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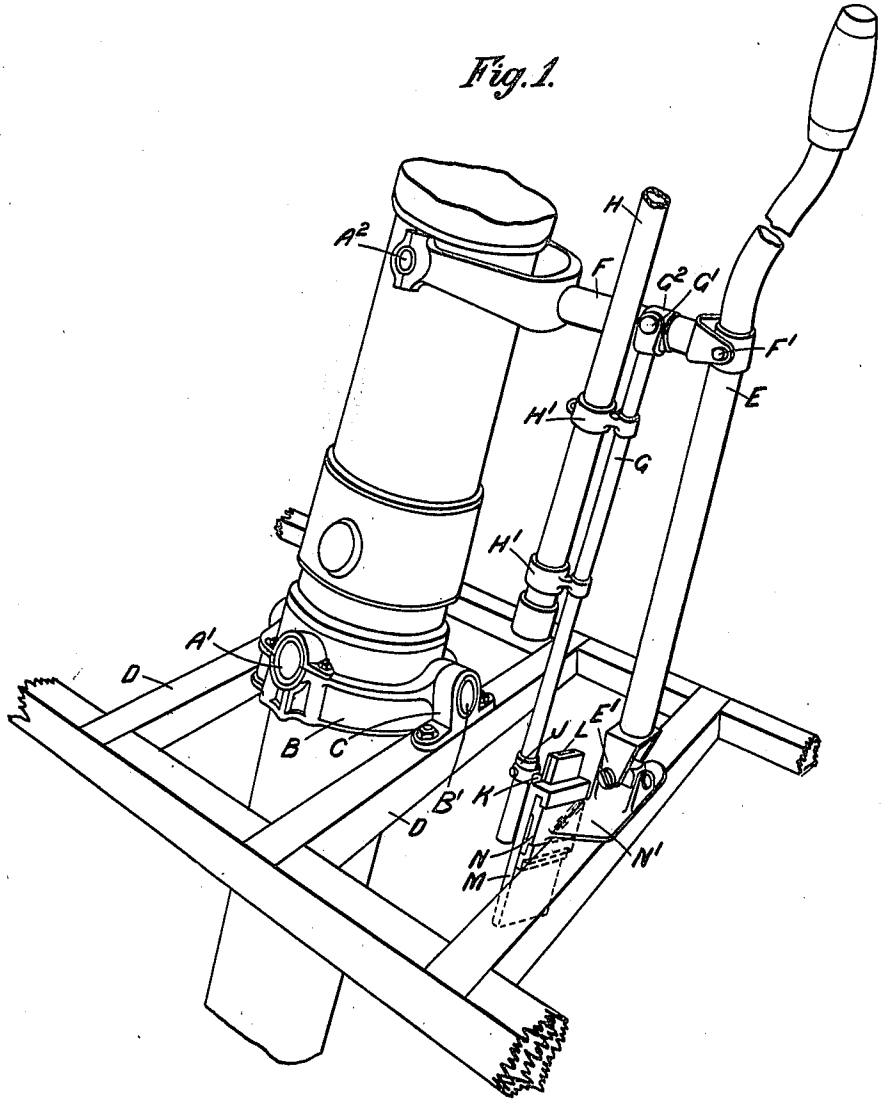
GUN MOUNTING AND SIGHTING APPARATUS.

APPLICATION FILED MAY 9, 1921.

1,398,688. Patented Nov. 29, 1921.

3 SHEETS—SHEET 1.

Fig. 1.



