

UNITED STATES PATENT OFFICE

2,012,238

LUMINOUS TUBE AND CIRCUIT

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7 Claims. (Cl. 176—124)

This invention includes the art of luminous tubes.

It relates specifically to the art of arc-discharge luminous tubes. Such tubes require current-limiting means in series therewith in order to prevent the development of a runaway arc and my invention provides a novel utilization of such current-limiting means where the latter develops magnetic flux as in operation of such tubes on alternating current.

Another object of my invention is to generate incandescent light in a highly efficient manner to be blended with the light radiated by a gas under the influence of an electric discharge.

Another object is to generate in a highly efficient manner energy to heat the thermionic cathodes of gas discharge tubes.

Other objects and advantages will be apparent hereinafter.

For illustrative purposes reference may be had to the accompanying drawing, it being understood that the invention is illustrated but not limited by the drawing and the description thereof.

Supply terminals 1, 2 and 3 of a three wire 220 volt supply deliver alternating current to corresponding terminals 1' and 3'. Terminal 1' is connected to anode 5 of tube 1 through ballast 4. Terminal 2' is connected to anode 7 through ballast 6. Cathode 8 of tube 1 is connected to the neutral or ground 3 of the three wire system through wires 9 and 10. Cathode 8 is coated with an activated thermionic substance and is heated by resistance. The current for this purpose may be supplied by coil 11 which is wound on core 12 of a transformer (switch 26 being then closed). Coil 11 is a secondary coil and is closely interlinked with primary coils 4 and 6. Another secondary coil 14 likewise receives magnetic flux from primary coils 4 and 6 and lights an incandescent lamp 15.

The tube 16 has similar connections, like numerals designating like parts.

If desired, cathode 8 of tubes 1 and 16 can be heated during operation of tubes 1 and 16 from an independent source such as transformer 22 through wires 20 and 21 (switch 24 being then closed) and in that case secondary coils 11 can be used to light additional incandescent lamps or employed to generate induced current for other purposes. Or, transformers 22 can be operated to heat cathodes 8 only until the tubes are "lighted" or rendered operative and thereafter heating current from the transformer 22 can be shut off by opening switch 24 and heating of the cath-

odes during operation of the tubes effected by coils 11.

Broadly, the respective tubes 1 and 16 or either of them may contain any gas and/or vapor capable of radiating light during a period of useful commercial life under the influence of an electric discharge. For example, tube 1 may contain neon and the incandescent light 15 may be used to effect a partial correction of the neon radiation and supply some of the wave lengths not found in the neon spectrum; or the tube 1 may contain mercury with or without a rare gas.

The tubes may be operated as follows:

First cathodes 8 coated with an activated thermionic substance are brought to an emissive temperature by current supplied from transformers 22 (switch 24 being then closed). Discharge potential is then applied to anodes 5 and 7 and cathodes 8 respectively and ionizing energy such as an externally applied high frequency discharge is applied by the device conventionally designated as 18. (In my copending application Ser. No. 659,803 filed on even date herewith I describe a means of applying ionizing energy to a gas discharge tube and I preferably employ that means. Said application is herewith incorporated by reference and made a part hereof.) An arc discharge then occurs through each leg of the double anode tube 1 (or 16). For example a discharge occurs from 1' through ballast 4, from anode 5 to cathode 8 and back to the neutral wire 3. Discharge also occurs from 2' through ballast 6, from anode 7 to cathode 8, and back to neutral wire 3. Alternating current passing through the respective coils 4 and 6 generates magnetic flux which interlinks with coil 14 on core 12 and induces current in coil 14 which lights incandescent lamp 15. Flux also interlinks with secondary coil 11 and generates current which heats thermionic cathode 8. For this purpose switch 26 must be closed and switch 24 can then be opened.

Thus the ballasts 4 and 6 simultaneously perform two important functions. They limit the current in the arc discharge tubes in series therewith and generate current which may be utilized as described.

From this point of view my invention therefore includes an arc discharge tube adapted to radiate light by the discharge of electricity through it, and current-limiting means comprising the primary coil of a transformer. Except for transformer losses, all the energy that otherwise would be dissipated in waste heat by said current-limiting means may by my invention be transformed

means to create additional incandescent radiation sufficient to make the total incandescent radiation about equal to the amount of light radiated by the mercury tube.

