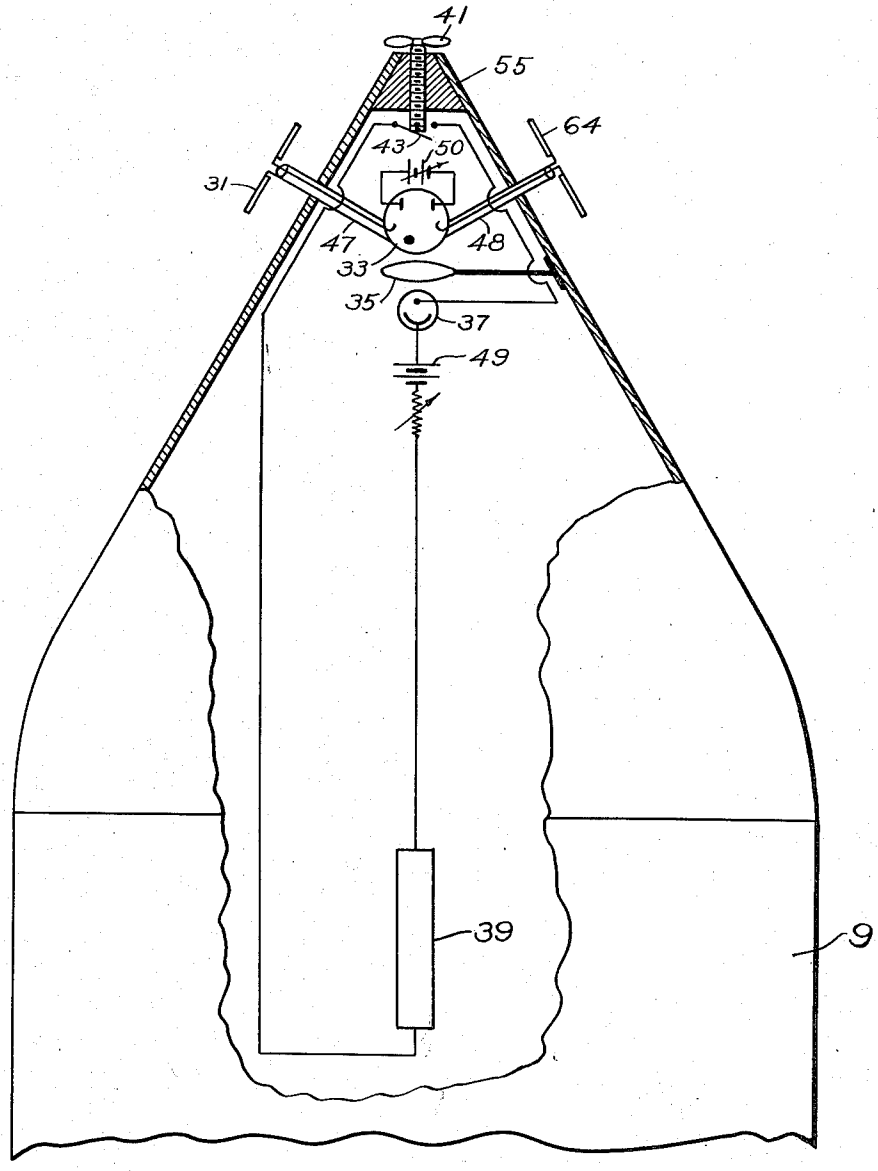
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FUSE

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FUSE

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The present invention relates to fuses, and more particularly to fuse systems for exploding shells or other projectile explosives from a point remote from the shell or the projectile. This present application is filed in response to a requirement for division in application, Serial No. 625,162, filed October 29, 1945.

An object of the invention is to provide a novel radio-controlled firing system.

A further object is to provide for controlling the burst of a shell or other projectile explosive from a point distant from the position of the projectile in motion.

