)
is in the form of a reflector hood for the discharge
lamp appliance.

10 7. A lighting circuit for discharge lamps, comprising
a power supply circuit having a series combination of
a ballast stabilizer (3) as set forth in any of claims
1 to 3, a switching element, and a discharge lamp (1),
a circuit for applying to said discharge lamp a voltage
15 higher than the discharge voltage thereof, and a
circuit for rendering said switching element conductive.

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Fig. 1

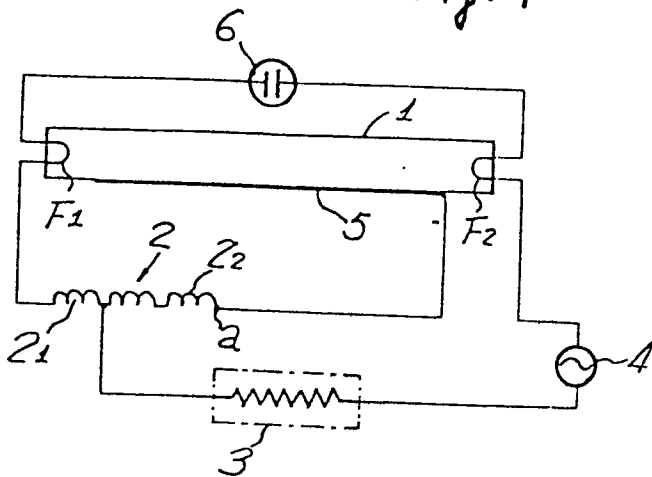


Fig. 2

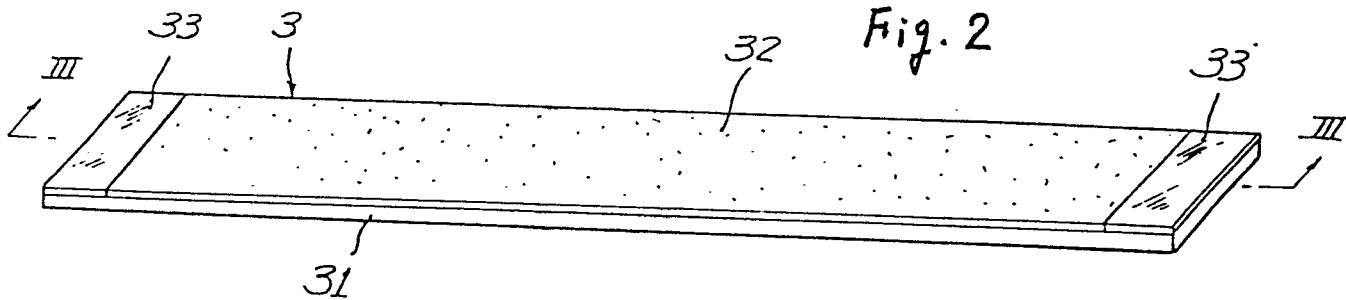
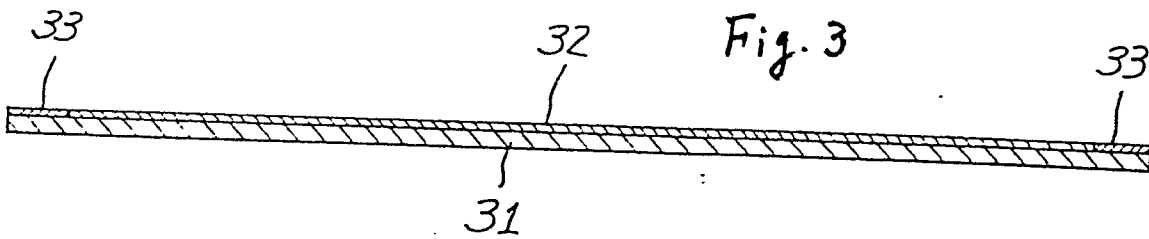


