Summary of Research on Distance Technology

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Abstract

Improve the independent combat capability and overall operational effectiveness of the infantry detachment in modern warfare, so that the infantry detachment can master more effective and flexible distance strike weapons, greatly reduce the dependence of infantry on superior firepower, and increase the fragmentation of small-caliber weapons and ammunition. The power of killing can adapt to the transformation of the future war mode. Therefore, it is necessary to study the fuze to determine the air-to-air bombing technology, effectively improve the killing effect of small-calibre ammunition, improve the individual combat capability of individual soldiers, and adapt to the future battlefield needs. The research status of three kinds of distance technology is summarized and summarized.

Keywords

Distance technology; counting number; timing; compound distance.

1. Introduction

With the application of microelectronics technology, computer technology and intelligent information processing technology in the field of fuze, fuze has gradually evolved into the "brain" of ammunition. The research on self-completed information acquisition, information processing and information transmission has become a trend of future development [1-4]. Precise control of the explosion point is a prerequisite for the use of precision strike weapons to achieve precise strikes in modern high-tech local wars. The fuze control technology of fuze is mainly realized by three methods: triggering, near-explosion, timing and distance [5].

2. Research Status of Distance Technology

2.1. Counting Number Explosion Point Control Technology

According to the external ballistic theory, for the rotating projectile fired by the line gun, if the damping is not considered, the projectile advances a winding distance in the speed direction every time it rotates after launching the muzzle. When the projectile is rotated n times, the distance traveled in the speed direction is n times the wrap, which is almost independent of the actual initial velocity of the projectile. Therefore, the relationship between the flying distance of the projectile and the number of rotating laps can be woven into a shooting table, and the number of revolutions of the fuze can be set according to the distance of the target before shooting or shooting, and the fuze is transferred to the set number of turns in the projectile. When the projectile is launched, the distance control can be realized.

According to the theory of external ballistics, when the projectile moves in the air, it will be affected by various external conditions. The accuracy of the projectile's explosion point is analyzed, and the correction of the projectile is beneficial to improve the accuracy of the projectile [6-7]. In the literature [8], the ballistic test environment of the counting number and distance fuze is analyzed, the attenuation law of the angular velocity of the external ballistic

rotation of the projectile is studied, and the projectile model is optimized. Ding Libo et al. [30] cannot guarantee the explosion point for the counting distance technique. With the problem of optimal distance from high-speed moving targets, an adaptive frying point control technology for counting and counting air-friction fuze is proposed. This technology automatically adjusts the detonation timing according to the relative motion of the barrage, so that the projectile is at the optimal detonation distance, and the damage effect is significantly improved. In order to improve the accuracy of the pitch of the fixed-range projectile.

2.2. Timing Explosion Point Control Technology

The timing mode is that the guidance letter uses the timing device to calculate the time elapsed since the launching of the projectile, and when the flight time is equal to the predetermined detonation time, the warhead is detonated. The preset time is calculated by the fire control system based on the target distance. Compared with the counting and spacing technology, the timing and spacing does not depend on the external magnetic field, and is not limited by the physical field. It has an independent operation mode and the output signal is more stable.

Based on the air-explosive electronic fuze system, Yan Anhao et al. [9] proposed a method to calculate the launch angle and corresponding time of the predetermined position of the space to improve the operational effectiveness of the ammunition for the 64mm explosion-proof projectile; Yun Saiying [10] The time fuze is the carrier, and the error source of the accuracy of the electronic fuze time is analyzed. The time correction technique is studied for the characteristics of the timing fuze. Li Haojie et al. [11] aim at the accuracy of the electronic time explosion point for altitude change. In this paper, an adaptive correction method for the plateau environment by electronic time fuze is proposed. For the deficiencies in fuze versatility and reliability, Wu Tao [12] combines information setting with precise explosion point control technology in fuze. The precision explosion control module is installed to achieve the purpose of the explosion of the predetermined explosion point, and the induction system of the fuse is improved.

2.3. Timing Count Revolution Composite Explosion Point Control Technology

The counting revolution control technology and the timing explosion control technology have their own advantages, but their respective limitations are also obvious. The number of rotations of the fixed distance is determined by the distance of the fixed distance, which is completely determined by the motion state of the projectile. Therefore, the accuracy of the distance is high and the reliability is strong. However, the magnetic field on which the number of revolutions depends depends on the geographical distribution. And can only be used on the fuze of the rotating bomb. The timing fuze is free of regional restrictions and has an independent timing system. However, for time fuzes, excessive dependence on set time has become an important factor limiting its accuracy. Dynamic errors caused by high-speed movement of projectiles and setting scales or the alignment is aligned, and these accidental errors can have a significant impact on their accuracy. Accuracy control using the counting number and timing composite system can avoid the disadvantages of both. He Zhencai et al. [13] analyzed the principle of the combined explosion point control technology based on the analysis of the traditional explosion point control method, and proposed the realization method of the precise control of the fuze point under the composite system; Zhu Xi [14] analyzed the calculation The advantages and disadvantages of the number of revolutions and the timing of the distance are studied. The simulation of the fuze spread after the projectile is launched by the fuze simulation analysis, and the conclusion that the accuracy of the electronic fuze is significantly improved compared with the traditional distance is obtained. Ma Shaojie et al [15] the system and the chronograph system are classified and corrected for error, which provides a reference for fuze design.

3. Summary

The method of the distance of the projectile is the key factor to determine the precise control of the projectile. According to the literature, we can find:

(1) The use of geomagnetic induction sensors to realize the fuze of the number of revolutions has a unique advantage. The structure is simple, the distance is independent of the initial velocity of the mouth, that is, the mouth speed measurement is not required, and the actual application is not easily interfered by the bad weather, and the performance is stable. However, for the distance fuze that records the number of revolutions by cutting the magnetic field lines, the magnetic field line cannot be completed during the projectile flight. The fuse number rotation device cannot accurately record the number of turns of the projectile, and the number of revolutions is chaotic and counted. In case of inaccuracy, the fuze may explode after the projectile exceeds the predetermined set distance; in addition, when the projectile flies in the air, due to the angle of attack and the nutation, the displacement of the projectile is different for each rotation, and the projectile is different. The spread of the fried spots has a serious impact.

(2) Electronic time fuze is the use of electric digital timing technology to control the detonation of the projectile. Compared with the timepiece and the medicine tray, the timing accuracy is high, and the long acting time can be obtained, and the timing part has no moving parts, which can be directly realized with the fire control system. Information cross-linking has high accuracy, reliability and safety. However, for time fuzes, in order to achieve precise control of the explosion point, real-time speed measurement and precise timing are required for each bullet. Therefore, the fuze must have an accurate oscillator inside, or the frequency of the inaccurate oscillator in the fuze, which will make the fuze structure complex, reduce reliability and cost; the poor launch environment will definitely cause the fuze performance to occur. Changes, the accuracy of electronic time fuzes can be severely affected.

(3) Although the chronograph revolutions and distance fuzes reduce the disadvantages of the independent mode of action, they still cannot get rid of the defects of timing and counting numbers, and the structure is more complicated, the design is more difficult, and the stability of performance is also affected by many factors. Limits.

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