According to present-day techniques, after a projectile, such as a shell or a rocket, has been fired from a projector toward a target object, such as an airplane, the time of its explosion is controlled at the projectile itself. The explosion may, for example, be under the control of a time fuse, a powder-train fuse, a radio-transmitting-and-receiving mechanism, or a photocell fuse in the projectile. The control is such as to assure the explosion of the projectile at the moment of its approach toward the airplane object. If a time fuse or a powder fuse be employed, the target airplane is detected, its line of flight is plotted in order to make possible the prediction of its future position, and the time mechanism in the projectile fuse is set accordingly before firing. In the case of a radio fuse or a photocell fuse, the explosion of the projectile is effected by the mere fact of its proximity to the target object, and no further control from the ground is necessary. All these prior-art methods are subject to the disadvantage that the projectile may explode at a time or a place where it will not harm the enemy and may, in fact, damage a friend. At the very least, a premature or a too-late or otherwise useless projectile explosion may serve to inform an enemy aircraft that it is under fire. In the case of proximity fuses, furthermore, firing at low-flying aircraft in low quadrants of elevation, for example, will often cause premature explosion because of the proximity of the ground to the shell.

A further object of the present invention is to provide a fuse mechanism for exploding the projectile accurately, at any desired time during its flight, from the point of its firing, or from any other position remote from the projectile.

Other and further objects will be explained hereinafter, and will be particularly pointed out in the appended claims.

The invention will now be more fully explained in connection with the accompanying drawing, the single figure of which is a diagrammatic view of a fuse system arranged and constructed according to a preferred embodiment thereof.

According to the system disclosed in the parent application, and as is described also, for example, in an article by H. G. Foster, entitled, "Radar in A. A. Defense," Electronic Engineering, vol. 18, No. 215, January 1946, pages 2 to 8, a radio-location or sound-location or other locator system may be employed to detect and track objects, such as aircraft, the data so obtained being used

to fire anti-aircraft guns or rockets or other projectiles at the objects.

Once a shell or other projectile is fired at an object, it is desired to cause the shell to explode when it approaches within a lethal area of the object. Thus a radio-location or other detecting station can track the shell as well as the object and can determine when the shell has approached within such a predetermined range of the object that it would do damage if it were exploded. At this instant, the radio-location station may send a special radio trigger signal, as described in the parent application, towards the shell to cause it to explode. A receiving-mechanism fuse provided in the projectile 9 will then cause the projectile to explode almost immediately, since radio waves travel 3×10^8 meters per second.

This receiving mechanism, according to the present invention, may comprise a receiving antenna or a plurality of antennas, providing omni-directional reception or a field pattern that permits reception from the direction of the firing point or any point from which the radio-triggering signal is to come. Two dipoles of dimensions resonant to the trigger signal frequency are shown at 31 and 64, preferably mounted externally to the fuse 55. If desired, the fuse casing 55 itself may constitute the antenna system, being of dimensions resonant to the radio frequency of the radio trigger signal.

The antenna or antennas feed into the fuse to energize a light-transparent radio-frequency cavity resonator 33 of dimensions resonant to the radio waves transmitted by the trigger transmitter. The radio-frequency resonant cavity 33 may be spherical, as shown, or of any other desired shape, and may be constituted of polystyrene or any other similar light-transparent material that serves as a conductor of high-frequency radio waves. The resonator may be filled with an illuminating agent; for example, a rare gas, such as neon or argon.

The antennas 31 and 64 are shown connected to the resonant cavity 33 by coaxial lines 47 and 48, respectively, the inner conductors of which provide feed-in or coupling loops which may terminate on the inner wall of the resonator. The radio-frequency energy received and conducted by the coaxial lines and coupling loops is thus fed into the gas in the cavity resonator 33, resulting in ionizing the gas therein, which therefore becomes illuminated. The illumination may be focused by a lens 35 upon a photocell 37, connected in series with a source of voltage, such as a battery 49, and an igniting mechanism 39, such as a charge, as of powder, for exploding the explosive mixture of the shell or projectile.

