Nov. 17, 1942. W. HOWELL 2,302,444

RETICLE ASSEMBLY FOR GUN SIGHTS AND THE LIKE

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Fig. 1

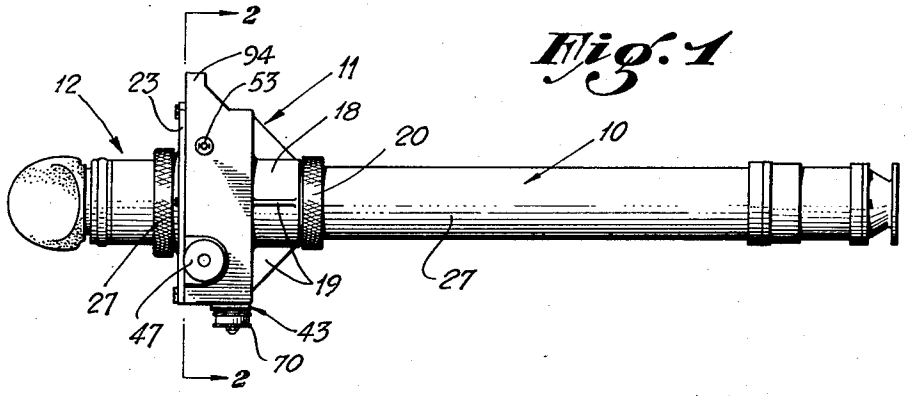
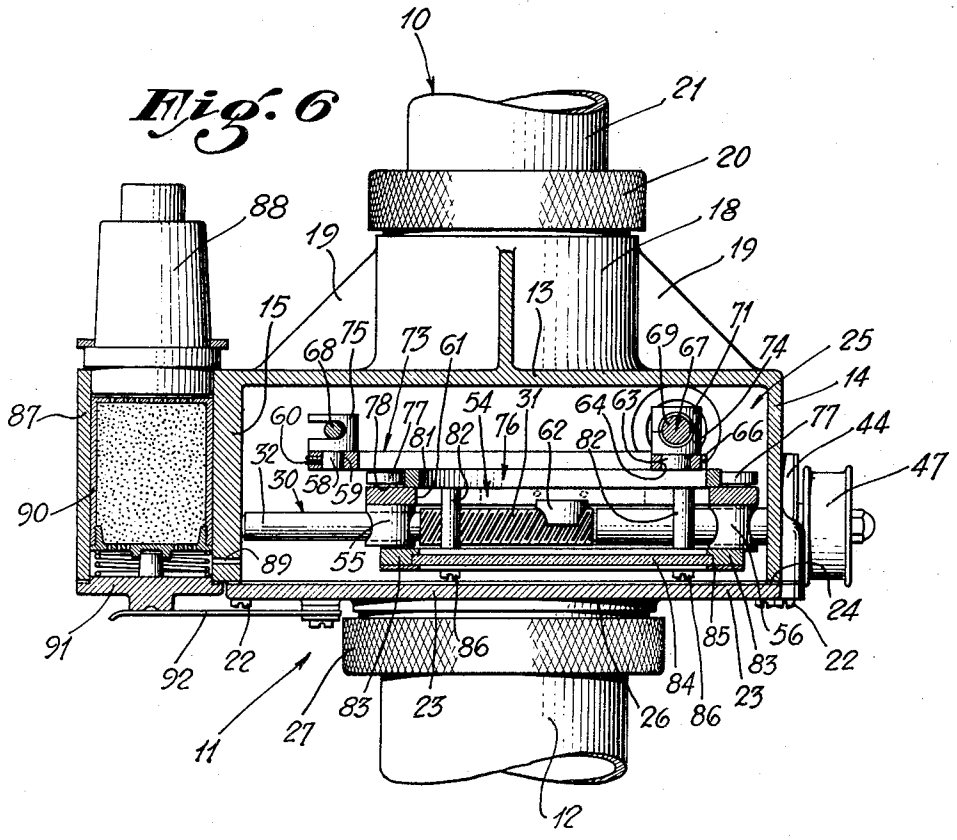


