

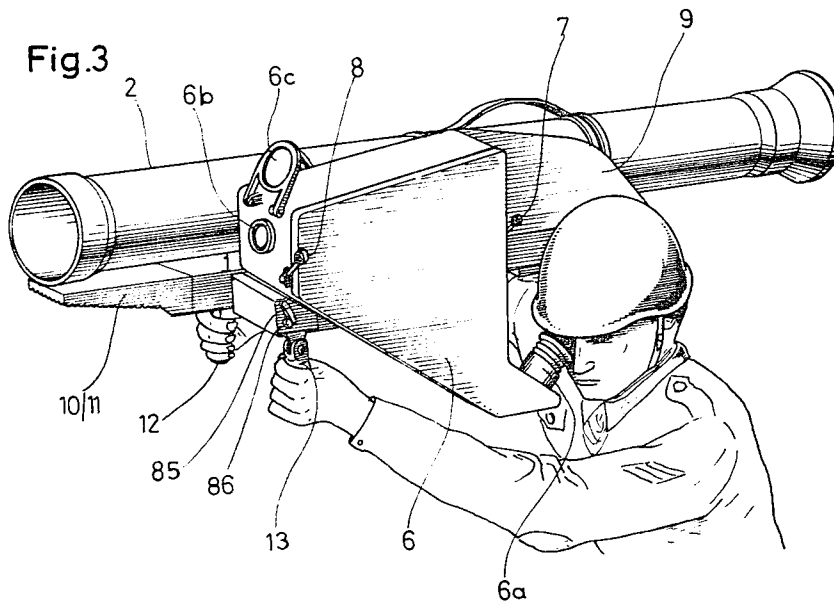
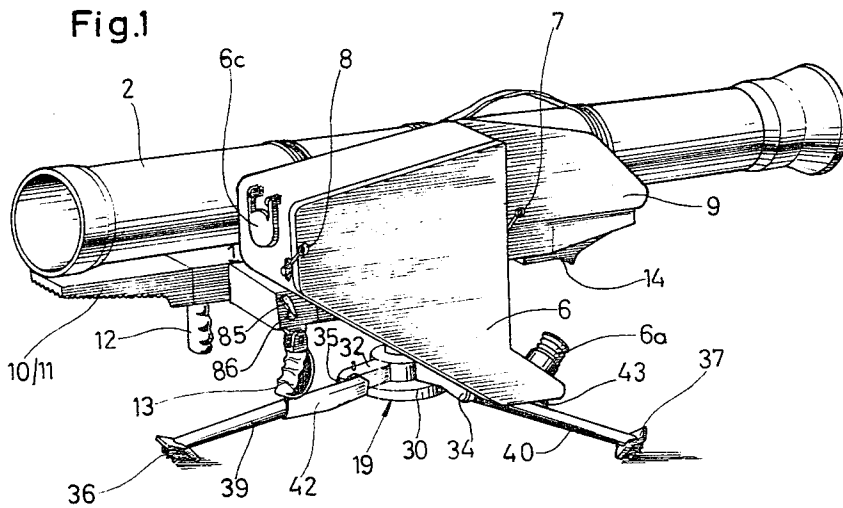
June 25, 1968

