

Superintendencia de Industria y Comercio



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Señores

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO

División de Nuevas Creaciones.

E. S. D.

Expediente: **NC2017/0008406**
Título: **ESPOLETA ELECTROMECAÁNICA DE PERCUSIÓN
PARA MUNICIÓN AÉREA MULTIPROPÓSITO**
Solicitante: **LUIS EDUARDO TOBÓN TRUJILLO**
Opositor: **INDUSTRIA MILITAR - INDUMIL**
Actuación: **Memorial de Advertencia**

Respetados,

ARLETH AROCA ALMANZA, mayor de edad, identificada como aparece al pie de mi firma, obrando en calidad de apoderada de **INDUSTRIA MILITAR - INDUMIL**, presento los siguientes argumentos con el propósito que el Despacho se sirva desestimar la patentabilidad de la solicitud de patente presentada por el señor **LUIS EDUARDO TOBÓN TRUJILLO**, teniendo en cuenta que no cumple con los requisitos señalados en la Decisión 486 de 2000, tal como se expone a continuación:

I. ANTECEDENTES

1.1. Mediante escrito radicado ante la Superintendencia de Industria y Comercio el día 17 de agosto de 2017, el señor **LUIS EDUARDO TOBÓN TRUJILLO** presentó la solicitud de patente de invención titulada "ESPOLETA ELECTROMECAÁNICA DE PERCUSIÓN PARA MUNICIÓN AÉREA MULTIPROPÓSITO".

1.2. La solicitud fue publicada en la Gaceta 805 de la Propiedad Industrial del 20 de septiembre 2017.

1.3. Si bien la oportunidad legal para interponer oposición ha expirado, en uso de las facultades legales conferidas y teniendo en cuenta el incumplimiento de los requisitos de patentabilidad por parte de la solicitud de patente de la referencia, esta parte se permite exponer los argumentos relevantes relacionados con la carencia de requisitos de patentabilidad por parte de la solicitud de la referencia.

II. PETICIÓN

Sírvase negar el beneficio patentario a la solicitud contenida en el expediente **NC2017/0008406** por no cumplir con lo dispuesto por los artículos 14, 16 y 18 de la Decisión 486 de 2000 referentes a los requisitos de patentabilidad, con base en los fundamentos que se exponen a continuación.

III. LEGÍTIMO INTERÉS

Industria Militar – INDUMIL es una Empresa Industrial y Comercial del Estado a cargo del monopolio de la industria armamentística en el país, así como del uso de explosivos. En ese sentido, cualquier invención relacionada con dispositivos que permiten el accionamiento de bombas aéreas es de particular interés para la institución, más cuando de manera injustificada se pretende la protección de presuntas invenciones que no cumplen los requisitos de patentabilidad y no divulgan de manera suficiente el objeto de la invención.

IV. FUNDAMENTOS DEL MEMORIAL DE ADVERTENCIA

4.1. EL CAPÍTULO REIVINDICATORIO NO CUMPLE CON EL REQUISITO DE CLARIDAD, Art. 30, D. 486.

Al respecto del criterio de claridad, el artículo 30 de la Decisión 486 de la Comunidad Andina establece:

"Artículo 30.- Las reivindicaciones definirán la materia que se desea proteger mediante la patente. Deben ser claras y concisas y estar enteramente sustentadas por la descripción.

Las reivindicaciones podrán ser independientes o dependientes. Una reivindicación será independiente cuando defina la materia que se desea proteger sin referencia a otra reivindicación anterior. Una reivindicación será dependiente cuando defina la materia que se desea proteger refiriéndose a una reivindicación anterior. Una reivindicación que se refiera a dos o más reivindicaciones anteriores se considerará una reivindicación dependiente múltiple."

En primer lugar, las reivindicaciones 1, 3 y 6 no son claras cuando emplean expresiones como "que emitirá una señal de alerta en caso de que la espoleta se encuentre armada", "que temporiza el tiempo de seguridad elegido por el usuario en la perilla de tiempo de armado 10" y "que recibe el tiempo ingresado por el usuario en la perilla de tiempo de armado 10", toda vez que se refiere a funcionalidades. Si

bien indican la función de un componente dentro de la invención, no son características técnicas que permitan diferenciar a la invención del estado de la técnica.

Así mismo, la reivindicación 4 no es clara toda vez que se refiere a un resultado a alcanzar cuando emplea la expresión “caracterizada por ser ensamblada en la parte superior (nariz) y/o posterior (cola o base) de la munición”. Como se puede evidenciar, en dicha reivindicación se menciona la posibilidad de ensamble tanto en la cola como en la nariz de una bomba aérea, sin embargo, no devela cuáles son las partes que podrían permitir dicho ensamble. De hecho, nada en la descripción explica la manera en que es posible llegar a dicho resultado. De manera que, permitir la patentabilidad de una expresión como la anterior afecta gravemente a la Industria Militar de Colombia al evitar que cualquier espoleta que se ensamble tanto a la cola como a la nariz de una bomba aérea pueda ser fabricada, con en agravante de que ni siquiera divulga la manera en la que la persona del oficio normalmente versada en la materia puede llegar a hacerlo; utilizando así el sistema de patentes en contra de su espíritu, el cual consiste en la divulgación completa de la invención a cambio de un monopolio legal.

Por lo tanto, se concluye que la invención no es clara, incumpliendo así el artículo 30 de la Decisión 486 de 2000.

4.2. EL ESTADO DE LA TÉCNICA

La materia divulgada en la solicitud no representa materia patentable, toda vez que no cumple con el requisito de novedad y nivel inventivo respecto de las anterioridades citadas a continuación, correspondiente a los documentos D01 a D05.

ÍTEM	DOCUMENTO	TÍTULO	FECHA DE PUBLICACIÓN
D01	US4380197	Dispositivo de seguridad y armado / Espoleta de contacto	1983/04/19
D02	US4372212	Mecanismo de seguridad y armado compuesto para misil guiado	1983/02/08
D03	US4013012	Sistema electrónico de armado seguro y de protección	1977/03/22
D04	US6363854	Mina alterable de un estado de armado a un estado seguro	2002/04/02
D05	US3994231	Espoleta de ojiva para misil guiado	1976/11/30
D06	US2001017090	Dispositivo espoleta para una vaina de mortero	2001/08/30

El documento **D01** se refiere a un dispositivo de armado y seguro neumáticamente operado para uso en un artículo de artillería en un ambiente de fluido, que comprende un alojamiento con recámara interior; un pistón; y un disco montado al alojamiento y rotable sobre un eje entre posiciones segura y de armado.

La anterioridad **D02** se refiere a un mecanismo compuesto de seguro y armado para un misil lanzado desde una aeronave y que tiene una ojiva; y un motor de cohete, caracterizándose también por un diseño pirotécnico fuera-de-línea.

El documento **D03** se refiere a un sistema para el armado de la ojiva de un misil luego de que dicho misil ha alcanzado una distancia predeterminada desde un vehículo de lanzamiento.

La anterioridad **D04** se refiere a una mina que tiene la habilidad de cambiar de un estado de armado a un estado seguro sin tocar la mina, que comprende un alojamiento, una carga explosiva, un detonador; un percutor movable, un miembro de bloqueo, un controlador para mover dicho miembro de bloqueo de dicha posición retraída hacia dicha posición de bloqueo sin el toque manual de dicho alojamiento.

El documento **D05** se refiere una espoleta para misil guiado que comprende un mecanismo de seguridad-armado. En cuanto el misil es lanzado intencionalmente el tren explosivo de la espoleta es mecánica y eléctricamente alineado, dado que lanzamiento prescrito y eventos de vuelo y un tiempo específico hayan transcurrido.

La anterioridad **D06** se refiere a un dispositivo de vaina de mortero que incluye un elemento de seguridad movable de una posición segura a una posición de armado, un resorte para producir tal movimiento y un mecanismo de presión de resorte que almacena energía en el resorte para producir el movimiento.

4.3. LA TECNOLOGÍA NO ES NUEVA. Artículo 16, Decisión 486

El artículo 14 de la Decisión 486 de 2000 establece los requisitos para la concesión de patentes:

"Artículo 14. *Los Países Miembros otorgarán patentes para las invenciones, sean de producto o de procedimiento, en todos los campos de la tecnología, siempre que sean nuevas, tengan nivel inventivo y sean susceptibles de aplicación industrial."*

[Énfasis fuera de texto]

Ahora bien, respecto del criterio de novedad, el artículo 16 de la Decisión 486 de la Comunidad Andina establece:

"Artículo 16.- *Una invención se considerará nueva cuando no está comprendida en el estado de la técnica.*

El estado de la técnica comprenderá todo lo que haya sido accesible al público por una descripción escrita u oral, utilización, comercialización o cualquier otro medio antes de la fecha de presentación de la solicitud de patente o, en su caso, de la prioridad reconocida."

Adicionalmente, la jurisprudencia del Tribunal de Justicia de la Comunidad Andina indica:

"Según lo establecido en el artículo 18 de la misma Decisión, el requisito de novedad exige que la invención no esté comprendida en el estado de la técnica, el cual comprende el conjunto de conocimientos tecnológicos accesibles al público antes de la fecha de presentación de la solicitud de patente o, en su caso, de la prioridad reconocida.

(...)

*En otras palabras, para que una invención sea novedosa se requiere que no esté comprendida en el estado de la técnica, es decir, que antes de la fecha de presentación de la solicitud de patente o de la prioridad reconocida, ni la innovación ni los conocimientos técnicos que de ella se desprenden hayan sido accesibles al público, entendiendo que la difusión de **la información que se menciona debe ser detallada y suficiente para que una persona versada en la materia pueda utilizar esa información a fin de explotar la invención.**"*

(Énfasis fuera de texto)

En general, los documentos citados reúnen características que individualmente o de manera colectiva se acercan en demasía a la invención divulgada en el documento NC2017/0008406. Varios de los documentos citados divulgan espoletas o dispositivos de seguridad y armado para municiones o minas; en todos los documentos citados se divulga, por ejemplo, la presencia o posible presencia de un tren de fuego que posiciona o tiende a posicionarse hacia el exterior del dispositivo, y así mismo en todos se divulga por lo menos de manera implícita la presencia de un circuito que puede alterar el estado de un solenoide y/o resorte para el giro o efecto rotacional que causa la alineación de un percutor con un tren de fuego.

Además, la implementación de medios por los cuales se pueda determinar el estado de armado de la espoleta, como lo es un LED que permita conocer dicho estado, no es nueva, como se puede evidenciar del texto del primer capítulo del manual NAVEDTRA

14313¹ en el que se describen términos comunes en el campo técnico de las espoletas tales como la evidencia externa de armado (también EEA por sus siglas en inglés), que se describe como sigue: *medios por los cuales una espoleta es determinada físicamente de estar en una condición segura o de armado.*

Así las cosas, no puede considerarse como nueva la invención en estudio.

