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Steck, III

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[54] OPTICAL SIGHT ALIGNER

[75] Inventor: **William F. Steck, III,** El Paso, Tex.

[73] Assignee: **W. R. Weaver Company**

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[51] **Int. Cl.**.....**G01b 11/26**

[58] **Field of Search** 356/138, 153; 350/11; 33/46

[56] **References Cited**

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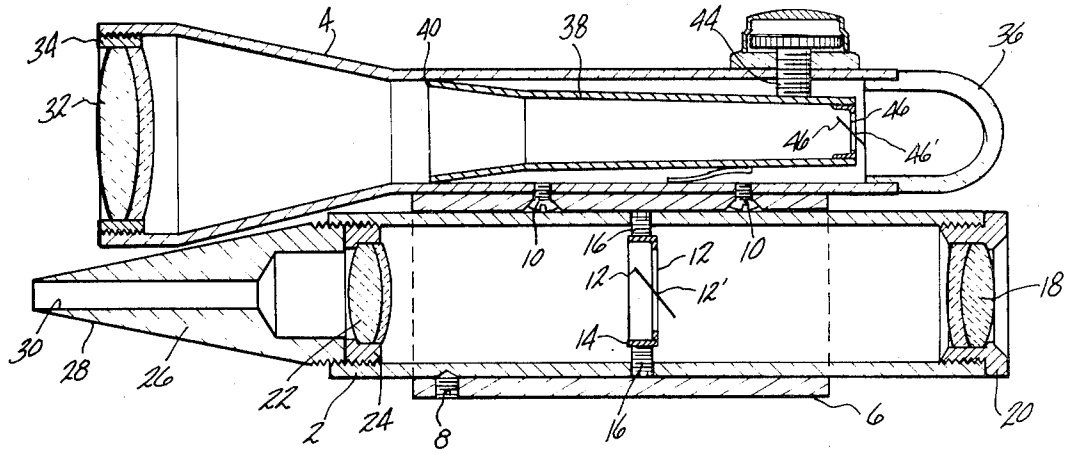
Primary Examiner—Ronald L. Wibert
Assistant Examiner—J. Rothenberg
Attorney—Donald R. Motsko et al.

[57] **ABSTRACT**

A device for aligning the aiming point of a sight with the axis of a gun barrel includes a housing containing two aiming points which are capable of being made coincidental. Collimating means is focussed on one of the aiming points of the device, and image inverting and reverting optical means is focussed on the other of the aiming points. Means is provided for mounting the device on the muzzle of a gun so as to permit universal pivotal movement of the device with respect to the gun and so that the bore of the gun barrel can be viewed through the inverting reverting optical means through the gun muzzle. Once the inverting reverting optical means is centered on the axis of the gun barrel, the device is made immobile with respect to the gun, and the collimated aiming point of the device is viewed through the sight. The aiming point of the sight is then made coincidental with the collimated aiming point of the device so as to become aligned with the gun barrel axis.

