Aug. 2, 1966 C. R. SANDAHL 3,263,567

GUNSIGHT DRIVE LINKAGE

Filed March 15, 1957 2 Sheets-Sheet 1

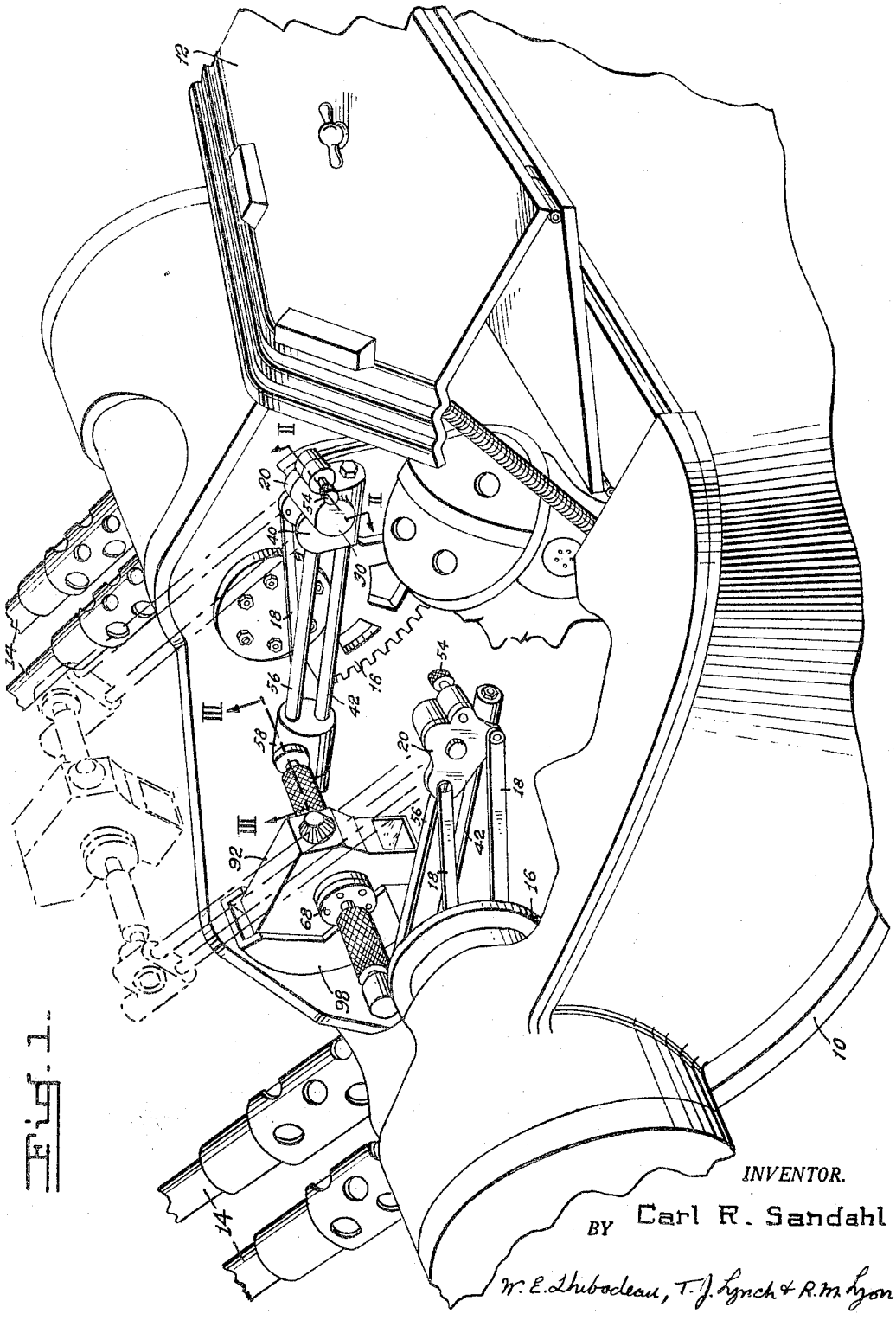


Fig. 1.

