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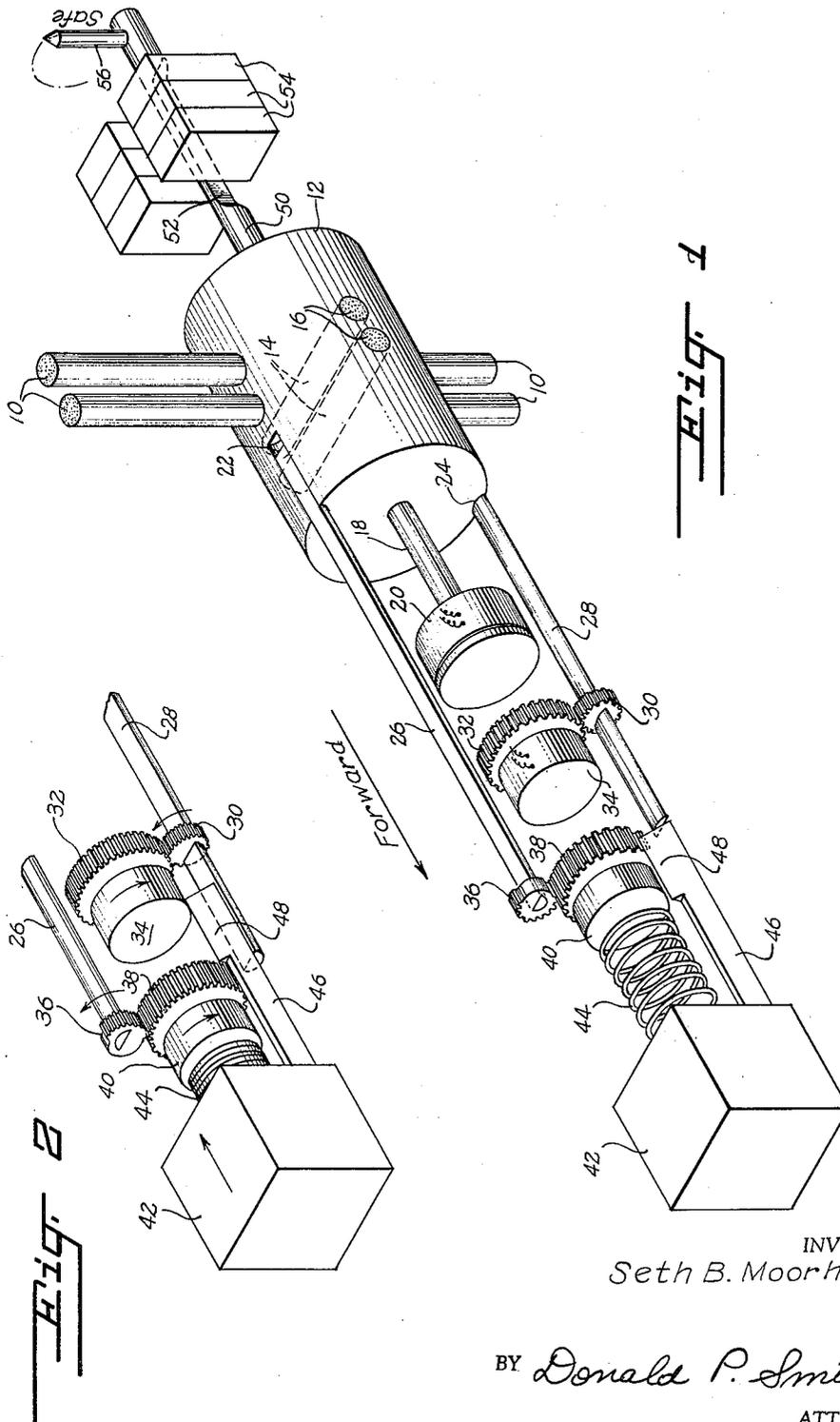
S. B. MOORHEAD, JR