Fig. 6



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RETICLE ASSEMBLY FOR GUN SIGHTS AND THE LIKE

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Fig. 2

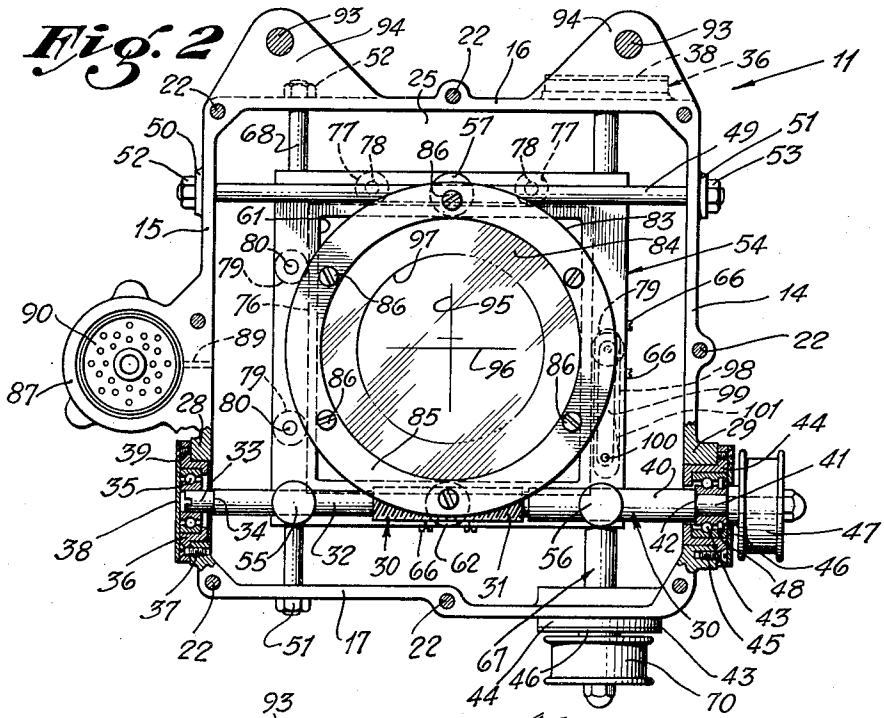
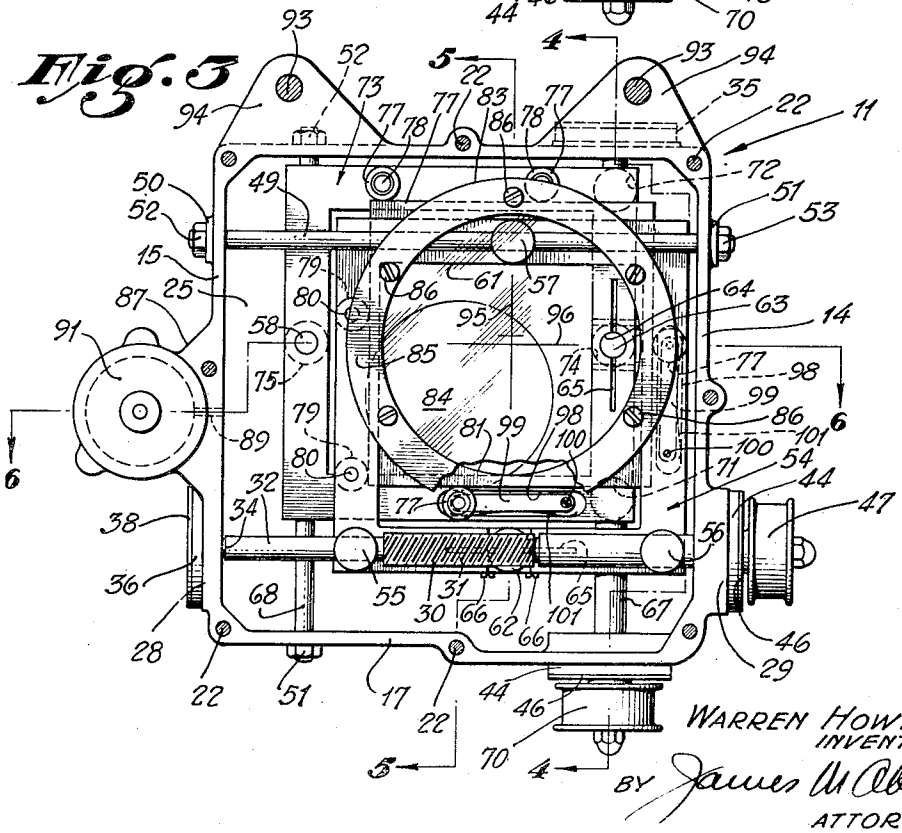


