

May 15, 1934.

S. M. KINTNER ET AL
PHOTOSENSITIVE APPARATUS

1,958,893

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2 Sheets-Sheet 1

Fig. 1.

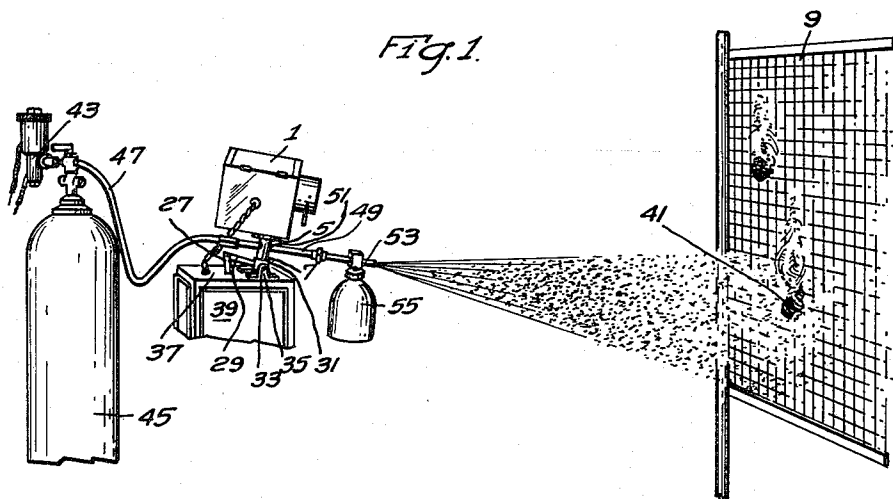
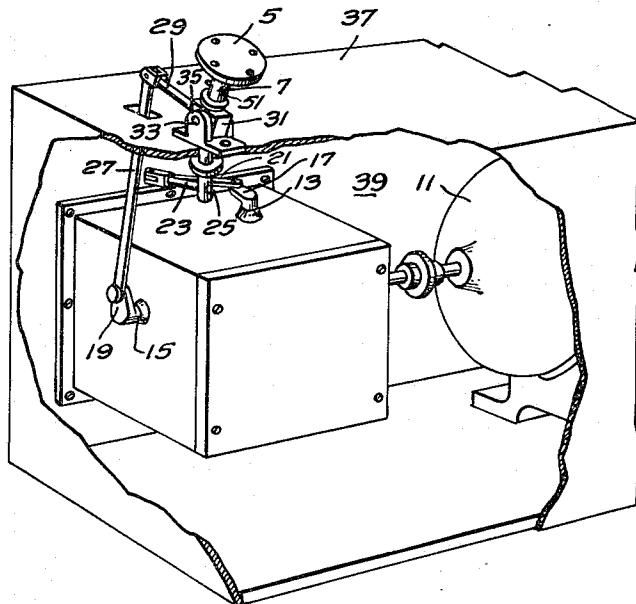


Fig. 2.



WITNESSES.

