PUBLISHED

MAY 18, 1943.

BY A. P. C.

A. DAUVILLIER ET AL

FIRE-ALARM SYSTEMS AND IN DETECTORS OF RADIO ACTIVE MATERIALS

Filed March 29, 1940

Serial No. 326,650

Fig.1

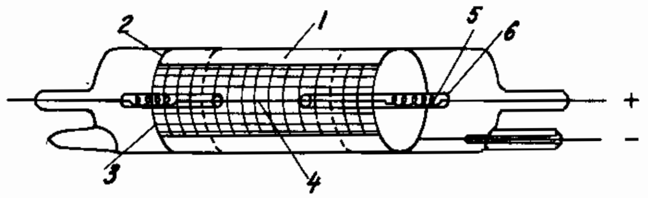



Fig.2

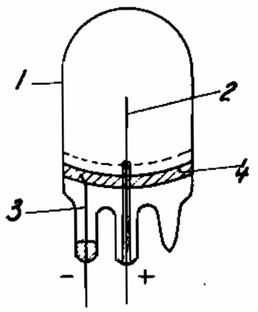
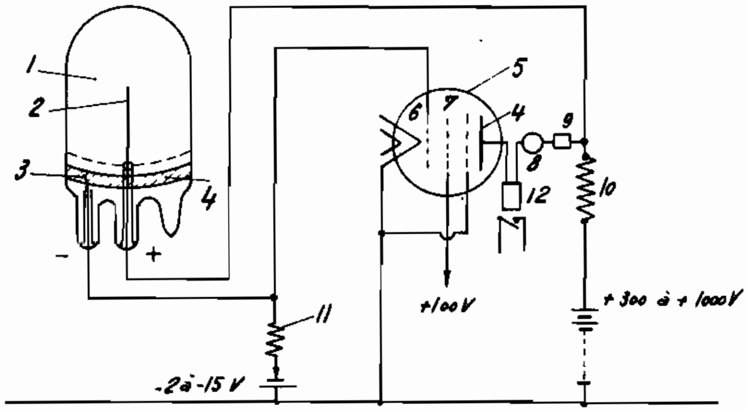



Fig.3





INVENTORS:
ALEXANDRE DAUVILLIER
MAURICE PONTE
BY: Haseltine, Lake & Co.
ATTORNEYS

Published May 18, 1943

Serial No. 326,650

# ALIEN PROPERTY CUSTODIAN

## FIRE-ALARM SYSTEMS AND IN DETECTORS OF RADIO ACTIVE MATERIALS

Alexandre Dauvillier and Maurice Ponte, Paris, France; vested in the Alien Property Custodian

Application filed March 29, 1940

This invention is for improvements in or relating to fire alarm systems and detectors of radio active materials.

Fires are generally detected by devices which respond to a rise of temperature. Systems including such devices of necessity only detect the fire after some damage has been caused which may be considerable and, in order to reduce the damage to a minimum, it is necessary to employ a comparatively large number of such alarm devices over a given area.

The use of fire detection by the light emitted by the conflagration has been restricted in view of the fact that it is necessary that such systems should not be unintentionally operated for example by daylight, artificial light and the like.

The present invention obviates such a possibility and also the necessity of producing very sensitive detector systems actuated by the light emitted by an incandescent fire, without it being set in operation by normal sources of light, or by daylight.

The present invention consists in employing the property inherent in unprotected flames of emitting to some distance (for example 2,200 to 3,000 A. U. or more) considerable quantities of ultra-violet radiations of which the ordinary sources of illumination are devoid owing to the ultra-violet rays being absorbed by the glass of their globes and in the case of daylight to the solar ultra-violet being absorbed by the terrestrial atmosphere. The detector system comprising the present invention will be only sensitive to the ultra-violet emanations Finally the system is designed and constructed in such manner that the ultra-violet reception by the system is expressed by a system of discharges of comparatively high frequency which are employed by any known system to operate a desired relay.

The detector according to the present invention is of a type employing the properties of the discharges in comparatively high gaseous pressures. It is composed essentially of a meter tube, the major portion of which may be of glass for convenience of manufacture but which is provided with a window of quartz; it contains a photo-cathode constituted of an only slightly electropositive element (ferrous metal such as nickel or a metal of the platinum group, or an alloy, or a chemical compound such as an oxide of these bodies, or the like) carefully freed from hydrogen in order that the photo-electric element is responsive to ultra-violet emanations and render the apparatus insensitive to normal artificial light or to daylight. If need be, the light can be filtered by a Wood glass thereby eliminating the radiations contained in solar light or the undesirable radiations proper to the installation to be protected.

The tube contains a mixture of rare gas and oxygen at a pressure in the vicinity of one tenth of an atmosphere; it also contains an anode for the passage of the discharges.

