

- [54] **AIMING DEVICE FOR INDIRECT FIRE GUNS**
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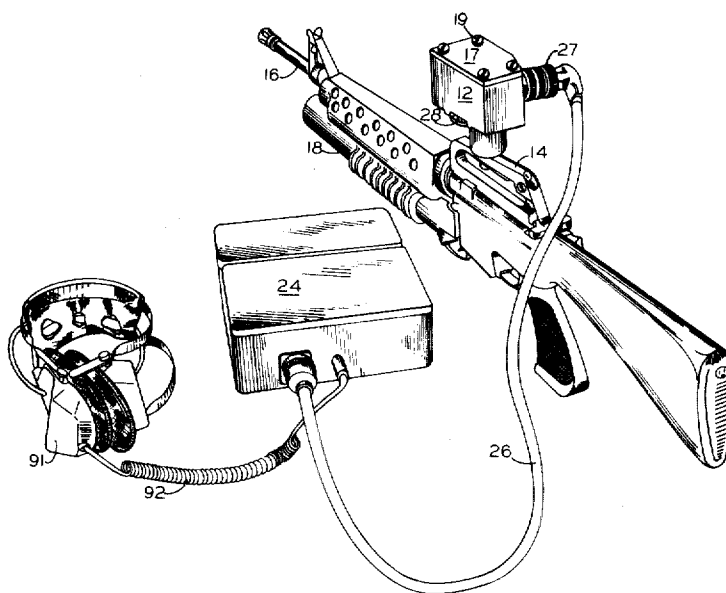
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- [58] Field of Search **33/334, 366; 89/1 F, 1 J, 89/37 C, 41 B, 41 D, 41 T, 41 CE; 340/267 C; 42/70 G**

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[57] ABSTRACT

In firearms which must be aimed at elevated firing angles in order to provide the fired projectile with an arcuate trajectory capable of hitting a hidden target, the attainment of the proper firing angle is automatically signaled by the return to zero inclination of a gravity sensing electrolytic switch which had been set at an angle corresponding to the degree of rotation required to position a range indicator at the estimated or known range of the target. A second gravity sensing switch may also be utilized to signal the absence of any transverse canting of the firearm when the required firing angle is attained.

