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VIEWING OPTIC WITH CONTOURS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority to and is a nonprovisional application of U.S. Provisional Application No. 62/961,447 filed January 15, 2020, which is incorporated herein by reference in its entirety.

FIELD

[0001] The disclosure relates to viewing optics. In one embodiment, the disclosure relates to a riflescope tube. In one embodiment, the disclosure relates to a riflescope tube having contours, which reduce weight compared to conventional riflescope tubes.

BACKGROUND

[0002] Today is the age of unprecedented technology – technology that makes our lives easier and more connected at the push of a touch-screen and glaze of a monitor. For shooters, civilian or military, this is no less true. Shooters carry numerous components, each adding critical weight to gear bags. For the military, specifically, ruggedized (and oftentimes heavier) equivalents provide tactical awareness, allowing soldiers and Marines to see beyond their personal sight using GPS, smartphones, tablets, and even helmet-mounted screens. For shooters, one of the most significant limitations, and perhaps the most significant limitation for our soldiers, is how much they can carry, and thus, reducing the weight of each and every component is important.

[0003] Today the average US soldier carries at least 60 pounds of gear, with an extended patrol often doubling that weight. Specialized warfighters, such as Automatic Riflemen, Combat Medics, and Special Operations can see totals much higher. The average U.S. soldier will have protective clothing, body armor and helmets, load carrying equipment, and a ruck.

[0004] The bane of every soldier's and marine's existence, the rucksack can come in many different shapes and sizes, from a large pack that holds 100+ pounds of gear to a more modestly-sized patrol pack that holds 20 to 30 pounds of gear. The longer the duration and more specialized the soldier, the more gear that needs to be carried, especially if you're stepping out of

an airplane inside enemy territory. In addition, the modern US soldier is bedecked in electronics, from night vision to radios, and new technology is coming using smartphones, tablets, and GPS.

[0005] The world has never seen better equipped warfighters, but it's now become clear that they are overburdened as well. The US Armed Forces and the Department of Defense have spearheaded initiatives to reduce weight in all categories, from case-less ammo to solar power.

[0006] Civilian shooters carry significantly lighter loads on average, but civilian shooters often prioritize certain pieces of gear over others in order to reduce the total load or avoid carrying a larger or secondary bag, resulting in a less-than-optimal set-up in some conditions.

[0007] For the reasons discussed above, having a viewing optic with reduced weight is advantageous. Thus, there is a large need for a viewing optic that addresses these concerns.

SUMMARY

[0008] In one embodiment, the disclosure provides a main body of a viewing optic. In accordance with embodiments of the present disclosure, a main body of a viewing optic comprises at least one void in the main body.

[0009] In a further embodiment, the main body includes a saddle portion having a top side, a bottom side, a left side and a right side, and the at least one void is in the saddle portion. In an embodiment, the main body has at least two voids on a surface of the saddle portion. In another embodiment, the main body has a plurality of voids on the saddle portion. In an embodiment, the voids are symmetrically positioned about the saddle portion.

[0010] In an embodiment, the plurality of voids comprises a first plurality of voids having a first geometry and at least one void having a second geometry. In a further embodiment, at least one of the first and second geometry is a pocket having a generally triangular profile. In yet a further embodiment, the other of the first and second geometry is a channel.

[0011] In another embodiment, the saddle portion comprises eight voids having the first geometry and four voids having the second geometry, wherein one of the eight voids of the first geometry is positioned at each of the top front right, top front left, top back right, top back left, bottom front right, bottom front left, bottom back right and bottom back left portions of the saddle, and wherein a void of the second geometry connects the top front right and top back right voids of the first geometry, the top front left and top back left voids of the first geometry, the bottom front right and bottom back right voids of the first geometry, and the bottom front left and bottom back left voids

of the first geometry. In a further embodiment, the voids are symmetrically positioned about the saddle.

[0012] In an embodiment, the saddle portion has a weight which is at least 2% less than the weight of an identical saddle portion without the plurality of voids. In a further embodiment, the saddle portion has a weight from 0.1 oz to 1.0 oz less than that of an identical saddle portion without the plurality of voids.

[0013] In an embodiment, the at least one void is on the top side. In a further embodiment, the at least one void is on the bottom side. In yet a further embodiment, the at least one void is on the left side. In still a further embodiment, the at least one void is on the right side.

[0014] In another embodiment, the disclosure provides a viewing optic. In accordance with embodiments of the present disclosure, the viewing optic comprises a main body comprising at least one void. In an embodiment, the viewing optic is a riflescope.

[0015] In another embodiment, the present disclosure provides a method of machining at least one void in a scope body comprising inserting a scope tube blank into a CNC mill; indexing the blank at 45 degrees off its normal axis; and machining, using an end mill, at least one void perpendicular to an axis of the end mill. In a further embodiment, the method further comprises indexing the blank 90 degrees; machining, using the end mill, at least one void perpendicular to the axis of the end mill; and repeating the indexing and machining steps two further times.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] Embodiments of the disclosure are disclosed with reference to the accompanying drawings and are for illustrative purposes only. The disclosure is not limited in its application to the details of construction or the arrangement of the components illustrated in the drawings. The disclosure is capable of other embodiments or of being practiced or carried out in other various ways. Like reference numerals are used to indicate like components. In the drawings:

[0017] FIG. 1 is a side view of an embodiment of a riflescope in accordance with embodiments of the present disclosure.

[0018] FIG. 2 is a cross-sectional view of the turret of FIG. 1 taken along line 2-2 in accordance with embodiments of the present disclosure.

[0019] FIG. 3 is a perspective view of the saddle portion of a riflescope with the adjustment knobs removed for clarity in accordance with embodiments of the present disclosure.

[0020] FIG. 4 is a 45° rotated side view of the turret saddle portion of a riflescope with the adjustment knobs removed for clarity in accordance with embodiments of the present disclosure.

[0021] FIG. 5 is a cross-sectional view of the turret saddle portion of FIG. 3 taken along line 5-5 in accordance with embodiments of the present disclosure.

[0022] FIG. 6 is a schematic showing the orientation of pockets in the main body of the riflescope in relationship to the primary axis in accordance with embodiments of the present disclosure.

