

[54] **GUN LAUNCHED TRAINING PROJECTILE**

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[51] Int. Cl. ... F42b 13/20, F42b 13/36, F42b 13/42

[58] Field of Search 102/92.7, 87; 35/25

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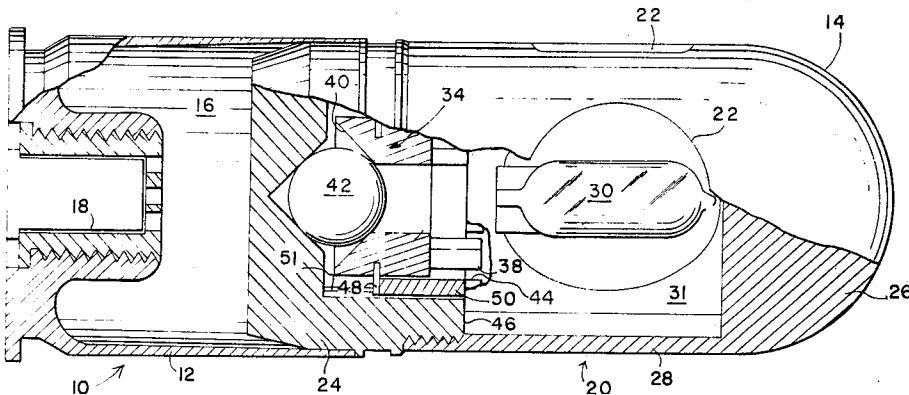
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[57] **ABSTRACT**

A flashcube is mounted in the body of a marking projectile. Upon impact of the projectile, a hammer drives actuating fingers into the base of the flashcube to fire the flashlamps and provide an impact signal.

