

Aug. 13, 1929.

R. KAUCH ET AL

1,724,092

AUTOMATIC COMPENSATING GUN SIGHT

Filed April 30, 1923

4 Sheets-Sheet 1

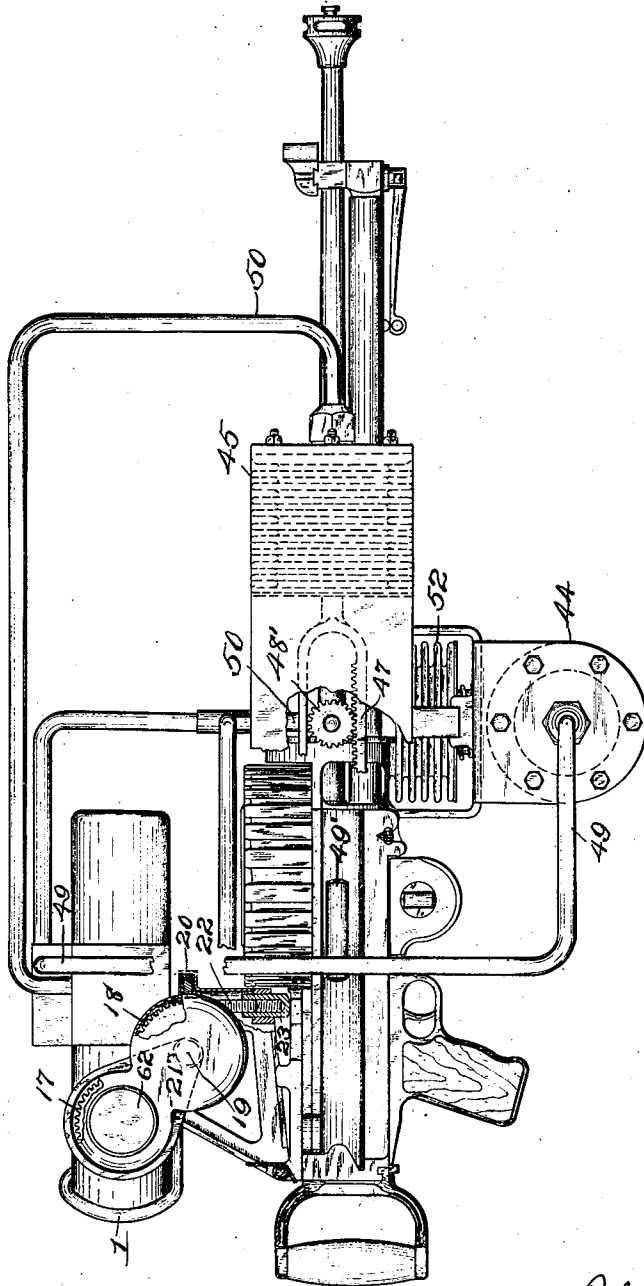


FIG. 1.

INVENTOR.

Robert Kauch
BY Charles L. Paulus

Robert H. Young ATTORNEYS.

Aug. 13, 1929.