4 Claims, 8 Drawing Figures



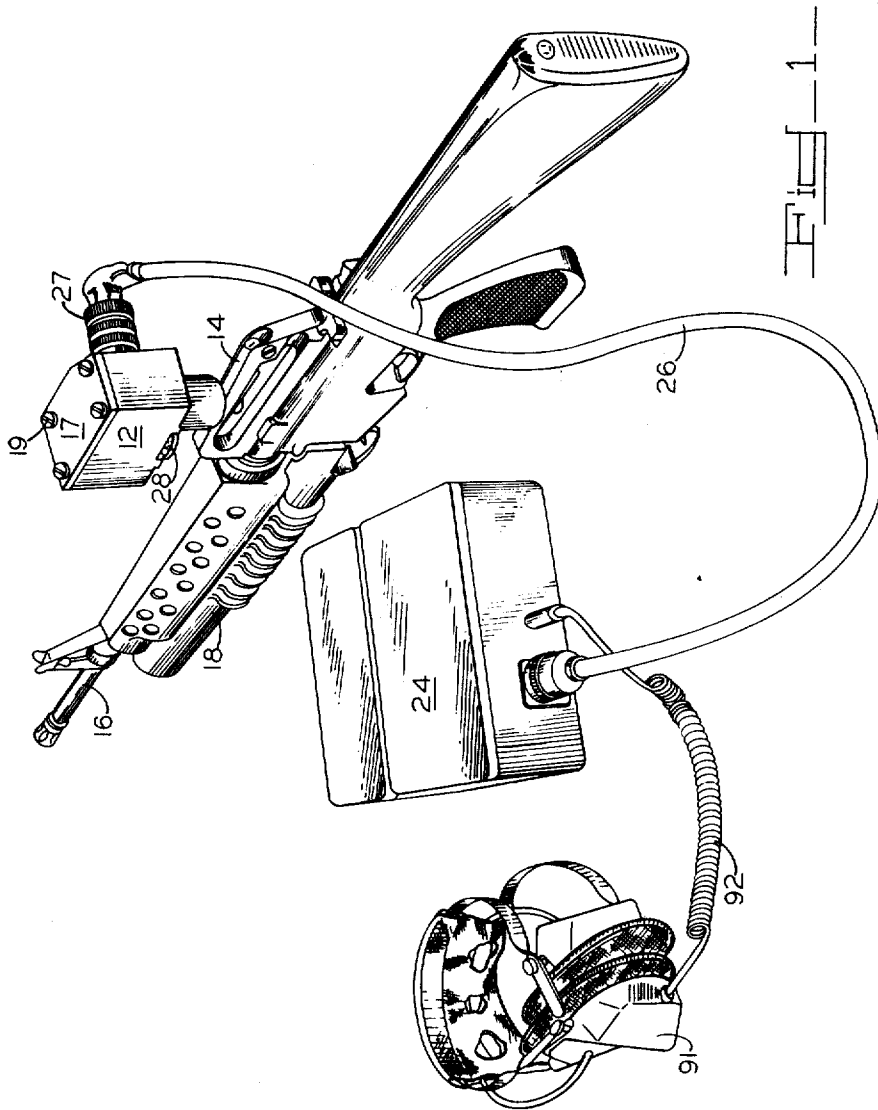
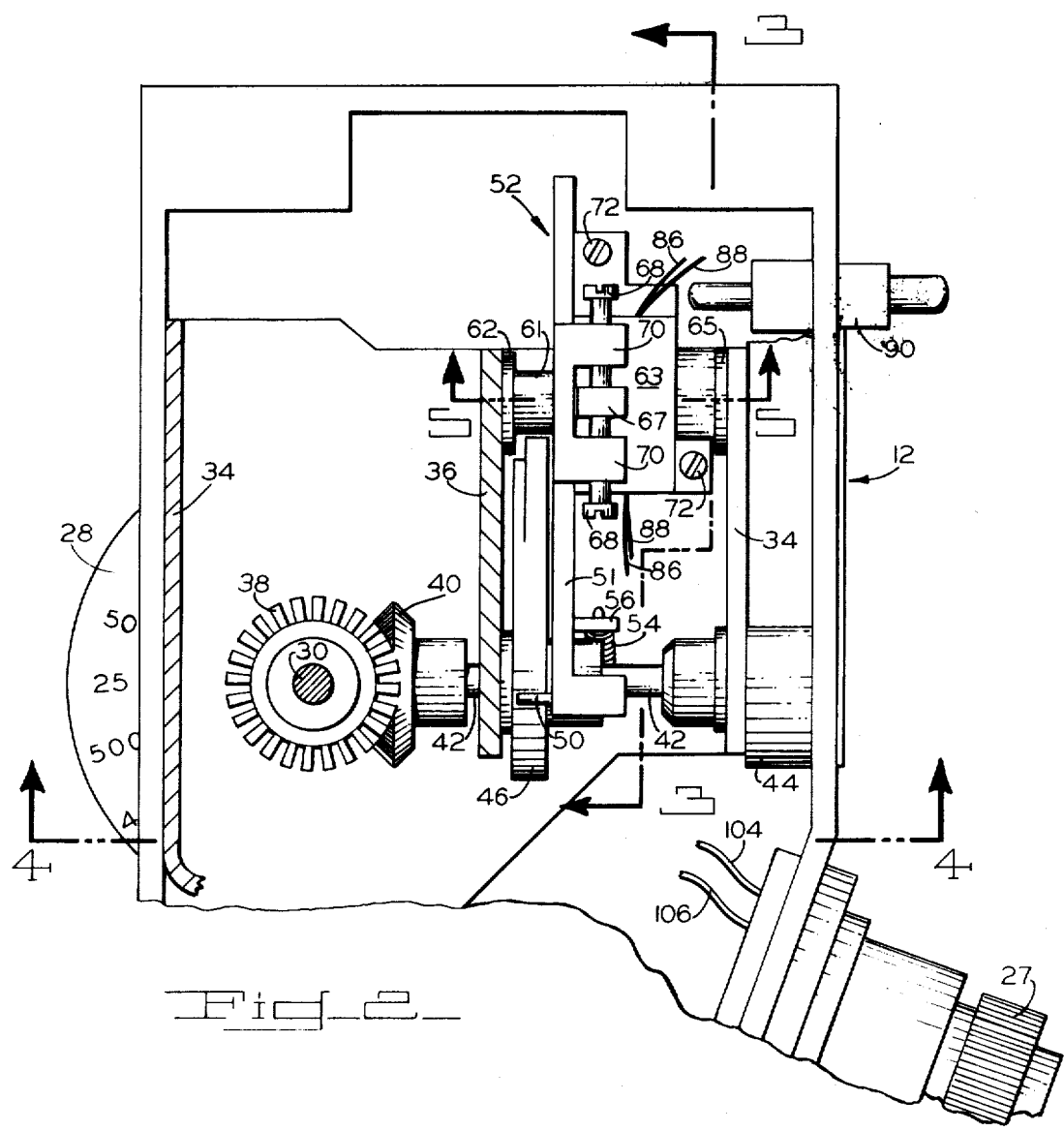