13 Claims, 5 Drawing Figures



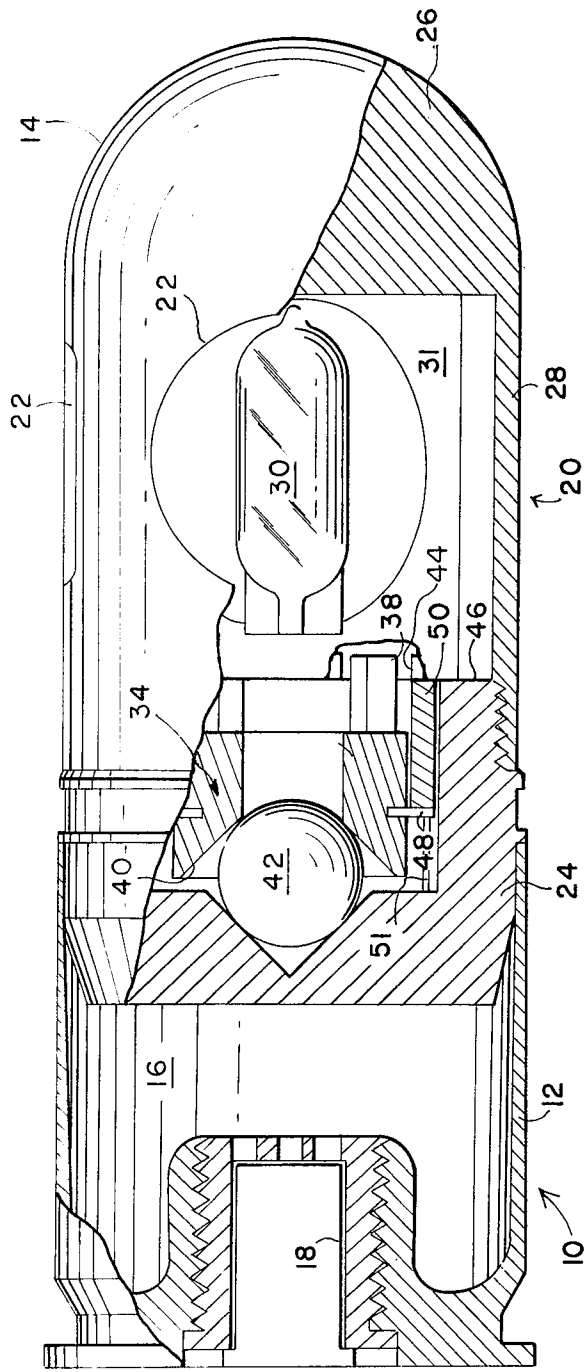


FIG. 1

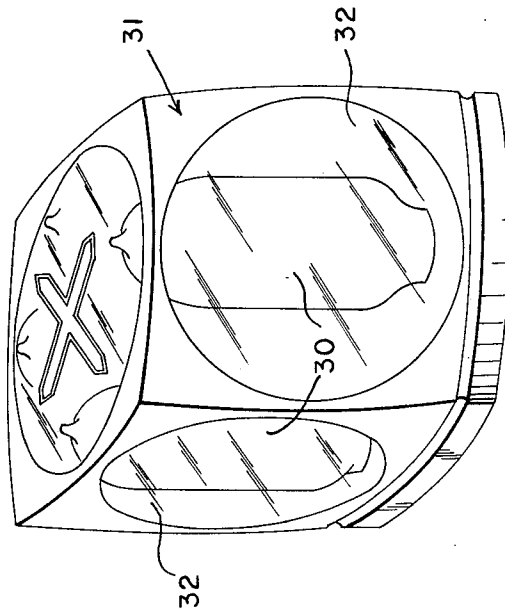
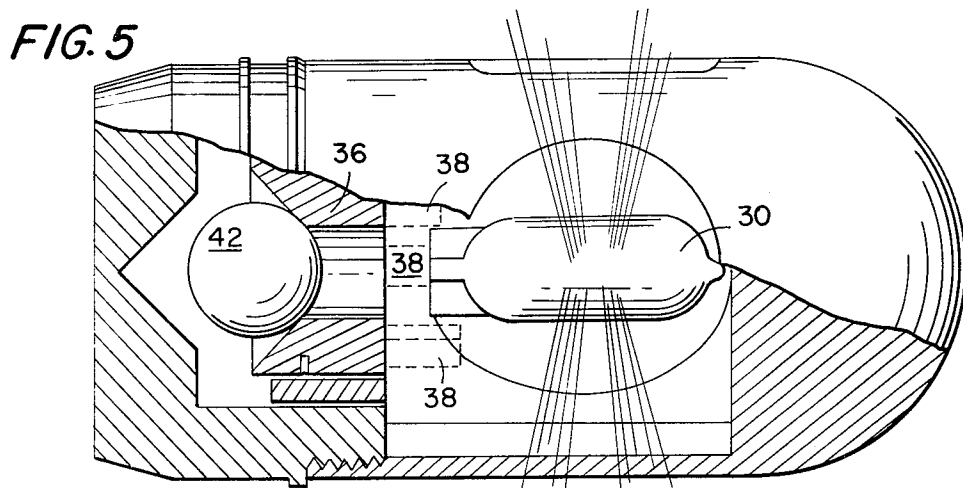
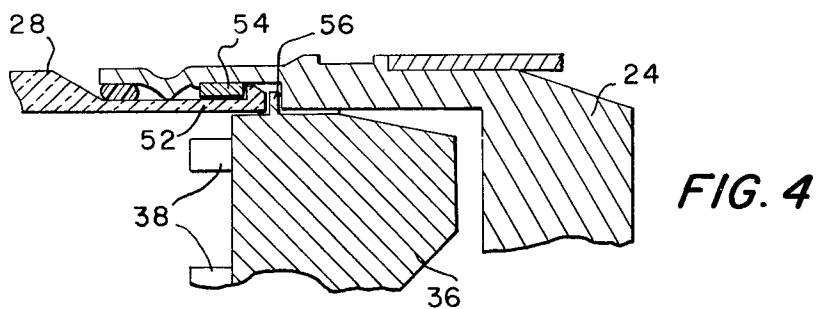
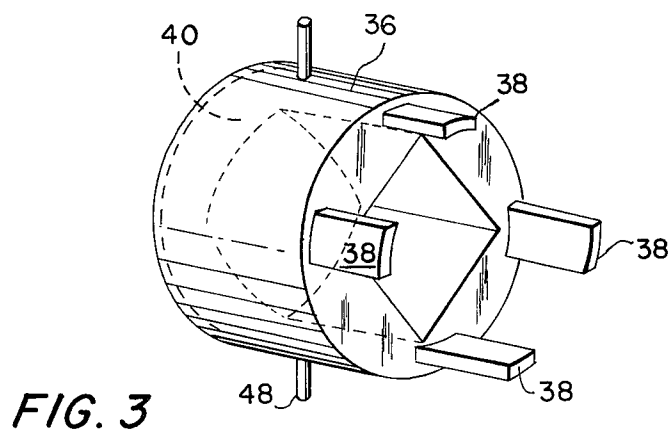