9 Claims, 4 Drawing Figures



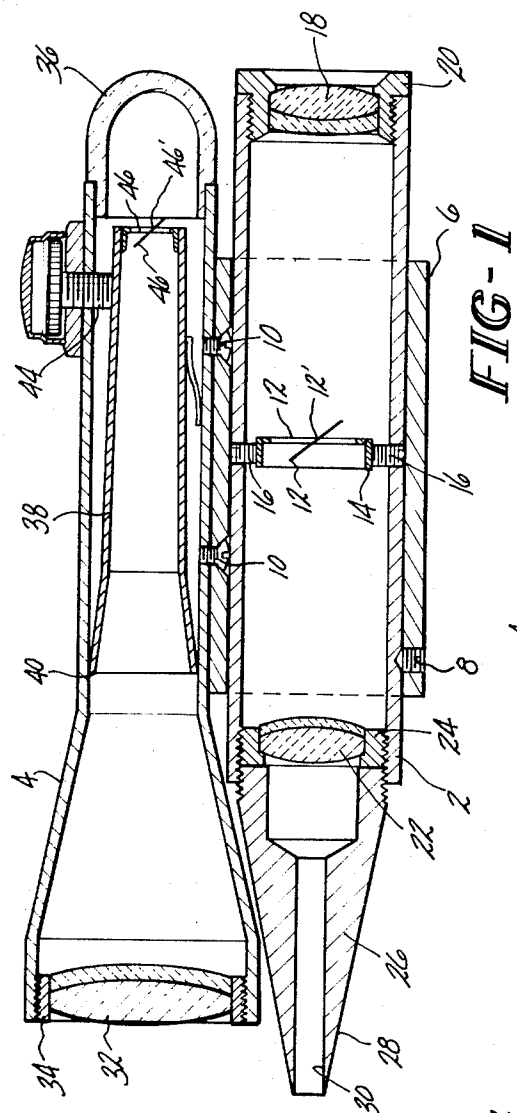


FIG-1

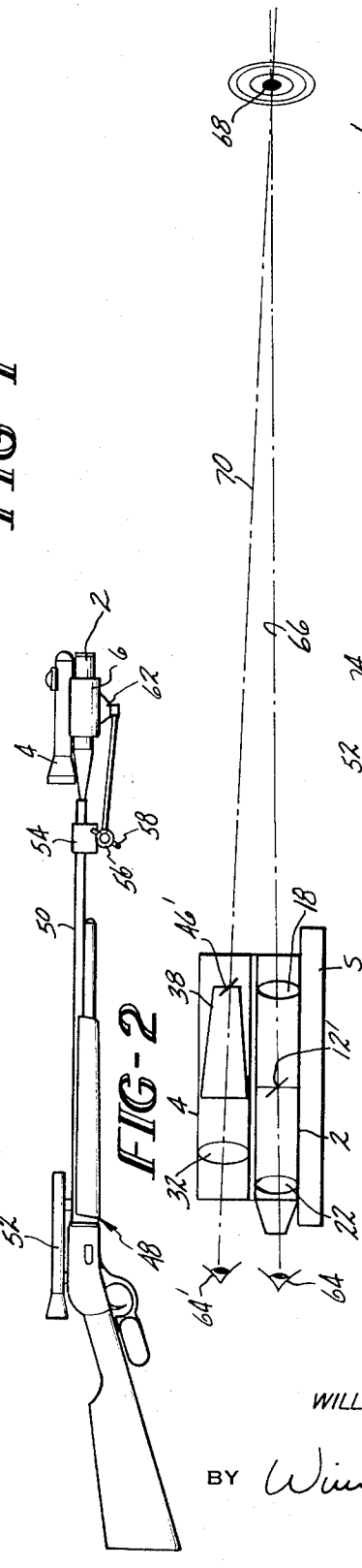


FIG-2

FIG-3

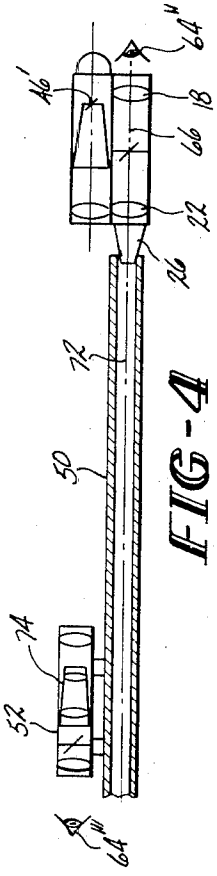


FIG-4

WILLIAM F. STECK III
INVENTOR

BY William W. Jones
ATTORNEY

OPTICAL SIGHT ALIGNER

This invention relates to a device for optically bore sighting a telescopic sighting device mounted on a firearm.

Devices for bore sighting telescopic gun sights are generally old in the prior art. Such conventional scope bore sighting devices generally include a plug or arbor which is inserted into the firearm muzzle for snug engagement with the barrel bore. A bracket is mounted on the arbor and a collimator having an aiming point is secured to the bracket. The optical axis of the collimator and the arbor axis are constructed so that when assembled, the axis will converge at infinity, which for sighting purposes is considered to be about one hundred yards from the device. Since the arbor axis when inserted into the barrel bore is coincidental with the barrel bore axis, the collimator optical axis is similarly convergent with the barrel bore axis. The collimated aiming point is then sighted through the scope and the scope reticle is adjusted so as to point at the collimated aiming point, thus bore sighting the scope. One such bore sighting device is disclosed in U.S. Pat. No. 1,994,177, issued Mar. 12, 1935 to J. B. Nolan.

