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(54) **METHOD AND APPARATUS FOR ALIGNMENT OF FIREARM SIGHTS**

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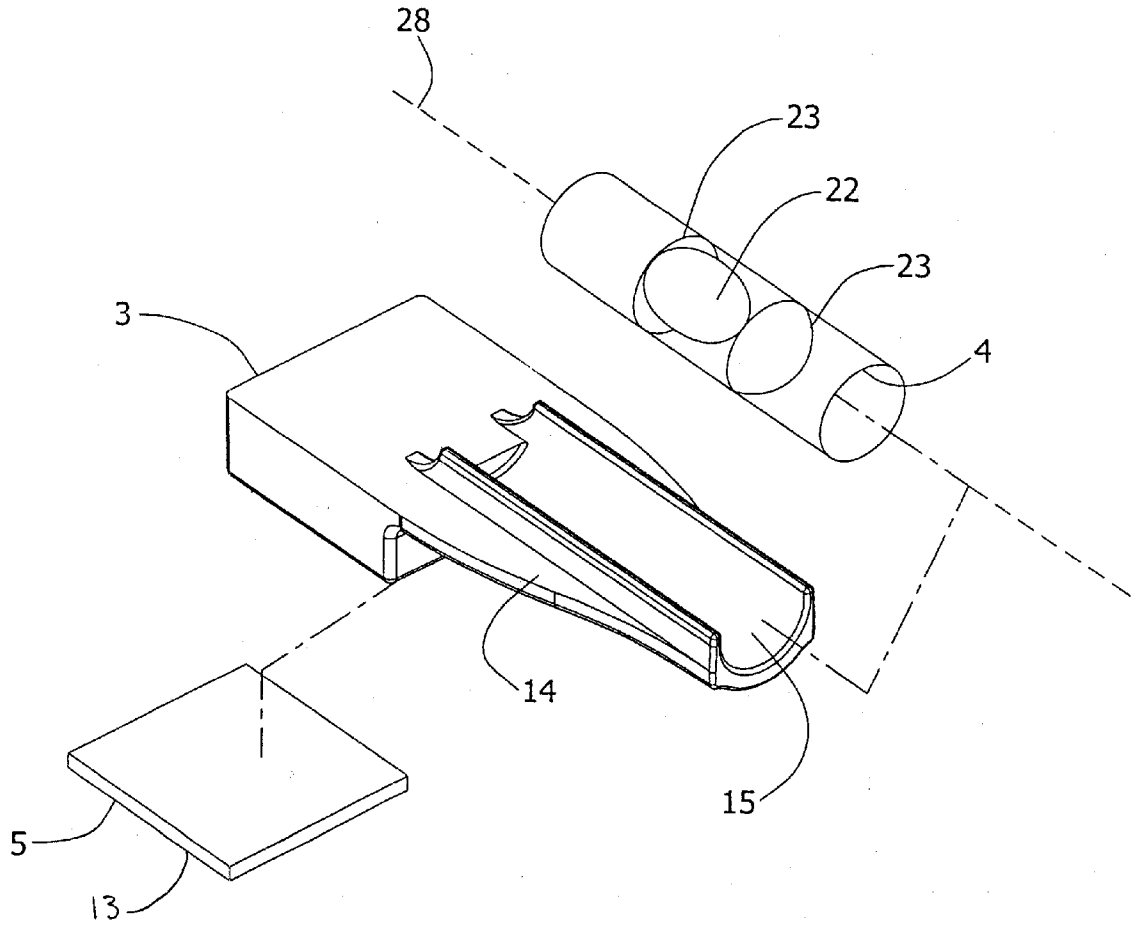
(57) **ABSTRACT**

An apparatus for aligning a sighting device mounted on a firearm. The apparatus has a first indicating device adapted to be positioned on a surface of the firearm to determine a rotational position of the firearm relative to a reference plane and a second indicating device adapted to be positioned on a surface of the sighting device to determine a rotational position of the sighting device relative to the reference plane.