2,915,013

ARMING DEVICE

Filed Jan. 22, 1957

2 Sheets-Sheet 1



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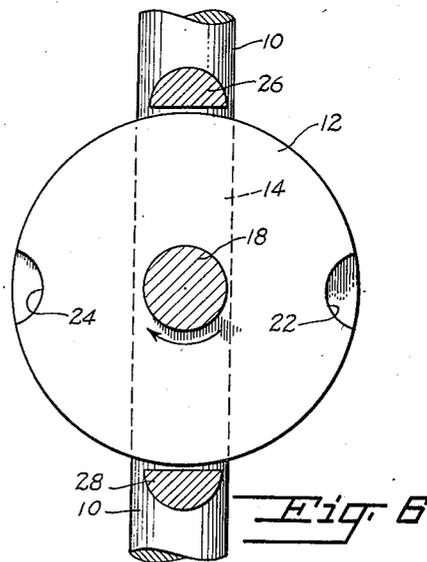
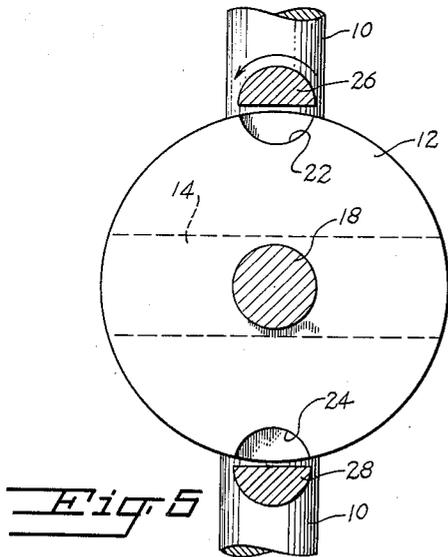
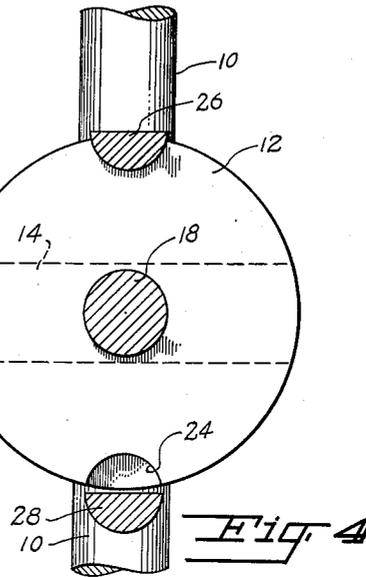
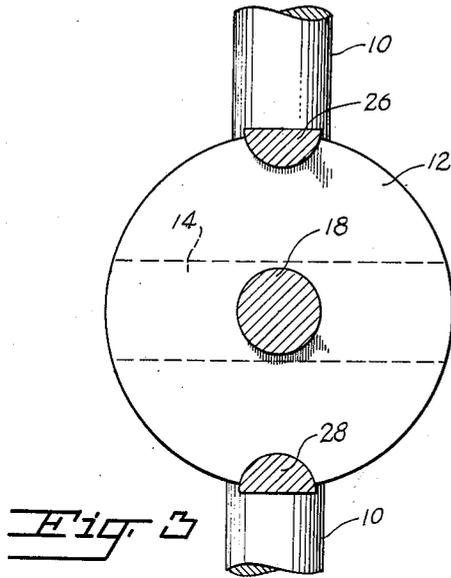
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ARMING DEVICE

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2 Sheets-Sheet 2



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2,915,013

ARMING DEVICE

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10 Claims. (Cl. 102-70.2)

This invention relates broadly to an arming device for a fin stabilized projectile and more particularly to a structure for arming an anti-aircraft projectile having provisions therein for ground radio control and having one or more homing devices. The general requirements for an arming device adapted to ready an explosive charge prior to engagement with a target or to prepare an explosive charge for detonation upon the occurrence of a condition likely to happen are that it be simple, reliable and effective in operation and that it be completely safe to the operator charged with initiating the cycle and, further, that it present no hazard to the gun crew, or the launching crew in the case of self-energized projectiles. The device must also guard against accidental arming during the stresses of normal transportation and possible rough handling and even the impact forces caused by an accident to the conveying vehicle. As will be more fully pointed out hereinafter the device disclosed herein adroitly fulfills the above condition.

It is accordingly a broad object of this invention to improve on the arming devices now in use.

It is a further object of this invention to provide an arming device for a fin stabilized projectile which is reliable in action and which guards against danger to the launching personnel.

It is a further and more distinct object of this invention to provide an arming device having an interrupted powder train and means to complete the powder train upon the fulfillment of a series of conditions.

It is a yet further and still more distinct object of this invention to provide an arming device having an hiatus in a powder train leading to a main charge and a member rotatable therein and carrying the necessary components to complete the train; having a plurality of detents separately removable to prevent accidental completion of the powder train.