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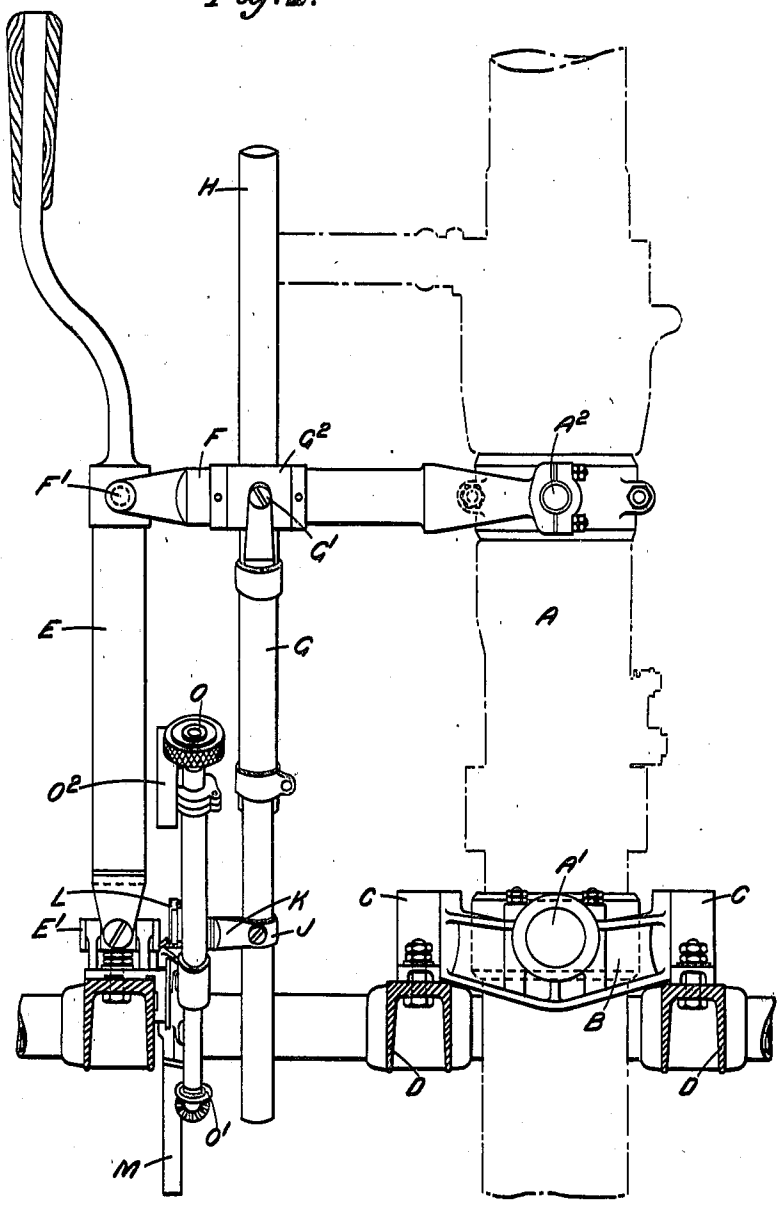
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3 SHEETS—SHEET 2.

Fig. 2.



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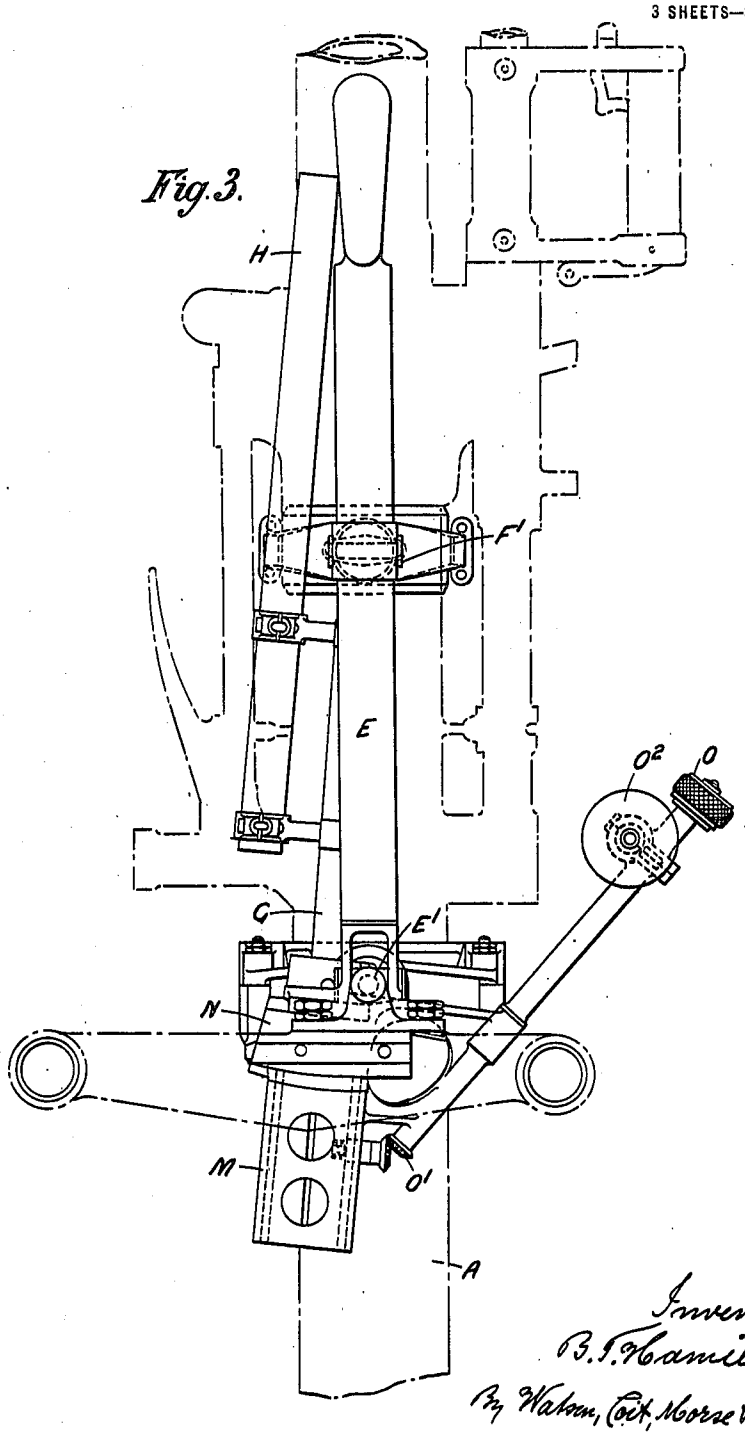
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3 SHEETS—SHEET 3.