R. KAUCH ET AL

1,724,092

AUTOMATIC COMPENSATING GUN SIGHT

Filed April 30, 1923

4 Sheets-Sheet 2

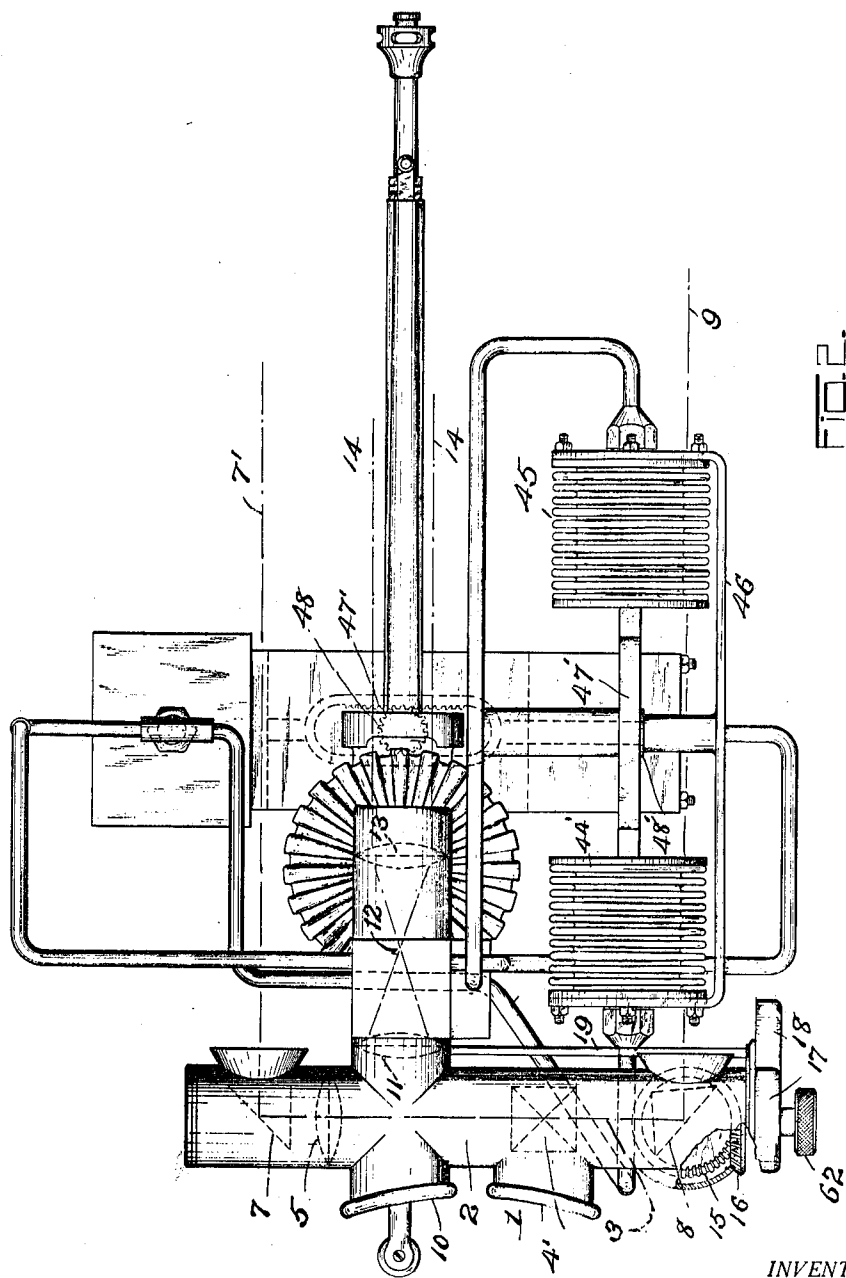


FIG. 2.

INVENTOR.

Robert Kauch
BY Charles L. Paulus

Robert H. Young ATTORNEYS.

Aug. 13, 1929.