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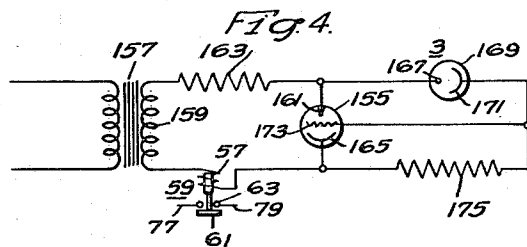
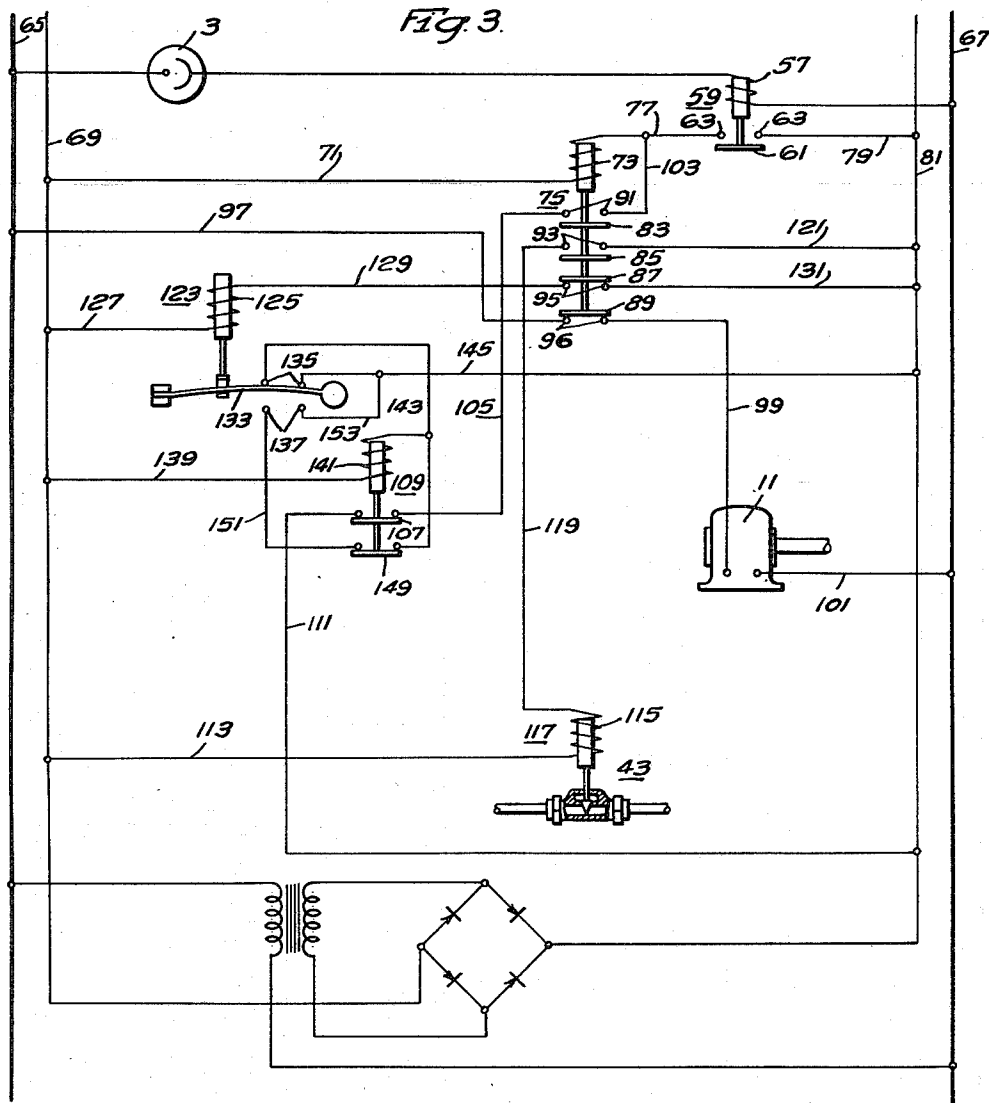
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2 Sheets-Sheet 2



WITNESSES

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PHOTOSENSITIVE APPARATUS

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8 Claims. (Cl. 169-2)

Our invention relates to photo-sensitive apparatus and has particular relation to apparatus of a type wherein a missile is projected automatically in response to a predetermined condition of its target.

It is an object of our invention to provide a device for automatically projecting a missile against a predetermined target.

A further object of our invention is to provide photo-sensitive apparatus for regulating the activity of a device adapted to project a material of predetermined properties.

An additional object of our invention is to provide a device for projecting a material of predetermined characteristics against a target having predetermined optical properties.

A more specific object of our invention is to provide a photo-sensitive sight for a missile-projecting device.

An incidental object of our invention is to provide an automatic fire-extinguishing device.

A further incidental object of our invention is to provide an automatic fire-extinguishing device that shall be active in a predetermined restricted region.