Es importante resaltar al momento de evaluar la patentabilidad de la reivindicación 4 que en la descripción de la invención se menciona que la espoleta puede ser ensamblada a la nariz o a la cola de la bomba, pero en ningún caso se menciona cómo es posible ninguna de dichas realizaciones ni cómo se pretende ensamblar la espoleta a la bomba en alguna de esas modalidades, un técnico medio comprenderá que dependiendo de la bomba a la que se desee acoplar una espoleta dicha realización debe ser minuciosamente considerada y sus características técnicas expuestas, especialmente si una espoleta pretende ser multi-posición en el sentido de poder ubicarse en cualquier lugar que puede ser la parte frontal o la parte posterior de la bomba; es así cómo dicha reivindicación es inválida en tanto que carece de sustento en la descripción detallada y su realización no se encuentra correctamente divulgada, por lo que no se debería evaluar como contentiva de características técnicas esenciales.

4.4. LA INVENCION NO CUMPLE CON EL REQUISITO DE NIVEL INVENTIVO. Art. 18, D. 486

El nivel inventivo, el artículo 18 de la Decisión 486 de la Comunidad Andina establece:

"Artículo 18.- *Se considerará que una invención tiene nivel inventivo, si para una persona del oficio normalmente versada en la materia técnica correspondiente, esa invención no hubiese resultado obvia ni se hubiese derivado de manera evidente del estado de la técnica."*

Al respecto del criterio de nivel inventivo, la jurisprudencia del Tribunal de Justicia de la Comunidad Andina indica:

"Con el requisito del nivel inventivo, lo que se pretende es dotar al examinador técnico de un elemento que le permita afirmar o no si a la invención objeto de estudio no se habría podido llegar a partir de los conocimientos técnicos que existían en ese momento dentro del estado de la técnica... En este punto conviene

¹ "Bombas, espoletas, y componentes asociados", o "BOMB, FUZES, AND ASSOCIATED COMPONENTS" en el texto original, del manual NAVEDTRA 14313 "Aviation Ordnanceman" de la marina estadounidense. Disponible en <http://navybmr.com/study%20material/NAVEDTRA%2014313.pdf>



advertir que uno es el examen que realiza el técnico medio respecto de la novedad y otro el que se efectúa con respecto al nivel inventivo; si bien en uno y otro se utiliza como parámetro de referencia el 'estado de la técnica', en el primero, se coteja la invención con las 'anterioridades' existentes dentro de aquella, cada uno (sic) por separado, mientras que en el segundo (nivel inventivo) se exige que el técnico medio que realiza el examen debe partir del conocimiento general que él tiene sobre el estado de la técnica y realizar el cotejo comparativo con su apreciación de conjunto, determinando si con tales conocimientos técnicos existentes ha podido o no producirse tal invención"².

En la tabla 1 se exponen en detalle la comparación de las características de la invención con el arte previo.

En cuanto a la invención objeto de este documento, y de acuerdo con la presencia de las características que pretendían ser diferenciadoras en el documento NC2017/0008406, la invenciones más cercanas son aquellas que se publican en las referencias **D01-D03**, en tanto que divulgan espoletas de artillería en donde el mecanismo de armado comprende el giro o rotación de elementos para alinear un percutor con un tren de fuego en donde se utilizan solenoides activados mediante una señal eléctrica y/o resortes.

La diferencia entre la invención y cualquiera de las espoletas de los documentos D01 a D03 corresponde a la utilización de señales de alerta para indicar un posible estado de armado. Sin embargo, el hecho de emplear señales de alerta para indicar un posible estado de armado en espoletas se considera implícito y rutinario en el sector tecnológico, de manera que la implementación de una señal de alerta por medio de un LED es obvia para persona versada en la materia, e incluso obvia para cualquier ingeniero electricista o ingeniero electrónico; en donde lo expuesto anteriormente junto con un análisis detallado por el examinador hará posible ver cómo la primera reivindicación alegada por el solicitante carece por completo de nivel inventivo.

En cuanto a las demás reivindicaciones, también los documentos **D01** a **D03** divulgan las características esenciales por las cuales un percutor se encuentra inicialmente desviado de su posición de alineación con un tren de fuego y en donde dicho estado puede cambiar por medio de la liberación de la energía de un resorte que inicie el proceso de alineación de dicho percutor y de dicho tren de fuego, además de que los documentos **D01** a **D03** también divulgan la presencia de tarjetas electrónicas, en especial medios de temporización electrónica como los que se encuentran en el documento **D03**.

² Proceso N° 12-IP-98. Doc. Cit. TRIBUNAL DE JUSTICIA DE LA COMUNIDAD ANDINA.

Invención en estudio	D1 (US4380197)	D2 (US4372212)	D3	D4	D5	D6
[R1] Una espoleta de percusión para munición aérea multipropósito que se caracteriza por comprender un sistema de armado electromecánico y un sistema de alerta que revela una posible condición insegura en tierra; donde	Un dispositivo de armado y seguro neumáticamente operado para uso en un artículo de artillería en un ambiente de fluido, que comprende: un alojamiento con recámara interior, un pistón..., un disco montado al alojamiento y rotable sobre un eje entre posiciones segura y de armado... [Reivindicación 1]	Un mecanismo compuesto de seguro y armado para un misil lanzado desde una aeronave y que tiene una ojiva; y un motor de cohete, dicho mecanismo comprendiendo: [Reivindicación 1]	Un sistema para el armado de la ojiva de un misil luego de que dicho misil ha alcanzado una distancia predeterminada desde un vehículo de lanzamiento y para la detonación de dicha ojiva dada la ocurrencia de un evento desencadenante, dicho aparato comprendiendo: [Reivindicación 1]	Una mina que tiene la habilidad de cambiar de un estado de armado a un estado seguro sin tocar la mina, que comprende un alojamiento, una carga explosiva, un detonador..., un percutor movable..., un miembro de bloqueo..., un controlador para mover dicho miembro de bloqueo de dicha posición retraída hacia dicha posición de bloqueo sin el toque manual de dicho alojamiento. [Reivindicación 1]	Una espoleta para misil guiado que comprende... [Reivindicación 1]	Un dispositivo de vaina de mortero que incluye un elemento de seguridad movable de una posición segura a una posición de armado, un resorte para producir tal movimiento, un mecanismo de presión de resorte que almacena energía en el resorte para producir el movimiento... [Reivindicación 1]
el tren de fuego 13 se encuentra ensamblado en un vaso de alojamiento 4 que se encuentra posicionado en la parte exterior de la espoleta de percusión; su propia sección de "ANTECEDENTES DE LA INVENCION" contradice la presencia de un tren de fuego, y la prudencia en su incorporación.	... Cuando el dispositivo es armado, una señal de fuego causa la detonación de un tren explosivo hacia el disco 31 bien en un detonador instantáneo o en un detonador con retardo hacia el camino de salida 35 que es encaminado hacia la carga de multiplicador explosivo 44... [Descripción de la modalidad preferida, columna 3, líneas 42-46].	Un mecanismo como en la reiv. 4 en donde los medios de armado comprenden: una platina con una vacidad que se extiende a través del centro de dicha platina y fijamente anexada al alojamiento; un tren explosivo en la forma de una barra y que atraviesa dicha cavidad y que encamina hacia la ojiva. [Reivindicación 5] El vaso de alojamiento del documento NC2017/0008406 especifica ubicarse en el área exterior de la espoleta; en el documento 08 la ojiva no hace parte de la invención descrita, por lo que el tren explosivo encamina hacia la ojiva también se ubica en un alojamiento que tiende y se encamina hacia el exterior de la espoleta (descrito como mecanismo en este documento)	... Después de que el reloj ha ejecutado una cuenta regresiva de su periodo de tiempo predeterminado, libera el resorte y causa que el explosivo primario sea alineado con el explosivo secundario. [Antecedentes de la invención, columna 2, líneas 19-23] El explosivo primario hace las veces de tren de fuego.	El detonador 26 es posicionado encima del multiplicador 28, que es posicionado en el suelo del alojamiento. [Descripción detallada de la invención, columna 3, líneas 25-27]	El armado por disparo permite un tiempo mínimo en el que el tren de fuego se encuentra en la condición fuera-de-línea gris o insegura durante el ciclo de armado [Descripción detallada de la invención, columna 2]	Una masa de impacto 92 que porta un detonador 94 es dispuesta en un espacio receptor 90 del revestimiento 16 (ver Figs. 1, 7 y 8). El revestimiento 16 porta un brazo de seguridad en la forma de una palanca de seguridad 98 que es dispuesta para rotar en torno a un pin 93... [Párrafo 25] La masa de impacto 92 y el detonador 94 hacen las veces de un tren de fuego y la masa de impacto 92 y el revestimiento son equivalentes al vaso de alojamiento.

[R1] el multiplicador del tren de fuego se encuentra roscado en dicho vaso de alojamiento 4; su propia sección de "ANTECEDENTES DE LA INVENCIÓN" contradice la presencia de materiales explosivos en general.	... La detonación de la carga de multiplicador explosivo 44 causa la detonación del explosivo de ojiva 63 mostrado en la Fig. 5. [Descripción de la modalidad preferida, columna 3, líneas 46-48]	El tren explosivo 18, como se ha descrito anteriormente, se conecta a un multiplicador convencional (no mostrado) en la ojiva del misil... [Descripción de la modalidad preferida, columna 3, líneas 61-63]	... Después de que el reloj ha ejecutado una cuenta regresiva de su periodo de tiempo predeterminado, libera el resorte y causa que el explosivo primario sea alineado con el explosivo secundario. [Antecedentes de la invención, columna 2, líneas 19-23] El explosivo secundario hace las veces de multiplicador.	El detonador 26 es posicionado encima del multiplicador 28, que es posicionado en el suelo del alojamiento. [Descripción detallada de la invención, columna 3, líneas 25-27]		
[R1] el sistema de armado electromecánico de la espoleta comprende un cable de armado de avión conectado a un pin de vida 14 que en estado de seguridad bloquea a un solenoide 19, el cual cuando se encuentra bloqueado impide la alineación del percutor 16 con el tren de fuego 13; y donde además dicho sistema comprende un circuito eléctrico que energiza el solenoide 19 cuando éste es desbloqueado por medio de la liberación del cable de armado y la eyección del pin de vida 14 con el fin de alinear el percutor con el tren de fuego 13;	... Un circuito eléctrico de armado y seguridad conectado a dichos medios de detonación instantánea, dichos medios de detonación retardada, y dicho solenoide rotacional. [Reivindicación 7]	El sistema mantiene circuitos de disparo y trenes explosivos en una condición abierta y segura hasta que el mecanismo recibe una señal de intención-de-lanzamiento, una señal de desbloqueo de pin retraible, la separación física del misil y la aeronave, y la ocurrencia de un retraso en tiempo... [Resumen de la invención] ... El solenoide 21 es un solenoide lineal con un émbolo 22 opuesto a un resorte de expansión 23. Cuando se aplica potencia a través del interruptor de seguro-armado 89 hacia el solenoide 21, el émbolo se retrae contra el resorte 23... [Descripción de la modalidad preferida, columna 2, líneas 39-42]	... Después de que el reloj ha ejecutado una cuenta regresiva de su periodo de tiempo predeterminado, libera el resorte y causa que el explosivo primario sea alineado con el explosivo secundario. [Antecedentes de la invención, columna 2, líneas 19-23] Se evidencia que la utilización de resortes activados de acuerdo con una señal de reloj en espoletas es de uso rutinario.	En otras modalidades, un émbolo cargado mediante un resorte puede ser desviado de manera que empuja un miembro de bloqueo entre el percutor y el detonador. Un electroimán tipo solenoide, cuando está energizado, puede jalar el émbolo y retraer el miembro de bloqueo a ser empujado entre el percutor y el detonador. Aún en otras modalidades, una trampilla puede sostener un émbolo cargado mediante resorte en su lugar hasta que sea liberado por un dispositivo de liberación aparte. [Resumen de la invención, columna 2 líneas 33-41].	... Al recibir la señal ATI (Iniciación por Transferencia Activa) el solenoide ATI 72 es energizado y el rotor ATI 71 con su asegurador ATI 69 rota aproximadamente 20 grados... [Descripción detallada de la invención, columna 4, líneas 1-3] ... El solenoide ATI es retornado por el torque de restauración ejercido por los resortes de retorno 79.... [Descripción detallada de la invención, columna 4, líneas 25-27]	... La desviación mecánica del dispositivo resorte que es necesaria para configurar el dispositivo espoleta en una posición de armado desde una de seguridad es efectuado solo después de que se deja el cañón desde el que la vaina de mortero es lanzada, por medio de un propulsor, en virtud de la conexión de operación adecuada del propulsor al dispositivo resorte, en donde el dispositivo resorte puede ser un resorte de torsión. [Párrafo 6]
[R1] el sistema de alerta comprende un led 8 dispuesto en el vaso de alojamiento 4 que emitirá una señal de alerta en caso de que la espoleta se encuentre armada.	Los sistemas de alerta son rutinariamente utilizados, como se demuestra en la referencia NAVEDTRA.					
Otras reivindicaciones						