When the trigger transmitter at a remote point, perhaps at the radio-location station or at the guns, thus sends a radio signal that is received by the antennas and energizes the resonant cavity 33, therefore, the light from the ionization of the cavity resonator gas causes current to flow in the light-sensitive circuit of the photocell 37, upon which the light is focused, thereby causing a sufficiently large current to flow through the charge 39 to ignite the charge 39 and to explode the shell.

If desired, the light-transparent radio cavity resonator may be maintained partially ionized by a striking potential from an energy source 50. The current produced in the photocell circuit is adjusted so that it is not enough to ignite the charge 39. When the radio energy from the trigger transmitter (not shown) is conveyed into the cavity resonator, the gas will become further ionized, producing an increased intensity of light discharge and a greater current in the photocell circuit for setting off the mechanism 39.

To prevent premature operation, thereby further to control the explosion of the projectile at any desired time, or when it occupies any desired position, from any desired remote point, an arming device, such as an arm-

ing propeller screw 41, may be provided to maintain the photocell circuit open, by holding down a switch 43, for example, until such time as the projectile has traveled a desired or predetermined length of time. At the end of this time, the arming propeller 41 will have unscrewed itself from the fuse nose in flight, thereby releasing the switch 43, and completing the photocell circuit in the fuse for operation upon the receipt of the energizing radio-trigger signal from the remote point.

Other and further modifications will occur to persons skilled in the art, and all such are considered to fall within the spirit and scope of the invention as defined in the appended claims.

What is claimed is:

1. A fuse having, in combination, means for receiving radio waves resonant to the frequency of the received waves, illumination-producing means, means for feeding the energy of the received radio waves to the illumination-producing means for producing illumination in response to the received radio waves, and means responsive to the illumination so produced for energizing the fuse.

2. An explodable mechanism having, in combination, means for receiving radio waves resonant to the frequency of the received waves, illumination-producing means, means for feeding the energy of the received radio waves to the illumination-producing means for producing illumination in response to the received radio waves, explodable means, and means responsive to the illumination so produced for energizing the explodable means.

3. A fuse having, in combination, means for receiving radio waves resonant to the frequency of the received waves, illumination-producing means, means for feeding the energy of the received radio waves to the illumination-producing means for producing illumination in response to the received radio waves, explodable means, means responsive to the illumination so produced for energizing the explodable means, and means for preventing the energization of the explodable means for a predetermined period of time.

4. A fuse having, in combination, means for receiving radio waves, a light-transparent cavity resonator connected to the radio-receiving means, the cavity resonator being provided with an illuminating agent to produce illumination upon the receipt of radio waves by the radio-receiving means, means responsive to the illumination so produced for energizing the fuse, and means for preventing the said energization for a predetermined period of time.

5. A fuse having, in combination, a charge, means for receiving radio waves resonant to the frequency of the radio waves, illumination-producing means, means for feeding the energy of the received radio waves to the illumination-producing means for producing illumination in response to the received radio waves, and means including a photocell in circuit with the charge for responding to the illumination so produced thereby to energize the said charge.

6. A fuse having, in combination, antenna means for receiving radio waves, a light-transparent cavity resonator of dimensions resonant to the radio waves and connected to the antenna means, the cavity resonator being provided with a gas to produce illumination upon the receipt of radio waves by the antenna means, and photocell-controlled means responsive to the illumination so produced for energizing the fuse.

7. In a fuse having explodable means energizable in response to an illumination signal, the combination of means for receiving high frequency energy and a light-transparent cavity resonator connected with the receiving means and of dimensions resonant to the frequency of the energy received, the resonantor being filled with a rare gas illuminable in response to high-frequency resonance therein to produce an illumination signal for energizing the explodable means.

8. A fuse having, in combination, antenna means for receiving radio waves, a light-transparent cavity resonator of dimensions resonant to the radio waves provided with a gas, means for partially ionizing the gas, means for connecting the cavity resonator to the radio-receiving means to produce increased ionization of the gas upon the receipt of radio waves by the antenna means, and photocell-controlled means responsive to the illumination of the increased ionization so produced for energizing the fuse.

