United States Patent

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[54] **ARMING UNIT**

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[73] Assignee: **The United States of America as represented by the Secretary of the Air Force**

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[52] **U.S. Cl.** .....**89/1.5 D**, 102/2

[51] **Int. Cl.** **B64d 1/04**

[58] **Field of Search**.....89/1.5, 1.5 D; 102/2, 70, 68

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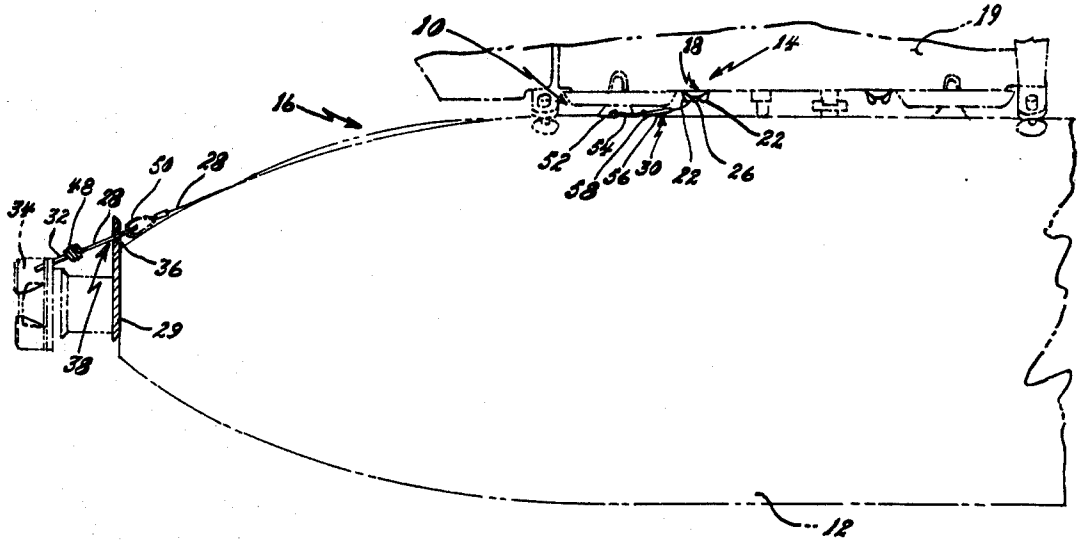
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[57] **ABSTRACT**

An arming unit which is capable of releasing in the armed or unarmed position a weapon. This arming unit is made up of an arming wire connected at one end to the weapon and at the other end to a locking member which is releasably secured to an aircraft. A uniquely designed spring loop and plate arrangement of the arming wire allows for arming of the weapon and then subsequent release of the arming wire along with the weapon from the locking member. If desired, however, the arming wire and locking member may also be released together with the weapon in the unarmed position.