[R2] La espoleta de percusión para munición aérea multipropósito de la reivindicación 1, caracterizada porque el percutor se encuentra montado en la leva 22 con un resorte helicoidal comprimido 23.	... El dispositivo es influenciado por la presión de aire y utiliza un rotor y resorte de armado para traducir el movimiento lineal de un pistón en movimiento rotacional. Una serie de interbloques previene el armado inadvertido del dispositivo. [Descripción del arte previo, columna 1, líneas 23-25] El resorte rotacional realiza el equivalente de mover un objeto rotacionalmente con respecto a un eje, como el eje de la leva, en el interior de una espoleta.	... La fuerza almacenada en el resorte 34 actúa contra el brazo de seguimiento 36 para rotar la barrera 40... [Descripción de la modalidad preferida, columna 3, líneas 33-35]	... Después de que el reloj ha ejecutado una cuenta regresiva de su periodo de tiempo predeterminado, libera el resorte y causa que el explosivo primario sea alineado con el explosivo secundario. [Antecedentes de la invención, columna 2, líneas 19-23]	Además, el miembro de bloqueo puede ser movido por una variedad de mecanismos derivando energía de fuentes tales como resortes de torsión, elastómeros, ..., etc. Asimismo, el miembro de bloqueo no tiene que deslizarse linealmente, y puede rotar o seguir un camino curvo, en otras modalidades. [Descripción detallada de la invención, columna 6, líneas 46-53; las enseñanzas de esta invención hacen que sea obvio que se puede intercambiar el miembro de bloqueo por un percutor para lograr el mismo efecto de alineación/desalineación con un tren de fuego o detonador].	Des-bobinado del resorte 58 del carrete de teflón 60 resulta en una fuerza que arrastra el carrete, y a su vez el pin de montaje de carrete 62, en la dirección del brazo de amartillamiento 57. [Descripción detallada de la invención, columna 3, líneas 36-39]	... La desviación mecánica del dispositivo resorte que es necesaria para configurar el dispositivo espoleta en una posición de armado desde una de seguridad es efectuado solo después de que se deja el cañón desde el que la vaina de mortero es lanzada, por medio de un propulsor, en virtud de la conexión de operación adecuada del propulsor al dispositivo resorte, en donde el dispositivo resorte puede ser un resorte de torsión. [Párrafo 6]
[R3] La espoleta de percusión para munición aérea multipropósito de la reivindicación 1, caracterizada porque el sistema de armado electromecánico de la espoleta comprende además una tarjeta electrónica 20 que temporiza el tiempo de seguridad elegido por el usuario en la perilla de tiempo de armado 10.	... Un circuito eléctrico de armado y seguridad conectado a dichos medios de detonación instantánea, dichos medios de detonación retardada, y dicho solenoide rotacional. [Reivindicación 7]	En un dispositivo de seguro y armado del arte previo, una serie de émbolos eléctricamente temporizados y varis resortes de retorno son empleados... [Descripción del arte previo]	... Una segunda rama de sistema que comprende: ... medios de temporización electrónica... [Reivindicación 1] temporización electrónica implica un circuito electrónico, que a su vez se realiza cotidianamente en una tarjeta electrónica, como una persona versada en la materia reconocerá.	La invención de la reivindicación 1 en donde el controlador y el miembro de bloqueo comprende: un dispositivo electromagnético; y un circuito conectado a dicho dispositivo electromagnético para producir una fuerza electromagnética. [Reivindicación 4] El subsistema 44 se muestra con una llave 46 actuando como una proyección operable manualmente para el armado de la mina de la manera descrita presentemente. [Descripción detallada, columna 4, líneas 1-4]	con ensamblaje de alojamiento de émbolo, tarjeta de circuito, interruptores de rotación y escape removido [Descripción de la Figura 7]	

En cuanto a la posible ubicación de una espoleta para bomba aérea que se pueda ubicar tanto en la sección de la nariz como en la sección de la cola de esta, se reitera lo que se ha dicho en las secciones 4.1 y 4.3 del presente documento, relacionadas con la claridad y la novedad de la invención en estudio, siendo esto la falta de una divulgación o descripción adecuada que permita sustentar la realización de una espoleta que es posible ensamblar o disponer en una sección anterior o posterior de una bomba de acuerdo con las partes que conforman la espoleta.

Como se ha dicho con anterioridad y reiterando un argumento previo, la implementación de medios por los cuales se pueda determinar el estado de armado de la espoleta, como lo es un LED que permita conocer dicho estado, no es nueva, como se puede evidenciar del texto del primer capítulo del manual NAVEDTRA 14313, citado con anterioridad en el que se describen términos comunes en el campo técnico de las espoletas tales como la evidencia externa de armado (o EEA por sus siglas en inglés), que se describe como sigue: *medios por los cuales una espoleta es determinada físicamente de estar en una condición segura o de armado*. La implementación de medios como los mencionados mediante la implementación de uno o más LEDs, por sí sola no cuenta con nivel inventivo puesto que es obvia para una persona versada en la materia, y es una característica que por sí sola no sustenta ni la novedad ni el nivel inventivo de la invención, mucho menos los requisitos que según la decisión 486 son de necesario cumplimiento para obtener una protección de patente de invención.

En este sentido y con base en el estado de la técnica referenciado, una persona versada en el oficio de la materia encontraría obvia la realización y puesta en conjunto de los elementos que permiten a una espoleta comprender una espoleta con retardo de armado temporizado electrónicamente en la que el mecanismo de armado se realiza mediante la obstrucción de un solenoide y la eventual liberación de la energía de un resorte para la alineación de un percutor con un tren de fuego.

Finalmente, es pertinente indicar que una eventual concesión del derecho de patente a la solicitud de la referencia contraviene el espíritu del ordenamiento jurídico colombiano. Esto teniendo en cuenta que la fabricación de armas, municiones de guerra y explosivos son exclusivos del Gobierno, tal como lo señala la Constitución Política de Colombia en su artículo 223 y que, el hecho de conceder una patente perteneciente en alguno de estos sectores técnicos a un particular entorpecería las labores del estado colombiano en sus funciones de defensa de la población.



V. FUNDAMENTOS DE DERECHO

Son fundamentos de derecho los artículos 14, 16 y 18 de la Decisión 486 de 2000.

VI. PRUEBAS

Téngase como soportes que sustentan este memorial los siguientes documentos:

- Patente US4380197.
- Patente US4372212
- Patente US4013012
- Patente US6363854
- Patente US3994231
- Publicación US2001017090A1
- Bomb, fuzes, and associated components, en NAVEDTRA 14313 Aviation Ordnanceman. Disponible en:
<http://navybmr.com/study%20material/NAVEDTRA%2014313.pdf>

VII. ANEXOS

Para efectos del trámite correspondiente, me permito anexar al presente escrito los siguientes anexos

- 8.1.** Poder para actuar.
- 8.2.** Certificado de existencia y representación legal de Industria Militar.
- 8.3.** Las documentales relacionadas en el acápite de pruebas.

VIII. NOTIFICACIONES

La Solicitante y el suscrito, recibiremos notificaciones en la Secretaría de su Despacho y en la Carrera 5 # 66-17 de Bogotá D. C.

Cordialmente,



ARLETH AROCA ALMANZA

C.C. 36.718.415

T.P. 123.758 del C.S. de la J.



United States Patent [19]

Eaton

[11] 4,380,197

[45] Apr. 19, 1983

[54] SAFETY AND ARMING DEVICE/CONTACT FUZE

[75] Inventor: Jefferson O. Eaton, Ridgecrest, Calif.

[73] Assignee: The United States of America as represented by the Secretary of the Navy, Washington, D.C.

