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(54) **ROTATIONAL POSITION SENSOR**

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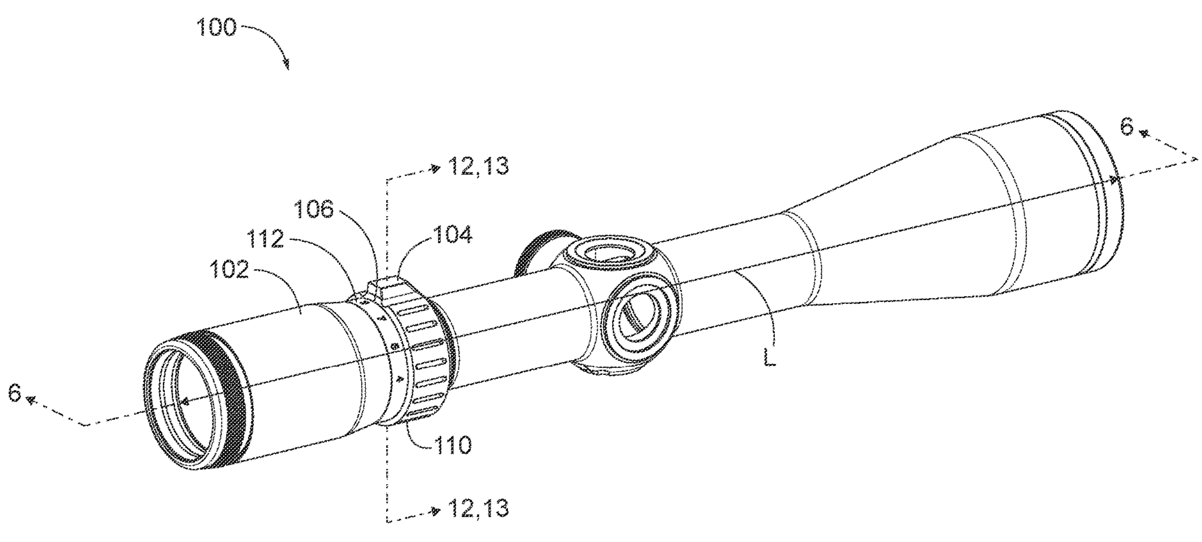
(52) **U.S. Cl.**

CPC ***G02B 7/04*** (2013.01); ***G01D 5/30*** (2013.01); ***G02B 23/16*** (2013.01); *F41G 1/38* (2013.01)

(57) **ABSTRACT**

A rotational position sensor assembly for detecting the selected rotational position of a rotatable selector is provided including a reference member positioned about an axis; a proximity sensor disposed on the reference member; a rotatable selector defining an inner surface, the rotatable selector mounted about the reference member and rotatable about the axis, the inner surface and the proximity sensor defining a gap there between, wherein the gap varies with respect to the rotational position of the rotatable selector, the proximity sensor generating a signal proportional to the size of the gap; and a processor and a non-transitory computer readable storage medium, the computer readable storage medium including instructions executable by the processor to receive the signal proportional to the size of the gap from the proximity sensor; and correlate the signal with a rotational position of the rotatable selector.