E. BEIER ET AL
FIRING AND GUIDING MECHANISM FOR JET-PROPELLED MISSILES
LAUNCHED FROM LAUNCHER TUBES

3,389,637

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3 Sheets-Sheet 1



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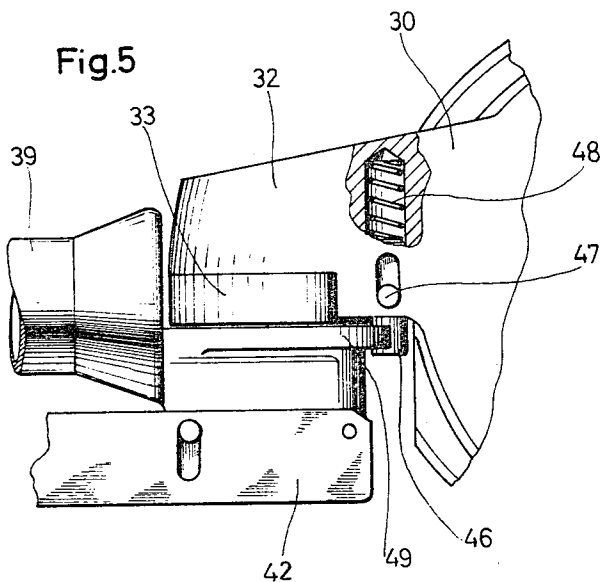
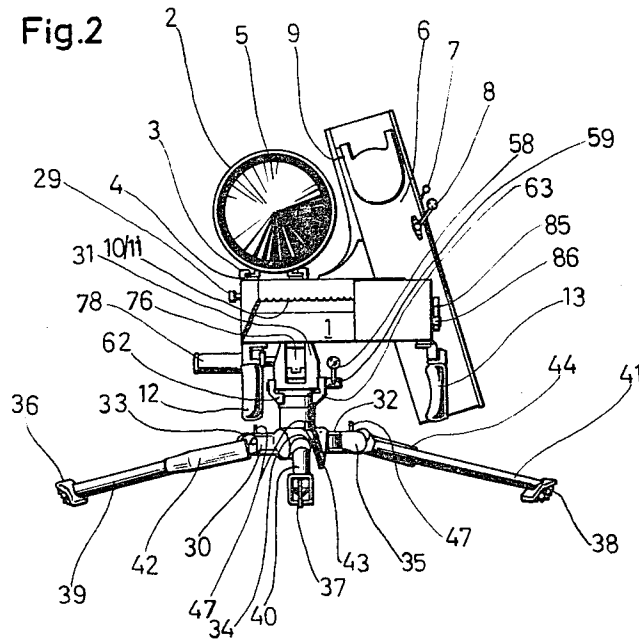
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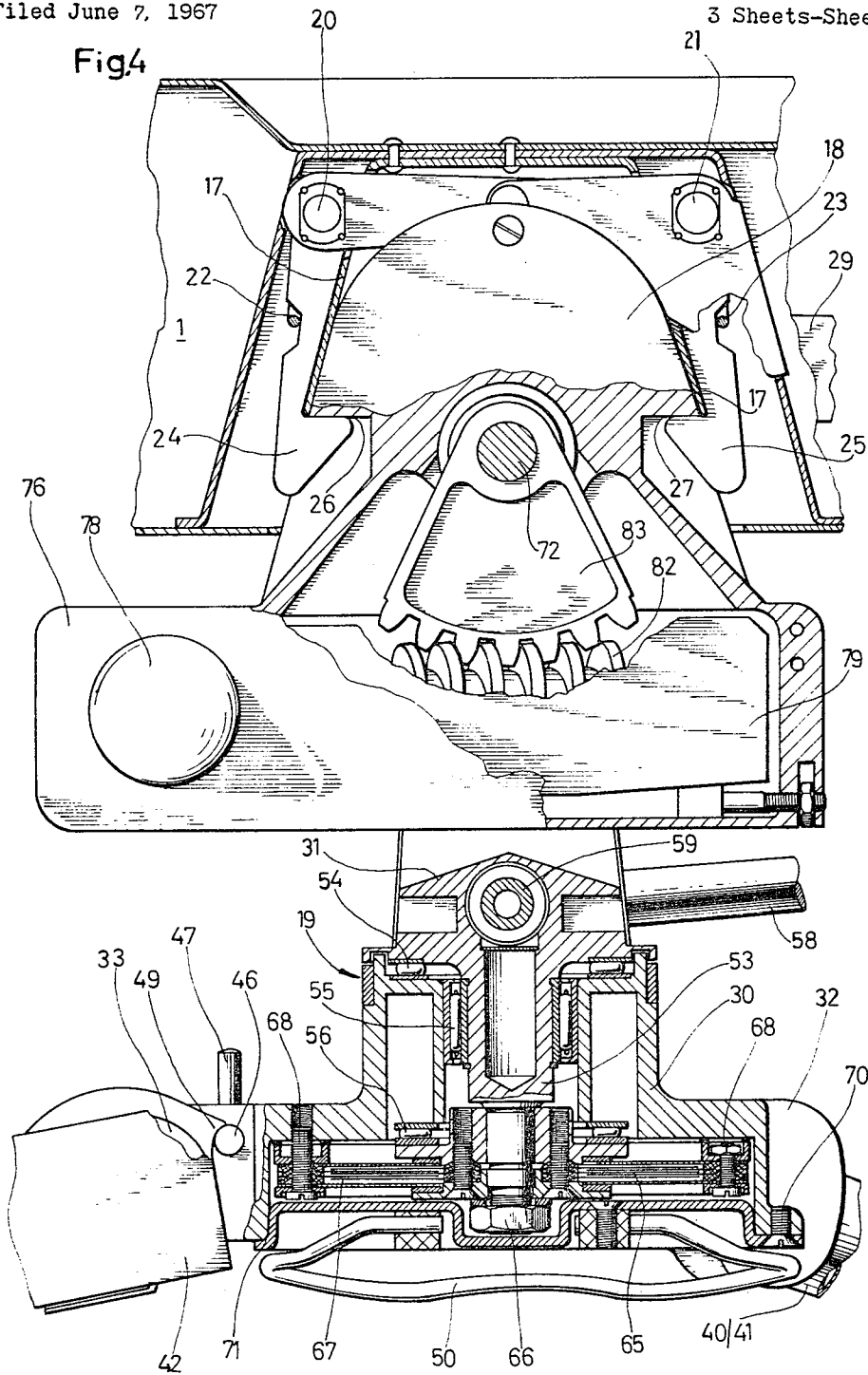
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Fig 4