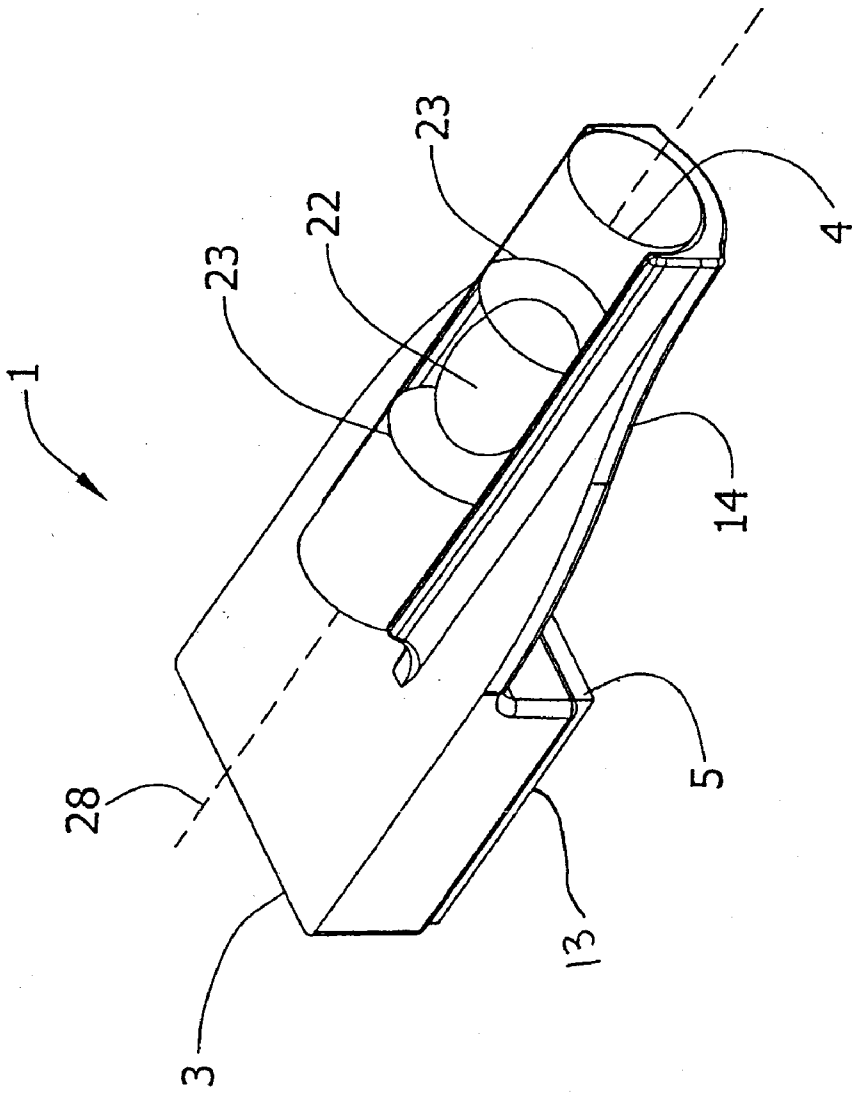


FIG. 1

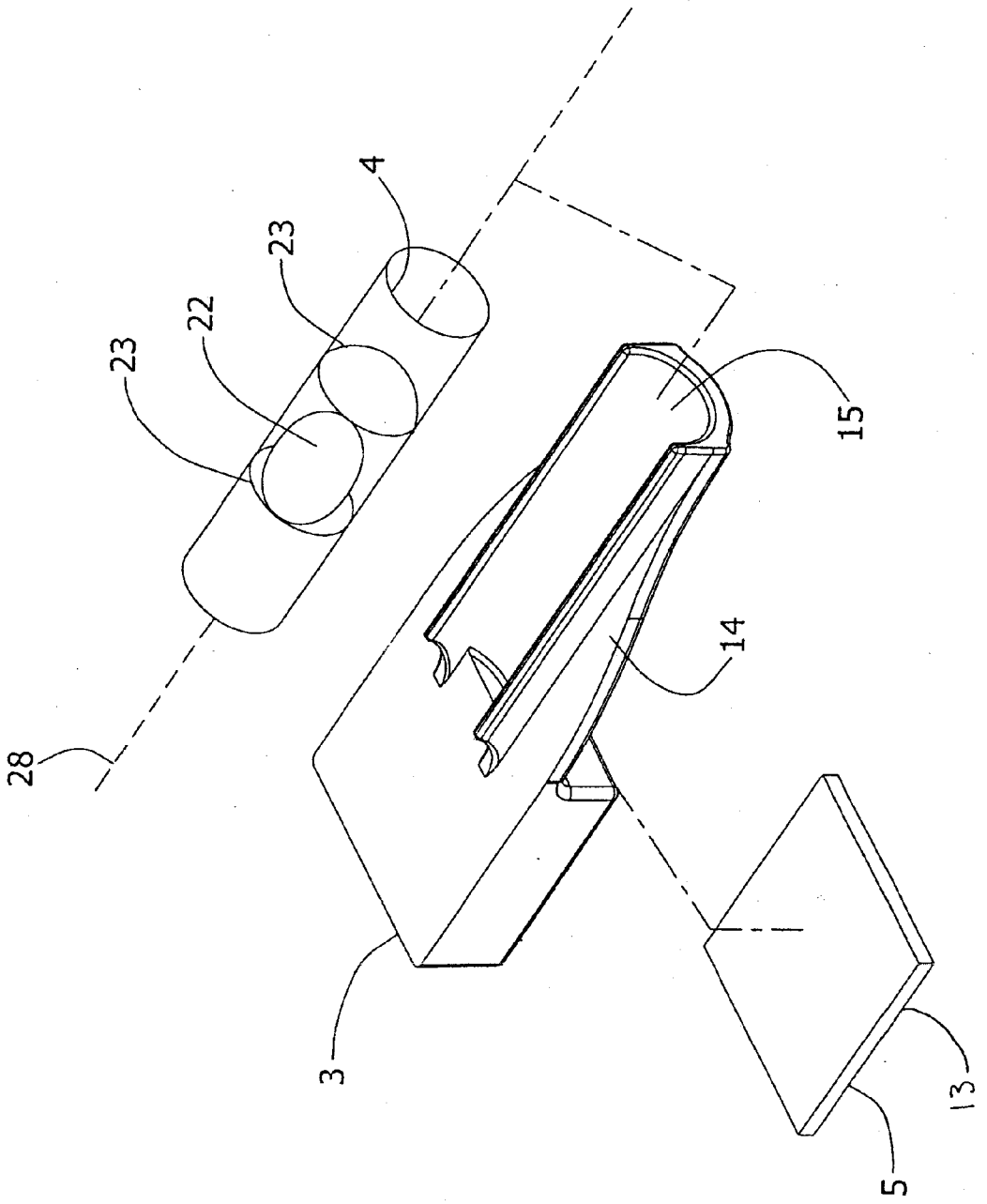


FIG. 2

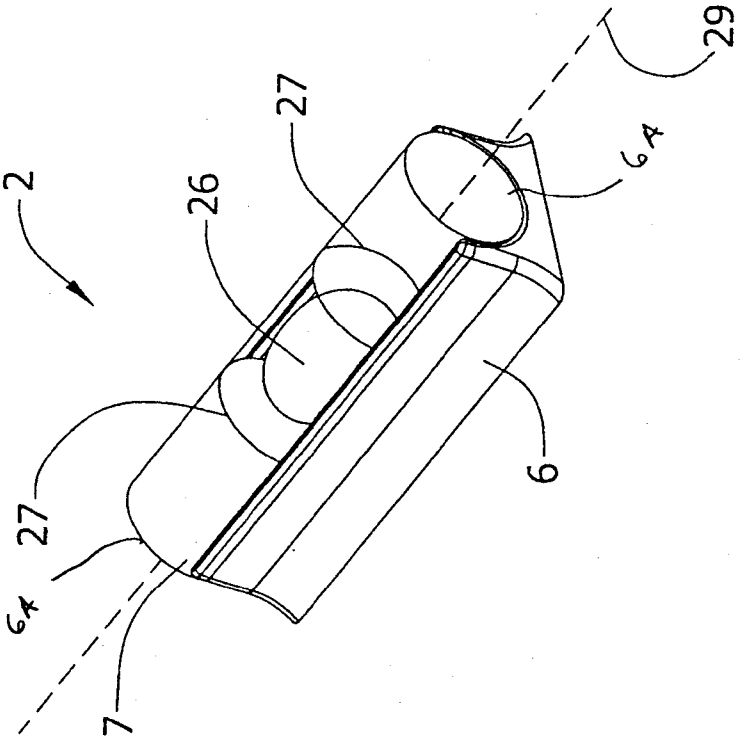


FIG. 3

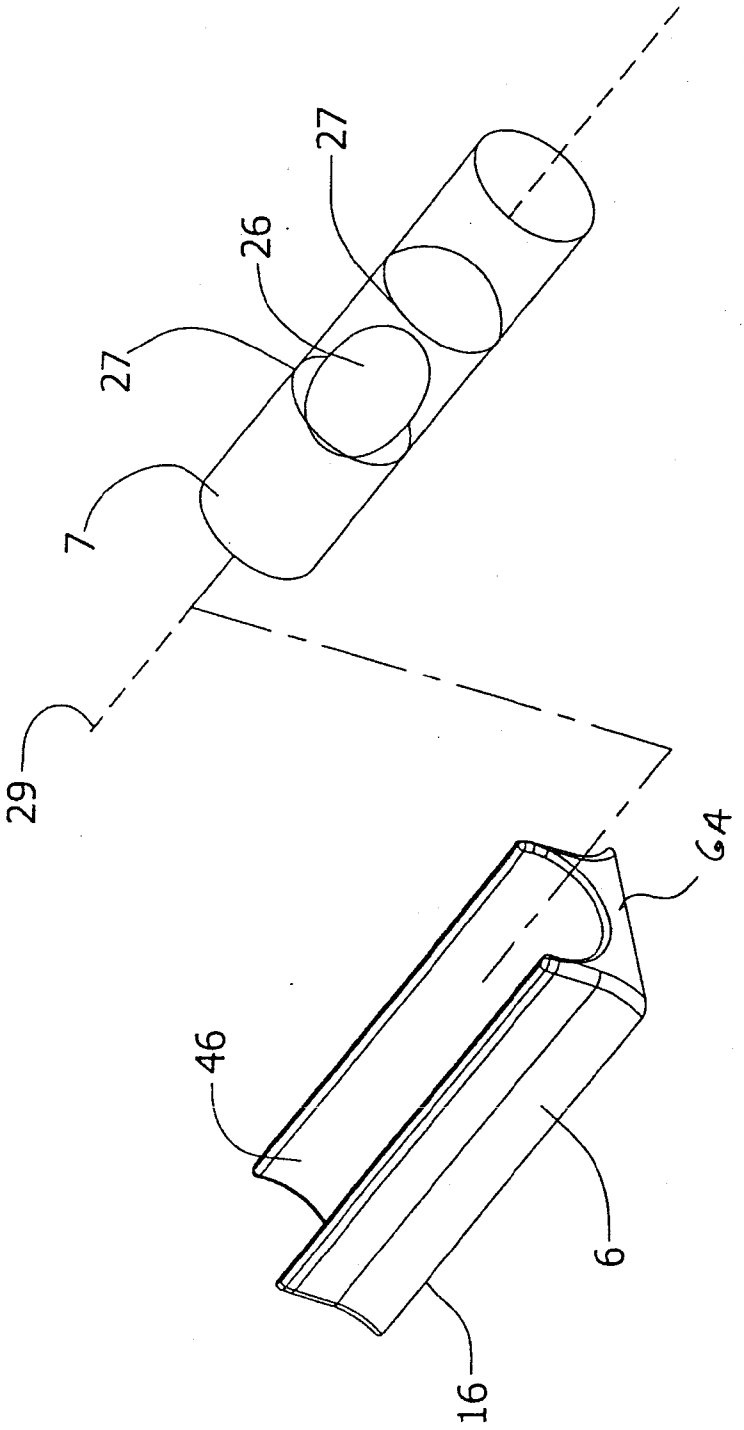