[0023] Before explaining embodiments of the disclosure in detail, it is to be understood that the disclosure is not limited in its application to the details of construction and the arrangement of the components set forth in the following description or illustrated in the drawings. The technology of this present disclosure is capable of other embodiments or being practiced or carried out in various ways. Also, it is to be understood that the phraseology and terminology employed herein is for the purpose of description and should not be regarded as limiting.

DETAILED DESCRIPTION

[0024] The apparatuses and methods disclosed herein will now be described more fully hereinafter with reference to the accompanying drawings, in which embodiments of the disclosure are shown. The apparatuses and methods disclosed herein may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that the disclosure will be thorough and complete and will fully convey the scope of the invention to those skilled in the art.

[0025] It will be appreciated by those skilled in the art that the set of features and/or capabilities may be readily adapted within the context of a standalone weapons sight, front-mount or rear-mount clip-on weapons sight, and other permutations of field deployed optical weapons sights. Further, it will be appreciated by those skilled in the art that various combinations of features and capabilities may be incorporated into add-on modules for retrofitting existing fixed or variable weapons sights of any variety.

[0026] It will be understood that when an element or layer is referred to as being “on”, “connected to” or “coupled to” another element or layer, it can be directly on, connected or coupled to the other element or layer. Alternatively, intervening elements or layers may be present. In contrast, when an element is referred to as being “directly on,” “directly connected to” or “directly coupled to” another element or layer, there are no intervening elements or layers present.

[0027] Like numbers refer to like elements throughout. As used herein, the term “and/or” includes any and all combinations of one or more of the associated listed items.

[0028] It will be understood that, although the terms first, second, *etc.* may be used herein to describe various elements, components, regions, and/or sections, these elements, components, regions, and/or sections should not be limited by these terms. These terms are only used to distinguish one element, component, region, or section from another element, component, region, or section. Thus, a first element, component, region, or section discussed below could be termed a second element, component, region, or section without departing from the disclosure.

[0029] Spatially relative terms, such as “beneath,” “below,” “lower,” “above,” “upper,” and the like, may be used herein for ease of description to describe one element or feature's relationship to another element(s) or feature(s) as illustrated in the figures. It will be understood that the spatially relative terms are intended to encompass different orientations of the device in use or operation in addition to the orientation depicted in the figures. For example, if the device in the figures is turned over, elements described as “below,” or “beneath” other elements or features would then be oriented “above” the other elements or features. Thus, the exemplary term “below” can encompass both an orientation of above and below. The device may be otherwise oriented (rotated 90° or at other orientations) and the spatially relative descriptors used herein interpreted accordingly.

[0030] The term “and/or” as used in a phrase such as “A and/or B” herein is intended to include both A and B; A or B; A (alone); and B (alone). Likewise, the term “and/or” as used in a phrase such as “A, B, and/or C” is intended to encompass each of the following embodiments: A, B, and C; A, B, or C; A or C; A or B; B or C; A and C; A and B; B and C; A (alone); B (alone); and C (alone).

[0031] The numerical ranges in this disclosure are approximate, and thus may include values outside of the range unless otherwise indicated. Numerical ranges include all values from and including the lower and the upper values, in increments of one unit, provided that there is a separation of at least two units between any lower value and any higher value. As an example, if a compositional, physical or other property, such as, for example, molecular weight, melt index, temperature, *etc.*, is from 100 to 1,000, it is intended that all individual values, such as 100, 101, 102, *etc.*, and sub ranges, such as 100 to 144, 155 to 170, 197 to 200, *etc.*, are expressly enumerated. For ranges containing values which are less than one or containing fractional numbers greater than

one (*e.g.*, 1.1, 1.5, *etc.*), one unit is considered to be 0.0001, 0.001, 0.01 or 0.1, as appropriate. For ranges containing single digit numbers less than ten (*e.g.*, 1 to 5), one unit is typically considered to be 0.1. These are only examples of what is specifically intended, and all possible combinations of numerical values between the lowest value and the highest value enumerated, are to be considered to be expressly stated in this disclosure. Numerical ranges are provided within this disclosure for, among other things, relative amounts of distances from a user of a device to a target, weights, percentages (*e.g.*, of weight reduction) and other measurements.

[0032] All patents, patent applications, and non-patent literature references are incorporated herein in their entireties.

[0033] As used herein, an “erector tube” is any structure or device having an opening to receive an erector lens mount.

[0034] As used herein, a “firearm” is a portable gun, being a barreled weapon that launches one or more projectiles often driven by the action of an explosive force. As used herein, the term “firearm” includes a handgun, a long gun, a rifle, shotgun, a carbine, automatic weapons, semi-automatic weapons, a machine gun, a sub-machine gun, an automatic rifle, and an assault rifle.

[0035] As used herein, the term “viewing optic” refers to an apparatus used by a shooter or a spotter to select, identify or monitor a target. The “viewing optic” may rely on visual observation of the target, or, for example, on infrared (IR), ultraviolet (UV), radar, thermal, microwave, or magnetic imaging, radiation including X-ray, gamma ray, isotope and particle radiation, night vision, vibrational receptors including ultra-sound, sound pulse, sonar, seismic vibrations, magnetic resonance, gravitational receptors, broadcast frequencies including radio wave, television and cellular receptors, or other image of the target. The image of the target presented to the shooter by the “viewing optic” device may be unaltered, or it may be enhanced, for example, by magnification, amplification, subtraction, superimposition, filtration, stabilization, template matching, or other means. The target selected, identified or monitored by the “viewing optic” may be within the line of sight of the shooter, or tangential to the sight of the shooter, or the shooter's line of sight may be obstructed while the target acquisition device presents a focused image of the target to the shooter. The image of the target acquired by the “viewing optic” may be, for example, analog or digital, and shared, stored, archived, or transmitted within a network of one or more shooters and spotters by, for example, video, physical cable or wire, IR, radio wave, cellular connections, laser pulse, optical, 802.11b or other wireless transmission using, for example,

protocols such as html, SML, SOAP, X.25, SNA, *etc.*, Bluetooth™, Serial, USB or other suitable image distribution method. The term “viewing optic” is used interchangeably with “optic sight.”

[0036] As used herein, the term “shooter” applies to either the operator making the shot or an individual observing the shot in collaboration with the operator making the shot.

[0037] The disclosure relates to viewing optic with reduced weight. In one embodiment, the disclosure relates to a viewing optic with a main body having pockets in the turret saddle. The disclosure is not limited to these embodiments.