Fig. 3



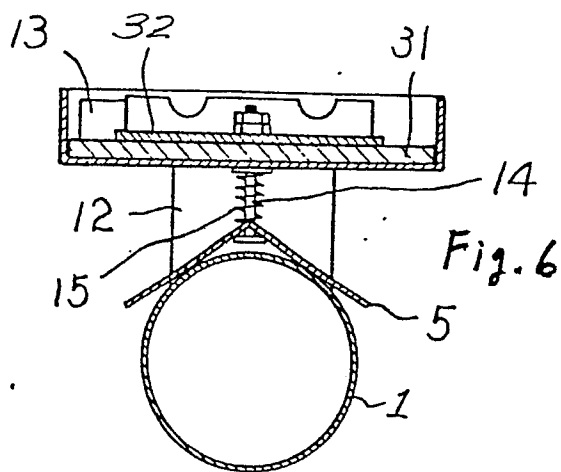
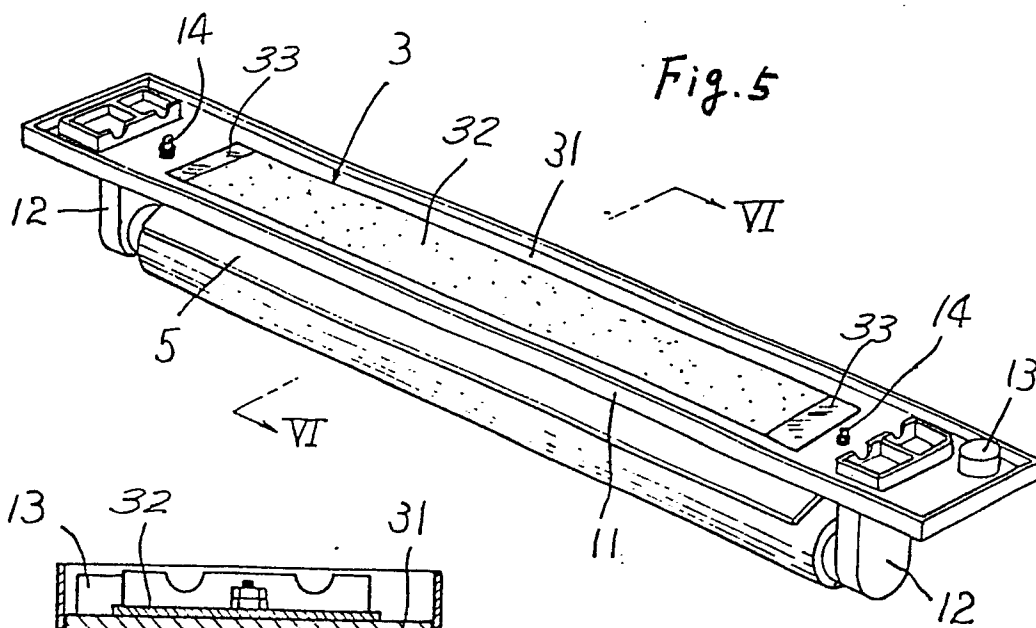
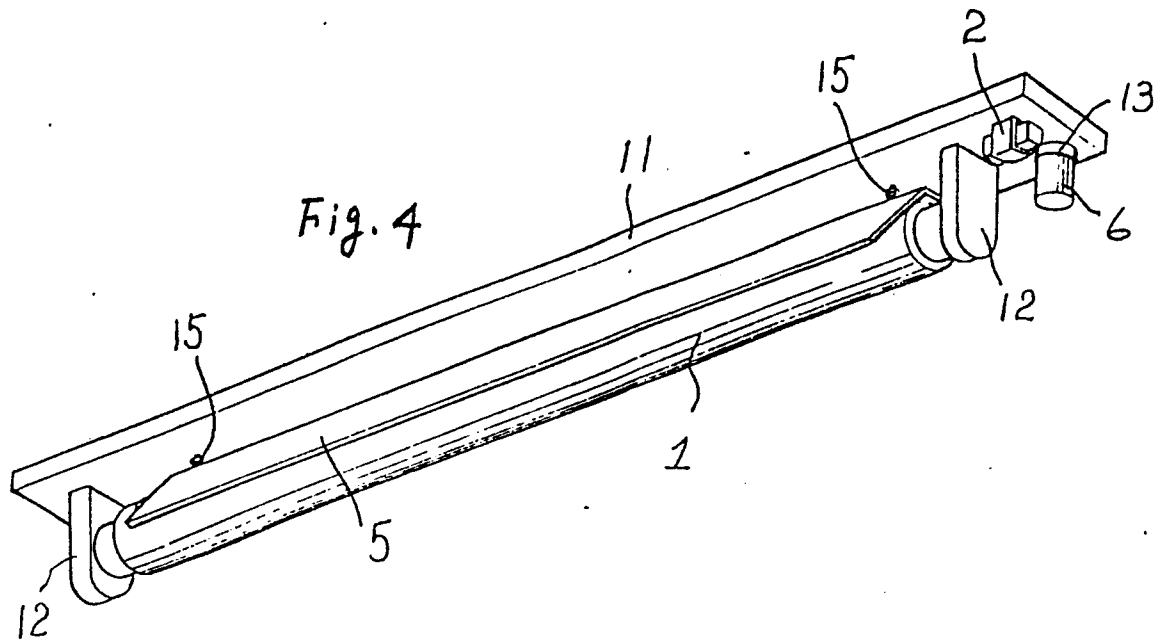