FIG. 4

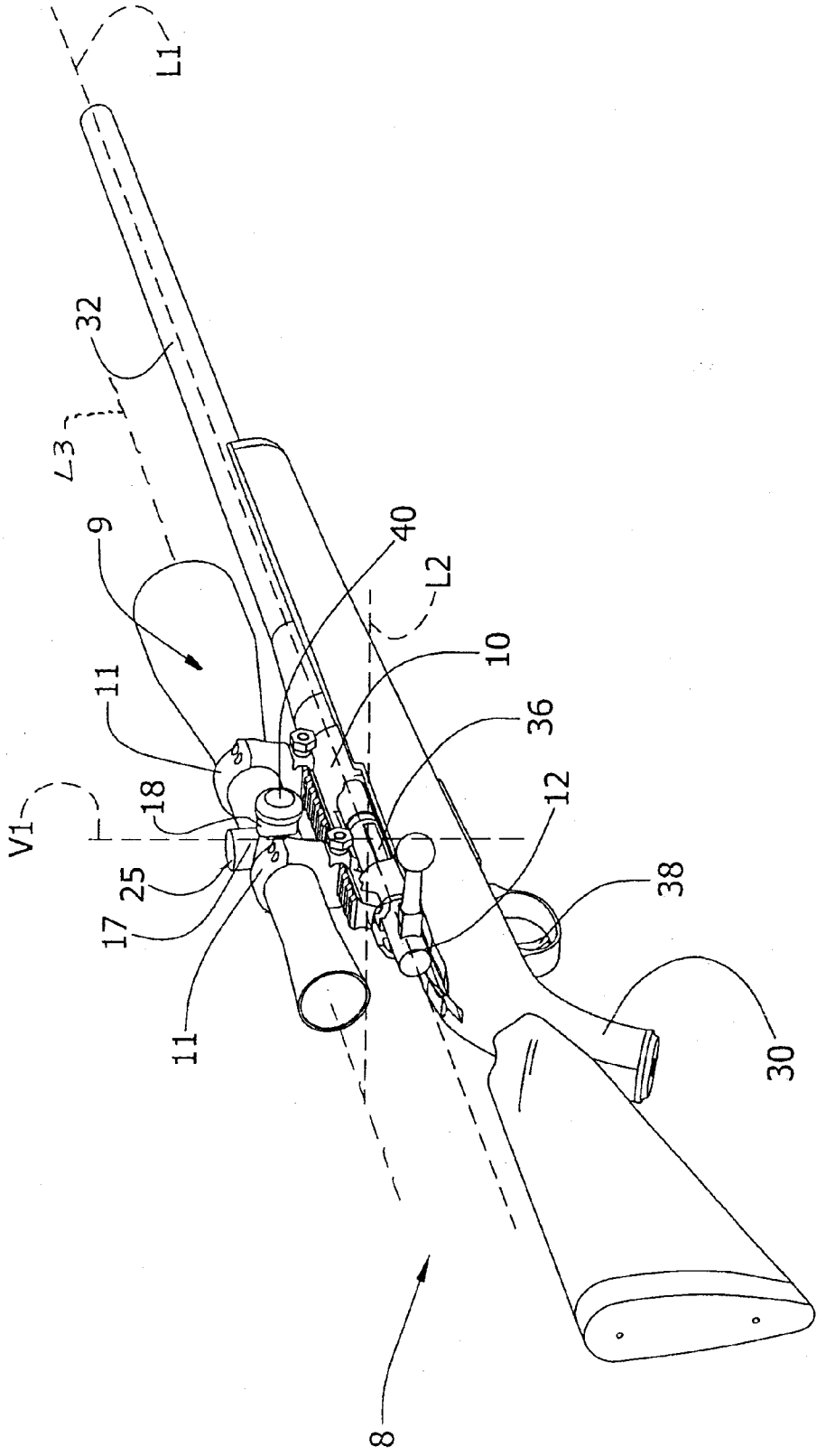


FIG. 5

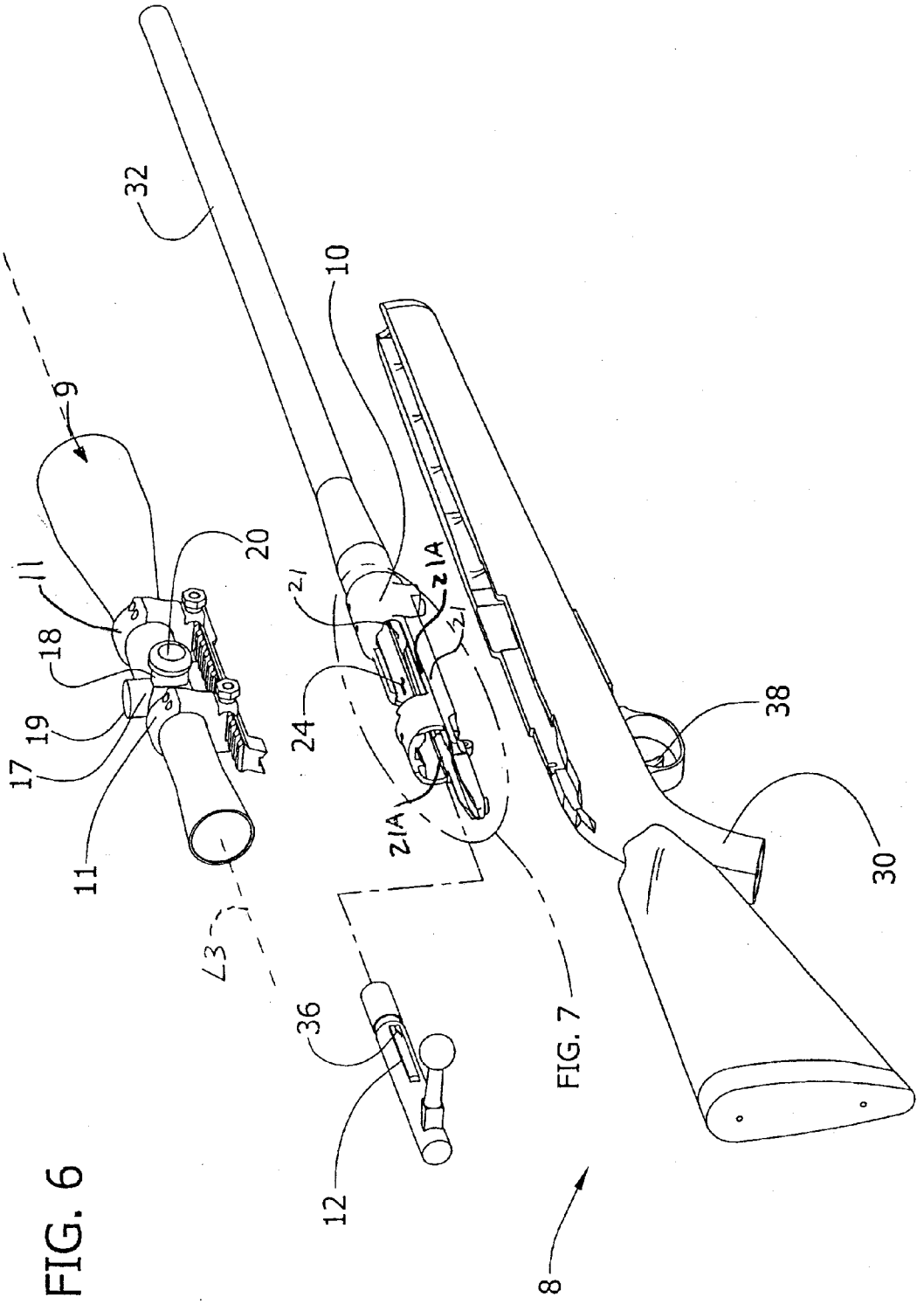


FIG. 6

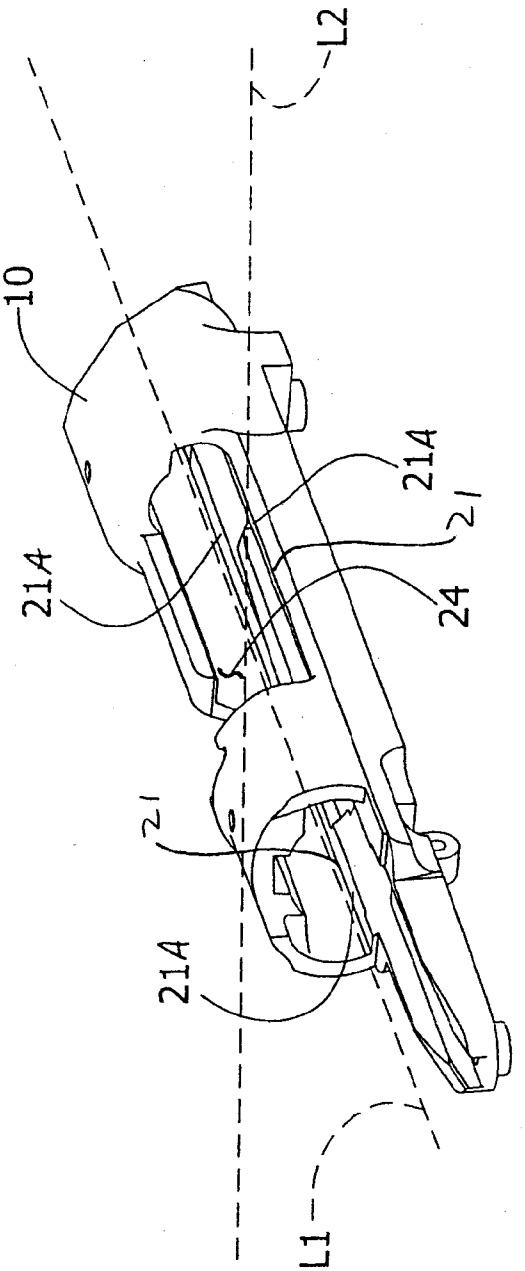


FIG. 7

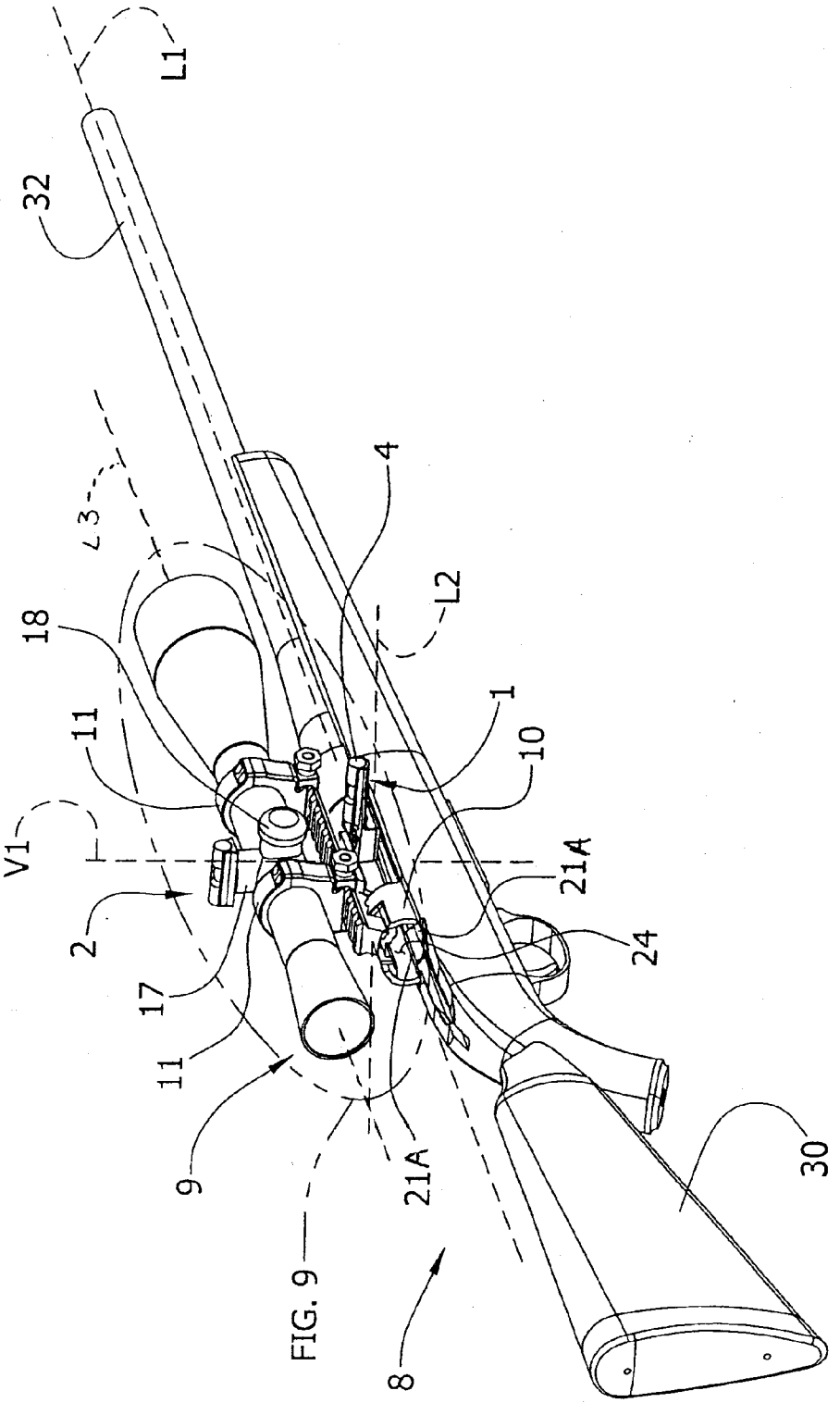