[21] Appl. No.: 915,030

[22] Filed: May 26, 1978

[51] Int. Cl.³ F42C 5/00; F42C 15/00

[52] U.S. Cl. 102/228; 102/229

[58] Field of Search 102/228, 229, 258, 222-225, 102/227, 208

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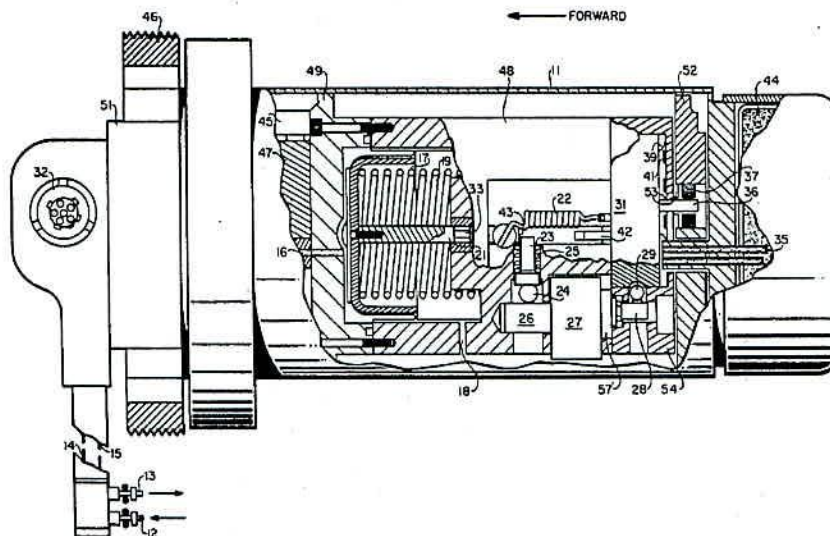
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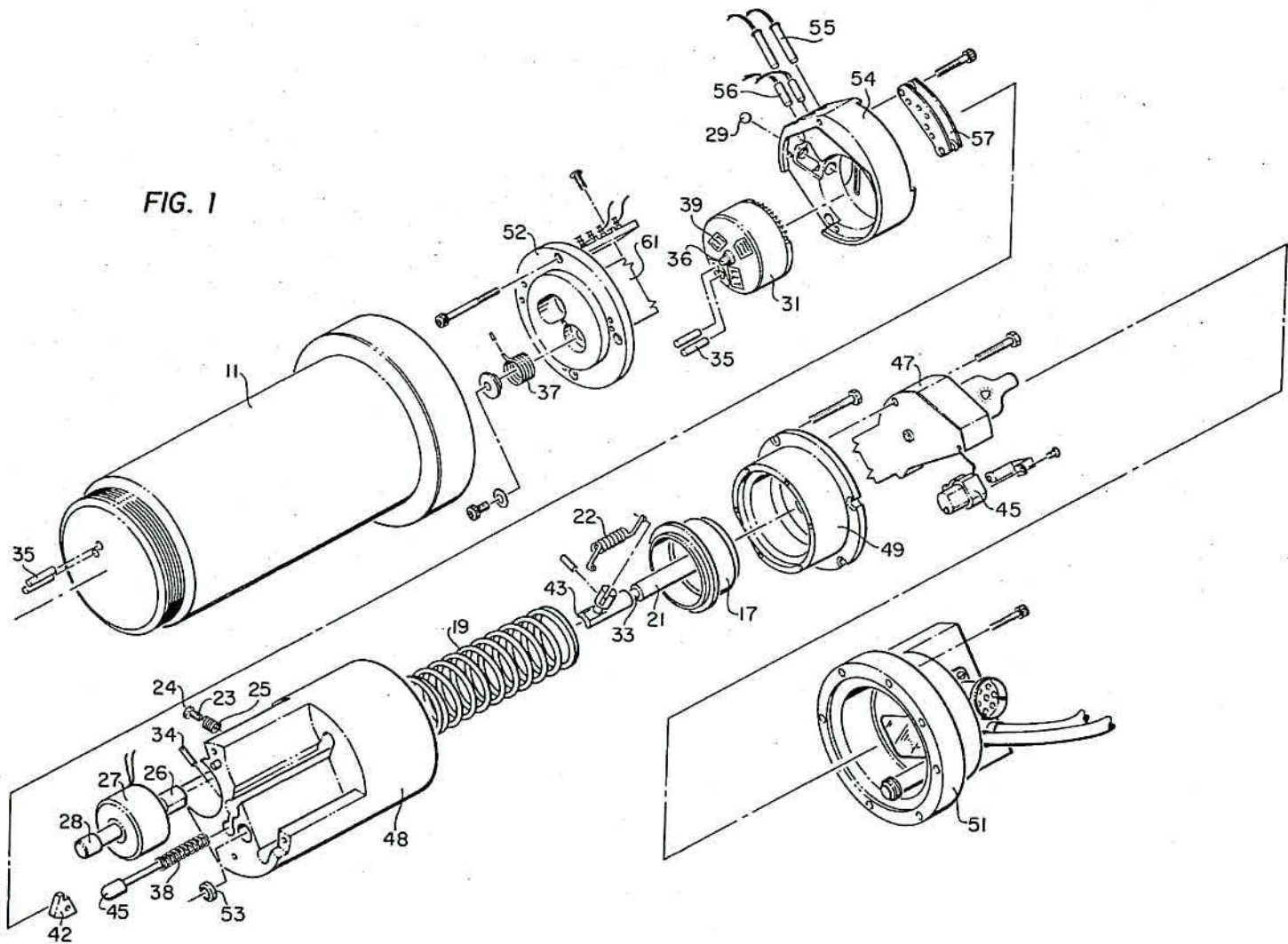
Primary Examiner—David H. Brown
Attorney, Agent, or Firm—Thomas W. Hennen; W. Thom Skeer; Robert F. Beers

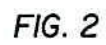
[57] ABSTRACT

A pneumatically operated safe and arm device for use in an ordnance item utilizes cam controlled mechanical interlocks to prevent premature arming. This device also utilizes staticdynamic fluid pressure differential to cause the enabled mechanism to proceed with arming after a predetermined ordnance item velocity has been obtained. This pressure differential operates on a piston and rod to store energy within a flexible coil spring. Energy stored within this spring is subsequently released to power rotation of a disc, thereby aligning an out-of-line explosive train and causing switching functions in an electric arming and fuzing circuit.

8 Claims, 5 Drawing Figures







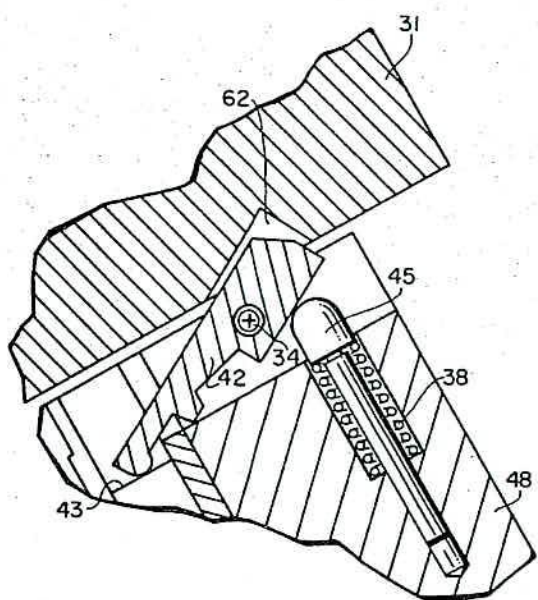


FIG. 3

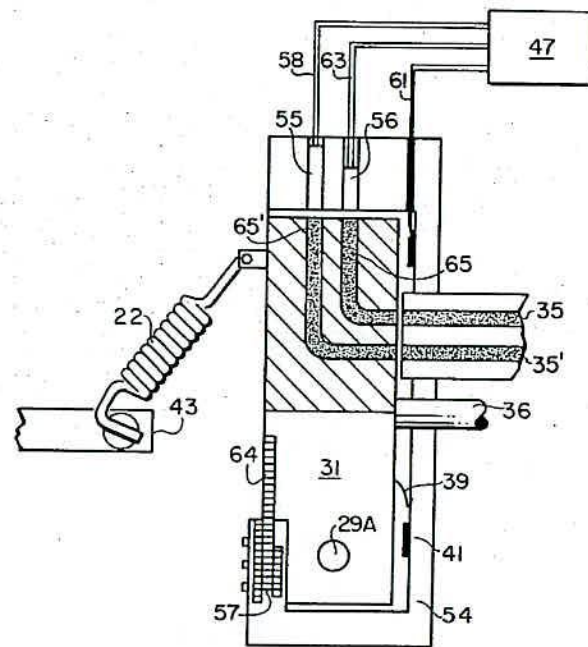


FIG. 4

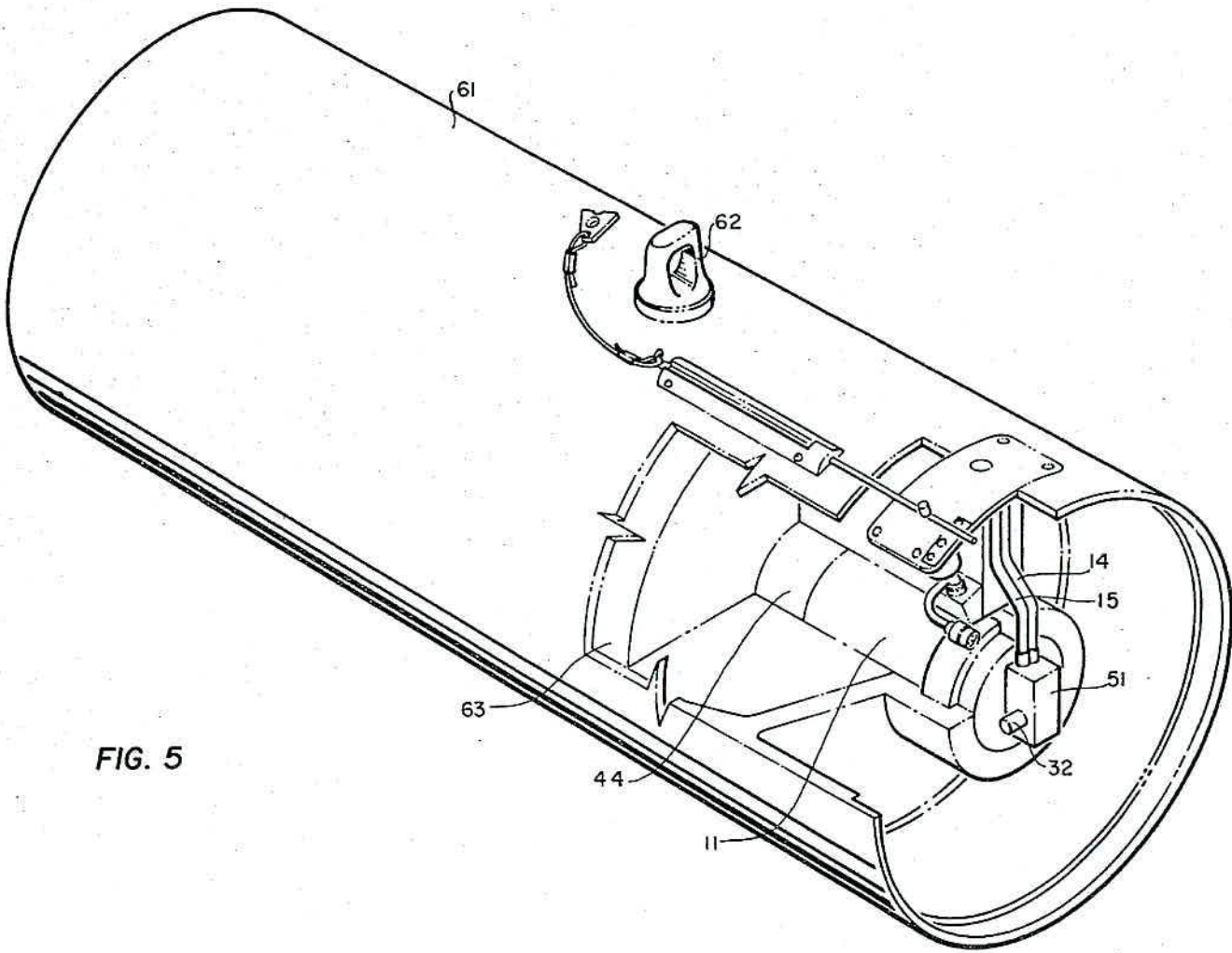


FIG. 5

SAFETY AND ARMING DEVICE/CONTACT FUZE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention pertains to safe and arming devices for use in guided missiles, and more particularly to such safe and arming devices which utilize pneumatic operators to power the arming function.