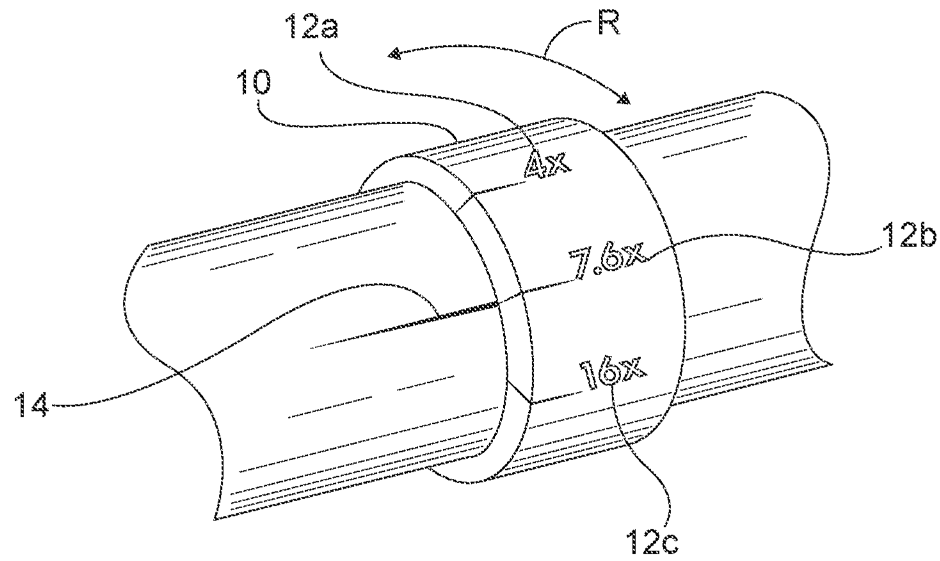


FIG. 1

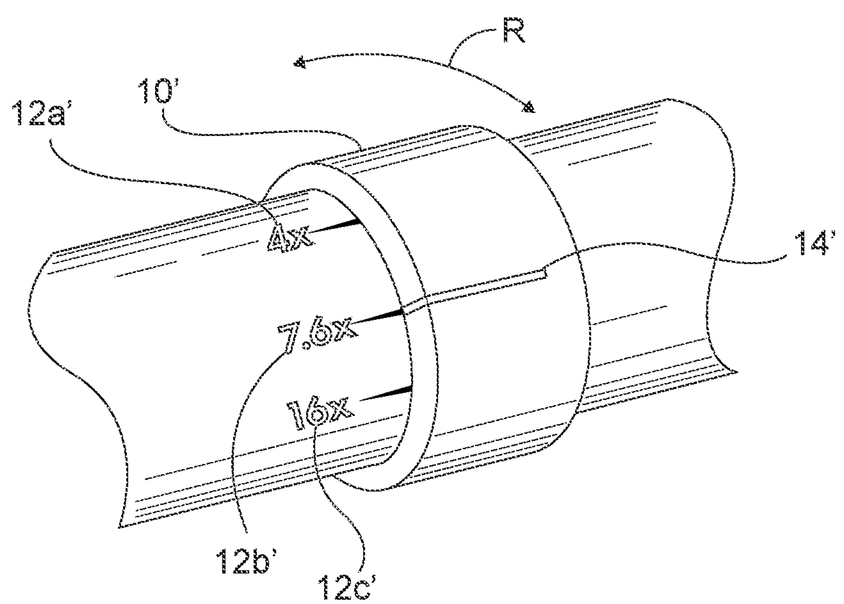


FIG. 2

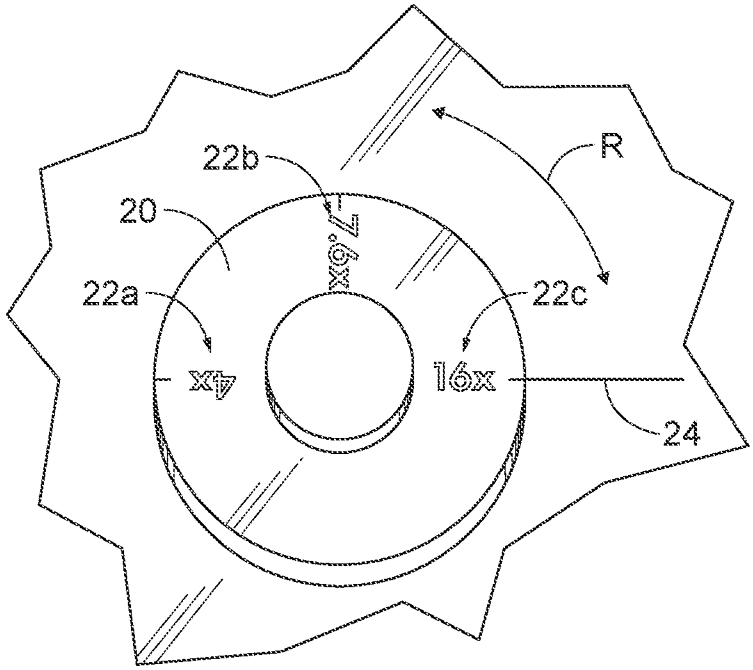


FIG. 3

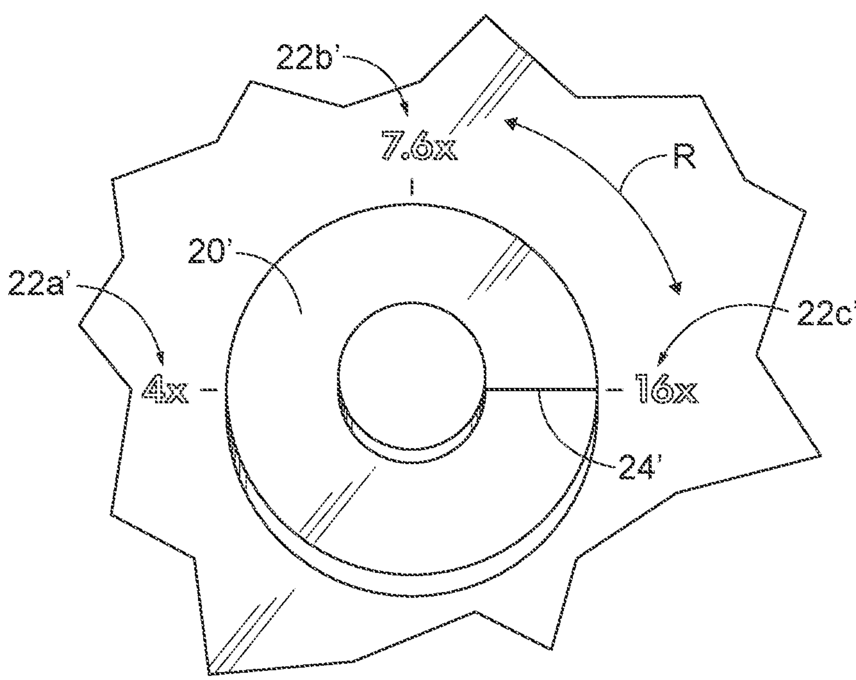


FIG. 4

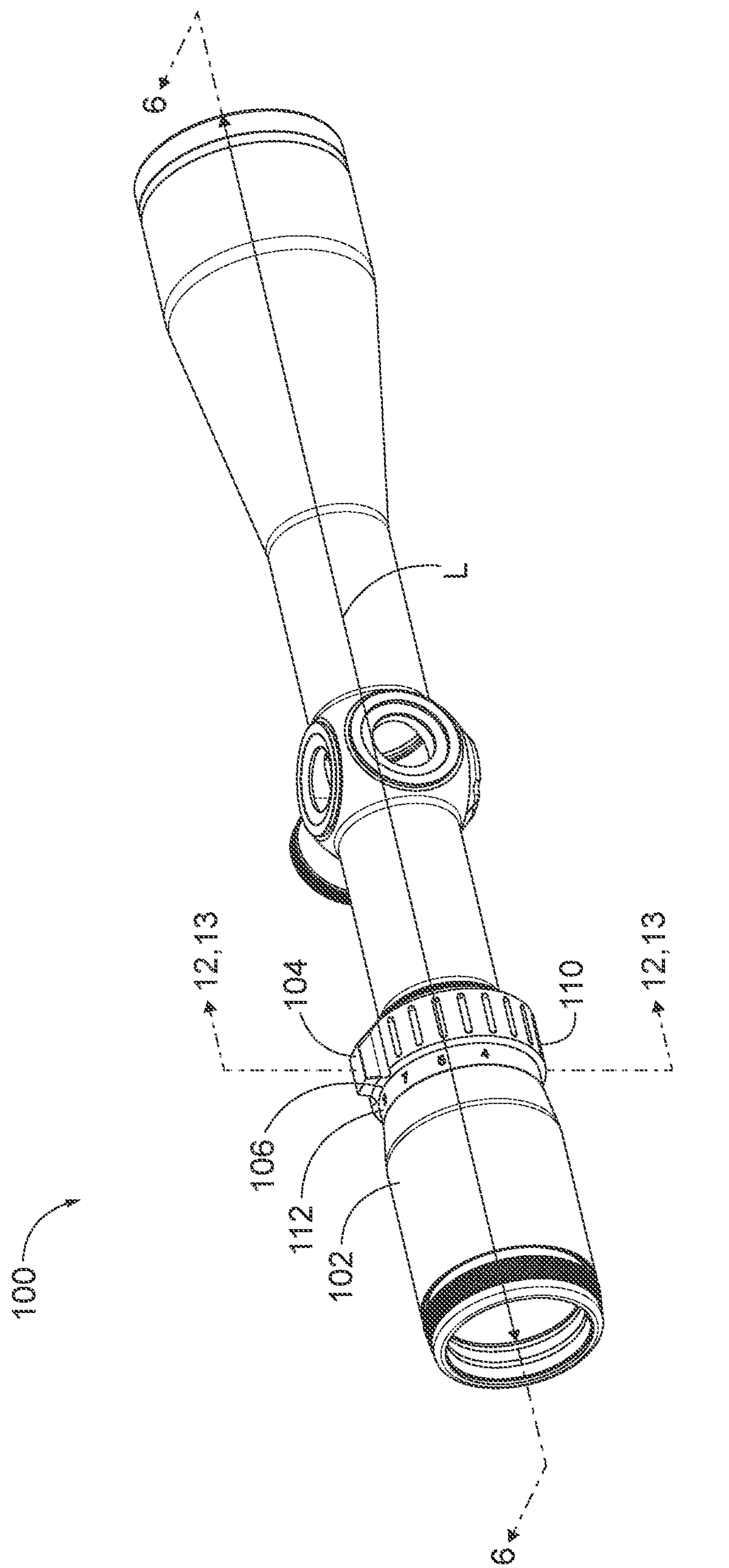


FIG. 5

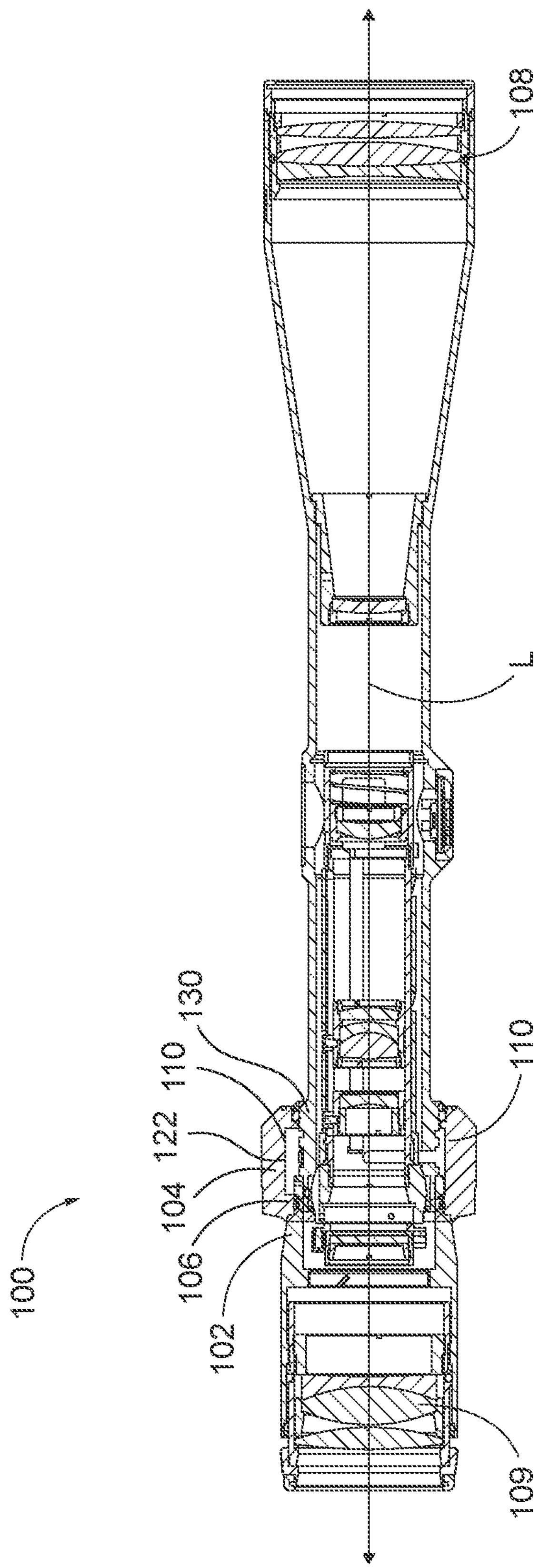


FIG. 6

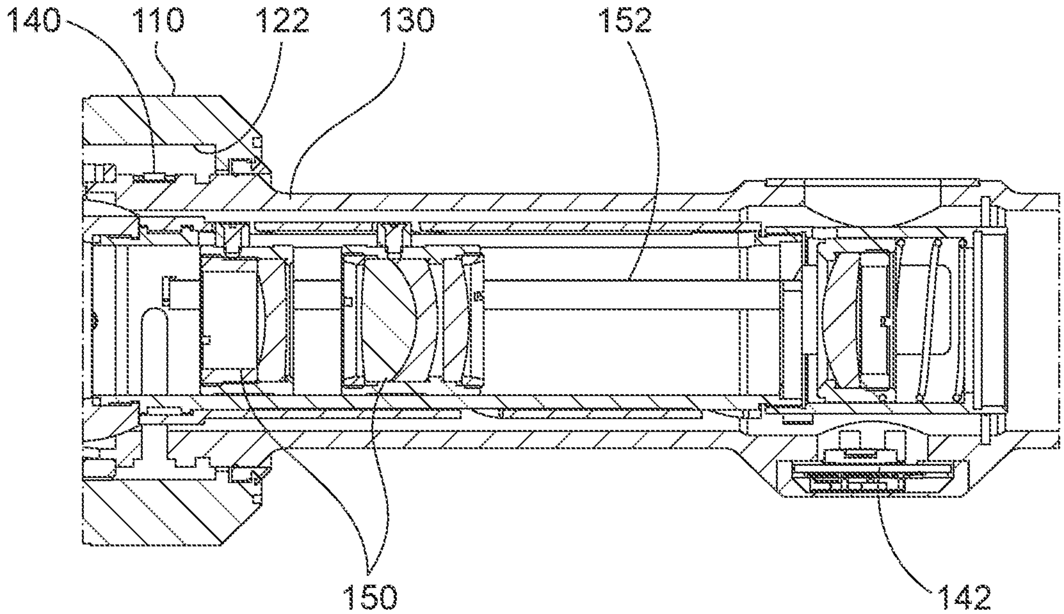


FIG. 7A

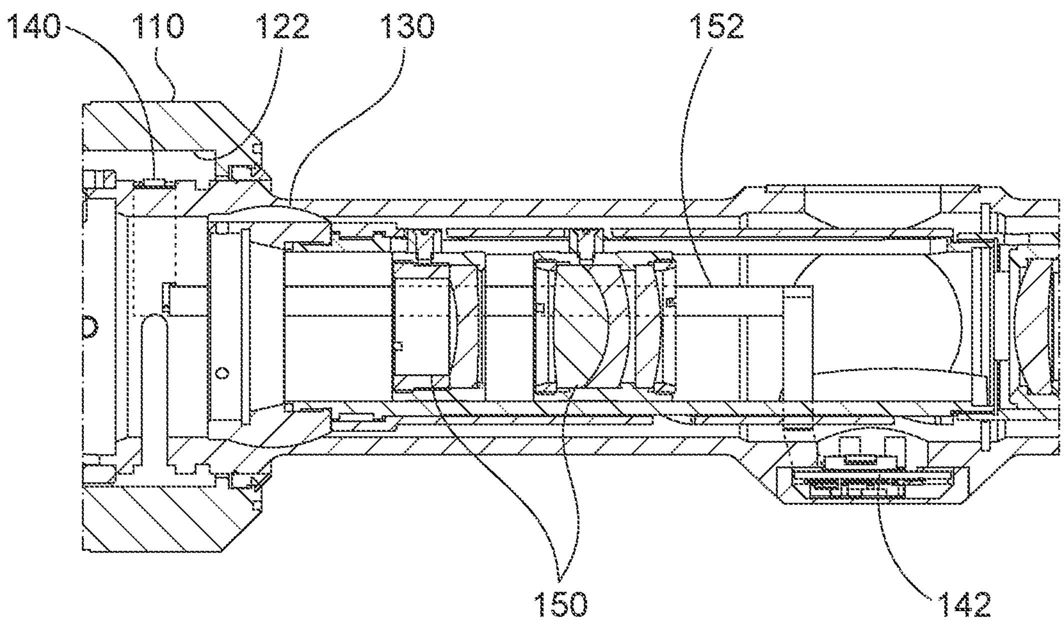


FIG. 7B

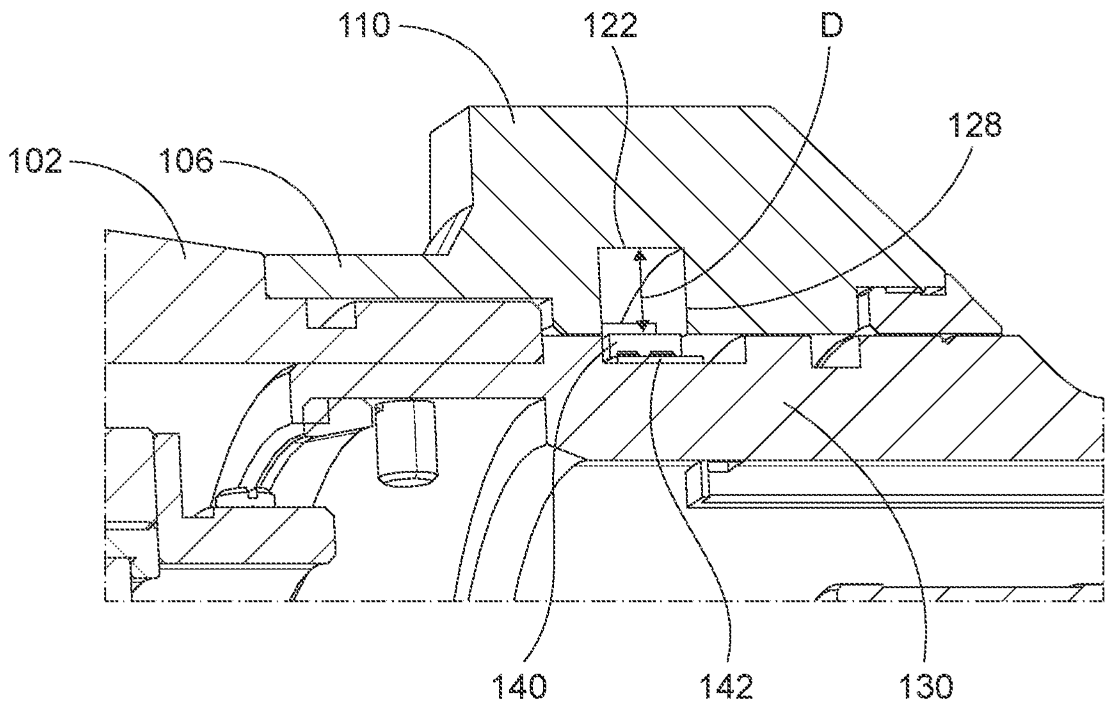


FIG. 8

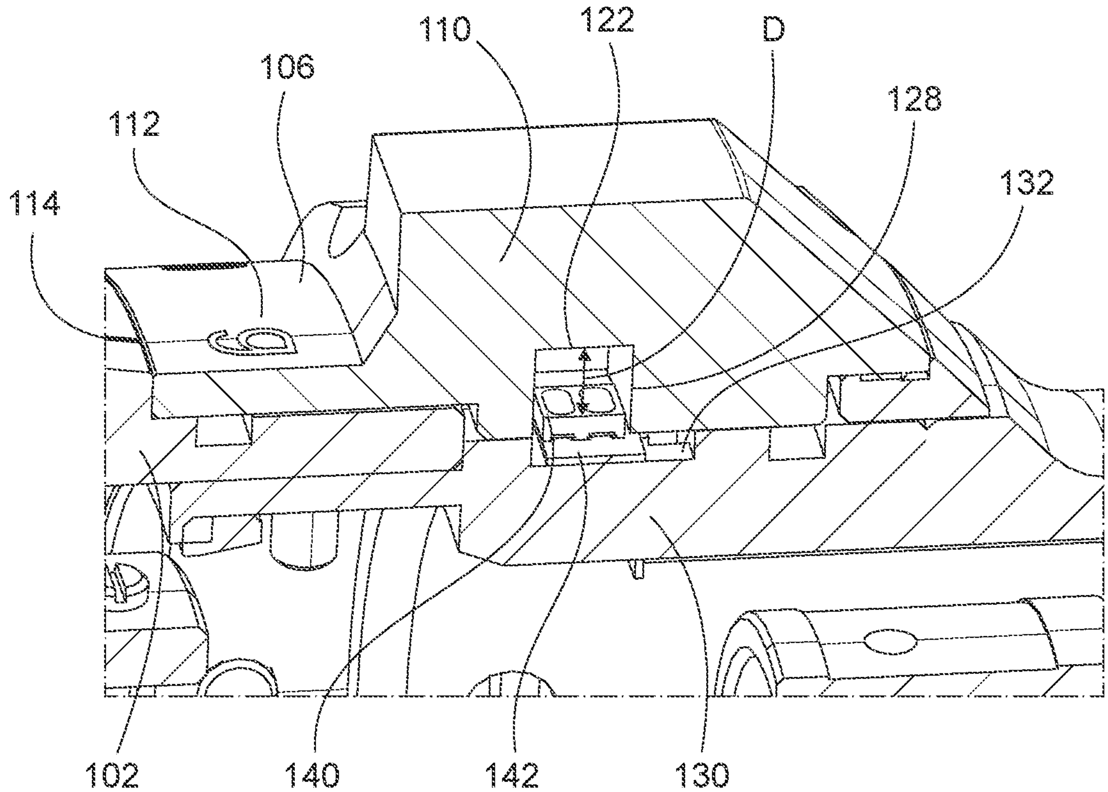


FIG. 9

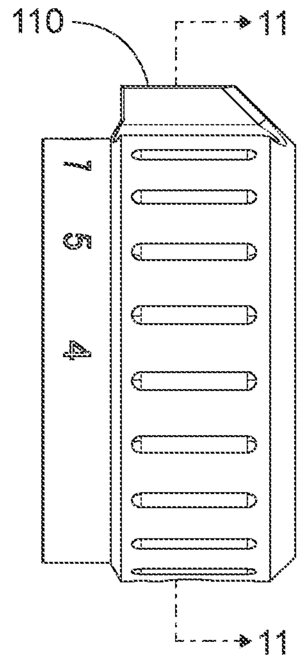


FIG. 10

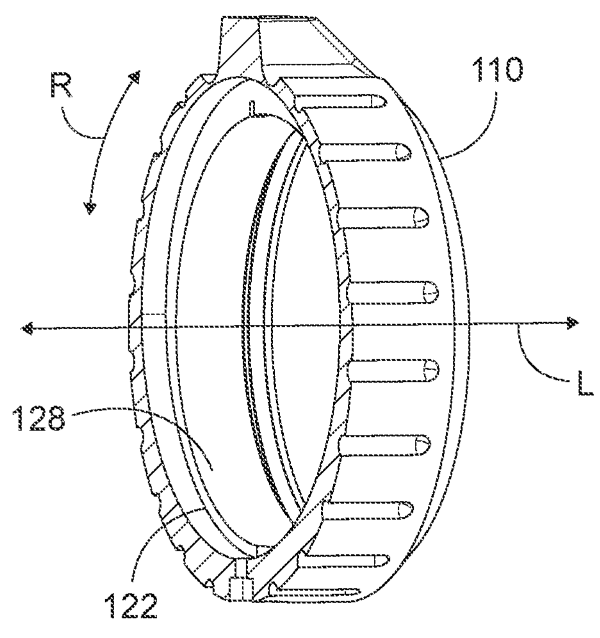


FIG. 11

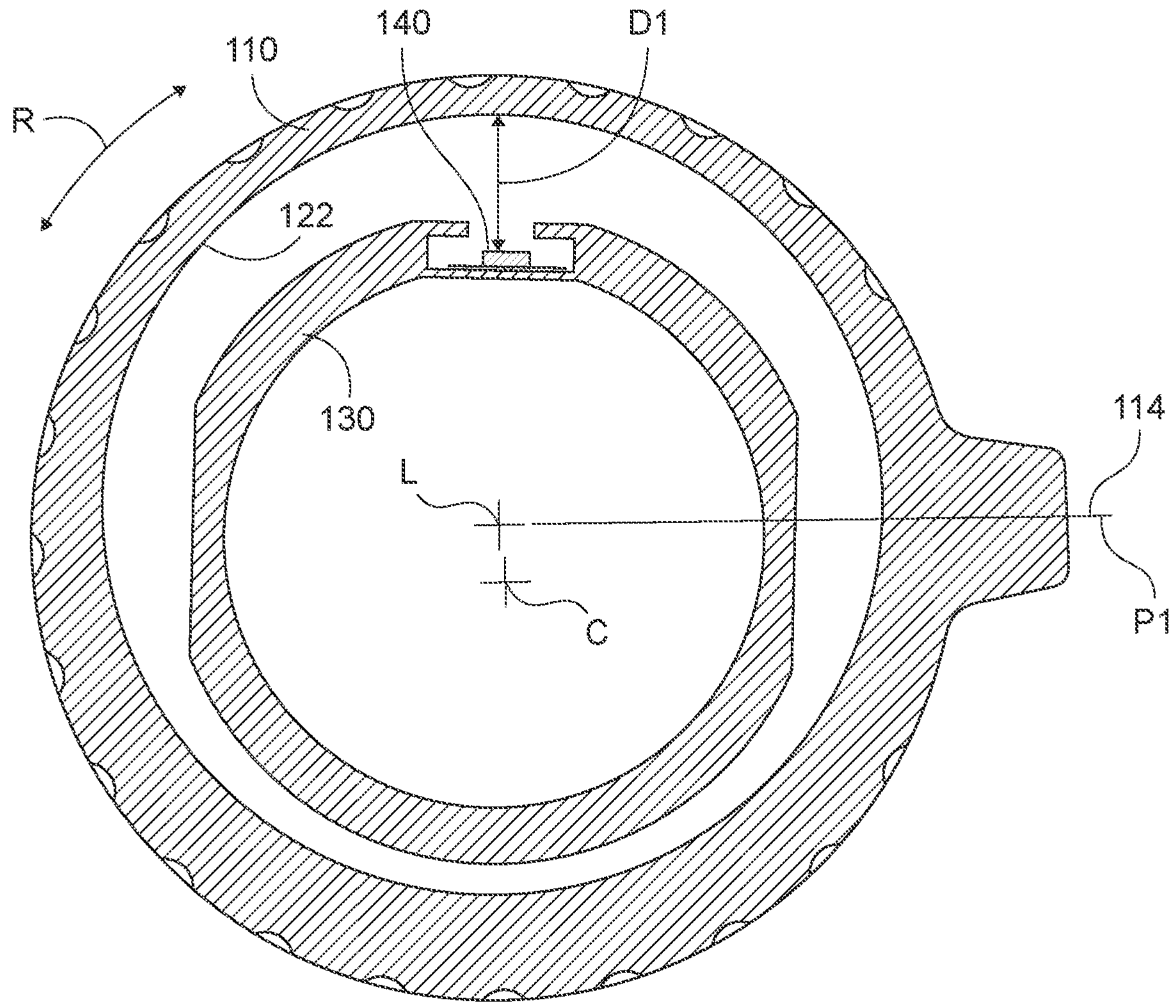


FIG. 12

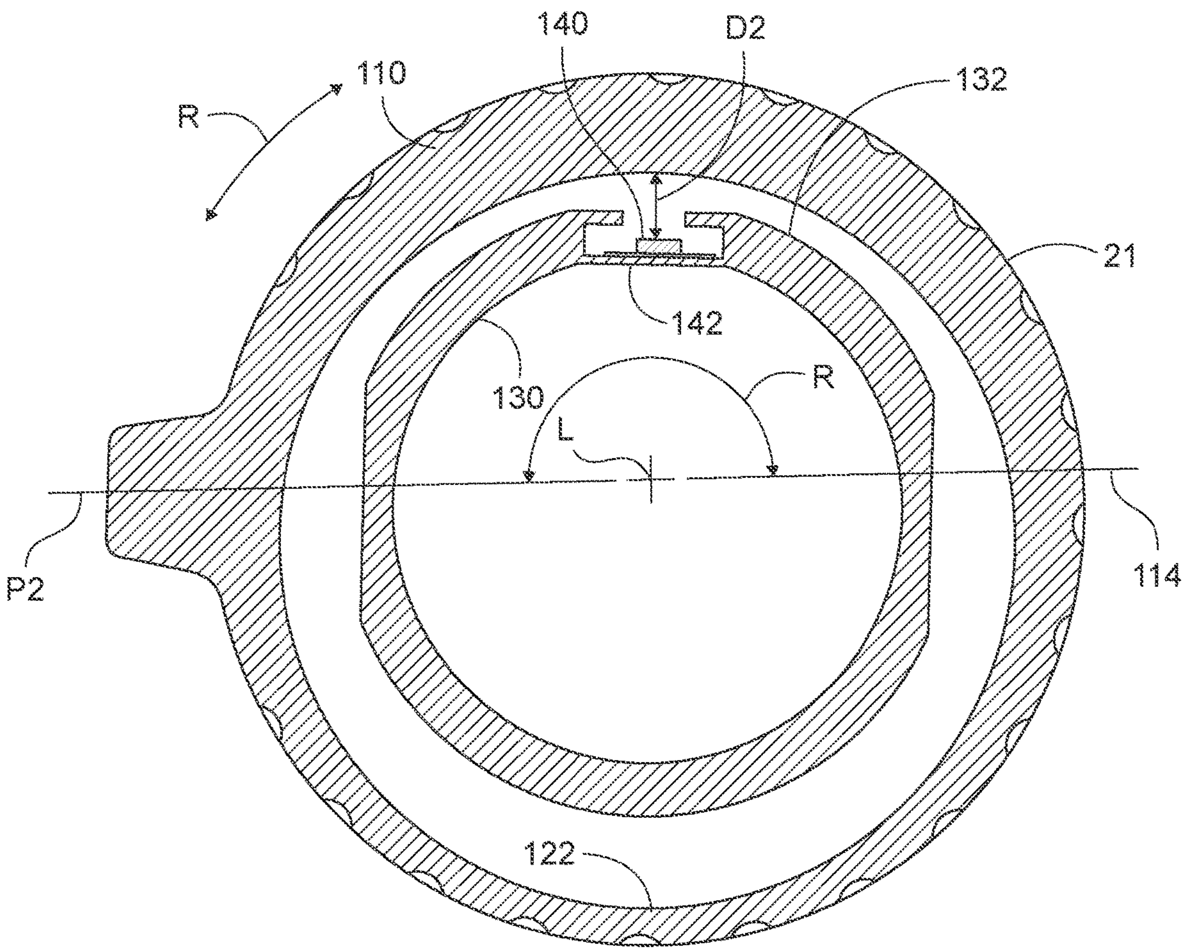


FIG. 13

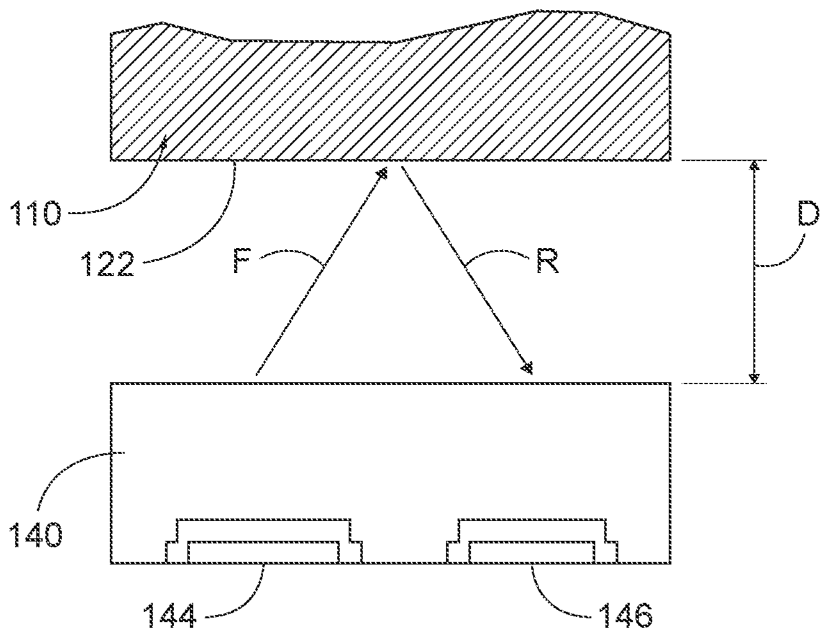