[0038] FIGS. 1-2 illustrate a rifle scope **10**, generally, in accordance with embodiments of the disclosure. The rifle scope **10** has a body **12** that encloses a movable optical element **13**, which is an erector tube. The scope body **12** is an elongate tube having a larger opening at its front **14** and a smaller opening at its rear **16**. An eyepiece **18** is attached to the rear of the scope body **12**, and an objective lens **20** is attached to the front of the scope body **12**. The center axis of the movable optical element **13** defines the optical axis **17** of the rifle scope **10**.

[0039] An elevation turret **22** and a windage turret **24** are two knobs in the outside center part (or saddle **100**) of the scope body **12**. The turrets **22**, **24** are marked in increments by indicia **34** on their perimeters **30** and **32** and are used to adjust the elevation and windage of the movable optical element **13** for points of impact change. These knobs **22**, **24** protrude from the turret housing **36**. The turrets **22**, **24** are arranged so that the elevation turret rotation axis **26** is perpendicular to the windage turret rotation axis **28**. Indicia typically include tick marks, each corresponding to a click, and larger tick marks at selected intervals, as well as numerals indicating angle of adjustment or distance for bullet drop compensation.

[0040] The movable optical element **13** is adjusted by rotating the turrets one or more clicks. A click is one tactile adjustment increment on the windage or elevation turret of the rifle scope **10**, each of which corresponds to one of the indicial **34**. In the current embodiment, one click changes the scope's point of impact by 0.1 milliradians (mrad). However, the turrets, systems and concepts disclosed herein can be used with other measures of increments. In other embodiments, the increments can be minutes of angle (MOA) increments.

[0041] FIGS. 3-6 show the saddle portion **100** of the scope body **12** in further detail. The saddle **100** includes a plurality of voids **50**. As used herein, a “void” refers to a volume of an otherwise solid object from which material has been removed to create an area having an absence of material. Voids may include pockets, depressions, hollows, channels, indentations, notches, and similar

features, whether or not completely surrounded or exposed on the outer surface of the saddle **100**. In the specific embodiment shown, the voids **50** include at least a plurality of pockets **50a** and/or plurality of channels **50b**. In an embodiment, two or more pockets **50a** may be connected by one or more channels **50b**.

[0042] In an embodiment, the saddle **100** can have voids **50** on top **101**, bottom **102**, left **103** and/or right **104** sides. In an embodiment, the saddle **100** can have voids **50** on only the top **101** and/or bottom **102** sides. In another embodiment, the saddle **100** can have voids **50** on only the left **103** and/or right **104** sides. In a further embodiment, the saddle **100** can have one or more voids **50** on each of the top **101**, bottom **102**, left **103** and right **104** sides.

[0043] In an embodiment, the saddle **100** can have voids in a symmetrical or asymmetrical, though preferably symmetrical, arrangement. In the embodiment shown in FIGS. 3-6, the optical axis **17** forms a horizontal (relative to the orientation shown in FIG. 4 and 5) line of symmetry, and axis **A** forms a vertical line of symmetry. In one embodiment, the voids **50** are symmetrically disposed on the saddle **50** relative to the optical axis **17**. In another embodiment, the voids **50** are symmetrically disposed on the saddle **50** relative to axis **A**. In another embodiment, the voids **50** are symmetrically disposed on the saddle **50** relative to both the optical axis **17** and axis **A**.

[0044] In another embodiment, the saddle **100** can have an even number of voids or an odd number of voids. Further, in an embodiment, the saddle **100** may have two or more voids that are identical in geometry (*e.g.*, shape and volume). In another embodiment, the saddle **100** may have two or more voids that have different geometries. In another embodiment, the saddle **100** may have three or more voids, with three or more different geometries. In a particular embodiment, the saddle **100** includes two or more voids of two different geometries.

[0045] In an embodiment, the saddle **100** includes at least a plurality of voids **50** having a first geometry and at least a plurality of voids **50** having a second geometry. The number of voids **50** having a first geometry may be greater than or equal to the number of voids **50** having a second geometry.

[0046] In particular, and with reference to FIGS. 4 and 6, the voids **50** are mirrored about axis **A**, which is perpendicular to axis **17**, and rotated equally spaced around the axis **17**. In the embodiment shown, there are a total of eight (8) pockets **50a** and four (4) channels **50b**. One each of the pockets **50a** is found at the “corners” of the saddle **100**, while the channels **50b** connect the front and back channels on the upper right of the saddle **100**, the front and back channels on the

upper left of the saddle **100**, the front and back channels on the bottom right of the saddle **100**, and the front and back channels on the bottom left of the saddle **100**. With reference to FIG. 1, it can be seen that, in the specific embodiment described, one or more voids **50** (or more specifically, channels **50b**) may form a contour between turrets **22**, **24**.

[0047] With reference to FIGS. 3 and 4, the pockets **50a** are shown as generally triangular in profile and having a depth into the surface of the saddle **100**. Similarly, the channels **50b** are shown as being generally linear with a rounded cross-section. It will be appreciated that other shapes and void geometries may be used.

[0048] The voids **50** together serve to reduce the overall weight of the riflescope **10**. By removing material that does not affect the function or structural integrity of the riflescope **10**, the overall weight of the structure is reduced. In an embodiment, the weight of the main body **12** of the riflescope **10** containing voids is reduced by at least 2%, or at least 3%, or at least 4%, or at least 5%, or at least 6%, or at least 7%, or at least 8%, or at least 9%, or at least 10%, compared to an identical main body having no voids. In an embodiment, the weight of the main body **12** of the riflescope **10** containing voids is reduced by 2%, or 3%, or 4%, or 5% to 6%, or 7%, or 8%, or 9%, or 10% to 15%, compared to an identical main body having no voids. In a particular embodiment, the weight of the main body **12** of the riflescope **10** is reduced by 3% as compared to the weight of a main body of a riflescope to identical dimensions.

[0049] In an embodiment, the weight of the main body **12** of the riflescope **10** is reduced from 0.1 oz, or 0.2 oz, or 0.3 oz, or 0.4 oz, or 0.5 oz to 0.6 oz, or 0.7 oz, or 0.8 oz, or 0.9 oz, or 1.0 oz, or 1.5 oz. In a particular embodiment, the weight of the main body **12** of the riflescope **10** is reduced by 0.51 oz as compared to the weight of a main body of a riflescope to identical dimensions.