Fig. 3.



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UNITED STATES PATENT OFFICE.

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GUN MOUNTING AND SIGHTING APPARATUS.

1,398,688. Specification of Letters Patent. Patented Nov. 29, 1921.

Application filed May 9, 1921. Serial No. 468,041.

To all whom it may concern:

Be it known that I, BELTON TATTNALL HAMILTON, a subject of the King of England, and resident of London, England, have invented certain new and useful Improvements in Gun Mounting and Sighting Apparatus, (for which I have filed application in Great Britain, No. 8489 of 1917, filed June 13, 1917,) of which the following is a specification.

This invention relates to mounting and sighting apparatus for aircraft and anti-aircraft guns more particularly of the non-recoil type such as the Davis gun and has for its object to provide a mounting and sighting mechanism which will enable the gun to be arranged for firing for example through an opening in the floor of the fuselage of an aircraft. Where so employed it is necessary that the gun be mounted so that it can be rocked fore and aft and also sidewise in either direction in order to give a conical zone of fire which will have a contained angle of about 60° in any plane. If the gun thus mounted were fitted with the usual form of sights these movements would roll the sights and render them useless. The present invention overcomes the difficulty in that it provides not only a mounting which permits of the gun being moved in this way but also comprises suitable sighting mechanism for use therewith.

It can be demonstrated that, with a gun firing downward from a given altitude, at a target on the surface of the sea or earth, the tangent elevation necessary to correct for variation of range and variation of angle of the gun from the vertical, varies within limits, for all practical purposes, directly as the angle of the gun from the vertical. Up to an angle of 30° from the vertical this law holds good, while up to an angle of say 45° from the vertical errors in the law may be averaged over the angle, in such manner that, good shooting may be obtained at any angle within the range. This fact permits of a very simple design of automatic range finding and sight setting device.

According to this invention the gun is mounted in gimbals carried on some fixed part and movably mounted adjacent to the gun is a sight bar, telescope or the like between which and the gun and the fixed part are linkages and pivoted connections such that any angular movement of the gun about its axis will cause an exactly similar and equal angular movement of the sight line. Means are provided for adjusting the sight bar in relation to the gun axis so that the sight line and the gun axis may be either constantly parallel or remain at a constant angle to one another whatever angular movement is imparted to the gun. In the preferred arrangement a sight bar is carried toward its ends in universal joints on the fixed part and at one end of a link whose other end is pivoted to the gun so that the bar is caused to move parallel to the gun axis. The point of connection between the bar and the fixed part is adjustable both in the direction of the length of the bar and also in a direction which is radial to the axis of the link which extends between the bar and the gun. By this means in the case of a gun mounted on an aircraft the sight line can be deflected so as to compensate automatically for gun platform speed and also as the sight can be adjusted for altitude in whatever direction the gun is pointed the sight line will be compensated automatically for the range to the surface of the earth, at sea level or to the surface of the sea.