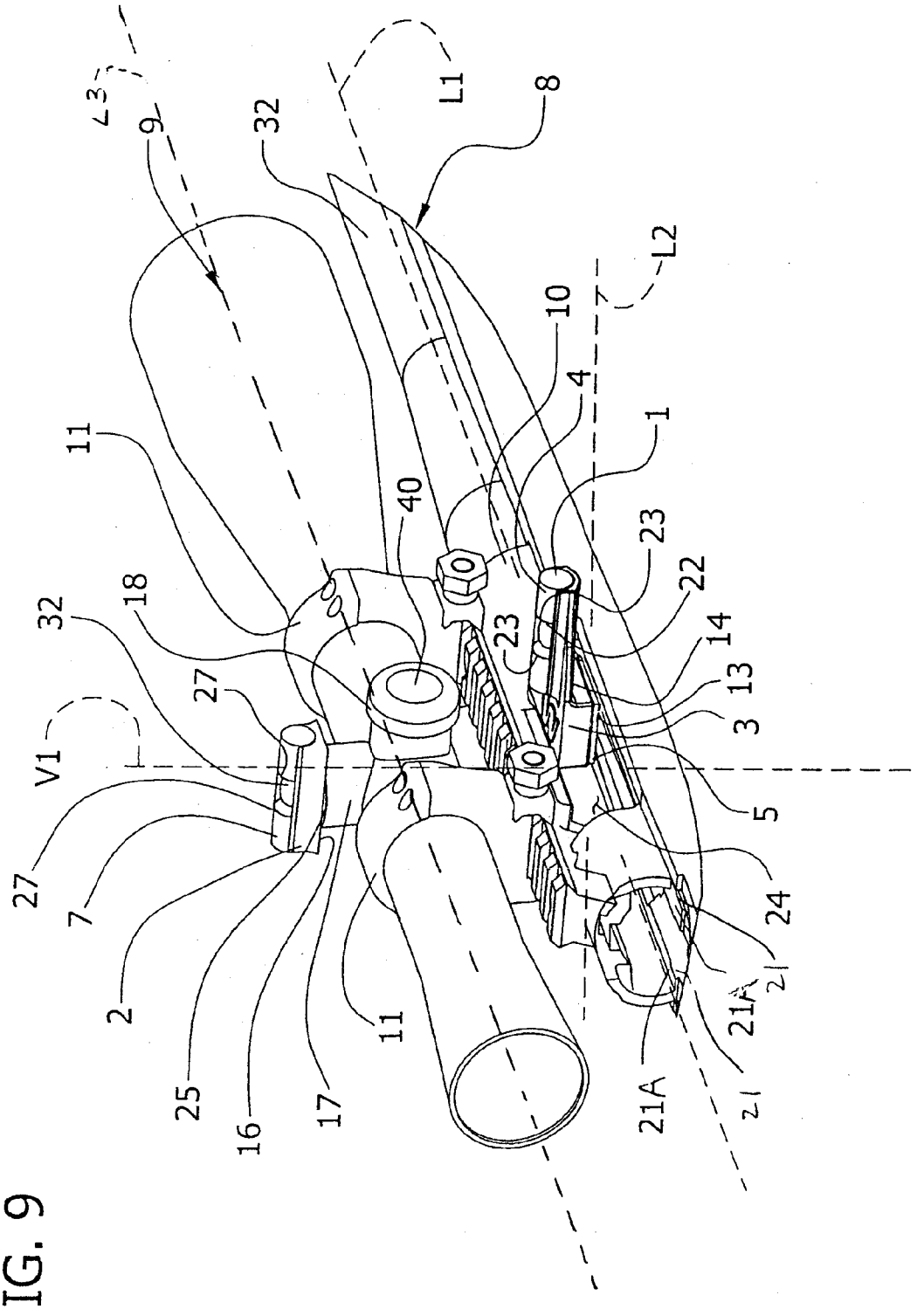


FIG. 8


L3
9
32
L1
8
L2
10
4
1
11
40
23
22
18
32
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14
27
13
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V1