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FIRING AND GUIDING MECHANISM FOR JET-PROPELLED MISSILES LAUNCHED FROM LAUNCHER TUBES

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ABSTRACT OF THE DISCLOSURE

A firing and guiding mechanism for jet-propelled missiles, launched from a launcher tube, is disclosed as including an undercarriage having a part adjustable laterally and vertically. This part disengageably supports a sight carrier, having the general form of a shaft, and carrying all the devices required for launching, tracking and guiding the missile. The sight carrier extends parallel to the axis of the launcher tube, and disengageably supports the launcher tube.

A damping unit is included in the undercarriage and controls the speed of traverse, and a self-locking, no-play gear means is provided for elevation of the launcher tube. The sight carrier carries an optical sight for precision long range sighting, tracking and guiding, and also carries a coarse sight for short range sighting.

The sight carrier is provided with a support surface conforming to a human shoulder, so that the sight carrier may be disengaged from the undercarriage and supported on the shoulder of the operator for so-called "shoulder shots."

Background of the invention

A known firing and guiding mechanism for jet-propelled missiles has a projector tube into which the launcher tube, carrying the missile, is introduced from the rear, with all necessary electrical and mechanical connections between the launcher tube and the undercarriage being established automatically. Such an arrangement is shown, for example, in *Interavia*, Volume 6, 1964, page 821. The projector tube is pivotally mounted on an elevating shaft in a cradle which, in turn, is mounted for rotation on a traversing shaft in a gear box supported by a tripod. The cradle carries a device for timing the launcher tube and launching the missile, and an electric battery, which is not arranged on the device, supplies the energy necessary for such launching and guiding. During guided flight of a missile, a sight, which extends co-axially of the launcher tube or parallel to the axis of the latter, must constantly track the target to be reached by the missile in order to produce the guiding signals.

A firing and guiding mechanism of this type is relatively heavy and requires special vehicles for its transportation. Because of its weight and dimensions, such a firing and guiding mechanism can consequently be used only when installed on the ground, so that a rapid change in location, necessary under changing battle conditions, is difficult to effect. If the firing and guiding mechanism must be manually transported because of a lack of vehicles, it must first be disassembled into different parts by specialists using special tools. Firing of such a missile from the shoulder of the gunner toward a relatively close target, namely the so-called "shoulder shot," which is necessary in close combat, or in assaults from enemy

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armored vehicles, is not possible with a firing and guiding mechanism of the mentioned type.