9. A fuse having, in combination, means for receiving radio waves, a light-transparent cavity resonator provided with an illuminating agent, means for illuminating the illuminating agent, means for connecting the cavity resonator to the radio-receiving means to produce increased illumination of the illuminating agent upon the receipt of radio waves by the radio-receiving means, and means responsive to the increased illumination so produced for energizing the fuse.

10. An electric system having, in combination, means for receiving radio waves, a cavity resonator having walls formed of light-transparent material and connected with the receiving means and of dimensions resonant to the received radio waves, and illuminating means controlled by the cavity resonator for indicating radio-wave resonance therein.

11. An electric system having, in combination, means for receiving high-frequency energy and a light-transparent cavity resonator connected with the receiving means and of dimensions resonant to the frequency of the received energy, the resonator being filled with a gas illuminable in response to high-frequency resonance therein.

12. An electric system having, in combination, means for receiving radio waves, a cavity resonator connected with the receiving means and of dimensions resonant to the received radio waves, illuminating means controlled by the cavity resonator for indicating radio-wave resonance therein, and an electric circuit responsive to the indication produced by the illuminating means for producing an electric signal corresponding to the said indication.

13. An electric system having, in combination, means for receiving high-frequency energy, a cavity resonator connected with the receiving means and of dimensions resonant to the frequency of the received energy, illuminating means controlled by the cavity resonator for indicating high-frequency resonance therein and a photoelectric circuit responsive to the illumination of the illuminating means for producing an electric signal corresponding to the said illumination.

14. An electric system having, in combination, means for receiving high-frequency energy and a cavity resonator having walls formed of light-transparent material and connected with the receiving means and of dimensions resonant to the frequency of the received energy.

15. An electric system having, in combination, means for receiving high-frequency energy, and a spherical cavity resonator having walls formed of light-transparent material and connected with the receiving means and of dimensions resonant to the received energy.

16. An electric system having, in combination, means for receiving high-frequency energy, a light-transparent cavity resonator cooperative with the receiving means and of dimensions resonant to the high-frequency energy and filled with an illuminating medium, and means for conditioning the illuminating medium for illumination in response to high-frequency resonance in the resonator.

17. A fuse having, in combination, means for receiving high-frequency energy, a light-transparent cavity resonator connected to the high-frequency-energy-receiving means, the cavity resonator being provided with an illuminating agent to produce illumination upon the receipt of high-frequency energy by the high-frequency-

energy-receiving means, and means responsive to the illumination so produced for energizing the fuse.

18. A fuse having, in combination, means for receiving high-frequency energy, a light-transparent cavity resonator connected to the high-frequency-energy-receiving means, the cavity resonator being provided with an illuminating agent to produce illumination upon the receipt of high-frequency energy by the high-frequency-energy-receiving means, and means comprising an illumination-sensitive circuit responsive to the illumination so produced for energizing the fuse.

19. A fuse having, in combination, means for receiving high-frequency energy, a light-transparent cavity resonator connected to the high-frequency-energy-receiving means, the cavity resonator being provided with a gaseous-discharge illuminating agent to produce illumination upon the receipt of high-frequency energy by the high-frequency-energy-receiving means, and means responsive to the illumination so produced for energizing the fuse.

20. An electric system having, in combination, means for conducting high-frequency energy and a light-transparent cavity resonator connected with the conducting means and of dimensions resonant to the frequency of the conducted high-frequency energy, the resonator being filled with a medium ionizable in response to high-frequency resonance therein.

21. An electric system having in combination, means for conducting high-frequency energy, a cavity resonator connected with the conducting means and of dimensions resonant to the conducted high-frequency energy, the resonator being filled with a medium ionizable in response to high-frequency resonance therein, means comprising electrode means associated with the cavity resonator for applying a biasing potential to the ionizable medium, and means responsive to the resonance-produced ionization of the medium for producing an electric signal indicative thereof.

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