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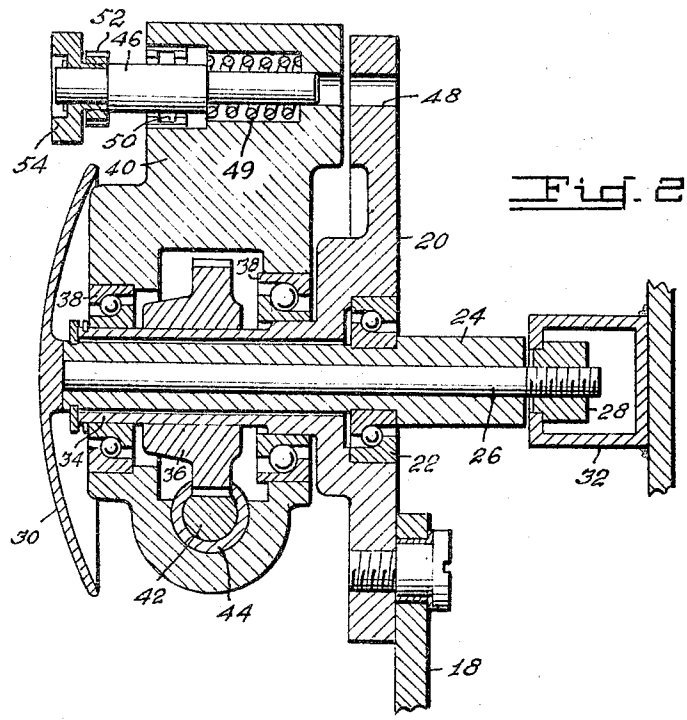


Fig. 2.

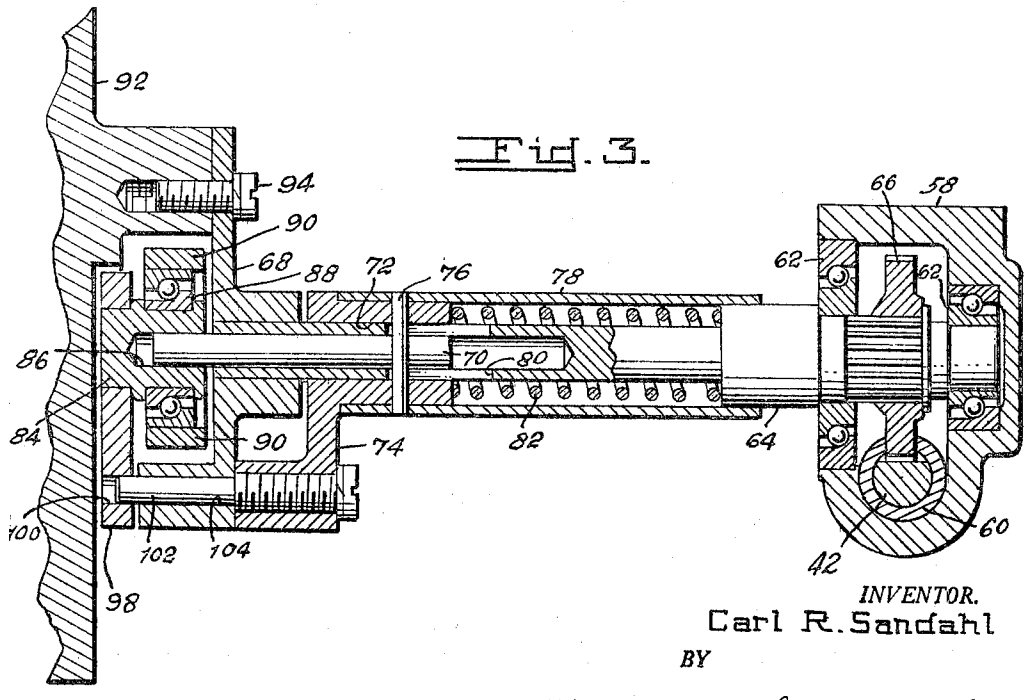


Fig. 3.

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GUNSIGHT DRIVE LINKAGE

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The invention relates to gunsight drive linkages, and more particularly to gunsight linkages wherein the sight may be adjustably positioned relative to the gun.

In the gunsight art, many various means have been utilized in linking the sight to the gun such that the line of sight will remain parallel to the gun at all times irrespective of the gun's traversing and elevational movements. Most of the present gunsight linkages are heavy and bulky and unsuitable for use with guns mounted on vehicles or other installations wherein space limitations are restricted. Also, it has heretofore been difficult to obtain a linkage which would permit the gun to be effectively used against anti-aircraft targets as well as terrestrial targets.

