July 5, 1960 W. J. FLETT 2,943,572

FUZE

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FIG. 1

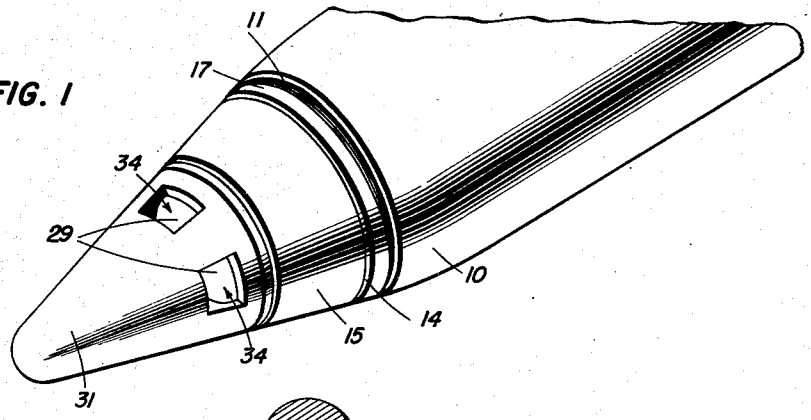
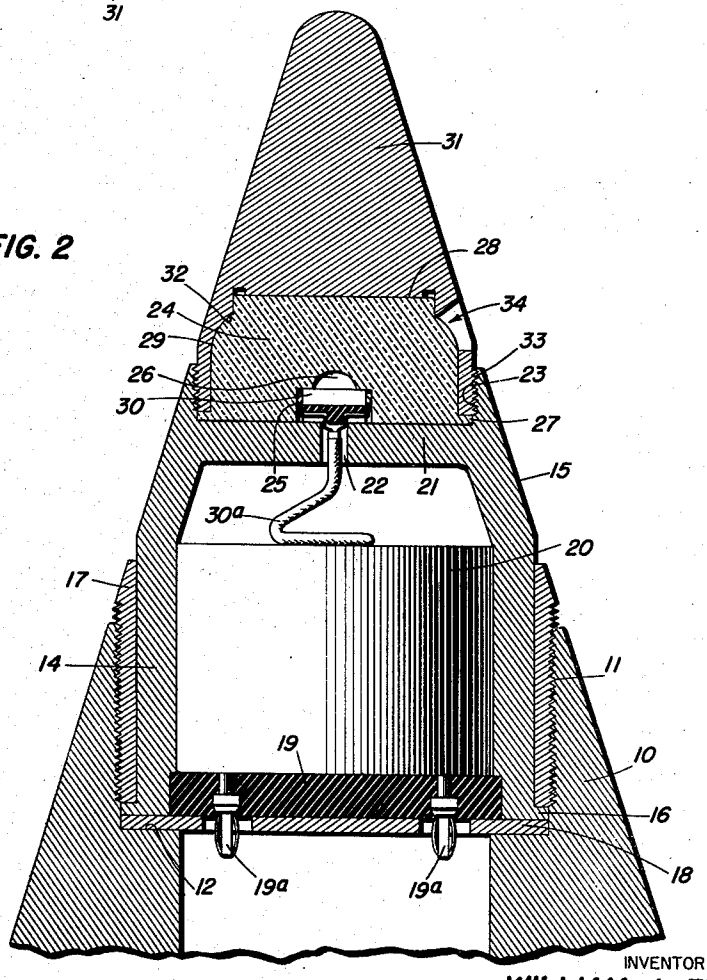