110
122
F
R
D
140
144
146

FIG. 14

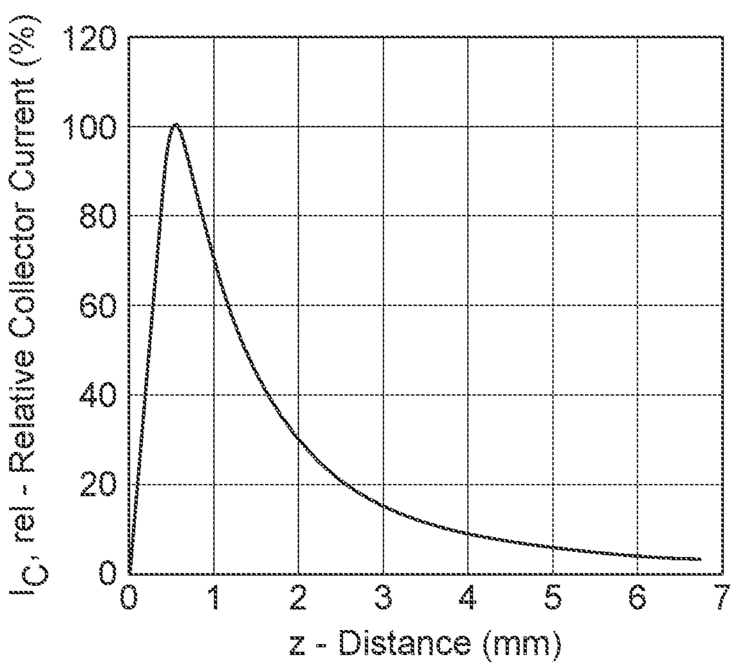

I_C, rel - Relative Collector Current (%)
120
100
80
60
40
20
0
0
1
2
3
4
5
6
7
z - Distance (mm)

FIG. 15

ROTATIONAL POSITION SENSOR

FIELD

[0001] The field of the present disclosure relates to sensors for detecting the rotational position of a selector and providing an output signal relating to the detected position.

DESCRIPTION OF RELATED ART

[0002] Many electro-mechanical devices include user-selected settings, such as magnification, focus, aperture opening, volume, power level, etc., which are provided by an input device, such as a rotatable selector, such as a knob or a ring. Such user-selected settings are often required for other purposes in operation of the device, such as the user interface or other user-assistance features. Typically, once the user selection is made, the user can view the selection made by the selector, and manually enter the selection into the user interface for further use. Optimally, the selection is automatically detected by the apparatus without further user input.

[0003] U.S. Pat. No. 6,253,630 describes a system for detecting the rotational position of a steering wheel. This system relies on a resistance sheet disposed on the steering column and wipers that are in contact with the steering shaft. Depending on the rotational position of the steering wheel, a level of voltage is defined, analogous to the operation of a standard commercially available potentiometer. The rotational position of the steering wheel can be determined on the basis of these voltages. This technique requires the moving and non-moving components to be in physical contact at all times.

[0004] U.S. Pat. No. 8,196,835 provides a method of determining the position of an object. Position markers, encoded with their identity, are viewed with a camera, images are captured and processed, and the position and rotational orientation of the object are calculated. This technique requires the use of a large number of position markers, each having their information pre-stored

[0005] Accordingly, there is a need for a sensor to detect the position of a selector device that is accurate and that does not require extensive hardware or data for use.

