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DEVICE FOR PRODUCING ELECTRIC CURRENT IN A RAPIDLY ROTATING DEVICE

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Fig. 1.

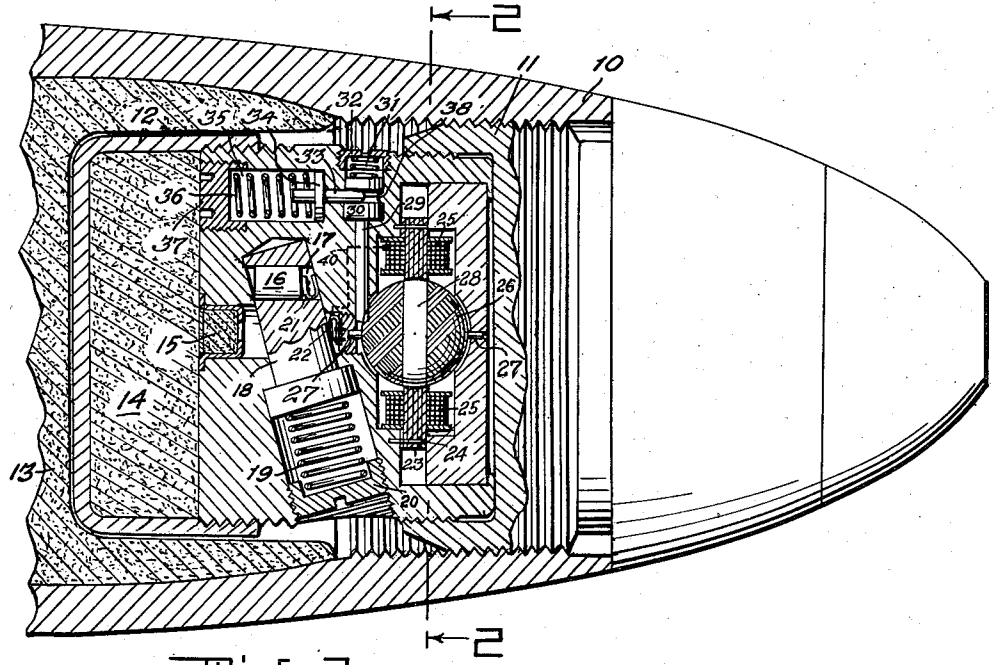
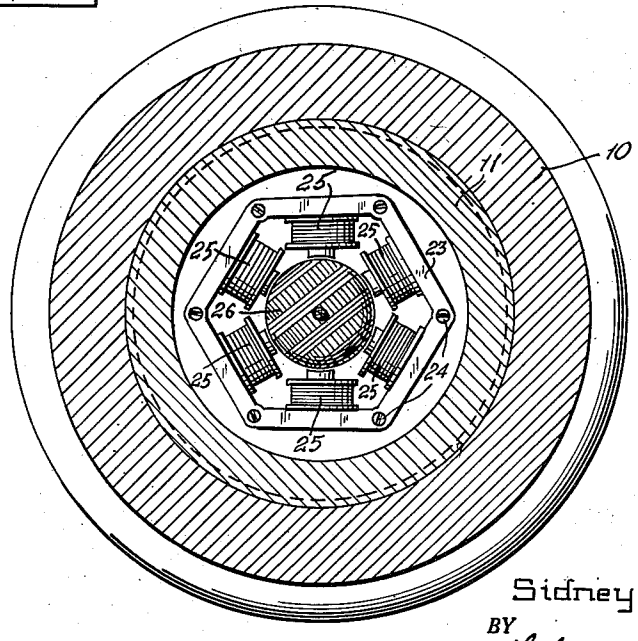


Fig. 2.



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DEVICE FOR PRODUCING ELECTRIC CURRENT IN A RAPIDLY ROTATING DEVICE

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This invention may be manufactured and used by or for the Government for governmental purposes without the payment to me of any royalty thereon.

The present invention relates to fuzes and related mechanisms for releasing the energy stored in explosive missiles and more particularly to selective fuze mechanisms incorporating a device for producing electric current by inertia-induced rotation of a magnet-containing rotor between poles of a field coil whereby delayed arming means are provided for the fuze mechanism and/or selective time action can be provided after proper setting of a variable resistance integral with a time ring or by a prefixed resistance so that the explosive charge will be detonated at the time and place desired after a safe delayed arming period.

The principal object of the present invention is to provide an explosive projectile of a simple, compact, efficient, and reliable character whereby the delay arming period is obtained by a combination of inertia and electrical means. In accomplishing this result advantage is taken of the difference between the angular deceleration rates of a projectile body spinning in air and a rotor within the casing spinning on bearings within a field structure to cause relative rotation therebetween to thereby generate electrical energy to explode a detonator.