Fig. 3



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Fig. 4

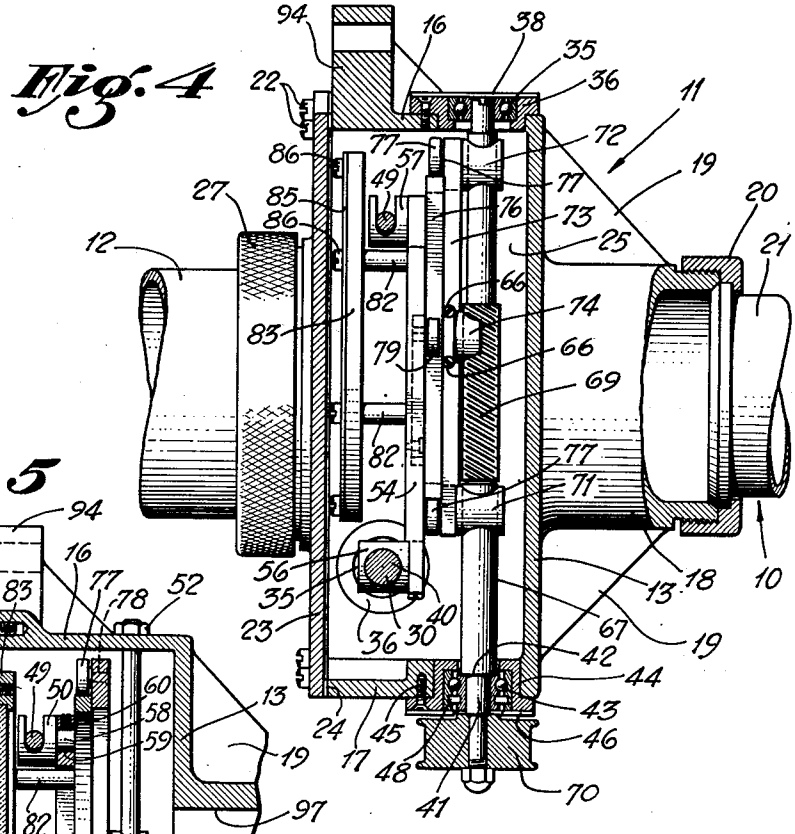
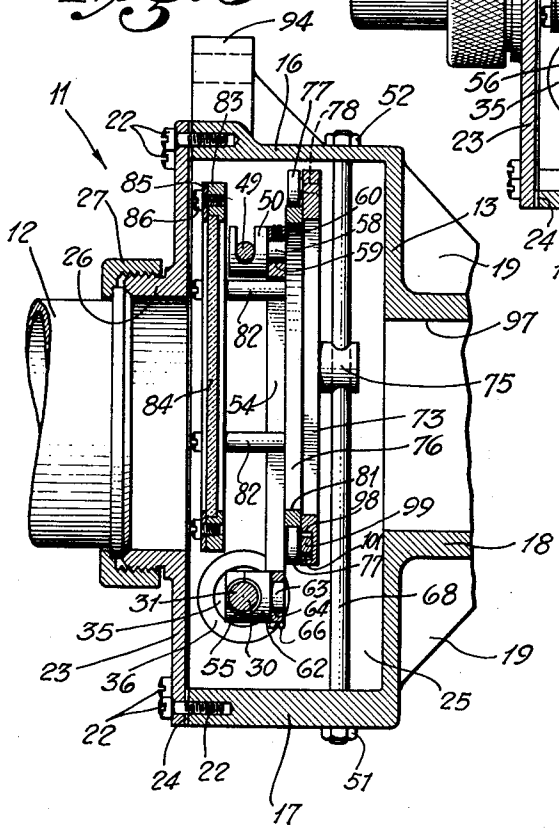