R. KAUCH ET AL

1,724,092

AUTOMATIC COMPENSATING GUN SIGHT

Filed April 30, 1923

4 Sheets-Sheet 3

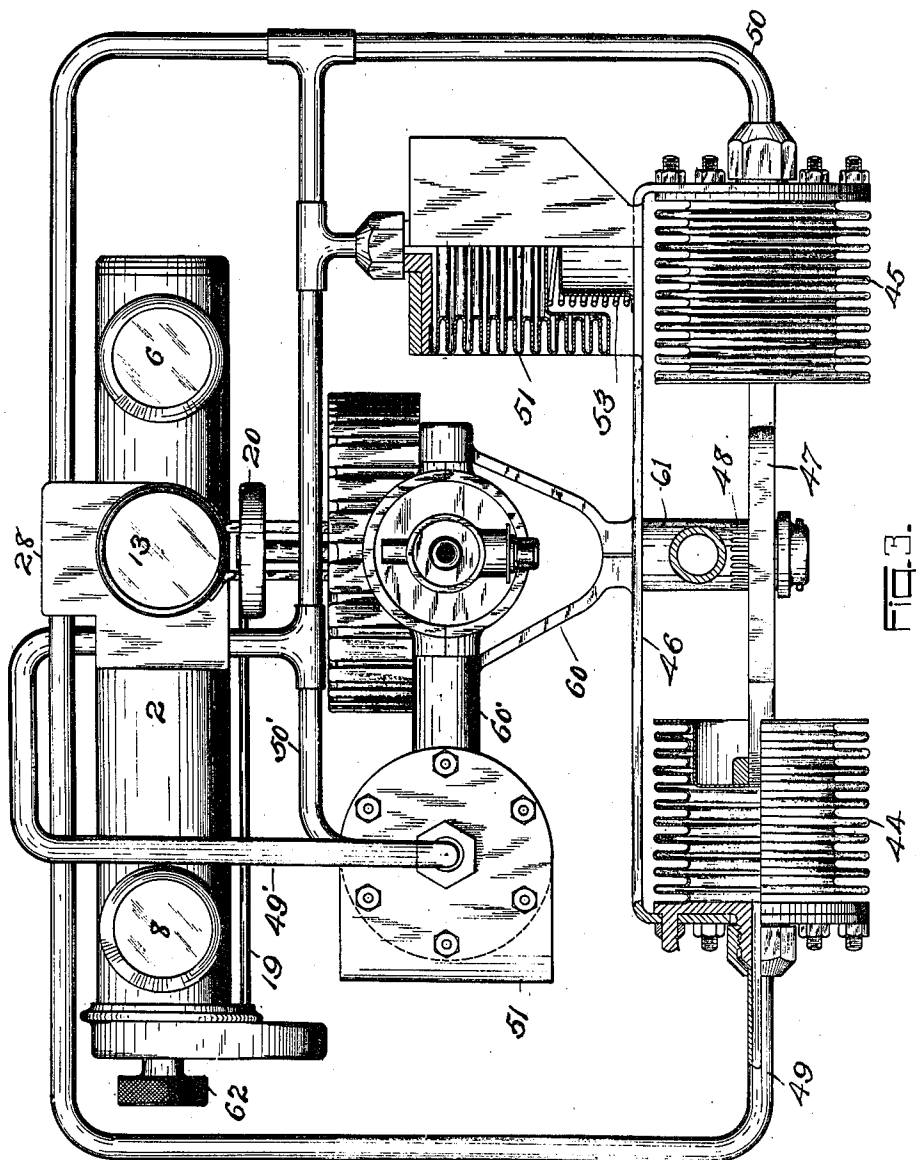


FIG. 3.

INVENTOR.
Robert Kauch
BY *Charles L. Paulus*
Robert H. Young ATTORNEYS.

Aug. 13, 1929.

R. KAUCH ET AL

1,724,092

AUTOMATIC COMPENSATING GUN SIGHT

Filed April 30, 1923

4 Sheets-Sheet 4

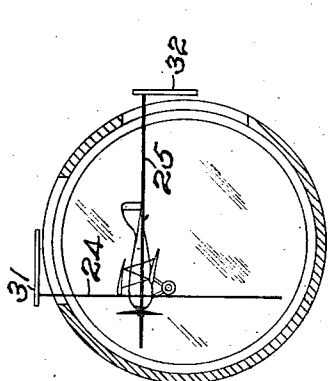


FIG. 8.

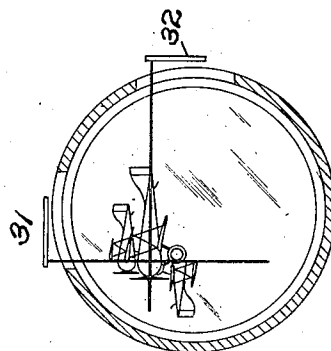


FIG. 9.