It is also an object of the invention to provide an improved fuse mechanism of the above described character that may be relied upon to initiate detonation without regard to target impact, that is, upon time action after firing.

In accordance with the invention a fuze is provided for causing detonation of a missile including an explosive charge and comprising an electric detonator, a fuse train for coupling the detonator to the explosive charge thereby to cause explosion thereof, and a magneto responsive to missile spin to generate electrical energy to initiate the detonator after a predetermined time, or to charge a capacitor for firing the detonator upon the closing of a switch.

For a better understanding of the present invention together with other and further objects thereof reference is made to the following description taken in connection with the accompanying drawings in which:

Figure 1 is a longitudinal elevation in section showing my novel fuze construction.

Figure 2 is a view taken on lines 2—2 of Figure 1 and looking in the direction of the arrows.

With reference to Figure 1 of the drawings there is disclosed a fuze in accordance with the present invention installed in a projectile **10** designed to be fired from a rifle. A casing **11** adapted to contain the component parts of the fuze is threadedly received in the forward part of the projectile and has a cup member **12** threaded thereto, substantially as shown, and intruding in the explosive charge **13**. A booster charge **14** is received within the cup member in the usual manner and a firing train is provided comprising an explosive capsule or lead **15** and

an electrically responsive detonator **16**. A plug member **18** is slidably received in a bore formed in the casing **11** and a spring **19** urges between cap **20** and plug **18** to normally hold the same in the position shown. The electrically responsive detonator **16** is held in a cavity **17** formed in the plug member and, in the illustrated position, the firing train is broken so that the fuze is in a safe condition. A spring clip **21** is affixed to one end at the detonator and is positioned to cooperate with spring clip **22** and connected by lead **40** to the output of the magneto, as will now be more fully explained.

The magneto comprises a frame **23**, as best seen in Figure 2, secured to casing **11** by bolts **24** and supporting wire wound poles **25** equiangularly spaced. A spherical rotor **26** is supported for rotation by bearings **27** at the center of the frame. A magnet **28** is received in the rotor and when the rotor spins at high speed the lines of force from the magnet will pass through the pole pieces in turn and be cut, whereby a voltage will be generated in the field coils. The coils are interconnected and one end thereof is connected (not shown) to the casing **11** as a ground return. The other end is connected to the before-mentioned lead **40** which is joined to spring clip **22** mounted on an insulating washer substantially as shown.

A shaft member **29** having an enlarged head **30** is slidable in a cavity formed in the casing. A spring **31** urges between a cavity sealing plug **32** and the enlarged head to keep the end of the shaft member in engagement with the rotor and thereby normally hold the same against rotation.

A pin member **33** carrying a disc **34** is slidably retained in a port **35**, and spring **36** urges between port sealing plug **37** and disc **34** to keep the end of the pin member in engagement with a groove **38** formed in the enlarged head of the shaft member **29**.

The operation of my novel fuze is as follows: When the projectile is discharged from a gun, set back causes pin member **33** to move rearwardly against spring **36** and thereby disengage from groove **38** in shaft member **29**. Passage of the projectile through the bore of the gun imparts a rapid spin thereto and the centrifugal force resulting therefrom forces plug member **18** outward against spring **19** to thereby align detonator **16** wtih capsule **15** and cause contacts **21** and **22** to engage. A spring biased detent of usual form (not shown) may be provided to retain the plug member **18** in its retracted position if projectile spin decays and the centrifugal force falls to a value below that necessary to overcome spring **19** before the charge is fired.

Projectile spin will also cause shaft **29** to move outwardly against spring **31** to release rotor **26** but in the interval before such release the rotor is constrained to rotate at the same angular velocity as the projectile. After set back ceases pin member **33** moves forward to engage under the enlarged head portion of shaft **29** to thereby prevent the same from again engaging the rotor.

As previously mentioned, the spherical rotor is rotating at the same angular velocity as the projectile. The projectile spins forward at high speed, and after an interval the resistance of the air causes the spin to decay. Since the rotor **26** is not exposed to the same resistance forces as the external projectile casing it continues to rotate at substantially the initial angular velocity. As projectile spin decays relative rotation between the rotor and field coils builds up a voltage in the field coil and current will flow through lead **40** to contacts **22** and **21** and through the electrical element in detonator **16** to the casing, or ground. The detonator is fired and causes detonation of capsule **15** which in its turn detonates the booster charge **14** to explode the pay load. Other ele-

ments, such as shunt capacitors, rectifiers, and resistors, may be added to balance out the electrical system and maintain sensitivity of the detonator.

