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(54) **ADJUSTMENT DEVICE FOR A HEAD-WORN VIEWING SYSTEM AND METHOD OF USE THEREOF**

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(52) **U.S. Cl.** **224/181**

(57) **ABSTRACT**

A device to adjust a position of a head-worn vision system such as a visual display apparatus in multiple directions. The device includes an adjustment assembly with a brake member and a mounting support moveably attached to the adjustment assembly in a fixed position by the brake member. The device allows simultaneous adjustment of a head worn vision system by release the brake member.

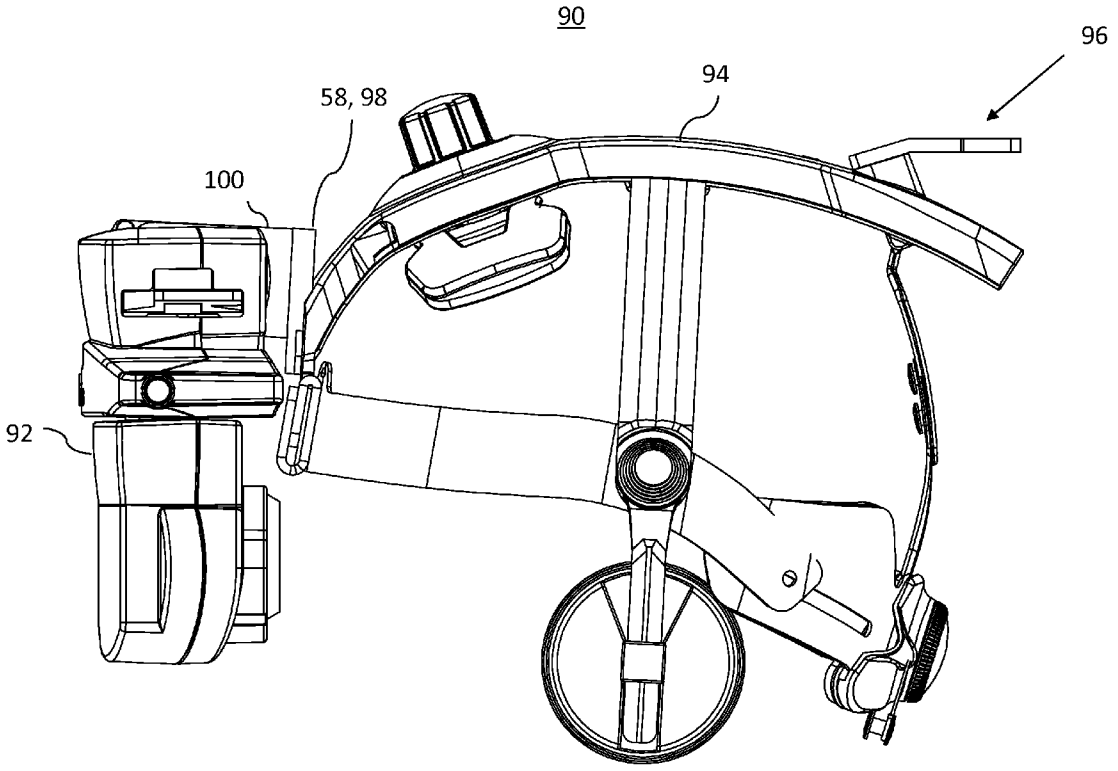


FIG. 1A

100

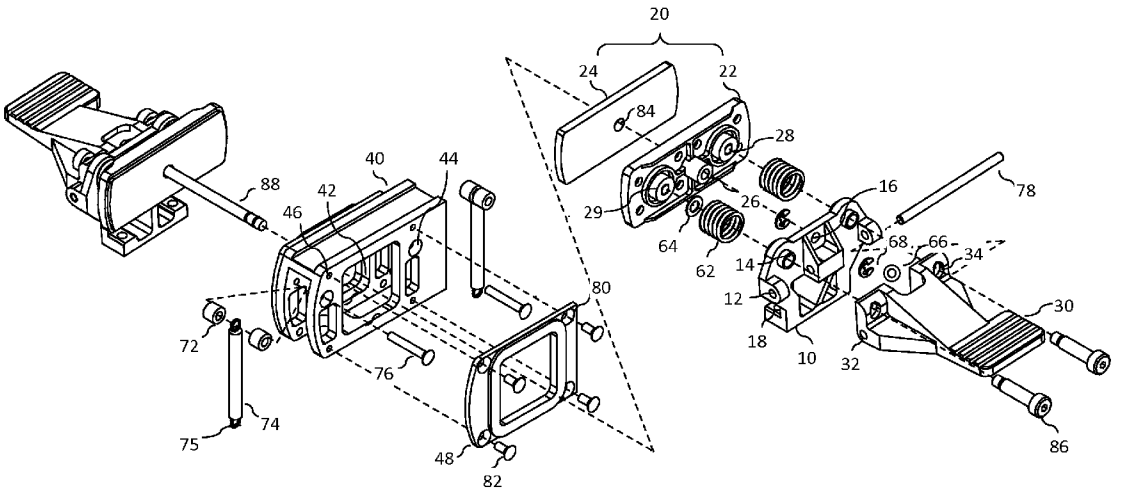

20
24
22
84
28
88
40
44
42
46
29
26
16
78
64
62
14
68
66
34
80
12
30
72
18
10
32
76
74
75
48
82
86

FIG. 1B

100

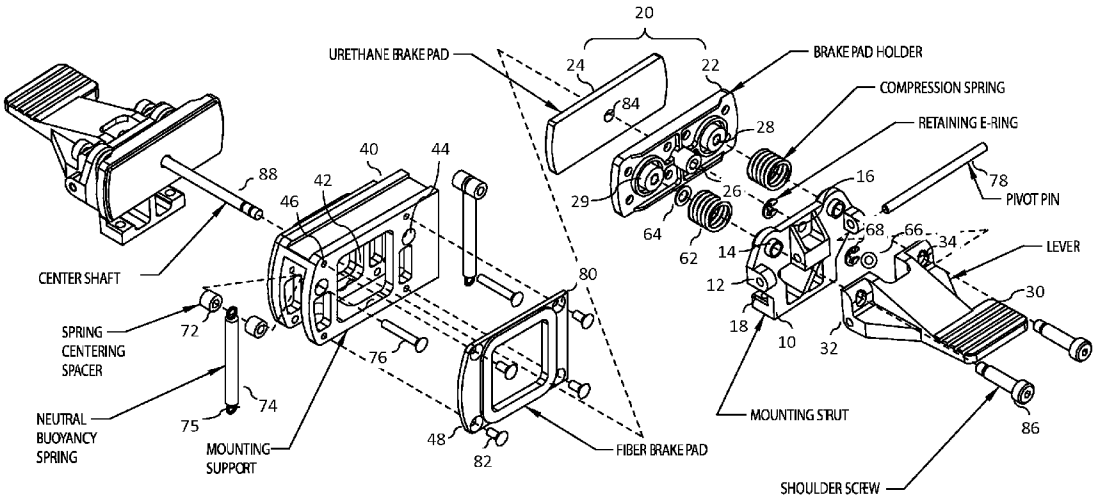

20
URETHANE BRAKE PAD
24
22
BRAKE PAD HOLDER
84
COMPRESSION SPRING
28
RETAINING E-RING
88
40
44
42
46
29
26
16
78
PIVOT PIN
64
62
68
66
34
LEVER
14
12
80
30
CENTER SHAFT
SPRING CENTERING SPACER
72
18
10
32
76
NEUTRAL BUOYANCY SPRING
75
74
MOUNTING SUPPORT
48
82
FIBER BRAKE PAD
MOUNTING STRUT
86
SHOULDER SCREW

