

United States Patent [19][11] **3,788,733****Breglia et al.**[45] **Jan. 29, 1974****[54] LASER DIRECT FIRE SIMULATOR
EMPLOYING REFRACTIVE MEDIA**

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[22] Filed: Nov. 17, 1972

[21] Appl. No.: 307,668

[57] ABSTRACT

[52] U.S. Cl. 350/287, 356/12, 35/25

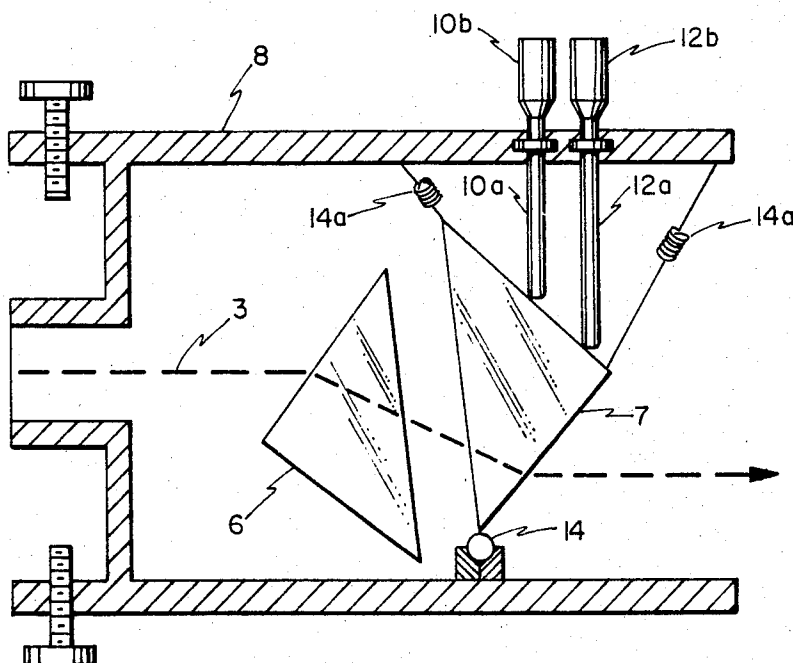
[51] Int. Cl. G02b 7/18

[58] Field of Search 350/286, 287, 288, 310; 356/241, 12; 35/25

Optical beam refracting means adapted to fit within a gun barrel are designed to cooperate with a laser beam generator positioned in the same gun barrel. Micrometer adjusting means are provided whereby optical elements can be adjusted to deflect the laser beam as desired.