FIG. 2



GUN LAUNCHED TRAINING PROJECTILE

BACKGROUND OF THE INVENTION

The present invention relates to a novel and improved marking projectile which provides a visual indication of the projectile's point of impact.

Marking and spotting-type projectiles presently in use commonly employ an explosive or other forms of chemical charge which is ignited upon impact to provide a smoke cloud or flash of fire to indicate the impact point. The primary problem with such devices is the inherent risk of injury or death to personnel and damage to property during the manufacture, storage, handling and launching caused by inadvertent or premature ignition and the resultant explosion or burning of the charge or its pyrotechnic actuator or igniter. Other problems include, in some cases, the inability to provide a signal which can be clearly observed during the day and night under a wide variety of background conditions; and the inability to function properly against all types of targets and at all angles of impact from low graze angles to head-on.

SUMMARY OF THE INVENTION

The marking projectile of the present invention overcomes the problems of the prior art by primarily being an intrinsically safe device, yet one which provides a signal at impact visible under virtually all conditions and which can be designed to function upon initial impact from head-on to low graze angles. In attaining these objectives, this invention does not use an explosive or other chemical charge as the signal means but instead in its specific form incorporates a flashcube in the projectile housing which is actuated at impact to emit a light signal. Preferably, an inertia-responsive hammer is included in the housing to actuate the flashcube upon impact, and its design is such that actuation is assured at almost any impact angle.

Additional objects and advantages of the invention will be set forth in part in the description which follows, and in part will be obvious from the description, or may be learned by practice of the invention. The objects and advantages of the invention may be realized and attained by means of the instrumentalities and combinations particularly pointed out in the appended claims.

To achieve the foregoing objectives and advantages and in accordance with the purposes of the invention, as embodied and broadly claimed herein, the marking projectile of this invention is adapted to be launched from a gun or similar launching device for indicating the occurrence of impact and comprises a housing, at least one flashlamp mounted within the housing, and means within said housing for actuating said flashlamp upon impact of said projectile.

Preferably, the actuating means includes an inertia-responsive actuator, said actuator being movably mounted within said housing so as to cause the actuation of said flashlamp upon impact.

It is also preferred that there are four flashlamps arranged as a flashcube mounted within the housing, and the actuator is a hammer having four actuating members extending outwardly therefrom, each member being positioned on said hammer to come into actuating contact with a respective one of said flashlamps upon movement of said hammer at impact. It is also

preferred that the bottom of the hammer contains a substantially conical recess and a ball is fitted in this recess.

The invention consists in the novel apparatus, constructions, arrangements, combinations and improvements shown and described. The accompanying drawings, which are incorporated in and constitute a part of this specification illustrate embodiments of the invention and, together with the description, serve to explain the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view of an embodiment of an improved marking projectile in partial longitudinal cross-section;

FIG. 2 is a perspective view of a flashcube used in the marking projectile of this invention;

FIG. 3 is a perspective view of an embodiment of a hammer used to actuate the flashcube;

FIG. 4 is a partial in longitudinal cross-section of an alternative embodiment of the invention; and

FIG. 5 is a view of the embodiment of FIG. 1 showing the arrangement of parts at impact of the projectile.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference will now be made in detail to the present preferred embodiments of the invention, examples of which are illustrated in the accompanying drawings.