2. Description of the Prior Art

Guided missiles launched from aircraft or from stationary launching devices are commonly designed to launch with an unarmed warhead, and to arm the warhead a predetermined time after launch. This prevents the possibility of the guided missile exploding prior to or during launch, and damaging the launching vehicle. One arming device which may be used to arm a guided missile warhead in response to the environmental conditions after launch, in U.S. Pat. No. 3,968,751 to Robert G. Palifka. This patent, entitled Arming Device, discloses a logic module system utilizing a spring energy storage means. The device is responsive to ram air pressure and utilizes a rotor and arming spring to translate linear piston motion into rotary motion. A series of interlocks prevent inadvertent arming of the device. Other safe and arming devices use gear train escape-ments and wind powered turbine wheels to provide a low RPM energy source for aligning an explosive train in response to slip stream air flow.

Prior art safe and arming devices which rely entirely on purely mechanical mechanisms or purely electrical circuits do not provide as adequate reliability of function and safety against premature function as do hybrid electro-mechanical devices.

SUMMARY OF THE INVENTION

The present invention overcomes some of the deficiencies in prior art safe and arming devices by incorporating electrical as well as mechanical aspects in a single device. A pneumatic piston and rod are supplied with fluid static and dynamic pressures on opposite faces so that force tending to operate the piston is proportional to the difference between static and dynamic pressures. This pressure differential is proportional to ordnance item velocity in a fluid and consequently is only great enough to stroke the piston after a predetermined minimum velocity has been obtained. Also, an electric signal must be sent to a rotary solenoid to unlock the rod to permit piston travel. Piston travel then loads a flexible coil spring until, at the extent of piston travel, a latching mechanism releases a disk to rotate on its axis under the influence of energy stored within the flexible coil spring. At the limit of disk rotation, a return spring on the rotary solenoid causes a detent ball to jam the disk in its fully rotated position, aligning an out-of-line explosive train and completing or opening various electric circuits in the arming, proximity, and contact fuse circuitry. Detonating signals from either the contact fuse or proximity fuse lead to instantaneous or delayed action detonators which begin detonation of the explosive train leading to a booster charge which detonates the warhead.

The present invention may advantageously be used in conjunction with the pressure probe described in U.S. Pat. No. 4,188,886 entitled "Pressure Probe For Safety Arming Device" and the electronic circuitry described

in U.S. Pat. No. 4,212,246 entitled "Fuze Electronic Circuitry" both filed of even date herewith.

BRIEF DESCRIPTION OF THE DRAWING

Further advantages of the present invention will emerge from a description which follows of the preferred embodiment of a safe and arming device/contact fuse according to the invention given with reference to accompanying drawing Figures in which:

FIG. 1 illustrates an exploded perspective view of a safe and arming device according to the invention;

FIG. 2 illustrates a partially broken away sectional view of an assembled safe and arming device according to the invention;

FIG. 3 illustrates a sectional view of a disk latching mechanism utilized in a safe and arming device according to the invention;

FIG. 4 illustrates, partially in section, a partially schematic view of a disk having explosive paths according to invention; and

FIG. 5 illustrates the placement of a safe and arming device according to the present invention within a missile warhead.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention is a pneumatically operated safe and arming device which utilizes electro-mechanical interlocks to control movement of a piston and rod to store energy within a flexible coil spring. Energy stored within the spring is then made available to rotate a disk, thereby aligning an out-of-line explosive train and arming the device. Referring now to the drawings, wherein like reference numerals correspond to like parts and elements throughout the several Figures, there is shown in FIG. 1 an exploded view of a safe and arming device. The device, when assembled, fits within shell 11 for installation in a missile warhead. Major portions of the device include base plate 52, housing 48, cylinder head 49, disk 31, disk housing 54, piston 17 and shell end cap 51.

Referring now to FIG. 2, the major parts described above are shown in their assembled relationships along with other parts. Static fluid pressure conduit 13 and dynamic fluid pressure conduit 12 are connected to apparatus not shown which samples fluid static and dynamic pressure on the exterior of the ordnance item in which the present invention is installed. Dynamic fluid pressure is conducted through dynamic pressure tubing 14 to dynamic fluid pressure passageway 16 and through cylinder head 49 to the upper volume of the cylinder head chamber. At the same time, static fluid pressure is conducted from static fluid pressure conduit 13 through static pressure tubing 15 to the interior of shell 11 where static pressure communicates with the lower volume of housing 48 piston chamber by means of static fluid pressure passageway 18. Of course static passageway 18 may simply represent leakage through housing 48, and is not necessarily a specific hole at any particular location. The lower volume in the piston chamber must be vented to ambient static fluid pressure however for the device to operate.

Piston 17 is shown within housing 48 and cylinder head 49. Piston 17 divides the central cylindrical chamber shown in FIG. 2 into upper and lower volumes which are air tight with respect to one another. Resilient spring 19 applies a biasing force to piston 17 urging it to remain in the position shown in FIG. 2. The

strength of biasing spring 19 determines the differential between static and dynamic fluid pressure that is necessary in order for piston 17 to be stroked. Rod 21 is rigidly attached to piston 17 and provides output force to operate the remaining mechanism.

Rotary solenoid 27 has a shaft which operates first interlock camming lobe or cam 26 and second interlock camming lobe or cam 28. Cam 26 bears against plunger 24 which is resiliently biased by plunger spring 25. The rotary position of cam 26 determines the extent that plunger end 23 protrudes to either block rod end 43 or enable movement of rod 21. Cam 28 and cam 26 are both attached to the same shaft and rotate simultaneously under the influence of rotary solenoid 27. Cam 28 operates detent ball 29 in a well in housing 54 against disk 31, controlling rotation of disk 31 and locking disk 31 in predetermined safe or armed positions.

Rotation of disk 31 is caused by energy stored within flexible coil spring 22 which attaches between rod 21 and disk 31. Spring 22, when loaded, buckles and flexes sideways to apply a lateral force to disk 31, rotating it when rotation is enabled.

Latching bar 42 maintains disk 31 in its initial position until sufficient energy has been stored within flexible coil spring 22 by the pressure induced stroking of piston 17. Rod end 43 contacts latching bar 42 at the extent of piston travel and pivots latching bar 42 to release disk 31 for spring powered rotation.

Disk 31 rotates against biasing spring 37 on disk shaft 36 and shaft bearing 53. As disk 31 rotates, electrical connections are made and broken by the placement of contacts 39 and 41 which are located according to the requirements of electrical system logic in the arming and fuzing circuits. Contacts 39 and 41 insure that the electrical fuzing portions of the device are inoperative until after disk 31 has been locked in the armed position. As rod end 43 releases latching bar 42, solenoid 27 is released and returns to its initial position under urging by a torsional spring 57'. As this occurs, cam 26 forces plunger end 23 into rod recess 33, while cam 28 forces detent ball 29 into a recess 29A on the periphery of disk 31. When the device is armed, a firing signal causes either instantaneous detonator 56 or delayed detonator 55 to begin detonation of an explosive train leading through disk 31 to output path 35 which leads to explosive booster charge 44. Detonation of explosive booster charge 44 causes detonation of warhead explosive 63 shown in FIG. 5.

Referring now to FIG. 3 there is shown a portion of disk 31 having notch 62. Latching bar 42, pivots about pin 34 and is normally held in position engaging notch 62 by latching plunger 45 which is spring loaded by coil spring 38. Latching plunger 45 and coil spring 38 are retained within a well in housing 48 by the end of latching bar 42. Rod end 43 at the extreme of its travel, contacts latching bar 42 and pivots bar 42 about pin 34, depressing spring loaded plunger 45 and disengaging notch 62 in disk 31. This releases disk 31 to rotate.

Referring now to FIG. 4 there is shown disk 31 partially in section, and delayed detonator 55 and instantaneous detonator 56. Electrical leads 58, 63 and 61 leading from the detonators and switching structure respectively, lead to electronic circuit housing 47 wherein electrical circuitry provides system logic. Delayed explosive path 65' and instantaneous explosive path 65, both within disk 31, align with explosive output paths 35 and 35' respectively when disk 31 is armed. Spring induced rotation of disk 31 is buffered by gear train

escapement 57 which engages peripheral gear teeth 64 on disk 31.

Referring now to FIG. 5 the safety and arming device is shown installed in missile warhead 61. Forward suspension lug 62 provides means for attaching the missile to launching apparatus. Also shown for use with the present invention are a lanyard connected to an arming wire which is threaded through an arming wire conduit to a pressure probe switch. Upon launch of the missile, the lanyard is pulled from the switch enabling it to close and fire an explosive charge which erects a pressure sampling probe to supply missile ambient dynamic and static fluid pressure by means of dynamic pressure tubing 14 and static pressure tubing 15 to the safe and arming device of the present invention. Electrical connection fitting 32 provides means for connecting the present safe and arming device into the total missile electrical circuitry. Electrical connection fitting 32 is a conventional fitting. Shell end cap 51 has peripheral threaded section 46 for securing the device within missile warhead 61. A contact fuze 45 which communicates with electronic circuitry in the safety and arming device, provides a means for distinguishing between proximity detonation which requires instantaneous detonation for maximum salvage effect, and delayed detonation for maximum combat effect in a direct hit situation. Direct hits on a target cause the contact fuze to close, lock out the proximity fuze, and initiate the delay detonators so that the guided missile may penetrate the target before detonating.

In operation, the present invention is installed within a guided missile. Just after launch, a pressure probe extends to sample fluid static and dynamic pressure. This pressure is fed to volumes on each side of piston 17, and as missile velocity increases the pressure differential across piston 17 also increases. At a predetermined point an electric signal is sent to solenoid 27 causing it to rotate, thereby causing cams 26 and 28 to permit plunger 24 and detent ball 29 to release rod 21 and disk 31 respectively. At this time disk 31 is still held locked in position by latching bar 42. As pressure differential on piston 17 increases, the pressure eventually overcomes the retarding force from resilient spring 19, and piston 17 begins to travel toward disk 31. As rod 21 approaches disk 31, energy is stored within flexible coil spring 22. Near the end of rod travel, rod end 43 operates latching bar 42 releasing disk 31. As disk 31 rotates, the contact pairs, such as 39 and 41 open and close at predetermined intervals so that electric current to solenoid 27 is interrupted, causing solenoid 27 to return to its initial position under urging of torsional spring 57'. When this occurs, cam 26 extends plunger end 23 into rod recess 33 locking rod 21 in its stroked position. Also, cam 28 jams detent ball 29 into detent recess 29A, locking disk 31 in the armed position.