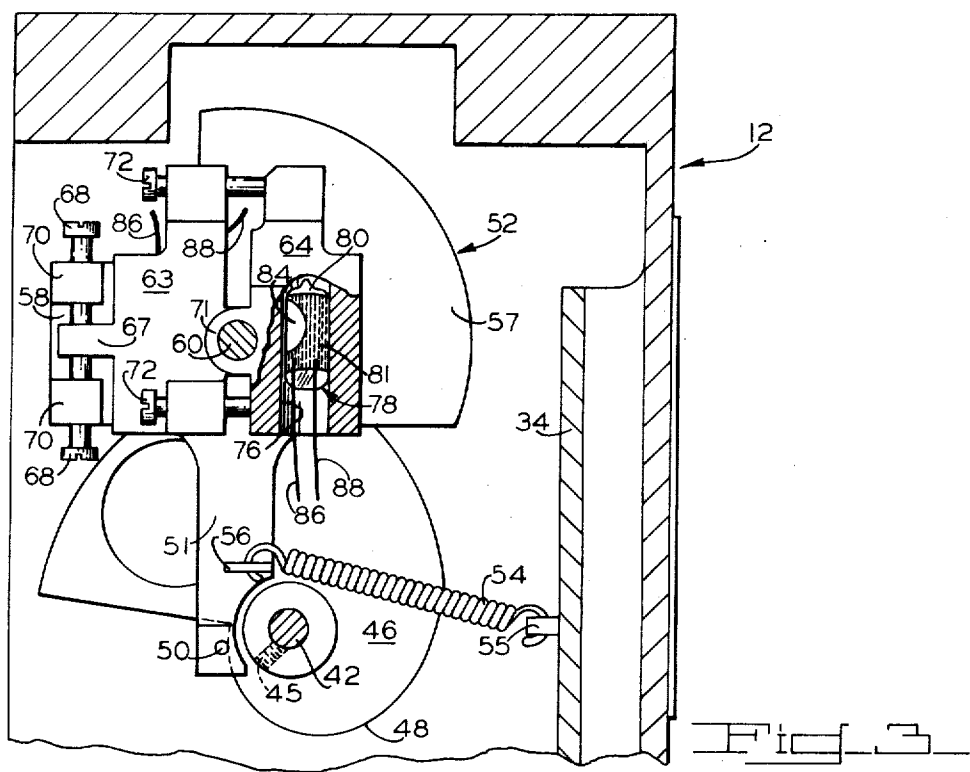
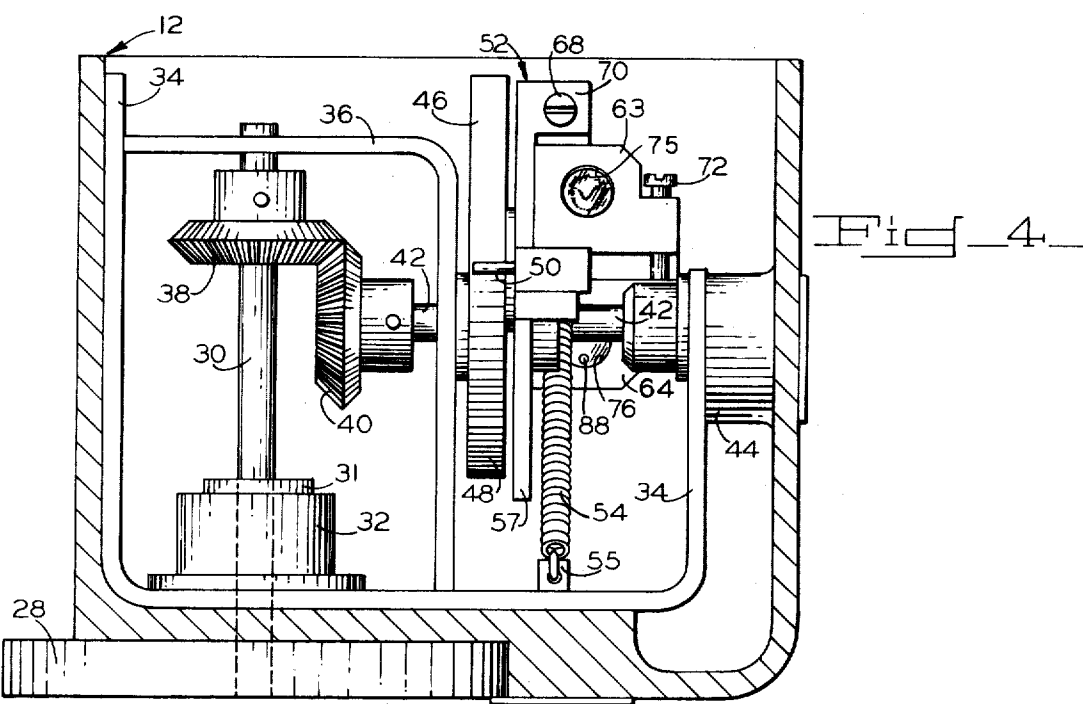