FIG. 2

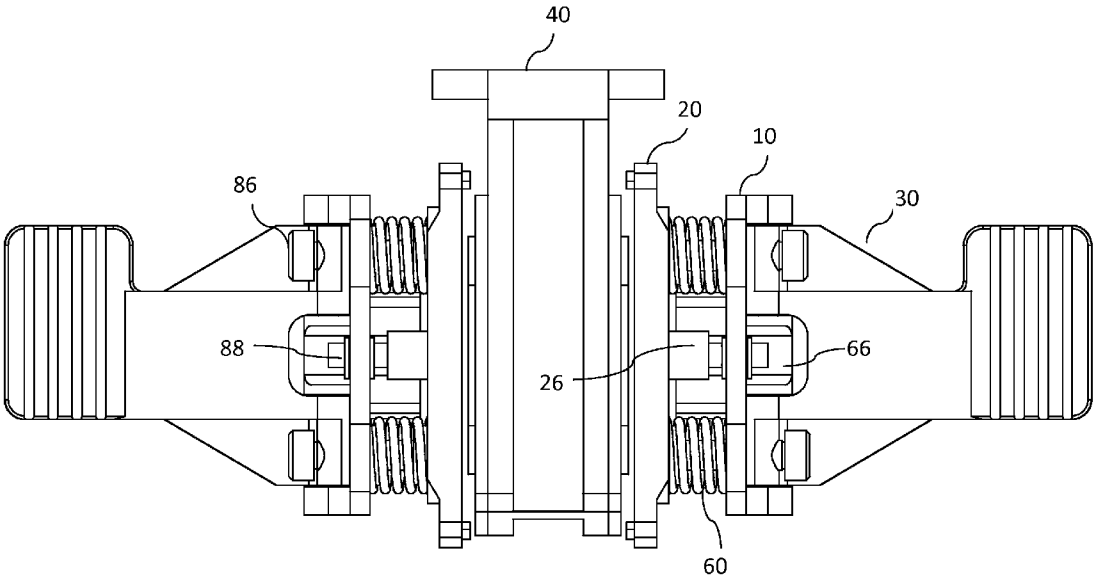


FIG. 3

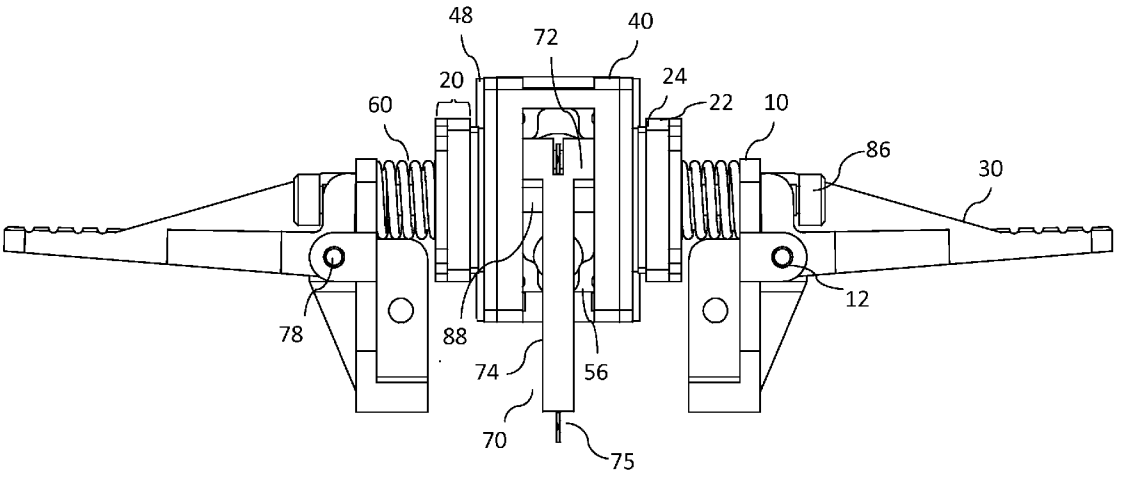


FIG. 4

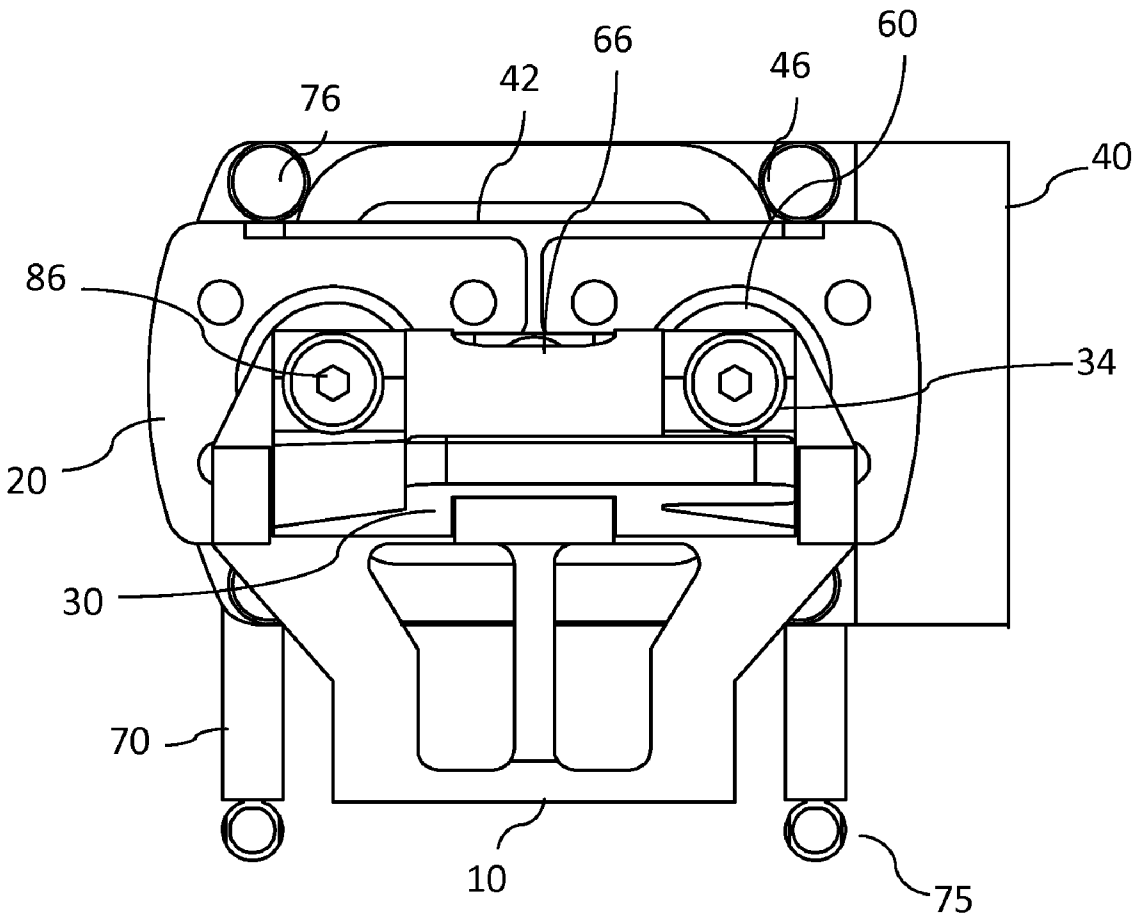


FIG. 5

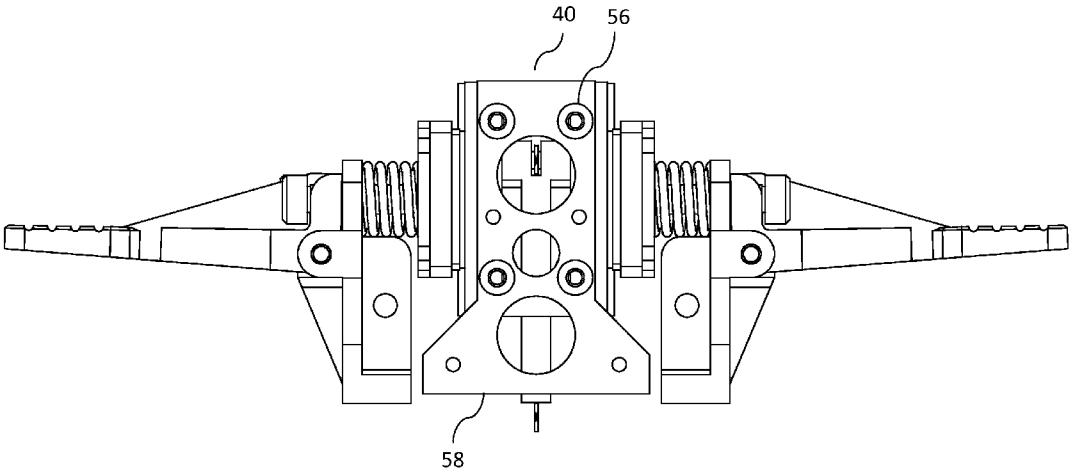


FIG. 6