FIG. 2



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FIG. 3

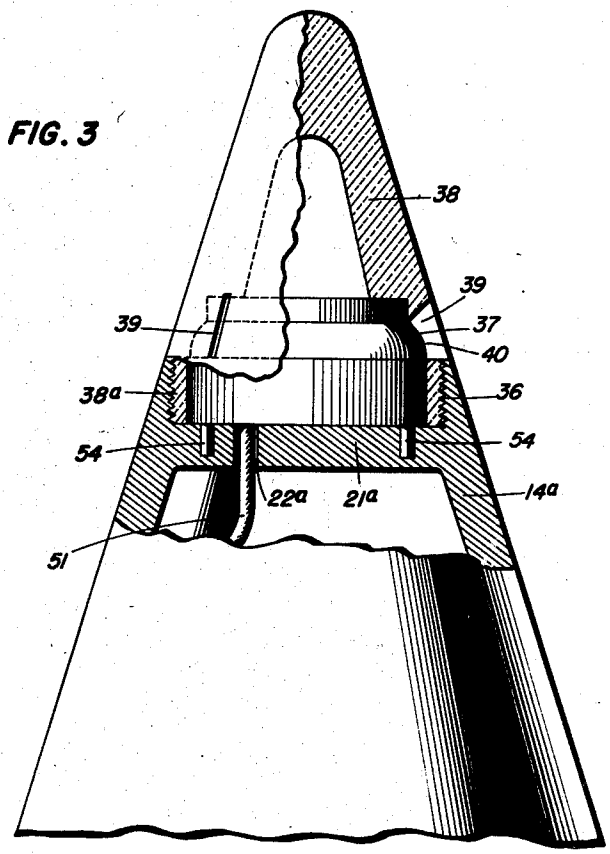
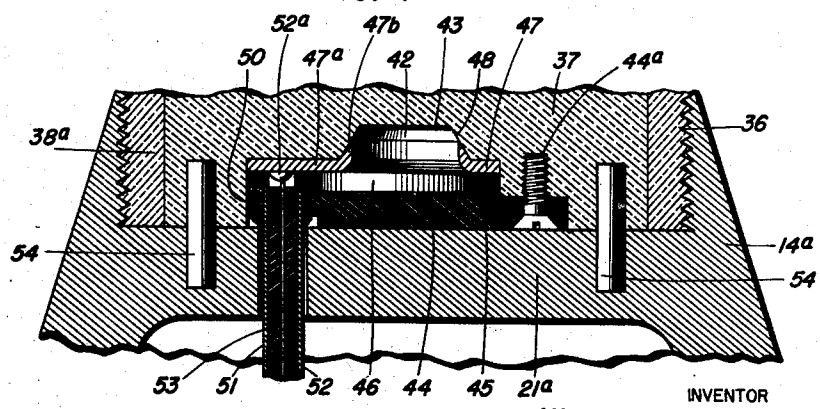


FIG. 4



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FUZE

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6 Claims. (Cl. 102—70)

This invention relates to electrically detonated projectiles and more particularly to a novel photoelectric fuze for use in rotary and other types of projectiles. The new fuze is simple and compact in construction and is well adapted to withstand shocks incident to handling and firing projectiles.

One object of the invention resides in the provision of a photoelectric proximity fuze having a barrier or photo-galvanic type photoelectric cell which is held in a compact mounting, whereby the fuze occupies a relatively small space in the projectile.

A further object of the invention is to provide a fuze of the character described having an improved light-slit arrangement.

Still another object of the invention is to provide a photoelectric proximity fuze which is sufficiently rugged to withstand accelerations of the order present in a projectile fired from a gun.

A fuze made in accordance with the invention comprises a housing, which may form the nose of a projectile, and a lens mounted in the housing adjacent a plurality of openings therein. If desired, the openings may be in the form of longitudinal slits spaced circumferentially around the housing. A photoelectric cell is fitted snugly in a recess in the lens and receives light passing through the openings and lens. In the preferred construction, the lens is disposed in the open end of a hollow body from which the lens projects, and the lens is held tightly in the body by the housing having the openings, the housing being threaded or otherwise secured to the hollow body. The photoelectric cell is preferably mounted in a central recess in the base of the lens so that the cell is confined between the lens and a part of the hollow body. With this construction, the lens may be connected by direct electrical connections to the necessary electrical components mounted in the hollow body.

These and other objects of the invention may be understood by reference to the accompanying drawings, in which

Fig. 1 is a perspective view of the nose portion of a projectile employing one form of the invention;

Fig. 2 is an enlarged longitudinal sectional view of the projectile fuze shown in Fig. 1;

Fig. 3 is a side view, partly in section, showing a modified form of the fuze, and

Fig. 4 is an enlarged longitudinal sectional view of part of the fuze shown in Fig. 3.

The fuze of the present invention is of the type which is adapted to fire automatically in proximity to a target, due to the interception by the target of light rays impinging upon a photoelectric cell in the fuze. A fuze of this type is disclosed in a copending application of L. R. Hafstad et al., Serial No. 568,020 filed December 13, 1944.

