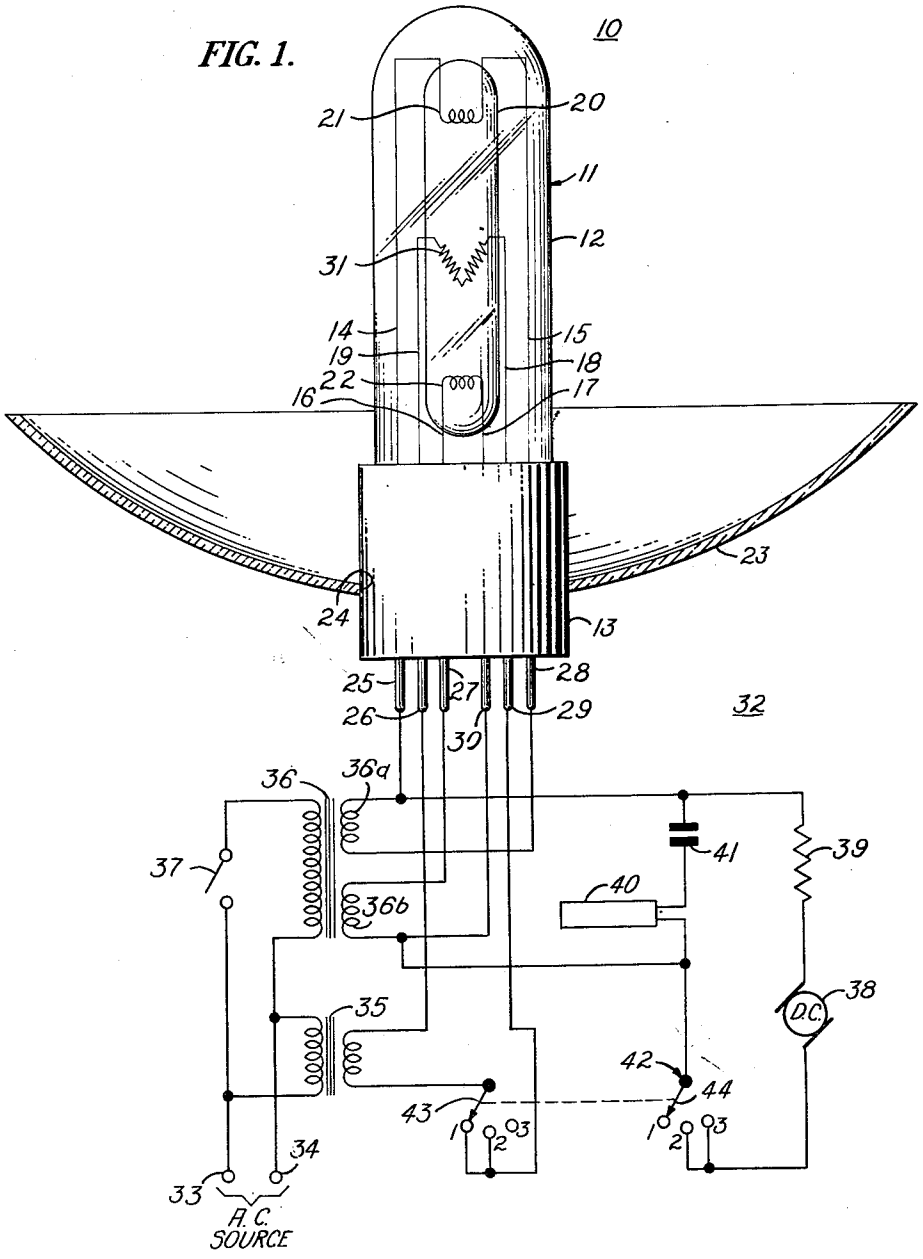
March 15, 1955 R. L. BARR 2,704,359

SIGNALING APPARATUS

Filed Dec. 10, 1951 2 Sheets-Sheet 1

FIG. 1.



