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Miyamoto

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[54] **POSITIONER FOR ADJUSTING INCLINATION AND POSITION OF AN OBJECT FROM ONE DIRECTION**

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[51] **Int. Cl.** **G05g 11/00**

[58] **Field of Search** 74/479, 89.13, 89.15, 89.17; 178/7.81; 335/210–212

[56] **References Cited**

UNITED STATES PATENTS

3,023,635	3/1962	Ballmer	74/479 X
3,689,695	9/1972	Rosenfield et al.	178/7.81

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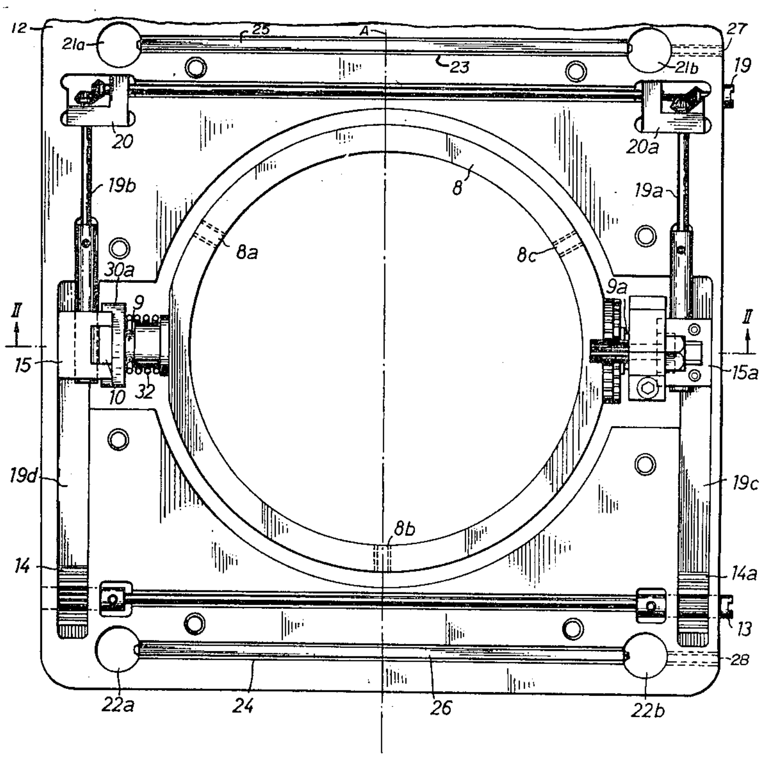
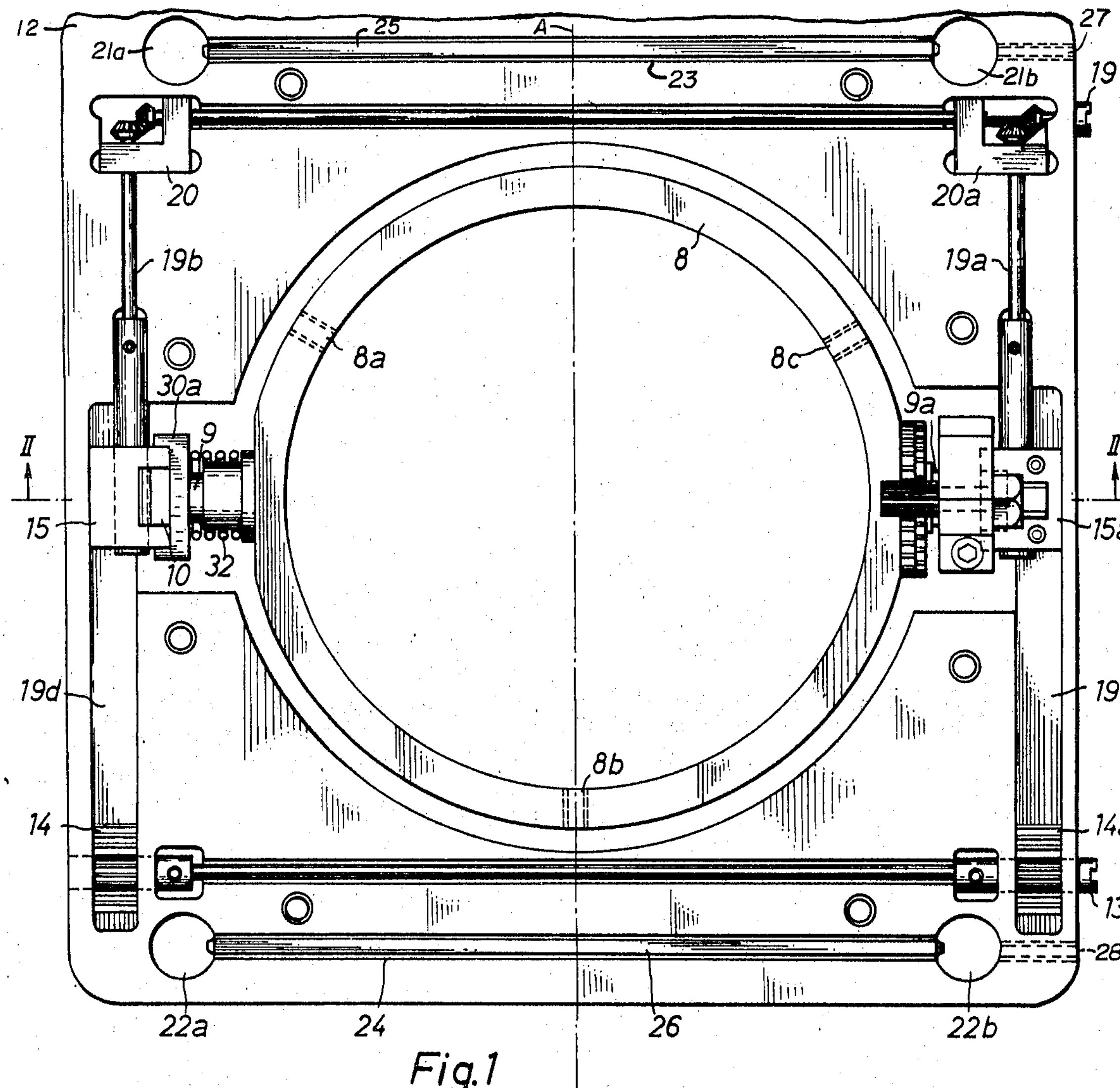
[57] **ABSTRACT**