A firing mechanism for unguided, relatively small ballistic missiles is shown in U.S. Patent No. 2,913,960, and includes a launcher tube containing a jet-propelled missile and detachably connected with the tripod in such a manner that the launcher tube can be adjusted both in elevation and in traverse. With this arrangement, the gunner can detach the launcher tube from the tripod with a few manipulations, and use the launcher tube alone to fire a shoulder shot. This arrangement, however, does not include a special elevating and traversing gear, since it is used to fire unguided missiles. The elevating and traversing gear on the tripod is suitable only to aim the ready-to-fire missile at the target.

Summary of the invention

The invention relates to the firing and guiding of jet-propelled missiles launched from launcher tubes and, more particularly, to a novel and improved firing and guiding mechanism of this type, and which is simple, lightweight and inexpensive, so that it can be carried by a single gunner and is usable both for a so-called shoulder shot and for firing of a missile ground-supported on an undercarriage or the like and using optical target and/or missile tracking.

Starting from the known provision of a firing and guiding mechanism for jet-propelled missiles launched from launcher tubes and arranged with a vertically and horizontally adjustable part carried by an undercarriage to receive the launcher tube and a sight for producing the guiding signals and for aiming, the invention provides a lockable shaft-like sight carrier extending parallel to the axis of the launcher tube and in or on which are arranged all of the devices necessary for launching, tracking and guiding. This sight carrier is detachably secured to the undercarriage, which latter is designed as a tripod and includes damping means for the traversing movement and a self-locking no-play elevation gear means for the elevation movement.

Due to the disengageable connection between the sight carrier, which can be secured with the launcher tube, and the tripod carrying the elevating and traversing gear, a missile can be launched and tracked, independently of the tripod, from the sight carrier connected with the launching tube and producing the guiding signals, by a gunner supporting the sight carrier on his shoulder in standing, kneeling, or prone position, or, after attachment of the sight carrier on the tripod, from the latter.

The sight carrier is formed with a recess having a coupling device by means of which the sight carrier can be disengageably coupled with a laterally and horizontally adjustable receiver part on the tripod. In addition, the sight carrier has, adjacent its front end, two folding handles on its underside and, at its rear part, a rounded supporting surface on its underside, the form of this surface being adapted to the human shoulder. The tripod includes a bearing body which is connected with a gear case through a bearing pin, for relative rotation, the gear case including a receiver part for the sight carrier. A folding handle is provided on the gear case so that the latter can be adjusted about the elevating and traversing axes of the tripod.

Legs are pivotally mounted on the bearing body of the tripod, and can be adjusted in length or angularly stepwise in a known manner by a locking device. In a limiting angular position, these legs engage retractable end stops preventing the bearing body from dropping to the ground. The legs can be swung upwardly, after retraction of the end stops, into a substantial vertical position for transport of the tripod, and can be locked in this position. The bearing body has a folding handle on its underside.

The detachable coupling device connecting the sight carrier and the tripod comprises two hooks arranged opposite each other inside the recess of the sight carrier. These hooks are spring biased and engage behind projections of the receiver part of the tripod.

In order to obtain a uniform angular velocity during traversing movement of the firing and guiding mechanism, a damping device is provided in the bearing body. This damping device comprises a number of closely spaced disks, alternate disks being rigidly connected with the stationary part of the tripod and intermediate disks being rigidly connected with a rotatable part thereof, such as a bearing fork. A damping liquid is interposed between the alternate and intermediate disks.

The elevating gear is a well-known worm gearing made free from play by an adjusting wedge, and this elevating gear is operated, through two bevel gears, by a handle. The tripod, containing the traversing and elevating gear, has a clamping device, provided with an operating handle, by means of which the sight carrier and the launcher tube may be locked in any given traversing position, or be released for traversing.

An object of the invention is to provide an improved firing and guiding mechanism for jet-propelled missiles launched from launcher tubes.

Another object of the invention is to provide such a mechanism which is simple, lightweight, and relatively inexpensive, and which can be carried by a single gunner and is adaptable both for a shoulder shot and for mounting on an undercarriage or the like.

A further object of the invention is to provide such a mechanism including a sight carrier extending parallel to the axis of the launcher tube, and carrying all of the devices necessary for launching, tracking and guiding of the missile.