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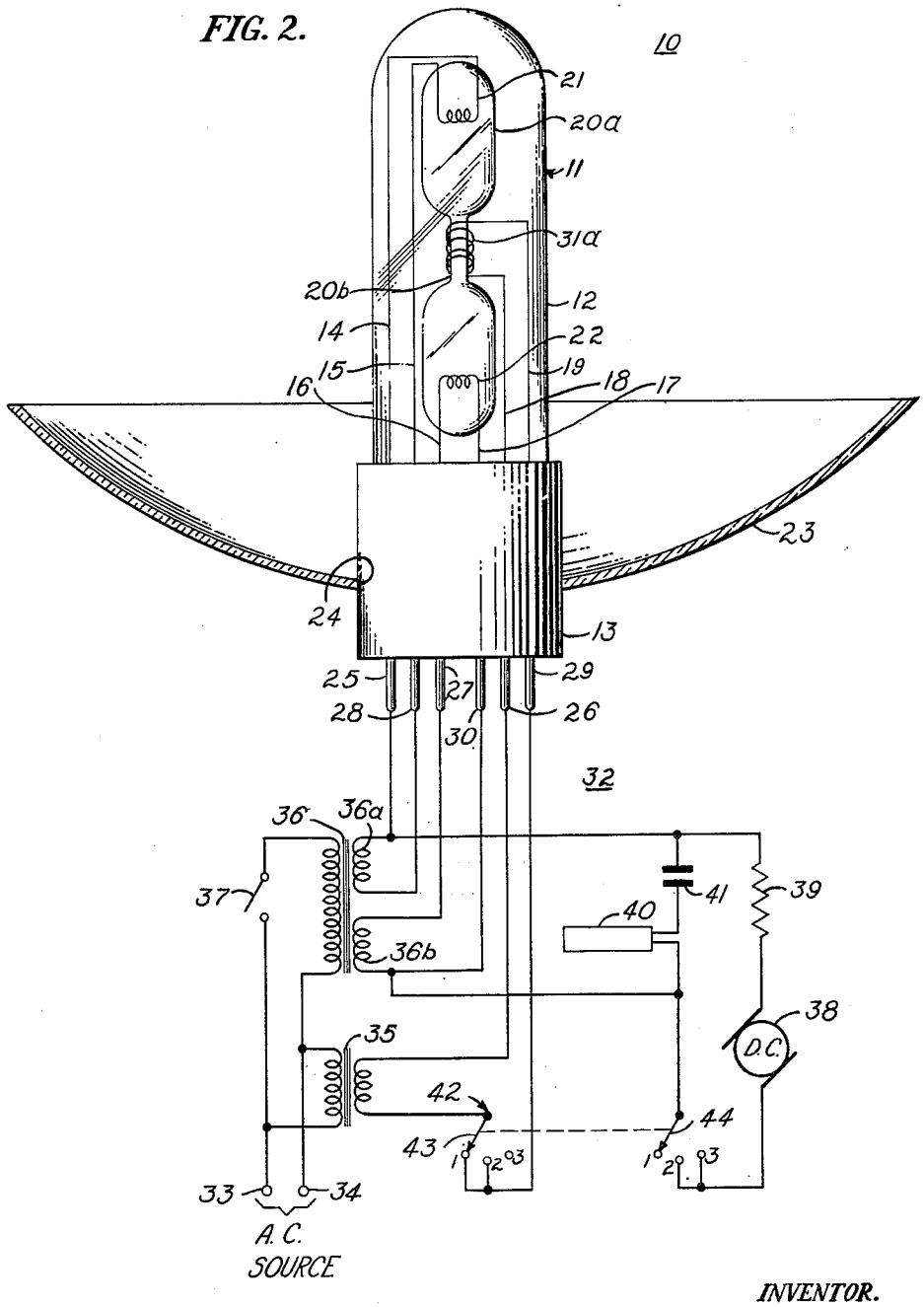
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SIGNALING APPARATUS

Filed Dec. 10, 1951 2 Sheets-Sheet 2

FIG. 2.



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United States Patent Office 2,704,359
Patented Mar. 15, 1955

2,704,359

SIGNALING APPARATUS

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Application December 10, 1951, Serial No. 260,870

6 Claims. (Cl. 340—25)

The present invention relates in general to a signaling apparatus, and more particularly to a signaling apparatus having a gaseous electric discharge device.