Fig. 5



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RETICLE ASSEMBLY FOR GUN SIGHTS AND THE LIKE

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Application November 9, 1940, Serial No. 365,095

6 Claims. (Cl. 33—50)

This invention relates to optical instruments, and particularly pertains to a reticle assembly for gun-sights and the like.

In the present day warfare various types of gun-sights and bomb-sights are provided for use upon airplanes and are designed to insure rapid and accurate coordination of a sighting apparatus with a gun or bomb dropping structure. Apparatus with which the present invention is particularly shown has been disclosed in application for U. S. Letters Patent Serial No. 300,789, filed by Wolfgang B. Klemperer on October 23, 1939. This general structure includes a telescope unit, an eye-piece, and an intermediate reticle unit. The present invention is concerned with the reticle unit. In this particular type of device it is desirable to provide a reticle unit which is coordinated with means for manipulating a gun, and which unit may be instantly adjusted while being maintained in a focal plane to sight a target, and it is the principal object of the present invention to provide a reticle unit which may be easily manipulated to dispose a reticle in a selected position in a focal plane without appreciable longitudinal displacement of the reticle, and while insuring that the structure of the reticle may be maintained in a condition to protect it from variation in temperature, altitude and atmospheric conditions which might tend to impair the operation of the device or visibility through it. It is also desirable to provide operating means which do not of themselves move longitudinally, thus keeping the operating connections in constant adjustment.

The present invention contemplates the provision of an outer housing adapted to be interposed between a telescope unit and an eye-piece unit and secured to the same, said housing carrying a reticle sealed within the housing and mounted in a manner to be adjusted in a transverse focal plane intersecting the optical axis of the telescope and the eye-piece, said housing structure being sealed to prevent the direct access of raw air into the structure and to eliminate the objectionable action which would take place due to temperature and altitude variations.

The invention is illustrated by way of example in the accompanying drawings, in which:

Figure 1 is a view in side elevation showing an assembled gun-sight unit in which the present invention forms a part.

Fig. 2 is a view in vertical section through the reticle unit as seen on the line 2—2 of Fig. 1 and showing the reticle element aligned with the focal center of the instrument.

Fig. 3 is a view similar to that indicated in Fig. 2 but shows the reticle element adjusted horizontally and vertically with relation to the optical axis of the instrument.

Fig. 4 is a view in transverse section through the reticle unit as shown on the line 4—4 of Fig. 3 and as viewed in the direction of the arrows.

Fig. 5 is a view in transverse vertical section through the reticle unit as seen on the line 5—5 of Fig. 3, and as viewed in the direction of the arrows.

Fig. 6 is a view in horizontal section through the reticle unit as seen on the line 6—6 of Fig. 3 and as viewed in the direction of the arrows.