The present invention enables arming to occur only after a predetermined pressure differential between fluid static and dynamic pressure, corresponding to a preselected minimum flight speed, has been obtained. This preselected minimum flight speed may advantageously be selected to be approximately 220 mph, or any other desired speed.

Obviously many modifications and variations of the present invention are possible in the light of the above teaching. It is therefore to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A pneumatically operated safe and arm device for use in an ordnance item in a fluid environment, comprising:

- a housing having an interior chamber;
- a piston sealingly retained within said housing and dividing said chamber into first and second volumes, said piston including a rigidly attached output rod having a free end, said piston and output rod being movable linearly between first and second positions and resiliently urged toward said first position;
- a disk mounted to said housing and rotatable about an axis between safe and armed positions, said disk including at least two explosive paths, each path having at least two exposed ends, and said disk being resiliently urged toward said safe position;
- resilient force transmission means linking said rod and said disk for converting linear rod motion to rotational disk motion;
- dynamic pressure means communicating between said fluid environment and said interior chamber for supplying fluid dynamic pressure to said first volume;
- static pressure means communicating between said fluid environment and said interior chamber for supplying fluid static pressure to said second volume;
- first interlock means releasably engaging said rod in a locking position for preventing said linear rod motion, said first interlock means being movable between said locking position and a releasing position, and resiliently urged toward said releasing position;
- second interlock means releasably engaging said disk in a jamming position for preventing rotation of said disk, said second interlock means being movable between said jamming position and a freeing position;
- a rotary solenoid attached to said housing, having a shaft configured for rotation between preventing and enabling positions, and being resiliently urged toward said preventing position, said shaft having first and second camming lobes contacting and operating said first and second interlock means respectively in response to rotation of said shaft;
- disk latching means pivotally attached to said housing and releasably engaging said disk in a storing position, said disk latching means being pivotal between said storing position and a tripping position, and resiliently urged toward said storing position, for releasing said disk in response to said output rod moving from said first position to said second position;
- instantaneous detonation means attached to said housing and positioned in alignment with one end of one of said explosive paths in said disk in said armed position for instantaneously detonating said one explosive path in response to a first signal;
- delay detonation means attached to said housing and positioned in alignment with one end of the other of said explosive paths in said disk in said armed

position for delayably detonating said other explosive path in response to a second signal; and
detonation output means attached to said housing and positioned in alignment with said other ends of said explosive paths in said disk in said armed position for directing detonation energy from detonation of at least one of said explosive paths to the exterior of said housing; whereby relative movement of said ordnance item in said fluid environment results in fluid static and dynamic pressures being applied to said piston, said relative movement at velocities greater than a preselected minimum causing said piston, enabled by release of said first interlock means, to load said resilient force transmission means and trigger rotation of said disk, thereby aligning an explosive train.

2. A pneumatically operated safe and arm device as set forth in claim 1 wherein said resilient force transmission means comprises a flexible coil spring.

3. A pneumatically operated safe and arm device as set forth in claim 1 wherein said delay detonation means comprises an electrically initiated detonator having a pyrotechnic delay.

4. A pneumatically operated safe and arm device as set forth in claim 1 wherein said resiliently urged first interlock means comprises a spring loaded plunger.

5. A pneumatically operated safe and arm device as set forth in claim 1 wherein said first interlock means in said locking position contacts said free end of said rod in said first position.

6. A pneumatically operated safe and arm device as set forth in claim 1 wherein said rod defines a recess positioned between said free end and said piston for engaging said first interlock means in said second rod position and said first interlock means locking position respectively.

7. A pneumatically operated safe and arm device as set forth in claim 1, further including:

an electric arming and fuzing circuit connected to said instantaneous detonation means, said delay detonation means, and said rotary solenoid;

said electric circuit having a plurality of contact pairs for performing switching operations, one of said contacts in each of said contact pairs being attached to said disk and the other of said contacts in each of said contact pairs being attached to said housing and positioned for contact with said one of said contacts in response to the rotational position of said disk.

8. A pneumatically operated safe and arming device as set forth in claim 1 wherein said second interlock means comprises:

said housing defining a cylindrical well having an opening adjacent the periphery of said disk;

a detent ball retained within said well; and

a plurality of recesses in said disk periphery for partially receiving said ball, said recesses being positioned relative to said explosive paths to define said safe and armed positions.

* * * * *

[54] COMPOSITE SAFE AND ARMING MECHANISM FOR GUIDED MISSILE

[75] Inventors: Warren R. Hoelzen, Ontario; John F. Prescott; Michael N. Tyler, both of Lake Isabella, all of Calif.

[73] Assignee: The United States of America as represented by the Secretary of the Navy, Washington, D.C.

[21] Appl. No.: 209,574

[22] Filed: Nov. 24, 1980

[51] Int. Cl.³ F42C 5/00; F42C 15/06

[52] U.S. Cl. 102/264; 89/1.812; 102/379

[58] Field of Search 89/1.5 D, 1.812; 102/379, 300, 263, 264, 276, 228, 206, 202

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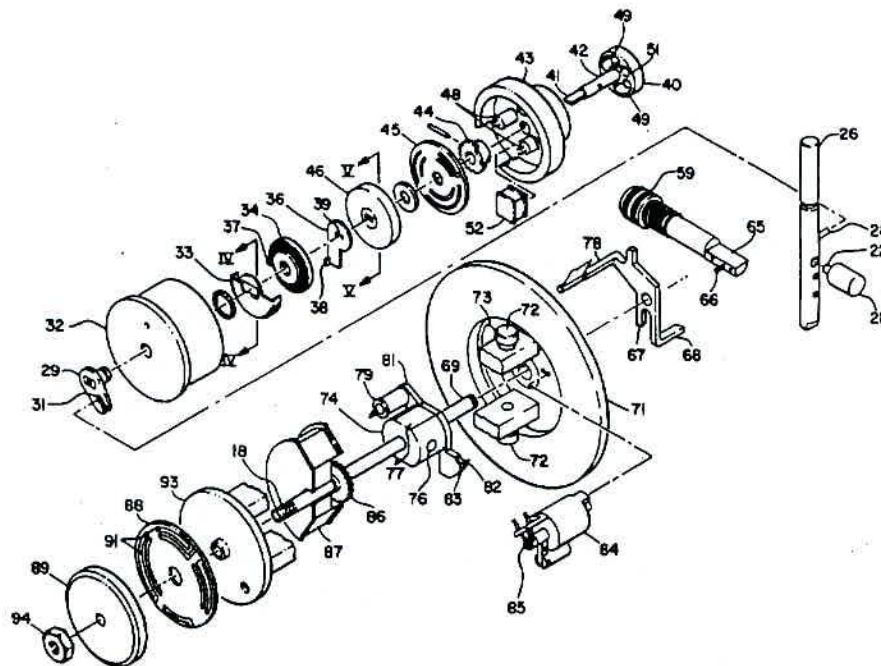
Primary Examiner—David H. Brown

Attorney, Agent, or Firm—R. F. Beers; W. Thom Skeer

[57] ABSTRACT

An electro-mechanical mechanism is disclosed which controls safety-arming-firing of an air-launched missile's rocket motor and safety-arming of the warhead. The mechanism has an out-of-line safety pyrotechnic design to maintain the electric firing circuits and explosive train in an open, safe position until a complete sequence of events occurs. Similarly, a second sequence must occur before warhead arming can proceed.