It is thus an object of the invention to design a gunsight linkage which is capable of operating a gunsight effectively for use against both air and terrestrial targets.

A further object of the invention is to produce an accurate gunsight linkage which is compact, lightweight, and may be readily adjusted to the gunner's height.

Another object of the invention is to design a gunsight drive linkage which will maintain the line of sight parallel to the gun at all times and will also operate a protective shield when used against terrestrial targets.

These and other objects of the invention will become apparent when viewed in relation to the eccompanying specification and drawings wherein:

FIGURE 1 is a perspective view of the invention as used in an armored vehicle.

FIGURE 2 is a cross-sectional elevational view of the invention taken along the line II—II of FIGURE 1.

FIGURE 3 is a cross-section elevational view of the invention taken along the line III—III of FIGURE 1.

Although the invention may be used with any type of sight aimed gun, FIGURE 1 illustrates use with a battery of machine guns mounted in a vehicle.

As seen in FIGURE 1, a turret **10** which is mounted on a vehicle, not shown, provides the housing for the guns and gunner. The turret **10** is provided with a hatch **12**, which may be folded back for purposes later described. A series of machine guns **14** are mounted for elevational movement within turret **10**, which in turn is rotatably supported in the vehicle, thus enabling the guns **14** to be aimed in any direction. The turret and guns are preferably power driven, however, the gunsight linkage may be operated by either manual or power driven guns. The elevation of gun **14** will be obtained by rotatable means including a gear sector and gun trunnions through a torque exerted by the gear section **16** which is connected to and has the same center of rotation as the gun trunnions and is rotated by power means engaging with the teeth on the periphery thereof.

Elevation gear sectors or the equivalents are present on all mounted guns, and thus it will be observed the following described gunsight linkage may be adapted to any type of mounted gun. In the disclosed embodiment

where guns are mounted on both sides of the gunner, the linkage is duplicated to provide accurate operation and equal operation forces and in the description of the invention like reference numbers indicate similar components.

The gunsight linkage consists of a pair of arms **18**, one end of which is pivotally connected to the rotatable means for example to the gear sector **16** and the other ends are pivotally attached to pivot plate **20**. The ends of arms **18** are pivotally connected to the rotatable means for example to the gear sector **16** and to pivot plate **20** at points diametrically equal and opposite to each other in respect to the center of rotation of gun trunnions and gear sector and to the center of pivot plate rotation, thereby constituting a paralellogram system.

As seen in FIGURE 2, the pivot plate **20** is mounted by means of anti-friction bearing **22** to the shaft **24**. A bolt **26** extends through shaft **24** and is provided with a nut **28** at one end and an operating knob **30** at the other. The nut **28** is located inside a box type bracket **32**, which is of an arcuate shape (FIGURE 1) and is fixed to the turret body whereby the shaft **24** may be adjusted along the bracket and held in a selected position by turning knob **30** causing nut **28** to draw the shaft **24** into engagement with the bracket **32**.

The pivot plate **20** is provided with a tubular extension **34** surrounding shaft **24** on which is keyed a gear **36** which will rotate with plate **20**. A pair of anti-friction bearings **38** journal a housing **40** to the extension **34**, which encompasses the gear **36**, as shown in FIGURE 2, thus it will be observed that pivot plate **20** and housing **40** will rotate about the same axis.

A rack **42** is slidably carried by housing **40**, within a bearing sleeve **44**, and engages the teeth of gear **36**, such that if the housing **40** should rotate relative to plate **20**, the rack **42** will slide within sleeve **44**. A locking pin **46** is also located within housing **40**, and it is positioned so as to engage a hole **48** within plate **20**. A spring **49** constantly urges pin **46** in the retracted position, however a bayonet groove **50**, within housing **40**, will co-operate with surfaces **52** of knob **54** to hold the pin **46** within hole **48** to prevent relative rotation of housing **40** and pivot plate **20** when desired.

A rod **56** is rigidly affixed to housing **40** and extends therefrom, as shown in FIGURE 1, while the rack **42** projects from housing **40** in spaced parallel relation to the rod **56**. The rod **56** terminates at the housing **58** and is attached rigidly thereto while the rack **42** projects into the interior of the housing **58** as seen in FIGURE 3.