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27
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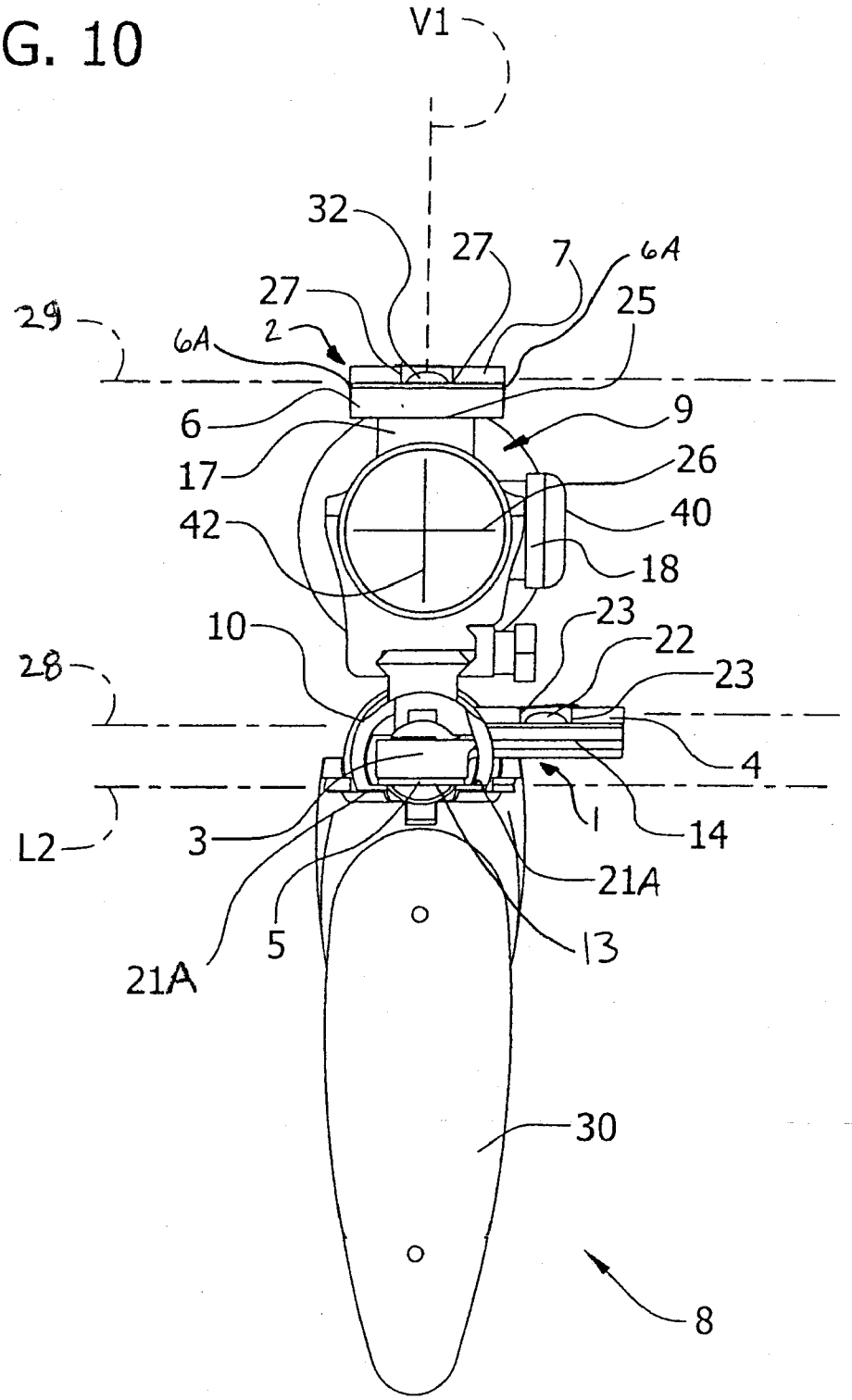
24
2
21
21A
25
16
17
11
21A
21