SUMMARY

[0006] In one aspect of the disclosed subject matter, a rotational position sensor assembly for detecting the selected rotational position of a rotatable selector is provided including a reference member positioned about an axis; a proximity sensor disposed on the reference member; a rotatable selector defining an inner surface, the rotatable selector mounted about the reference member and rotatable about the axis, the inner surface and the proximity sensor defining a gap there between, wherein the gap varies with respect to the rotational position of the rotatable selector, the proximity sensor generating a signal proportional to the size of the gap; and a processor and a non-transitory computer readable storage medium, the computer readable storage medium including instructions executable by the processor to receive the signal proportional to the size of the gap from the proximity sensor; and correlate the signal with a rotational position of the rotatable selector.

[0007] In some embodiments, the processor is configured to correlate the rotational position of the rotatable selector with a user selected setting. In some embodiments, the processor is configured to generate an output signal corresponding to the user selected setting.

[0008] In some embodiments, the user selected setting is a magnification setting. In some embodiments, the fixed reference member is a ring defining a central opening. In some embodiments, the proximity sensor is an optical proximity sensor. In some embodiments, the gap includes a range of 1-5 mm. In some embodiments, the selector is a ring.

[0009] In another aspect of the disclosed subject matter, a rotational position sensor assembly for detecting the selected rotational position of a rotatable selector is provided including a fixed reference member positioned about an axis and defining a first surface; a rotatable selector mounted about the fixed reference member and rotatable about the axis, the rotatable selector defining a second surface opposing the first surface; a proximity sensor disposed on one of the fixed reference member and the rotatable selector, wherein the proximity sensor and the second surface define a gap therebetween when the proximity sensor is disposed on the fixed reference member and the proximity sensor and the first surface define the gap therebetween when the proximity sensor is disposed on the rotatable selector, wherein the gap varies with the rotational position about the axis of the rotatable selector with respect to the fixed reference member, the proximity sensor generating a signal proportional to the size of the gap; and a processor and a non-transitory computer readable storage medium, the computer readable storage medium including instructions executable by the processor to receive the signal proportional to the size of the gap from the proximity sensor; and correlate the signal with a rotational position of the rotatable selector.

[0010] In some embodiments, the processor is configured to correlate the rotational position of the rotatable selector with a user selected setting. In some embodiments, the processor is configured to generate an output signal corresponding to the user selected setting.

[0011] In some embodiments, the user selected setting is a magnification setting. In some embodiments, the fixed reference member is a ring defining a central opening. In some embodiments, the proximity sensor is an optical proximity sensor. In some embodiments, the gap includes a range of 1-5 mm. In some embodiments, the selector is a ring.

[0012] In a further aspect of the disclosed subject matter, an aiming device for displaying a down-range image and a reticle display field is provided including a housing defining an axis; an objective disposed in the housing for producing the image of the down-range image; an eyepiece disposed in the housing for displaying a down-range image and a reticle display field; a lens element disposed in the housing and having adjustable optical magnification; a rotational position sensor assembly comprising: a fixed reference ring positioned about the axis; a proximity sensor disposed on the fixed reference ring; a rotatable selector to adjust an optical magnification of the image of the down-range image, the selector defining an inner surface, the rotatable selector mounted about the fixed reference member and rotatable about the axis, the inner surface and the proximity sensor defining a gap there between, wherein the gap varies with respect to the rotational position about the axis of the rotatable selector, the proximity sensor generating a signal proportional to the size of the gap; and a processor and a non-transitory computer readable storage medium, the computer readable storage medium including instructions executable by the processor to receive the signal proportional to the size of the gap from the proximity sensor; and correlate the signal with a rotational position of the rotatable selector.

[0013] In some embodiments, the processor is configured to correlate the rotational position of the rotatable selector with a user selected setting. In some embodiments, the processor is configured to generate an output signal corresponding to the user selected setting.

[0014] In some embodiments, the user selected setting is a magnification setting. In some embodiments, the fixed reference member is a ring defining a central opening. In some embodiments, the proximity sensor is an optical proximity sensor. In some embodiments, the gap includes a range of 1-5 mm. In some embodiments, the selector is a ring.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The disclosed aspects will hereinafter be described in conjunction with the appended drawings, provided to illustrate and not to limit the disclosed aspects, wherein like designations denote like elements.

[0016] FIGS. **1-2** illustrates a rotatable selector in a first and second position.

[0017] FIGS. **3-4** illustrates another rotatable selector in a first and second position.

[0018] FIG. **5** is a perspective view of a sensor assembly used in a firearm scope in accordance with an exemplary embodiment of the disclosed subject matter.

[0019] FIG. **6** is a longitudinal cross section view of the rotational position sensor assembly taken along lines **6-6** of FIG. **5**.

[0020] FIG. **7**A is an enlarged view of the longitudinal cross section of FIG. **6** with a lens carriage in a first position.

[0021] FIG. **7**B is an enlarged view of the longitudinal cross section of FIG. **6** with a lens carriage in a second position.

[0022] FIG. **8** is an enlarged view of the longitudinal cross section of FIG. **6** taken at the selector ring.

[0023] FIG. **9** is an enlarged longitudinal cross-section of the scope of FIG. **5** rotated from the position of FIG. **8**.

[0024] FIG. **10** is a side view of the selector ring of the scope in accordance with an exemplary embodiment of the disclosed subject matter.

[0025] FIG. **11** is a cross-sectional view in perspective of the selector ring taken along line **11-11** of FIG. **10** in accordance with an exemplary embodiment of the disclosed subject matter.

[0026] FIG. **12** is an axial cross-sectional view of the rotational position sensor assembly in a first position, taken along line **12-12** of FIG. **5**.

[0027] FIG. **13** is an axial cross-sectional view of the rotational position sensor assembly in a second position, taken along line **13-13** of FIG. **5**.

[0028] FIG. **14** is an enlarged view of the rotation position sensor illustrated in FIGS. **12-13**.

[0029] FIG. **15** is a plot illustrating the gap distance vs. sensor output.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0030] Various aspects of the apparatuses and methods disclosed herein are described more fully hereinafter with reference to the accompanying drawings. This disclosure may, however, be embodied in many different forms and should not be construed as limited to any specific structure or function presented throughout this disclosure.

[0031] As used throughout the description herein a rotatable selector or control device is rotated, e.g., by a user, in order to select any number of settings on mechanical and electronic devices. In some embodiments, the selector is a selector ring or a selector knob.

[0032] As illustrated in FIG. **1**, selector ring **10** typically includes a number of visible markings **12***a*, **12***b*, **12***c* representing a plurality of levels (magnification settings, volume levels, power levels, etc.) The selector ring **10** is rotatable (in direction R) with respect to a stationary reference **14**. The user can rotate the selector ring **10** such that the desired level marking **12***a*, **12***b*, **12***c* are aligned with the stationary reference **14**. In some cases, as shown in FIG. **2**, the selector ring **10'** includes the reference **14'**, and the various levels **12***a*', **12***b*', and **12***c*' are fixed. In such case, the user can rotate the selector ring **10'** such that the reference **14'** on the selector ring **10'** is aligned with the desired stationary level marker **12***a*', **12***b*', and **12***c*.

[0033] As illustrated in FIG. **3**, selector knob **20** is functionally identical to ring **10**. Knob **20** includes a number of visible markings **22***a*, **22***b*, **22***c* representing a plurality of levels (magnification settings, volume levels, power levels, etc.) The selector knob **20** is rotatable (in direction R) with respect to a stationary reference **24**. The user can rotate the selector knob **20** such that the desired level marking **22***a*, **22***b*, **22***c* are aligned with the stationary reference **24**. In some cases, as shown in FIG. **4**, the selector knob **20** includes the reference **24'**, and the various levels **22***a*', **22***b*', and **22***c*' are fixed. In such case, the user can rotate the selector knob **20'** such that the reference **24'** on the selector knob **20'** is aligned with the desired stationary level marker **22***a*', **22***b*', and **22***c*.

