Jan. 9, 1968 H. HAUSENBLAS ETAL 3,362,073

DEVICE FOR AIMING A HEAVY WEAPON BUILT INTO A VEHICLE

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FIG. 1

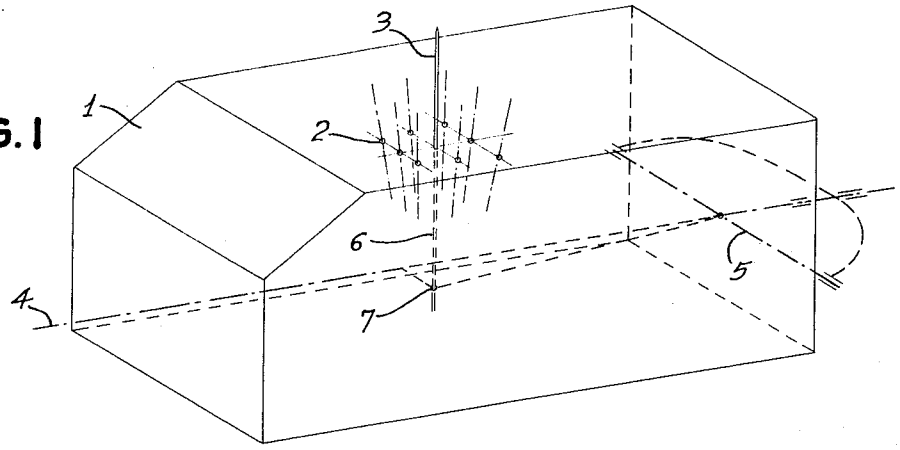


FIG. 2

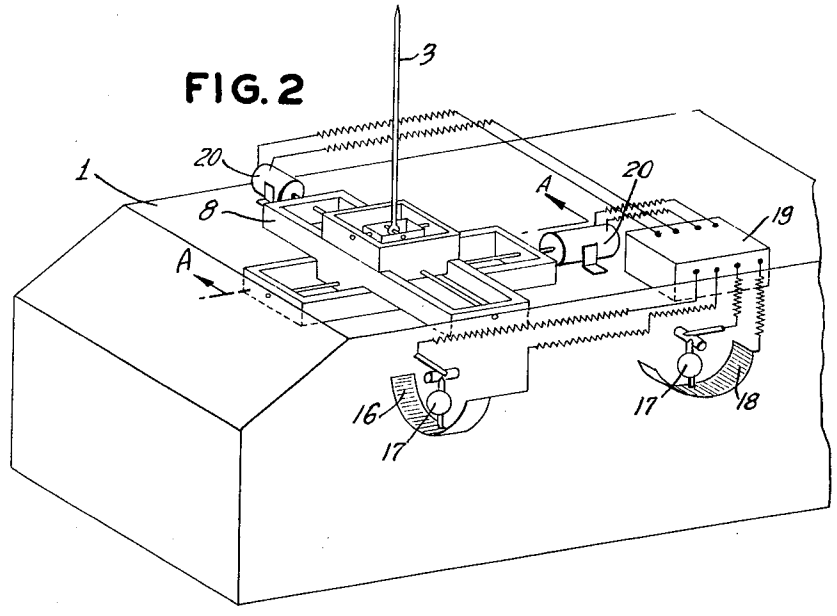
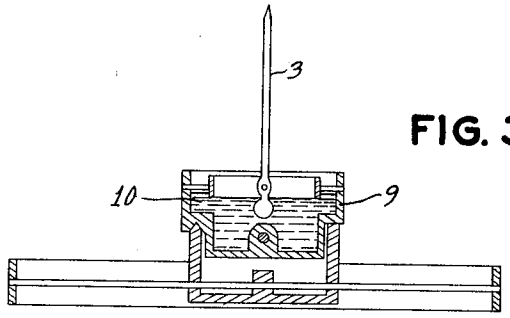