This conventional type of scope bore sighter has several disadvantages in its usage. It requires a variety of arbor sizes, all of which must be made interchangeable to compensate for caliber variations of firearm bores, or an arbor the size of which can be varied. It must be carefully handled so as to ensure that the preset axis relationship is not disturbed. Furthermore, it is not generally adaptable for use with full bore or choked shotguns.

The device of this invention is designed for universal usage with all caliber firearms, and full bore or any size choked shotguns. Any change in factory alignment or calibration of its principal axes can be easily corrected in the field and the device can be recalibrated. The preferred embodiment of the device includes a first tubular housing in which spaced apart lenses are mounted, each lens being focussed on a reticle forming a first aiming point between the lenses. The lenses are such that an image viewed through the device is inverted and reverted. A cone-shaped positioning member is positioned at one end of the first tubular housing for insertion into the muzzle of the firearm so that the barrel bore of the firearm can be viewed through the inverting and reverting lenses. The conical shape of the positioning member permits the viewer to move the housing universally with respect to the muzzle. It has been found that misalignment of the barrel bore axis and the optical axis of the inverting reverting lenses will appear to the viewer to be on the order of twice what it actually is or what it appears to be when viewed through an optical system which produces an erect image. The apparent magnification of axial misalignment is caused by the inversion and reversion of the viewed image. Thus the viewer can readily align the axis of the lenses with the axis of the barrel bore visually by pivoting the device until the alignment is apparent. Once such alignment is accomplished the device is immobilized with respect to the firearm.

The device also includes a second tubular housing which is secured to the first housing and which contains a collimating lens and a reticle forming a second aiming point. The reticle is mounted in a pivoting tube within the second tubular housing and is laterally movable by means of adjustment screws similar to windage and elevational adjustments on conventional scopes. The second aiming point is illuminated by ambient light passing through a translucent end cap on the second housing. The collimating lens and second aiming point form an axis which can be made to converge with the optical axis of the inverting reverting lenses by aligning the two aiming points of the device with the same target, at one hundred yards, for example. This alignment or calibration of the aiming points can be initially accomplished at the factory, and can be checked and corrected, if necessary, in the field. Once the prealignment is accomplished, and the device is made coaxial with the barrel bore, in the manner described above, one merely sights in on the collimated aiming point of the device through the scope and aligns the scope reticle with the collimated aiming point image. The scope is then bore sighted and the device is removed from the firearm.

It is, therefore, an object of this invention to provide a scope bore sighting device which is universally usable with firearms of different calibers, and full bore or choked shotguns.

It is a further object of this invention to provide a device of the character described which can be recalibrated in the field should original calibration be disturbed.

It is yet another object of this invention to provide a device of the character described wherein alignment with the firearm bore axis is accomplished visually.

Other objects and advantages will become apparent from the following detailed disclosure of a preferred embodiment of the device of this invention taken in conjunction with the accompanying drawings, in which:

FIG. **1** is a vertical sectional view of a preferred embodiment of a device formed in accordance with this invention;

FIG. **2** is a side view of the device of FIG. **1** shown mounted on the muzzle of a rifle for use in bore sighting a scope mounted on the rifle;

FIG. **3** is a schematic view of the device of FIG. **1** showing the manner in which the device is calibrated; and

FIG. **4** is a schematic view of the device of FIG. **1** showing the manner in which the device is axially aligned with the gun barrel bore and the scope is sighted in on the barrel axis.