FIG. 9

FIG. 10


V1
32
27
7
6A
27
25
29
6A
2
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17
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42
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L2
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30
8

METHOD AND APPARATUS FOR ALIGNMENT OF FIREARM SIGHTS

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application is a non-provisional of U.S. Provisional Patent Application Ser. No. 60/602,768, filed Aug. 18, 2004, which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] This invention relates generally to an apparatus for aligning a sighting device on a firearm, and more particularly to an apparatus for rotationally aligning the sighting device with a horizontal plane.

[0003] A sight or sighting device is designed to enable the firearm user to accurately locate a projectile (e.g., bullet) at a precise point on a target. Typical sights have a horizontal crosshair and a vertical crosshair that assist the shooter in accurately aiming the firearm. The sight allows the shooter to precisely adjust or move the point of impact of the projectile on the target as necessary. Some examples of typical sights used on firearms include telescopic sights, receiver sights, and open sights. The discussion of firearms will pertain specifically to long arms (e.g., rifles and shotguns) although many of the principles discussed could be applied to other types of firearms (e.g., handguns).

[0004] A sight is typically attached to a firearm at a position above the longitudinal axis of the barrel. It is desirable that the sight be rotationally aligned such that the horizontal crosshair of the sight is parallel with a horizontal plane of the firearm. If a sight is rotationally misaligned the shooters ability to accurately fire the firearm will be compromised. For example, when the user of a firearm moves the crosshairs of the sight to move the point of impact on the target, it is essential that the movement of the sight in a given direction (e.g., horizontally) will have a corresponding singular effect upon the location of the point of impact on the target. As such, a horizontal movement (right or left) of the sight and firearm should only effect the horizontal movement of the point of impact of the projectile with the target. If the sight is misaligned, movement that appears to be truly horizontal, as viewed through the sight, will also affect the vertical placement of the projectile. Consequently the precise alignment of the sight relative to the horizontal plane of the firearm is critical for achieving and maintaining accuracy of the firearm.

[0005] Existing apparatus for aligning a sighting device with a firearm require the establishment of a vertical reference line by the user external to the firearm and sighting device. The vertical reference line must be sighted through the sighting device and visually aligned by the shooter to correspond with the vertical crosshair of the scope. The creation of an external vertical reference line and visual alignment of the reference line with the vertical crosshair of the sighting device are time consuming and require precision in checking that the external reference is truly vertical and perfectly aligned with the vertical crosshair. Further, a fixed external reference line is difficult to establish in some shooting environments (e.g., uneven terrain or high wind conditions). Reference may be made to U.S. Pat. No. 5,878,504 and U.S. Patent Application Publication No. 2003/0177685, for additional information regarding existing sighting device apparatus.

[0006] Currently there are no commercially available devices that provide quick and accurate alignment of the sighting device and the firearm. Accordingly, there is a need for such a device that quickly and easily aligns the horizontal position of the sighting device with the horizontal plane of the firearm in such a way that does not require the creation of a reference line external to the firearm.

SUMMARY OF THE INVENTION

[0007] Among the several objects of the invention may be noted the provision of an apparatus for aligning a sighting device with a firearm, the provision of such an apparatus that reduces the time needed to accurately align the sighting device with the firearm, and the provision of such an apparatus that is easy to use and manufacture.

[0008] In general, the present invention is directed to an apparatus for aligning a sighting device mounted on a firearm. The apparatus comprises a first indicating device adapted to be positioned on a surface of the firearm to determine a rotational position of the firearm relative to a reference plane and a second indicating device adapted to be positioned on a surface of the sighting device to determine a rotational position of the sighting device relative to the reference plane.

[0009] In another aspect, the present invention is directed to an apparatus for aligning a sighting device mounted on a firearm having a longitudinal axis and a receiver with a surface generally flat and parallel to the longitudinal axis. The apparatus comprises a firearm level having a magnet for removable attachment of the firearm level to the surface of the receiver to determine the rotational position of the firearm relative to a horizontal plane and a sight level for mounting on a generally flat surface of the sighting device to determine the rotational position of the sighting device relative to the horizontal plane.

[0010] In yet another aspect, the invention is directed to a method of aligning a sighting device mounted on a firearm. A first indicating device positioned on a surface of the firearm is used to determine a rotational position of the firearm relative to a reference plane. A second indicating device positioned on a surface of the sighting device is used to determine a rotational position of the sighting device relative to said reference plane.

[0011] Other objects and features will be in part apparent and in part pointed out hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] FIG. **1** is a perspective view of a firearm level;

[0013] FIG. **2** is an exploded perspective view of the firearm level;

[0014] FIG. **3** is a perspective view of a sight level;

[0015] FIG. **4** is an exploded perspective view of the sight level;

[0016] FIG. **5** is a perspective view of a firearm having a telescopic sight;

[0017] FIG. **6** is an exploded perspective view of the firearm of FIG. **5**;

[0018] FIG. **7** is a detail perspective of a receiver of the firearm;

[0019] FIG. **8** is a perspective of the rifle showing placement of the firearm level and sight level;

[0020] FIG. **9** is an enlarged detail view of the firearm of FIG. **8** showing placement of the firearm level and the sight level;

[0021] FIG. **10** is an elevation view from the end of the firearm showing the firearm level and sight level positioned relative to crosshairs of the sight.

[0022] Corresponding parts are designated by corresponding reference numbers throughout the drawings.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0023] As shown in FIGS. **8** and **9**, the present invention serves as an aid for mounting a sighting device or sight, generally designated **9**, on a firearm, generally designated **8**. The present invention comprises a first level (firearm level) **1** removably attached to the firearm **8** and a second level (sight level) **2** removably mounted on the sighting device **9**. In the illustrated embodiment, the sighting device **9** is a telescopic scope but it will be understood that the sighting device may be any other device for improving the accuracy of the firearm **8** such as a receiver sight, or an open sight.