[56] References Cited**UNITED STATES PATENTS**

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3 Claims, 5 Drawing Figures

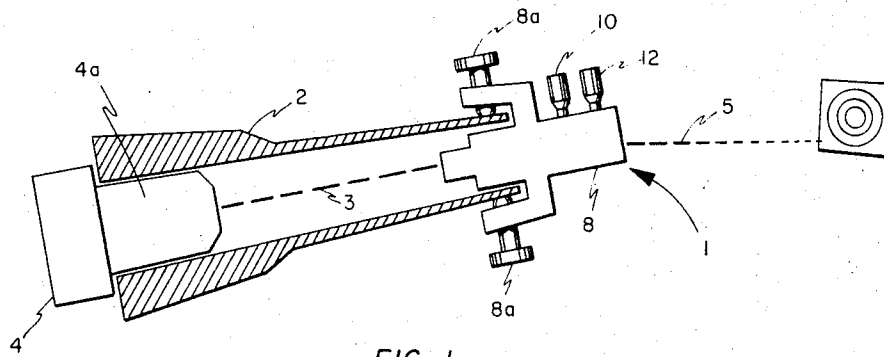


FIG. 1

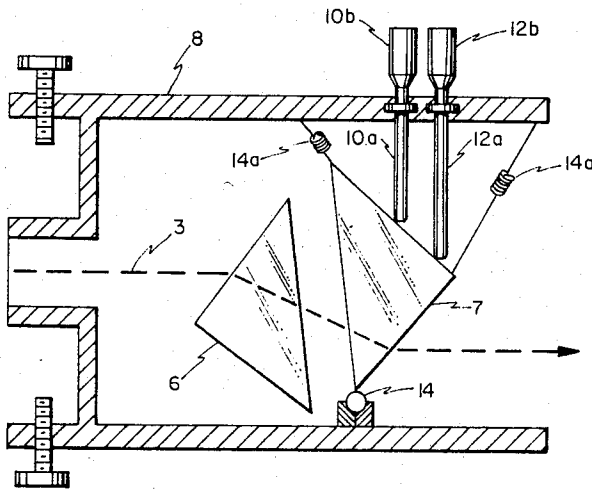


FIG. 2

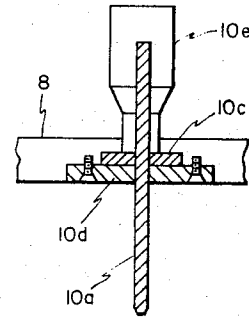


FIG. 5

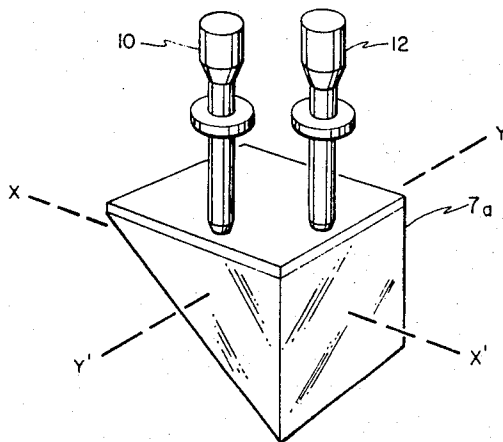


FIG. 3

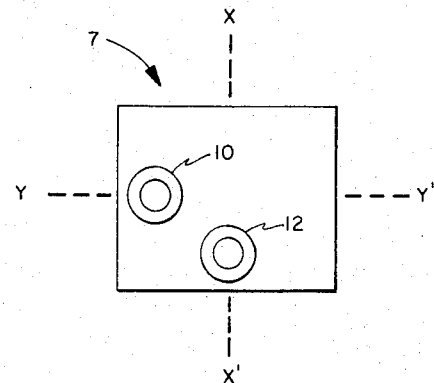


FIG. 4

LASER DIRECT FIRE SIMULATOR EMPLOYING REFRACTIVE MEDIA

BACKGROUND OF THE INVENTION

The invention is in the field of optical beam deflecting means for laser beam artillery training devices. In the prior art are several devices which are adapted to be aligned with a gun barrel and to project a laser beam towards a target to simulate gun fire. These devices enable trainees to obtain valuable experience in aiming and firing without the expense, inconvenience, and wear and tear on equipment occasioned by firing live ammunition.

A primary object of the invention is to enable an instructor to preset aiming problems in training exercises by misaligning a beam with the gun barrel to simulate the effects of windage, trajectory, etc.

SUMMARY OF THE INVENTION

A fixed prism and a moveable prism are positioned in a housing which is adapted to fit into the muzzle end of a gun barrel. The gun barrel has a laser beam generating device positioned in the breech end which is adapted to project a laser beam out the muzzle end at a target. The beam is aligned with the longitudinal axis of the gun barrel.

The moveable prism is equipped with micrometer controls which are adjustable to position the prism in such manner that the laser beam is refracted at an angle to the gun barrel. An instructor may adjust the micrometers to simulate windage, trajectory and/or other conditions which require an offsetting aiming of the gun by a student to hit the target.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 shows the positioning of the invention in a gun barrel with laser beam generating device;
FIG. 2 is a side view of the invention; and
FIG. 3 is a top view of the invention;
FIG. 4 is a plan view of FIG. 3;
FIG. 5 shows a micrometer control in detail;

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 shows a simplified sectional view of the invention 1 positioned in the muzzle end of a gun barrel 2. A laser beam generating device 4 is positioned in the breech end of gun barrel 2. Device 4 has a tubular projecting end 4a which is designed to fit snugly into the gun barrel so that device 4 is perfectly aligned with the barrel. Collets, bushings, or other adaptors may be provided to fit device 4 tightly to barrels of different sizes. This is necessary to maintain accuracy of alignment between beam and barrel during training exercises when the barrel is frequently moved. Device 4, when activated by a firing mechanism not shown, projects a laser beam 3 through barrel 2 towards a target to simulate firing projectile. Ordinarily the impact of the beam on the target is visible as a bright flash. However sensing means may be provided at the target to sense the impact of a beam and to activate a hit signaling and/or a recording device.