An additional incidental object of our invention is to provide a fire-extinguishing device that shall be active only for a predetermined period of time.

More concisely stated, it is an object of our invention to provide missile-projecting apparatus, of a type provided with a photo-sensitive eye for regulating the activity of the apparatus, wherein the position of the photo-sensitive eye and the projecting device are so related that the missiles are projected in accordance with the position of the target, as it affects the photo-sensitive eye.

According to our invention, we provide a photo-sensitive system wherein a predetermined region is scanned by a photo-sensitive eye. A missile-projecting device is secured to the eye and moves therewith. The relative disposition of the eye and the projection device is such that the trajectory of the missile and the line from the target to the photo-sensitive eye intersect at the target.

In the preferred embodiment of our invention, that is illustrated and described herein, the motion of the missile-projecting device is arrested for a predetermined time, during which time the missile is projected, the device then continuing to operate and to seek a further target in the region which it commands.

Specifically, our invention is illustrated herein, as will be presently apparent, as applied to a

fire extinguisher. In the specific embodiment of our invention, a nozzle through which an atomized fire-extinguishing fluid is projected follows the motion of a photo-sensitive scanning eye. The eye scans the surface, which may be the cross-section of a predetermined region, and, when an optical inhomogeneity in the region, such as a fire, comes into line therewith, the valve regulating the transmission of a fluid through the nozzle is opened, and an atomized fire-extinguishing fluid is projected upon the fire.

The valve, however, is not opened for an indefinite length of time but only for a period determined by the time in which the atomized extinguishing fluid is certain to extinguish a flame. It then continues to scan the surface and guard the region against further fire.

It will be noted that our invention has specific advantages in the field of fire extinguishers. In many localities, it is highly desirable that the extinguishing fluid, which has a highly deleterious effect on metallic apparatus, shall be restricted, in its activity, to a region as small as possible.

In the extinguishing apparatus constructed and operated according to the teaching of the prior art, of which we are aware, the fire-extinguishing fluid is released for an indefinite time and, consequently, does considerable damage to any property in the vicinity of the fire. It is apparent that there is considerable advantage in apparatus constructed according to our invention, wherein the extinguishing fluid is utilized only in the immediate neighborhood of the fire, and its projection is interrupted when the fire has been extinguished. The damage done to apparatus by reason of the deleterious properties of the extinguishing fluid is thus minimized.

However, we feel that it should be remembered that our apparatus may be applied, with facility, to systems other than that specifically mentioned above. In particular, the system has comparatively wide utility in the art of fire arms, by utilizing it as an automatic sighting device.

As will be set forth hereinafter, the photo-sensitive eye in the particular system described is responsive to the presence of a source of light. It may also be rendered responsive to a non-luminous region in a luminous background. In particular, it may be rendered responsive to a man or a body of men appearing in a landscape in the path of the sun's rays, for example. A device of this type may be secured to a gun of predetermined character, and the disposition of the two may be so regulated that, when the light illuminating the eye is obstructed by the presence

of a target, such as men or other bodies, the gun is fired directly at the target.

A series of guns of this type would render an attack in daylight suicidal. They have the further advantage of requiring little attention and may be operated by a comparatively small group of men.

The gun having a photo-sensitive sight may further be utilized in air fighting, where it may be so disposed on a plane as to fire when another plane comes between it and the sun. It has also considerable possibilities in the field of anti-aircraft artillery work. The shadow of a plane or of a squadron of planes may be utilized to de-energize the cell and to cause the gun associated therewith to fire directly at the target.

It is apparent that a gun equipped with a photo-sensitive device, in accordance with our invention, has the advantage of being independent of the human element that ordinarily enters into the operation of fire arms of the ordinary type.