FIG. 3



INVENTORS
Helmut Hausenblas
BY Kurt Bohrmann

James E. Bryan
ATTORNEY

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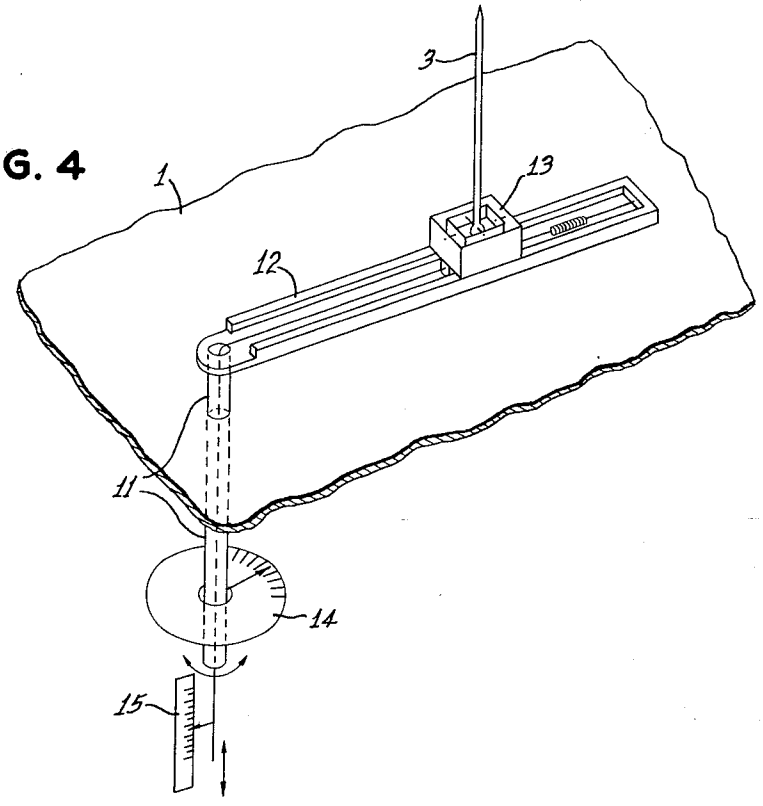
FIG. 4



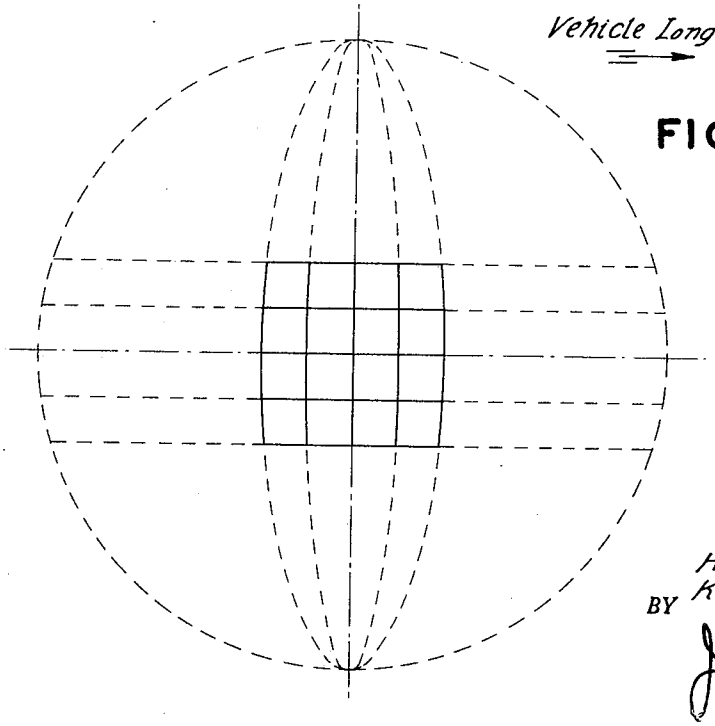


FIG. 5

INVENTORS
Helmut Hausenblas
Kurt Bohrmann
BY James E. Bryan
ATTORNEY

United States Patent Office

3,362,073

Patented Jan. 9, 1968

3,362,073

DEVICE FOR AIMING A HEAVY WEAPON BUILT INTO A VEHICLE

Helmut Hausenblas and Kurt Bohrmann, Kassel, Germany, assignors to Rheinstahl Henschel A.G., Kassel, Germany, a corporation of Germany

Filed May 6, 1964, Ser. No. 366,225
Claims priority, application Germany, May 18, 1963, H 49,217
10 Claims. (Cl. 33—46)

This invention relates to a device for aiming a heavy weapon, more particularly a mortar, built into a vehicle.