In airplane guiding light systems of the type wherein a single light beacon would oscillate from two angular positions, a concentrated light source, as well as a modulated light source, is needed to enable a pilot to determine whether the airplane is "on course," or in a common area of the light beam. When the airplane is flying "on course" the pilot receives a continuous signal, whereas, if the airplane were flying to the right of the common area, the pilot would receive one signal and, if the airplane were flying to the left of the common area, the pilot would receive another signal.

Signaling apparatus of the type adaptable for use as an airplane guiding light beacon may use any suitable arc tube, such as a cesium arc tube, which produces divergent light rays regardless of the type of reflector used in conjunction therewith. This factor is prevalent in the use of gaseous discharge lamps, since they do not lend themselves to function as a point source of light. To produce a point source of light, it is desirable to use an incandescent filament light source. However, the incandescent filament light source, such as the concentrated tungsten filament, cannot be modulated in the event voice modulation becomes necessary.

Accordingly, an important object of the present invention is to provide a signaling apparatus that at times provides a modulating light source and at other times provides a narrow angular light beam.

Another object of the present invention is to provide a signaling apparatus having a gaseous electric discharge device for providing at times a modulating light source and an incandescent filament in said discharge device to provide at other times a narrow beam of light.

Another object of the present invention is to provide a signaling apparatus wherein a gaseous electric discharge device provides at times a modulated light source, and an incandescent filament in said gaseous discharge device positioned at the focal point of a reflector provides at other times a concentrated light source having a narrow beam width.

Other objects will appear upon a further perusal of the detailed description taken in conjunction with the accompanying drawings in which:

Figure 1 is a partial schematic diagram of the signaling appaartus embodying the present invention; and

Figure 2 is a partial schematic diagram of a modification of the signaling apparatus embodying the present invention.

Briefly described, the signaling apparatus of the present invention comprises a gaseous electric discharge device suitably positioned at the base thereof at the apex or any other suitable place of a suitable reflector member, which in the preferred embodiment is a parabolic reflector. The gaseous electric discharge device comprises an outer envelope and an inner envelope, and in the preferred embodiment having therebetween a vacuous area. The inner envelope contains a glow discharge vapor or gas, such as cesium vapor or gas, and in conjunction therewith suitable means to produce the arc glow in order to provide a light source capable of modulation.

According to the invention, in order to provide a point source of light, an incandescent filament, such as a tungsten filament is positioned within the inner envelope of a gaseous electric discharge device.

In the modification, the incandescent filament is placed

in the vacuous area between the inner and outer envelopes. To provide a narrow angular light beam, thereby lessening divergent rays of light, the incandescent filament is placed at the focal point of the suitable reflector member.

In order to provide a signaling apparatus wherein at times the gaseous electric discharge device provides the modulated light source, and at other times the incandescent filament in said gaseous electric discharge device provides a point source of light, circuit means are provided for at times energizing suitable means to ionize the vapor or gas, and at other times energizing the incandescent filament. The incandescent filament, when desired, can be utilized in addition to the functions heretofore mentioned for maintaining the vapor ionized when the starter electrodes are deenergized.

Referring now to Figures 1 and 2, a signaling apparatus 10 is provided adaptable for use in airplane beacon systems having a single light beacon which oscillates between two angular positions. The signaling apparatus comprises a gaseous electric discharge device 11, which in the preferred embodiment is a cesium arc lamp.

The gaseous electric discharge device 11 comprises an outer envelope 12 of a suitable type, size and shape, which is supported by a conventional or any suitable base 13. Within the neck of the outer envelope 12 is sealed a stem or standard which constitutes the usual means for introducing support wire conductors 14–18, inclusive, into the inner envelope 20. For supporting the various elements within the outer envelope 12, the support wires 14–18 are provided.

Referring more particularly to Figure 2, there is shown an inner envelope 20*a*, similar to inner envelope 20, except that a narrow neck portion 20*b* is provided at the central portion thereof for reasons to be described hereinafter. The inner envelope 20*a* is supported in a manner similar to that for the supporting of inner envelope 20.