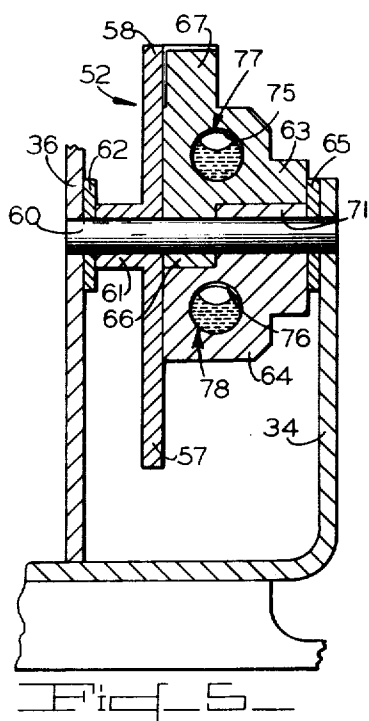
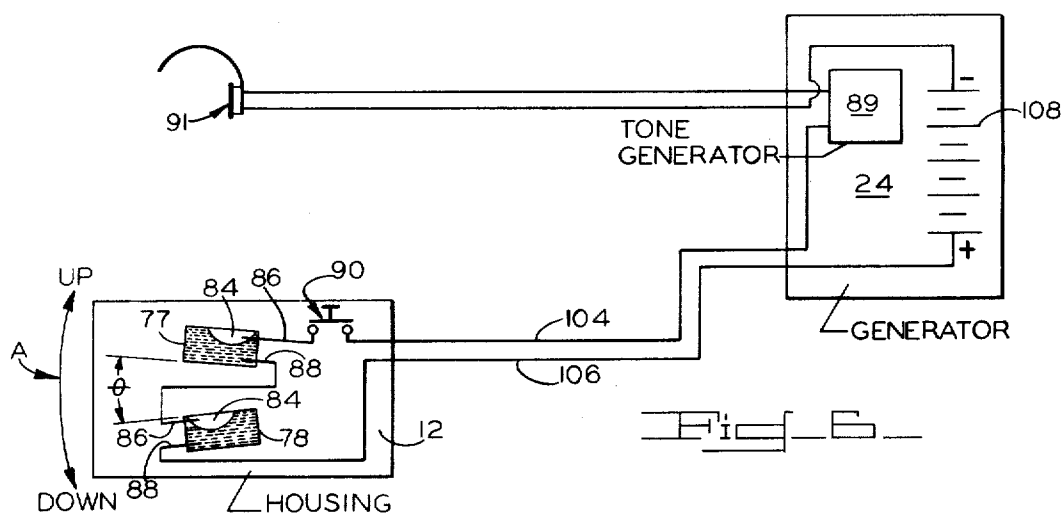