It is known to aim a heavy weapon, in particular a mortar, for firing from the ground by means of an optical aiming or sighting device attached to the weapon and an aiming post placed vertically in the ground at a predetermined distance in front and at the side of a spherical weapon support. When mounting the weapon on a vehicle, the need arises for maintaining the position of the aiming post relative to the spherical weapon support within a fixed terrestrial reference system, even if the vehicle assumes an inclined position relative to the fixed terrestrial reference system, for example, due to uneven terrain.

It is known to achieve the above condition in an approximate manner by supporting the aiming post on the vehicle in a gimbal and constructing it in the form of a gravitational pendulum. This construction, however, leads to a number of drawbacks. The gimbal mounting of the aiming post must, in order to achieve a substantial degree of accuracy for the position of the post relative to the weapon also at inclined positions of the vehicle, be located in the interior of the vehicle, in the same horizontal plane as the spherical weapon support. This means that a conically shaped space must be left free for the movement of the post above its mounting, which is lost for the storage of, for example, equipment or ammunition. For the same reason, a comparatively large opening must be provided in the armor plate of the roof of the vehicle well. Furthermore, the mounting point of the aiming post does not remain in the same plane as the spherical weapon support in the event of a longitudinal inclination of the vehicle.

The present invention provides an arrangement for mounting the aiming post on the top side of the vehicle, which does not require a large amount of space in the vehicle interior and which compensates for inclinations of the vehicle in such a manner that the post maintains the same position relative to the fixed terrestrial reference system as when firing the weapon from the ground, under given conditions.

Accordingly, the present invention comprises a sighting or aiming device for aiming heavy weapons, particularly mortars, having an aiming post and adapted to be mounted on a weapon-carrying vehicle, wherein means are provided for mounting the aiming post on the vehicle top in a manner such that the securing point for the aiming post is displaced on or in the roof plate of the vehicle in the event of longitudinal and transverse inclinations thereof, and the aiming post is set to a vertical position in relation to a fixed terrestrial system of coordinates in such a manner that a downward projection of the axis of the aiming post intersects an imaginary horizontal fixed terrestrial plane, which extends through the center of a spherical support of the weapon at all inclinations of the vehicle, at the point

determined for firing of the weapon from the ground. The practical embodiments of the invention can, as is described below, be constructed in various ways, depending on the desired comfort for the operating crew and the amount of technical expenditure.

The simplest embodiment of the invention consists in providing holes in the roof of the vehicle, suitably arranged and drilled at such angles that the aiming post is located in the required position by insertion into the hole corresponding to the longitudinal and transverse inclinations.

In order that the invention may be more readily understood, reference is made to the accompanying drawing which illustrates diagrammatically several embodiments thereof, and in which:

FIGURE 1 is a perspective view of the well of an armored vehicle incorporating one embodiment of the invention,

FIGURE 2 shows the well of FIGURE 1 with the aiming post arranged on a cross support,

FIGURE 3 is a section on line A—A of FIGURE 2 through the cross support, also showing the dashpot,

FIGURE 4 shows an adjusting device for the aiming post corresponding to a system of polar coordinates, and

FIGURE 5 shows a horizontal projection of a scale on the spherical cap of a spirit level.

Referring to the drawings, the armor well 1 (FIGURE 1) has the holes 2 drilled in the roof at various angles of inclination for insertion of an aiming post 3. The axes 4 and 5, about which, respectively, the transverse and longitudinal inclinations of the well can be visualized, are shown in phantom in the well. The downward projection 6 of the aiming post 3 intersects, as shown, an imaginary fixed terrestrial horizontal plane passing through the center of a spherical weapon support (not shown), at all inclinations of the vehicle, in the point 7 determined for firing from the ground.