These and other objects and advantages of the invention will be in part obvious and in part explained in the following specification and drawings in which:

Figure 1 is a perspective drawing showing the arrangement of the component parts of the arming device in unarmed condition,

Figure 2 is a partial perspective view of the arming device illustrating the action of the components subsequent to launching of the projectile,

Figure 3 is an elevation partly in section showing the arming rotor with the several detents in safe position,

Figure 4 is an elevation partly in section showing the arming rotor with one detent removed from safe position,

Figure 5 is an elevation partly in section showing the arming rotor with both detents removed from safe position and prior to the start of motion of the rotor, and,

Figure 6 is an elevation partly in section showing the rotor moved to armed position.

Referring now to the drawings wherein like parts are designated by like reference characters, the perspective view of Figure 1 best shows the functional interrelation

of the parts of the device. The structure there shown is housed within a casing (not shown) having suitable cavities and bearing surfaces to receive the parts. Starting substantially midway of the drawing, reference character 10 indicates a portion of a powder train leading to a main explosive charge. A parallel arrangement of powder trains is there provided in the event that one of them becomes defective then the other will be available for exploding the charge. A cylindrical member 12 is fixed for rotation in the casing to interrupt the train and has formed therein a pair of axially disposed cavities 14 extending from side to side. The cavities are filled with powder 16 and are normally arranged to form a right angle with the longitudinal axis of the main powder train 10 in the disarmed position. Upon rotation of member 12 through 90° the powder-filled cavities 14 will complete the hiatus in the powder train 10 whereby the device is armed and ready for detonation. A longitudinal shaft 18 is secured to and extends from the axis of member 12 and has a rotating solenoid 20 secured thereto for turning member 12. A pair of cavities 22 and 24 are formed in the outer surface of member 12 parallel to the longitudinal axis thereof to receive in unarmed position a pair of hemicylindrical rods 26 and 28 substantially as is there shown. Rod 28 has fixed thereon a pinion 30 for cooperation with a ring gear 32 fixed to a rotating solenoid 34. Shaft 26 carries pinion gear 36 engageable with a ring gear 38 fixed to a spring motor 40. A weight 42 responsive to the force of setback is urged forward in the casing by spring 44 arranged between one side of the weight and one wall of spring motor 40 and has an arm 46 extending therefrom and a pyramidal detent 48 at the end to interfere with the ring gear 38 as will later be more fully explained. It will be noted that in unarmed position the distal end of the hemicylindrical shaft 28 lies directly in the path of motion of rod 46 to thereby retain detent 48 in engagement against the teeth of ring gear 38. A shaft 50 extends from the other side of member 12 substantially as there shown and has a flat 52 formed to act as a cam for a plurality of switches 54. At the end of shaft 50 is fixed for rotation therewith an indicating arm 56 adapted to extend beyond the wall of the casing to show the user the condition of the device.

The operation of this device is as follows:

The arming device is intended to be inserted in a cavity formed in the body of a guided missile from the exterior thereof just prior to launching and the indicating arm 56 shows the operator the condition of the device prior to its insertion. In the normal safe position the organization is assembled into the missile and from an exterior source an electrical signal, as from a push button, is applied to energize solenoid 34. The solenoid will rotate carrying ring gear 32 therewith turning pinion 30 which carries shaft 28 into the position shown in Figure 4 wherein it no longer rests in cavity 24 and member 12 is free on one side thereof. In addition the flat upper surface has been turned so that the rod is no longer in the path of motion of shaft 46. When the missile is launched the force of setback slides weight 42 rearwardly against the urging of spring 44 into the position shown in Figure 2 wherein detent 48 no longer engages in the teeth of ring gear 38. In Figure 2 the end of shaft 46 lies in overlapping relation with the flat upper side of rod 28. In this position spring motor 40 will run, carrying ring gear 38 therewith and turning pinion 36. In order to avoid excessive frictional losses occasioned by the pressure imparted by weight 42 through spring 44 a wall (not shown) is provided to receive this thrust. When pinion 36 has rotated rod 26 through 180° the rod takes the position shown in Figure 5 wherein it no

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longer lies within cavity 22 and the member 12 is free of restraint.

A pressure responsive device of any well known configuration is depended upon to initiate and maintain rotation of solenoid 20 so that the missile will take its fully armed position upon reaching a predetermined altitude thereby providing complete safety to the launching crew. When the source of self contained energy such as a battery has rotated member 12 through 90° the powder filled cavities 14 are longitudinally aligned with the interrupted powder trains ends 10 and the device is fully armed. Coincidentally therewith shaft 50 rotates and displacement of flat 52 from the position shown initiates a delayed firing cycle.

In this type of anti-aircraft device pressure responsive means are provided initiated by switches 54, which will automatically ready a circuit to explode the missile if it drops below a predetermined altitude to thereby eliminate danger and hazard to friendly personnel.