5 Claims, 5 Drawing Figures



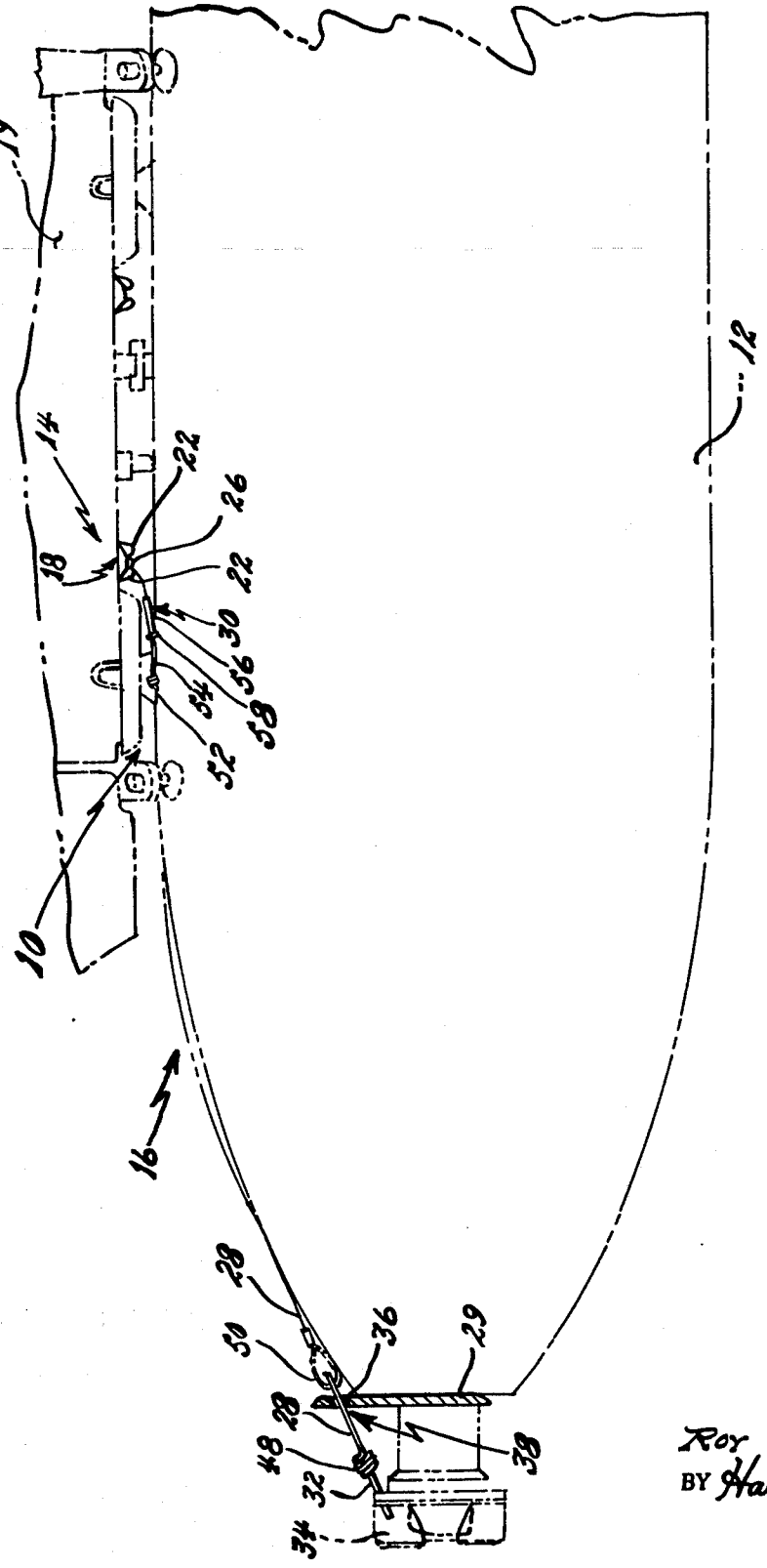


FIG. 1

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