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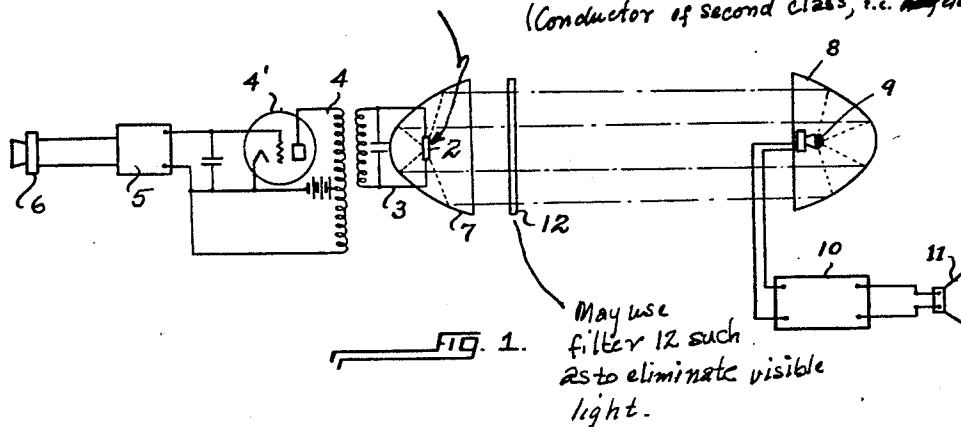
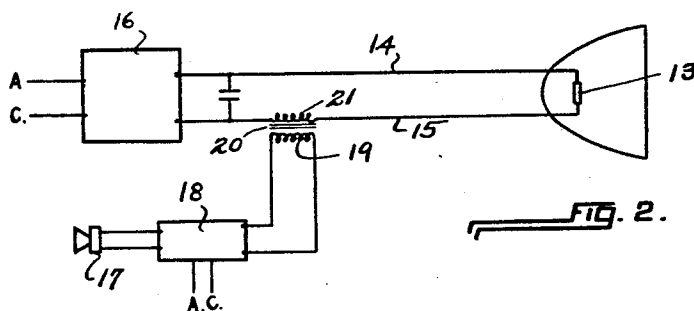
R. E. STARK ET AL

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VARIABLE INTENSITY LIGHT SIGNALING APPARATUS

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*CERAMIC NEGATIVE RESISTOR
USED AS Modulable LIGHT SOURCE
(Conductor of second class, i.e. electrolytic)*



INVENTORS
Ramon E. Stark and
BY Donald E. Stark
Christy, Pamelu and Strickland
ATTORNEYS

x 250-84
x 315-76-176-21

British 594,300

x 177-329

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VARIABLE INTENSITY LIGHT SIGNALING
APPARATUSRawson E. Stark and Donald E. Stark, Greens-
burg, Pa., assignors to Stupakoff Ceramic &
Manufacturing Co., a corporation of Pennsyl-
vania

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5 Claims. (Cl. 250—7)

This invention pertains to a variable intensity light source and to signaling apparatus embodying such a light source.

It has heretofore been proposed to modulate the intensity of a light-emitting source by signal impulses, but difficulty has been encountered in providing a light source which would respond to relatively high frequency variations, as for example, variations of the order of audible frequencies, but which, at the same time, produce an intense light. For example, television apparatus has been produced in which the intensity of the light emitted by a gas-filled tube or glow tube is modulated by the video signal to change the intensity of the glow or emitted light. Such a tube produces at its maximum brilliance a light which is relatively feeble and which can not be projected any appreciable distance. Television receiving means employing such a lamp must be viewed at close range.

Attempts have been made to use hot filament lamps for the same purpose, but it has been found that such lamps do not respond to a sufficient extent or with sufficient rapidity. These filaments are either enclosed within a vacuum or in an inert atmosphere at reduced pressure, so that heat is not rapidly conducted from the filament. Moreover, the tolerance of such filaments is such that they will give a fairly constant light, even though there is a substantial voltage fluctuation.