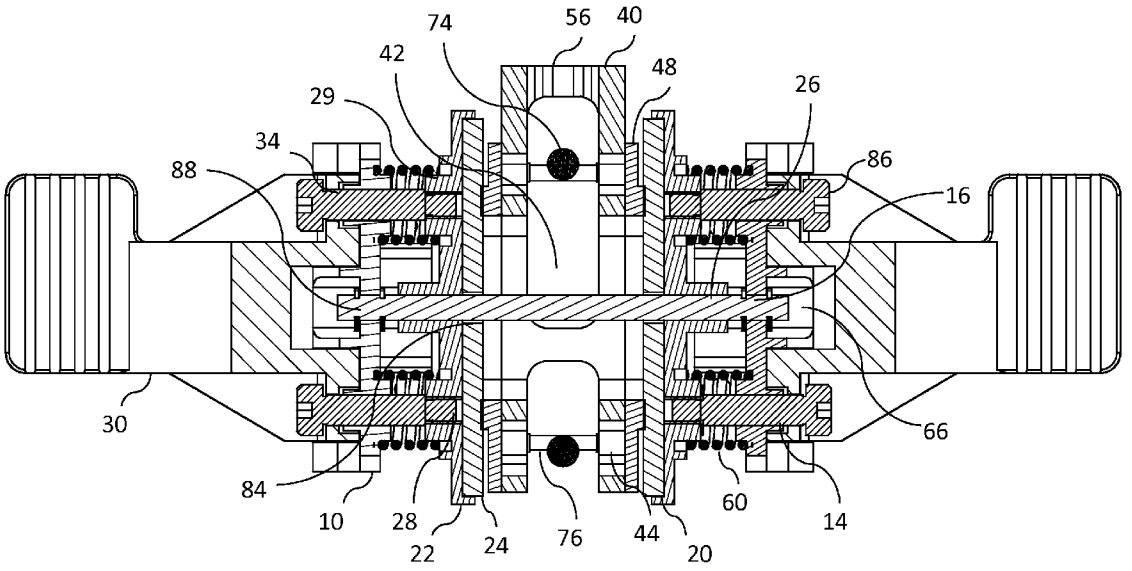


FIG. 7A

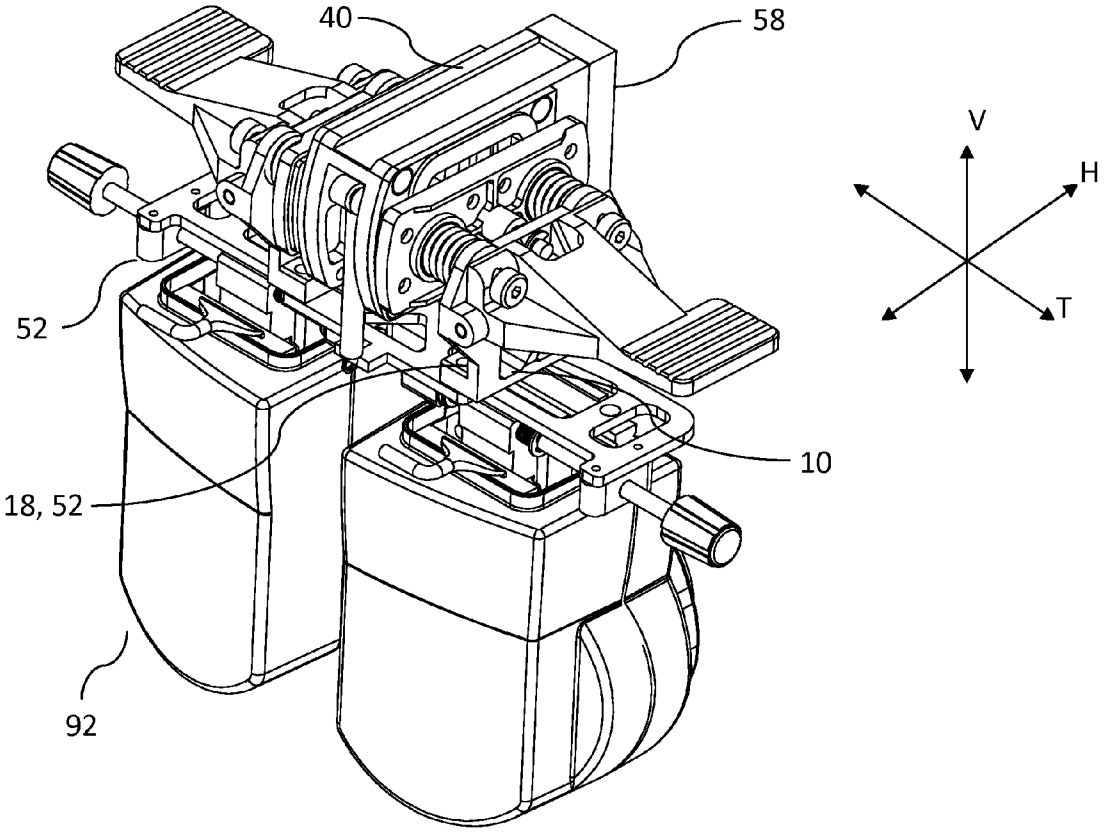


FIG. 7B

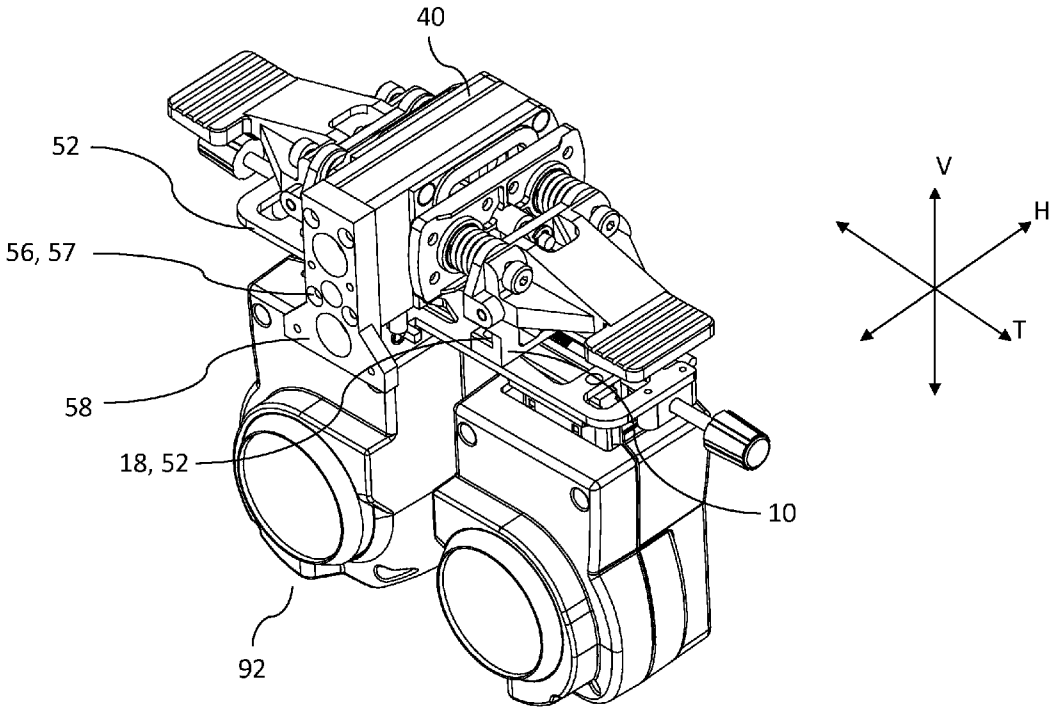


FIG. 8A

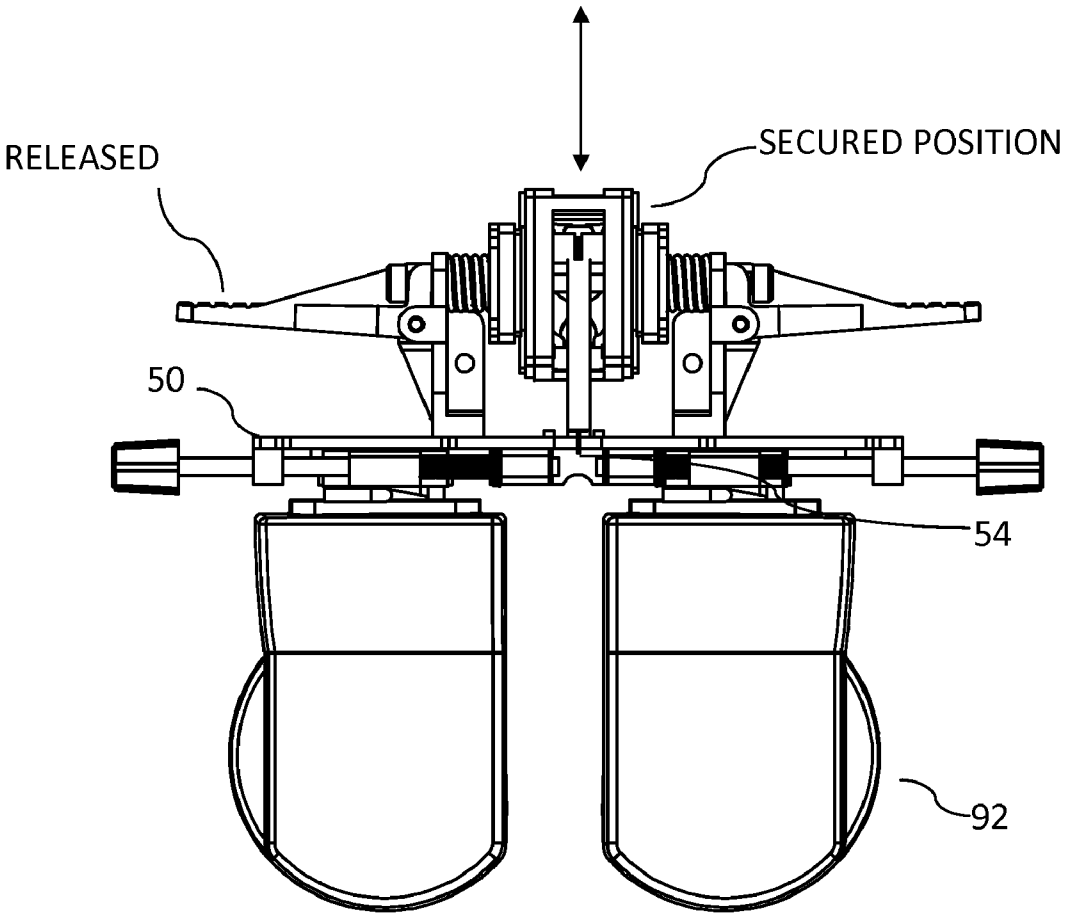


FIG. 8B