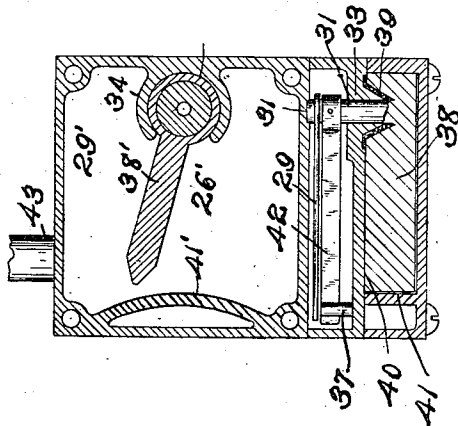


FIG. 5.

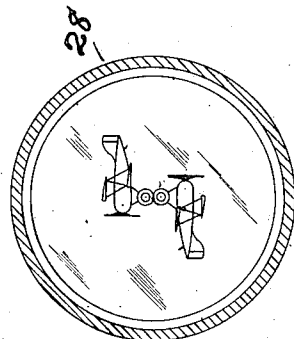


FIG. 7.

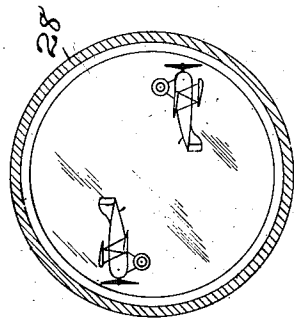


FIG. 6.

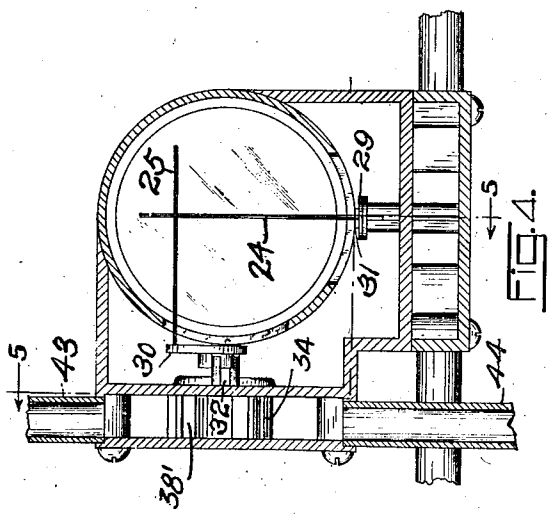


FIG. 4.

INVENTOR.
Robert Kauch
BY Charles L. Paulus
Robert Young ATTORNEYS.

UNITED STATES PATENT OFFICE.

ROBERT KAUCH AND CHARLES L. PAULUS, OF DAYTON, OHIO.

AUTOMATIC COMPENSATING GUN SIGHT.

Application filed April 30, 1923. Serial No. 635,755.

This invention relates to an automatic compensating gun sight, the broad object of the invention being to provide simple and reliable means whereby as the gun is swung upwardly or downwardly, or to the right or to the left, the gun sight is automatically adjusted to compensate for the change in the aiming position of the gun, the sight being moved at a speed proportionate to the movement of the gun about either or both axes.

The compensating gun sight is especially designed for flexibly mounted aircraft guns and the sight is so designed as to compensate for the speed of the aircraft on which the gun is carried, and also the speed at which the enemy aircraft is flying. By means of the mechanism hereinafter fully described, the proper lead is obtained on the enemy aircraft to secure accurate firing.

With the above and other objects in view, the invention consists in the novel features of construction, combination and arrangement herein fully described, shown and claimed.

In the accompanying drawings.

Figure 1 is a side elevation of a gun showing the improvements applied thereto.

Figure 2 is a top plan view of the same.

Figure 3 is a view partly in rear elevation and partly in section thereof.

Figure 4 is a sectional view showing the cross hair arrangement and the means for imparting movement to the cross hairs.