Referring now to FIG. **1**, a preferred embodiment of the device of this invention is shown. The device includes a first tubular housing member **2** and a second tubular housing member **4**. The housings **2** and **4** are secured together by a bracket **6**, a plurality of set screws **8** being used to secure the bracket **6** to the housing **2**, and a plurality of set screws **10** being used to secure the bracket **6** to the housing **4**. A reticle member formed from a pair of intersecting cross hairs **12** is mounted in a ring **14** within the first housing member **2** and secured thereto by means of screws **16**. The point of intersection of the cross hairs **12** forms a first aiming point **12'** within the first housing member **2**. At the right hand end of the housing member **2**, as shown in FIG. **1**, is positioned a first compound lens **18** which is held in place by a retainer ring **20** threaded into the end of the housing member **2**. The lens **18** is focussed on

the aiming point 12'. At the left hand end of the housing member 2, as shown in FIG. 1, there is positioned a second compound lens 22 held into position by a retainer ring 24 threaded into the left hand end portion of the tubular housing member 2, the lens 22 being also focussed on the aiming point 12'. A positioning member 26 is also threaded into the left hand portion of the housing member 2, the positioning member 26 including an external conical surface 28, the purpose of which will be explained in greater detail hereinafter. The positioning member 26 includes a through bore 30 so that one may look through either end of the first tubular housing 2 and see the aiming point 12' and also see a field of view through the other end of the housing member 2. The lenses 18 and 22 are of a type which will produce an inverted-reverted image of a field of view to the eye of the viewer. It will be readily apparent to those skilled in the art that such an inverted-reverted image could also be produced by prismatic means as well as lenses without departing from the spirit of this invention.

A collimating lens 32 is positioned in the left hand end portion of the second tubular housing member 4 and is held in place by a retainer ring 34 which is threaded into the left hand end portion of the housing member 4, as viewed in FIG. 1. A cap member 36 of a translucent light transmitting material is fitted onto the right hand end portion of the second tubular housing member 4. A reticle tube 38 is positioned inside of the second tubular housing member 4, the reticle tube having a flared end portion 40 forming a universal pivot for the tube 38 within the housing member 4. A spring 42 is sandwiched between the reticle tube 38 and the tube housing member 4 to bias the reticle tube 38 for pivoting movement about its flared end portion 40. A threaded vertical adjusting member 44 contacts the reticle tube 38 at a point spaced apart from the flared pivot 40 and is operative to move the reticle tube 38 laterally and pivotally against the bias of the spring 42, thus the adjustment member 44 can be operated to cause vertical lateral movement of the tube 38. A similar member (not shown) is mounted on the tube 4 to cause horizontal lateral pivotal movement of the reticle tube 38. A reticle comprising a pair of intersecting cross hairs 46 is mounted in the end of the reticle tube 38 opposite from the flared pivot 40, the point of intersection of the cross hairs 46 forming a second aiming point 46' within the second tubular housing member 4. The collimating lens 32 is focussed on the aiming point 46' so as to produce a collimated image of the aiming point 46'. The translucent cap 36 provides a bright background for the reticle cross hairs 46 by transmission of ambient light.

Referring now to FIG. 2, the device of FIG. 1 is shown mounted on a rifle identified generally by the numeral 48. The rifle includes a barrel 50 and has mounted thereon a telescopic gun sight 52. A collar 54 is mounted on the rifle barrel 50, the collar 54 being connected to a ball and socket joint 56. A wing nut 58 is mounted on the ball and socket joint 56 to tighten and loosen the latter to permit universal movement of the ball within the socket when desired and further upon being tightened to lock the ball within the socket. A lever arm 60 is secured to the ball portion of the ball and socket joint 56 and is movable therewith. A connector 62 is secured to the lever arm 60 and also to the bracket 6. The conical external surface 28 of the positioning member 26 is inserted into the muzzle end of the rifle barrel 50 and provides a universal connection between the device and the rifle barrel so that the device may be universally pivoted with respect to the rifle barrel muzzle. When the ball and socket joint 56 is loosened by loosening the wing nut 58, universal pivoting movement of the device may be imparted thereto and will be permitted by the loose connection of the ball portion of the ball and socket joint 56 and the lever arm 60. Once proper alignment of the device is accomplished, the wing nut 58 is tightened to immobilize the ball and socket joint 56 and thus operate through the lever arm 60 and connector 62 to immobilize the device in the properly adjusted position.