The inner envelope 20, as well as the inner envelope 20*a*, contains a suitable means for ionizing gas or vapor, such as a pair of arc or starter electrodes 21 and 22 at the opposite ends thereof. The starter electrode 21 is supported within the inner envelope 20, as well as inner envelope 20*a*, by means of the support wire conductors 14 and 15. The starter electrode 22 is supported within the inner envelope 20, as well as inner envelope 20*a*, by means of support wire conductors 16 and 17. The support wire conductors 14 and 15 are suitably received through the inner envelope 20, as well as inner envelope 20*a*, by any conventional or suitable means for establishing electrical connections to the pair of arc electrodes 21 and 22, such as a sealed stem or a fused stem.

In order to provide a source of light capable of modulation, the starter electrodes 21 and 22 establish an arc in the inner envelope 20, as well as the inner envelope 20*a*, in an atmosphere of suitable gas or vapor, which in the preferred embodiment is a cesium gas or vapor. In the preferred embodiment, a vacuous state is provided between the outer envelope 12 and the inner envelope 20, as well as the inner envelope 20*a*.

For concentrating the ray of light emitted, a suitable reflector member 23 is associated with the gaseous discharge device 11 at the base portion 13 thereof. In the preferred embodiment, the reflector 13 is a parabolic reflector which has a suitable opening 24 at the apex thereof for receiving the base 13 of the gaseous discharge device 11.

For establishing electrical connections from the gaseous discharge device, the support wire conductors 14–18, inclusive, are fused or pressed at a stem in the gaseous discharge device 11 contained in the base 13 in a well-known manner. Prongs 25–30, inclusive, are secured to the base 13 and are electrically connected to the support wire conductors 14–18, inclusive, in any suitable manner for establishing electrical connections from the gaseous discharge device 11 to an external circuit.

According to the invention, in order to provide a point source of light, an incandescent filament 31 is provided, which in the preferred embodiment is a tungsten filament. The incandescent filament 31 is supported within the inner envelope 20 by means of the support wire conductors 18 and 19 at the focal point of the reflector mem-

ber 23. The support wire conductors 18 and 19 are received by the inner envelope 20 by means such as a sealed or fused stem.

Referring more particularly to the modification shown in Figure 2, an incandescent filament 31*a* is provided, which in the preferred embodiment is a tungsten filament. The incandescent filament 31 is supported by means of the support wires 18 and 19 at the focal point of the reflector member 23.

In order to increase the operating time of the incandescent filament, the incandescent filament is wound in a spiral configuration, such as coil form, encompassing the narrow neck portion 20*b* of the inner envelope 20*a*, thereby being positioned in the vacuous area and also at the focal point of the reflector member 23.

It is to be noted that in airplane signaling systems, particularly of the type using a single light beacon that oscillates between two angular positions, a signaling apparatus is required that at times would provide a modulated light source and at other times would provide a narrow angular beam for spotting or aiming. The electric discharge device, such as a cesium arc lamp, emits divergent rays even when used in conjunction with a reflector member. This is caused by the fact that a gaseous discharge device provides a wide source of light and therefore, when reflected, the rays have angular dispersions of light and are not parallel to one another. The airplane light beacons require at times a narrow angular light beam, which cannot be had when using a gaseous electric discharge device, such as a cesium arc lamp. A point source of light, when reflected, provides rays that are substantially parallel to one another, and therefore not divergent. An incandescent filament, such as a tungsten filament provides a point source of light, but the incandescent filament cannot be modulated, when audio modulation is required for providing coded signals. By placing the incandescent filament at the focal point of the reflector member, such as a parabolic reflector, and in the gaseous electric discharge device, the beam of light becomes a concentrated angular light beam.

Accordingly, circuit means 32 are herein provided to at times energize the incandescent filament to provide a point source of light and at other times to energize the suitable means, such as starter electrodes 21 and 22, to ionize the vapor or gas contained in the inner envelope 20 or 20*a*, and in addition thereto modulate the light emitted thereby to provide a modulated light source. In addition to the foregoing, at still other times the vapor or gas contained in the inner envelope is ionized by the potential on the arc electrodes in order to provide a modulated light source and the incandescent filament is energized to maintain the gas or vapor energized in the event the starter electrodes 21 and 22 are deenergized or become extinguished.