- 5 4. A luminous arc discharge tube containing neon, a second luminous arc discharge tube containing mercury and a gas selected from the group consisting of argon, krypton and xenon, the mercury tube having an envelope that intensifies the green wave lengths in the mercury light
10 said mercury light during operation of the tubes radiating from about 3.5 to 4.5 times as much light as the neon tube, current carrying means in series with each tube which means generates
15 magnetic flux when a discontinuous current is passed through said means, means to convert said flux into energy which acts as ballast for said tube during operation thereof and also is converted into incandescent radiation which is
20 blended with the light from the neon and mercury tubes, and means to create additional incandescent radiation sufficient to make the total incandescent radiation about equal to the amount of light radiated by the mercury tube.
- 25 5. Means to discharge an electric current through a column of a substance which in the gaseous phase emits light in which blue and green radiations predominate under the influence of an electric discharge said means constituting a first source of light, means to discharge an electric current through a column of
30 a substance which in the gaseous phase emits light in which red radiations predominate under the influence of an electric discharge said means constituting a second source of light, means to control the current discharged through the respective columns at least one of said control means comprising current carrying means which generates magnetic flux when a discontinuous
35 current is passed through the said means at least one incandescent filament in an envelope separate from the envelope of the discharge tube and means to convert the flux capable of being generated by said current carrying means into current which during operation heats the incandescent filament to incandescence thereby generating a significant proportion of incandescent

light which is blended with the light from said first and second sources.

6. Means to discharge an electric current through a column of a substance which in the gaseous phase emits light in which blue and green radiations predominate under the influence of an electric discharge said means constituting a first source of light, means to discharge an electric current through a column of a substance which in the gaseous phase emits light in which red radiations predominate under the influence of an electric discharge said means constituting a second source of light, means to control the current discharged through the respective columns at least one of said control means comprising current carrying means which generates magnetic flux when a discontinuous current is passed through the said means at least one incandescent filament in an envelope separate from the envelope of the discharge tube and means to convert the flux capable of being generated by said current carrying means into current which during operation heats the incandescent filament to incandescence thereby generating a significant proportion of incandescent light which is blended with the light from said first and second sources.

7. Means to discharge an electric current through a column of mercury said means constituting a first source of light, means to discharge an electric current through a column of neon said means constituting a second source of light, means to control the current discharged through the respective columns at least one of said control means comprising current carrying means which generates magnetic flux when a discontinuous current is passed through the said means at least one incandescent filament in an envelope separate from the envelope of the discharge tube and means to convert the flux capable of being generated by said current carrying means into current which during operation heats the incandescent filament to incandescence thereby generating a significant proportion of incandescent light which is blended with the light from said first and second sources.

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Aug. 20, 1935.