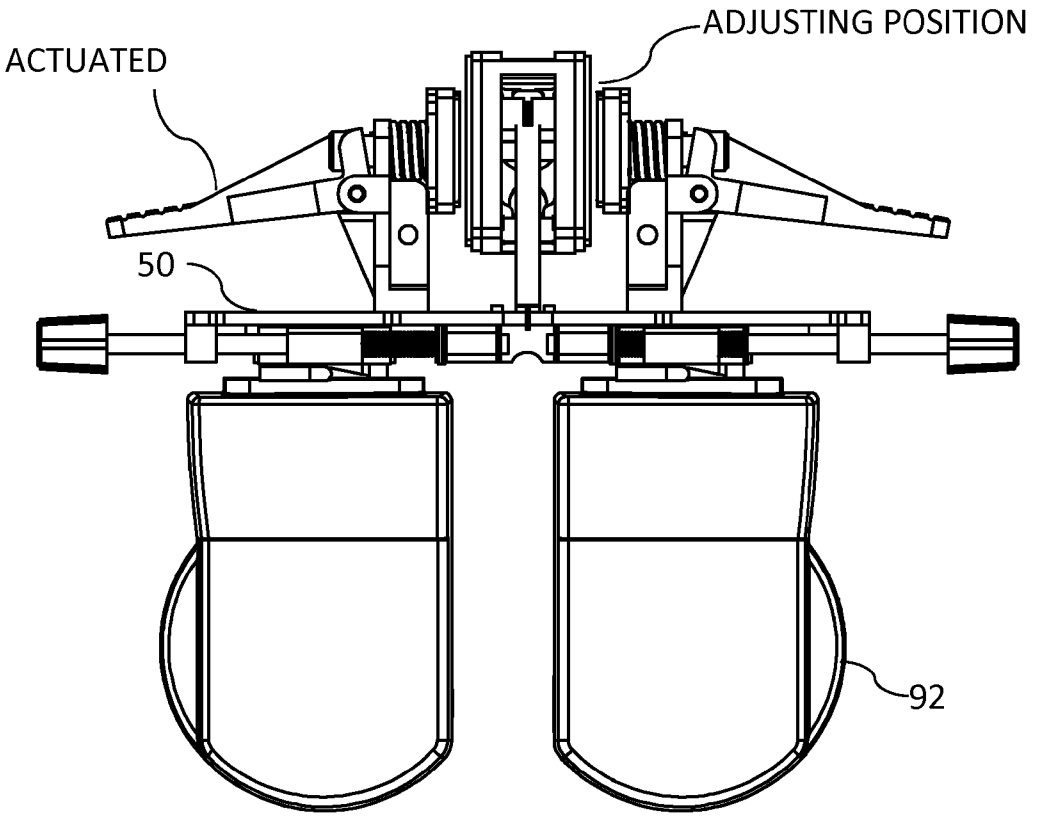


FIG. 9

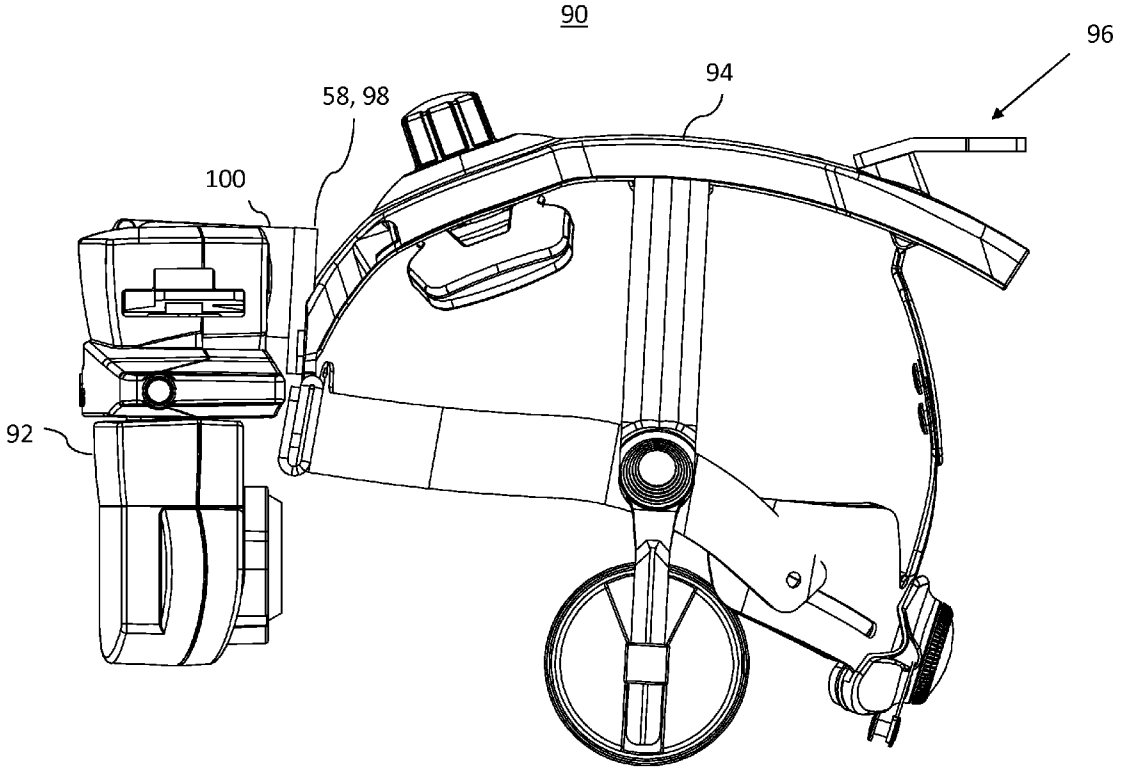


FIG. 10

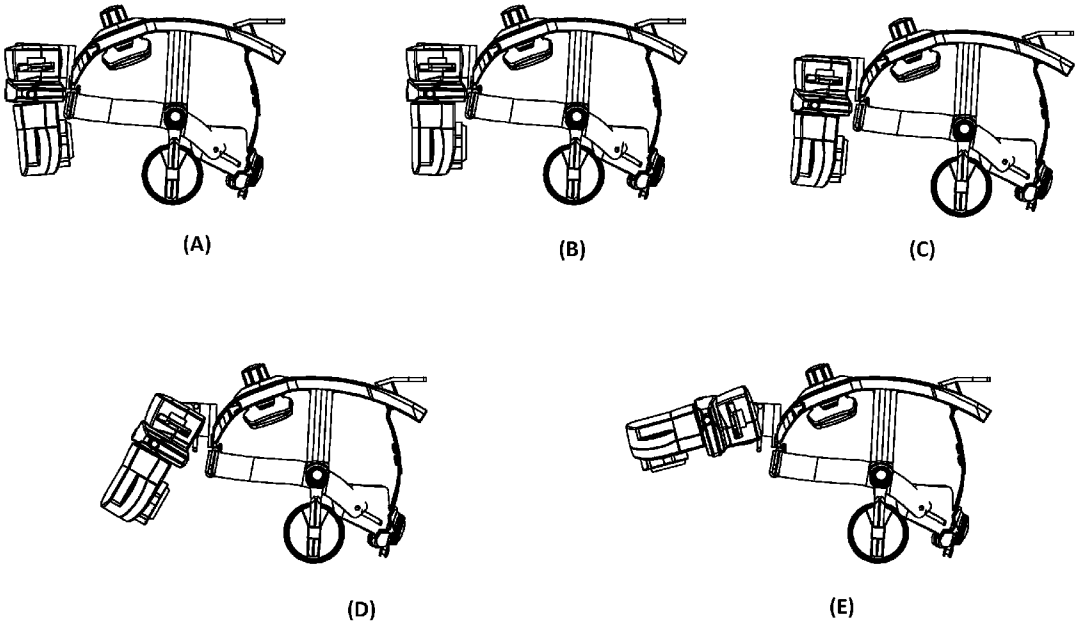
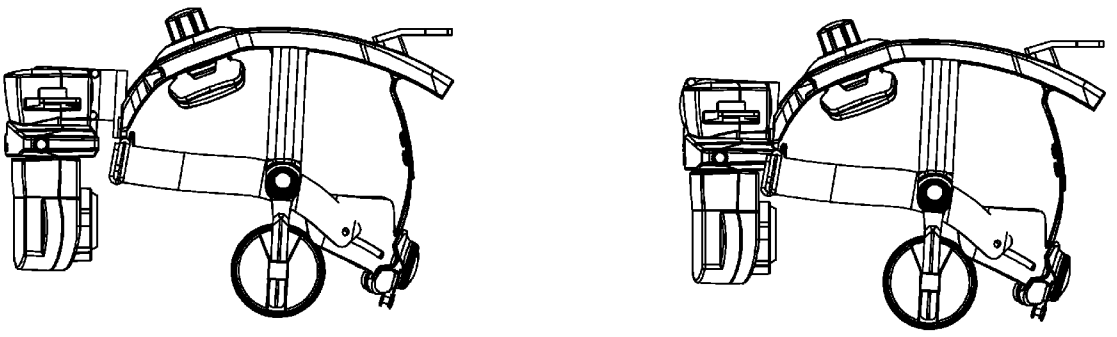
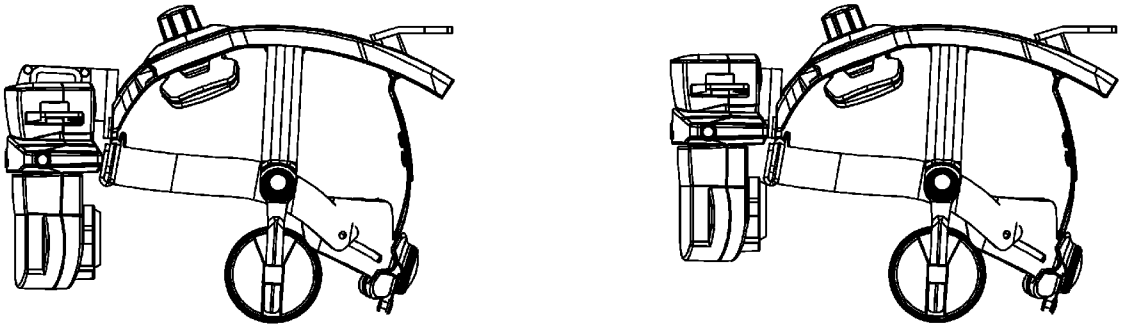