Figure 5 is a sectional view on line 5—5 of Figure 4.

Figures 6, 7, 8 and 9 are sight charts showing the appearance of the images transmitted through the eye piece of the range finding unit.

In view of the multi-unit construction of the mechanism forming the subject matter of this invention, it is thought advisable to describe the function of the units separately.

With this idea in view, the range finder will first be considered, the function thereof being to interpret the exact range of an enemy airplane and in so doing make the necessary correction for the projectile in trajectory.

In order to explain the action of the range finder, we will first consider the case where the gunner's vision is entering the opening 1 of the casing 2 of the instrument. In this connection, particular attention is called to Figure 2. In this case the gunner's line

of vision will be deflected to follow a path shown by the dashed and dotted lines 3; that is, the vision would first strike the double prism 4' mounted just within the casing in line with the opening 1. At this point the line of vision will be separated into two parts, one part being reflected to the left and passing through the lens 5, thence to the prism 7 and from that point following a line 7' parallel to the original line of vision of the enemy airplane.

The portion of the vision which is reflected to the right by the prism 4' is reflected by the prism 8 along the line 9 in such a way and at such an angle as to follow upon the target or enemy airplane. The arrangement just described permits the exact range of the enemy airplane to be determined through the calibration of the angle between the two lines of vision shown by the dashed and dotted lines in said Figure 2.

By this arrangement, an erect and an inverted image of the enemy airplane is seen as shown in Figures 6 and 7 in the sight charts. Figure 6 shows the position of the enemy airplane as observed by the gunner when the range finder is not adjusted to suit the range. Figure 7 shows the enemy airplane as it will appear after the range finder has been set to the exact range at which the enemy airplane is flying.

Considering the case where the gunner would have his right eye closed and observe only with his left eye, his vision would pass through the eye piece 10, thence to the lens 11, cross at the focal point 12, pass through the second lens 13 and from that point the vision would follow the dashed and dotted lines 14 to the enemy airplane. This arrangement permits a vision similar to the sight chart shown in Figure 8, in which the enemy airplane appears right side up and slightly larger than the vision obtained by the use of the other eye. This is accomplished through manipulation of the magnification obtained through the lens 5. It is of course, the idea of the sight to use both eyes simultaneously so that the enemy airplane will appear as shown in sight chart Figure 9; that is, the right eye will record a double image of the enemy airplane, one image being inverted and the other upright, while the left eye will record an upright outstanding target. Due to the fact that it is necessary to introduce a correction for the trajectory of the projectile, the knob

which controls the angular prism 8 through the bevel gears 15 and 16 is connected by use of the spur gears 17 and 18 to the shaft 19 which actuates the worm gear 20 by rotation of the worm 21 (see Fig. 1). A movement of the worm gear 20 rotates the threaded shaft 22 which in turn raises or lowers the shoe 23 bearing against the gun frame. This arrangement causes movement of the knob 1 to change the horizontal axial relation between the gun sight and the gun bore and permits an adjustment which will compensate for the fall of the projectile in trajectory.

The cross hair shifting means will now be described, reference being had first to Figures 4 and 5. The shifting means for each cross hair is identical, therefore only one will be described, the other being indicated, wherever practicable, by the same numerals primed. The cross hairs 24 and 25 are mounted in such a way as to cause the positions thereof to change an amount which will depend upon the volume of liquid displaced in the chambers 26 and 27 of the casing 28 (see 26' and 27') of a hydraulic operating system. The cross hairs 24 and 25 are fixed permanently upon arms 29 and 30 respectively, which arms are mounted on shafts 31 and 32, the shaft being journaled in bearings 33 and 34 in the casing 28 of the cross hair mounting. Leakage of the liquid contained in the casings is prevented through use of cupped leather washers as shown at 39 (Fig. 5). The shaft 31 has mounted thereon a vane 38. This vane is constructed in such a way as to maintain a liquid-tight joint regardless of the direction of movement thereof. This is accomplished by the use of a ground bearing 39 (see 39') and a ground fit along the lines 40 where the vane rides in contact with the casing. The arcuate surface 41 lies opposite the free end of the vane 38 and is developed in curvature in such a way as to cause the vane 38 to shift or move an amount exactly proportional to the speed of flow of the liquid contained in the chambers 26 and 27. The vane 38 is normally retained in a central or neutral position by the action of a leaf spring 42, one end of which is fixed to the shaft 31 and the other extending between and limited by pins 37. This position is assumed at a time when there is absolutely no movement of the liquid or fluid. The vane 38 when standing in the normal position separates the liquid chamber of the casing into equal portions 26 and 27.