A positioner for adjusting inclination and position of an object from one control direction, in which inclination of the object along the control direction is adjusted by rotating in the same direction gear pieces respectively attached at opposide ends of the object by means of two rotation shafts provided in parallel so as to be meshed respectively with the gear pieces in response to rotation of a first control shaft, which is provided in the control direction and engaged with the two rotation shafts to drive them in the same rotation direction. The slide movement of the object along a direction perpendicular to the control direction is controlled by sliding the gear pieces along the two rotation shafts in response to the rotation of a second control shafts, which is provided in the control direction and engaged with the gear pieces through a gear mechanism. The inclination of the object along a direction perpendicular to the control direction is controlled by slidably supporting the object at opposide ends by supporting shafts on the same axis and by rotating the object about the axis in response to a control shaft, which is provided on one of the gear pieces along the control direction to rotate the object through a gear mechanism. The slide movement of the object along the control direction is controlled by shifting the object along the supporting shafts by use of screw mechanism between one of the gear pieces and one of the supporting shafts in response to rotation of a control shaft, which is provided on the one of the gear pieces along the control direction to totate the one of the supporting shafts through a gear mechanism.

7 Claims, 4 Drawing Figures

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A
23
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21b
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9a
II
II
15
15a
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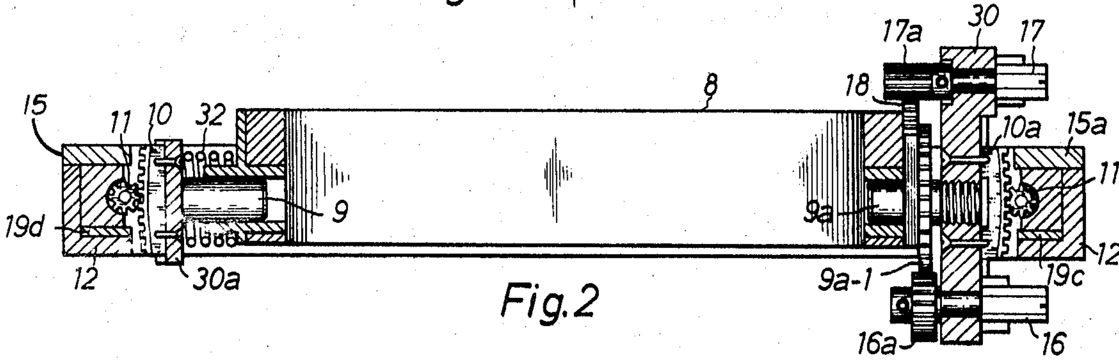
32
19d
19c
8b
14
14a
13
28
22a
24
26
22b