8 Claims, 6 Drawing Figures



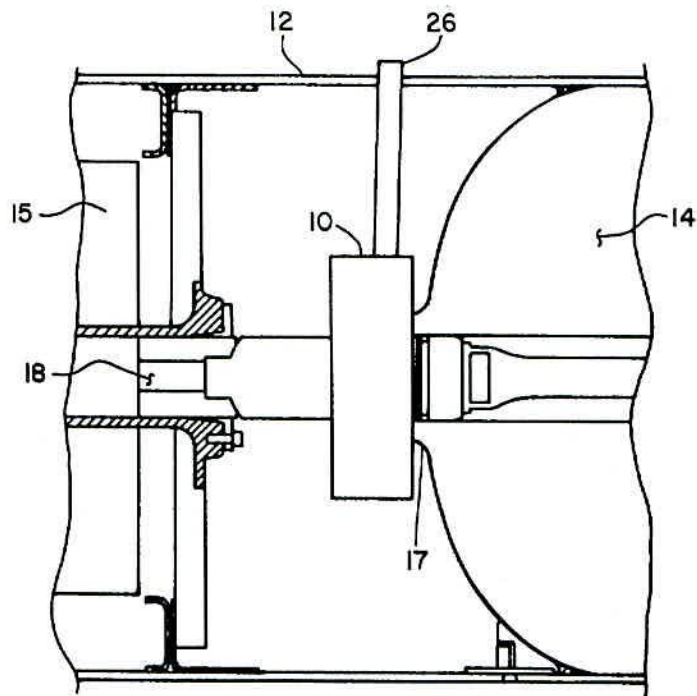


FIG. 1

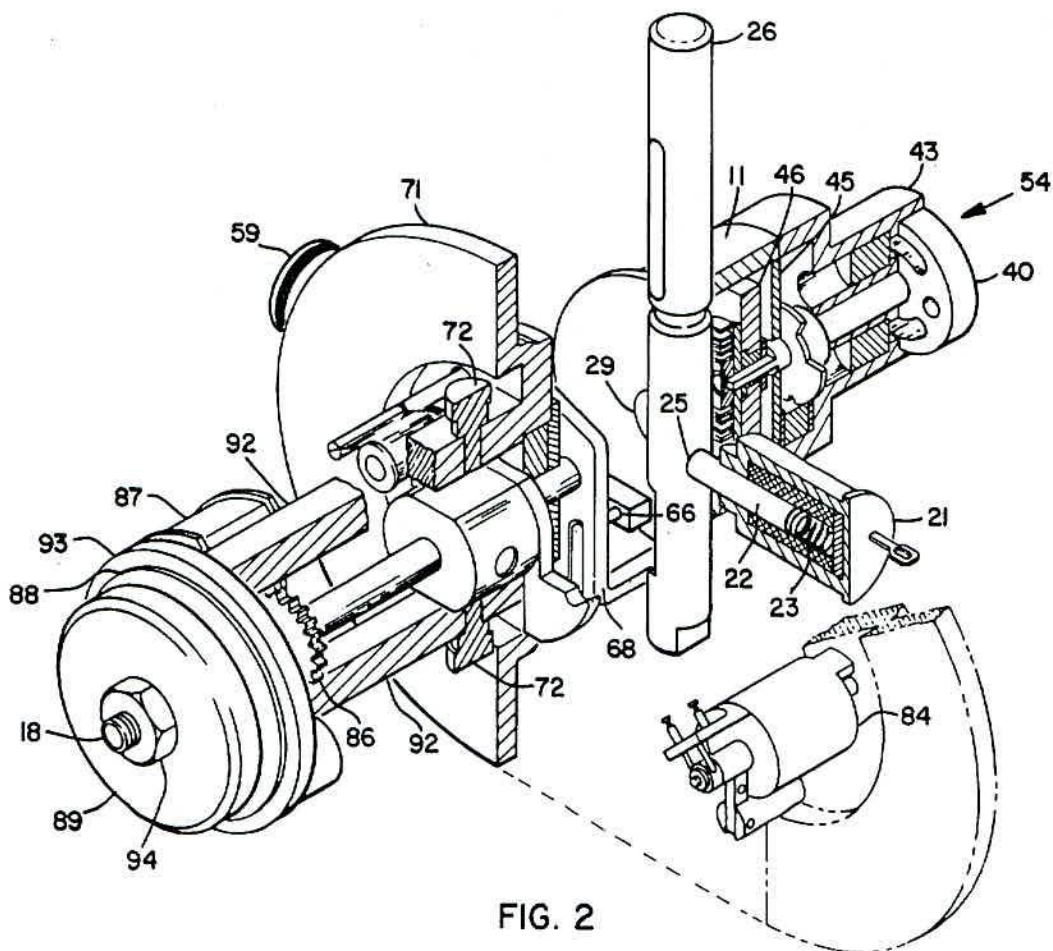


FIG. 2

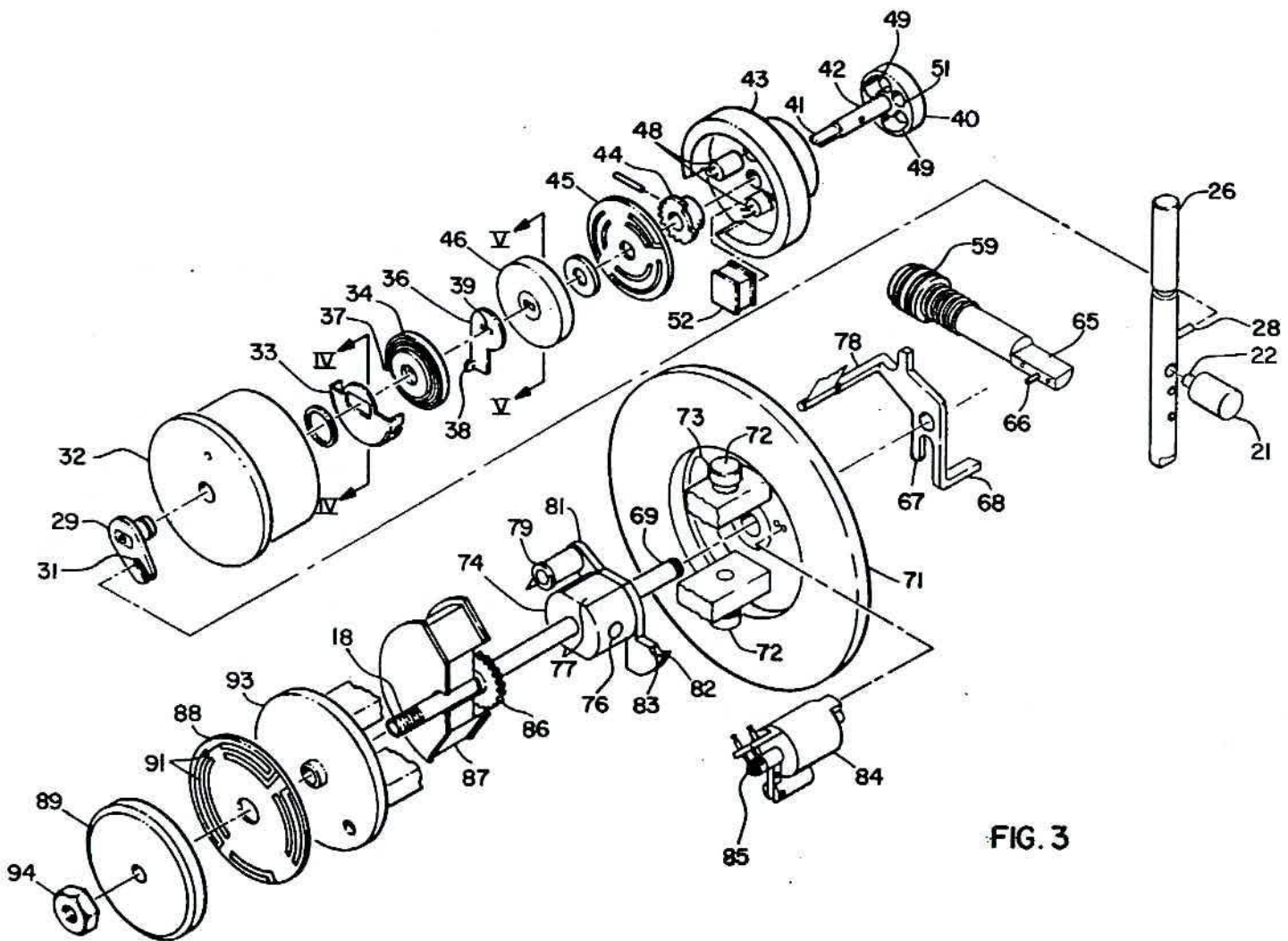


FIG. 3

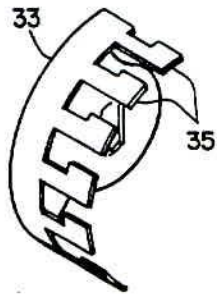


FIG. 4

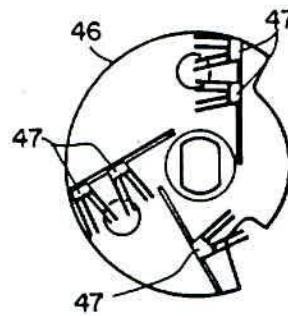


FIG. 5

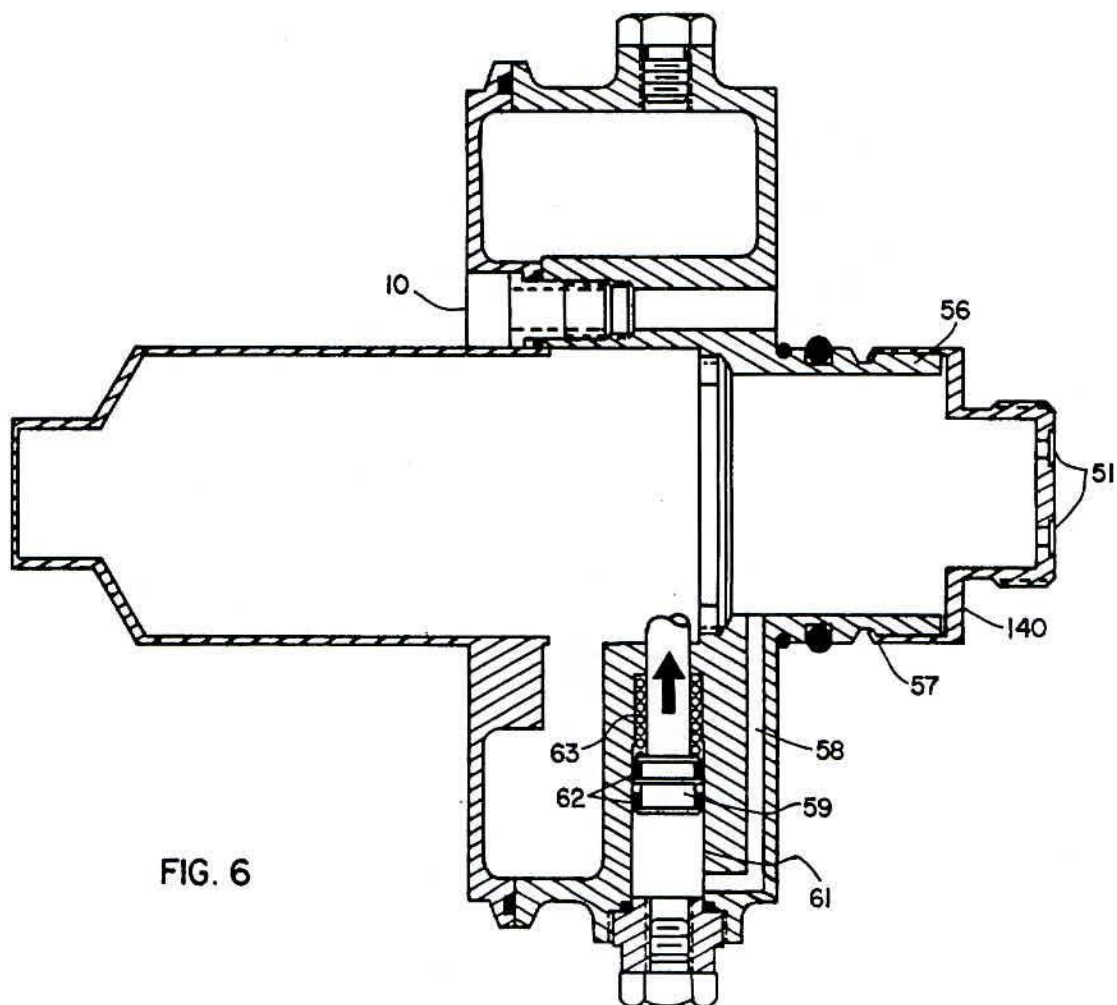


FIG. 6

COMPOSITE SAFE AND ARMING MECHANISM FOR GUIDED MISSILE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to the fuze in an air-launched missile. More particularly, it relates to a fuze that combines the functions of (1) safing-arming-firing the missile rocket motor and (2) safing-arming the missile warhead.

2. Description of the Prior Art

Air launched missiles are equipped with a rocket motor and a warhead. Traditionally, safing and arming of the warhead and rocket motor have been accomplished through separate devices. The warhead safe and arm mechanism employs a series of redundant safety interlocks to allow safe and reliable carriage, release, and arming. These functions are duplicated for the rocket motor which adds to the number of parts in the missile. At the other extreme, engineers are trying to reduce the overall weight to allow better aircraft and missile performance.

In one prior art arming and safing device, a series of electrically-timed plungers and several return springs are employed, along with the rocket motor gases, to arm a warhead of an air-launched missile. That device uses several back-up parts to provide the necessary safety and reliability. The various parts interact with one another to provide fail-safe control.

SUMMARY OF THE INVENTION

The composite safe and arm mechanism of the instant invention is an electromechanical device which accomplishes two major functions: (1) safety-arming-firing for the missile's rocket motor and (2) safety-arming for the missile's warhead. The mechanism includes a mechanical and electrical out-of-line safety pyrotechnic mechanism. This system maintains electrical firing circuits and explosive trains in an open and safe condition until after the mechanism receives an intent-to-launch signal, a pull pin unlock signal, the missile physically separates from the aircraft, and a short time delay has occurred. Arming of the warhead explosive train occurs after the above sequence plus rocket motor pressure build-up, an arming time delay, an active transfer initiate, and a second short time delay.