We have discovered that a conductor of the second class, i. e., a glower such as the glower used in a Nernst lamp, or a steatite refractory unit such as manufactured and sold under the trade name "Insulcon," responds very readily to changes in the current which operates it, so that when the current which operates it is modulated with the voice frequencies or with other signal impulses, the emitted light will increase and diminish to a very marked extent. This phenomenon is contrary to that which would be expected from the mass of the light-emitting body, but is probably accounted for in part by the fact that the emitter operates in the normal atmosphere, and hence may rapidly dissipate its heat, and may be partly accounted for by the fact that, having a negative coefficient resistance, its conductivity increases as it becomes hotter, and its conductivity also varies according to the potential applied across its terminals, and these two factors have a cumulative action such that the slight change in voltage appreciatively reflects itself in the intensity of the light which is emitted.

Our invention resides, therefore, in the use of

a conductor of the second class as a signal modulated light emitter.

Since a conductor of the second class may be used as a signal modulated light emitter, our invention further contemplates the use of such an element in an apparatus for point-to-point signaling between points which are within visible distances of each other. Such a conductor emits infra-red rays to a very substantial extent, and our invention further contemplates an apparatus for point-to-point signaling in which the visible rays are filtered out and the infra-red rays transmitted, so that direct point-to-point signaling within the visible range may be accomplished without the transmission of visible light. For example, our invention contemplates an apparatus by means of which ship to ship telephone conversation may be carried on, using light, and particularly infra-red light, as the carrier, so that at night messages may be transmitted without reliance upon radio or visible signals, and, of course, operative also in daylight. It is highly desirable to transmit signals, particularly conversations, from ship to ship or ship to shore without the use of radio or visible light.

Our invention may be more fully understood by reference to the accompanying drawing, in which

Figure 1 is a schematic diagram of a transmitting and receiving apparatus constructed in accordance with our invention;

Figure 2 is a similar schematic view of a modified form of transmitter.

Referring to Figure 1 of the drawing, 2 designates a conductor of the second class, such as an "Insulcon" unit or a Nernst glower, light emitting glowers of this type being well known to those skilled in the art. Generally speaking, they comprise a refractory composition which, when cold, are poor conductors or insulators, but which, upon being heated, become increasingly conductive. In order to prevent their decomposition, they are most effectively operated in air. They may be brought up to an operating temperature by means of an auxiliary heater of some type, such as is well known to those skilled in the art, and not shown in the accompanying drawing. In the diagram shown in Figure 1, the "Insulcon," or other light emitting unit is energized by a radio frequency current. The drawing illustrates a tuned circuit 3 in which the light emitting unit 2 is included. This tuned circuit 3 is inductively coupled to an oscillator circuit such as the regenerative vacuum tube circuit 4 in which 4' designates a vacuum tube. The circuit

4 is a conventional circuit. At 5 there is an amplifier, and 6 designates a microphone which is connected to the amplifier, the arrangement being such that when the operator speaks into the microphone 6, the signal current thus generated is amplified in the amplifier 5 and is then used to modulate the output of the oscillator 4'. A speech modulated high frequency current is thereby provided for energizing the light emitting unit 2. We have found that such a unit functions very satisfactorily when included in a high frequency circuit.

The light emitting unit 2 is illustrated as being located in front of a collector such as a parabolic reflector 7.

The receiving station comprises a light collector such as a parabolic reflector 8 at the focus of which there is a photoelectric cell 9. This photoelectric cell is connected through an amplifier 10 to a translating device such as a receiver or loud speaker 11.

In the operation of the device, when the unit 2 has been brought to a conducting temperature, it will continue to operate as long as it is energized from the oscillator circuit. When the operator speaks into the microphone 6, the output of the oscillator is modulated, and the light emitted by the element 2 increases and diminishes in intensity as the output of the tube 4' is modulated. This modulation of the light intensity is of such magnitude that it may be readily observed with the eye. Nevertheless, the light emitted by the element 2 is a strong light, so that it will carry for a considerable distance.

A light source comprising a conductor of the second class produces also strong, powerful, infra-red rays. Where secrecy of communication is desired, a filter, designated 12, may be placed in front of the reflector 7 so that substantially no visible light is transmitted beyond the filter 12.