Referring more particularly to the drawings, 10 indicates a telescope unit, the lens arrangement of which is not part of the present invention, although it is disclosed in the above mentioned co-pending application. The reticle unit with which the invention is particularly concerned is indicated at 11, and is secured at the rear end of the telescope unit 10. An eye-piece unit 12 is secured upon the opposite side of the reticle unit from the telescope. The reticle unit comprises an outer housing having a substantially square front wall 13 around the perimeter of which side walls 14 and 15 occur as well as a top wall 16 and a bottom wall 17. Extending forwardly from the front wall 13 is a tubular boss 18 suitably reinforced by webs 19. The forward end of this boss is designed to receive a threaded nut 20 by which the tube 21 of the telescope 10 is detachably secured in position. A plurality of bosses are formed in the edge faces of the walls 14 to 17, inclusive, to receive screws 22 by which a cover plate 23 is held in position. A suitable sealing gasket 24 is interposed between the cover plate and the edges of the side walls to hermetically seal the compartment 25 which is enclosed by the housing structure and the cover plate. Formed centrally of and projecting outwardly from the cover plate 23 is a threaded boss 26 receiving a nut 27 by which the eye-piece 12 is held in position. Formed in the opposite side walls 14 and 15 of the main housing and adjacent the lower wall 17 are bearing bosses 28 and 29. These are in axial alignment and receive a horizontal screw shaft 30. This shaft is formed with a central threaded cylindrical portion 31 having a multiple thread cut thereon. At one side of this central portion is a cylindrical length 32 which terminates in a reduced cylin-

drical portion 33. A shoulder 34 occurs between these two portions. The reduced end portion extends into the inner race of an an anti-friction bearing 35. Attention is directed to the fact that the shoulder 34 is spaced from the contiguous face of the inner bearing race for purposes of compensation in expansion and contraction of parts, as will be hereinafter explained. The anti-friction bearing structure 35 is mounted within a cup 36 secured into the boss 28 of screws 37. A cover plate 38 is fastened over the end of the cup and held by screws 39 so that the bearing will be completely air-tight.

At the opposite end of the shaft 30 is a cylindrical portion 40. This cylindrical portion terminates with a reduced cylindrical end 41 separated therefrom by a shoulder 42. The reduced end 41 fits within the inner race of an anti-friction bearing structure 43. The shoulder 42 bears continuously against the end face of the inner race of the anti-friction bearing structure 43. Thus, expansion and contraction takes place longitudinally of the shaft 30 and toward the end 33. A bearing cup 44 is secured within the boss 29 and receives the anti-friction bearing 43. This is held by screws 45. A cover 46 is positioned over the cup to seal the same while accommodating the extending end of the shaft portion 41. Fixed upon this shaft end is a pulley or drum 47. It is to be understood that this drum may be operatively associated with various types of mechanism and apparatus, such for example as the gun-control described in the aforementioned co-pending application. In the present case, however, it is not believed necessary to describe in detail the coordinate action of the reticle structure with any other piece of apparatus, since the present invention lies in the novelty of the reticle structure, its housing and the means for manipulating the reticle elements. In view of the fact that the extension 41 of the shaft 30 must project through the anti-friction bearing structure 43 and carry the drum 47, it is necessary to provide suitable packing means, such as indicated at 48, to seal the bearing and to prevent air from passing in or out of it. Disposed parallel to the horizontal screw shaft 30 and fixed within the reticle housing is a guide shaft 49. This guide shaft passes through bosses 50 and 51 in the side walls 14 and 15 of the housing and is held by nuts 52 and 53. The shaft 49 is disposed above the optical axis of the structure a distance equal to that to which the horizontal screw shaft 30 is disposed below said optical center. The axis of the shafts 30 and 49 lie in the same vertical plane. A rear guide slide plate 54 is disposed in a plane parallel to that within which the shafts 30 and 49 lie and at a point between said shafts and the end wall 13 of the housing. Secured to the rear guide slide plate 54 is a pair of lower bearing blocks 55 and 56 having openings through them to receive the portions 32 and 40, respectively, of the horizontal screw shaft 30, and to cooperate with the screw shaft 30 in guiding the rear guide slide plate 54 in horizontal movement. Carried by the plate 54 adjacent to its upper edge is a forked bearing block 57 within which the guide shaft 49 is seated. The member 57 is formed with a reduced shank portion 58 which extends into an opening 59 in the rear guide plate 54. The shank may be set in position by a set screw 60. The rear guide plate is square in section and is formed with a square central opening therethrough as indicated at 61. Carried along the lower face of the rear guide plate 54 and disposed at a point midway between the bearing blocks 55 and 56 is a half nut or saddle 62. This member seats within a recess in the face of the guide plate 54 and is formed with a stem 63 which projects into an opening 64 of the guide plate. The plate is split longitudinally at opposite sides of the opening, as indicated at 65, so that the member 62 may be adjusted and held by a set screw 66. The outer face of the saddle 62 is cut arcuately, and has threaded lengths corresponding in pitch and contour to those formed on the screw section 31 of the shaft 30 and with which threads the threads of the saddle accurately engage. It will be evident that the saddle 62 may be rotated on its stem 63 to bring the threads of the screw section 31 and the threads of the saddle 62 into accurate adjustment and without lost motion. This relationship is particularly shown in Fig. 5 of the drawings. It will therefore be seen that when the drum 47 is rotated the horizontal screw shaft 30 will be rotated correspondingly and its threaded section 31 will act to move the saddle 62 longitudinally of the threaded section, and thus shift the back guide plate 54 correspondingly. Disposed in a plane parallel to that occupied by shafts 30 and 49 and in advance thereof is a vertical screw shaft 67 and a vertical guide shaft 68. These are spaced from each other upon opposite sides of the optical center of the instrument as described for shafts 30 and 49 but are disposed at right angles thereto.