[0050] In addition to the utility of weight savings, the design of voids **50** about the saddle **100** can serve as a quick and unique optical identity. That is, the voids **50** may be designed such to provide a distinct visual identification of the riflescope. Having the ability to identify a product by a specific visual feature other than logos can provide a competitive advantage by allowing bystanders and social media user to positively identify an optic an influencer is using without the need of that influencer to specifically callout the optic.

[0051] In the embodiments shown, the voids **50** are machined into the saddle **100**. However, in further embodiments, the voids **50** may be created using other technologies, including, but not limited to, laser technologies, and even manually.

[0052] In an embodiment, the disclosure provides a method for machining a main body, and particularly a saddle, of a riflescope.

[0053] To machine these features, the scope tube blank is mounted into a CNC mill with a 4th axis rotary table. The part was indexed 45 degrees off its normal axis, as shown in FIG. 6. In FIG. 6, the 0-degree position is identified, along with the 45-degree, 135-degree, 225-degree and 315-degree positions. The spaces for the windage turret (not shown) and elevation turret (not shown), as well as the saddle cover (not shown) and illumination control (not shown) are also marked for clarity; however, it will be understood that the arrangement of these components may be altered for some uses (*e.g.*, opposite dominate hand) and/or other adjustment mechanisms provided. Using a flat end mill, a majority of material was removed from the two pockets **50a** perpendicular to the axis of the end mill. A ball end mill was then used to machine in the final shape and contours of the pockets **50a**. The same ball end mill then cut the connecting channel **50b** and blending contours between these two pockets **50a**. The 4th axis rotary table indexed the scope tube another 90 degrees and machined the next set of pockets **50a** and channels **50b**. This was repeated for the final two sets of pockets **50a** and channels **50b**.

[0054] It will be appreciated that the above method describes a method for machining the specific exemplary main body **12**, and particularly the specific exemplary saddle portion **100**, shown and described with references to the figures. As discussed with reference to FIGS. 1-6, the number, geometry and positioning of voids on the saddle **100** may vary within the scope of this disclosure, and the method of machining may be modified accordingly.

[0055] Various modifications and variations of the described compositions and methods of the invention will be apparent to those skilled in the art without departing from the scope and spirit of the invention. One skilled in the art will recognize at once that it would be possible to construct the present invention from a variety of materials and in a variety of different ways. Although the invention has been described in connection with specific preferred embodiments, it should be understood that the invention should not be unduly limited to such specific embodiments. While the preferred embodiments have been described in detail, and shown in the accompanying drawings, it will be evident that various further modification are possible without departing from the scope of the invention as set forth in the appended claims. Indeed, various modifications of the described modes for carrying out the invention which are obvious to those skilled in marksmanship or related fields are intended to be within the scope of the following claims.

WHAT IS CLAIMED IS:

1. A main body of a viewing optic comprising at least one void in the main body.
2. The main body of Claim 1, wherein the main body further includes a saddle portion having a top side, a bottom side, a left side, and a right side, and the at least one void is in the saddle portion.
3. The main body of Claim 1, comprising at least two voids on a surface of the saddle portion.
4. The main body of Claim 1, comprising a plurality of voids on a surface of the saddle portion.
5. The main body of Claim 4, wherein the plurality of voids are symmetrically positioned on the saddle portion.
6. The main body of Claim 4, wherein the plurality of voids comprises a first plurality of voids having a first geometry and at least one void having a second geometry.
7. The main body of Claim 6, wherein one of the first and second geometry is a pocket having a generally triangular profile.
8. The main body of Claim 7, wherein the other of the first and second geometry is a channel.
9. The main body of Claim 8, wherein the saddle portion comprises eight voids having the first geometry and four voids having the second geometry, wherein one of the eight voids of the first geometry is positioned at each of the top front right, top front left, top back right, top back left, bottom front right, bottom front left, bottom back right and bottom back left portions of the saddle, and wherein a void of the second geometry connects the top front right and top back right voids of the first geometry, the top front left and top back left voids of the first geometry, the bottom front right and bottom back right voids of the first geometry, and the bottom front left and bottom back left voids of the first geometry.
10. The main body of Claim 9, wherein the voids are symmetrically positioned about the saddle.

11. The main body of Claim 4, wherein the saddle portion has a weight that is at least 2% less than the weight of an identical saddle portion without the plurality of voids.
12. The main body of Claim 4, wherein the saddle portion has a weight from 0.1 oz to 1.0 oz less than that of an identical saddle portion without the plurality of voids.
13. The main body of Claim 2, wherein the at least one void is on the top side.
14. The main body of Claim 2, wherein the at least one void is on the bottom side.
15. The main body of Claim 2, wherein the at least one void is on the left side.
16. The main body of Claim 2, wherein the at least one void is on the right side.
17. A viewing optic having the main body of Claim 1.
18. The viewing optic of Claim 17, wherein the viewing optic is a riflescope.
19. A method of machining at least one void in a scope body comprising:
inserting a scope tube blank into a CNC mill;
indexing the blank at 45 degrees off its normal axis; and
machining, using an end mill, at least one void perpendicular to an axis of the end mill.
20. The method of Claim 19 further comprising:
indexing the blank 90 degrees;
machining, using the end mill, at least one void perpendicular to the axis of the end mill;
and
repeating the indexing and machining steps two further times.

