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M. KNOLL

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INFRARED RAY GENERATOR AND COMMUNICATION SYSTEM

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Fig. 1

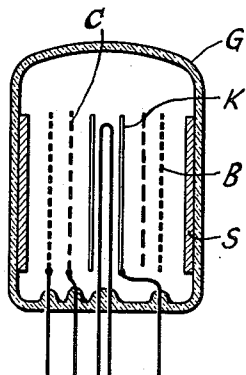


Fig. 2

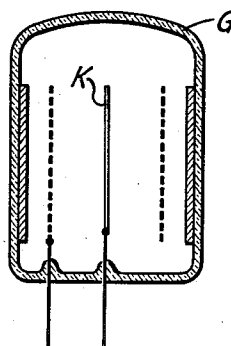


Fig. 3

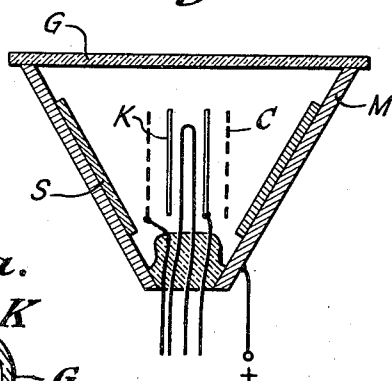
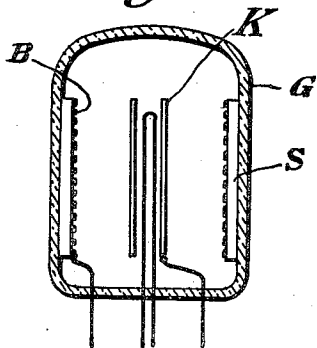


Fig. 1a.



BY

INVENTOR.
MAX KNOLL
H. S. Brown
ATTORNEY.

UNITED STATES PATENT OFFICE

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INFRARED RAY GENERATOR AND COMMUNICATION SYSTEM

Max Knoll, Berlin, Germany, assignor to Telefunken Gesellschaft für Drahtlose Telegraphie m. b. H., Berlin, Germany, a corporation of Germany

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4 Claims. (Cl. 250-7)

For the generation of visible light-rays, it is known in the art to dispose on the inner wall or shell of discharge vessels, such as glow tubes, coats or films of phosphorescent substances which are excited to give off radiations by action of the discharge so that light is radiated to the outside. It has been ascertained that with the use of suitable substances, radiations of longer wavelengths are similarly generable; that is radiations of a length nearly bordering in the region of shortest electromagnetic waves producible by spark discharges or other means. Over the methods of generating electromagnetic radiations by the agency of spark gaps or the like, the use of phosphorescent substances offers the practical advantage that the yield and economy are far greater.

Among the infrared phosphors that may primarily be employed, selenides or tellurides of zinc, cadmium, or mercury may here be mentioned. If a mercury telluride is used, for instance, it is readily feasible to produce radiations of a wavelength of several thousandths of one millimeter, the intensity of which is increasable to any desired degree by increasing the intensity of the exciting radiations.

The sensitivity or responsiveness of the phosphors, as well as the wavelength of the ensuing radiations, may further be increased to an appreciable degree, in the case of these substances, by the incorporation in the phosphors of activating materials (metals) such as copper, silver, platinum, or yttrium, with the result that for each and every wavelength or wave band a particularly effective or yielding phosphor may be prepared.

A number of exemplified embodiments of the invention shall now be described in more detail by reference to the appended drawing, wherein Figs. 1, 1a, 2 and 3 show different embodiments of the invention.

Fig. 1 shows an evacuated glass bulb G in the axis of which is mounted an indirectly heated cathode K. The leads brought to the heater, as well as the cathode leads, are sealed in the glass bulb. Upon the interior wall or face of the vessel is brought a coat or layer S consisting of an infrared phosphor, say mercury selenide or telluride, or else a mixture of several dissimilar phosphors. Mounted in the path of the rays of electrons is an accelerator electrode B, which, for instance, in the form of a grid or grate or a layer of metal permeable to electrons, may be placed upon the surface of the phosphor coat, as illustrated in Fig. 1a. Instead of this, it is

also possible to embed in the phosphor metallic particles in such a way that there results a conductive coat or layer designed to be directly connected with a potential source of supply. In the arrangement as shown, control or modulation of light is feasible in an extraordinarily simple manner by interposing in the ray path, between cathode and anode a control grid C, said grid serving to produce a control action upon the intensity of the electrons exciting the phosphor.

