Aug. 23, 1960 C W. MUSSER ET AL 2,949,825

DUAL WEAPON SYSTEM ALIGNMENT MECHANISM

Filed May 7, 1958

FIG.1.

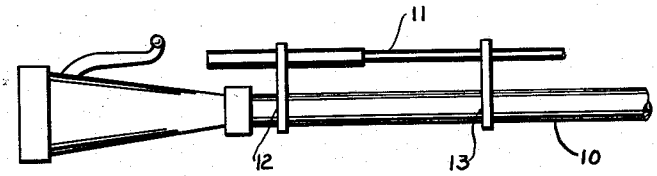


FIG.1A.

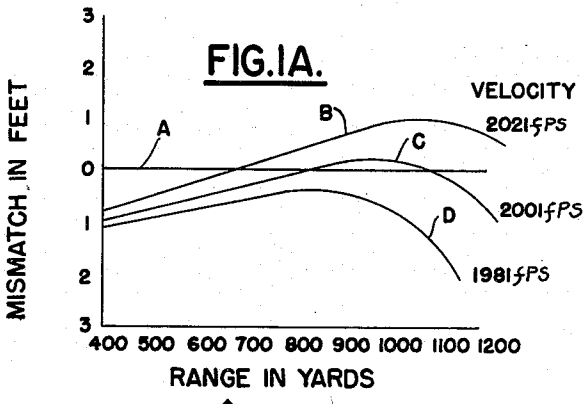
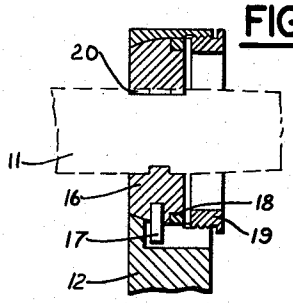


FIG.2.



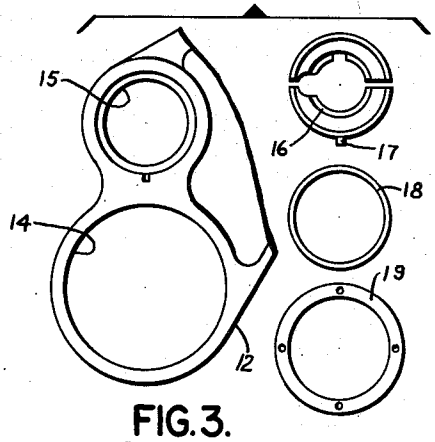


FIG.3.

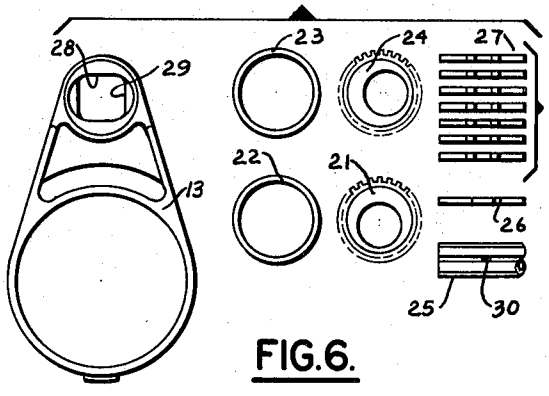


FIG.6.

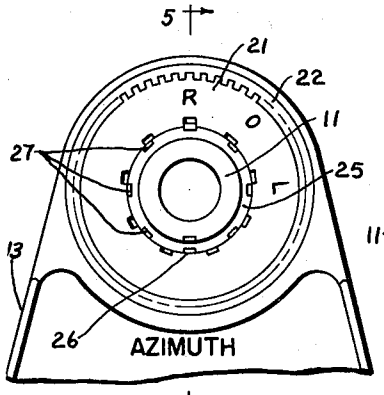


FIG.4.

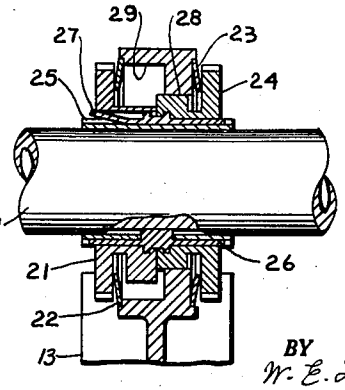


FIG.5.