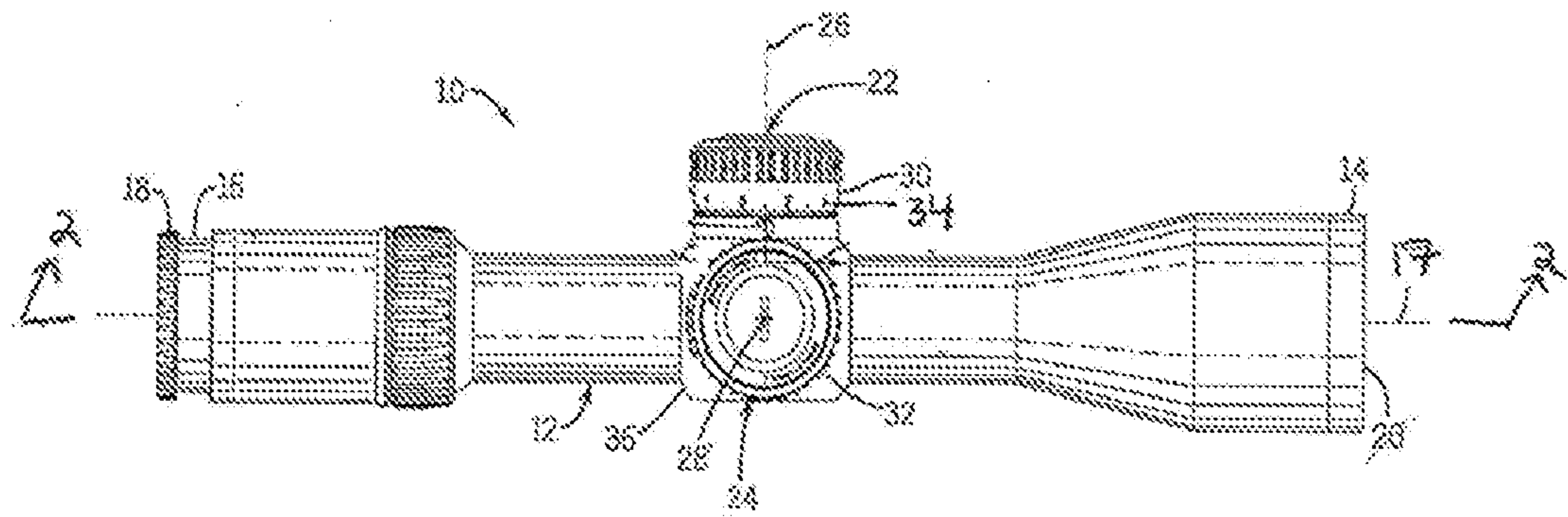


FIG. 1

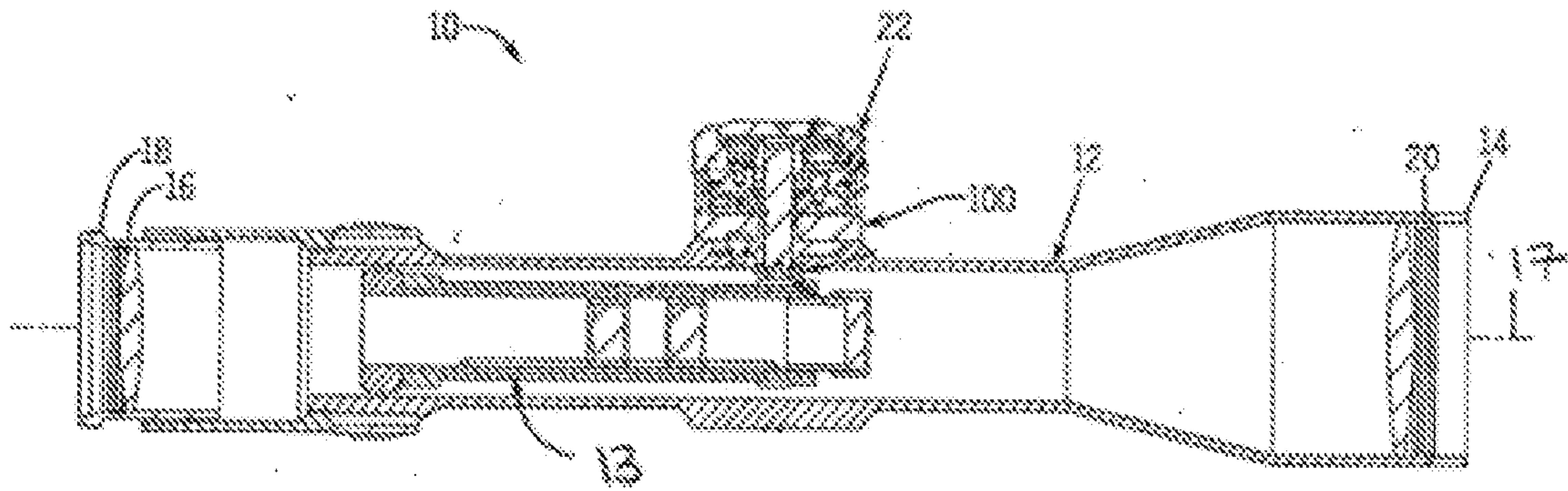


FIG. 2

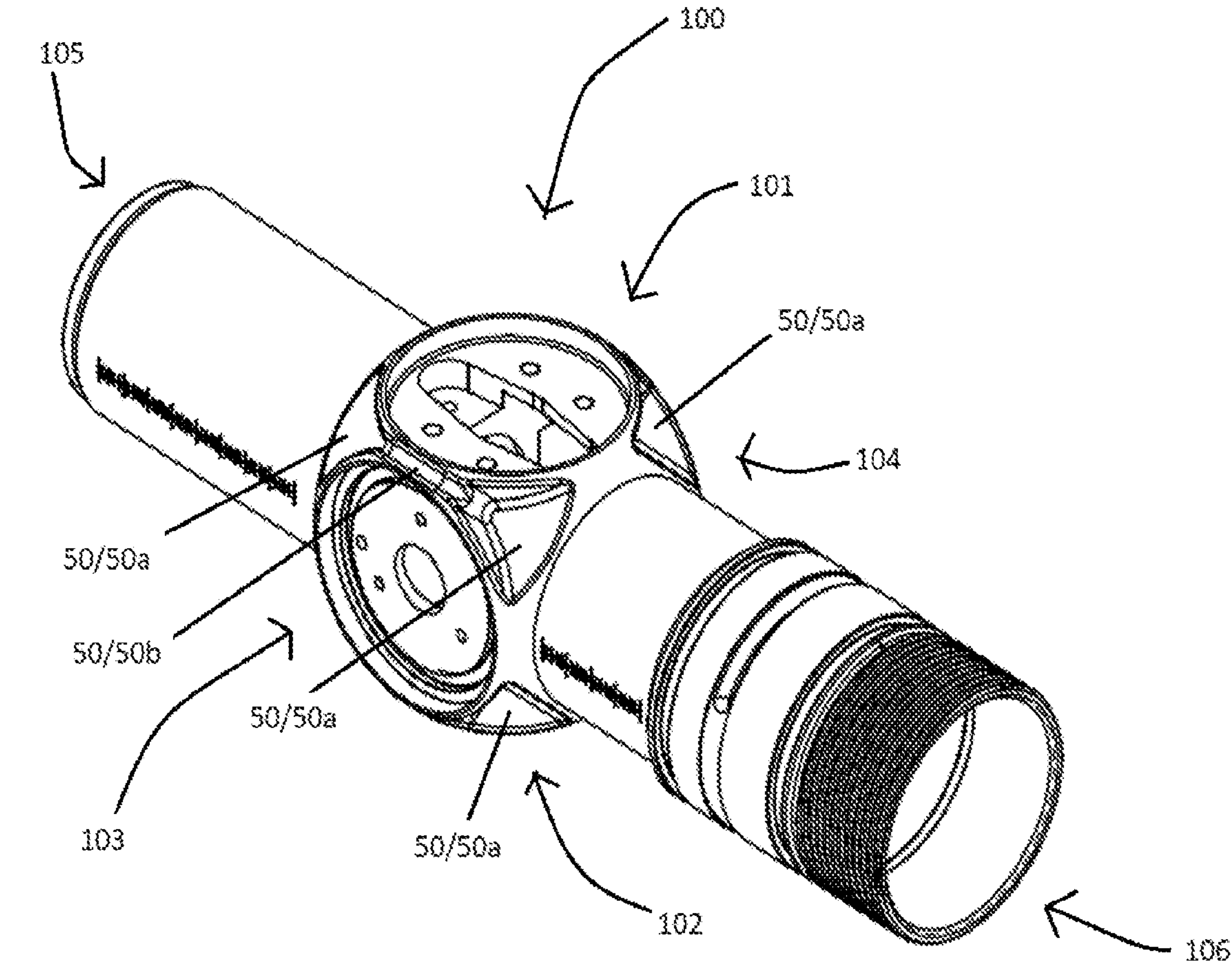


FIG. 3