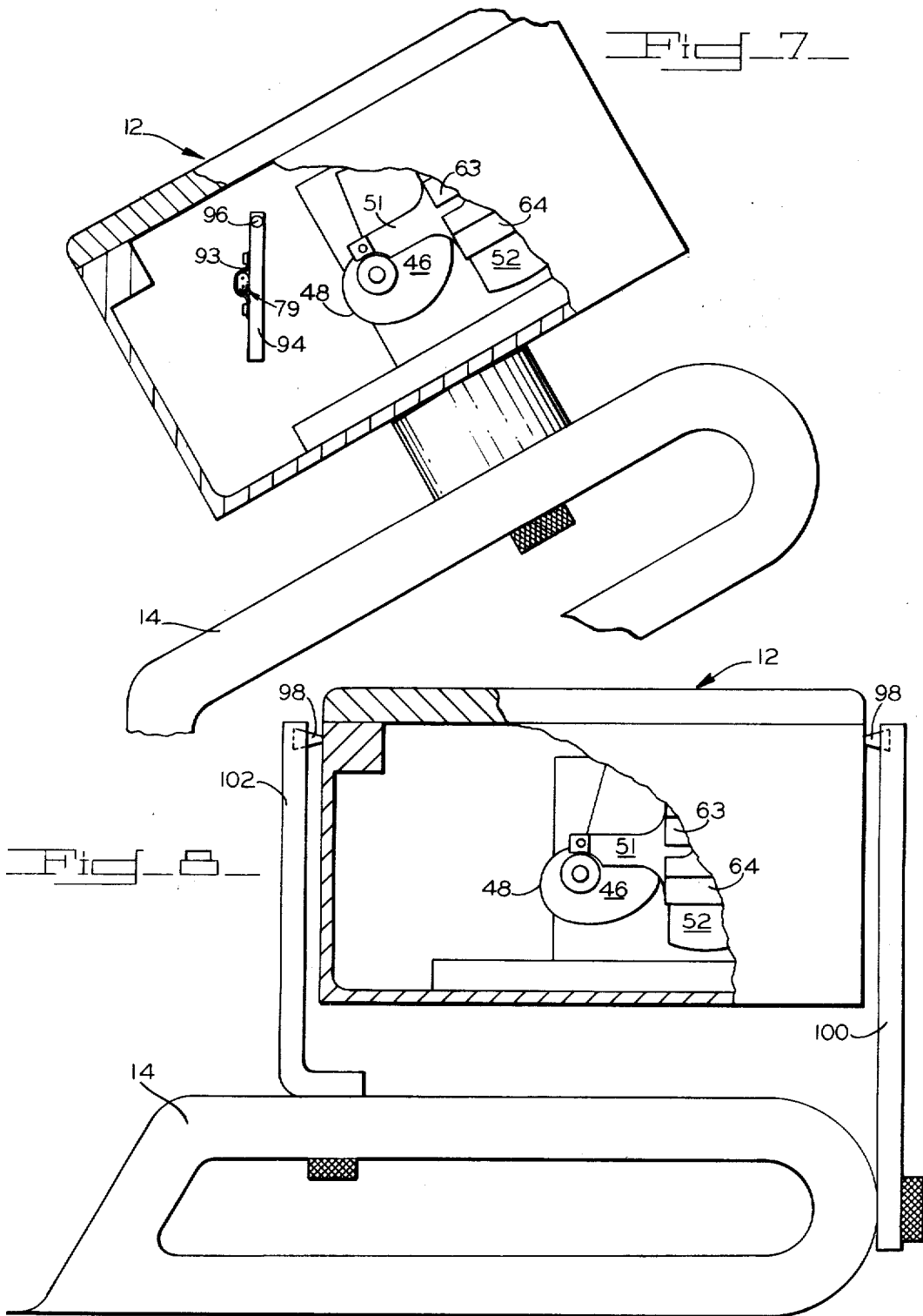
Fig. 1







SHEET 5 OF 5



AIMING DEVICE FOR INDIRECT FIRE GUNS

BACKGROUND OF THE INVENTION

This invention relates to aiming devices for firearms which must be fired at elevated firing angles in order to provide the projectile with a trajectory capable of hitting a hidden target and is more particularly directed to improved means for signaling the operator when the firearm is correctly oriented to hit the target at the estimated range.

Many of the firearms in current military use are designed to fire grenade type ammunition in addition to the standard cartridges with single projectiles. Since the ballistic trajectory of the much heavier grenade projectiles is considerably different than that imparted to a small caliber round fired from a rifled barrel, separate sights are generally provided for each type of fire. The grenade sight is ordinarily pivoted to the firearm so that it can be readily preset, in accordance with the information provided by any suitable range indicating means, to the particular angle at which the firearm must be elevated in order for the grenade projectile to hit the desired target area. The attainment of the proper firing angle has heretofore been determined by such various expedients as a gunner's quadrant, a spirit level, or a pendulum indicator. However, the proper utilization of these prior art devices requires repeated visual checking by the operator during the elevation of the firearm to the desired firing angle and consequently interferes with his ability to keep his attention focused on the target area. Moreover, the necessary correlation between the sighting of the target and the determination of the proper firearm elevation is further complicated in the event of poor visibility due to fog, rain or approaching nightfall.

Another problem frequently encountered in elevating the firearm to the desired firing angle lies in the difficulty of avoiding some degree of transverse cant thereof at the instant of firing. Obviously, if the firearm is in a canted position at the instant the tip of the grenade sight is aligned with the target, the firing axis of the projectile will be transversely misaligned relative to the target to an extent determined by the degree of cant and the height of the sighting element above the firing axis of the projectile.

SUMMARY OF THE INVENTION

Accordingly, it is an object of this invention to provide an aiming device for grenade launching firearms which will automatically signal the operator upon the attainment of the proper firing angle required to hit a target at the estimated range thereof.

It is a further object of the present invention to provide an aiming device as aforesaid, wherein the point at which the signal is energized is readily controlled by the presetting of a calibrated range indicator.

It is another object of this invention to provide a grenade launching aiming device, as aforesaid, with the added capacity for signalling the absence of any transverse cant in the orientation of the firearm once the required firing angle has been attained.

Still another object of the invention lies in the provision of an aiming device, as aforesaid, which will automatically nullify the effect of any transverse cant in the firearm during the elevation thereof to the desired firing angle.

It has been found that these objects can be readily accomplished by an aiming device containing a gravity sensing switch which, upon passage through a zero inclination relative to the ground, will automatically signal the attainment of the proper firing angle at which the grenade-launching firearm must be elevated to provide a target hit. A preferred switch of this type is one in which an electrolytic medium such as mercury, is contained in a capsule provided with an electrical contact designed to close a circuit and energize an audible signal when gravity forces cause the mercury to contact both of the electrodes in the capsule. A rotatable range indicator, calibrated in accordance with the maximum range to which the grenade projectile can be fired, is utilized to cam the member on which the switch is mounted to the particular angle at which the firearm will be correctly elevated to produce a target hit when the sensor is returned to a zero inclination. In order to avoid or correct any transverse canting of the firearm, the aiming device may also be provided with a second switch, identical to the first, but mounted at right angles thereto for pivotal fore and aft swinging movement. Both switch mechanisms are preferably arranged to operate independently of one another and provide recognizably different signals, or they can be connected in series so that the audible signal will only be heard upon the gun being oriented correctly in elevation and not canted. In the event increased simplicity and compactness is required of the aiming device, the transversely mounted switch may be eliminated from the assembly and the function thereof retained by mounting the entire aiming device so as to freely swing in a plane transverse to the firing axis of the firearm. As a result, the tilt plate on which the elevation switch is mounted will remain in a true vertical plane at all times despite any canting of the entire firearm.