As herein described and claimed, no limitation is to be imposed because of the terms employed to designate the object or objects or the material or materials, the projection of which is effected and controlled by means of an electric eye in conjunction with electrical devices and circuits which are subject to its action, as governed by light rays. It is to be understood, therefore, that the term "missile", as employed herein, may be a solid, a liquid or a gas or a mixture of all or any two such materials. Furthermore, a missile may be a single body or a plurality of bodies, provided they are projected simultaneously from a single source.

The novel features that we consider characteristic of our invention are set forth with particularity in the appended claims. The invention, itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of a specific embodiment when read in connection with the accompanying drawings, in which

Figure 1 is a view, in perspective, illustrating the principal elements of an embodiment of our invention in operation,

Fig. 2 is a view, in perspective, illustrating the essential features of the power-transmission elements utilized in motivating the scanning eye, a portion of the casing being broken away.

Fig. 3 is a diagrammatic view illustrating the electrical circuit utilized in the application of the embodiment of our invention illustrated in Fig. 1, and

Fig. 4 is a diagrammatic view showing, in detail, the photo-sensitive eye.

The apparatus shown in Figs. 1 and 2 comprises an enclosure 1 within which the photo-sensitive eye 3, to be hereinafter described, is disposed, and which is, in turn, mounted on a table 5 supported on a shaft 7, that is motivated in such manner as to scan a surface 9.

The table 5, on which the photo-sensitive eye 3 is mounted, is operated by a motor 11 that is geared to a plurality of shafts 13 and 15 through which a plurality of bell-crank arms 17 and 19 are rotated at a predetermined rate in accordance with the rate at which it is desirable to scan the surface. One bell crank arm 17 is mounted in such manner that it rotates in a horizontal plane, while the remaining bell-crank arm 19 is mounted to rotate in a vertical plane. The gearing is not illustrated in the drawings but is of a type well

known in the art which need not be described herein.

The link 17 has a joining arm 21 pivotally secured thereto that is, in turn, pivotally connected to a forked arm 23 fastened to a vertical shaft 25. The link 21 between the forked arm 23 and the bell-crank arm 17 is reciprocated by the rotation of the shaft 13, and the vertical shaft 25 is, consequently, caused to oscillate by reason of the oscillating motion transmitted to the forked arm 23, by the joining link 21.

The vertical shaft 25 is flexibly coupled to the shaft 7 which supports the table 5 on which the photo-sensitive eye 3 is mounted and, in oscillating, causes the table to oscillate. It is to be noted that the oscillation is in a horizontal plane. As a consequence, the particular motion imparted to the photo-sensitive eye 3 thereby causes it to scan the desired surface 9 in a horizontal direction.

The flexible coupling between the shaft 7 and the shaft 25 may be of any desired nature, and we have found a knuckle joint particularly useful in this connection.

Vertical motion is imparted to the photo-sensitive eye 3 in a manner substantially as the horizontal motion is imparted, although, in most instances, it has a considerably greater period. The bell-crank arm 19, rotating in a vertical plane, has a joining link 27 pivotally fixed thereto that is pivotally secured to a forked arm 29. The arm 29 is secured to a block 31 that is pivoted between a plurality of pins 33, with which a bracket 35, mounted on the top 37 of the enclosure 39, is provided, the power-transmission apparatus being disposed within the enclosure.

The rotation of the bell-crank arm 19 causes a reciprocation of the joining link 27 and a consequent oscillation of the forked bar 29. The oscillation is transmitted to the pivoted block 31 and, hence, to the photo-sensitive eye 3.

It is to be noted that the relative period of scanning may be regulated by regulating the period of rotation of the two bell-crank links.

The electrical circuit for the system is illustrated in Fig. 3 and will be described presently. However, when the photo-sensitive eye 3 is so positioned that it receives the radiation from a region 41 of the scanned surface 9, the electrical system is so actuated as to release the valve 43 for regulating the flow of gas from a supply 45. The gas is fed, through a flexible tube 47, into a metallic tube 49 that traverses an opening 51 in the shaft 7 which supports the photo-sensitive eye 3 and is secured thereto. A nozzle 53 is secured to the rigid tube 49 and has a container 55 fastened thereto in which a fire-extinguishing fluid is contained.