Still another object of the invention is to provide such a mechanism in which the sight carrier is disengageably connected with an undercarriage designed as a tripod and carrying a damping gear for the traversing movement and a play-free self-locking gear for the elevating movement.

A further object of the invention is to provide such a mechanism in which the sight carrier is formed with a support surface adaptable to the human shoulder, the sight carrier being disengageably connected to a tripod for removal therefrom for a so-called shoulder shot.

Yet another object of the invention is to provide such a firing and guiding mechanism which is easily manually transportable and which does not require special tools or specialized personnel for attachment of the sight carrier and the launcher tube to a support or detachment from the support.

Brief description of the drawings

For an understanding of the principles of the invention, reference is made to the following description of a typical embodiment thereof as illustrated in the accompanying drawings.

In the drawings:

FIG. 1 is a perspective view of firing and guiding mechanism embodying the invention and including a launcher tube, a sight carrier with an optical sight, and an undercarriage in the form of a tripod;

FIG. 2 is a front elevational view corresponding to FIG. 1;

FIG. 3 is a perspective view illustrating the firing and guiding mechanism positioned for a so-called shoulder shot;

FIG. 4 is a longitudinal sectional view through a portion of the tripod and a portion of the sight carrier, on a large scale; and

FIG. 5 is a plan view, partly in section, of a detail of the tripod illustrating a retractable end stop preventing the bearing body dropping to the ground.

Description of the preferred embodiment

Referring to the drawings, a sight carrier 1 is illustrated,

in FIGS. 1, 2 and 3, as supporting a launcher tube 2 having a missile 5 mounted therein, the launcher tube 2 having its axis extending parallel to the longitudinal axis of the sight carrier and being locked thereto by means of retaining means 3 and 4 secured on the launcher tube 2 and the sight carrier 1, respectively.

Sight carrier 1 is designed as a tub-shape shaft which is completely enclosed, and inside of which are arranged the mechanical and electrical devices necessary for launching and guiding the missile, in a manner which forms no part of the present invention. On the right side of sight carrier 1, as viewed in FIG. 2, there is secured an optical sight 6 provided with a night visibility device, sight 6 having an eyepiece 6a and a light entry portion 6b, a pivoted cover 6c being associated with the light entry surface. An additional mechanical folding short-range or coarse sight is provided on the outer surface of sight 6, and comprises a rear sight 7 and a front sight 8.

Between sight 6 and the right end of sight carrier 1, as viewed in FIG. 1, there is a covering 9 protecting the head of the gunner. Sight carrier 1 has additionally, at its front or left end viewed in FIG. 1, a support 11 provided with a series of teeth 10, and also has adjacent its front end two folding handles 12 and 13 which can be secured from the under surface of the sight carrier. On its rear end, or to the right as indicated in FIG. 1, the sight carrier is formed with a rounded supporting surface 14 adapted to the shoulder of a gunner.

Referring to FIG. 4, the underside of the sight carrier is formed with a recess 17 in the form of a truncated pyramid, and conforming to a corresponding receiver part 18 of a tripod 19 described hereinafter. Receiver part 18 is cooperable with two hooks 24 and 25 positioned opposite each other in recess 17, these hooks being pivoted on respective bolts 20 and 21 and biased by springs 22 and 23. Hooks 24 and 25 engage behind respective projections 26 and 27 of receiver part 18 to lock sight carrier 1 frictionally to the tripod. The hooks can be released by means of a lever 29 acting against the bias of springs 22 and 23, the manner of operation not being shown here, so that the sight carrier 1 can be lifted or disengaged from the tripod.

Tripod 19 had a bearing body 30 which rotatably mounts a bearing fork 31. On the base 32 of bearing body 30 there are pivotally mounted three legs 39, 40 and 41 by means of respective joints 33, 34 and 35, these legs being provided at their outer ends with respective claws 36, 37 and 38, as also seen in FIG. 2. On the base of bearing body 30 there are also provided end stops 46 which engage with extensions 49 of the tripod legs in the limiting position of the latter, and thus prevent the bearing body from dropping to the ground during adjustments. The tripod legs can be folded substantially vertically upwardly after retracting of the end stops 46. As illustrated in FIG. 5, end stops 46 can be retracted into the interior of the bearing body by means of handles 47 acting against the bias of springs 48. A folding handle 50 is arranged on the underside of the bearing body for easy transportation of the tripod.