FIG. 11



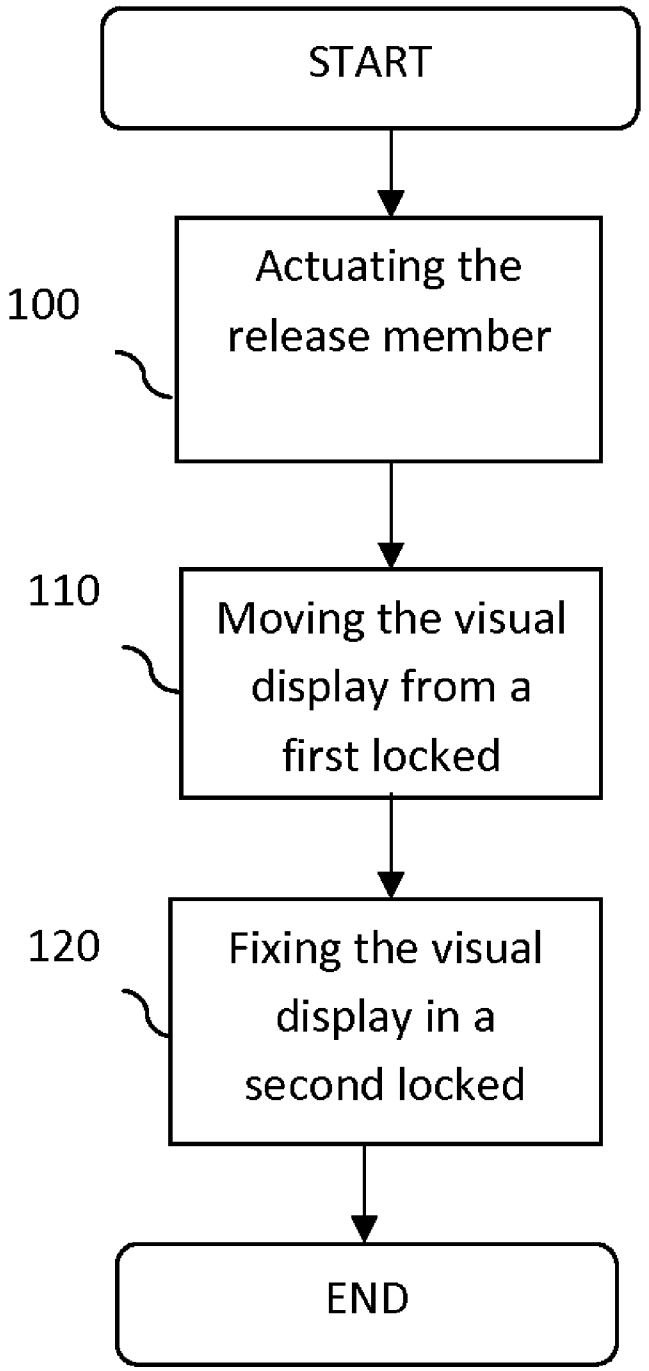
Horizontal Adjustment Range (+/- 10mm)

FIG. 12



Vertical Adjustment Range (+/- 10mm)

FIG. 13


START
100
Actuating the release member
110
Moving the visual display from a first locked
120
Fixing the visual display in a second locked
END

ADJUSTMENT DEVICE FOR A HEAD-WORN VIEWING SYSTEM AND METHOD OF USE THEREOF

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This utility patent application claims priority to U.S. provisional patent application Ser. No. 61/265,320 filed on Nov. 30, 2009, which is incorporated by reference herein.

TECHNICAL FIELD

[0002] The present disclosure relates to an adjustment device for use in a head-worn viewing system to adjust a visual display apparatus in multiple directions.

BACKGROUND

[0003] Head-worn viewing systems and head displays include virtual reality displays, infrared goggles, binoculars, cameras and monocular devices. They need to be adjustable so that a user can change the placement of a visual display based on the user's head shape/size. However, head-worn viewing systems may be limited in the way they can be adjusted or may have complex adjustment features. Variations in the users head shape and size, as well as difference in eye locations, necessitates various adjustments of a visual display. Typical head-worn viewing systems are adjustable in only one direction at a time. For example, current head-worn viewing systems may have ways of adjusting the placement of the visual display by having a knob for moving the visual display horizontally, a separate knob for moving the visual display vertically, and still another separate knob for tilting the visual display. Adjusting such a head-worn viewing system can be cumbersome, may waste precious time and may not provide precise adjustment to a particular user's needs. For example, if the head-worn viewing system includes night vision goggles being used for a military operation, any time wasted adjusting several knobs and buttons to get the placement of the night vision goggles to be in the right position could jeopardize the operation. Therefore, adjusting current head-worn viewing systems is a time consuming process that requires several adjustments to be made independently of one another.

SUMMARY

[0004] Embodiments of the present disclosure provide an adjustment device for use in a head-worn viewing system to adjust a visual display apparatus in multiple directions. Additional features and utilities of the present disclosure will be set forth in part in the description which follows and, in part, will be obvious from the description.

[0005] In one general aspect, a device to adjust a position of head-worn vision system includes an adjustment assembly with a brake member and a mounting support attached to the adjustment assembly by the brake member. The adjustment assembly is simultaneously adjustable in multiple directions relative to the mounting support by disengagement of the brake member.

[0006] Embodiments may include one or more of the following features. For example, the adjustment assembly includes a release member to disengage the brake member and a display support attachable to a visual display device of the head-worn vision system. The adjustment assembly may have a support shaft coupling the release member, display support, and the brake member, and a first spring mechanism secured by the support shaft to provide elasticity between the release member, the display support, and the brake member. A second spring mechanism may also moveably attach the mounting support to the adjustment assembly.

[0007] The mounting support may have a mounting interface to secure the device to a head mount strap or to a helmet.

[0008] As another feature, the adjustment assembly is adjustable from a first locked position by actuating the release member to separate the brake member from the mounting support, by moving the adjustment assembly, and by releasing the release member to secure the adjustment assembly in a second locked position relative to the mounting support. For example, the adjustment assembly may be simultaneously adjustable along multiple axes that include a vertical axis, a horizontal axis, and a tilt axis relative to the mounting support.

[0009] In another general aspect, a head-worn viewing system includes a visual display apparatus, an adjustment assembly attached to the visual display apparatus, the adjustment assembly having a brake member and a mounting support moveably attached to the adjustment assembly. The adjustment assembly is operable to move the visual display apparatus in multiple directions relative to the mounting support by disengagement of the brake member.

[0010] Embodiments may include one or more of the above or following features. For example, a release member may be used to disengage the brake member. The adjustment assembly may be adjustable from a locked position relative to the mounting support by actuating the release member to disengage the brake member from the mounting support and by deactivating the release member to secure the adjustment assembly via the brake member in a second locked position relative to the mounting support.

[0011] The mounting support may have a brake pad in frictional contact with the brake member that allows the adjustment assembly to be simultaneously adjustable in multiple directions relative to the mounting support by disengagement of the brake pad from the brake member.

[0012] The adjustment assembly may have a release member to disengage the brake member, a display support attached to the visual display apparatus and a support shaft that connects the release member, the display support and the brake member. A first spring mechanism may secure the support shaft between the release member and the brake member. A second spring mechanism may be used to elastically attach the mounting support to the display support.

[0013] The visual display apparatus may be a virtual reality display, virtual reality goggles, night vision goggles, heat vision goggles, infrared goggles, binoculars, a camera, or a monocular device.

[0014] As another feature, a head strap may be attached to the mounting support. The mounting support may also include a mounting portion to attach the device to a head strap or helmet.

[0015] In still another general aspect, a method of adjusting a position of a head-worn visual display apparatus relative to a mounting support includes releasing the visual display apparatus from a first locked position and moving the visual display apparatus along more than one axis relative to the mounting support to a second position.

[0016] Embodiments may include one or more of the above or following features. For example, releasing the visual display apparatus may include disengaging a brake that locks the

mounting support to the visual display apparatus. Another feature may include engaging the brake to lock the mounting support to the visual display apparatus at the second position. Disengaging the brake may include applying a compressive force to a first spring mechanism.

[0017] According to another aspect, an adjustment device to adjust a position of a visual display apparatus in multiple directions includes a display support secured to the visual display apparatus, a brake member, a release member attached to the display support and the brake member, and a mounting support attached to the display support and secured by the brake member, wherein the mounting support is simultaneously adjustable in multiple directions relative to the display support and the visual display apparatus by actuating the release member to disengage the brake member from the mounting support.