[0024] In the illustrated embodiment, the firearm **8** is a conventional bolt-action rifle, but it will be understood that the present invention may be used to align a sighting device **9** attached to other types of firearms. As shown in FIGS. **5-7**, the rifle **8** comprises a stock **30**, a receiver **10** attached to the stock, and a barrel **32** threadably attached to the receiver. The rifle **8** has a central longitudinal axis L**1** aligned with the axis of the barrel **32** that is generally perpendicular to a lateral or transverse axis L**2**. In the illustrated embodiment, the firearm **8** is level with respect to a horizontal plane so that the reference plane defined by the axis L**1** and axis L**2** is a horizontal reference plane. The firearm **8** has a vertical axis V**1** passing through the firearm perpendicular to the reference plane defined by the longitudinal axis L**1** and the lateral axis L**2**. The longitudinal axis L**1**, lateral axis L**2**, and vertical axis V**1** define a three-dimensional coordinate system of the firearm **8**.

[0025] As shown in FIGS. **5** and **6**, the firearm **8** has a bolt **12** which is removably received in the receiver **10** and which has a chamber **36** for receiving a cartridge (not shown). As shown in FIGS. **6** and **7**, a bolt slot **24** is provided in the receiver **10** for loading the cartridge into the chamber **36** when the bolt **12** is assembled in the receiver. A bullet (not shown) is fired from the firearm **8** by actuating a trigger mechanism **38** to cause the discharge of the bullet from the cartridge. During normal operation of the rifle **8**, the bolt **12** is supported within the receiver **10** by two spaced apart support members referred to as bolt ways **21** (FIG. **7**). The bolt ways **21** are precision machined to have a generally flat top surface **21**A that is parallel or co-planar with the reference plane defined by the longitudinal axis L**1** and the lateral axis L**2** of the firearm **8**. Typically, the bolt ways **21** comprise a metal material (e.g., steel) that provides a durable and wear resistant surface **21**A during the life of the firearm **8**.

[0026] In the illustrated embodiment, the scope **9** is attached to the top of the receiver **10** by two scope rings **11**. The scope has a longitudinal axis L**3**. The scope rings **11** are releasably attached to the receiver **10** to hold the scope **9** in a fixed axial and rotational position. In the illustrated embodiment, the scope **9** is a telescopic scope having an elevation adjustment turret or knob **17** and a horizontal adjustment turret or knob **18** that are used to adjust the position of the sighting device. The elevation adjustment knob **17** is mounted on the top of the scope **9** and is used to adjust the vertical position of the sighting device (along or parallel to axis V**1**) to compensate for the elevation drop of the bullet between the firearm **8** and a target. The horizontal adjustment knob **18** extends from a side of the scope **9** and is used to adjust the horizontal position of the scope (along or parallel to axis L**2**) to make sighting corrections based on the horizontal deflection of the bullet resulting from the wind. As shown in FIG. **10**, the elevation adjustment knob **17** has a top surface **25** that is parallel with the horizontal crosshair **26** of the sight **9**. The horizontal adjustment knob **18** has an external surface **40** that is parallel with the vertical crosshair **42** of the sight **9**. In one embodiment, the scope has protective caps (not shown) that are threadably engaged with respective turrets **17**, **18** to cover and protect the turrets during normal use.

[0027] Referring to FIGS. **1**, **2** and **9**, the firearm level **1** is configured for mounting on the top surface **21**A of the bolt ways **21** of the rifle **8**. Alternatively, the firearm level **1** may be mounted on any other flat, machined surface of the firearm **8** that is oriented parallel or co-planar to the reference plane defined by the longitudinal axis L**1** and lateral axis L**2** of the firearm. As shown in FIGS. **1** and **2**, the firearm level **1** comprises a generally rectangular base **3** which includes a magnetic pad **5** having a bottom surface **13**. A support **14** projects laterally outward from the base **3** and has a semi-circular cavity **15** for supporting level vial **4**. The level vial **4** has a longitudinal axis **28** and is retained by an interference fit in the semi-circular cavity **15** of the support wall **14** so that the longitudinal axis **28** of the level vial is parallel to the bottom surface **13** of the base **3**. The level vial **4** comprises a transparent tube containing fluid that has a bubble **22** that moves in the tube based on the position of the level vial relative to a horizontal plane. It is understood that the magnetic pad **5** is sized and shaped such that the bottom surface **13** is generally parallel to the longitudinal axis **28** of the vial **4**. When the longitudinal axis **28** of the level vial **4** and bottom surface **13** of the base **3** are parallel with a horizontal plane, the bubble **22** is positioned between indicating marks **23** on the tube.

[0028] The firearm level **1** may have a base **3** with other shapes and configurations as long as the bottom surface **13** remains generally parallel with the longitudinal axis **28** of the level vial **4** so that the level provides an accurate reading of the position of the bottom surface relative to the horizontal reference plane. For example, the level **1** may have a magnetically attractive base without a separate magnetic pad **5**. The level **1** may have a base that is non-magnetic and attaches to the firearm **8** by other attachment means (e.g., adhesive). Further, the base may have a magnetic pad that is shaped other than rectangular or may have a magnetic pad with a top surface that is non-parallel with the bottom surface of the pad.

[0029] As shown in FIGS. **3** and **4** the sight level **2** has a generally rectangular base **6** with a top wall having a cavity **46** for receiving a level vial **7**, generally flat longitudinal end surfaces **6**A, and a flat bottom surface **16**. The level vial **7** has a longitudinal axis **29** and is retained by an interference fit in the cavity **46** so that the longitudinal axis **29** is parallel to the bottom surface **16** of the base **6**. The level vial **7** of the sight level **2** is substantially similar to the level vial **4** of the firearm level **1** in that it has a transparent tube containing a liquid and a bubble **26**. The bubble **26** is positioned between two indicating lines **27** on the tube when the longitudinal axis **29** of the level vial **7** and the bottom surface **16** of the base **6** are parallel to a horizontal plane.

[0030] FIGS. **8** and **9** show the firearm level **1** and sight level **2** positioned for rotationally aligning and adjusting the telescopic scope **9** with the firearm **8**. With the bolt **12** removed from the receiver **10**, the firearm level **1** is placed inside the receiver with the magnetic pad **5** resting on the flat

top surfaces **21**A of the bolt ways **21**. The bolt ways are typically made of a magnetically attractive material (e.g., steel) so that the magnetic pad **5** secures the level **1** to the bolt ways at a position parallel to the top surfaces of the bolt ways. The upper wall **14** and level vial **4** protrude through the bolt slot **24** of the receiver **10** so that the level vial **4** is visible to the user. With the firearm level **1** securely mounted on the firearm **9** such that the bottom surface **13** of the firearm level is parallel with the flat top surfaces **21**A of the bolt ways **21**, the rifle **8** is rotated about its longitudinal axis L**1** until the bubble **22** of the level vial **4** is centered between the indicator marks **23** of the level vial **4** to indicate that the lateral axis L**2** of the rifle **8** is level relative to a horizontal plane. In addition, a separate level (not shown) should be used to check that the longitudinal axis L**1** of the rifle **8** is level relative to the horizontal plane. The position of the longitudinal axis L**1** of the rifle **8** relative to the horizontal plane can be checked by placing the sight level **2**, or other conventional level, lengthwise along the top of the barrel **32**, the flat top surface **21**A of the bolt ways **21**, or other flat surface of the rifle that is oriented parallel to the longitudinal axis L**1**.