Fig.1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19c
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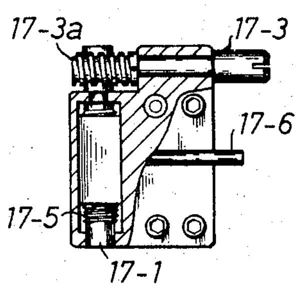
16a
16

Fig.2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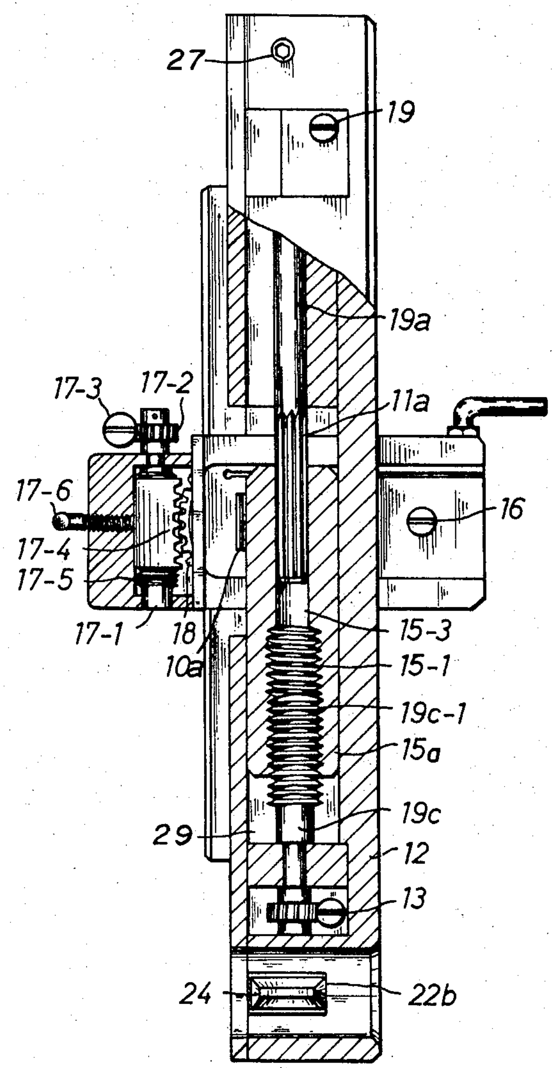
17-6
17-5
17-1

Fig.4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17-3
17-2
11a
17-6
16
17-4
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17-1
18
10a
15-3
15-1
19c-1
15a
19c
29
12
13
24
22b

Fig.3

POSITIONER FOR ADJUSTING INCLINATION AND POSITION OF AN OBJECT FROM ONE DIRECTION

This invention relates to a positioner employed mainly for freely moving and selecting the set position of a focusing coil, a deflection coil or the like in a cathode-ray tube.

In a flying spot Braun tube widely used in information processing equipments in recent years or in a cathode-ray tube for electronic photography, commonly referred to as OFT, it is necessary to precisely adjust the set position of a focusing coil, a deflection coil or the like for obtaining an optimum picture on the screen of the Braun tube or the OFT. This adjustment is required to cover three dimensional movement and forward, backward and lateral inclination of the object. In a conventional positioner, an inner ring and an intermediate ring are employed. The neck portion of a cathode-ray tube and a coil are supported in the inner ring, which is supported by the intermediate ring by the use of first two supporting shafts arranged along a first line. The intermediate ring is supported by an outer frame by the use of second two supporting shafts arranged along a second line, which intersects at right angles with the afore-mentioned line. With such a construction, however, adjustment from at least two directions, that is, from the front and one side of the coil is necessary to achieve adjustment of its forward, backward and lateral inclination and of its two dimensional position along the above two lines. Moreover, the structure inevitably becomes bulky. Since the cathode-ray tube is usually enclosed in a shield case or the like as of perpalloy, the position-and-inclination adjustment of the coil is generally very difficult, and it is usually impossible to achieve the adjustment from two directions when the cathode-ray tube is housed in the case.

Therefore, the position and inclination adjustment of the coil requires removal of the cathode-ray tube from the case. However, this makes it difficult to achieve the adjustment at the operating condition of the cathode-ray tube, and this presents a serious problem in the practice of the position and inclination adjustment of the coil.

An object of this invention is to provide a positioner capable of adjusting from one direction at least two dimensional position and/or forward, backward and/or lateral inclination of an object to be controlled.

The construction and operations of the present invention will be clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a plan view illustrating an embodiment of this invention;

FIG. 2 is a section along a line II—II in FIG. 1;

FIG. 3 is a right side view including a section illustrating a modification of a part of the embodiment shown in FIG. 1; and

FIG. 4 is a plan view including a section illustrating a part of the modification shown in FIG. 3.