The container 55 and the nozzle 53, being fastened to the moving shaft 7, are motivated thereby to scan the surface 9, together with the photo-sensitive eye 3. The gas, in flowing through the tubes 47, 49, and nozzle 53, passes over a constriction (not shown) in the nozzle 53 that has an opening leading into the container 55 of the extinguishing fluid. The extinguishing fluid is then drawn into the nozzle 53 and projected, in atomized form, upon the surface. By reason of its position in the shaft 7, the nozzle 53 is so directed that the fluid is projected directly upon the burning area 41, from which the light, that excites the photo-sensitive eye 3 is emitted.

It will be noted that the extinguishing fluid is projected for only a predetermined time, and that the photo-sensitive eye 3 is directed to the posi-

tion of the flame for the time that the fluid is projected. The time during which the fluid is projected may be regulated at will and is ordinarily made greater than the time necessary for the fluid to extinguish the flame. However, if the flame should not be extinguished after the fluid projection has been interrupted, the photo-sensitive eye, being directed to the position of the flame, will again be energized, and the operation of the fluid will continue for another period, as predetermined.

As illustrated in Fig. 3, the system is in its inactive position, that is to say, the photo-sensitive eye 3 is scanning the surface and has not come under the influence of light rays projected from a flame.

When the eye 3 is excited by the light radiations from a flame, it is energized, the exciting coil 57 of a relay 59, connected in series therewith, is energized, and the movable contact 61 of the relay 59 engages a plurality of fixed contacts 63. As illustrated, the photo-sensitive eye 3 and the relay 59 associated therewith are operated from the bus lines 65 and 67 of an alternating-current supply source.

The contacts 61 and 63 of the relay 59 are adapted to close a circuit from one bus line 69 of a direct-current source, through a lead 71, the exciting coil 73 of a second relay 75, a lead 77, the movable contact 61 of the relay 59 and a lead 79, to the remaining bus line 81 of the direct-current source. The relay 75 is equipped with a plurality of movable contacts 83, 85, 87, and 89 and, in being energized, it causes these contacts to become engaged with, or to be disengaged from, their corresponding fixed contacts 91, 93, 95 and 96, as the case may be, causing a series of circuits to be interrupted and closed.

The lower movable contact 89 that is in closed position, when the relay 75 is deenergized, is adapted to be serially connected to the windings of the motor 11 that drives the table 5 on which the photo-sensitive eye 3 is supported.

The circuit through the motor 11 is as follows: from one bus line 65 of the alternating-current source, through a lead 97, the movable contact 89 of the relay 75, a lead 99, the windings of the motor 11 and a lead 101 to the remaining bus line 67 of the alternating-current source. Consequently, when the relay 75 is energized, the motor 11 is deenergized, and the motion of the photo-sensitive eye 3 and its attached projection device is interrupted.

The relay 75, to which reference was made hereinabove, is also equipped with a lock-in circuit that prevents it from becoming open when the light emitted from the fire is of such low intensity as to no longer radiate enough light to the photo-sensitive eye, to operate the system.

The lock-in current takes the following path: from one bus line 69 of the direct-current source, through the lead 71, the exciting coil 73 of the relay 75, a lead 103, a normally open contact 83 of the relay 75, a lead 105, a normally closed contact 107 of another relay 109, and a lead 111, to the remaining bus line 81 of the direct-current source. It will be noted that the second relay is now locked in through its own contact 83 and through a contact 107 of the relay 109. The relay 109 is utilized in opening the circuit after the fire has been extinguished, and its operation will be explained presently.

A third contact 85 of the relay 75 closes a circuit from one bus line 69 of the direct-current source, through a lead 113, the exciting coil 115 of

a relay 117, that operates the valve 43 of the gas supply 45, a second lead 119, the contact 85, and a lead 121 to the remaining bus line 81 of the direct-current source. When the exciting coil 115 of the relay 117 is excited, the gas valve 43 is opened, and the gas passes into the tube 47 and causes the extinguishing fluid to be projected upon the flame 41.