[0018] According to a further aspect, a head-worn viewing system includes a visual display apparatus, a fixed member to support the visual display apparatus, and an adjustment mechanism attached to the visual display apparatus and the fixed member, wherein the adjustment member includes a release member to adjust the visual display apparatus in multiple directions relative to the adjustment mechanism.

[0019] According to another aspect, a method of simultaneously adjusting a positioning of a visual display apparatus secured to a display support in multiple directions includes actuating a release member attached to the display support to release a mounting support from a first position, moving the mounting support in multiple directions to a second position relative to the display support and the visual display apparatus, and releasing the release member to secure the mounting support in the second position.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] The drawings are meant for illustration of one or more embodiments and do not limit the scope on the invention. The description and drawings use reference numerals to identify the elements that are described in which:

[0021] FIGS. **1**A and **1**B illustrate exploded views of an adjustment device for a head-worn viewing system according to an exemplary embodiment.

[0022] FIG. **2** illustrates a top down view of an adjustment device for a head-worn viewing system according to an exemplary embodiment.

[0023] FIG. **3** illustrates a front view of an adjustment device for a head-worn viewing system according to an exemplary embodiment.

[0024] FIG. **4** illustrates a side view of an adjustment device for a head-worn viewing system according to an exemplary embodiment.

[0025] FIG. **5** illustrates a rear view of an adjustment device for a head-worn viewing system according to an exemplary embodiment.

[0026] FIG. **6** is a top down sectional illustration of an adjustment device for a head-worn viewing system according to an exemplary embodiment.

[0027] FIGS. **7**A and **7**B illustrate views of the adjustment device for a head-worn viewing system according to exemplary embodiments.

[0028] FIG. **8**A illustrates an adjustment device for a head-worn viewing system of a head-worn viewing system in a secured position according to an exemplary embodiment.

[0029] FIG. **8**B illustrates an adjustment device of a head-worn viewing system in a released position according to an exemplary embodiment.

[0030] FIG. **9** illustrates a head-worn viewing system according to an exemplary embodiment.

[0031] FIGS. **10-12** illustrate ranges of motion of a visual display apparatus according to an exemplary embodiment.

[0032] FIG. **13** is a flow chart illustrating a method of simultaneously adjusting a positioning of a visual display apparatus in multiple directions according to an exemplary embodiment.

DETAILED DESCRIPTION

[0033] The following detailed description provides example embodiments that are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements in the description and the drawings. Repetitive description of like elements of various exemplary embodiments may be omitted for clarity.

[0034] In one embodiment, an adjustment device **100** of a head-worn viewing system **90** adjusts a visual display apparatus **92** in multiple directions. The visual display apparatus **92** may be simultaneously adjusted in multiple directions thereby requiring only a single adjustment to customize the positioning of the visual display apparatus **92** according to a user's individual requirements. The adjustment device is intuitive and easy to operate, and does not shift or move once an adjustment has been completed. The visual display apparatus **92** may include, but is not limited to, a virtual reality display, virtual reality goggles, night vision goggles, heat vision goggles, infrared goggles, binoculars, a camera, a monocular device (such as a scope), and the like. The visual display apparatus **92** may include an optical element through which a user may look.

[0035] According to one embodiment, a device to adjust a position of a head-worn vision system (adjustment device or device) **100** is provided to adjust a position of a visual display apparatus **92** in multiple directions. FIGS. **1**A and **1**B illustrate exploded views of the adjustment device **100** according to an exemplary embodiment. The adjustment device **100** includes a display support or base member **10**, a brake member **20**, a release member **30**, and a mounting support **40**. The display support/base member **10**, brake member **20** and release member may be grouped into one sub-assembly referred to as an adjustment assembly.

[0036] The display support **10** may be secured to the visual display apparatus **92**. The release member **30** may be attached to the display support **10** and the brake member **20**. The mounting support **40** may be attached to the display support **10** and secured by the brake member **20**. The display support **10** may be secured to a fixing plate **50**, and the fixing plate **50** may be attached to the visual display apparatus. Alternatively, the display support **10** may refer to the display support **10** and the fixing plate **50** attached to one another. The release member **30** may be a lever which a user may actuate by hand. In other embodiments, the release member electrically or magnetically engages and disengages the brake member **20**.

[0037] According to another embodiment, the display support **10** may include a display support pin accommodation **12**, a first display support screw accommodation **14**, a display support shaft accommodation **16**, and a second display support screw accommodation **18**. The brake member **20** may include a brake pad holder **22**, a brake pad **24**, a brake shaft

accommodation **26**, a brake screw accommodation **28**, a brake spring accommodation **29**, and a brake pad shaft accommodation **84**.

[0038] The release member **30** may include a release pin accommodation **32** and a release screw accommodation **34**. The mounting support **40** may include a pivot shaft accommodation **42**, a first pivot screw accommodation **44**, a second pivot screw accommodation **46**, and a pivot brake pad **48**. The pivot brake pad **48** may include a pivot brake pad screw accommodation **80**. The adjustment device **100** may include a screw **82**. The screw **82** secure the pivot brake pad **48** to the mounting support **40**. The display support **10** may be secured to the visual display apparatus **92** by feeding a fixing screw **52** through the second display support screw accommodation **18**.

[0039] According to another embodiment, the adjustment device **100** may include a first spring mechanism **60** and a second spring mechanism **70**. The first spring mechanism **60** may include a spring **62** and a washer **64**. The first spring mechanism **60** may also include a screw **86**. The second spring mechanism **70** may include a spring spacer **72**, a neutral buoyancy spring **74**, a securing means **75**, and a screw **76**. The second spring mechanism **70** may elastically attach the mounting support **40** to the display support **10** or the fixing plate **50**. The adjustment device **100** may include a support shaft **88**. The support shaft **88** may be fed through the pivot shaft accommodation **42**, the brake pad shaft accommodation **84**, the brake shaft accommodation **26**, and the display support shaft accommodation **16**. The adjustment device **100** may include a nut **66** and retaining e-ring **68**. The nut **66** and the retaining e-ring **68** may secure the support shaft **88** to the brake member **20** and the display support **10**. The adjustment device **100** may include a pivot pin **78**. The pivot pin **78** may be fed through the display support pin accommodation **12** and the release pin accommodation **32**. The adjustment device **100** may include a screw **82** to secure the pivot brake pad **48** to the mounting support **40**. The adjustment device **100** may include a screw **86**. The screw **86** may be fed through the release screw accommodation **34**, the first display support screw accommodation **14**, the compression spring **62**, the washer **64**, and into the brake spring accommodation **29**.

[0040] FIG. **2** illustrates a top down view of an adjustment device **100** according to an exemplary embodiment. According to another embodiment, the adjustment device may include more than one display support **10**, more than one brake member **20**, and more than one release member **30**. Each brake member **20** and each release member **30** may be attached to the display support **10** using at least one screw **86**. In FIG. **2**, two screws **86** are threaded through each release member **30**, each display support **10**, each first spring mechanism **60**, and each brake member **20**. In particular, each screw **86** is fed through the release screw accommodation **34**, the first display support screw accommodation **14**, the compression spring **62**, and into the brake screw accommodation **28**. The support shaft **88** may be included to align and support each display support **10**, each brake member **20**, and the mounting support **40**. The support shaft **88** may be fed through the pivot shaft accommodation **42** of the mounting support **40**, each brake pad shaft accommodation **84**, each brake shaft accommodation **26**, a retaining e-ring **68**, each display support shaft accommodation **16**, and another retaining e-ring **68**. The support shaft **88** may have two ends, each of which are secured to a display support **10** by a nut **66**.

[0041] FIG. **3** illustrates a front view of an adjustment device **100** according to an exemplary embodiment. The pivot pin **78** may be used to secure the display support **10** to the release member **30**. The pivot pin **78** may be inserted into the display support pin accommodation **12** of the display support **10** and the release pin accommodation **32** of the release member. The pivot pin **78** may permit the release member **30** to rotate around the circumference of the release pin **78** when the release member **30** is actuated in order to release the brake member **20** from the mounting support **40**. As illustrated in FIG. **3**, the second spring mechanism **70** may include a spring spacer **72**, a neutral buoyancy spring **74**, a securing means **75**, and a screw **76**. The screw **76** may be fed through the mounting support **40**. The neutral buoyancy spring **74** may be secured to the screw **76**. A spring spacer **72** may be disposed on each side of the portion of the neutral buoyancy spring **74** that is secured to the screw **76** to keep the neutral buoyancy spring **74** centered in the mounting support **40**. As illustrated in FIG. **3**, the brake member **20** may include a brake pad holder **22** secured to the display support **10** via screw **86**, and a brake pad **24** attached to the brake pad holder **22** to secure the mounting support **40** in a locked position. The mounting support **40** may include a pivot brake pad **48** disposed on the outer side(s) of the mounting support **40** so that when the release member **30** is disengaged, the brake pad **24** and the pivot brake pad **48** are pressed together by the first spring mechanism **60** so that the mounting support **40** is secured and locked place. The mounting support **40** may include a pivot mounting accommodation **56** disposed on the read side of the mounting support **40** so that the mounting support **40** may be mounted to a head-worn viewing apparatus **90**.