With reference to FIGS. 1 and 2, a positioner of this invention has a control shaft **19** provided on one marginal portion of a frame **12**. A rotation shaft **19***a* is coupled through a gear box **20***a* with the right-hand end of the control shaft **19** at right angles and driven with rotation of the shaft **19**. A rotation shaft **19***b* is coupled through a gear box **20** with the left-hand end of the

control shaft **19** at right angles and driven with the rotation of the control shaft **19**. The rotation shafts **19***a* and **19***b* are respectively disposed on the right- and left-hand marginal portions of the frame **12** in parallel relation to each other.

A retaining ring **8** for holding by three screwed bolts **8***a*, **8***b* and **8***c* the object to be controlled is supported at both sides thereof by respective one ends of supporting shafts **9** and **9***a* disposed diametrically opposite to each other with respect to the ring **8** along an axis of rotation. The other ends of the supporting shafts **9** and **9***a* are provided respectively with gear pieces **10** and **10***a*, each of which is a part of a gear wheel. In this case, the left-hand gear piece **10** is fixed to a gear base **30***a* formed integrally with the supporting shaft **9**, and the supporting shaft **9** is supported in a hole of the retaining ring **8** in such a manner so as to be freely movable along the direction of the hole. At the right hand, the supporting shaft **9***a* is rotatably engaged with a hole of the retaining ring **8** at one end thereof and has a screw coupled to a gear base **30** at the other end thereof.

Further, a control shaft **13** is disposed on the frame **12** at the opposite side of the aforementioned shaft **19** in parallel relation thereto. A control shaft **19***c* is coupled through a rack **14***a* thereon with the right-hand end of the control shaft **13** at right angles to each other, so that the sliding movement of the control shaft **19***c* is controlled by rotation of the shaft **13**. A pinion gear **11***a* mounted on the control shaft **19***a* is linked with a holder box **15***a* of the gear piece **10***a*. A control shaft **19***d* is linked through a rack **14** thereon with the left-hand end of the control shaft **13** at right angles to each other, so that the sliding movement of the control shaft **19***d* is controlled by rotation of the shaft **13**. A pinion gear **11** mounted on the control shaft **19***b* is slidably coupled with a holder box **15** of the gear piece **10**. The holder boxes **15** and **15***a* hold the gear bases **30** and **30***a* respectively. The resilient force of a coil spring **32** acts between the gear base **30***a* and the retaining ring **8**.

A gear **17***a* provided on a control shaft **17** passing through the upper end portion of the gear base **30** is meshed with a gear **18** provided on the upper part of the right-hand end portion of the retaining ring **8**. A gear **16***a* on a control shaft **16** passing through the lower end portion of the gear base **30** is meshed with a gear **9***a*-**1** fixed to the supporting shaft **9***a*.

With such a construction as mentioned above, the object seated in the hole of the retaining ring **8** can be moved in the forward and backward directions along a line A by rotating the shaft **13** to move the holder boxes **15** and **15***a* of the gear pieces **10** and **10***a* through the rack **14** and **14***a*, since the gear pieces **10** and **10***a* and the pinion gears **11** and **11***a* are thereby caused to slide to each other. Furthermore, the lateral movement of the object perpendicular to the line A can be achieved by rotating the shaft **16** to drive shaft **9***a* through the gears **16***a* and **9***a*-**1** to slide the shaft **9***a* and the retaining ring **8** against the gear base **30**, since the screwed end of the shaft **9***a* is meshed with the gear base **30**. The forward and backward inclination of the object along the line A is achieved by rotating the shaft **17** to cause the retaining ring **8** to rotate about the shafts **9** and **9***a* through the gears **17***a* and **18**. For controlling the lateral inclination of the object about the line A, the control shaft **19** is rotated to rotate the pinion gears **11** and **11***a* through the gear boxes **20** and **20***a* in synchronism with each other and hence to shift the coupling relationship between the gear pieces **10** and **10***a* and the pinion gears **11** and **11***a*, so that the retaining ring **8** can be rotated about an imaginary axis A of rotation.