While the apparatus shown in Figure 1 illustrates particularly a point-to-point signaling system in which the intensity of the light 2 is modulated according to voice signals, our invention may be used in other applications where it is desired to modulate a source of bright illumination with a signal of varying intensity, as, for example, a received video signal in television may be used to modulate the current supplied to the light emitting unit 2, and the schematic drawing is intended to illustrate broadly any such arrangement where, for example, 6, instead of being a microphone, may be a video signal generator.

While the modification shown in Figure 1 is entirely satisfactory, the arrangement illustrated in Figure 2 is one wherein the light emitter is included in a direct current circuit, and the signal which is used to modulate the light is inductively impressed upon the direct current circuit. In this figure, 13 designates the light emitting unit comprising a conductor of the second class. Its terminals are connected through wires 14 and 15, with a source of direct current such as a rectifier schematically illustrated at 16. A microphone designated 17 is connected with an amplifier 18 and the output of the amplifier 18 is connected to the primary 19 of a transformer designated generally as 20. The secondary of the transformer 21 is in series with the light emitting unit 13. The arrangement is such that when voice currents or other signals are impressed upon the amplifier 18, such signals will be amplified and inductively imposed by the transformer 20 through the windings 19 and 21 into the direct current circuit. The design of the transformer

20 should be related to the unit 13 to secure the maximum benefit of our invention. By using a transformer of proper values, it is possible to produce very wide fluctuations in the intensity of the light emitting element 13. The transformer not only serves the purpose of transferring the signal to the direct current line, but it provides sufficient impedance to eliminate any need for a separate ballast in the circuit 14-15.

One of the advantages of our invention resides primarily in the use of a conductor of the second class as a strong source of light with means for impressing a signal frequency or frequencies onto the circuit for energizing said conductor of the second class, whereby the conductor is caused to fluctuate according to the signal frequency or frequencies, and thus modulate the emitted light. Another important advantage of my invention is the provision of a projector with a strong light source, particularly a strong infra-red light source, which may be modulated with voice or other signal impulses for point-to-point signaling. As above indicated, this is of special advantage for military purposes, and particularly for signaling between ships or between ships and shore at times when the use of radio might be dangerous.

While we have illustrated and described certain particular embodiments of our invention, it will be understood that this is merely by way of illustration, and that various changes and modifications may be made in the apparatus and in the circuits within the contemplation of our invention, and under the scope of the following claims.

We claim:

1. Apparatus of the class described comprising a light-emitting unit which is exposed to the air, a circuit including a source of power for operating said unit, and means for impressing a signal on said circuit to modulate the light emitted by said unit, said light-emitting unit being a conductor of the second class, said conductor of the second class being a ceramic composition which is an insulator at normal temperatures and which becomes a conductor at elevated temperatures.

2. Apparatus of the class described comprising a light-emitting unit, a circuit for operating said unit, and means for impressing a sustained modulated signal on said circuit to continuously modulate the light emitted by said unit, said light-emitting unit being a conductor of the second class constituted of ceramic material and being an insulator at normal temperatures but which becomes incandescent upon the passage of current therethrough at an elevated temperature.

3. In a system wherein modulated impulses are used to modulate a light emitter in which there is a source of light, a circuit including a source of current for operating the light source, and means in said circuit for modulating the current flow in the circuit to modulate the intensity of the emitting light, said system being characterized by the provision of a glow element formed of a conductor of the second class which is an insulator when cold and becomes a conductor at elevated temperatures.

4. In a transmitter for point-to-point light signaling of the type comprising a projector, a light source in said projector, a circuit for operating the light source, means including a microphone for impressing a signal on said circuit to vary the intensity of the light characterized by the light source being a glow element formed of a conductor of the second class which is an insulator when

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cold and a conductor at elevated temperatures and the light from which is strong in the infra-red end of the spectrum.

5. In a transmitter for point-to-point signaling of the type comprising a projector, a light source in said projector, a circuit for operating the light source, means including a microphone for impressing a signal on said circuit to vary the intensity of the light characterized by the light

source being a glower formed of a conductor of the second class which is an insulator when cold and a conductor at elevated temperatures and the light from which is strong in the infra-red end of the spectrum, and a filter in front of said projector which is highly opaque to visible light and transparent to infra-red.

RAWSON E. STARK.
DONALD E. STARK.