Fig. 2 illustrates a similar embodiment of the invention, though in this instance the phosphor is irradiated and excited by a glow discharge rather than being subjected to electronic bombardment. K denotes a cathode which is disposed inside the gas filled vessel G. Also, in this case the anode may consist of the layer or film of phosphor itself or may consist of a tenuous film or a reticulated metal (gauze) structure disposed anteriorly thereof. Instead of using for excitation electrons or a glow discharge, it is also possible to resort to irradiation of the phosphor by other corpuscular radiations or short wave electromagnetic radiations. For instance, the electrons escaping from a cathode could first be used to generate Roentgen rays and these, in turn, may be employed for the excitation of the infrared phosphor.

In Fig. 3 is shown a tube which is particularly suited for larger powers. Inside a metallic bulb M is mounted a layer of phosphor material S which is irradiated from a cathode K by electrons. The anode consists of the metallic bulb M itself. At its anterior end the bulb is shut by a glass or quartz pane or plate G so that the ensuing infrared radiations have a chance to issue from the bulb. The application of the layer of phosphor material upon a metallic support or base offers the advantage that the conditions of thermal abduction are improved and this means an increase in the generable energy. Moreover, there is no risk or chance for charges accumulating upon the coat of phosphor. Also, in the case of this tube, the arrangement of control grids C, etc., is readily feasible.

Because of the extremely high efficiency of phosphorescent materials as known in the art, the arrangement here disclosed represents a source of electromagnetic waves falling inside the region of infrared and thermal radiations that combines great economy and ease of construction. But the invention, as will be understood, is not confined to the exemplified embodiments here shown. In fact, the forms of the tubes may be chosen at will, and also the electrode assemblies

may be chosen to suit requirements, in fact, the invention satisfies a great number of purposes. Because of the fact that the ensuing radiations can be readily controlled and modulated in the simplest possible manner by acting upon the stimulating or exciting radiations, new vistas are opened up for infrared telephony and telegraphy. For instance, the tube here disclosed may be mounted in the very focus of a parabolic reflector so that a directed radiation or beam may be sent out at the receiving end. This radiation is picked up either by a bolometer arrangement or else by the aid of an ultra short wave demodulator also mounted inside a reflector.

What is claimed is:

1. In a message wave communication system, a transmitting device in the form of a controllable source of infrared radiation whose wavelength is longer than that of visible light, having an envelope containing therein means for generating a high velocity electron stream, a screen in the path of said stream and made to yield infrared radiation dependent upon the amount of impacting energy, and control means for controlling said impacting energy in accordance with a modulation voltage, said screen being arranged to present a large proportion of impacted surface to view through an energy permeable window in said envelope.

2. In a communication system, the combination with a transmitting device in the form of a controllable source of infrared ray radiation having a wavelength longer than that of visible light,

said source including an envelope containing therein an electron emitting cathode, a layer of phosphor material in the path of the electron stream for yielding infrared radiation upon impact by said electron stream, an electrode for accelerating said stream toward said layer, and a control element located between said layer and said cathode, of means for applying modulating potentials to said control element.

3. A controllable source of infrared radiation comprising a metallic envelope having an energy permeable window, an electron emitting cathode contained within said envelope, a layer of material mounted on said metallic envelope in the interior thereof in the path of the electron stream for yielding infrared radiation upon impact by said electron stream, and a control element for modulating the resulting radiations in accordance with a modulation voltage, said layer being arranged to present a large area of impacted surface to view through said window.

4. In a telephone or telegraph communication system, a transmitter in the form of a controllable source of infrared radiation whose wavelength is longer than that of visible light, said source comprising an envelope containing therein an electron emitting cathode, a layer of material in the path of said electrons emitted by said cathode and made to yield infrared radiation dependent upon the amount of impacting electrons, and an electrode for accelerating said electrons toward said layer, at least a portion of said envelope being permeable to said infrared radiation.

MAX KNOLL.