Any movement of the liquid, no matter how minute, will cause a corresponding movement of the vane 38. This, together with the fact that the vane is directly coupled to the cross hair, causes the latter to shift an amount directly proportional to the

speed of movement of the liquid. It will be observed again that there are two cross hairs 24 and 25. This arrangement is necessary due to the fact that movement of the gun either vertically, horizontally or in a direction the component of these two, must be compensated for in firing; that is, a movement of the gun around the horizontal axis will cause the cross hair 24 to shift upwardly or downwardly, thereby causing the projectile to lead the enemy air plane in this direction. A movement of the gun to the right will shift the cross hair 25 to the right, thereby causing the projectile to lead the enemy airplane the proper amount in this direction. A combination of these movements will, of course, cause both of these corrections to take place simultaneously. The liquid, the movement of which causes the above described function, is fed through the casing 28 by means of the sylphons 44 and 45. The means for causing movement of the volume of liquid an amount proportional to the movement of the gun will now be described.

Referring to Figure 3 it will be observed that sylphons 44 and 45 are mounted in position on the gun mount through the use of a split bracket 46 and the sylphons are connected for simultaneous operation by means of a rack element 47 which engages and is actuated by a pinion 48. The pinions 48 and 48' are so connected with the gun by means of the bracket 60 and trunnion tube 61 that as the gun is partially rotated, said pinions are also partially rotated so as to move the rack elements 47 and 47' in one direction or the other. This arrangement causes movement of the gun in a horizontal plane to shift the rack 47 in a corresponding direction and in such a way as to displace the liquid contained in one sylphon while the corresponding proportion of the liquid is received in the other sylphon. The moving of liquid between the sylphons is performed by flexible tubes or pipes 49 and 50 and is thereby conducted to and from the cross hair shifting apparatus above described. The unit 51 for operating the other cross hair is identical in construction with the unit just described, in order that the liquid contained in this part of the system or apparatus is set in motion by the vertical movement of the gun. A constant pressure is maintained in the entire hydraulic system by the use of a sylphon 52 which is acted upon by the spring 53 and is connected in series with the two pairs of opposed sylphons. The function of this part of the mechanism is to maintain a constant pressure in the system, and also to form a reservoir which will compensate for expansion and contraction of the liquid, due to varying atmospheric temperatures under which the mechanism will be used. The rack and pin-

ion are better illustrated in Figure 1 as 47 and 48'. It will be observed that the pinion 48 is turned when the gun mount is turned about the vertical axis, and that the corresponding pinion 48' which operates the other pair of sylphons is turned when the gun is swung about a horizontal axis, or on the gun trunnions carried by the yoke of the gun mount 65.

It is believed that the operation of each portion of the device has been so specifically explained that further description thereof is unnecessary.

We claim:

1. In an automatic gun sight, the combination of a gun mount, a gun mounted for vertical and horizontal rotative movement thereon, an optical gun sight mounted to move with the gun and embodying movable cross hair members, and hydraulic means controlled by the rotative movements of the gun for shifting said movable cross hair members.