Fig. 7

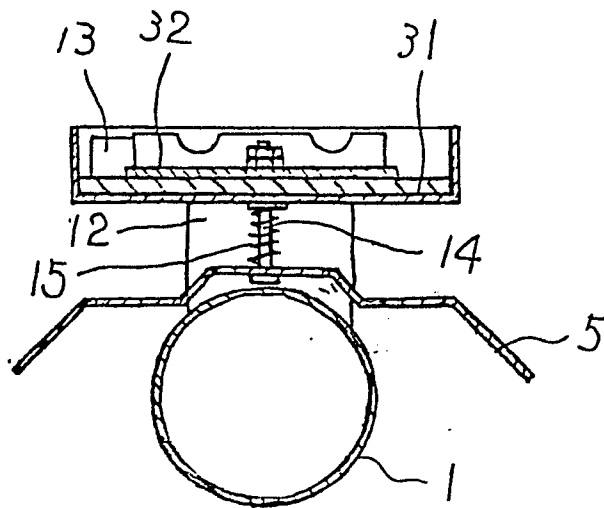
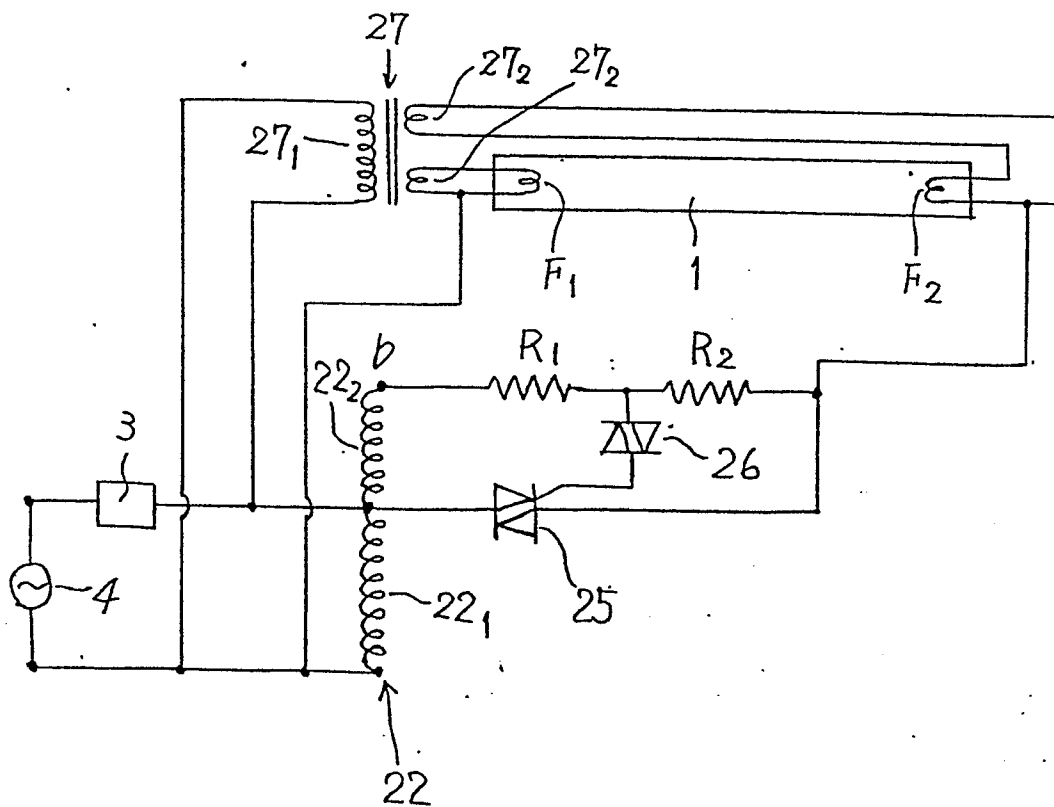


Fig. 8





DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
X	GB-A-1 187 280 (GENERAL ELECTRIC) * Page 1, lines 53-67; figure 1 *	1,2,4	H 05 B 41/14
X	US-A-4 092 562 (GENERAL ELECTRIC) * Column 2, line 41 - column 3, line 7; figure 2 *	1,2,4	
Y	FR-A-1 477 257 (SAIE) * Page 1, right-hand column, lines 10-35; figure 1 *	3	
			TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
			H 05 B 41/00
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 19-09-1983	Examiner DUCHEYNE R.C.L.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			