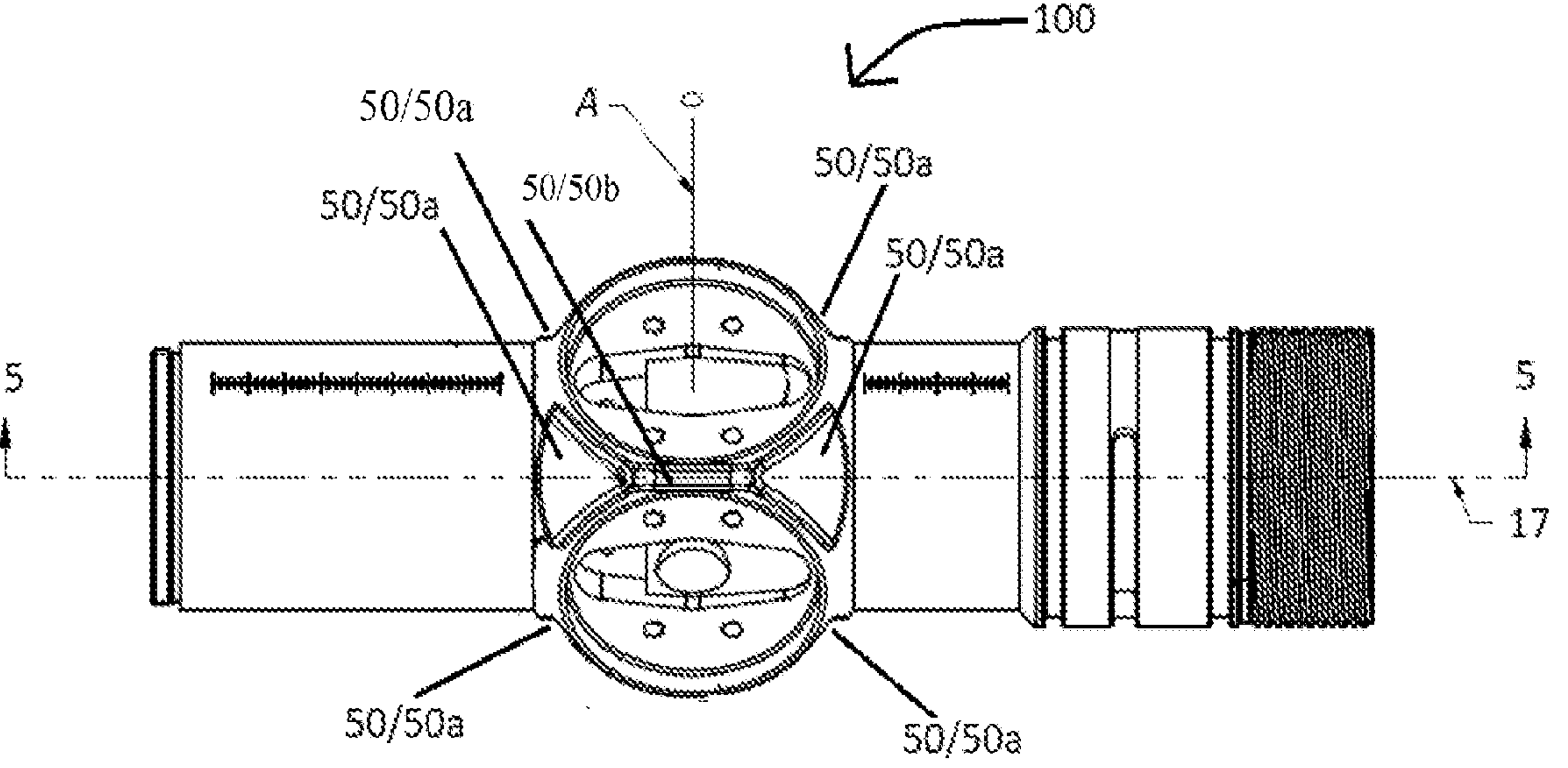


FIG. 4

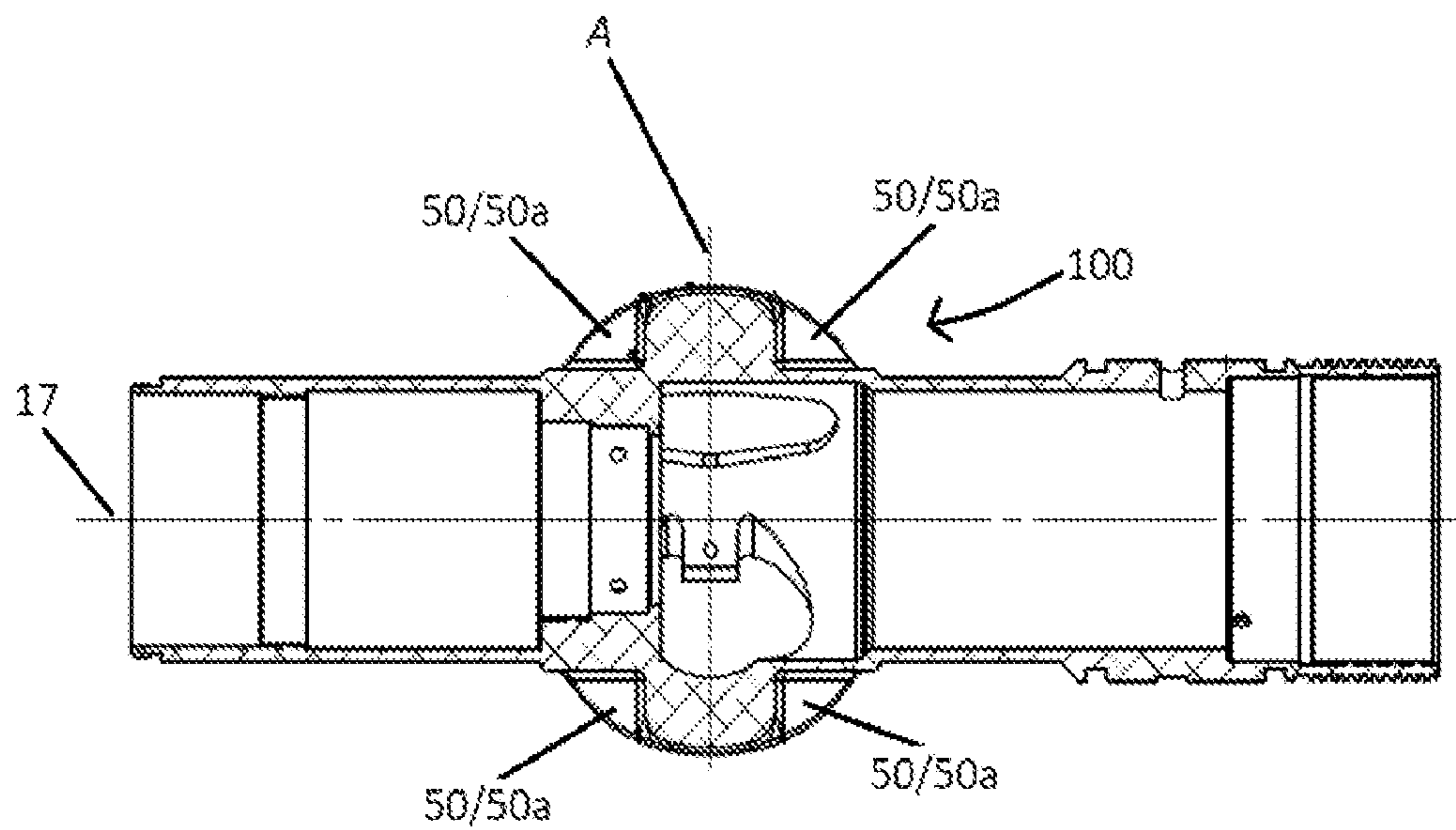


FIG. 5

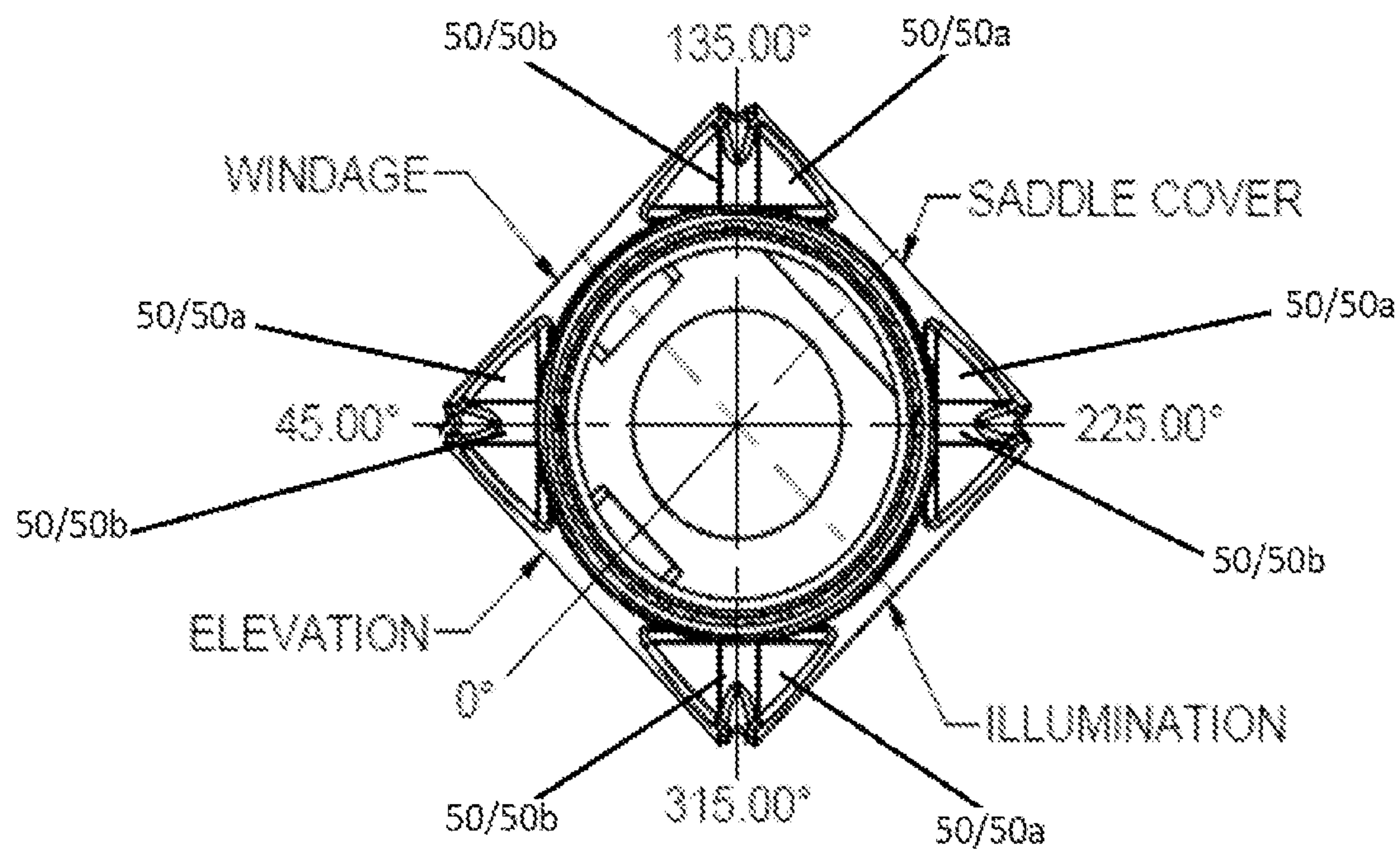


FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 21/13596

A. CLASSIFICATION OF SUBJECT MATTER

IPC - F41G 1/38, F41G 1/00, F41G 11/00, G02B 23/16, G02B 23/14 (2021.01)