Referring to the drawings, the numeral **10** designates the forward end of a projectile casing containing an explosive charge (not shown). It will be understood that the projectile may be of the type to be fired from

a gun, or it may in the form of a bomb or rocket. At its forward end, the projectile casing **10** is open and is internally threaded, as shown at **11**, the threaded portion terminating in an internal shoulder **12**.

The fuze, as shown, comprises a metal body or shell **14** which is of cylindrical shape throughout the major portion of its length but is tapered to form a generally frusto-conical forward end portion **15**. At its lower end or base, the body **14** is formed with a radial flange **16** positioned near the lower end of the threaded recess **11**. The frusto-conical portion **15** is disposed so that its external surface is substantially flush with the outer surface of the front end portion of the projectile casing **10**.

In order to lock the body **14** in place in the threaded recess **11**, there is provided a locking ring **17** which is screwed into the open front end of the projectile around the body **14**. The ring **17** is screwed inwardly on the threads **11** until the lower end of the ring contacts the upper surface of the flange **16** and clamps the flange tightly against the rim of a bottom plate **18** which is seated on the shoulder **12**. The plate **18** provides reinforcement for an insulating terminal plate **19** fitted in the lower end portion of the body **14**. The terminal plate **19** carries a generally circular series of connecting prongs **19***a* for providing electrical connection between the detonator (not shown) in casing **10** and an amplifier and thyratron unit **20** in the body **14**. The electrical circuit for the fuze forms no part of the present invention and therefore is not shown, although reference may be had to the above-identified application of L. A. Hafstad et al., which discloses a suitable circuit for this use.

The body **14** is closed near its upper end by a transverse wall **21** which has an axially disposed opening **22**. The side walls of the body **14** project above the wall **21** and define an internally threaded recess **23** at the upper end of the body **14**.

A lens block **24** is seated in the recess **23** on the transverse wall **21**. The lens **24** has in its bottom surface an axially disposed cylindrical chamber **25** terminating at its upper end in a reduced hemispherical refracting surface **26**. At its lower end, the lens **24** has a radial flange **27**, and the lens is formed at its upper end with a flat wall **28**. The lens is enlarged below the wall **28**, and the upper portion of the lens enlargement is shaped to provide an arcuate, circular lens surface **29**.

Mounted in the chamber **25** in concentric relation to the lens surface **29** is a barrier or photo-galvanic type photo cell **30**. The cell **30** is connected with the components of the amplifier **20** in the body **14** by a conductor **30***a* extending through the central opening **22** in wall **21**.

To lock the lens block **24** in position, there is provided a nose element **31** of generally conical shape and preferably formed of metal. The nose element **31** has a central recess **32** in its base for receiving the upper end portion of the block **24** and is formed with an externally threaded rim **33** which screws into the recess **23** and clamps the lens flange **27** against the upper surface of wall **21**. A circular series of openings **34** is formed in the nose element **31** and communicates with recess **32** near the upper end thereof. The openings **34**, which are shown as substantially square, are disposed opposite the lens surface **29** and cooperate therewith for admitting light through the lens block **24** to the refracting surface **26** and thus to the photoelectric cell **30**. In order to restrict the entrance of light to the openings **34**, the nose element **31** may be coated with a suitable masking paint.

The operation of the device is as follows: When the projectile **10** is fired from a gun, the control means, including the amplifier and thyratron unit **20**, are armed by a suitable safety device (not shown). During the flight of the projectile, a sudden change in the intensity of the light on the cell **30**, caused by the proximity of a target

such as an airplane, will cause a current pulse, and this pulse is amplified by the unit 20 to such an extent that it will cause the thyratron 20 to trigger, whereby the detonator (not shown) is energized and fired through the plugs 19*a*. It will be evident that the photoelectric cell 30 is subjected only to the light passing through the openings 34 and the adjacent lens block 24, and that the light impinges upon the cell from openings on all sides of the cell. Thus, the cell is responsive to light changes from any direction around the nose portion of the projectile.

The fuze structure shown in Figs. 3 and 4 comprises a hollow, frusto-conical body 14*a* having a top wall 21*a*. The top wall has an opening 22*a* communicating with a threaded recess 36 in the upper or nose portion of the body 14*a*. A lens block 37 is mounted in the recess 36 and is held in place by a conical nose element 38 having at its base end a hollow boss 38*a* threaded into the recess 36, whereby the lens block is clamped against the wall 21*a*. The nose element 38 is provided with a circular series of longitudinal slits 39 for admitting light to a convex lens surface 40 on the lens block. In the base of the lens block 37 is a central recess 42 which is reduced at its upper end, the latter forming a flat wall which is coated with a masking paint 43.