Referring now to FIGS. 3 and 4, the manner in which the device is calibrated and used to sight in the telescopic sight is shown. In order to calibrate the device, it is first secured to a supporting member S and properly positioned so that the viewer's eye, when in the position 64 looking through the first housing member 2, sees the first aiming point 12' centered on a target 68. When this condition is met it is apparent that the optical axis 66 of lenses 18 and 22 will pass through the center of the target 68. The eye of the viewer is then moved to the position 66' to view the target 68 through the second housing member 4. The collimating lens 32 and the second aiming point 46' form a second axis 70 termed the "aiming axis" of the device. The reticle tube 38 is pivoted by means of the adjustments so as to place the second aiming point 46', as viewed through the collimating lens 32, into alignment with the target 68. In this condition it is apparent that the aiming axis 70 will converge on the optical axis 66 and intersect the latter at the target 68. In this condition the device is calibrated and ready to use to boresight a telescopic sight mounted on a firearm. It is preferred when making the calibrating adjustments, which may be made at the factory or in the field, that the target 68 be positioned approximately 100 yards from the device. In order to properly align the second aiming point 46' with the target 68 one may remove the transluscent cap 36 so that the target can be viewed directly through the second housing member 4, or one may use a conventional beam spliting device which superimposes the image of the second aiming point 46' over the image of the first aiming point 12'. Still further, one could look through both tubes 2 and 4 at the same time with different eyes and use his own inherent binocular visual ability to superimpose the two images of the aiming points 46' and 12'. This latter-most method is not preferred, however, since the phenomenon of exophoria can introduce error.

As previously noted once the two axes 66 and 70 are made to converge upon the target 68 the device is ready for use in sighting-in a scope. The sighting-in is accomplished by inserting the positioning member 26 into the muzzle of the firearm barrel 50 as shown in FIG. 4. The viewer's eye is then moved to position 64'' so that the barrel bore is viewed through the lenses 18 and 22. Thus the eye in the position 64'' sees an inverted-reverted image of the barrel bore. This inverted-reverted image causes any misalignment of the optical axis 66 and the barrel bore axis 72 to appear to be dou-

ble what the actual misalignment is. In this manner, magnification of the actual misalignment permits simple visual correction thereof by pivoting the device about the positioning member **26** until the optical axis **66** appears to be coincidental with the barrel bore axis **72**. Once this condition is observed the device is locked onto the end of the barrel by tightening the wing nut **58**. The eye of the viewer is then moved to the position **64'''** opposite the ocular end of the telescopic sight **52** so that the collimated image of the second aiming point **46'** can be viewed through the scope **52**. The scope, shown schematically in FIG. **4**, uses an internal erector system **74** which is conventional and which is operative to shift the image viewed through the scope laterally to align the image with the reticle of the scope. Thus the image of the second aiming point **46'** is shifted by movement of the scope erectors **74** until the second aiming point **46'** is coincidental with the aiming point of the scope reticle, collimation of the second aiming point **46'** enabling one to view the latter in sharp focus through the scope **52** during the alignment process. Once the reticle of the scope **52** is aligned with the second aiming point **46'** it will be readily apparent that the optical axis of the scope will intersect the barrel bore axis **72** at the target and the scope will thus be bore sighted.

The device of this invention has been successfully tested and has produced **4** inch shot groups at **100** yards. Of course, once the scope has been bore sighted with the device, further windage and elevation adjustments of a minor character can be easily made with conventional windage and elevation adjustment means provided on the scope.

It will be readily apparent that the device of this invention has universal utility with guns of different caliber and full bore or choked shotguns. The device is simple to calibrate, and can be re-calibrated in the field should the original calibration become disturbed for any reason. The use of image inverting and reverting lenses to magnify axial misalignment makes the step of aligning the optical axis of the device and the barrel bore axis a simple visual operation which can be quickly accomplished. The device can be easily and inexpensively manufactured since the lenses can be made of inexpensive optical plastic, and yet the device can be of rugged construction able to withstand shocks incident to normal handling.

Since many changes and variations of the disclosed embodiment of the invention may be made without departing from the inventive concept, it is not intended to limit the invention otherwise than as required by the appended claims.