BRIEF DESCRIPTION OF THE DRAWINGS

The exact nature of the invention as well as other objects and advantages thereof, will be readily apparent from consideration of the following specification relating to the annexed drawings wherein:

FIG. 1 is a perspective view of a grenade launching rifle equipped with the orientation sensing unit of the present invention;

FIG. 2 is an enlarged partial top view of the sensing unit with the cover and portions of the interior framework removed to show the connection between the range selector and the cam means utilized to pivot the follower mechanism containing the gravity sensing switches;

FIG. 3 is a sectional view taken along line 3—3 of FIG. 2 to show the configuration of the cam and follower mechanism utilized to orient the switches to the angle corresponding to the range at which the selector dial is set;

FIG. 4 is a sectional view taken along line 4—4 of FIG. 2 to show additional structural detail of the carriers in which the switches are mounted;

FIG. 5 is a cross-sectional view taken along line 5—5 in FIG. 2 to show the manner in which the cam follower and the switch carriers are mounted in adjacent relationship;

FIG. 6 is a schematic diagram of the electrical circuit utilized to connect the gravity sensing switches to the buzzer elements in the battery pack;

FIG. 7 is a side view of an alternate sensing unit similar to that shown in FIGS. 2-5 and is partially cut away to schematically show the additional gravity sensing switch utilized to signal the absence of any transverse canting of the firearm during the elevation thereof to the predetermined firing angle; and

FIG. 8 shows an alternate arrangement for providing the same function as the sensing unit of FIG. 7 without the need for the additional switch and swinging tilt plate therefor.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

As best shown in FIG. 1, the aiming device of the present invention is contained within a rectangular housing 12 which is preferably secured to the top of the carrying handle 14 of the rifle in parallel relation to the barrel 16 thereof and the grenade launching attachment 18 mounted therebeneath. A cover 17 is removably secured to the top of housing 12 by screws 19 to permit access to the interior thereof for a purpose to be hereinafter shown. Power for the operation of the aiming device is provided by a portable generator unit or battery pack 24 electrically connected by a cable 26 to a suitable socket 27 in the side of housing 12.

As best shown in FIGS. 2 and 4, a range dial 28, calibrated in increments of 25 meters to a maximum range of 500 meters, is fixed to the lower end of a rotatable shaft 30 which extends vertically upward through housing 12. Shaft 30 is supported by a flanged bearing 31 rotatably seated in a bushing 32 which is, in turn, fixed to a framework 34 extending along the interior wall surfaces of housing 12. A portion of dial 28 protrudes sufficiently from the side of housing 12 to permit a clear view of the range indicia thereon. The upper end of shaft 30 is journaled in a right-angled bracket 36 fixed at each end thereof to framework 34. A bevel gear 38 secured to the upper portion of shaft 30 is arranged to mesh with a similar gear 40 oriented at right angles thereto for imparting the rotation of range dial 28 to a horizontally disposed shaft 42 journaled at one end in bracket 36 and at the other end thereof in a suitable bushing 44 fixed between an inturned portion of framework 34 and the sidewall of housing 12.

Fixedly secured to shaft 42 by a setscrew 45 is a cam 46 whose exterior periphery is contoured, as indicated at 48 in FIG. 3, in accordance with the ballistic ratio between any given elevation of the firearm from which the grenade projectile is launched and the range which will be imparted to the projectile at that particular elevation of the firearm. Cam 46 is positioned on shaft 42 so that the periphery 48 thereof bears against a pin 50 projecting outwardly from the free end of an arm 51 depending from a cam follower 52. In order to maintain pin 50 in continuous contact with periphery 48 during the rotation of cam 46, a tension spring 54 is extended between a projecting lug 55 disposed on the base of framework 34 and a corresponding projection 56 disposed on follower arm 51.

Cam follower 52 is a generally T-shaped member with a quadrant portion 57 on one side of follower arm 51 and a rectangular portion 58 on the opposite side thereof. As best shown in FIG. 5, a shaft 60 secured at one end to bracket 36 and at the other end thereof to framework 34 serves to rotatably support cam follower 52 in adjacent and spaced relation to cam 46. The desired spacing between cam 46 and cam follower 52 is

provided by a hub 61 which projects outwardly from quadrant portion 57 into bearing contact with a suitable pad 62 fixed to bracket 36. Shaft 60 also serves to rotatably support an upper and a lower switch carrier, 63 and 64 respectively, between cam follower 52 and a suitable bearing pad 65 affixed to framework 34.

The underside of upper carrier 63 is formed with a depending mounting lug 66 for passage therethrough of shaft 60 while the top of carrier 63 is provided with an upwardly extending lug 67 disposed between a pair of adjusting screws 68 threadably mounted, as shown in FIG. 3, in spaced support blocks 70 projecting outwardly from the end of rectangular portion 58. When screws 68 are advanced to contact the opposite sides of lug 67, carrier 63 is adjustably secured to cam follower 52 for joint rotation therewith. Lower carrier 64 is provided with a mounting lug 71 extending upwardly into adjacent axial alignment with lug 66 on carrier 63 whereby the passage of shaft 60 therethrough positions both carriers in spaced relation, as best shown in FIG. 3. A second pair of adjusting screws 72 are threadably secured in opposite end portions of carrier 63 to project therefrom into contact with the corresponding end portions of lower carrier 64 which like carrier 63 is thereby adjustably secured to cam follower 52 for joint rotation therewith. Screws 68 are utilized to position carrier 63 so that the long axis thereof is slightly inclined relative to the corresponding axis of follower arm 51. Similarly, screws 72 serve to position lower carrier 64 so that the long axis thereof is also inclined in the opposite direction relative to follower arm 51. Thus, carriers 63 and 64 can be individually adjusted to provide a given included angle therebetween for a purpose to be hereinafter shown. Such angle may be increased or decreased by rotating both screws in each set in corresponding opposite directions.