The period of time during which the fluid is projected upon the flame is regulated by a time-delay relay 123, the exciting coil 125 of which is deenergized by the disengagement of a fourth contactor 87 associated with the relay 75. The exciting circuit for the relay 123 is as follows: from one bus line 69 of the direct-current source, through a lead 127, the exciting coil 125 of the time-delay relay 123, a lead 129, the contactor 87 and a lead 131, to the remaining bus line 81 of the direct-current source.

When the time-delay relay 123 becomes deenergized, it causes a pendulum contactor 133 to oscillate between two sets of fixed contacts 135 and 137, alternately closing two circuits; one circuit being from a bus line 69 of the direct-current source, through a lead 139, the exciting coil 141 of the relay 109, a lead 143, contacts on the pendulum, one set of fixed contacts 135 and a lead 145, to the remaining bus line 81 of the direct-current source, and the other circuit being from the bus line 69 of the direct-current source, through the lead 139, the exciting coil 141 of the relay 109, the lead 143, a movable contact 149 of the relay 109, a lead 151, contacts on the pendulum 133 the other fixed contacts 137 and a plurality of leads 153 and 145, to the remaining bus line 81 of the direct-current source.

The relay 109, that is excited through the pendulum contactor 133, is sluggish in its action and only opens after the pendulum 133 has ceased to vibrate and rests between the fixed contacts 135 and 137. When the contactor 133 is in this position, the relay 109 is deenergized and, consequently, the contactor 107, associated with the lock-in circuit of the principal relay 59, is opened, and the relay 59 is deenergized. The system is thus reverted to its original condition, as illustrated in the view, and the photo-sensitive eye 3 continues to scan the surface 9.

In Fig. 3, the photo-sensitive eye 3 is designated by the symbolical characters utilized in illustrating a photo-sensitive tube. It is true that a photo-sensitive tube may be made to operate in the particular system. However, under ordinary circumstances, it is highly desirable that an electron-discharge relay be utilized in combination with the photo-sensitive tube.

The relay system is illustrated in Fig. 4 and comprises an electron-discharge tube 155, of any well-known type operated from the alternating-current source through a transformer 157. The secondary 159 of the transformer 157 is connected to the anode 161 of the tube 155 through a current-limiting resistance 163 and to the cathode 165 of the device, through the exciting coil 57 of the relay 59, to which reference was made hereinabove. The anode 167 of a photo-sensitive tube 169 is connected to the anode 161 of the electric-discharge device 155, and its cathode 171 is connected to the control electrode 173 of the device 155. An impedance 175 is connected between the cathode 165 of the device 155 and the control electrode 173 thereof.

It will be noted that, when the photo-sensitive tube 169 is in an excited state, the impedance between the anode 161 and the control electrode 173

of the electric-discharge device 155 is decreased, and the device becomes energized. The coil 57 of the relay is, therefore, excited, and the movable contactor 61 of the relay engages its corresponding fixed contacts 63 and initiates the operation of the system, as has been described above.

It is apparent that a number of modifications of our system are possible and certain of them have been mentioned in the above description. It is, furthermore, to be noted that a number of specific features described herein may be changed without changing the essential elements of our invention. In particular, the type of tube utilized and the specific circuit in which it is connected may be modified in several ways. These modifications, of course, are included within the scope of our invention.

It should be further remembered that our invention may also have further uses besides those ascribed to it above. It may, for example, be utilized on vaudeville stage. In one of its modifications, a number of illuminated balloons may be exploded by the operation of a scanning device similar to the device described herein. In this particular application, our invention may be applied in a system that is rather spectacular and, consequently, excites the interest of an audience. The number of possible applications of our invention in this field is apparently limitless.