There could also be employed a device incorporating a filling of hydrogen at a suitable pressure; in this case use should be made of a suitable filter to allow the passage of radiations of short wave length.

The invention will be more particularly described with reference to the accompanying drawings, in which:—

Figure 1 illustrates one embodiment of the present invention comprising a cylindrical tube,

Figure 2 illustrates a modified form of tube to that illustrated in Figure 1, and

Figure 3 illustrates a circuit arrangement in which either of the tubes illustrated in Figures 1 or 2 may be employed.

Referring to Figure 1 of the drawings, a cylindrical tube comprises a central median part transparent to ultra-violet light. The tube contains a cathode cylinder **2** a part of which is constituted by a grid **3**. A fine anodic axial wire **4** is stretched by springs **5** mounted in holder tubes **6**. The electrodes are for example made of platinum carefully purified of any traces of hydrogen and the photo-electric portion of which is at a distance sufficient for the system to be sensitive to the ultra-violet rays only at a distance from the unprotected flames. Nickel is also suitable. A system of this nature gives at the reception of each ultra-violet photon (or of greater frequency) a very short discharge if the source of supply is suitable. In darkness or in daylight the system is only traversed by a small number of discharges per second caused for example by the cosmic rays or the radio-activity of its surroundings. As soon as it is subjected to the light coming from an unprotected flame, the number of discharges per second increases considerably, for example up to 10,000 or 20,000, and it is this phenomenon which is employed to detect the flame. The sensitiveness of the system is considerably higher than that of an ordinary photo-electric cell and may be employed directly with the arrangement illustrated in Figure 3, without any amplification: Voltage values are given on the drawing.

The same advantages may be obtained with a tube of the shape illustrated in Figure 2. In this construction the quartz transparent body 1 is of a cylindrical shape with a hemispherical end. The axial wire 2 serves to deposit on its internal surface, by thermal or cathodic evaporation, a semi-transparent photo-sensitive cathodic layer. The electric contact with this deposit is obtained by a metallic wire attached to the glass 3 by means of a silvered or aquadag ring 4. The wire 2 serves as an anode; the tube is filled with rare gas and oxygen at the same pressure as that given for the tube illustrated in Figure 1.

Figure 3 represents the employment of the embodiment illustrated in Figure 2 with a circuit arrangement employing a pentode.

The anode 7 of a pentode 8 is connected directly to the anode 2 of the detector 1 and also to a source of high tension (300 to 1000 volts) through a high resistance 10, for example 4 megohms. A control grid 9 of the pentode 8 is connected to the cathode 3 of the detector 1 and also to a source of polarisation through a very high resistance 11, for example 10 megohms. A screen 10 is raised to a normal positive potential such as 100 volts. When the detector 1 is at rest, the pentode is only traversed by a very feeble current. When the detector receives a photon (for example a cosmic ray) a discharge takes place between the anode 7 carried to a high potential and the cathode; the anode potential drops whilst at the same time the potential of the control grid rises in consequence of the development of a positive potential in the grid resistance; the pentode is traversed by a current impulse corresponding to the amplification of the pentode and the detector is extinguished; each photon thus gives a very brief impulse and a listening device located at 8 will indicate a shock. Thus the described system, placed in the shade or in daylight or in a normal artificial light such as that of an incandescent lamp, will indicate a series of irregular shocks, for example 40 per second. But if the detector is subjected to the light of a bare flame the number of shocks becomes very great (for example, several thousands); the telephone receiver will give a buzzing noise due to this frequency and a microammeter located at 9 will register an increase of mean current which may be from a few microamperes to thirty or fifty. A relay 12 placed at the same point may be actuated by this current and set any desired system in operation. An idea of the sensitiveness of the apparatus may be given by stating that the phenomena above described are caused by the flame of a match placed a few metres distant.

If necessary, amplification by any usual system such as thyratron relays could be used.

The detectors above described can be used wherever it is necessary to detect bare flames, fire in residences, automatic surveillance and localisation of forest fires, use in mining galleries and the like.

On the other hand the apparatus only requires supplies of little importance, the whole thus forms a very compact block which is easy to shift. As the detector is equally sensitive to photons of very great energy such as $\gamma$ and other rays, the apparatus described, mounted in this way will be usefully employed in prospecting for radio-active materials either in galleries or pits or even in the sea by making a water-tight apparatus.

The apparatus may also be employed in hospital work where radium is used. This extremely expensive material is generally enclosed in needles or tubes which are easily lost in the dressings where it is disagreeable and painful to look for them. The apparatus according to the invention will at once detect an infinitely small mass of radium among a large amount of other material.

Finally the apparatus easily lends itself to quantitative measurements of radiant sources, by the previous calibration of the micro-ammeter inserted in the plate circuit.

ALEXANDRE DAUVILLIER.
MAURICE PONTE.