Referring now to FIG. 1 there is shown a cartridge or round 10 in partial longitudinal section composed of a casing 12 and a projectile 14 fitted in the casing. As is known, casing 12 is designed to contain propellant powder in its interior chamber 16, and a primer (not shown) is inserted into the rear chamber 18. The specific 40mm round depicted in FIG. 1 is inserted in a grenade launcher and fired to launch the projectile 14. As an alternative construction of the casing 12, rear chamber 18 is fitted with a 38 cal. propulsion cartridge (not shown) so that when fired the gases created by the burning propellant within the cartridge expand into the interior chamber 16 of the casing 12. These propellant gases, under substantial pressure, propel the projectile 14 from the barrel of the launcher. Although a grenade round has been specifically referenced here in describing the preferred embodiment, it should be apparent that the marking projectile of this invention which is to next be described, can take the form of other ordnance items, including but not limited to, missiles and mortar rounds.

In accordance with the invention, the marking projectile 14 includes a housing, indicated generally by the numeral 20. As embodied herein, housing 20 includes a base 24, a nose 26 and a tubular central body portion 28 connecting the base and nose. A plurality of openings 22, are formed in the body 28 in a spaced manner. Preferably, as shown in this embodiment, the nose 26 and body 28 are integrally formed in the general configuration of a rearwardly-facing cup having a threaded edge for connection to the threaded base 24. Nose 26 is here shown rounded in the general configuration of a bullet nose, and is thickened to add ballast so that the projectile when launched will have the desired ballistic properties.

In accordance with the invention, the projectile further includes at least one flashlamp 30 mounted within the housing 20. As here embodied, flashlamp 30 is

shown positioned in the central body portion 28 between the nose and base and aligned with an opening 22 so that upon actuation the light created by the flashlamp can be projected from the projectile 14. Preferably there are four flashlamps in the arrangement of a flashcube 31 mounted within the housing. In FIG. 2, two miniature flashlamps 30 in a flashcube 31 are shown, each of which is backed by a parabolic reflector 32 to concentrate the projection of light when its associated flashlamp 30 is fired.

A typical flashcube is shown in U.S. Pat. No. 3,327,105 in which the four flashlamps are mounted on a base and enclosed with a transparent cover, with each of the lamp-reflector assemblies facing a respective one of the four side walls of the cube. Each of the flashlamps consists of an hermetically sealed light transmitting glass envelop containing a filamentary combustible material such as oxygen. In the case of flashcubes employing electrically ignited lamps, a pair of lead-in wires pass through the lamp envelop to support therein a filament. The four pairs of lead-in wires terminate externally of the flashlamps at a connector formed in the base of the flashcube. Each flashlamp can be individually actuated by a suitable power source such as a dry cell battery.

An alternative construction of the flashlamp, and one which is preferred for the present invention, is a percussively-ignitable flashlamp which can be mechanically fired without the need of a power source. As described in U.S. Pat. No. 3,535,063, for example, such flashlamps have a mechanical primer sealed in one end of the lamp in lieu of lead-in wires. Operation of the percussive flashlamp is initiated by an impact against the primer. The percussive-type lamps are also produced in miniature envelop sizes and are employed in percussive flashcube units having respective pre-energized striker springs associated with each lamp, as described in U.S. Pat. No. 3,597,604. Each flashlamp is fired by the action of a member moving up through an aligned aperture in the flashcube base to release the associated pre-energized striker spring whereby it sharply impacts against the primer of the lamp to cause the lamp to ignite. The flashcube 31 preferably embodied in the present invention and illustrated in FIG. 2 is of the percussive type having pre-energized striker springs (not shown). When this flashcube 31 is mounted in the housing 20 of FIG. 1, each flashlamp 30 is aligned with an opening 22 of the housing.

In accordance with the invention, there are means provided within the housing 20 for actuating said flashlamp upon impact of said projectile. As embodied herein, and with reference again to FIG. 1, said actuating means includes an inertia-responsive actuator 34 movably mounted within the housing 20 so as to cause the actuation of the flashlamp 30 upon impact. Actuator 34 is preferably designed as a hammer 36 having at least one actuating member or finger 38 extending or protruding outwardly therefrom toward the base of the flashcube 31, so that this member 38 will come into actuating contact with the pre-energized striker spring (not shown) embodied in flashcube 31, upon movement of the hammer 36 at impact, as more fully described hereinafter.