The accompanying drawings iliustrate by way of example one construction as applied to the mounting and sighting of a gun of the Davis type on an aeroplane. In these drawings

Figure 1 is a perspective view of the apparatus as seen from the front and to one side (certain parts being omitted and the whole simplified for the sake of clearness).

Fig. 2 is an elevation of the rear of the mounting and sighting mechanism on a somewhat modified supporting frame and

Fig. 3 is a side elevation of the same.

Like letters indicate like parts throughout the drawings.

The gun A is mounted on fore and aft trunnions A′ in a gimbal ring B which in turn is mounted on transverse trunnions B′ in fixed bearings C carried by the framework D which is suitably fixed transversely across the floor of the aircraft. The axis of the gun trunnions A′ and the axis of the gimbal ring trunnions B′ are arranged to intersect at right angles with the axis of the gun and further the axis of the gun trunnions when the gun is vertical is so disposed as to be parallel to the line of flight of the gun platform.

Mounted at a convenient distance at one side of the gun is a lever E universally

jointed at E′ at its lower extremity to the framework D carrying the gun. This may consist of a ball and socket joint or it may consist, as shown in the drawings of a pinned cardan point having two axes of rotation intersecting at right angles. If the latter, the lever should be hinged on the fore and aft axis and the block carrying the same should be hinged on the transverse axis which should lie in the continuation of the line containing the gimbal ring trunnions B′; in any case, whatever the form of universal joint used, the center thereof should lie in the continuation of the axis of the gimbal ring trunnions. The lever E is connected with the gun by a link F hinged to the lever by the pin joint F′ and to the gun by the small trunnions A^2. The length of the link F is equal to the distance between the center of the gimbal ring B (that is to say the axis of the gun); and the center of the universal joint E′ at the lower extremity of the lever E while the distance from the axis of the pivot pin F′ to the center of the universal joint E′ is equal to the distance from the axis of the small trunnions A^2 to the axis of the gun trunnions A′, thus forming a hinged parallelogram, so arranged that in whatever direction or to whatever degree the gun be rocked in its mounting, the lever E will be rocked in sympathy and to the same degree, in such a manner that it will at all times remain parallel to the gun axis.

Mounted conveniently to the gunner's eye between the lever E and the gun A is a sight bar G carrying a sighting telescope H attached thereto by clips H′. The sight bar G is universally jointed at its upper extremity to the connecting link F being hinged on pins G′ having a fore and aft axis attached to a collar G^2 which is capable of rotation about a transverse axis, the center of the joint lying in the straight line drawn through the centers of the hinges at the ends of the connecting link F. The lower end of the bar G passes with a sliding fit through a guide collar J carried in a universally jointed mounting K by a vertically adjustable carriage which slides in guides L formed in a secondary carriage M which in turn is adjustable horizontally in a fore and aft direction in the concentric guides N formed in the bracket N′. The latter adjustment rocks the primary carriage and mounting K around a point which is the center of the universal joint at the upper extremity of the sight bar G when the gun is in a vertical position. By means of this adjustment, the center of the universally jointed mounting K may be set forward, in a direction parallel to the direction of flight, a predetermined distance representing a velocity vector proportional to the speed of the gun platform, in relation to the distance between the centers of the upper and lower universal joints carrying the sight bar G, as representing a velocity vector proportional to the muzzle velocity of the gun.

The lower universal joint K with the collar J may be slidably adjusted up or down on the sight bar G by means of a hand wheel O through suitable gearing O′ the extent of such adjustment being indicated on a scale marked on the periphery of a drum O^2 which corresponds to altitude. The hand wheel O contains any known mechanism which automatically locks the adjustment of the lower universal joint in any desirable position. This adjustment should be continuously made while flying, according to change in altitude, as indicated by an altimeter, so that the sight is always ready for immediate use. Upon such an occasion arising, a signal should be given to the pilot to keep a steady straight course in a horizontal plane until such time as the firing is concluded.