[0031] After leveling the rifle **8** with respect to the horizontal plane, the sight level **2** is placed on the top surface **25** of the elevation adjustment knob **17** to check the positioning of the scope **9** relative to the rifle. The telescopic sight **9** is rotated about its longitudinal axis L**3** until the bubble **32** of the level vial **7** is centered between the indicator marks **27**. As shown in FIG. **10**, the telescopic scope **9** is level and aligned with the firearm as illustrated by the level indication of both the receiver level **1** and sight level **2**. In the aligned condition of the scope **9** and firearm **8**, the horizontal crosshair **26** is parallel to the flat top surfaces **21**A of the bolt ways **21** and to the longitudinal axes **28**, **29** of the levels **4** and **7**, respectively. This alignment indicates to the user that the telescopic scope **9** is level and properly mounted on the rifle **8**.

[0032] In use, the firearm **8** is first placed in a secure holding fixture such as a vise (not shown). The scope **9** may be separated from the firearm **8** if performing an initial installation and alignment or the scope may be attached to the receiver **10** of the firearm if performing a check of the rotational alignment of an existing mounted scope. The bolt **12** is removed from the receiver **10** and the position of the firearm **8** is adjusted and checked so that the firearm is horizontally level with respect to the reference plane defined by the longitudinal axis L**1** and the lateral axis L**2**. Specifically, the firearm level **1** with magnetic base **5** is placed on the flat top surfaces **21**A of the bolt ways **21** of the receiver **10**. The firearm **8** is adjusted as needed so that the firearm level **1** indicates that the firearm is level relative to the horizontal reference plane. In addition, a separate level (not shown) is used to check that the longitudinal axis L**1** of the rifle **8** is level relative to the horizontal plane. The position of the longitudinal axis L**1** of the rifle **8** relative to the horizontal plane can be checked by placing the sight level **2**, or other conventional level, lengthwise along the top of the barrel **32**, the flat top surface **21**A of the bolt ways **21**, or other flat surface of the rifle that is oriented parallel to the longitudinal axis L**1**.

[0033] If performing an initial assembly of the scope **9** to the firearm **8**, the scope may be attached to the firearm at this stage in the alignment process. The sight level **2** is placed on the top surface **25** of the elevation adjustment knob **17** of the scope **9**. Comparison of the firearm level **1** and sight level **2** enables the user to quickly determine whether the scope **9** is rotationally aligned with the firearm **8**. Rotational adjustments of the scope **9** are made by loosening the scope rings **11**, rotating the scope as needed about axis L**3** until the sight level **2** indicates that the scope is level, and re-tightening the scope rings. When the scope **9** is rotationally aligned with the firearm **8**, the horizontal crosshair **26** of the scope should be perfectly parallel to the flat top surfaces **21**A of the bolt ways **21** of the receiver **10**, the longitudinal axis **28** of the firearm level **1**, and the longitudinal axis **29** of the sight level **2**.

[0034] When introducing elements of the present invention or the preferred embodiment(s) thereof, the articles "a", "an", "the" and "said" are intended to mean that there are one or more of the elements. The terms "comprising", "including" and "having" are intended to be inclusive and mean that there may be additional elements other than the listed elements.

[0035] As various changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense. For example, the scope **9** may have other surface(s) aligned with the horizontal crosshairs **26** that may be suitable for checking the alignment of the scope relative to the firearm **8**. Further, the longitudinal ends **6**A of the sight level **2** may be generally perpendicular to the flat bottom surface **16** of the level. As such, one of the longitudinal ends **6**A of the sight level **2** may be placed against the flat external surface **40** of the windage adjustment knob **18** to determine if the scope **9** is rotationally aligned with the firearm **8**. The firearm level **1** and sight level **2** could comprises level indicators other than bubble levels **4** without departing from the scope of this invention

[0036] In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

1. An apparatus for aligning a sighting device mounted on a firearm, the apparatus comprising:

a first indicating device adapted to be positioned on a surface of the firearm to determine a rotational position of the firearm relative to a reference plane wherein the first indicating device does not include the use of an ocular lens to determine a rotational position of the firearm relative to a reference plane; and

a second indicating device adapted to be positioned on a surface of the sighting device to determine a rotational position of the sighting device relative to the reference plane wherein the second indicating device does not include the use of an ocular lens to determine a rotational position of the sighting device relative to the reference plane.

2. The apparatus set forth in claim **1** wherein said first indicating device comprises a firearm level, said second indicating device comprises a sight level, and said reference plane is a horizontal plane.

3. The apparatus set forth in claim **2** wherein said firearm level and said sight level each comprise a bubble level.

4. The apparatus set forth in claim **2** wherein said firearm level comprises a base for mounting on the surface of the firearm.

5. The apparatus set forth in claim **4** wherein said firearm level further comprises a level support projecting laterally from the base for supporting said sight level.

6. The apparatus set forth in claim **5** wherein said base further comprises a magnet for removable attachment of the firearm level to the firearm.

7. The apparatus set forth in claim **5** wherein said support defines a cavity for supporting said firearm level.

8. The apparatus set forth in claim **7** wherein said firearm level is retained in the cavity by interference fit.

9. The apparatus set forth in claim **1** wherein said firearm comprises a receiver and said surface of the firearm is a surface of the receiver that is parallel to a longitudinal axis of the firearm.

10. An apparatus for aligning a sighting device mounted on a firearm having a longitudinal axis and a receiver with a surface generally flat and parallel to the longitudinal axis, the apparatus comprising:

a firearm level having a magnet for removable attachment of the firearm level to said surface of the receiver to determine the rotational position of the firearm relative to a horizontal plane; and

a sight level for mounting on a generally flat surface of the sighting device to determine the rotational position of the sighting device relative to said horizontal plane wherein the sight level is positioned to allow the firearm level and the sight level to be viewable at the same time.

11. The apparatus set forth in claim **1** wherein said firearm level and said sight level each comprise a bubble level.

12. The apparatus set forth in claim **11** wherein said firearm level further comprises a base and a level support projecting laterally from the base for supporting said sight level.

13. A method of aligning a sighting device mounted on a firearm, the method comprising the steps of:

using a first indicating device positioned on a surface of the firearm to determine a rotational position of the firearm relative to a reference plane wherein the first indicating device does not include the use of a firearm scope; and

using a second indicating device positioned on a surface of the sighting device to determine a rotational position of the sighting device relative to said reference plane wherein the second indicating device does not include the use of a firearm scope.

14. The method set forth in claim **13** wherein said first indicating device comprises a firearm level, and wherein the steps of determining the rotational position of the firearm comprises attaching the firearm level to a flat surface of the firearm.

15. The method set forth in claim **14** wherein said firearm has a receiver and said flat surface of the firearm is a surface of the receiver that is parallel to a longitudinal axis of the firearm.

16. The method set forth in claim **15** wherein said firearm level has a base comprising a magnet, and wherein the step of attaching the firearm level to the firearm comprises attaching the magnet to the surface of the receiver by magnetic attraction.

17. The method set forth in claim **16** wherein said sighting device comprises a scope and said second indicating device comprises a sight level, and wherein the step of determining the rotational position of the sighting device comprises placing the sight level on a flat external surface of the scope.

18. The method set forth in claim **17** wherein said sight level has a base with a generally flat surface, and wherein the step of placing the sight level on the scope comprises supporting the generally flat surface of the base with the flat external surface of the scope.

19. The method set forth in claim **13** further comprising comparing the first indicating device to the second indicating device to determine whether the sighting device is rotationally aligned with the firearm.

20. The method set forth in claim **13** further comprising adjusting the position of the sighting device relative to the firearm based on said determining steps.

* * * * *