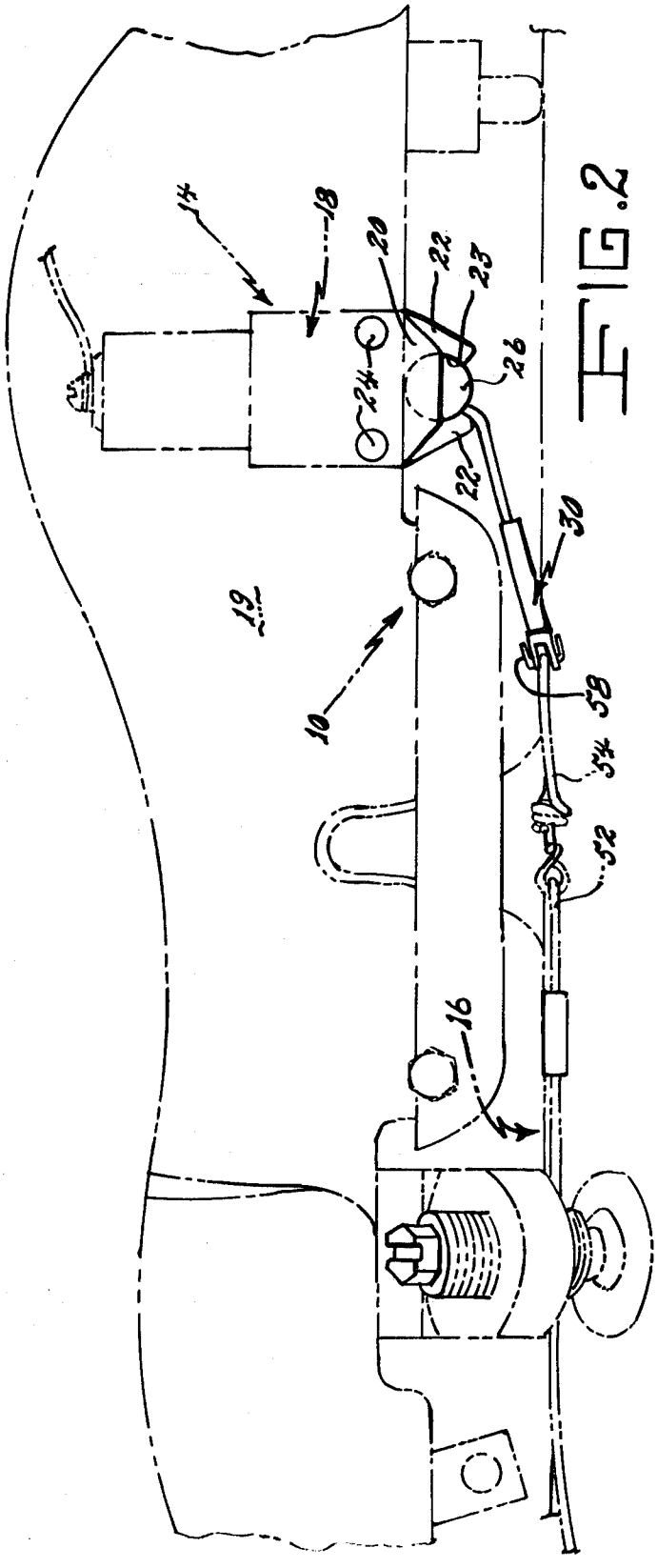


FIG. 2

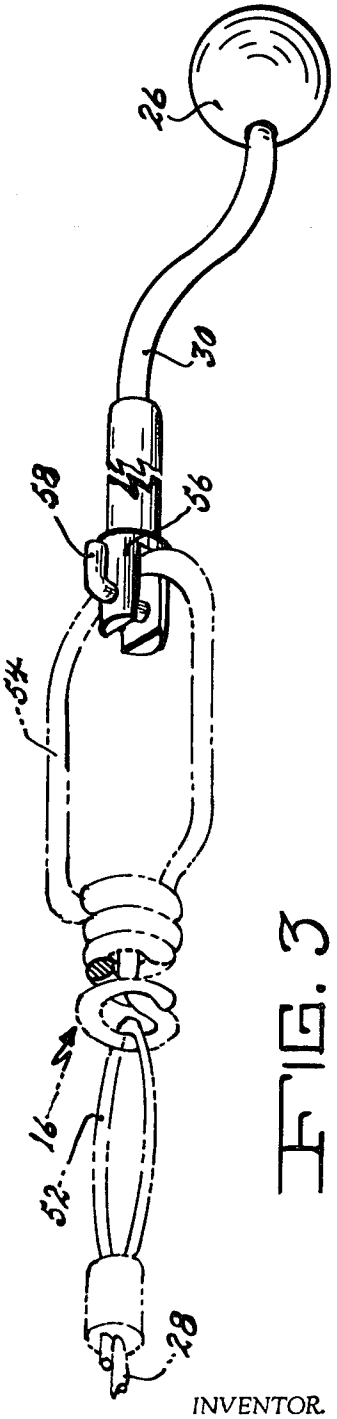
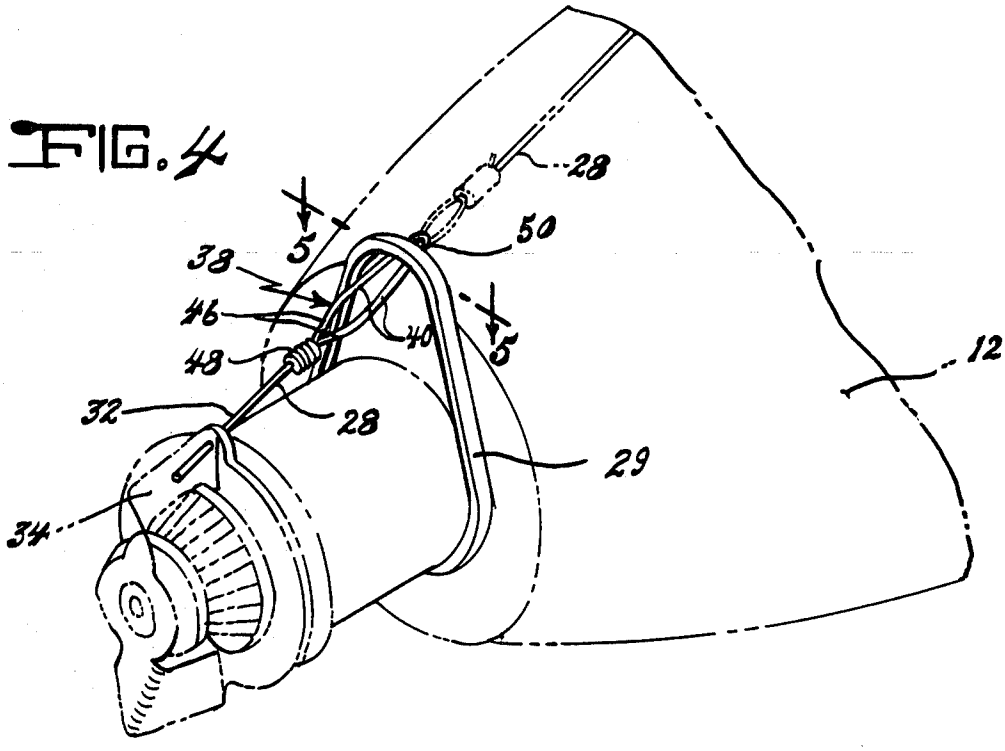