The housing **58** contains a sleeve type bearing **60** for accommodating rack **42** (see FIGURE 3) and is also provided with a pair of anti-friction bearings **62** which rotatably support the shaft **64**. A gear **66** is keyed to shaft **64** and engages rack **42** whereby reciprocation of the rack will cause the shaft **64** to rotate.

The outer portion of shaft **64** is reduced in diameter, and a bracket **68** is affixed to the extreme end for rotation therewith. A pivot pin **70** is slidably carried by shaft **64** within bore **72** and is connected to the sliding arm **74** by a pin **76**. A knurled sleeve **78** is also connected to arm **74** by pin **76** and telescopingly engages the enlarged diameter of shaft **64**, thus sleeve **78** may be gripped by the gunner and moved to the right, as viewed in FIGURE 3, thereby also moving arm **74** and pin **70**

to the right. A slot **80**, cut in shaft **64**, permits pin **76** to be translated within limits, and the spring **82** will bias the movable elements **70**, **74**, **76** and **78** to the left.

A support shaft **84** is located adjacent the end of shaft **64** and provides the means for supporting the reduced end thereof. Support shaft **84** is provided with a bore **86** and is rotatably held in a position by anti-friction bearings **88** and bracket **90**, which is an integral part of the turret **10**. Thus, support shaft **84** will provide a rotatable support for the shaft **64** when the pivot pin **70** engages the bore **86**.

The gunsight **92**, which is of the reflex type, is attached to the bracket **68** by a series of screws **94** and will therefore rotate with the shaft **64**.

The shield **98** is of an arcuate channel shape and is adapted to receive the gunsight **92** within the channel. A small opening is formed in shield **98** in alignment with the lens of gunsight **92**, and a large opening is cut in turret **10** such that the gunner may see outside the turret by locking into the gunsight **92** while the shield **98** will protect the gunsight from exterior damage. The shield **98** is supported by support shaft **84** which is supported by bearing **88** mounted in bracket **90**. A hole **100** is drilled in shield **98** into which the stud **102**, which is carried by arm **74**, may project. A bore **104** is drilled in bracket **68** such that stud **102** will extend through bracket **68** before engaging with hole **100**, thus the shield **96** will also rotate about support shaft **84** in synchronism with the shaft **64**.

The operation of the gunsight linkage is as follows:

When the guns **14** are to be used on terrestrial targets, the hatch **12** will be closed, and the linkage will be in the relationship shown by the solid lines of FIGURE 1. As shown in FIGURE 3, the pin **70** will be within bore **86** and stud **102** engages hole **100** and the locking pin **46**, FIGURE 2, will be biased out of contact with hole **48**.

As the gunner sights the target, he will operate the turret rotating and gun elevation means until the sight **92** indicates the guns are aimed at the target, thus as the guns are elevated or depressed, the sight must move to maintain the line of sight parallel to the gun at all times. It is the function of the linkage system to maintain this parallel relationship by a parallelogram as will be apparent.

As the guns **14** are elevated or depressed, the gear sector **16** will rotate through an equal movement causing the arms **18** to rotate pivot plate **20** about the shaft **24**. Rotation of plate **20** will likewise rotate gear **36** which will cause rack **42** to be axially translated. Translation of rack **42** will react on gear **66** rotating the shaft **64**. Since gunsight **92** and shield **98** are drivingly connected to the shaft **64** by means of bracket **68** and stud **102**, respectively, the rotation of the guns **14** will thus be transmitted to the gunsight **92**.

The parallelism between the gunsight and guns is assured by the fact that the gear sector **16**, arms **18** of equal length and pivot plate **20** constitute a parallelogram linkage system while the gears **36** and **66** have the same gear ratios so that rotation of gear **36** on rotation of pivot plate **20** causes identical rotation of gear **66** through rack **42**. Since gear **66** drives shaft **64** to which the gunsight **92** is connected the line of sight through the gunsight and guns will always be parallel to all elevations of the guns **14**.

To use the guns **14** against air targets, the hatch **12** must first be opened to the position shown in FIGURE 1, after hatch **12** is opened the operator will grasp the sleeves **78** and move them in a direction away from the gunsight **92**. This motion will cause the pin **76**, pivot pin **70** and arm **74** to also move in the direction of sleeve **78** withdrawing pin **70** from bore **86** and removing stud **102** from the hole **100**. While the pin **70** and stud **102** are held in the retracted position, the gunsight **92** may be lifted upwardly out of the turret **10** to a location as shown by the dotted lines of FIGURE 1. When the gunsight **92** is raised thusly, the shield **98** remains in the turret **10** pivotally mounted on the support shaft **84**.