It is impracticable to provide a suitable laser beam alignment changing adjustment at device 4 because of the nature of laser beam generators, the bore-length ratio of certain barrels, the nature of breech mecha-

nisms, and the proximity of the gun crews who must necessarily be stationed at the breech. A beam refractor 1 is positioned in the muzzle end of barrel 2 in such position that beam 3 passes through two prisms located in the beam refractor. As shown in FIG. 2, beam 3 passes through a first prism 6 fixed to a housing 8 which comprises the outer surface of the beam refractor and which is adapted to fit snugly within the bore of barrel 2. Beam 3 is refracted (downward in the embodiment shown) at an angle from its original direction parallel to the longitudinal axis of barrel 2.

Beam 3 then enters a second prism 7 and emerges at an angle to the axis of barrel 2 which is determined by the position of prism 7. Prism 7 may be positioned so as to offset the refraction of beam 3 caused by its passage through prism 6 so that the beam emerges from prism 7 parallel to the bore axis of barrel 2.

Prism 7 is moveably mounted to housing 8 by means such as a ball joint 14 so that the prism is rotatable about two mutually perpendicular axes. Prism 7 may be caused to bear against ball joint 14 by springs 14a or other resilient means, or the prism may be fastened to the housing by other flexible connections, i.e., an interposed block of rubber, or other material.

Two micrometer type controls 10 and 12 are positioned in housing 8 in such manner that their respective spindles 10a and 12a contact prism 7 to push (or pull) 7 around two perpendicular axes X, X' and Y, Y' (FIGS. 3 and 4). A plate 7a may be fixed to prism 7 so that the spindles may bear on the plate rather than directly on the prism.

Thus, when the sleeves 10b and/or 12b are rotated, movement of spindles 10a and/or 12a cause prism 7 to rotate around one or both axes so that beam 3 emerges from 7 at an angle determined by the rotation of the micrometer sleeves.

FIG. 5 shows micrometer control 10 in detail. Micrometer 10 may be similar to a modified micrometer caliper having a modified frame comprising a flange 10c which is fastened in a recess inside housing 8 by means such as a plate 10d. When thimble 10e is rotated, spindle 10a is caused to move downwardly or upwardly to adjust prism 7. Control 12 is similar.

An instructor may adjust micrometers 10 and 12 to refract beam 3 so that it will strike a target at some place other than the place indicated by the alignment of the gun barrel. Thus an instructor may adjust prism 7 to simulate a particular range or wind condition without approaching the breech end of the gun where the gun crew could observe his actions. Then trainees must adjust elevation and windage controls on the gun correctly to score a hit.

What is claimed is:

1. In a training device adapted to fire a laser beam through a gun barrel, the improvement comprising:
 - a laser beam generating mechanism adapted to fit within the breech end of a gun barrel,
 - said mechanism being adapted for firing a laser beam through said gun barrel in response to actuation of a firing means,
 - a beam refractor having a housing positioned in the muzzle end of said barrel,
 - a first opening in one end of said housing for receiving a beam from said generating mechanism, said beam being parallel to the longitudinal axis of said barrel,

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a second opening in the other end of said housing for passing said beam out of said refractor, and adjustable control means in said housing for refracting said beam to a predetermined angle to said longitudinal axis of said barrel.

2. The apparatus of claim 1, said adjustable control means comprising a first prism fixed to said housing, said first prism being fixed to said housing adjacent to said first opening and positioned to refract said beam to a first angle from said bore axis, a second prism rotatably attached to said housing, said second prism being rotatable about two mutually perpendicular axes,

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said second prism being positioned to receive said beam after it passes through said first prism and to pass said beam through said second opening at a second predetermined angle,

5 said adjustable control means comprising micrometer means for rotating said second prism about one or both of said mutually perpendicular axes to adjust said second predetermined angle.

3. The apparatus of claim 2, said micrometer means comprising micrometer screw means passing through said housing and contacting said second prism to rotate said prism about said mutually perpendicular axes.

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