Fitted snugly in the recess 42 is a photo cell supporting plate 44, which may be secured to the lens block in any suitable manner, as by means of screws 44*a*. The supporting plate 44 is made of insulating material and supports a contact plate 45 which, in turn, supports a photogalvanic cell 46 in recess 42. A terminal ring 47 overlies the cell 46 throughout its marginal region and extends radially at one side of the opening 42 to define a terminal 47*a*. As shown, the ring 47 is formed with an upstanding, generally frusto-conical flange 47*b* which cooperates with the top wall of the recess to define an annular light admitting slit 48, the slit being presented toward the convex lens surface 40.

A contact sleeve 50 is secured in an opening in the plate 44 and engages a portion of the conducting plate 45. Connected to the sleeve 50 is a tubular conductor 51 which forms part of an electrical connection from the photo cell through the sleeve 50 and contact plate 45. The other electrical connection from the photo cell includes a wire 52 which extends through an insulating tube 53 in the tube 51, the upper end of the wire 52 being soldered to contact 47*a*, as shown at 52*a*. It will be understood that the conductors 51 and 52 are connected to suitable electrical components in the body 14*a*. The lens block 37, and the parts connected thereto, may be held firmly in position in the body 14*a* by means of dowels 54.

It will be evident that the new fuze structure is simple and compact and is readily adapted for manufacture at low cost. The photoelectric cell is housed in the lens block which not only transmits light to the cell but also shields the cell and protects it from damage. The conical nose cap serves to clamp the lens block in position and protect it from damage and also to admit light to the lens from spaced points around the photoelectric cell.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

I claim:

1. In a photoelectric proximity fuze for a projectile, a hollow body open at one end, a lens mounted in the open end of the body and projecting from said end, the lens having a recess in the end of the lens disposed in the body, a photoelectric cell fitted closely in the recess, and a nose cap secured to the body over the lens for holding the lens in the body and having a plurality of slits spaced circumferentially around the cap to admit light to the lens and the cell.

2. In a photoelectric proximity fuze for a projectile, a hollow body open at one end, a lens mounted in the open end of the body and projecting from said end, the lens having a recess in the end of the lens disposed in the body, a photoelectric cell fitted closely in the recess, a nose cap secured to the body over the lens for holding the lens in the body and having a plurality of slits spaced circumferentially around the cap to admit light to the lens and the cell, an amplifier unit mounted in the body, and an electrical connection between the amplifier and the cell.

3. In a photoelectric proximity fuze for a projectile, a hollow body open at one end, a lens mounted in the open end of the body and projecting from said end, the lens having a recess in the end of the lens disposed in the body, a photoelectric cell fitted closely in the recess, a nose cap secured to the body over the lens for holding the lens in the body and having a plurality of slits spaced circumferentially around the cap to admit light to the lens and the cell, an amplifier unit mounted in the body, an electrical connection between the amplifier and the cell, and means for securing said body in a projectile.

4. In a photoelectric proximity fuze for a projectile, a lens having a recess in its base, the recess having a substantially flat top wall, a photoelectric cell in the recess, a generally annular contact element engaging the upper face of the cell and defining with said wall a generally annular light-transmitting zone for admission of light through the lens and contact element to the cell, and a conductor extending into the recess and connected to said contact element.

5. In a photoelectric proximity fuze for a projectile, a lens having a recess in its base, the recess having a substantially flat top wall, a photoelectric cell in the recess, an opaque covering for said wall, a generally annular contact element engaging the upper face of the cell and defining with said covering a generally annular light-transmitting zone for admitting light through the lens and contact element to the cell, and a conductor extending into the recess and connected to said contact element.

6. In a photoelectric proximity fuze for a projectile, a lens having a recess, a photoelectric cell fitted closely in the recess, an insulating plate on the lens for covering said recess to confine the cell therein, electrical contact elements engaging opposite faces of the cell, means for insulating said elements from each other, a tubular conductor mounted in the insulating plate and electrically connected to one of said elements, a conductor extending through the tube and connected to the other contact element, and insulating means between the conductor and tube.

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