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DUAL WEAPON SYSTEM ALIGNMENT MECHANISM

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3 Claims. (Cl. 89—41)

(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment of any royalty thereon.

This invention relates to an alignment mechanism for dual weapon systems such as those including a major weapon and a spotting rifle. It has for its principal object the provision of an improved alignment mechanism and method of operation whereby the probability of a first round hit by the major weapon is greatly increased.

With a major weapon of the low muzzle velocity type, it is essential that the range be accurately estimated if the probability of a first round hit is to be relatively high. When such an estimate is obtained by the firing of a spotting rifle, it is necessary that the trajectory of the projectile fired from the spotting rifle approximate as closely as possible the trajectory of the projectile fired from the major weapon. In accordance with the present invention this result is achieved by the provision of an improved alignment mechanism which is operable to effect a minimum of mismatch of trajectories of the projectiles fired from the two guns.

The invention will be better understood from the following description when considered in connection with the accompanying drawings and its scope is indicated by the appended claims.

Referring to the drawings:

Fig. 1 illustrates the physical relation between the major weapon and the spotting rifle,

Fig. 1A is a set of curves relating to the operation of the invention,

Fig. 2 is a sectional view of the rear support of the spotting rifle,

Fig. 3 is an exploded view of the support shown in Fig. 2,

Fig. 4 is an end view of the front support of the spotting rifle,

Fig. 5 shows a partial section taken on the line 5—5 of Fig. 4, and

Fig. 6 is an exploded view of the front support of the spotting rifle.

Fig. 1 shows a barrel **10** of a major weapon and a barrel **11** of a minor weapon, the barrel **11** being supported by brackets **12** and **13** which are fixed to the barrel **10**. As is well known, the minor weapon fires tracer and spotter ammunition enabling the gunner to follow the trajectory of the bullet from gun location to the target and to determine the point of impact.

In order to utilize this information to the best advantage, means are required for minimizing mismatch of the trajectories of the projectiles fired by the minor and major weapons. Thus if the major caliber trajectory (curve A of Fig. 1A) is considered as fixed, the mismatch varies with the range, the ballistic coefficient and launching velocity of the minor caliber projectile, and the angle between the axes of the two weapons. Assuming all these quantities, constant, muzzle velocity dispersion will affect the mismatch at all ranges. Curves B, C and D of Fig. 1 indicate the extent of mismatch

for a given ballistic coefficient, optimum angle between the axes of the two weapons and different launching velocities of the minor caliber projectile. It will be noted that the curve C represents the best match. The achievement of this match is facilitated by the alignment mechanism about to be described. This mechanism is embodied in the front and rear brackets **12** and **13** by which the minor weapon is supported.

As indicated by Fig. 3, the rear bracket **12** has an opening **14** which is shrunk fitted onto the barrel **10** of the major weapon, and an opening **15** within which a rear portion of the minor weapon is mounted. The bracket **12** is also arranged to support certain fire control equipment which is omitted because it forms no part of the present invention.

Forming the rear mount of the minor weapon are a recoil pad **16**, a pin **17**, a gimbal spring **18** and a pressure ring **19**. How these various parts are assembled to form a spherical bearing for supporting the rear end of the barrel **11** is indicated more clearly in Fig. 2.

It will be noted that the barrel **11** is held in place by the recoil pad **16** which fits into a groove in the barrel **11**. The recoil pad **16** has a spherical surface on the back which rests in a spherical seat in the rear bracket **12**. Holding the recoil pad in place are the gimbal spring **18** and the pressure ring **19**. When the pressure ring **19** is tightened against the face of the bracket, the gimbal spring **18** has not reached solid height. Therefore angular adjustment can be made to the barrel **11** while still maintaining a spherical seat in the socket.

Rotation of the barrel **11** is prevented by the key **20** between the barrel **11** and the recoil pad **16** and the pin **17** which fits into a slot in the bracket **12** as indicated by Fig. 2.