Carriers 63 and 64 are each centrally bored, as shown at 75 and 76 in FIG. 5, to respectively seat gravity sensing switches 77 and 78 formed by at least one gravity responsive unit or capsule 80 partially filled with a quantity of mercury or other equivalent electrolytic medium 81. A pair of spaced apart electrodes 86, 88 extend into capsule 80 from one end thereof. As shown particularly in FIG. 6 of the drawings, the upper switch 77 is disposed with its electrodes toward the butt stock end of the gun and the lower switch 78 is disposed with its electrodes toward the muzzle end of the gun. The two switches are connected in series and the upper electrode 86 of the upper switch 77 is connected with a tone generator or buzzer 89 by a lead 104. The lower electrode 88 of lower switch 78 is connected with a source of electrical energy, such as a battery 108. Both tone generator 89 and battery 108 are conveniently mounted in the generator housing unit 24. As heretofore described, the upper and lower switches 77 and 78 are adjustably disposed for angular relation to each other, whereby the bubbles in each switch will be disposed adjacent to the electrodes incident to the switch being disposed at the proper horizontal position governed by the angle of elevation of the gun. In such position, the bubbles permit the mercury to establish contact between the electrodes in each switch. Thus, as shown in FIG. 6, the gun having been directed to the proper elevation angle, both mercury switches 77 and 78 are conductive. If the gun should be tilted upward, as indicated by the arrow A in FIG. 6, the lower switch 78 becomes non-conductive. If the gun should be tilted

downward, as indicated by the arrow A in FIG. 6, the upper switch 77 becomes non-conductive. In order to render the signal producing elements inoperative except upon demand, a mechanical switch 90 is disposed in the circuit. The switch 90 may be conveniently provided on the housing 12 for use by the user of the gun and it may be connected in circuit with either lead 104 or 106 to activate the unit. The tone generator 89 is activated by electrical energy passing through switches 77 and 78 when disposed in a zero-gravity position during the elevation of the firearm, the signal then being transmitted to at least one earphone 91 connected to generator unit 24 by a flexible cable 92.

In operation, once a specific target has been located and the position coordinates thereof established by any suitable fire control method, range dial 28 is rotated to the determined range thereby actuating bevel gears 38 and 40 to impart equivalent rotation to cam 46. Since cam periphery 48 is in contact with pin 50 on follower arm 51, rotation of cam 46 will impart a corresponding pivotal movement to cam follower 52 thereby tilting switches 77 and 78 relative to the zero-gravity position thereof. The new orientation imparted to switches 77 and 78 results in a displacement of the mercury 81 and associated air bubble 84 which interrupts the electrical continuity of the circuit. Thereafter, switch 90 is manually actuated to activate buzzer 89 and as the firearm is elevated in line with the desired target, the passage of switch 77 in upper carrier 63 through a zero-gravity position parallel to true ground level will energize buzzer 89 and alert the operator of the firearm that the gun is at proper elevation and firing may be initiated. However, if the elevating movement of the firearm is not immediately halted and switch 78 in lower carrier 64 is moved through the zero-gravity position thereof, the energization of the latter will terminate the buzzer signal thereby informing the operator of the necessity for lowering the firearm until the buzzer signal is again established. The energization period of the buzzer can be appropriately increased or decreased by the selective rotation of adjusting screws 68 and 72 as previously explained.

While the foregoing arrangement will generally provide adequate firing accuracy for rifle-launched grenade projectiles, this is, of course, contingent on the ability of the operator to elevate the firearm to the required firing angle without any appreciable transverse canting thereof. In the event the firearm is canted either to the right or left relative to the true ground level, the resulting misalignment between switches 77 and 78 and the vertical plane perpendicular to the true ground level will affect the gravity flow of the mercury along the arcuate wall surface of glass capsule 80 and thereby produce a false indication of the attainment of a zero-gravity position. Thus, the firearm may not be elevated to the exact firing angle which will permit the grenade projectile to reach the range for which dial 28 was set.