[0042] According to another embodiment, the brake pad **24** and the pivot brake pad **48** may be made of suitable materials to generate a frictional force greater than that required to prevent the visual display apparatus **92** to move when the mounting support **40** is secured by the brake member **20**. The brake pad **24** may be comprised of urethane rubber. The pivot brake pad **48** may be comprised of a fiber material, such as that used on brake pads in the automotive industry.

[0043] FIG. **4** illustrates a side view of an adjustment device **100** according to an exemplary embodiment. The mounting support **40** may include a pivot brake pad **48**. The pivot brake pad **48** may have at least one second pivot screw accommodation **46**. The pivot brake pad **48** may be secured to the mounting support **40** my feeding a screw **76** into each second pivot screw accommodation **46**. The release member **30**, the display support **10**, the first spring mechanism **60**, and the brake member **20** may be secured to one another by feeding screw **86** through release screw accommodation **34**. Additionally, the second spring mechanism **70** may include more than one securing means **75**. The securing means **75** may be configured as a loop which can be affixed to a fixing arm **54** of the fixing plate **50**. A first securing means **75** may attach to a front of the fixing plate **50**, and a second securing means **75** may attach to a back of the fixing plate **50**.

[0044] FIG. **5** illustrates a rear view of an adjustment device **100** according to an exemplary embodiment. The mounting support **40** may include more than one pivot mounting accommodation **56**. In an exemplary embodiment, the mounting support **40** may include four pivot mounting accommodations **56**. The adjustment device **100** may include a mounting portion including a mounting support **40**, a mounting bracket **58**, and pivot mounting accommodations **56**. The mounting bracket **58** may be secured to the pivot mounting accommodations **56** of the mounting support **40** using mounting screws **57**.

[0045] FIG. **6** is a top down sectional illustration of an adjustment device **100** according to an exemplary embodiment. According to another embodiment, the adjustment device **100** may include a first spring mechanism **60** secured between the display support **10** and the brake member **20**. The first spring mechanism **60** may generate elasticity between the display support **10** and the brake member **20**. The first spring mechanism **60** may be secured between the display support **10** and the brake member **20** using the screw **86**. The screw **86** may be fed through the first display support screw accommodation **14** of the display support **10**, the first spring mechanism **60**, and into the brake screw accommodation **28** of the brake member. By fixing the screw **86** to the brake screw accommodation **28**, the first spring mechanism **60** may be secured to a brake spring accommodation **29** of the brake member **20**. The first spring mechanism **60** may include a compression spring **62** and a washer **64**. The washer **64** may be disposed between the compression spring **62** and the brake spring accommodation **29**.

[0046] The mounting support **40** may be in a first locked position by the brake member **20** when the release member **30** is not actuated, i.e., disengaged or released. When the release member **30** is actuated, the release member **30** disengages the brake member **20** from the mounting support **40**. When the release member **30** is actuated, the first spring mechanism **60** is compressed between the display support **10** and the brake member **20** and the mounting support **40** is released from a locked position. When the brake member **20** is disengaged from the mounting support **40**, the mounting support **40** can be moved in multiple directions relative to the display support **10** and the visual display apparatus **92** from the first locked position to an adjusting position. In other words, when the brake member **20** is disengaged from the mounting support **40**, the visual display apparatus **92** may be moved in multiple directions relative to the mounting support **40** from the first locked position to an adjusted position. The movement of the adjustment device **100** may be described as the mounting support **40** moving relative to the adjustment assembly (major components including the display support **10**, brake member **20** and release member **30**) and the visual display apparatus **92**, or as the visual display apparatus **92** and the adjustment assembly moving relative to the mounting support. The movement of the adjustment device **100** is the same whether described from the perspective of the mounting support **40** or the visual display apparatus **92**.

[0047] When the release member **30** is released, the brake member **20** re-engages the mounting support and secures the mounting support **40** in the adjusted position, or alternatively, a second locked position. When the release member **30** is released, the compression of the first spring mechanism **60** is released which pushes the brake member **20** to lock the mounting support **40** in place. A user may actuate the release member **30** using their hand(s). The release member **30** may require a force of about 5 to 10 lbs to fully compress the first spring mechanism **60** and to disengage the brake member **20** from the mounting support **40**. The release member **30** may reduce a spring load in order for the adjustment device **100** to be easy to use while maintaining a high clamping force to eliminate relative movement of the visual display apparatus **92** and the head-worn viewing system **90**.

[0048] As illustrated in FIG. **6**, the support shaft **88** may be fed through the pivot shaft accommodation **42** of the mounting support **40**, each brake pad shaft accommodation **84**, each brake shaft accommodation **26**, a retaining e-ring **68**, each display support shaft accommodation **16**, and another retaining e-ring **68**. The support shaft **88** may have two ends, each of which are secured to a display support **10** by a nut **66**. The support shaft **88** may prevent the mounting support **40** from being completely released from the adjustment device **100** by preventing the mounting support **40** from being moved out of alignment with the one or more brake members **20**. By securing the mounting support **40** in alignment with the brake member(s) **20**, the support shaft **88** ensures that the adjustment device **100** does not fail. The adjustment device **100** may include more than one second spring mechanism **70**. Each second spring mechanism **70** may be secured in the mounting support **40** by a screw **76** fed through a first pivot screw accommodation **44**. The neutral buoyancy spring **74** may include a ring portion that loops around the screw **76** to fix the second spring mechanism **70** inside the mounting support **40**.

[0049] FIGS. **7**A and **7**B illustrate views of the adjustment device **100** according to exemplary embodiments. As illustrated in FIG. **7**A, the adjustment device **100** may be attached to a fixing plate **50**. The display support **10** of the adjustment device **100** may include a second display support screw accommodation **18**. A fixing screw **52** may be inserted through the second display support screw accommodation **18** to fix the display support **10** to the fixing plate **50**. The fixing plate **50** may be fixed to the visual display apparatus **92**. A mounting bracket **58** may be secured to the mounting support **40** by inserting mounting screws **57** into the pivot mounting accommodations **56**. The mounting bracket **58** may then be attached to a head strap (or helmet) **96**. The mounting bracket **58** may slide into a mounting bracket accommodation **98** of the head strap (or helmet) **96**.

[0050] According to another embodiment, the multiple directions along which the mounting support **40** may be moved or adjusted include a horizontal axis H, a vertical axis V, and a tilt axis T. The adjustment device **100** may be adjusted along these multiple axes in order to align the visual display apparatus **92** with an optical axis. The optical axis is an axis that is collinear with a user's line of sight. By aligning the visual display **92** with the optical axis, a user can see can maximize their field of vision through the visual display apparatus **92**. A movement along the horizontal axis H may increase or decrease a distance between the visual display apparatus **92** and a user's eyes. In other words, an adjustment along the horizontal axis H may change the horizontal distance of an optical element of the visual display apparatus **92** to a user's pupil. A movement along the vertical axis V may raise or lower the visual display apparatus **92** in relation to the user's eyes. In other words, an adjustment along the vertical axis V may change the height of the optical axis relative to the mounting support **40** and the head-worn viewing system **90**. A movement along the tilt axis T may correspond to the rotation around an axis parallel a line that goes from one ear of the user to another. In other words, an adjustment along the tilt axis T may change the relative angle of the optical axis relative to the head-worn viewing system. The multiple directions of movement of the mounting support **40** allow a user to simultaneously adjust the visual display apparatus **92** in several directions to quickly determine the most comfortable fit based on the user's individual needs.

[0051] According to another embodiment, mounting support **40** may be adjusted, relative to the display support **10** and the visual display apparatus **92**, along the horizontal axis H, the vertical axis V, and the tilt axis T simultaneously. The mounting support **40** may be moved the horizontal axis H, the

vertical axis V, and the tilt axis T by actuating the release member **30**, and moving the mounting support **40**. The second spring mechanism **70** enables the movement of the mounting support **40** along the horizontal axis H, the vertical axis V, and the tilt axis T by elastically securing the mounting support **40** to the fixing plate **50**. The adjustment device **100** may be affixed to a head-worn viewing system **90** and a visual display apparatus **92**. When the adjustment device **100** is fixed to a head-worn viewing system **90**, the visual display apparatus **92** is adjustable along the horizontal axis H, the vertical axis V and the tilt axis T relative to the mounting support **40**. In this example, when the release member **30** is actuated, the release member **30**, the display support **10**, the brake member **20**, the fixing plate **50**, and the visual display apparatus **92** are adjustable in multiple directions relative to the mounting support **40**.

[0052] FIG. **8**A illustrates an adjustment device **100** of a head-worn viewing system **90** in a secured position according to an exemplary embodiment. The fixing plate **50** may be attached to the adjustment device **100** and the visual display apparatus **92**. The second spring mechanism **70** of the adjustment device **100** may be secured to the fixing plate **50** by attaching the securing means **75** of the second spring mechanism to the fixing arm **54** of the fixing plate. As illustrated in FIG. **8**A, when the release member **30** is released, the brake member **20** is in a secured or locked position with the mounting support **40**. FIG. **8**A may be illustrative of a first locked position of the mounting support **40** or of a second locked position of the mounting support **40** after an adjustment has been made.