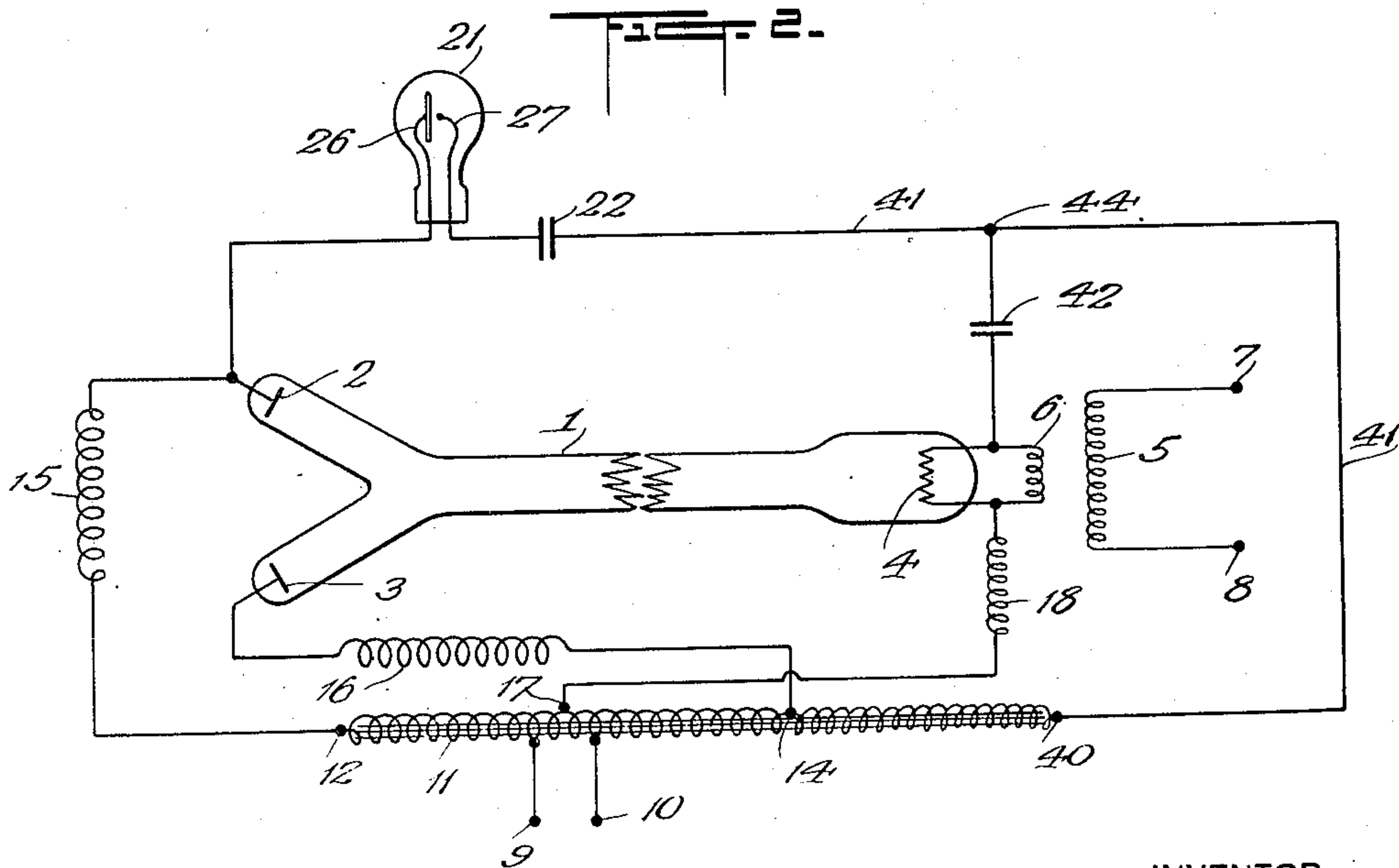
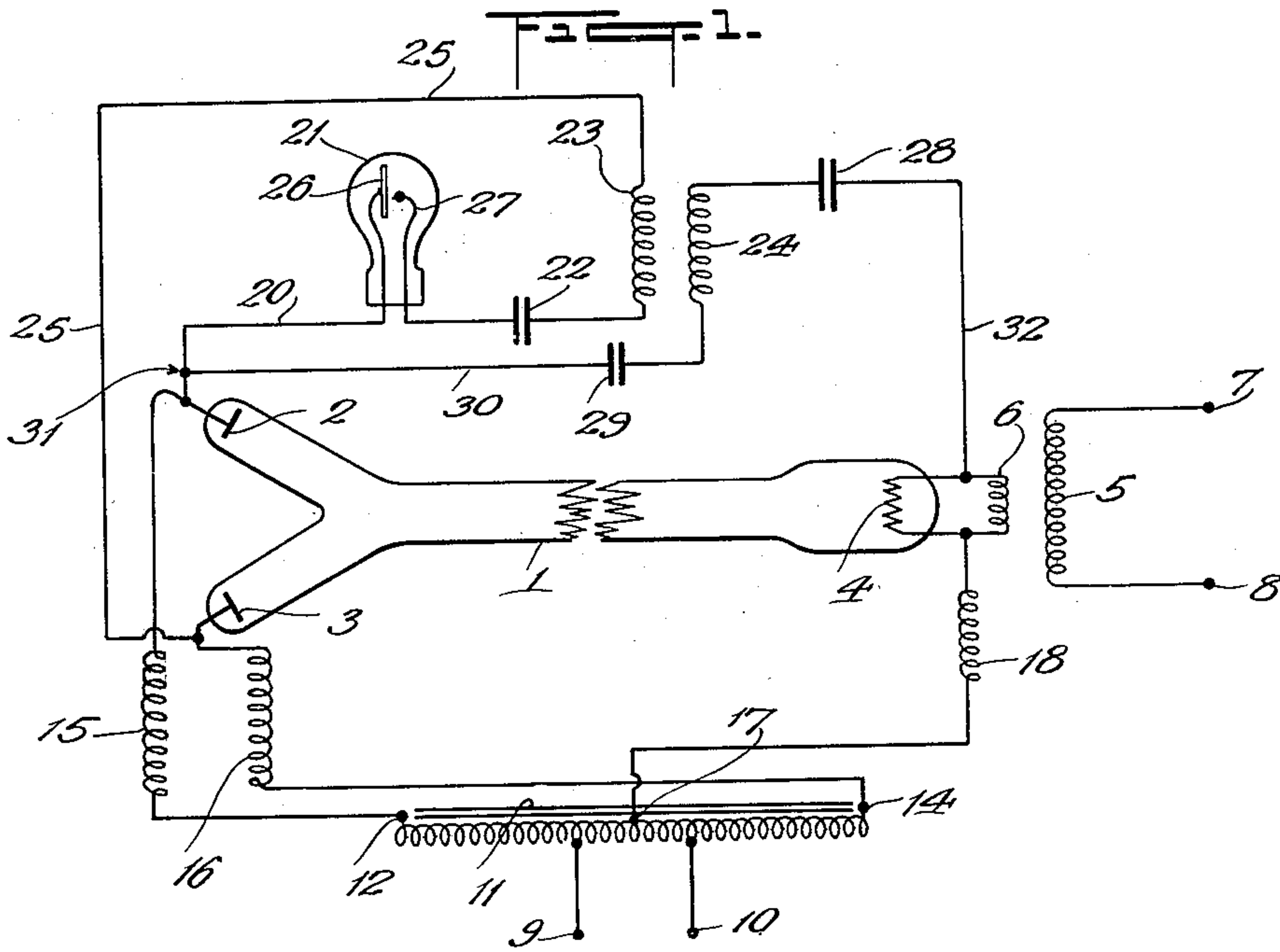
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LUMINOUS TUBE STARTING DEVICE

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2 Sheets-Sheet 1



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