The circuit means 32 comprises terminals 33 and 34 which are connected to a suitable source of alternating current. Connected to the alternating current source by way of terminals 33 and 34 is a suitable transformer 35 to provide a suitable voltage for heating the incandescent filament 31, and similarly 31*a*.

For heating the filaments of the starter electrodes 21 and 22, transformer 36 is connected to the alternating current source by way of the terminals 33 and 34. A suitable starting switch 37 is provided to control the application of the filament voltage to the starter electrodes 21 and 22.

For supplying the firing potential to the starting electrodes 21 and 22, a suitable direct current source is provided, such as direct current generator 38. Connected in series therewith is a ballast 39, which limits the load on the generator 38 once the gas or vapor contained in the inner envelope 20 or 20*a* becomes ionized. While the preferred embodiment shows the filament being heated by an alternating current, it is to be understood that a direct current source can be used equally as well. Further, it is to be understood that, although the electric discharge arc is shown operating on a direct current, it can be operated equally as well on an alternating current over a wide range of frequencies.

In order to provide a modulating potential, a suitable modulating unit 40 is provided, which can be any conventional unit, well known in the art of voice modulation. Connected in series therewith is a blocking condenser 41 to prevent the direct current from flowing into the modulating unit. The modulating voltage is superimposed on the direct current potential for energizing the arc electrodes 21 and 22. For controlling the operation of the circuit 32, a suitable three-position switch 42 is provided having two contact arms 43 and 44 operated simultaneously.

In operation, in order to provide at times the narrow angular light beam by energizing the incandescent filament 31 or 31*a*, the switch 42 is actuated to place the contact arms 43 and 44 on contact 1. Thereupon, the incandescent filament 31 or 31*a* is energized over the following path: terminals 33 and 34, transformer 35, contact arm 43, prongs 26 and 29, conductors 18 and 19, and filament 31 or 31*a*. Since contact 1 for contact arm 44 is an open terminal there is no continuity through contact arm 44 to energize the starter electrodes 21 and 22.

In order to provide at other times a modulated light source by ionizing the gas or vapor contained in the inner envelope 20 or 20*a*, the switch 44 is actuated to place the contact arms 43 and 44 on contacts 3. Before the actuation of the switch 42, it is conventional to close starter switch 37 to energize the filaments of the starter electrodes 21 and 22. The filament of starter electrode 21 is energized over the following path: terminals 33 and 34, switch 37, transformer 36, prongs 25 and 28, conductors 14 and 15, and starter electrode 21. The filament of starter electrode 22 is energized over the following path: terminals 33 and 34, switch 37, transformer 36, prongs 27 and 30, conductors 16 and 17, and starter electrode 22.

A direct current potential is applied to the starter electrodes 21 and 22 to ionize the gas or vapor contained in the inner envelope 20 or 20*a* over the following path: electrode 21, conductors 14 and 15, prongs 25 and 28, secondary winding 36*a*, ballast 39, D. C. generator 38, contact 3, contact arm 44, secondary winding 36*b*, prongs 27 and 30, conductors 16 and 17, and electrode 22.

For modulating the arc glow, the potential on the electrodes 21 and 22 is varied over the following path: electrode 21, conductors 14 and 15, prongs 25 and 28, secondary winding 36*a*, condenser 41, modulating unit 40, secondary winding 36*b*, prongs 27 and 30, conductors 16 and 17 and electrode 22.

Since contact 3 for contact arm 43 is an open terminal, there is no continuity through contact arm 43 to energize the incandescent filament 31 or 31*a*.

In order to provide at still other times a modulated light source by ionizing the gas or vapor contained in the inner envelope 20 or 20*a*, and in addition thereto use the incandescent filament 31 or 31*a* for maintaining the gas or vapor contained in the inner envelope 20 or 20*a* ionized in the event the starter electrodes 21 and 22 are deenergized or extinguished, switch 42 is actuated to place the contact arms 43 and 44 on contacts 2. The operation of the circuit is similar to that previously described in that the operation is a combination of the operations previously described when the contact arms 43 and 44 were engaging contacts 1 and 3.

It is to be understood that variations and modifications may be effected without departing from the scope of the appended claims.