FIG. 3

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FIG. 4



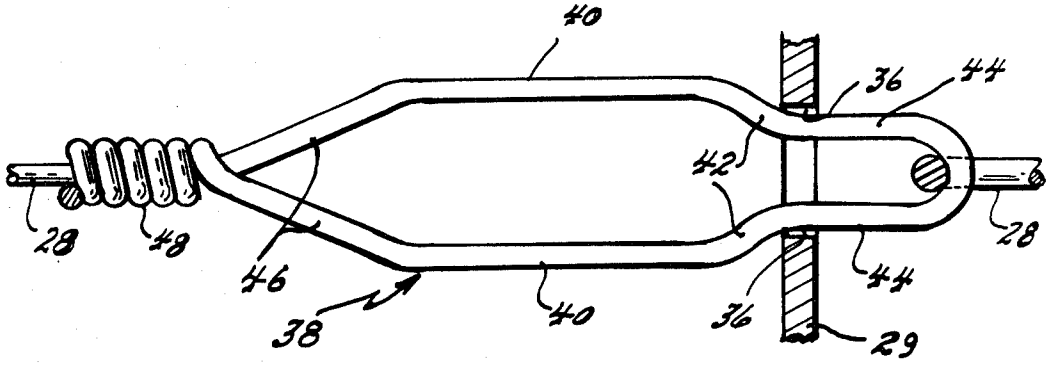


FIG. 5

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ARMING UNIT

BACKGROUND OF THE INVENTION

This invention relates generally to arming units, and more particularly to an arming unit adapted to be used with a variety of free-fall weapons and which prevents the accidental arming of these weapons.

Airborne free-fall weapons, such as bombs, have fuzes that must be maintained in a safe condition until the weapon is launched from the aircraft.

Although there are many ways of accomplishing the arming function, perhaps the most common method is by means of an arming wire. Basically, one end of the wire is connected to the fuze and the other end of the wire is connected to the aircraft. To actuate the bomb, the wire must be held as the bomb falls away from an aircraft and the weight of the falling bomb causes withdrawal of the wire and energizes or activates the bomb so that it will detonate upon impact. In some instances the wire starts, or places in condition to start, fuzing mechanisms.

Although the basic arming wire concept is simple, an operational design becomes more complicated as it is applied to modern weapons systems. The arming wire must be protected from mechanical damage during the time that the weapon is being stored, handled during installation on the aircraft bombrack and during flight. The system must also provide means to assure that the arming wire is not prematurely extracted from the fuze during handling or during the time that it is carried by the aircraft. It is also necessary to provide a simple and convenient means for connecting the arming wire to the widely varying arming wire solenoid positions found on various tactical aircraft.