[0034] User-selected settings can include a magnification setting, a volume setting, a power setting, etc. On the other hand, there may be a need for detect the user-selected setting, e.g., a system input that relies on the user setting. For example, the selector ring or knob may be used to mechanically adjust the magnification setting of a lens on a viewing scope. At the same time, the magnification setting is needed to vary a reticle display in accordance with the magnification setting. Thus, there is a need for the magnification setting, as selected by the selector ring, to be automatically detected and provided to the reticle display system to provide the appropriate scaling of the reticle.

[0035] A rotational position sensor assembly is described herein in connection with a firearm scope **100** or other direct view optical aiming device in an exemplary embodiment of the disclosed subject matter. It is understood that the rotational position sensor assembly can be used in connection with other apparatuses for detecting the user-selected rotational position of a rotatable selector ring or knob or control device.

[0036] Generally, a direct view optical sighting device includes one or more lenses, prisms, or other optical components that operate to enhance the human eye and may include pistol scopes, spotting scopes, rangefinders, bow sights, or other riflescopes that differ from those specifically discussed herein. FIGS. **5-6** illustrate an exemplary embodiment of a rotational position sensor assembly used with a firearm scope **100** according to the present disclosure. With reference to FIG. **6**, scope **100** includes a typically elongated and tubular housing **102** supporting an objective **108** adjacent a target-facing end of the housing **102**, an eyepiece **109** adjacent a viewing end of the housing **102**.

[0037] The rotational position sensor assembly used in connection with firearm scope **100** detects a user-selected magnification setting as selected by the rotatable selector ring, or magnification setting ring **110**. The magnification setting ring **110** includes a user-engageable portion **104** that may be knurled or textured and a ring portion **106** being inscribed with magnification settings **112**. The user may select a magnification setting by rotating the magnification setting ring **110** with respect to the fixed housing **102**, and aligning the desired magnification setting **112** with an inscribed reference **114** on the fixed housing **102**. (See, e.g., FIG. **9**).

[0038] As shown in FIGS. **7A-7B**, rotation of the magnification setting ring **110** cause a lens element disposed in the housing and having adjustable optical magnification, e.g., the magnification lens or lens group mounted on an associated carriage **150**, to move along the optical axis L to optically magnify the image to vary the size of image visible to the user at the eyepiece **109**. As illustrated in FIG. **7A**, when the magnification setting ring **110** is rotated to a first position, the magnification lens carriage **150** is positioned at a first location along the optical axis L. As illustrated in FIG. **7B**, when the magnification setting ring **110** is rotated to a second position, the magnification lens carriage **150** is positioned at a second location along the optical axis L

[0039] The scope may include an electronic display that generates an image display of a reticle. The reticle may be displayed at the rear focal plane, or alternatively at the front focal plane. The output of the rotational position sensor assembly is in communication with an electronic controller to receive a signal indicative of the adjustment of the magnification by the setting ring **110**. The electronic controller may, e.g., continuously resize the reticle in response to the signal indicating a continuous adjustment of the optical magnification of riflescope. In some embodiments the rotational position sensor assembly is used to show correct yardages on a given ballistic drop compensated reticle in the scope **100** or in an application on a connected computing device, such as a mobile device wirelessly connected to the scope **100**. In some embodiments, the user can set preferred magnification points. When the preferred magnification points are selected, the scope alerts the user that the selector knob or ring has been rotated to such preferred magnification setting. In some embodiments, the rotational position sensor assembly can be used as an input control when a rotational position is selected. In some embodiments, the rotational position sensor assembly can be used to move up/down or left/right through a menu system. In some embodiments, the rotational position sensor assembly can be used to make adjustments to illumination or other settings in an electronic riflescope. It is understood that the selector ring or knob is useful to use rotational position to provide any number of inputs to an associated system.

[0040] FIGS. **5-9** illustrate the rotational position sensor assembly. In some embodiments, the sensor assembly includes a fixed reference ring **130**, a rotatable selector ring **110**, a proximity sensor **140** and processor and memory, disposed on a PCB **142**. An exemplary processor is an STM32 32-bit microncontroller manufactured by STMicroelectronics, but it is understood that any microcontroller with an ADC would be suitable in this capacity. The reference ring **130** is positioned about the longitudinal axis L and defines an outer surface **132** (See FIG. **9**). The reference ring **130** can be fixed with respect to the housing **102**. A proximity sensor **140** is disposed on the fixed reference ring **130**, and positioned on the ring **130** such that the sensing component is disposed radially outwardly from the longitudinal axis L. As illustrated in FIG. **7B**, the proximity sensor **140** is electrically coupled to the PCB **142** via conductor, such as a copper or other metallic ribbon **152** positioned on the inner portion of the housing **102** and partially shown in dashed line.

[0041] Rotatable selector ring **110** is rotatably mounted about the fixed reference ring **130** about the longitudinal axis L, and has a substantially cylindrical shape. In some embodiments, an annular groove **128** is provided in the inner portion of the ring **110**. The groove **128** defines an inner surface **122**. As shown in FIG. **12**, the inner surface **122** may be substantially circular having a center C that is offset from the longitudinal axis L. In some embodiments, the inner surface **122** is oval or elliptical or other shapes. As shown in FIG. **9**, a gap distance D is defined between the inner surface **122** of the rotatable ring **110** and the proximity sensor **140**. As shown in FIGS. **12** and **13**, the gap distance D**1**, D**2** varies as the rotatable selector ring **110** is rotated about the longitudinal axis L. Accordingly, the shape of the inner surface **122** defines a “ramp” that varies the gap distance with the rotational position of the selector ring **110**. In some embodiments, the inner surface **122** is circular, defining a substantially constant distance from the Longitudinal axis L, and the outer contour **132** defines the ramp that varies the gap distance with the rotational position of the selector ring **110**.

[0042] In some embodiments, the proximity sensor **140** is s a reflective optical sensor, such as VCNT2020, manufactured by Vishay Semiconductors. It is understood that any proximity sensor known in the art for measuring the proximity of objects on the order of several millimeters is suitable for use. The proximity sensor arrangement is shown in FIG. **14**. The gap distance or working distance D is defined between the proximity sensor **140** and the opposing surface. In the exemplary embodiment, the sensor **140** is disposed on the fixed ring **130**, and the opposing surface is the inner surface **122** of selector ring **110**. In some embodiments, the sensor **140** is disposed on the selector ring **110**, and the opposing surface is disposed on the fixed ring **130**. In some embodiments, the sensor **140** includes an LED emitter **144** and a detector **146**. The emitter **144** emits light, e.g., IR light at 950 nm, which travels on a forward path F to the inner surface **122**. The light is reflected back to the detector **146** on the return path R. As the selector ring **122** is rotated, the gap distance D changes. Accordingly, the light reflected back by the inner surface **122** to the detector **146** also changes. The output of the sensor **140** is a current proportional to the light reflected back to it from the inner surface **122**. As shown in FIG. **15**, changing the gap distance from 1 mm to 3 mm changes the output current by about 50%. Other proximity sensors known in the art, such as inductive proximity sensors or magnetic proximity sensors may be used to determine the gap distance D.

[0043] FIG. **12** illustrates a first position P**1** of the rotatable selector ring **110** with respect to the proximity sensor **140** in an exemplary embodiment. Position P**1** can be arbitrarily defined as 0° with respect to a reference **114**. Position P**1** is associated with a 16× magnification. In this first position, a gap D**1** of 1 mm is defined between the inner surface **122** and the proximity sensor **140**. The gap D**1** is associated with a position P**1** of the rotatable selector ring **110**.

[0044] FIG. **13** illustrates a second position of the rotatable selector ring **110** with respect to the proximity sensor **140** in an exemplary embodiment. Position P**2** can be arbitrarily defined as 180° with respect to reference **114**. Position P**2** is associated with a 4× magnification. In this second position, a gap D**2** of 3 mm is defined between the inner surface **122** and the proximity sensor **140**. The gap D**2** is associated with a position P**2** of the rotatable selector ring **110**.

[0045] The proximity sensor **140** generates a signal proportional to the size of the gap. For example, the proximity sensor generates a signal S**1** associated with gap D**1** and a signal S**2** associated with gap D**2**. A data structure, such as a table associating the signal strength with the gap distance D**1**, D**2**, etc., and the positions of the rotatable selector ring **110** P**1**, P**2**, etc., is stored for access by a processor on the firearm scope **100**. Exemplary TABLE 1 illustrates the correlation between the signal strength, the gap distance and the position of the selector ring **110**. As will be described in greater detail below, the sensor assembly can be calibrated such that output signal at a first range, e.g., P**1**, is set to 0%, and the output signal at the second range, e.g., P**2**, is set to 100%.