I claim:

1. In a signaling system, a gaseous electric discharge device, an envelope in said discharge device containing gas to provide an arc glow, a first means for ionizing the gas contained therein, an incandescent filament in said envelope for providing a point source of light, a first circuit for energizing said incandescent filament to provide a point source of light, a second circuit for energizing said first means to provide an arc glow, a modulating unit connected to said second circuit for superimposing voice modulating signals thereon to provide a voice modulated light source, and a switching circuit operated at times for connecting said first circuit to said incandescent filament to provide a point source of light and operated at other times to connect said second circuit to said first means to provide a voice modulated light source.

2. In a signaling system, a gaseous discharge device, an envelope in said discharge device containing gas to provide an arc glow, a first means in said envelope for ionizing the gas therein, a reflector member encompassing a portion of said device for directing light rays, an incandescent filament in said envelope for providing a point source of light and positioned at the focal point of said reflector member for concentrating the light rays emittable thereby, a first circuit for energizing said in-

candescent filament to provide a point source of light, a second circuit for energizing said first means to provide an arc glow, a modulating unit connected to said second circuit for superimposing voice modulating signals thereon to provide a voice modulated light source, and a switching circuit operated at times for connecting said first circuit to said incandescent filament to provide a point source of light and operated at other times to connect said second circuit to said first means to provide a voice modulated light source.

3. In a signaling system, a cesium arc lamp, an envelope in said arc lamp containing gas to provide an arc glow, a first means in said envelope for ionizing the gas therein, a reflector member encompassing a portion of said lamp for directing light rays, a tungsten filament in said envelope for providing a point source of light and positioned at the focal point of said reflector member for concentrating the light rays emittable thereby, a first circuit for energizing said tungsten filament to provide a point source of light, a second circuit for energizing said first means to provide an arc glow, a modulating unit connected to said second circuit for superimposing voice modulating signals thereon to provide a voice modulated light source, and a switching circuit operated at times for connecting said first circuit to said tungsten filament to provide a point source of light and operated at other times to connect said second circuit to said first means to provide a voice modulated light source.

4. In a signaling system, a cesium arc lamp, an envelope in said arc lamp containing gas to provide an arc glow, a first means in said envelope for ionizing the gas therein, a reflector member encompassing a portion of said lamp for directing light rays, a tungsten filament in said cesium arc lamp for providing a point source of light and positioned at the focal point of said reflector member for concentrating the light rays emittable thereby, a first circuit for energizing said tungsten filament to provide a point source of light, a second circuit for energizing said first means to provide an arc glow, a modulating unit connected to said second circuit for superimposing voice modulating signals thereon to provide a voice modulated light source, and a switching circuit operated at times for connecting said first circuit to tungsten filament to provide a point source of light and operated at other times to connect said second circuit to said first means to provide a voice modulated light source.

5. In a signaling system, a cesium arc lamp, an envelope in said arc lamp containing gas to provide an arc glow, a first means in said envelope for ionizing the gas therein, an incandescent filament in said cesium arc lamp to provide a point source of light, a first circuit for energizing said incandescent filament to provide a point source of light, a second circuit for energizing said first means to provide an arc glow, a modulating unit connected to said second circuit for superimposing voice modulating signals thereon to provide a voice modulated light source, and a switching circuit operated at times for connecting said first circuit to said incandescent filament to provide a point source of light and operated at other times to connect said second circuit to said first means to provide a voice modulated light source.

6. In a signaling system, a cesium arc lamp, an envelope in said arc lamp containing gas to provide an arc glow, a first means in said envelope for ionizing the gas therein, a reflector member encompassing a portion of said lamp for directing light rays, an incandescent filament in said cesium arc lamp for providing a point source of light and positioned at the focal point of said reflector member for concentrating the light rays emittable thereby, a first circuit for energizing said incandescent filament to provide a point source of light, a second circuit for energizing said first means to provide an arc glow, a modulating unit connected to said second circuit for superimposing voice modulating signals thereon to provide a voice modulated light source, and a switching circuit operated at times for connecting said first circuit to said incandescent filament to provide a point source of light and operated at other times to connect said second circuit to said first means to provide a voice modulated light source.

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