It will be seen from the above that the fuze will explode after a time delay without target impact, which is especially important in anti aircraft duty. It is obvious that an impact responsive explosive train of any known type may be included in the organization whereby a projectile results that will explode either on target engagement or, if no target be encountered, then by lapse of time.

While there has been described what at present is considered to be the preferred embodiment of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention and it is therefore intended in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

I claim:

1. A fuze for causing detonation of a rotatable missile of the type that includes an explosive charge, comprising a casing; a booster charge in said casing; an explosive capsule in said casing in communication with and adapted to explode said booster charge; a detonator in said casing and responsive to the passage of electrical energy therethrough to detonate said explosive capsule, said detonator normally resting in a safe position misaligned with said explosive capsule; means responsive to rotation of said missile to move said detonator from a safe position misaligned with said explosive capsule to a ready position aligned with said explosive capsule; a magneto responsive to decay of projectile spin to generate electrical energy to explode said detonator, said magneto comprising a field coil fixed to said casing and a spherical armature having a permanent magnet mounted in said casing for rotation therein; means electrically connecting said magneto with said detonator when said detonator is in the ready position; a shaft normally engaging said armature; and a pin normally engaging said shaft and responsive to missile set back to disengage from said shaft whereby said shaft releases said armature to permit the same to rotate.

2. A fuze for causing detonation of a rotatable missile of the type that includes an explosive charge, comprising a casing; a booster charge in said casing; a detonator in said casing and responsive to the passage of electrical energy therethrough to explode said booster charge; means responsive to rotation of said missile to move the said detonator from a safe to a ready position, said means comprising a generally transversely reciprocable spring biased plug carrying said detonator; a magneto responsive to decay of projectile spin to generate electrical energy to explode said detonator, said magneto comprising a field coil fixed to said casing and an armature mounted in said casing for rotation therein; a shaft normally engaging said armature; and a pin normally urged into engagement with said shaft and responsive to missile setback to disengage from said shaft whereby said shaft releases said armature to permit the same to rotate.

3. A fuze for causing detonation of a rotatable missile of the type that includes an explosive charge, comprising a casing; a booster charge and a core in said casing; a detonator in said core and responsive to the passage of electrical energy therethrough to explode said booster charge; a generally transverse bore in said core; an axial bore in said core, one end of which communicates with said transverse bore intermediate its ends and the other end of which communicates with said booster charge; a plug reciprocable within said transverse bore and responsive to the rotation of said missile, said plug housing said detonator; spring means within said transverse bore normally biasing said plug in the safe position with said detonator in misalignment with said axial bore; additional means comprising a dynamo-electric machine responsive to the rotation of said missile to generate electrical energy in response to decay of missile spin to explode said detonator; and means adapted to complete the electrical circuit including said dynamo and said detonator when said detonator moves into alignment with said axial bore.

4. The fuze in accordance with claim 3 wherein said electric generating means comprises an armature and a plurality of field coils, there being means adapted to releasably lock said armature to said casing during missile setback, said means comprising a recess in said armature, a transverse cavity in said core containing a spring biased shaft responsive to the rotation of said missile, said shaft having a point at one end adapted to engage said recess in said armature and an enlarged head at the other end having an annular groove, an axial recess provided in said core containing a pin, said pin being normally biased forwardly to engage said groove in said shaft to maintain said shaft engaged with said armature, said pin being set back responsive and adapted upon setback to move rearwardly to disengage from said shaft and permit said shaft to release said armature in response to missile rotation, said pin adapted upon abatement of missile setback to reengage said shaft to maintain said shaft thereafter disengaged from said armature.

5. A fuze for causing detonation of a rotatable missile of the type that includes an explosive charge, comprising a casing; a booster charge in said casing; a detonator in said casing initiated in response to the passage of a predetermined amount of electrical energy therethrough, means responsive to rotation of said missile to move the said detonator from a safe to a ready position in alignment with said booster, said means comprising a generally transversely reciprocable spring biased plug carrying said detonator; a magneto for generating electrical energy to explode said detonator in response to decay of projectile spin, said magneto comprising a field coil fixed to said casing and an armature mounted in said casing for rotation relative to said field coil, said magneto gengerating said predetermined amount of electrical energy when decay of projectile spin has produced a predetermined relative rotation between said armature and field coil; a shaft normally engaging said armature; and a pin normally urged into engagement with said shaft and responsive to missile setback to disengage from said shaft whereby said shaft releases said armature to permit the same to rotate.

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