A bearing pin 53 of fork 31 is rotatably mounted in bearing body 30 by means of needle bearings 54, 55 and 56, for rotation about a vertical axis. Fork 31 either can be locked relative to bearing body 30 or can be released for angular displacement relative thereto by means of an adjusting lever 58 connected to a threaded clamping shaft passing through the bearing fork and threadedly engaged with clamping jaws 62 and 63, one having a right hand thread and the other a left hand thread.

At the bottom end of bearing pin 53 there are secured a number of thin disks 65, as best seen in FIG. 4. These disks are arranged closely adjacent and parallel to each other, being held in position by means of a nut 66. Between each pair of adjacent alternate disks 65 is arranged an intermediate disk 67 which is secured by screws 68 to the bearing body, and a damping fluid is contained

between the disks. The disks 65, secured to pin 53, and the disks 67, secured to bearing body 30, form a damping unit insuring a uniform angular velocity of the traversing movement. A cover 71 is secured on the underside of bearing body 30 by means of screw 70, and forms a water-tight and dust-tight seal for the bearing body.

A continuous shaft 72 is fixed to the upper end of bearing fork 31, as best seen in FIG. 4, being secured in recesses in the bearing fork and extending perpendicularly to the longitudinal axis of bearing body 30. A gear case 76 is mounted rotatably about shaft 72, and has its upper part designed as the aforementioned receiver part 18 which can be disengageably locked in recess 17 of sight carrier 1. A handle 78 is rotatably mounted on gear case 76 and extends perpendicularly to the longitudinal axis of bearing body 30, handle 78 being operable to effect the elevating movement. By means of handle 78, gear case 76, and with it sight carrier 1, can be turned about the axis of shaft 72 through bevel gears (not shown) and a worm 82 rotatably mounted in a bearing 79 and meshing with a worm gear sector 83 fixed to the stationary shaft 72.

If a missile is to be launched, for example in a so-called shoulder shot, sight carrier 1 must be disengaged from tripod 18. For this purpose, lever 29 is operated against the action of springs 22 and 23 to disengage hooks 24 and 25 from projections 26 and 27, respectively. The hooks are held in their inoperative position. Sight carrier 1 can now be grasped by handles 12 and 13 with one hand each, and lifted to the shoulder of a gunner, as shown in FIG. 3. In this position, sight carrier 1 has its supporting surface 14 bearing on the right shoulder of the gunner. The gunner can now aim the sight carrier on a very close target by using the close-range or coarse sight 7-8, which is at the eye level in front of the gunner. The target can also be traced by optical sight 6, as illustrated by the gunner's position in FIG. 3.

For the sake of completeness it should also be mentioned that, by actuating a safety lever 85 on sight carrier 1 with the thumb of the left hand, the missile can be made ready to launch, and can be launched by means of a starter 86 for launcher tube 2, and guided to the target in the so-called target covering method wherein the target cross hairs or the like of mechanical sight 7-8 or of optical sight 6 are kept constantly aligned on the target.

For more remote targets, it is advisable to launch missile 5 by means of mounting sight carrier 1, with launching tube 2, on tripod 18 provided with the elevating and traversing gear, as seen in FIG. 1. For this purpose, sight carrier 1 has its recess 17 engaged on receiver part 18 of tripod 19, with the spring-loaded hooks 24 and 25 being released to engage projections 26 and 27 of receiver 18 and lock the tripod 19 automatically with sight carrier 1. Legs 39, 40 and 41, which can turn by means of joints 33, 34 and 35, respectively, permit a coarse elevation of the firing and guiding mechanism. Aiming at the target is effected by means of handle 78 on gear case 76. This handle can be used to traverse the sight carrier about the vertical axis of tripod 19, and simultaneously can be turned to adjust the longitudinal axis of the sight carrier in an elevational movement.