[0053] FIG. **8**B illustrates an adjustment device **100** of a head-worn viewing system **90** in a released position according to an exemplary embodiment. As illustrated in FIG. **8**B, when the release member **30** is actuated, the brake member **20** is disengaged from the mounting support **40**. When the brake member **20** is disengaged, the mounting support **40** allows the movement of the rest of the adjustment device **100**, the fixing plate **50**, and the visual display apparatus **92** along the horizontal axis H, the vertical axis V, and the tilt axis T. The ability to simultaneously adjust the positioning of the visual display apparatus **92** along the three axes allows a user to simply customize the positioning of the visual display apparatus **92** in one fluid motion.

[0054] FIG. **9** illustrates a head-worn viewing system **90** according to an exemplary embodiment. The head-worn viewing system may include a head strap (or helmet) **96**, a fixed member **94**, an adjustment device **100**, and a visual display apparatus **92**. The visual display apparatus **92** may be fixed to the adjustment device **100** by means of a fixing plate **50**. The mounting support **40** of the adjustment device **100** may be attached to the fixed member **94** by means of a mounting bracket **58** and a mounting bracket accommodation **98**. The fixed member **94** may be attached to a head strap **96** or a helmet **96**. The fixed member **94** may be a boom that supports the visual display apparatus **92** and prevents the adjustment device **100** and the visual display apparatus **92** from moving away from a user's line of sight.

[0055] FIGS. **10-12** illustrate ranges of motion of a visual display apparatus **92** according to an exemplary embodiment. As illustrated in FIG. **10**, the visual display apparatus **92** may be rotated around the tilt axis T. In FIG. **10**A, the visual display apparatus **92** is moved around the tilt axis T at −5 degrees, or 5 degrees towards a user's head/face. In FIG. **10**B, the visual display apparatus **92** is moved around the tilt axis T at 0 degrees. In FIG. **10**C, the visual display apparatus **92** is moved around the tilt axis T at +5 degrees. In FIG. **10**D, the visual display apparatus **92** is moved around the tilt axis T at +30 degrees. In FIG. **10**E, the visual display apparatus **92** is moved around the tilt axis T at +75 degrees. When the visual display apparatus **92** is adjusted around the tilt axis T at +75 degrees, the visual display apparatus **92** is removed from the user's line of sight by being flipped up so that the user can view their actual surroundings without the aid or assistance of the visual display apparatus **92**.

[0056] As illustrated in FIG. **11**, the visual display apparatus **92** may be adjusted along the horizontal axis H. The visual display apparatus **92** may be adjusted along the horizontal axis H to increase or decrease a distance between the visual display apparatus **92** and a user's eyes. As illustrated in FIG. **11**, the visual display apparatus **92** may be adjusted along the horizontal axis H by approximately +/−10 millimeters towards or away from a user's eyes.

[0057] As illustrated in FIG. **12**, the visual display apparatus **92** may be adjusted along the vertical axis V. The visual display apparatus **92** may be adjusted along the vertical axis V to raise or lower the visual display apparatus **92** in relation to the user's eyes. As illustrated in FIG. **12**, the visual display apparatus **92** may be adjusted along the vertical axis V by approximately +/−10 millimeters up or down to level the visual display apparatus **92** with the user's eyes.

[0058] FIG. **13** is a flow chart illustrating a method of simultaneously adjusting a positioning of a visual display apparatus **92** in multiple directions according to an exemplary embodiment. In operation S**100**, the release member **30** is actuated to release the mounting support **40** from the first locked position. When the release member **30** is actuated, the brake member **20** is released from the mounting support **40** by applying a compressive force to the first spring mechanism **60**. In operation S**110**, the mounting support **40** is moved in multiple directions relative to the display support **10** and the visual display apparatus **92** to an adjusted position. When the position of the mounting support **40** is adjusted, the mounting support **40** may be moved along a horizontal axis H, a vertical axis V, and a tilt axis T relative to the visual display apparatus **92** via a second spring mechanism **70** secured to the mounting support **40**. In operation S**120**, the release member is released to secure the mounting support **40** in the adjusted position, or alternatively, the second locked position. When the release member **30** is released, the brake member **20** is moved from a retracted position to a secured position at which the mounting support **40** is secured in place by the brake member **20**. The brake member **20** is moved from the retracted position to the secured position by the expansion of the compressed first spring mechanism.

[0059] Unless defined otherwise, all technical terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. Any methods and materials similar or equivalent to those described herein also can be used in the practice or testing of the present disclosure

[0060] It must be noted that as used herein and in the appended claims, the singular forms "a", "and", and "the" include plural references unless the context clearly dictates otherwise.

[0061] While the present disclosure has been described with reference to particular embodiments, those skilled in the art will understand that various changes may be made and equivalents may be substituted without departing from the

true spirit and scope of the invention. In addition, many modifications may be made to adopt a particular situation, material, composition of matter, process, process step or steps, to the objective spirit and scope of the present disclosure. All such modifications are intended to be within the scope of the claims appended hereto.

[0062] For example, the release member in the figures described above is mechanically actually with one or more spring mechanisms. However, the release may be hydraulic, magnetic or electromechanical. Alternatively, the brake may employ may employ various types of frictional or locking surfaces such as a fabric fastening device or lockable fiber.

[0063] In addition, the device described above describes the adjustment of the visual display along horizontal, vertical and tilt axes relative to the mounting support. Other degrees of types of adjustments may be accomplished with the release member. For example, in a further embodiment the mounting support includes two plates that can move apart or together to account for differences in intraocular pupil distance from one user to another.

What is claimed is:

1. A device to adjust a position of head-worn vision system, the device comprising:
- an adjustment assembly that includes a brake member; and
- a mounting support attached to the adjustment assembly by the brake member;
- wherein the adjustment assembly is simultaneously adjustable in multiple directions relative to the mounting support by disengagement of the brake member.

2. The device of claim **1**, wherein the adjustment assembly comprises a release member to disengage the brake member and a display support attachable to a visual display device of the head-worn vision system.

3. The device of claim **2**, wherein the adjustment assembly further comprises:
- a support shaft coupling the release member, display support, and the brake member; and
- a first spring mechanism secured by the support shaft to provide elasticity between the release member, the display support, and the brake member.

4. The device of claim **2**, further comprising:
- a second spring mechanism to moveably attach the mounting support to the adjustment assembly.

5. The device of claim **1**, wherein the mounting support includes a mounting interface to secure the device to a head mount strap or to a helmet.

6. The device of claim **1**, wherein the adjustment assembly is adjustable from a first locked position by actuating the release member to separate the brake member from the mounting support, by moving the adjustment assembly, and by releasing the release member to secure the adjustment assembly in a second locked position relative to the mounting support.

7. The device of claim **1**, wherein the adjustment assembly is simultaneously adjustable along multiple axes that include a vertical axis, a horizontal axis, and a tilt axis relative to the mounting support.

8. A head-worn viewing system, comprising:
- a visual display apparatus;
- an adjustment assembly attached to the visual display apparatus, the adjustment assembly having a brake member; and
- a mounting support moveably attached to the adjustment assembly, wherein the adjustment assembly is operable to move the visual display apparatus in multiple directions relative to the mounting support by disengagement of the brake member.

9. The device of claim **8**, wherein the adjustment assembly comprises:
- a release member to disengage the brake member.

10. The head-worn viewing system of claim **9**, wherein the adjustment assembly is adjustable from a locked position relative to the mounting support by actuating the release member to disengage the brake member from the mounting support and by deactivating the release member to secure the adjustment assembly via the brake member in a second locked position relative to the mounting support.

11. The head-worn viewing system of claim **8**, wherein:
- the mounting support comprises a brake pad in frictional contact with the brake member; and
- the adjustment assembly is simultaneously adjustable in multiple directions relative to the mounting support by disengagement of the brake pad from the brake member.

12. The head-worn viewing system of claim **8**, wherein the adjustment assembly comprises:
- a release member to disengage the brake member;
- a display support attached to the visual display apparatus;
- a support shaft that connects the release member, the display support and the brake member; and
- a first spring mechanism secured by the support shaft between the release member and the brake member.

13. The head-worn viewing system of claim **12**, further comprising:
- a second spring mechanism to elastically attach the mounting support to the display support.

14. The head-worn viewing system of claim **8**, wherein the visual display apparatus is selected from the group consisting essentially of:
- a virtual reality display, virtual reality goggles, night vision goggles, heat vision goggles, infrared goggles, binoculars, a camera, and a monocular device.

15. The head-worn viewing system of claim **8**, further comprising:
- a head strap attached to the mounting support.

16. The head-worn viewing system of claim **8**, wherein the mounting support includes a mounting portion to attached the device to a head strap or helmet.

17. A method of adjusting a position of a head-worn visual display apparatus relative to a mounting support, the method comprising:
- releasing the visual display apparatus from a first locked position; and
- moving the visual display apparatus along more than one axis relative to the mounting support to a second position.

18. The method of claim **17**, wherein releasing comprises:
- disengaging a brake that locks the mounting support to the visual display apparatus.

19. The method of claim **18**, further comprising:
- engaging the brake to lock the mounting support to the visual display apparatus at the second position.

20. The method of claim **18**, wherein disengaging the brake comprises applying a compressive force to a first spring mechanism.

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