TABLE 1

SIGNAL STRENGTH	GAP DISTANCE	POSITION OF SELECTOR RING
0%	3 mm	0°
50%	2 mm	90°
100%	1 mm	180°

[0046] In some embodiments, another table is stored to associate the detected position of the rotatable selector ring **110** with a user adjustments such as a magnification setting, a power setting, a volume setting, etc. Exemplary TABLE 2 illustrates the correlation between the user setting, such as magnification, and the position of the selector ring **110**.

TABLE 2

MAGNIFICATION	POSITION OF SELECTOR RING
4x	0°
7.6x	90°
16x	180°

In some embodiments, a single table is used to provide the correlation between the gap distance, the selector ring position and the user setting.

[0047] The firearm scope **10** includes a processor and a non-transitory computer readable storage medium, which may be disposed on the PCB **142**. The computer readable storage medium including instructions, such as software or firmware, executable by the processor to receive the signal proportional to the size of the gap generated by the proximity sensor **140**. By reference to the one or more tables stored on the device, the processor correlates the signal generated by the proximity sensor with a rotational position of the rotatable selector ring. For example, a signal strength of 0% (e.g., Gap D**1**) generated by the sensor **140** is correlated with the position 0° (e.g., P**1**) of the rotatable selector ring **110**. Subsequently, by reference to the one or more tables stored on the device, the rotational position of the rotatable selector ring **110** can be correlated with a user selected setting, such as a magnification setting (e.g., 16×), a power setting, a volume setting, etc. The detected user selected setting is provided as an output for use by the firearm scope **10** or other device. In some embodiments, the detected magnification setting is used to vary a reticle displayed by the scope. For example, on a second-focal plane reticle, the magnification determines the distance of any bullet-drop compensation markings on the reticle. Usually on the values for only one magnification setting are known by the user.

[0048] In use, the rotational position sensor assembly may need to be calibrated to provide accurate position readings. The sensor output may vary depending upon the LED drive current, the LED optical efficiency, the reflectivity of the inner surface **122** of the selector ring **110**, the actual size of the gap D, the sensitivity of the sensor. A calibration will take into account one or more of the variables described above. A first step of the calibration occurs after final assembly of the scope **10**. The processor includes a calibration mode. As a second step, selector ring **110** is rotated to the minimum position, e.g., P**1** (0°) and the sensor value is set to 0%. As a third step, selector ring **110** is rotated to the minimum position, e.g., P**2** (180°) and the sensor value is set to 100%. The calibration mode is then complete.

[0049] While the disclosure has been illustrated and described in detail in the drawings and foregoing description, such illustration and description are to be considered illustrative or exemplary and not restrictive. The disclosure is not limited to the disclosed embodiments. Variations to the disclosed embodiments and/or implementations can be understood and effected by those skilled in the art in practicing the claimed disclosure, from a study of the drawings, the disclosure and the appended claims. For example, a selector knob can be substituted for the selector ring to provide the same functionality described herein above.

[0050] With reference to the drawings, this section describes particular embodiments and their detailed construction and operation. The embodiments described herein are set forth by way of illustration only and not limitation. The described features, structures, characteristics, and methods of operation may be combined in any suitable manner in one or more embodiments. In view of the disclosure herein, those skilled in the art will recognize that the various embodiments can be practiced without one or more of the specific details or with other methods, components, materials, or the like. In other instances, well-known structures, materials, or methods of operation are not shown or not described in detail to avoid obscuring more pertinent aspects of the embodiments.

What is claimed is:

1. A rotational position sensor assembly for detecting the selected rotational position of a rotatable selector comprising:

a reference member positioned about an axis;

a proximity sensor disposed on the reference member;

a rotatable selector defining an inner surface, the rotatable selector mounted about the fixed reference member and rotatable about the axis, the inner surface and the proximity sensor defining a gap there between, wherein the gap varies with respect to the rotational position of the rotatable selector, the proximity sensor generating a signal proportional to the size of the gap; and

a processor and a non-transitory computer readable storage medium, the computer readable storage medium including instructions executable by the processor to:

receive the signal proportional to the size of the gap from the proximity sensor; and

correlate the signal with a rotational position of the rotatable selector.

2. The rotational position sensor assembly of claim **1**, wherein the processor is further configured to correlate the rotational position of the rotatable selector with a user selected setting.

3. The rotational position sensor assembly of claim **1**, wherein the processor is further configured to generate an output signal corresponding to the user selected setting.

4. The rotational position sensor assembly of claim **2**, wherein the user selected setting is a magnification setting.

5. The rotational position sensor assembly of claim **1**, wherein the reference member is a ring defining a central opening.

6. The rotational position sensor assembly of claim **1**, wherein the proximity sensor is an optical proximity sensor.

7. The rotational position sensor assembly of claim **1**, wherein gap includes a range of 1-5 mm.

8. The rotational position sensor assembly of claim **1**, wherein the selector is a ring.

9. A rotational position sensor assembly for detecting the selected rotational position of a rotatable selector comprising:

a fixed reference member positioned about an axis and defining a first surface;

a rotatable selector mounted about the fixed reference member and rotatable about the axis, the rotatable selector defining a second surface opposing the first surface;

a proximity sensor disposed on one of the fixed reference member and the rotatable selector, wherein the proximity sensor and the second surface define a gap therebetween when the proximity sensor is disposed on the fixed reference member and the proximity sensor and the first surface define the gap therebetween when the proximity sensor is disposed on the rotatable selector, wherein the gap varies with the rotational position about the axis of the rotatable selector with respect to the fixed reference member, the proximity sensor generating a signal proportional to the size of the gap; and

a processor and a non-transitory computer readable storage medium, the computer readable storage medium including instructions executable by the processor to:

receive the signal proportional to the size of the gap from the proximity sensor; and

correlate the signal with a rotational position of the rotatable selector.

10. The rotational position sensor assembly of claim **9**, wherein the processor is further configured to correlate the rotational position of the rotatable selector with a user selected setting.

11. The rotational position sensor assembly of claim **10**, wherein the user selected setting is a magnification setting.

12. The rotational position sensor assembly of claim **9**, wherein the fixed reference member is a ring defining a central opening.

13. The rotational position sensor assembly of claim **9**, wherein the proximity sensor is an optical proximity sensor.

14. The rotational position sensor assembly of claim **9**, wherein gap includes a range of 1-5 mm.

15. The rotational position sensor assembly of claim **9**, wherein the processor is further configured to generate an output signal corresponding to the user selected setting.

16. The rotational position sensor assembly of claim **9**, wherein the selector is a ring.

17. An aiming device for displaying a down-range image and a reticle display field comprising:

a housing defining an axis;

an objective disposed in the housing for producing the image of the down-range image;

an eyepiece disposed in the housing for displaying a down-range image and a reticle display field;

a lens element disposed in the housing and having adjustable optical magnification;

a rotational position sensor assembly comprising:

a fixed reference ring positioned about the axis;

a proximity sensor disposed on the fixed reference ring;

a rotatable selector to adjust an optical magnification of the image of the down-range image, the selector defining an inner surface, the rotatable selector mounted about the fixed reference member and rotatable about the axis, the inner surface and the proximity sensor defining a gap there between, wherein the gap varies with respect to the rotational position about the axis of the rotatable selector, the proximity sensor generating a signal proportional to the size of the gap; and

a processor and a non-transitory computer readable storage medium, the computer readable storage medium including instructions executable by the processor to:

receive the signal proportional to the size of the gap from the proximity sensor; and

correlate the signal with a rotational position of the rotatable selector.

18. The aiming device of claim **17**, wherein the processor is further configured to correlate the rotational position of the rotatable selector with a user selected setting.

19. The rotational position sensor assembly of claim **18**, wherein the user selected setting is a magnification setting.

20. The rotational position sensor assembly of claim **17**, wherein the proximity sensor is an optical proximity sensor.

21. The rotational position sensor assembly of claim **17**, wherein gap includes a range of 1-5 mm.

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