The frame **12** has four holes **21***a* **21***b*, **22***a* and **22***b* at the four corner portions to pass respectively four supporting shafts in the perpendicular direction thereto. The holes **21***a*, **21***b*, **22***a* and **22***b* are larger in diameter than the passed shafts by one milli-meter or so. Further, grooves **23** and **24** are formed to extend between the holes **21***a* and **21***b* and between the holes **22***a* and **22***b* respectively to receive push rods **25** and **26** respectively. The length of each of the push rods **25** and **26** is longer by one to one point 5 milli-meters than the inner distance between the holes **21***a* and **21***b* or between the holes **22***a* and **22***b*. Therefore, if set screws **27** and **28** are rotated, the supporting shafts inserted in the holes **21***b* and **22***b* are pushed by the set screws **27** and **28** respectively, so that the push rods **25** and **26** are pushed and then the supporting shafts passing through the holes **21***a* and **22***a* are fixed therein by the other ends of the push rods **25** and **26.** Namely, fixing of the vertical position of the frame **12** on the four supporting shafts can also be achieved by adjusting the two set screws from only one direction.

With reference to FIG. **3**, the control shaft **13** may be meshed with the control shaft **19***c* (or **19***d*) by a worm gear mechanism, while the screwed portion **19***c*-**1** of the control shaft **19***c* is meshed to the screwed hole **15-1** of the gear box **15.** Accordingly, the gear box **15***a* can be slid along a groove **29** in the frame **12** in response to rotation of the shaft **19***c* caused by the rotation of the control shaft **13.** The pinion gear **11***a* is held in the hole **15***a*-**3** of the gear box **15.** Moreover, the gear **18** may be indirectly rotated as shown in FIGS. **3** and **4** by a control shaft **17-3** through a worm gear mechanism including a gear **17-3***a*, in which a shaft **17-1** is rotated through a gear **17-2** thereon by rotating the control shaft **17-3** while a rack **17-4** meshed with the geat **18** is shifted through a screw **17-5** meshed with the rack **17-4** in response to the rotation of the shaft **17-1.** The rotation angle of the gear **18** with respect to the rotation angle of the control shaft **17-3** is extremely reduced in comparison with the embodiment shown in FIGS. **1** and **2.**

As mentioned above, all the operations for adjusting three dimensional positions and forward, backward and lateral inclinations can be effected from one control direction by the above simple mechanism in accordance with this invention. Moreover, the above adjustment is possible while an object to be controlled is under an operative condition. Accordingly, this invention is very advantageous in practical use.

What I claim is:

1. A positioner comprising, a support element on which an object to be positioned in three dimensions is disposed, means defining an axis of rotation for said support element terminating in two axially spaced gear sectors for tilting said axis of rotation about a second axis normal to the axis of rotation, means comprising gear means meshing with said gear sectors for tilting said axis of rotation, means to translate said means defining said axis of rotation to translate said axis of rotation along said second axis in two opposite directions, means to translate said means defining said axis of rotation laterally along said axis of rotation thereby to translate said support element laterally in opposite directions, and means to rotate said means defining said axis of rotation about said axis of rotation, whereby said support element is adjustably positionable in three dimensions.

2. A positioner according to claim **1**, in which said support element comprises two axially spaced bores, said means defining said axis of rotation comprising two shafts each disposed in one of said bores and terminating in said gear sectors, said means for tilting said axis of rotation comprising two parallel shafts each having a pinion gear meshing with one of said gear sectors, a third control shaft for rotating said two parallel shafts, and gears coupling said third control shaft and said parallel shafts.

3. A positioner according to claim **2,** in which said means to translate said axis of rotation comprises gear boxes at opposite ends of the axis of rotation each mounting one of said pinion gears and being slidable relative thereto, a pair of parallel gear racks coupled to corresponding ones of the gear boxes, and a rotatable rod having gears thereon meshing with said gear racks for moving them jointly longitudinally thereby to translate said support element in opposite directions along said second axis.

4. A positioner according to claim **3,** in which said means to translate said means defining said axis of rotation comprises a gear element, a shaft coupled to said support element defining a part of said axis of rotation, and threaded in said gear base element, means to rotate said shaft in opposite directions to move it axially relative to said gear base element thereby to translate said support element laterally in opposite directions along said axis of rotation.

5. A positioner according to claim **4,** in which said means to rotate said means defining said axis of rotation comprises a gear coupled to said shaft defining a part of said axis of rotation, a drive gear meshing with the last-mentioned gear, means rotatably supporting said drive gear on said gear base element, and means to rotate said drive gear thereby to rotate said shaft.

6. A positioner according to claim **1,** including a base having four openings adjacent corners thereof for receiving removable legs therethrough, and means to tighten said legs when disposed in said openings.

7. A positioner according to claim **1,** in which said means comprising gear means meshing with said gear sectors for tilting said axis of rotation comprises for each gear sector a threaded element adjacent a corresponding gear sector and a gear having a threaded bore receiving said threaded element, each threaded element having a worm gear thereon, and a shaft having a worm gear meshing with the first-mentioned worm gear for moving said threaded gear axially on said threaded element.

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