Alignment of the barrel **11** is achieved by the parts of the mechanism which are located in the front bracket **13**. As indicated by Fig. 6, these parts include cams **21** and **24**, Belleville springs **22** and **23**, a sleeve **25**, a locking spring **26** and keying springs **27**. It will be noted that the bracket **13** has at its upper end a horizontal slot **28** and a vertical slot **29**. How these parts are assembled to permit elevation and transverse adjustment of the barrel **11** is indicated more clearly by Figs. 4 and 5.

From these figures, it is seen that the cam **24** rotates in the horizontal slot **28** for vertical adjustment of the barrel **11** and the cam **21** rotates in the vertical slot **29** for horizontal adjustment of this barrel. The Belleville springs **22** and **23** are fitted between the bracket **13** and the cams to seal out dust and provide friction within the mechanism. The key **26** has a protrusion which extends through an aperture **30** in the sleeve **25** into a keyway in the barrel **11**. This fixes the sleeve to the barrel.

Upon the outer periphery of the sleeve **25** are eight longitudinal keyways adapted to cooperate with nine similar keyways on the inner peripheries of the cams. In each of the keyways on the sleeve is one of the leaf type springs **27**. These springs have two protrusions (see Fig. 5) which fit into a radial groove in each of the cams. These protrusions prevent the mechanism from pulling apart. The cams are notched at their exposed edges to facilitate their rotation.

Rotation of either cam to attain proper alignment of the barrel **11** is effected by depressing the end of the leaf spring **27** (see Fig. 5) which engages the cam. Then the cam may be rotated until the next leaf spring enters the next keyway of the cam. With the number of keyways shown, this amount of rotation moves the barrel **11** approximately one-third of a mil.

The brackets **12** and **13** are designed to minimize the effect of the forces produced by the firing of the weapons. Thus the flanges of the brackets are cut away so that

the fire control equipment is protected from the recoil shock of the minor weapon and the web of the brackets is cut away so that radial expansion of the major weapon upon firing does not transmit its force directly to the sighting equipment.

We claim:

1. In a combination with major and minor weapons, a rear bracket fixed to the barrel of said major weapon and arranged to support a rear portion of said minor weapon in a spherical bearing on said bracket, a front bracket fixed to the barrel of said major weapon and having an opening through which the barrel of said minor weapon extends, said opening having on its inner surface first and second slots which are perpendicular to one another and to the axis of said minor weapon barrel, a first eccentric cam rotatable in the first of said slots for traversing said minor weapon barrel and movable longitudinally of said first slot during elevation of said minor weapon, a second eccentric cam rotatable in said second slot for elevating said minor weapon barrel and movable longitudinally of said second slot when said minor weapon barrel is traversed, and means for locking said cams to said minor weapon barrel in different angular positions.

2. In a combination with major and minor weapons, a rear bracket fixed to the barrel of said major weapon and arranged to support a rear portion of said minor weapon in a spherical bearing on said bracket, a front bracket fixed to the barrel of said major weapon and having an opening through which the barrel of said minor weapon extends, said opening having on its inner surface first and second slots which are perpedicular to one another and to the axis of said minor weapon barrel, a first eccentric cam rotatable in the first of said slots for traversing said minor weapon barrel and movable longitudinally of said first slot during elevation of said minor weapon, a second eccentric cam rotatable in second slot for elevating said minor weapon barrel and movable longitudinally of said second slot when said minor weapon barrel is traversed, said cams having on their inner surfaces a series of longitudinal slots, a sleeve keyed to said minor weapon barrel and having on its outer surface a series of longitudinal slots, and a locking spring in each slot of said sleeve whereby said cams may be locked in any one of a plurality of different angular positions.

3. In a combination with major and minor weapons, a rear bracket fixed to the barrel of said major weapon and arranged to support a rear portion of said minor weapon in a spherical bearing on said bracket, a front bracket fixed to the barrel of said major weapon and having an opening through which the barrel of said minor weapon extends, said opening having on its inner surface first and second slots which are perpendicular to one another and to the axis of said minor weapon barrel, a first eccentric cam rotatable in the first of said slots for traversing said minor weapon barrel and movable longitudinally of said first slot during elevation of said minor weapon, a second eccentric cam rotatable in second slot for elevating said minor weapon barrel and movable longitudinally of said second slot when said minor weapon barrel is traversed.

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