In order to enable the operating member of the crew to ascertain the momentary longitudinal and transverse inclinations of the vehicle, instruments for indicating the inclinations, such as a spirit level (not shown) are provided, preferably inside the vehicle. Such a spirit level has one scale for reading the longitudinal inclination and another for the transverse inclination. The holes for inserting the aiming post are provided for sufficiently narrow-stepped values of the longitudinal and transverse inclination angles and are marked with both these appertaining angular values.

If it is required to also take all intermediate values for the angles of inclination into account without any errors, the aiming post 3 is mounted on a cross support 8 (FIGURE 2) which comprises two slides arranged to move in two guides in two directions at right angles to one another. The cross support 8 is of known construction, preferably comparatively flat and partially sunk into the roof of the armor well 1. The two guides are respectively arranged in the longitudinal and transverse directions of the vehicle. The cross support 8 allows for stepless movement of the aiming post 3 in a Cartesian system of coordinates on the vehicle roof. The automatic movement of the aiming post 3 is effected by means of the servomotors 20 which obtain electrical impulses, by way of a computer 19, from the gravity pendulums 17 which are suspended on gimbals and are mounted to

coact with the potentiometers 16 and 18 provided for the transverse and longitudinal inclinations of the vehicle respectively, the potentiometers measuring on the circular resistance paths thereof values corresponding to inclinations of the vehicle. The resistance paths of the potentiometers are so mounted that they will always be positioned perpendicularly below the gravity pendulums. This means that the potentiometer 16 which measures the vehicle inclination in the transverse direction compensates for the transverse vehicle inclination. The opposite is the case for the potentiometer 18 which indicates the longitudinal vehicle inclination so that it is stable in the transverse direction and compensates for the longitudinal inclination. In order to obtain accurate vertical positioning of the aiming post 3, relative to a fixed terrestrial system of coordinates, the post is constructed as a gravitational pendulum mounted in a gimbal, the lower end of the pendulum being arranged for movement in a dashpot 9 filled with a suitable viscous liquid 10 (FIGURE 3). Adjustment of the aiming post also may be effected in accordance with the reading of inclination measuring instruments (not shown), for example, spirit levels provided on each of the slides.

Instead of the cross support 8, which corresponds to a Cartesian system of coordinates on the vehicle roof, a rotary adjusting device (FIGURE 4), having a substantially vertical axis, for the aiming post 3 mounted as a pendulum suspended in a gimbal, can be used, this device corresponding to a system of polar coordinates having its origin preferably coinciding with the mounting point of the aiming post on the vehicle roof, with the vehicle inclined neither in the longitudinal nor transverse direction.

In FIGURE 4, an arm 12 pivotal about an axis 11 is shown, the arm carrying a slide 13 movable in the longitudinal direction of the vehicle, on which the aiming post 3 is mounted in a dashpot, as described above with reference to the embodiment of FIGURES 2 and 3. This arrangement enables a movement of the aiming post in a system of polar coordinates on the vehicle roof. The vertical position of the aiming post 3, relative to an assumed fixed terrestrial reference system, is again ensured by pivotable mounting thereof with the lower end in a dashpot. Numerals 14 and 15 denote scales, used for adjustment of the device in accordance with the readings of instruments used for measuring the vehicle inclination. This adjusting or setting divice has, when compared with the cross support 8, the advantage that the elements for adjusting the aiming post, to reflect the vehicle inclinations, can be arranged for operation from the interior of the vehicle by very simple means, for example, by using belt drives, gearwheels, or levers traversing the vehicle roof at the origin of the coordinate system (pivot point of the adjusting device).

In all the embodiments described above, the adjustment of the aiming post in accordance with the vehicle inclinations must be manually performed by a member of the crew. This can be obviated by embodying another very useful feature of the invention, in that the rectilinear movement of both the slides of the cross support 8, and the rotary movement of the arm 12 together with the alteration of the radius of the adjusting device 13, corresponding to a system of polar coordinates, is effected by adjusting motors, operated, for example, by electric, hydraulic or pneumatic power.