The vertical screw shaft 67 is mounted in an anti-friction bearing structure 43 supported in the lower wall 17 of the housing and constructed in the same manner as described for the mounting of the central bearing in the side wall 14. The opposite and upper end of the shaft 67 is mounted within an anti-friction bearing structure 35 similar to that described for the shaft 30 and is carried in the upper wall 16. The details of construction of these two bearing mountings agree with the details previously described in connection with shaft 30 and the numerals therefor for corresponding parts will be identical. The vertical screw shaft 67 is formed at a point intermediate its lengths with a screw section 69 similar to the section 31 on the shaft 30. The end of the shaft 67 is provided with a drum 70 comparable to the drum 47 on the shaft 30. Mounted upon the shaft 67 are blocks 71 and 72 which extend along the side of a front guide slide plate 73. The plate 73 is identical with the rear plate 54. These plates are disposed in parallel planes with relation to each other and are positioned between the sets of shafts 30 and 49, and 67 and 68. Secured to the front guide plate 73 and at a point between the members 71 and 72 is a saddle nut 74 which agrees in design and function with the nut 62 carried by the rear guide plate 54. Along the opposite edges of the front guide plate 73 from that of the saddle nut 74 is a bearing block 75 through which the guide rod 68 extends. The member 65 agrees in construction with the member 67 shown in Fig. 5 of the drawings and has a slotted recess to receive the shaft 68 and to permit compensation of parts without binding. It will be evident from the description thus far that a front guide plate 73 and a rear guide plate 54 are provided and are supported in common parallel planes, the front plate moving vertically and the rear plate moving horizontally.

Disposed between the contiguous faces of the front plate 73 and the rear plate 54 is a floating

slide plate 76. The faces of the floating plate 76 and the abutting faces of the front and back guide plates 54 and 73 lie directly against each other and are ground to fit so that the three plates may move freely in parallel planes and without movement with relation to each other longitudinally of the device. In fact the specifications for the manufacture of this device provide that there shall be no more than $\frac{1}{1000}$ of an inch tolerance in the movement of the reticle ring, to be hereinafter described, from its determined focal plane. The floating plate 76 is square, its dimensions being less than the dimensions of the front and rear guide plates 54 and 73. This difference in size is shown in Fig. 4 of the drawings, where it will be seen that the front guide plate 73 projects beyond the marginal upper and lower edges of the floating plate 76. Mounted on the faces of the projecting portions of the front guide plate are rollers 77 which bear against the upper and lower faces of the floating guide plate and are carried upon pins 78. Mounted on the faces of the rear guide plate at opposite vertical sides of the floating plate 76 are rollers 79 carried upon pins 80. It is desirable to mount the rollers directly on anti-friction bearings. It will thus be seen that the floating plate 76 may move vertically between pairs of rollers 79 carried upon the rear guide plate 54 and that the floating plate 76 may move horizontally between the rollers 77 carried by the front guide plate 73. A central circular opening 81 is formed through the floating plate 76. Extending from the rear face of the floating plate 76 are standards 82 which project through the central square opening of the rear plate 54 and receive a reticle ring 83. This ring is formed with a seat within which a reticle glass 84 is mounted. A bezel 85 is held in position by screws 86.