In the case of high speed aircraft, it is also very desirable to retain the arming wire with the weapon after release rather than with the aircraft. If the arming wire were left with the aircraft, whipping of the wire in the airstream could cause extensive damage to the aircraft.

It is therefore desirable to employ a device which selectively controls the arming of explosive missiles so that, for example, bombs carried beneath an aircraft may have an arming wire extended therefrom which is retained in fixed relationship to the aircraft. Thereby, upon release of the missile, the arming wire is withdrawn from the missile placing the various parts thereof in condition for firing at the critical time or under the critical conditions of impact or proximity.

Furthermore, it is desirable that such arming apparatus be capable of remote control by a pilot or the like to selectively release the arming wire, permitting the discharge of the missile in an emergency without conditioning the various parts thereof for firing. For example, it is sometimes desirable or necessary to discharge missiles while over friendly territory, or a portion of an airfield.

Essentially, the arming devices comprise a lever arrangement in which two movable jaws or grippers are biased toward each other to hold or retain an arming wire or ring. The wire or ring can be pulled from the jaws by a pull on the arming wire overcoming the bias applied to holding the jaws together. This pull is substantially below the force required to arm the projectile or bomb and facilitates the loading of the bomb on the aircraft in that the ring or wire loop is merely forced into and between the jaws of the levers. Similarly, for example, if a bomb should be accidentally dislodged or even purposely dropped from its hangars, the wire loop or ring readily pulls free from the jaws, thereby preventing activation of the bomb or projectile. At the selection of the aircraft personnel, however, the jaws and levers are locked in their closed position by the action of a solenoid and associated apparatus so that the ring or wire loop is secured against removal. In such an event the release of a bomb or projectile results in the activation of the bomb or projectile, the wire thereupon setting the fuze elements in the bomb in a functioning position.

The arming devices of the past usually have a rather poor reliability record and basically have three major categories of failures. The first failure is in the case of the armed drop of a weapon when a safe jettison is intended. In this case the inherent danger involved is most obvious since such a safe jettison is usually intended to take place over or near friendly territory.

The second mode of failure is the inert or safe drop when armed drop is intended. This category of failure is emphasized by the great cost of the wasted weapon; however, such a loss is trivial compared to the cost of delivering the weapon to the target. Furthermore, there is an actual risk to life to the crew during the delivery of equipment when the intended armed drop fails to detonate.

The third category of failure is the destruction of the arming unit due to a structural failure. This third category of failure is especially costly since it involves the expenditures of the first two categories of failure, plus the cost of the replacement of the failed part.

Many types of arming devices have been constructed in the past to overcome the problems listed above; however, most have resulted in marginal or temporary solutions to a specific mode of failure and have resulted in adding to the problems in another failure mode.

SUMMARY OF THE INVENTION

The arming unit of the instant invention overcomes the problems set forth in detail hereinabove. This arming unit is divided into two subassemblies; a lower unit or arming assembly which forms part of the arming wire of a conventional weapon, and an upper unit or solenoid which is fixedly secured to the underside of an aircraft. In the completely assembled position the upper unit of this invention locks the lower unit in place for "armed" drops or is capable of releasing the lower unit when a safe jettison is required.

The upper unit of the present invention utilizes a uniquely designed solenoid which is capable of holding the lower unit or arming assembly in a locked position during the "armed" drop of a weapon. This solenoid has a lower section thereon which retains securely in position the ball forming the end portion of the arming assembly and holds the ball on one axis by a pair of fixed sides and on the other axis by a pair of pivotally mounted jaws having a cylindrical cross-bore.

The lower unit or arming assembly of the instant invention is made up of an arming wire having a straight segment which engages the fuze on any conventional weapon in the unarmed position. Adjacent the straight segment of the arming wire is a spring loop which passes through a spring loop plate mounted on the

weapon. The spring loop is designed so as to pass through a slot in the spring loop plate until a twisted segment on the arming wire abuts the plate. In the position wherein the twisted segment abuts the spring loop plate the straight segment of the arming wire is withdrawn from the fuze and the weapon is in the armed position. The other end of the arming wire is attached to a locking member. This attachment is in the form of a swivel loop on the arming wire which is retained within a clevis secured to one end of the locking member. The other end of the locking member terminates in a ball which is securely gripped by the upper unit or solenoid.