It should be understood that this invention is not limited to specific details of construction and arrangements thereof herein illustrated and that changes and modifications may occur to those skilled in the art without departing from the spirit of the invention.

I claim:

1. In an arming device for a fin stabilized projectile having an interrupted powder train the combination comprising, a member disposed for rotation in the spacing between the ends of the interrupted powder train and having a radial powder receiving cavity formed from side to side, driving means connected to said member to rotate the same, first means to lock said member, means responsive to an electrical signal to unlock said first locking means, second means to lock said member against rotation, means to unlock said second locking means, means to lock said second recited unlocking means, and slidable means responsive to the force of set back to unlock said second unlocking means whereby the said driving means rotates said member to align the powder filled cavity between the ends of the interrupted powder train.

2. In an arming device for a fin stabilized projectile of the type having an interrupted powder train, the combination comprising a member disposed for rotation and having a radial powder receiving port formed therein extending from side to side, means connected to said member to drive the same, the said port forming a right angle with the powder train in the disarmed position, first means to lock said member against rotation, means responsive to an electrical signal to unlock said first locking means, second means to lock said member against rotation, means to unlock said second locking means, means to lock said second recited unlocking means, and means responsive to the force of set back to unlock said second unlocking means whereby the said driving means rotates said member to complete the hiatus formed in the powder train, the said first locking means disposed in part at least in interfering relationship with the said means responsive to set back force in the disarmed position.

3. An arming device for a fin stabilized projectile having an interrupted powder train comprising in combination, a member fixed for rotation in the spacing between the ends of the interrupted train, a radial powder receiving cavity formed from side to side of said member, the axis of the cavity normally forming a right angle with the powder train in disarmed condition, driving means connected to said member to rotate the same to armed position, a first longitudinal cavity formed in said member, a rod having a substantially hemicylindrical cross section lying in said first cavity to prevent rotation of said member, means to rotate said rod to remove the same from the cavity, a second longitudinal cavity formed in said member diametrically opposed to the first longitudinal

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cavity, a substantially semicylindrical rod lying in said second longitudinal cavity to prevent member rotation, means to rotate the said second rod to remove the same, a detent to prevent rotation of the second rod in unarmed position, and means responsive to the force of set back to move said detent to permit rotation of the second rod whereby the said driving means rotates said member to the armed position wherein the powder cavity is aligned with the interrupted powder train.

4. The invention as set forth in claim 3 wherein the said first hemicylindrical rod has a portion thereof disposed in interfering relationship with the said means responsive to set back force to prevent motion thereof in normal disarmed condition.

5. The invention as set forth in claim 4 including a normally open switch, and an actuator carried by said member and rotatable therewith to close the switch to initiate detonation.

6. The invention as set forth in claim 5 including an arm fixed to said actuator and rotatable therewith to indicate the armed condition of the device.

7. In an arming device for a fin stabilized projectile of the type having an altitude responsive device to yield an arming signal and an interrupted powder train communicating between a detonator and a main explosive charge, the combination comprising, a member disposed for rotation in the spacing between the ends of the interrupted powder train, a powder filled passage formed from side to side in said member, electrical means to rotate said member, first means to lock said member, means responsive to an electrical signal to unlock said first locking means, second means to lock said member against rotation, means having potential energy means to unlock said second locking means, means to lock said second recited unlocking means, and slidable means responsive to the force of set back to unlock said last recited means whereby the said electrical means rotates said member to align the powder filled passage between the ends of the interrupted powder train.

8. The invention as set forth in claim 7 wherein the said first locking means has a portion thereof normally disposed in interfering relationship with the said slidable means to prevent motion thereof in unarmed condition.

9. The invention as set forth in claim 8 including switch means connected to said member and responsive to rotation thereof to initiate detonation of the device.

10. In an arming device of the type intended for use with a fin stabilized projectile having an interrupted powder train intercommunicating between a detonating device and a main explosive charge, the combination comprising a member disposed for rotation in the spacing between the train ends, a passage formed through said member to receive powder, the longitudinal axis of said passage being substantially normal to the axis of the train in un-armed condition, first means to lock said member against rotation, means responsive to an electrical signal to unlock said first locking means, second means to lock said member against rotation, means urging said second locking means to unlocked position, third locking means to lock said last recited means, and means responsive to the force of set back to unlock said third locking means following initiation of projectile flight to free the said member for rotation to an armed position wherein the axis of the said passage is aligned with the axis of the powder train.

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