Preferably, where a percussively-ignitable flashcube 31 is employed, the hammer 36 employs four such actuating members 38 protruding outwardly therefrom. This can be better seen by additional reference to the

perspective view of FIG. 3 where hammer 36 is shown as having a generally cylindrical shape and a flat top surface from which the four actuating members 38 extend. Each member 38 is positioned adjacent to the periphery of the top hammer surface so as to come into actuating contact with a respective one of the four flashlamp striker springs (not shown) upon movement of hammer 36 at impact. In the embodiment shown in FIG. 3 the four actuating members 38 are of unequal lengths so that the flashlamps 30 in the flashcube are actuated sequentially upon impact.

With reference also to FIG. 1, hammer 36 is shown as having a conical recess 40 formed in its base. An impact ball 42 which also forms a part of the projectile actuator is fitted in said recess 40, and thus assumes a position between hammer 36 and the base 24 of the housing.

The flashcube 31 is mounted in the housing 20 such that its top surface abuts against the inside of nose 26. The flashcube 31 is firmly retained within the housing 20 by engagement of the top face of base 24 against the base of flashcube 31 when the projectile is assembled. Hammer 36, although normally restrained, is slidably mounted within the housing between the flashcube 31 and the base 24. For alignment of the hammer members 38 with the apertures in the flashcube 31 base and thereby with the striker springs, it is preferred that each member is partially inserted within an aperture 44, one of which is shown here. Of course, the positioning of the hammer 36 is such that the members 38 do not protrude through these apertures 44 to where they would actuate the striker springs prematurely.

It is also preferred that the projectile 14 include means for arming the projectile, such arming means being activated upon launching of the projectile. In the embodiment shown, and with reference to both FIGS. 1 and 3, the arming means includes a plurality of shear pins 48 positioned within holes formed in the side surface of hammer 36. An arming ring 50 encircles hammer 36 and abuts the shear pins 48. This ring 50, although normally restrained, is slidably mounted within housing 20 between the shear pins 48 and the base of the flashcube 31. An annular space 51 is provided between the shear pins 48 and the base 24 so that upon launching of the projectile, the arming ring 50 which can be made of steel or similar heavy material, can move rearwardly under the forces induced by acceleration to fracture the shear pins 48 and free the hammer 36 for movement.

An alternative arming means is shown in the partial view, in section, of FIG. 4. As embodied herein, body 28 has a plurality of resilient latch fingers 52 (one of which is shown here) which ride over and engage a retaining band 54 formed on the interior surface of the base 24. Hammer 36 is here integrally formed with a plurality of restraining tabs, such as indicated at 56, which are preferably spaced about its periphery and inserted between the base 24 and latch finger 52 to hold the hammer immobile within the projectile and thus prevent premature actuation of the flashcube (not shown). At launch, the accelerative forces cause the relatively heavy hammer 36 to move rearwardly against base 24 and thus shear or bend the restraining tabs 56. The hammer is then free to move forward against the flashcube at impact.

The projectile body 28, in the embodiment of FIG. 4, is made of a clear material such as an acrylic having

high strength and excellent light transmission characteristics. By the use of such material, the necessity for openings such as shown at 22 in FIG. 1 are obviated because the light which is generated by the flashlamps 30 can be projected through the clear body 28.

With reference again to FIG. 1, the operation of the marking projectile of the present invention will now be explained. The hammer 36 is normally restrained from moving forward and thus actuating the flashcube 31 by the presence of arming ring 50 which abuts the shear pins 48. When the cartridge 10 is fired, the gases generated within chamber 16 launch or expel projectile 14. The attendant accelerative forces cause the arming ring 50 to shift rearwardly towards base 24 and shear the shear pins 48 to free hammer 36. During flight the hammer remains essentially in the position shown due to its own inertia.

When the projectile impacts the target, and with reference now to FIG. 5, the hammer 36 is caused to move forward under the acceleration forces created by its own mass plus the mass of the impact ball 42. The actuating members 38 enter fully into the flashcube base to release the four pre-energized striker springs (not shown) whereby each striker impacts against its respective primer to fire its associated flashlamp 30. The four flashlamps in the flashcube 31 thus fire simultaneously to give off a light signal to indicate that impact has occurred.

In the embodiment shown in FIG. 3, where the actuating members 38 are of unequal length, the four flashlamps 30 in the flashcube 31 are caused to fire sequentially to give off an extended light signal.