Upon the release of the weapon from an aircraft, the arming wire disengages from the fuze on the weapon and passes through the spring loop plate until the twisted segment of the arming wire abuts the plate. This extremely high resisting force is transmitted through the arming wire to the swivel loop at the end of the arming wire and thereby shears a copper or monel (copper-nickel alloy) wire in the clevis. The arming wire is thereby released along with the armed weapon. If the weapon is to be released in the unarmed position, the solenoid is deactivated and releases the locking member, thereby releasing the entire lower unit with the unarmed weapon.

It is therefore an object of this invention to provide an arming unit which is extremely reliable in arming a weapon and which is capable of a high degree of reproductibility.

It is another object of this invention to provide an arming unit which prevents the accidental arming of a weapon.

It is still another object of this invention to provide an arming unit which is capable of releasing an unarmed weapon.

It is a further object of this invention to provide an arming unit which is economical to produce and which utilizes conventional currently available components that lend themselves to standard mass producing manufacturing techniques.

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 drawing and its scope will be pointed out in the appended claims.

DESCRIPTION OF THE DRAWING

FIG. 1 is a side elevational view of the arming unit of this invention, shown partly in cross-section, mounted on the underside of an aircraft and in position on a weapon shown in he unarmed position;

FIG. 2 is an enlarged side elevational view of the upper unit of the arming unit of this invention holding the lower unit in place;

FIG. 3 is a pictorial view of the clevis mounting arrangement of the arming unit of this invention;

FIG. 4 is a pictorial view of the straight section of arming wire of this invention in place in the fuze of a weapon in the unarmed position; and

FIG. 5 is a plan view of the spring loop of the arming unit of this invention taken along lines 5—5 of FIG. 4.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Reference is now made to FIG. 1 which shows the arming unit 10 of this invention in position on a weapon 12, and thereby maintaining the weapon 12 in the unarmed position.

The arming unit 10 of the present invention is made up of an upper unit 14 and a lower unit or arming assembly 16. The upper unit 14 (which is best seen in FIG. 2) is made up of a solenoid 18 fixedly secured to the underside of any conventional aircraft 19. Solenoid 18 has a pair of fixed sides 20 and a pair of jaws 22 each pivotally secured between sides 20 by any suitable mounting means such as bolts 24. These jaws 22 have a cylindrical cross-bore 23 and operate by conventional solenoid action so as to securely grip therebetween in the locked position the terminal ball 26 of the arming assembly 16 of this invention.

As best shown in FIGS. 1, 2 and 4 the lower unit or arming assembly 16 is made up of an arming wire 28 at one end thereof, a spring loop plate 29 through which the arming wire passes and a locking member 30 at the other end thereof. The arming wire 28 has a straight segment 32 (see FIGS. 1 and 4) which is operably connected in any conventional manner to the fuze 34 of weapon 12. The spring loop plate 29 is secured in any conventional manner to the weapon 12 and has a slot 36 therein through which the arming wire 28 passes. The portion of the arming wire 28 which passes through the slot 36 in plate 29 is in the form of a spring loop 38. The spring loop 38 best shown in FIG. 5 has a central section 40 terminating at one end in in a pair of tapered shoulders 42 and an extended segment 44 which protrudes through slot 36 when the weapon is unarmed. At the other end of central section 40 is a pair of reverse-tapered shoulders 46 which end in a twisted segment 48 of a diameter greater than the width of slot 36 (see FIGS. 1 and 5). The operation of the spring loop 38 of arming wire 28 will be explained in detail hereinbelow. Spring loop 38 is secured to the remainder of the arming wire 28 by any conventional securing arrangement 50.