What is claimed is:

1. A device attachable to a gun for producing an aiming point aligned with the axis of a gun barrel bore, said device comprising:

a. image-inverting and reverting optical means providing an optical axis;

b. means providing an aiming point for said device;

c. means combining with said aiming point to provide an aiming axis for said device, said aiming point being disposed on said aiming axis, and said aiming axis converging with said optical axis at a predetermined distance from said device; and

d. positioning means for engaging the muzzle of a gun to position said optical means opposite the gun muzzle to provide for viewing an inverted reverted image of the gun barrel bore through said optical means, said positioning means providing for pivotal movement of said optical means with respect to the axis of the gun barrel bore to permit visual coaxial positioning of said optical axis and the gun barrel bore axis, whereby said aiming axis will converge with the gun barrel bore axis at said predetermined distance from said device.

2. A device attachable to a gun for producing an aiming point aligned with the axis of a gun barrel bore, said device comprising:

a. image-inverting and reverting optical means providing a first optical axis;

b. means providing an aiming point for said device;

c. collimating means focussed on said aiming point to produce a collimated image thereof, said collimating means and said aiming point providing an aiming axis, and said aiming axis being disposed to converge with said first optical axis at a predetermined distance from said device; and

d. positioning means for engaging the muzzle of a gun to position said optical means opposite the gun muzzle to provide for viewing of an inverted reverted image of the gun barrel bore through said optical means, said positioning means providing for substantially universal pivotal movement of said optical means with respect to the axis of the gun barrel bore to permit visual coaxial positioning of said first optical axis and the gun barrel bore axis, whereby said aiming axis will converge with the gun barrel bore axis at said predetermined distance from said device.

3. A device attachable to a gun for producing an aiming point aligned with the axis of a gun barrel bore, said device comprising:

a. means providing a first aiming point;

b. image-inverting and reverting optical means focussed on said first aiming point, said optical means providing an optical axis intersecting said first aiming point;

c. means providing a second aiming point;

d. collimating means focussed on said second aiming point to produce a collimated image thereof, said collimating means and said second aiming point providing an aiming axis;

e. means for causing convergence of said optical axis and said aiming axis at a predetermined distance from said device; and

f. positioning means for engaging the muzzle of a gun to position said optical means opposite the gun muzzle to permit viewing of an inverted reverted image of the gun barrel bore through said optical means, said positioning means permitting pivotal movement of said optical means with respect to the axis of the gun barrel bore to permit visual coaxial positioning of said optical axis and the gun barrel bore axis, whereby said aiming axis will converge with the gun barrel bore axis at said predetermined distance from said device.

4. A device attachable to a gun for producing an aiming point aligned with the axis of a gun barrel bore, said device comprising:

a. first tubular housing means;

b. image-inverting and reverting optical means carried by said first housing means and providing an optical axis;

c. second tubular housing means secured to said first housing means;

d. means in said second housing means to provide an aiming point for said device;

e. means combining with said aiming point to provide an aiming axis for said device, said aiming point being disposed on said aiming axis, and said aiming axis converging with said optical axis at a predetermined distance from said device; and

f. positioning means carried by said first housing means for engaging the muzzle of a gun to position said optical means opposite the gun muzzle to provide for viewing an inverted reverted image of the gun barrel bore through said optical means, said positioning means providing for pivotal movement of said optical means with respect to the axis of the gun barrel bore to permit visual coaxial positioning of said optical axis and the gun barrel bore axis, whereby said aiming axis will converge with the gun barrel bore axis at said predetermined distance from said device.

5. The device of claim 4, wherein said optical means comprises first and second lenses positioned at opposite ends of said first housing means.

6. The device of claim 5, further comprising reticle means in said first housing means, said first and second lenses both being focused upon said reticle means.

7. The device of claim 4, wherein said aiming axis is formed by collimating means combining with said aiming point, said collimating means being carried by said second housing means and focussed upon said aiming point to produce a collimated image thereof.

8. The device of claim 4, further comprising joint means connected to said device and adapted for connection to the gun, said joint means having a loose condition wherein said pivotal movement of said optical axis of said device is permitted, and a tightened condition wherein said device is immobilized with respect to the gun; and means associated with said joint means for imparting said loose and tightened conditions to said joint means.

9. The device of claim 4, wherein said aiming point is formed by a reticle, and further comprising means mounted in said second housing and connected to said reticle to shift said reticle and said aiming point laterally within said second housing to vary the point of convergence of said aiming axis with said optical axis.

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