Formed as a part of the housing of the reticle unit and here shown as being integral with the side 15 of the housing is a cylindrical case 87 which receives a desiccator structure through which air flows into the housing and by which air is dried. The details of this construction are not part of the present invention. Suffice it to say, however, that the case 87 carries an air valve mechanism 88 at one end through which air may pass into the case. An air duct 89 is formed through the wall 15 and extends from the case to the desiccator housing. Mounted within the case 87 and interposed between the valve 88 and the duct 89 is a cartridge 90 carrying a suitable deliquescent material. An end disc 91 is held in position by a yieldable latch finger 92 and closes the end of the desiccator case opposite from the end carrying valve 88.

After the structure has been assembled as here shown, it is then mounted in connection with a suitable optical apparatus and if desired the drums 47 and 70 may be operatively connected with other devices, such for example as a gun mounting. The structure may be supported rigidly by bolts 93 passing through lugs 94 formed on the housing of the unit 11. When the structure is assembled the front and rear guide plates 54 and 73, respectively, may coincide in position as shown in Fig. 2 of the drawings. At this same time the floating plate 76 will be centrally aligned between the guide plates. The reticle lens 84 is formed with reticle lines 95 and 96. These may be provided by reticle wires or lines ground directly on the surface of the lens. When an object is sighted in the field of vision, as represented by the telescope and the opening 97, the floating plate 76 may be shifted to superimpose the inner section of the reticle lines 95 and 96. This may be done by the coordinate action of operating mechanism connected with the drums 47 and 70 in which event the shafts 30 and 67 may be appropriately rotated and simultaneous or separate action will move the saddle nuts 62 and 74 along the rotating screws 31 and 69, respectively, thus shifting the rear guide plate 54 horizontally and the front guide plate 73 vertically. This will move the floating plate 76 and the reticle lens 84 to a position where the intersection of the reticle lines will represent a point the coordinates of which are determined by the abscissa and ordinate established by the separate movement of the guide plates 54 and 73. In the event that temperature change or atmospheric changes take place as a result of changeable weather conditions or rapid variation in altitude of an airplane, in which the present structure might be installed, expansion and contraction of operating parts may be accommodated by longitudinal movement of the shafts 30 and 67. Furthermore, since variation in air conditions may cause air to pass through the desiccator unit and into the main housing this air is completely dehydrated as it passes through the valve 88, the desiccator unit 90 and the duct 89.

It will thus be seen that the structure here disclosed comprises a precision instrument which supports a reticle lens in a focal field, in a manner to prevent longitudinal displacement of the reticle lens in a focal plane and at the same time permitting the reticle lines to be instantly shifted in said focal plane to any point in the focal plane as may be established by the coordinate movement of the guide plates, the structure further being designed to insure against inaccuracy due to temperature, atmospheric or altitude variations.

It is also to be pointed out that the bearings are packed with a hard grease which seals the case even at very low pressures.

While I have shown the preferred form of my invention as now known to me, it will be understood that various changes may be made in combination, construction and arrangement of parts by those skilled in the art, without departing from the spirit of my invention as claimed.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A reticle unit for optical systems, comprising a pair of guide plates disposed in parallel planes mounted for rectilinear movement at right angles to each other, and a floating plate cooperatively supported by said guide plates and carrying reticle lines supported in a focal plane and actuating means whereby separate movement of the guide plates will move the floating plate and dispose the reticle lines at a coordinate point in said focal plane.