At the other end of arming wire 28 is mounted by any conventional securing arrangement 52 a swivel loop 54. This swivel loop 54 is retained within a clevis 56 formed at one end of locking member 30. Any suitable locking means, such as a shear pin or wire 58, made preferably of monel (copper-nickel alloy), holds the swivel loop 54 securely in place. The only criteria for construction of the shear pin 58 is that the pin be sufficiently strong to allow for the arming load to be imposed thereon; that is, the force necessary to pull the arming wire spring loop 38 through the slot 36 in plate 29 until the twisted segment 48 abuts the plate 29. This procedure retracts the straight segment 32 of arming wire 28 from fuze 34 and thereby permits the weapon to reach the fully armed position.

MODE OF OPERATION

In operation, the unarmed weapon 12 with the lower unit 16 of the arming unit 10 of this invention in place is mounted beneath the aircraft by any conventional weapon mounting arrangement. The ball 26 of locking member 30 is inserted within the solenoid 18 and the

solenoid **18** is activated thereby locking the ball **26** between jaws **22**. Upon the release of the weapon **12** from the aircraft a pull of approximately 40 lbs is required to pull the shoulders **42** of the spring loop **38** (as shown in FIG. **5**) through the slot **36** in the spring loop plate **29**. Once the shoulders **42** have squeezed through slot **36** the central section **40** of loop **38** easily slips through, restrained only by a much lower force, until the reverse-tapered end **46** of the loop **38** passes through the slot **36**. This action pulls the straight segment **32** of arming wire **28** out of fuze **34** of weapon **12** and thereby places the weapon **12** in the armed position.

The arming wire **28** is restrained from completely passing through the slot **36** by the twisted segment **48** of the spring loop **38**, which is much larger in diameter than the width of the slot **36** and thereby jams against the plate **29**. At this time an extremely high resisting force is transmitted through the arming wire **28** back to the swivel loop **54** at the end of the arming wire **28** (shown in FIG. **3**). The swivel loop **54** is retained within clevis **56** of locking member **39** by a copper shear wire **58**. This shear wire **58** is strong enough to withstand the arming load imposed thereon when the spring loop **38** passes through slot **36** of plate **59** but fails when the twisted segment **48** of the spring loop **38** hits the spring loop plate **29** as described hereinabove. Upon the shearing of wire **58** the arming wire **28** is released along with the armed weapon **12**. In case of emergency or any other time when it is desirable to drop the weapon **12** in the safe or unarmed position, it is merely necessary to deactivate solenoid **18** and thereby unlock the jaws **22** and release the terminal ball **26**. In this instance the entire lower unit **16** with the weapon **12** in the unarmed position is released from the aircraft **19**.

Although this invention has been described with reference to a particular embodiment, it will be understood to those skilled in the art that this invention is also capable of a variety of alternative embodiments within the spirit and scope of the appended claims.

I claim:

1. An arming unit adapted to be used with a weapon comprising an arming wire operably connected at one end to the fuze of said weapon, a plate mounted on said weapon adjacent said arming wire, said plate having a slot therein of a predetermined width, said arming wire having a spring loop and a twisted segment at said on end thereof, said twisted segment being of a greater diameter than the width of said slot and said spring loop protruding through said slot in said plate, a locking member having a clevis at one end thereof secured to a swivel loop at the other end of said arming wire, means secured to said clevis for holding said swivel loop in place, and means mounted on a weapon delivery unit for releasably securing the other end of said locking member thereto whereby upon the release of said weapon from said delivery unit while said locking member is secured to said weapon delivery unit said spring loop passes through said slot in said plate until said twisted segment abuts said plate thereby arming said weapon by disconnecting said arming wire from said fuze.

2. An arming unit as defined in claim **1** wherein said means for releasably securing said locking member is in the form of a solenoid.

3. An arming unit as defined in claim **2** wherein said locking member has a ball at said other end thereof and said solenoid has a pair of fixed sides and a pair of pivotally mounted jaws for engaging said ball, said jaws having a cylindrical cross-bore.

4. An arming unit as defined in claim **7** wherein said means for holding said swivel loop in place is a shear wire whereby a predetermined time after said twisted segment abuts said plate said shear wire will sever thereby releasing said arming wire from said locking member.

5. An arming unit as defined in claim **4** wherein said spring loop has a central section terminating at one end adjacent said twisted segment in a pair of reverse-tapered shoulders and the other end of said central section terminating in a pair of tapered shoulders and an extended segment which protrudes through said slot in said plate.

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