In order to avoid such inaccuracy in the response of the pair of switches 77 and 78, a similar gravity sensing switch 79 is included in housing 12 in position to sense any tilting or canting of the firearm in a transverse direction. As indicated at 93 in FIG. 7, such switch 79 may be fixedly strapped on a tilt plate 94 disposed rearwardly of cam 46 and provided with outwardly extending pivot pins 96 at the opposite upper ends thereof arranged to rotatably engage in the corresponding side-

walls of housing 12. Thus, tilt plate 94 will remain in the same vertical plane and position switch 79 at right angles to switches 77 and 78, regardless of the extent to which the firearm is being elevated and consequently be accurately responsive to the introduction of any transverse cant in the firearm. Additional switch 79 is preferably in electrical connection with a second buzzer element (not shown) having a tone which is clearly distinguishable from that of the buzzer element arranged to be energized by the switches 77 and 78 contained in carriers 63 and 64. Accordingly, whenever both buzzers are simultaneously sounded, the operator of the firearm will be automatically informed that the elevation thereof to the required firing angle has been accomplished without any undesirable cant in the transverse direction. If, on the other hand, only one of the buzzers is sounded, the operator will realize the need for further manipulation of the firearm in the direction required to energize the silent buzzer. On the other hand, this additional switch 79 may be connected in serie with the elevation switches 77 and 78 so that energization of the buzzer will take place only when the gun is properly elevated and not canted.

It has also been found that the adverse effect of canting the firearm in the transverse direction during the elevation thereof to the firing position can also be avoided without the necessity for the additional switch arrangement shown in FIG. 7. This can be accomplished simply by mounting housing 12 between opposing pivots 98 provided at the upper ends of upright posts 100 and 102 which are, in turn, fixedly secured to the forward and rear portions of the firearm carrying handle 14 as shown in FIG. 8. Thus, even if the firearm should be transversely canted, housing 12 will still maintain the true vertical position required to keep switches 77 and 78 therein accurately responsive to the changing orientation of the firearm during the elevation thereof to the required firing angle.

Accordingly, the present invention provides a unique aiming device for automatically determining the attainment of the required firing angle for a grenade-launching firearm and, thereupon notifying the operator of the existence or absence of any cant in the transverse direction. The device is readily adaptable to any firearm for which a source of electricity is available and, provides the required accuracy of fire even though the target is not visible at the time of firing.

The foregoing disclosure and description of the invention is illustrative only. Various changes may be made within the scope of the appended claims without departing from the spirit of the invention.

We claim:

1. An aiming device for guns from which projectiles are fired at elevated firing angles in order to provide an arcuate trajectory capable of effecting a hit on a hidden target comprising,
 - a housing fixed to the gun in parallel relation to the firing axis thereof,
 - a first tilt plate vertically mounted in said housing for rotation about a transverse axis therethrough,
 - a pair of gravity sensing units secured to one side of said first tilt plate and oppositely inclined relative to each other to provide an included angle therebetween,
 - an electrical circuit containing means for producing an audible signal during the interval in which the

included angle between said pair of units intersects a line parallel to true ground level,

adjusting means rotatably mounted in said housing for selective adjustment to a desired reading,

cam means rotatably supported in said housing for converting the rotation of said adjusting means to corresponding rotation of said first tilt plate whereby said units are preset to the angle at which the subsequent return thereof to the horizontal during the elevation of the firearm will sound said audible signal to indicate the attainment of the desired firing angle,

a second tilt plate pivotally mounted at right angles to said first tilt plate for fore and aft swinging movement designed to maintain a vertical position during the elevation of the firearm, and

at least one gravity sensing unit secured to one side of said second tilt plate in electrical connection with said signal circuit for producing an additional signal in the event the gun is canted relative to the horizontal during the elevation thereof to a firing position.

2. The aiming device defined in claim 1 including means for adjusting the size of said included angle between said sensing units on said first tilt plate to vary the duration of said audible signal upon attainment of the desired firing angle.

3. An aiming device for firearms from which projectiles are fired at elevated firing angles in order to provide an arcuate trajectory capable of effecting a hit on a hidden target, comprising,

a gravity sensing switch mounted for rotation about an axis disposed at right angles to the firing axis of the firearm,

cam means for rotating said switch to a predetermined tilted position corresponding to the firing angle required of the firearm in order to impart a given range to the projectile,

means for pivotally mounting said switch for swinging movement at right angles to the firing axis of the firearm to maintain said switch in a true vertical position relative to the ground despite any transverse canting of the firearm during the elevation thereof to the required firing angle, and

means for providing an audible signal when the firearm has been sufficiently elevated to return said switch to a position of zero tilt thereby informing the operator that the required firing angle has been attained.

4. An aiming device for firearms from which projectiles are fired at elevated firing angles in order to provide an arcuate trajectory capable of effecting a hit on a hidden target, comprising,

a first gravity sensing switch mounted for rotation about an axis disposed at right angles to the firing axis of the firearm,

cam means for rotating said first switch to a predetermined tilted position corresponding to the firing angle required of the firearm in order to impart a given range to the projectile,

a plate pivotally mounted for swinging movement about an axis disposed at right angles to said first switch,

a second gravity sensing switch fixedly mounted on said plate at right angles to said first switch,

means for providing a first audible signal when the firearm has been sufficiently elevated to return said first switch to a position of zero tilt thereby informing the operator that the required firing angle has been attained, and

means responsive to said second switch for providing a second audible signal in the event the firearm is canted relative to the horizontal during the elevation thereof to the required firing angle.

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