The gunsight **92** is raised until the locking pin **46** aligns with hole **48**, pin **46** is then inserted in hole **48** and held therein by means of bayonet joint **50–52**, thus the gunsight will be locked in the elevated position. As the gunsight **92** is raised housing **40** rotates relative to plate **20** so that the line of sight will remain parallel to the guns due to the action of rack **42** and gears **36** and **66**. However, once pin **46** engages hole **48**, this action of rack **42** and gears **36** and **66** will be rendered inoperative as there will be no relative rotation between plate **20** and housing **40**. Therefore, when the guns **14** are being used against aircraft targets, parallelism between the line of sight and the guns are maintained by the parallelogram linkage defined by gear sector **16**, plate **20** and arms **18**.

Since gunners of different heights will require different positions of the gunsight **92**, adjustment may be made by unloosening nut **28** through knob **30**, relocating shaft **24** in the bracket **32** and retightening nut **28**.

To return the gunsight **92** to the internal turret position, the pin **46** is retracted, sleeves **78** are moved away from the gunsight and the sight is lowered until the pin **70** and stud **102** are inserted into the bore **86** and hole **100**, respectively.

It is thus apparent that the invention discloses a gunsight drive linkage which enables a gunsight to be used for either terrestrial or air targets, will always maintain a parallel relationship between the line of sight and gun, and will drive a protective shield in the terrestrial position while providing a wide variety of sight positions.

It will be understood that various modifications of the disclosed embodiment may be apparent to those skilled in the art without departing from the spirit and scope of the invention, and it is intended that the invention be confined only by the breadth of the following claims.

I claim:

1. A gunsight drive linkage comprising, in combination, rotatable means including a gear sector for elevating a gun about a first center of rotation, a pivot plate spaced therefrom and adapted to rotate about a second center of rotation, a pair of arms pivotally connecting at ends thereof said rotatable means and said pivot plate at points spaced radially from the respective said first and second centers of rotation and constituting a parallelogram linkage providing corresponding rotation of said rotatable means and said pivot plate through said arms, a first gear fixed to said pivot plate, a first housing rotatably supported on said pivot plate, a rack slidably supported in said first housing in engagement with said first gear, a second housing held in connected spaced relation to said first housing by a common connecting member, a shaft rotatably journaled in said second housing, a second gear keyed to said shaft within said second housing and in engagement with said rack, rotation of said shaft thereby being responsive to rotation of said second gear which through said rack, first gear and arms is responsive to rotation of said rotatable means, and a gunsight fixed to said shaft and thereby responsive to elevation of the gun.

2. A gunsight drive linkage as defined in claim **1** and further comprising a rotatable support shaft positioned adjacent an end of said shaft, a shield mounted on said support shaft, and means carried by said shaft for engagement with said support shaft and said shield.

3. A gunsight drive linkage as defined in claim **2**, wherein said means carried by said shaft comprises an axially movable pin and stud which co-act with corresponding holes formed in said support shaft and said shield, respectively.

4. A gunsight drive linkage for a gunsight adapted for selective use against terrestrial and air targets comprising, in combination, rotatable means including a gear sector for elevating a gun about a first center of rotation, a pivot plate spaced therefrom and adapted to rotate about a second center of rotation, a pair of arms pivotally connecting at ends thereof said rotatable means and

said pivot plate at points spaced radially from the respective said first and second centers of rotation and constituting a parallelogram linkage providing corresponding rotation of said rotatable means and said pivot plate through said arms, a first gear fixed to said pivot plate, a first housing rotatably supported on said pivot plate, a rack slidably supported in said first housing in engagement with said first gear, a second housing held in connected spaced relation to said first housing by a common connecting member, a shaft rotatably journaled in said second housing, a second gear keyed to one end of said shaft within said second housing and in engagement with said rack, rotation of said shaft thereby being responsive to rotation of said second gear which through said rack, first gear and arms is responsive to rotation of said rotatable means, a rotatable support shaft adjacent the other end of said shaft, a gunsight shield mounted on said support shaft, a gunsight fixed to said shaft and adjacent said shield, means for selectively locking together said

shaft, shield and gunsight for terrestrial targets, and means for selectively locking together said first housing and pivot plate for air targets.

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