In the case of a stationary target, sight carrier 1 can be locked by means of adjusting lever 58 so that it can not be turned about the axis of the tripod. Such a locking is not necessary for elevation, since the frictional force of the self-locking worm gearing 82, 83 is so great that sight carrier 1 can be moved by means of handle 78 about shaft 72. During traverse, damping unit 65, 67 permits only a constant angular velocity independent of the force exerted by a gunner during the traversing movement.

While a specific embodiment of the invention has been shown and described in detail to illustrate the application of the principles of the invention, it will be understood

that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. In a firing and guiding mechanism for a jet-propelled missile launched from a launcher tube, of the type including an undercarriage, a part carried by said undercarriage and adjustable laterally and vertically, and a sight for elevation and traverse of the launcher tube and for guiding of the missile; the improvement comprising, in combination, a sight carrier having the general form of a shaft and extending parallel to the axis of the launcher tube, said sight carrier carrying all devices required for launching, tracking and guiding the missile; means on said sight carrier disengageably connecting the same to said part of said undercarriage; a damping unit in said undercarriage connected to said part thereof and controlling the traversing speed; and self-locking, no-play elevation gear means on said undercarriage connected to said part thereof.

2. In a firing and guiding mechanism, the improvement claimed in claim 1, in which the undersurface of said sight carrier is formed with a recess substantially conformingly receiving said laterally and vertically adjustable part of said undercarriage; and coupling means in said recess for disengageable coupling of said sight carrier to said part.

3. In a firing and guiding mechanism, the improvement claimed in claim 1, including handle means positionable in operative relation for manual grasping on the underside of said sight carrier; the rear portion of said sight carrier having an undersurface with a form adapted to the human shoulder; whereby said sight carrier, when released from said undercarriage, may be mounted on the shoulder of a gunner for a so-called shoulder shot.

4. In firing and guiding mechanism, the improvement claimed in claim 3, in which the sight carrier is formed with a recess substantially conformingly receiving said laterally and vertically adjustable part of said undercarriage; and coupling means in said recess for disengageable coupling of said sight carrier to said part.

5. In a firing and guiding mechanism, the improvement claimed in claim 1, in which said undercarriage includes a bearing body; a gear case rotatably connected through a bearing pin with said bearing body, for rotation about a substantially vertical axis; said gear case including said laterally and vertically adjustable part of said undercarriage; elevating gear means in said gear case; and a handle secured on said gear case and operable to adjust the same angularly about the axis of said bearing pin as a traversing axis, and operable to activate said gear means for elevation movement of said sight carrier.

6. In a firing and guiding mechanism, the improvement claimed in claim 1, in which said undercarriage is a tripod having a bearing body and legs pivoted on said bearing body for step-wise adjustment by respective locking devices; end stops on said bearing body engageable with said legs to limit movement thereof in a direction lowering said bearing body; said end stops being retractable for swinging of said legs into a substantially vertically upwardly extending position for transport of said tripod; and a handle pivotally connected to the underside of said bearing body for transport of said tripod.

7. In a firing and guiding mechanism, the improvement claimed in claim 2, in which said coupling means comprises a pair of opposing hooks pivotally mounted in said recess in said sight carrier; said laterally and vertically adjustable part of said undercarriage having projections co-operable with said hooks; and spring means biasing said hooks into engagement with the respective projections.

8. In a firing and guiding mechanism, the improvement claimed in claim 1, in which said undercarriage includes a housing; said damping unit including a plurality of closely spaced disks in said housing, with alternate disks fixedly connected to said laterally and vertically adjustable part of said undercarriage and intermediate disks fixedly connected with said housing; and a damping fluid in said housing between said disks.

9. In a firing and guiding mechanism, the improvement claimed in claim 5, in which said elevating gear means includes a worm and a worm gear sector engaged with said worm, and an adjusting wedge preventing play between said worm and said worm gear sector; a handle for elevating said sight carrier; and bevel gear means connecting said handle to said worm.

10. In a firing and guiding mechanism, the improvement claimed in claim 1, including clamping means selectively operable to clamp said laterally and vertically adjustable part against lateral adjustment to lock said sight carrier against traverse; and an operating handle connected to said clamping means.

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