Although we have shown and described certain specific embodiments of our invention, we are fully aware that many modifications thereof are possible. Our invention, therefore, is not to be restricted except insofar as is necessitated by the prior art and by the spirit of the appended claims.

We claim as our invention:

1. A photo-sensitive eye, means for causing said eye to progressively scan a surface and means for projecting a material of predetermined properties upon said surface, the activity of said projecting means being instantaneously responsive to a variation in the excitation of said eye superinduced by an inhomogeneity of a predetermined nature in said surface, means for fixedly adjusting the direction of the trajectory of said material with respect to said eye, so that the material intersects with the straight line drawn between said photo-sensitive eye and said inhomogeneity, said point of intersection being located within the inhomogeneity.

2. A photo-sensitive eye, means for causing said eye to progressively scan a region and means for projecting a material of predetermined properties into said region, the activity of said projecting means being instantaneously responsive to a variation in the excitation of said eye superinduced by an inhomogeneity of a predetermined nature in said region, means for fixedly adjusting the direction of the trajectory of said material with respect to said eye, so that the material intersects with the straight line drawn between said photo-sensitive eye and said inhomogeneity, said point of intersection being located within the inhomogeneity.

3. A photo-sensitive eye, means for causing said eye to progressively scan a surface and means for projecting a material of predetermined properties upon said surface, the activity of said projecting means being instantaneously responsive to a variation in the excitation of said eye superinduced by an inhomogeneity of a predetermined nature in said surface, the means for projecting said material being fixedly correlated with respect to the orientation of said eye so as to effect the

coverage by said material of a considerable portion of said surface including said inhomogeneity.

4. A photo-sensitive eye, means for causing said eye to progressively scan a region and means for projecting a material of predetermined properties into said region, the activity of said projecting means being instantaneously responsive to a variation in the excitation of said eye superinduced by an inhomogeneity of a predetermined nature in said region, means for fixedly adjusting the direction of the trajectory of said material with respect to said eye, so that the material is substantially directed onto the location had by the inhomogeneity at the time when it effects the actuation of said photo-sensitive eye.

5. A photo-sensitive eye, means for causing said eye to progressively scan a surface and means for projecting a fire-extinguishing fluid upon said surface, the activity of said projecting means being instantaneously responsive to a variation in the excitation of said eye superinduced by a burning or glowing spot on said surface, means for fixedly adjusting the direction of the trajectory of said fluid with respect to said eye, so that the fluid intersects with the straight line drawn between said photo-sensitive eye and said burning or glowing spot, said point of intersection being located within said spot.

6. A photo-sensitive eye, means for causing said eye to progressively scan a surface and means for projecting a material of predetermined properties upon said surface, the activity of said projecting means being instantaneously responsive to a variation in the excitation of said eye superinduced by an inhomogeneity of a predetermined nature in said surface, means for fixedly adjusting the direction of the trajectory of said material with respect to said eye, so that the material intersects with the straight line drawn between said photo-sensitive eye and said inhomogeneity, said point of intersection being located within the inhomogeneity, and time delay means for prolonging the activity of said projecting means for a predetermined time.

7. A photo-sensitive eye, means for causing said eye to progressively scan a region and means for projecting a material of predetermined properties into said region, the activity of said projecting means being instantaneously responsive to a variation in the excitation of said eye superinduced by an inhomogeneity of a predetermined nature in said region, means for fixedly adjusting the direction of the trajectory of said material with respect to said eye, so that the material intersects with the straight line drawn between said photo-sensitive eye and said inhomogeneity, said point of intersection being located within the inhomogeneity, and time delay means for prolonging the activity of said projecting means for a predetermined time.

8. A photo-sensitive eye, means for causing said eye to progressively scan a region and means for projecting a material of predetermined properties into said region, the activity of said projecting means being instantaneously responsive to a variation in the excitation of said eye superinduced by an inhomogeneity of a predetermined nature in said region and means for fixedly adjusting the direction of the trajectory of said material with respect to said eye, so that the material is projected on said inhomogeneity.

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