On all the described adjusting devices for the aiming post, the functional relationship between the positioning of the aiming post on the vehicle roof and the longitudinal and transverse inclinatons of the vehicle is conditioned by geometrical factors and can be determined by various methods, for example, by calculation, graphically, or by trial and error. For the first-described arrangement (FIGURE 1) with the aiming post inserted at various positions in the roof of the well 1, the following consideration has proved to be particularly useful: If the vehicle is at first given a certain longitudinal inclination, it is still uncertain, about which axis the transverse inclination shall take place. This axis can either be horizontal in the fixed terrestrial system of coordinates on the vehicle longitudinally inclined or not inclined, or it can be an axis which is horizontal in the longitudinally uninclined vehicle, which is assumed to be rigid in the vehicle, so that it will particpate in the longitudinal inclination of the vehicle. Experience has shown the first assumption to be the more useful one. A scale is thus formed on the spherical cap of a spirit level shown in horizontal projection in FIGURE 5. The lines of equal transverse inclination extend parallel to the longitudinal axis of the vehicle while the lines of equal longitudinal inclination are ellipses, with their major axes identical to the diameter of the sphere of the spirit level and extending across the longitudinal direction of the vehicle. If the aiming post, mounted in a gimbal and constructed as a gravitational pendulum, is placed onto a cross support, a diagram of straight lines running parallel and transversely to the direction of travel of the vehicle is obtained. Transferring this diagram back onto the spirit level results in a similarly distorted diagram, whereby the relationship between the individual points of this diagram and of the rectangular diagram on the vehicle roof is recorded by suitable numbering of the points of the diagram. Similar conditions apply when using the adjusting device for the aiming post corresponding to a system of polar coordinates.

It will be obvious to those skilled in the art that many modifications may be made within the scope of the present invention without departing from the spirit thereof, and the invention includes all such modifications.

What is claimed is:

1. A device for aiming a heavy weapon mounted in a spherical support on a weapon-carrying vehicle comprising an aiming post displaceably mounted on the vehicle and means for setting the aiming post in a vertical position relative to a fixed terrestrial system of coordinates in a manner such that a downward projection of the axis of the aiming post intersects an imaginary horizontal fixed terrestrial plane extending through the center of the spherical support for the weapon at all inclinations of the vehicle, at the point determined for firing the weapon from the ground.

2. A device accordiing to claim 1 in which the aiming post is mounted on the vehicle roof.

3. A device according to claim 2 in which the means includes a plurality of holes drilled at different angles of inclination in the roof of the vehicle for insertion of the aiming post.

4. A device according to claim 1 in which the means includes a cross support having two slides and being mounted on the vehicle roof.

5. A device according to claim 1 in which the means includes an arm pivotally secured to the vehicle and a slide, carrying the aiming post, mounted on the arm, the arm and slide corresponding to a system of polar coordinates.

6. A device according to claim 1 in which the aiming post has the form of a gravitational pendulum and is mounted in a gimbal, the lower end of the pendulum forming an element of a dashpot.

7. A device according to claim 1 including spirit level means provided with scales for reading the longitudinal and transverse inclinations of the vehicle.

8. A device according to claim 1 including potentiometer means having circular resistance paths, the slides of which are operated by a gravitational pendulum, for measuring the longitudinal and transverse inclinations of the vehicle.

9. A device according to claim 4 in which the slides are moved relative to the cross support by adjusting motors.

10. A method of aiming a heavy weapon mounted on a weapon-carrying vehicle which comprises setting an aiming post, displaceably mounted on the vehicle, in a vertical position relative to a fixed terrestrial system of coordinates in a manner such that a downward projection of the axis of the aiming post intersects an imaginary horizontal fixed terrestrial plane extending through the center of a spherical support for the weapon at all inclinations of the vehicle, at the point determined for firing the weapons from the ground.

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ROBERT B. HULL, *Primary Examiner.*