It will thus be seen that the sight bar G with the telescope H is connected to the gun by a parallel linkage so that at point blank range any angular movement of the gun axis from the vertical in any direction will cause an exactly similar and equal movement of the sight line in a vertical plane parallel to the vertical plane in which the gun is moved. By adjustment of the sight bar mounting K in the guides L the point about which the sight bar moves in this mounting can be set below the line passing through the trunnions B′ of the gimbal ring B and the joint E′ at the lower end of the lever E. If now the gun be rocked in any direction the upper joint G′ will constrain the upper end of the sight bar to follow its previous movement but the angle which the sight line now makes with the vertical will be less than the angle which the axis of the gun makes with the vertical the difference between the two angles constituting a tangent elevation of the gun with reference to the sight line. According to the distance which the joint K is set below the line between the gimbal trunnions B′ and the joint E′, which may correspond to any given altitude, so will the tangent elevation automatically given be arranged to correct automatically for range from the predetermined altitude to points on the surface of the earth or sea, since the tangents of small angles are for all practical purposes directly proportional to the angles.

It is to be noted that although the gun is rolled as it is rocked on its trunnions and in the gimbal ring yet the tangent elevation of the gun with reference to the sight line is at all times in a true vertical plane.

Compensation for gun platform speed is effected by adjusting the secondary car-

riage M in the fixed guides N in a fore and aft direction, that is to say parallel to the direction of flight or movement of the gun platform. Since the degree of this adjustment represents the velocity of flight the distance between the upper and lower joints of the parallel linkage represents on the same scale the muzzle velocity of the gun. The correct allowance for the velocity of flight will be maintained irrespective of the downward adjustment of the joint K.

What I claim as my invention and desire to secure by Letters Patent is:—

1. In a gun mounting for aircraft and aircraft defense guns, in combination, a fixed support, a gun mounted on said support for universal movement relatively thereto, a sighting device also mounted on said support for universal movement, and means connecting said gun and sighting device whereby angular movement of the gun about its axis will result in an exactly similar and equal movement of the sighting device.

2. In a gun mounting for air craft and aircraft defense guns, in combination, a fixed support, a gun mounted on said support for universal movement relatively thereto, a sighting device also pivotally connected to the support adjacent the gun, means connecting the gun and sighting device whereby an angular movement of the gun will cause an equal and exactly similar movement of the sighting device, and means for adjusting the sighting device in relation to the gun axis so that the sight line and gun axis may be constantly parallel or may remain at a given angle to one another whatever angular movement may be given to the gun.

3. In a gun mounting the combination of a fixed support, gimbals mounted on said support, a gun carried by said gimbals, a sighting device pivotally connected to the support adjacent to the gun, a gun actuating lever similarly connected to the support adjacent to the gun and a link so connecting said lever, sighting device and gun that any angular movement of the gun about its axis imparted by the lever will cause an exactly similar and equal angular movement of the sight line.

4. In a gun mounting for aircraft and aircraft defense guns, the combination of a fixed support, a gun mounted for universal movement of said support, a sighting device having universal joints at each end, one of said joints being connected to the fixed support, a link having the other universal joint of the sighting device connected thereto, said link being pivotally connected to the gun so that the sighting device is caused to move parallel to the gun axis and means for adjusting the point of connection between the sighting device and the fixed support.

5. In a gun for mounting aircraft and aircraft defense guns, the combination of a fixed support, a gun mounted for universal movement of said support, a sighting device having universal joints at each end, one of said joints being connected to the fixed support, a link having the other universal joint of the sighting device connected thereto, said link being pivotally connected to the gun so that the sighting device is caused to move parallel to the gun axle and means for adjusting the point of connection between the sighting device and the fixed support both in the direction of the axis of the gun and about the axis of the link as a center.

6. In a gun mounting the combination of a fixed support, gimbals mounted on said support, a gun carried in said gimbals, a lever disposed adjacent to the gun, a universal joint connecting the lower end of said lever to the support, a link pivotally connecting the gun to the lever so that the lever is constrained to move parallel to the gun axis, a sighting device, universal joints connecting said device to the fixed support and link so that it will move with the gun and lever and parallel thereto and means for adjusting the point of connection between the sighting device and the fixed support.

7. In a gun for mounting aircraft and aircraft defense guns, the combination of a fixed support, a gun mounted for universal movement of said support, a lever disposed adjacent to the gun, a universal joint connecting the lower end of the lever to the fixed support, a link pivotally connecting the gun to the lever so that the lever moves parallel to the gun axis, a sight bar, universal joints thereon respectively connecting the bar to the fixed support and to the link so that it will move with the gun and lever and parallel thereto and means for adjusting the point of connection between the bar and fixed support both in the direction of the length of the bar and about the axis of the link as a center.

In testimony whereof I have signed my name to this specification.

BELTON TATTNALL HAMILTON.