2. A reticle unit for optical systems, comprising a pair of guide plates spaced from each other in parallel planes lying at right angles to the optical center of an instrument, means supporting said plates for rectilinear movement at right angles to each other, a floating plate disposed between said guide plates and bearing against the plane surfaces thereof whereby said floating plate will be held in rectitude therewith, cooperating means between said guide plates and said floating plate whereby the floating plate will move in coordination with the rectilinear movement of said guide plates to correspondingly translate the floating plate a like distance in the

same direction, a reticle ring supported by the floating plate and carrying reticle lines lying in a focal plane and within which plane said lines may be moved as the floating plate moves.

3. A reticle unit for optical systems, comprising a pair of guide plates spaced from each other in parallel planes lying at right angles to the optical center of an instrument, means supporting said plates for rectilinear movement at right angles to each other, a floating plate disposed between said guide plates and bearing against the plane surfaces thereof whereby said floating plate will be held in rectitude therewith, cooperating means between said guide plates and said floating plate whereby the floating plate will move in coordination with the rectilinear movement of said guide plates to correspondingly translate the floating plate a like distance in the same direction, a reticle ring supported by the floating plate and carrying reticle lines lying in a focal plane and within which plane said lines may be moved as the floating plate moves, the supports for said guide plates including threaded shafts along which the guide plates may move, and a nut in threaded engagement with the thread of the shaft, said nut being carried by the guide plate to be moved by said shaft.

4. A reticle unit for optical systems, comprising a pair of guide plates spaced from each other in parallel planes lying at right angles to the optical center of an instrument, means supporting said plates for rectilinear movement at right angles to each other, a floating plate disposed between said guide plates and bearing against the plane surfaces thereof whereby said floating plate will be held in rectitude therewith, cooperating means between said guide plates and said floating plate whereby the floating plate will move in coordination with the rectilinear movement of said guide plates to correspondingly translate the floating plate a like distance in the same direction, a reticle ring supported by the floating plate and carrying reticle lines lying in a focal plane and within which plane said lines may be moved as the floating plate moves, the supports for said guide plates including threaded shafts along which the guide plates may move, a nut in threaded engagement with the thread of the shaft, said nut being carried by the guide plate to be moved by said shaft, and a guide rod for each of the guide plates.

5. A reticle unit comprising a housing for enclosing the same and having light openings in opposite side walls thereof, a reticle disposed in a focal plane within said housing and between said openings, a floating plate carrying said reticle and being disposed in a plane parallel to the focal plane, the opposite sides of said plate being flat and parallel, a pair of guide plates between which said floating plate is mounted, said guide plates having flat faces bearing against the opposite flat faces of the floating plate and between which faces the floating plate may slide, means counting the guide plates within the housing for rectilinear movement at right angles to each other, means separately actuating said guide plates in their paths of travel, bearing members carried by the guide plates, the bearing members of one guide plate engaging diametrically opposite edges of the floating plate and bearing members of the other guide plate engaging the remaining opposite edges of the floating plate, whereby relative movement of the two guide plates will impart a coordinate action to the floating plate and the reticle carried thereby.

6. A reticle unit comprising a housing for enclosing the same and having light openings in opposite side walls thereof, a reticle disposed in a focal plane with said housing and between said openings, a square floating plate carrying said reticle and being disposed in a plane parallel to the focal plane, the opposite sides of said plate being flat and parallel, a pair of guide plates between which said floating plate is mounted, said guide plates having flat faces bearing against the opposite flat faces of the floating plate and between which faces the floating plate may slide, means mounting the guide plates within the housing for rectilinear movement at right angles to each other, means separately actuating said guide plates in their paths of travel, rollers carried by the guide plates and overhanging the edges of the floating plate, the rollers of one guide plate engaging the diametrically opposite edges of the floating plate, and the rollers of the other guide plate engaging the remaining diametrically opposite edges of the floating plate, whereby relative movement of the guide plates will produce a coordinate movement of the floating plate and the reticle carried thereby.

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