2. In an automatic gun sight, the combination of a gun mount, a gun mounted for vertical and horizontal rotative movement thereon, an optical gun sight horizontally disposed above said gun and mounted to move therewith and embodying movable cross hair members, and hydraulic means controlled by the rotative movements of the gun for shifting said movable cross hair members in degrees proportionate to the speed of rotative movements of the gun.

3. In an automatic gun sight, the combination of a gun mount, a gun mounted for vertical and horizontal rotative movement thereon, a horizontally positioned optical gun sight mounted to move with the gun and embodying movable cross hair members, and hydraulic means controlled by the rotative movements of the gun for shifting said movable cross hair members in degrees proportional to the speed of rotative movements of the gun, means to interpret the range and relative speed of the target and further means operated by the range interpreting means for concurrently making the necessary correction for the projectile in trajectory.

4. In an automatic gun sight, the combination of a gun mount, a gun mounted for vertical and horizontal rotative movement thereon, an optical gun sight mounted to move with the gun and embodying movable cross hair members, and hydraulic means controlled by the rotative movements of the gun for shifting said movable cross hair members, said hydraulic means embodying a plurality of opposed sylphons, fluid circulating conduits connecting respective pairs of said sylphons, and cross hair shifting elements connected to said cross hairs and having means arranged in the path of flow of the fluid in said conduits respectively for

transmitting motion to said elements in accordance with the flow of fluid therein.

5. In an automatic gun sight, the combination of a gun mount, a gun mounted for vertical and horizontal rotative movement thereon, an optical gun sight mounted to move with the gun and embodying a movable cross hair member, and hydraulic means controlled by the rotative movements of the gun for shifting said movable cross hair member, said hydraulic means embodying a pair of sylphons, fluid circulating conduits connecting said sylphons and cross hair shifting elements arranged in the path of flow of the fluid in said conduits for transmitting motion to said elements in accordance with the flow of fluid therein.

6. In an automatic gun sight, the combination of a gun mount, a gun mounted for vertical and horizontal rotative movement thereon, an optical gun sight mounted to move with the gun and embodying movable cross hair members, and hydraulic means controlled by the rotative movements of the gun for shifting said movable cross hair members, said hydraulic means embodying pairs of opposed sylphons, fluid circulating conduits connecting respective pairs of said sylphons, means operatively connected to said conduits for maintaining a constant fluid pressure in the hydraulic system, and cross hair shifting elements arranged in the path of flow of the fluid in said conduits for transmitting motion thereof to said cross hairs in response to motion of said fluid.

7. In an automatic gun sight, the combination of a gun mount, a gun mounted for vertical and horizontal rotative movement thereon, an optical gun sight mounted to move with the gun and embodying movable cross hair members, and hydraulic means controlled by the rotative movements of the gun for shifting said movable cross hair members to interpret the range of the target, and a linkage between the gun and hydraulic means whereby the latter is controlled by the former.

8. In an automatic gun sight, the combination of a gun mount, a gun mounted for vertical and horizontal rotative movement thereon, an optical gun sight mounted to move with the gun and embodying movable cross hair members, and hydraulic means controlled by the rotative movements of the gun for shifting said movable cross hair members to interpret the range of the target, and a linkage between the gun and hydraulic means whereby the latter is controlled by the former, and means for adjusting said sight means for effecting a preliminary adjustment of said sight vertically with respect to said gun in accordance with the range of the target.

9. In an automatic gun sight, the combination of a gun mount, a gun mounted for

vertical and horizontal rotative movement thereon, an optical gun sight mounted to move with the gun and embodying movable cross hair members, and hydraulic means
5 controlled by the rotative movements of the gun for shifting said movable cross hair members, said hydraulic means including a casing, and means operable by the passage of fluid through said casing induced by
10 movement of the gun for shifting said cross hair members by an amount proportional to the range and relative speed of the target, and a linkage between said gun and said hydraulic means comprising a pinion and rack element whereby the latter is controlled by the former.

In testimony whereof, we affix our signatures.

ROBERT KAUCH.
CHARLES L. PAULUS.