CPC - F41G 1/38, F41G 1/00, F41G 11/00, G02B 23/16, G02B 23/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

See Search History document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

See Search History document

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,363,559 A (McCarty) 15 November 1994 (15.11.1994). Entire document, especially Figs. 1, 12; col 1, ln 6-36; col 3, ln 22-23, 26-30, 36-40, 64-68; col 4, ln 10-44, ln 64-68; col 5, ln 1-11, 36-56; col 9, ln 38-48.	1-5, 11-18
X -- Y	US 2016/0061567 A1 (Leupold and Stevens, Inc.) 03 March 2016 (03.03.2016). Entire document, especially Figs. 1-7; para [0002], [0034]-[0035], [0038]-[0039].	1-2, 4, 6-8 ----- 9-10
Y	US 2017/0254615 A1 (Kennair, JR.) 07 September 2017 (07.09.2017). Entire document, especially Fig. 2; para [0024]-[0027].	9-10
A	US 5,813,107 A (Chen) 29 September 1998 (29.09.1998). Entire document.	1-18
A	US 4,200,355 A (Williams, Jr.) 29 April 1980 (29.04.1980). Entire document.	1-18
A	US RE46,011 E (Lightforce USA, Inc.) 24 May 2016 (24.05.2016). Entire document.	1-18
A	US 2009/0000176 A1 (Robitaille) 01 January 2009 (01.01.2009). Entire document.	1-18
A	US D275,495 S (Tominaga) 11 September 1984 (11.09.1984). Entire document.	1-18



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"D" document cited by the applicant in the international application

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

16 April 2021

Date of mailing of the international search report

JUN 03 2021

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US, Commissioner for Patents
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 21/13596

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be searched, the appropriate additional search fees must be paid.

Group I: Claims 1-18 are directed to a main body of a viewing optic comprising at least one void in the main body.

Group II: Claims 19-20 directed to a method of machining a void in a scope body.

-*- Continued in extra sheet -*-

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-18

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 21/13596

-*- Continuation of Box No. III - Observations where unity of invention is lacking -*-

The inventions listed as Groups I-II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

SPECIAL TECHNICAL FEATURES

The invention of Group II includes the special technical feature of a method of machining at least one void in a scope body including, inserting a scope tube blank into a CNC mill, indexing the blank at 45 degrees off a normal axis of the blank (see NOTES), and machining, using an end mill, at least one void perpendicular to an axis of the end mill, not required by the claims of Group I.

COMMON TECHNICAL FEATURES

Groups I-II share the technical features of a main body of a viewing optic comprising at least one void in the main body. Specifically, Groups I and II are related as an apparatus (Group I) and methods of making the apparatus (Group II). The apparatus is known in prior art as shown in US 5,363,559 A (MCCARTY). Therefore, Groups I and II lack unity since the shared technical features do not represent a contribution over MCCARTY which discloses:

Regarding claim 1, MCCARTY discloses a main body (Fig. 12 - see outer tube mounting area 22 showing enlarged section of the telescope outer tube 21 extending axially as best shown in Fig. 1; col 3, ln 22-23 "FIG. 1 is a side view of a prior art rifle showing a typical telescope attached to the rifle.", ln 26-30 "FIG. 3 is a cross sectional view, taken through lines 3--3 of FIG. 1 showing the inside of the telescope of FIG. 1 or FIG. 2 and how a typical prior art telescope uses two adjustment screws with an oppositely positioned spring bias only on the inner erector guide tube.", ln 36-40 "FIG. 5 is a cross sectional view, similar to the view of FIG. 3 showing the applicant's new and novel biasing locking means which combines a locking screw with a spring bias and which will be described more fully hereinafter.", ln 64-68 "FIG. 12 is a cross sectional view, similar to the view of FIG. 5, showing a modification the applicant's invention using two spring biased locking means positioned opposite to the windage and elevation adjustment screws of the telescope."; col 4, ln 10-32; col 4, ln 64-col 5, ln 4; col 5, ln 36-48; col 9, ln 38-48) of a viewing optic (col 1, ln 6-18) comprising at least one void (Fig. 12 - see area 22 showing un-numbered bores receiving threaded sections 54, 56 of adjustment screws 18, 20 and tube biasing locking means 84 of biasing locking means 80 are voids extending through walls of area 22; col 3, ln 22-23, ln 26-30, ln 36-40, ln 64-68; col 4, ln 10-44; col 4, ln 64-col 5, ln 11; col 5, ln 36-56; col 9, ln 38-48) in the main body (Fig. 12 - see outer tube mounting area 22 showing enlarged section of the telescope outer tube 21 extending axially as best shown in Fig. 1; col 3, ln 22-23, ln 26-30, ln 36-40, ln 64-68; col 4, ln 10-32; col 4, ln 64-col 5, ln 4; col 5, ln 36-48; col 9, ln 38-48).

As the common technical features were known in the art at the time of the invention, these cannot be considered special technical feature that would otherwise unify the groups.

Therefore, Groups I-II lack unity under PCT Rule 13 because they do not share a same or corresponding special technical feature.

NOTES:

Regarding claim 19, the recitation "indexing the blank at 45 degrees off its normal axis;" is confusing and lacks clarity. Specifically, the term "normal axis" lacks proper antecedent basis. Based upon the applicant's specification and drawings, this ISA has interpreted the term "normal axis" as 'a normal axis of the blank'. For the purposes of this opinion, the term "normal axis" has been interpreted as 'a normal axis of the blank', which provides proper antecedent basis.