

Infrared system for control of Postoffice Messages

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Abstract — It is proposed a simultaneous method for treatment and control of potentially dangerous objects like viruses or explosives. Those methods are based on the prophylaxis irradiation and post irradiation IR-control.

Index Terms — bolometer, explosives, viruses, post-office, low-contrast objects, radiation – induced heating.

I. INTRODUCTION

One of the reasons of the modern world vulnerability is high organization and mass character of its industrial, commodity and transport lines. Unfortunately one of the most unsafely items is mail because of the following reasons: high speed of delivery, integration into the WorldNet, the sender's actual anonymity, and identification of the addressee. To possible minuses of this channel usage for mailing items of provocative character is their restricted carrying capacity, therefore the subject of dangerous immersions can be, as it is already known, bacteria and viruses culture or plastic explosive, that took place even before the peak of terrorist activity.

Reflecting on solutions of the problem of possible dangerous immersions revealing and neutralization in mail items our author's collective has turned to existing civil and special experience. In particular, we have turned to making of sterilization sections for disposable medical production and to detection and identification of objects by indirect temperature-contrasting imaging [1,2]. With reference to a problem of mail items safety by our opinion these two methods can successfully supplement each other especially while using modern developments in nanotechnologies.

For preventive bactericidal treatment of mail items it is expedient to use the method of radiative sterilization, which is widely spread all over the world for processing of medical production. The value of the absorbed dose 15-25 kGr can kill the vital activity of pathogenic microorganisms. Estimated cost of such treatment can be received proceeding from the calculation that for processing of 15 kg of envelopes it is necessary to apply electric power equal to 1 KWatt-hour.

Besides the preventive treatment there is also a problem of revealing of envelopes with suspicious immersions. Here we should return to values of the sterilizing absorbed doses of ionizing radiation. It is known, that at radiation passing through the substance the part of the absorbed energy is spent for temperature increasing of irradiated object. Thus the object absorbing ability depends on its density and geometrical sizes, in particular thickness of an immersing layer.

II. RESULTS AND DISCUSSION

The processing of mail is supposed to be made as well as in case of medical production by conveyor method (Fig. 1). Taking into account that we initially guess homogeneity of the processed objects, which are placed in the area of irradiation, will immerse the radiation field with equal intensity and according to this their temperature will raise on some given quantity. If in a post envelope there is a unauthorized immersion (for example the plastic explosive), the radiation field will be immersed more intensively and the temperature on an irradiation zone output will differ from a background temperature. Radiation induce heating of polymers materials determined by the formula

$$\Delta T = \frac{D \pm E}{C}, \quad (1)$$

D - absorbed dose, kGr, C - heat capacity, kJ/(kgK),
 E - energy, which adsorbed as result of chemical reactions.

The task of revealing of object with boosted temperature and fixing of more intensive absorption of a radiation field appears.

One more indication of the unauthorized immersion presence can be the change of a radiation field after passing through the irradiated object. For controlling the radiation field it is offered to use the screen that is made of a thin foil. The change of a radiation flow also will cause a change of its surface temperature.

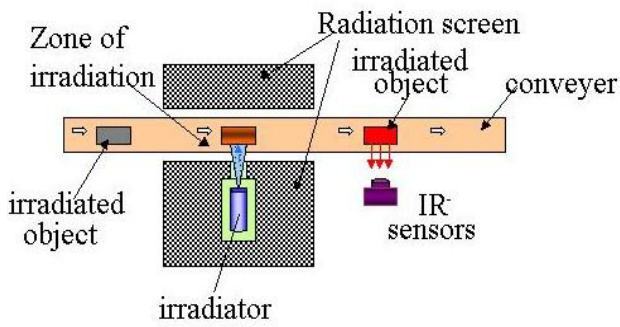


Figure 1. The equipments for the post-office processing and control.

The measuring of a screen temperature and irradiated objects is offered to be made with the help of an Infrared radiometer (Fig. 2).

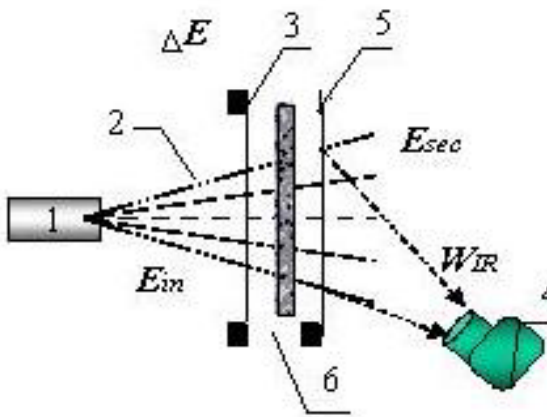


Figure 2. Method of thermal-and-vision control / measuring.

1 - source of the accelerated electrons beam; 2 - beam of the accelerated electrons; 3 - the sounding screen for definition of irradiation doses (is erected in a frontal plane of the object irradiation zone); 4 - IR-bolometer [3]; 5 - the sounding screen for definition of absorbed doses; 6 - irradiated object; E_{in} - energy of initial electrons; ΔE - energy of electrons absorbed by the screen; E_{sec} - energy of electrons, past through the screen; W_{IR} - energy of Infrared radiation

The temperature T_S - of the irradiated screen surface element ΔS can be determined guessing that the main losses are the losses of radiation in an Infrared range of a radiation spectrum. The value is defined by a Stefan-Boltzmann law. Under the steady conditions the energy of the accelerated electrons bundle immersing by the element S is equal to energy of Infrared radiation increase W_{IR} concerning energy of an element radiation at a temperature of an external environment, i.e. at $T_S = T_{en}$.

III. CONCLUSION

It is proposed the simultaneous method of treatment and control of potentially dangerous objects. This method is based on the prophylaxis irradiation and irradiation IR-control of the correspondence or post-offices deliveries.

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