It is quite possible that impact might not occur head-on upon the nose 26 of the projectile. Nevertheless, firing of the flashlamps still occurs even if the angle of impact is reduced to where the projectile only grazes the target. This is because even at low angles of impact there is an abrupt deceleration of the projectile 14, and the momentum of ball 42 acting upon the conical surface of hammer recess 40 results in an axial movement of the hammer 36 to cause the flashcube 31 to fire. Thus, operation is assured even though projectile impact varies from head-on through any angle down to a grazing impact where the contact is made by the body 28.

The marking projectile of the present invention provides a safe device having a long storage life and, where percussive type flashlamps are used, requires no stored energy. The projectile is absolutely safe and its high intensity flash is visible at long distances both at night and day and against all backgrounds including bright sun, sky, dirt, grass and snow. The triggering mechanism is rugged and yet is operative even at low energy levels of graze impact because of the hammer and impact ball system. The projectile works against almost any type of target including cardboard, plywood, a tank hull, hard sand, soft snow, grass or watery mud. Preferably, the marking projectile is made to copy the ordnance item both as to size, weight, balance and trajectory so as to simulate effectively and realistically its "feel" and operation as an aid in training exercises.

Although the invention has been described with respect to specific embodiments, it will be appreciated that modifications and changes may be made by those skilled in the art without departing from the true spirit and scope of the invention.

What is claimed is:

1. A marking projectile adapted to be launched from a gun or similar launching device for indicating the occurrence of impact comprising:

- a. a housing,
- b. at least one flashlamp mounted within the housing, and
- c. means within said housing for actuating said flashlamp upon impact of said projectile.

2. A marking projectile as claimed in claim 1 wherein:

- a. said actuating means includes an inertia-responsive actuator, said actuator being movably mounted within said housing so as to cause the actuation of said flashlamp upon impact.

3. A marking projectile as claimed in claim 2 wherein:

- a. said at least one flashlamp is percussively-ignitable,

- b. and said actuator includes a hammer having at least one actuating member extending outwardly therefrom,

1. said member being positioned to actuate said flashlamp upon movement of said hammer at impact.

4. A marking projectile as claimed in claim 3 further comprising:

- a. four flashlamps arranged as a flashcube, and mounted within the housing,

- b. and said hammer having four actuating members extending outwardly therefrom,

1. each member being positioned on said hammer to actuate a respective one of said flashlamps upon movement of said hammer at impact.

5. A marking projectile as claimed in claim 4 wherein:

- a. said actuating members are of unequal length to actuate said flashlamps sequentially upon impact.

6. A marking projectile as claimed in claim 4 wherein

said housing comprises:

- a. a base,
- b. a nose and
- c. a tubular central body portion connected between said base and nose.

7. A marking projectile as claimed in claim 6 wherein said housing has a plurality of openings formed in said body, at least one opening aligned with each flashlamp.

8. A marking projectile as claimed in claim 6 wherein said body is made of a transparent material.

9. A marking projectile as claimed in claim 7 wherein:

- a. said flashcube is mounted in said housing adjacent to said nose, and

- b. said hammer is positioned for sliding movement between said base and said flashcube.

10. A marking projectile as claimed in claim 9 wherein:

- a. the bottom of said hammer contains a substantially conical recess and

- b. said actuator further includes a ball fitted in said recess.

11. A marking projectile as claimed in claim 10 further comprising:

- a. means for arming said projectile, said arming means being activated upon launching of said projectile.

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12. A marking projectile as claimed in claim 11 wherein said arming means includes:

- a. a plurality of shearable pins extending outwardly from said hammer,
- b. a ring encircling said hammer and slidably 5 mounted within said housing, and
- c. said pins being positioned between said ring and said base so that said pins are sheared upon launching of said projectile by movement of said ring toward said base. 10

13. A marking projectile as claimed in claim 6 further comprising:

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a. means for arming said projectile, said arming means being activated upon launching of said projectile, and including:

- 1. a plurality of shearable tabs formed integrally on said hammer and extending outwardly therefrom,
- 2. said tabs being inserted between said base and said body so that said tabs are sheared upon launching of said projectile by movement of said hammer toward said base.

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