OBJECTS OF THE INVENTION

It is therefore an object of the invention to integrate rocket motor ignition and warhead safing-arming into a single device.

It is a further object of the invention to utilize rocket motor gases to provide arming energy for warhead arming in lieu of a separate mechanism.

It is a still further object of the invention to construct a fuze that will insure physical separation of the missile from the aircraft before allowing warhead arming.

These and other objects of this invention will appear from the following specification, and are not to be construed as limiting the scope of the invention thereto, since in view of the disclosure herein, others may be able to make additional embodiments within the scope of the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a partial side view of an air-launched, guided missile with the composite safe and arm mechanism installed;

FIG. 2 shows a cut-away, perspective view of the composite safe and arm mechanism;

FIG. 3 shows an exploded view of the instant invention;

FIG. 4 is a sectional view taken along lines IV—IV of FIG. 3;

FIG. 5 is a sectional view taken along lines V—V of FIG. 3; and

FIG. 6 shows a bottom view of the instant invention and the pressure lines for venting rocket motor pressure to the pressure piston.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The composite safe-arm mechanism is designed to function in an air-launched, guided missile. FIG. 1 shows a partial side view of a safe-arm mechanism 10 installed in a missile 12. Missile 12 is of the type typically flown in combat and has a rocket motor 14 and a warhead 15. Mechanism 10 is threaded into the forward end of rocket motor 14 at interface 17 and connects to warhead 15 through an explosive train 18. As is typical with air-launched, guided missiles of this type, a missile autopilot, target sensors, a control processor and a thermal battery (all not shown in FIG. 1) sit in the forward section and are electrically connected to mechanism 10.

FIGS. 2-4 show in greater detail the individual elements of mechanism 10. FIG. 2 is a partial cutaway of a perspective view and FIG. 3 is an exploded view of the composite safe and arm mechanism.

When the decision is made to launch the missile, an electrical signal is sent to an intent-to-launch (ITL) solenoid 21. Solenoid 21 is a linear solenoid with a plunger 22 in opposition to an expansion spring 23. When power is applied through a safe-arm switch 89 to solenoid 21, plunger 22 is retracted against spring 23, and withdrawn from a lock hole 25 in a pull pin 26. When power is shut off to solenoid 21, spring 23 will force plunger 22 back to its first position.

Plunger 22 has a hardened tip (not shown) that interacts with pull pin 26. Pin 26 is sufficiently strong such that if the missile, with an approximate weight of 900 pounds, were to inadvertently fall away from the launch aircraft, the tip would not be sheared off and mechanism 10 would prevent rocket firing and arming of warhead 15.

Under normal operation, simultaneously with the signal to solenoid 21, the ejector rack on the launch aircraft pushes the missile away. This causes pull pin 26 to move upward and unblock a piston 59 and a safe-arm cocking lever 68.

As pull pin 26 moves upward, a small, arm-fire pin 28 (FIG. 3) located at the midway distance on pull pin 26, at a 90° angle to pull pin 26, forces arm-fire cocking arm 29 to rotate approximately 90° in a counter-clockwise direction. Arm-fire pin 28 rides in slot 31 on cocking arm 29.

Cocking arm 29 is fixedly attached through a central hole in a cover 32 to a spring keeper 33. Spring keeper 33 is a hemispherically shaped plate with a series of tooth-like projections 35 extending from its outer edge at a right angle (see FIG. 4). A coiled spring 34 with a

bent tip 37 rests adjacent to spring keeper 33. The bent tip 37 of spring 34 is securely attached around one of the projections 35 on spring keeper 33. A follower arm 36 is fixedly attached by a rectangular shaped hole 39 to a cooperatively shaped tip end 41 of a barrier shaft 42 and presses against coiled spring 34. The inner end of spring 34 is also attached to tip end 41. A tab 38 on follower arm 36 out at a 90 degree angle from arm 36 to an interfering position with lead projection 35. Barrier shaft 42 extends from the center of an ignition-blocking, disc-shaped barrier 40 through a circular squib block 43, a timing gear 44, a disc-shaped switch deck 45 and a circular, switch contact carrier 46 to coiled spring 34. FIG. 5 is a sectional view taken along lines V—V and shows how a plurality of switch brushes 47, small U-shaped conducting wires, are mounted on contact carrier 46. As carrier 46 is rotated, brushes 47 sweep around the electrical circuitry on switch deck 45 and open or close those circuits.

Squib block 43 is securely attached to casing 11 and carries two pyrotechnic ignition squibs 48 that are electrically connected through switch deck 45 and contact carrier 46 to the thermal battery. Squibs 48 extend through block 43, and in the "safe" position, are adjacent shallow depressions 49 in squib block 43. When barrier shaft 42 has rotated sufficiently, a pair of oppositely-disposed holes 51 (one shown) through barrier 40 align with squibs 48.

An escapement 52 is securely fastened to the inside of block 43 so as to interact with timing gear 44 to control the time necessary for barrier 40 to move to align holes 51 with squibs 48. In actual use, a delay time of 150 milsec is set in escapement 52. The force stored in spring 34 acts against follower arm 36 to rotate barrier 40. Timing gear 44 and escapement 52 control the rotation and allow a proper delay interval for the missile to separate from the aircraft before ignition. If squibs are ignited prior to full barrier rotation, the ignition of the rocket motor will be blocked by shallow depressions 49.

After the rocket motor 14 is ignited, some of high pressure is vented back inside mechanism 10. FIG. 6 shows a plan view of the underside of mechanism 10 with some simplifications made for purposes of explanation.

Rocket motor pressure flows through holes 51 in housing 140. Housing 140 is hermetically sealed to casing 56 at a seal 57. The high pressure causes gas to flow through passage 58 to arrive at the head of pressure piston 59 and force piston 59 to move in the direction of the arrow. The head of piston 59 is hermetically sealed to the inside of piston shaft 61 by o-rings 62. A second, expansion spring 63 is positioned around piston 59 and acts against any movement of piston 59. When pressure on piston 59 drops below a predetermined level, spring 63 forces piston 59 back into shaft 61.

The opposite end from the head of piston 59 is formed in a flat bar shape 65 (FIG. 3) with a stroke pin 66 extending from the forward side thereof. Pin 66 slidingly moves inside of slot 67 on safe arm cocking lever 68. Lever 68 is pivotally attached to framework 71.

Explosive train 18, as previously described, is connected to a conventional booster (not shown) in the missile's warhead. Explosive train 18 is shaped into a slender shaft and extends through a hole in the center of a detonator framework 71. Framework 71 is a circular disk with a 90° arc 73 cut through the inner side portion from the seven o'clock position to the eleven o'clock position. Two MK 71 detonators 72 are securely at-

tached to the inner portion of framework 71 at the six o'clock and twelve o'clock positions, as shown in FIG. 2. Fixedly attached to explosive train 18 and located coplanarly with detonators 72 is an explosive train interrupter 74. Interrupter 74 is a solid piece of cylindrical material with a pair of oppositely disposed openings 76 leading to explosive train 18. Interrupter 74 has two oppositely disposed flattened sides 77 that align with detonators 72 until after the rocket motor is ignited.

Safe-arm cocking lever 68 is built in the shape of a two-handled lever with the side opposite slot 67 slanted approximately 30° from the vertical. A solid bar 78 extends forward at a 90° angle from this side and has one end of a negator spring 79 anchored to it. Bar 78 extends through arcuate cut-out 73 to a position adjacent negator spring 79. Negator spring 79 is attached to one end of a two-ended lever 81. Lever 81 is attached to explosive train 18 at its center so that it also is offset 30° from the vertical. The end of lever 81, opposite negator spring 79, is in the form of a square with a hook-like portion 82 extending from the outer edge to be adjacent a notch 83. Also attached to the inner portion of framework 71, at about the 3 o'clock position, is an active-transfer-initiate (ATI) solenoid 84. Solenoid 84 is similar to solenoid 21 and has a plunger 85 that extends out into the path of rotation of hook 82.

Extending out from framework 71 are two stabilization bars 92 (FIG. 2). Bars 92 connect framework 71 with a buffer plate 93 at the 12 o'clock and six o'clock and serve as a housing for detonators 72. A second escapement 87 is attached between bars 92 and interacts with a second timing gear 86, which is fixedly attached to explosive train 18, to moderate the rate of rotation of explosive train 18, in the same manner as escapement 52 and first timing gear 44. Similarly, a second switch deck 88 with electric circuitry 91 is fastened to buffer plate 93, and circular safe-arm switch 89 is secured to the end of explosive train 18 by hex-nut 94. As safe-arm switch 89 rotates with explosive train 18, electrical leads travel around circuitry 91 on switch deck 88 and turn on or off power to ITL solenoid 21 and ATI solenoid 84.

The operation of safe-arm mechanism 10 will now be described. The first occurrence in the sequence sending power to ITL solenoid 21. This causes plunger 22 to withdraw from pull pin 26. Next, when missile 12 is ejected, pull pin 26 is raised enough to unblock both pressure piston 59 and safe-arm cocking lever. Arm-fire pin 28 causes arm-fire cocking arm to rotate 90°. When arm-fire cocking arm is moved, spring 34 starts to unwind, and a rotational force is exerted on barrier 40. Escapement 52 controls, through its movable connection to timing gear 44, the time necessary for electrical switch contact carrier 46 and barrier 40 to turn until all electrical connections to squibs 48 are complete and holes 51 are in line with squibs 48.

When the missile autopilot senses the above events, it sends an ignition signal to the thermal battery and power is transmitted to squibs 48. The resulting ignition starts the rocket motor and missile 12 assumes a powered-flight mode.

Rocket motor gas pressure, as indicated by arrow 54, flows back through barrier 40, and through vent 58 to pressure piston 59. This pressure forces piston 59 forward against the retarding force of spring 63. O-rings 62 prevent the passage of rocket motor gases into the warhead portion of missile 12.

When piston 59 is moved forward, pin 66 forces safe-arm cocking lever 68 to rotate up 90°, which in turn,

extends negator spring 79. The subsequent rotation of interrupter 74 is controlled by escapement 87 and timing gear 86, and after a predetermined delay, timing gear 86 runs off escapement 87 and interrupter 74 snaps toward the armed position until notch 83 engages plunger 85. At this position, explosive leads 76 are 45° out of line with detonators 72 and the electrical circuits between safe-arm switch 89 and circuitry 91 are still open, and hence detonators 72 are immune to spurious firing signals.

The circuit to ITL solenoid 21, which is routed through switch 89, opens during the snap portion of travel. ITL plunger 22 is forced back and blocks safe-arm cocking lever 68 in the up position. Since lever 68 is locked in the rotated position, the arming energy is locked into negator spring 79 and no longer dependent on the presence of rocket motor pressure.

When target encounter is imminent, a signal is sent from missile sensors to ATI solenoid 84. Plunger 85 is withdrawn, and interrupter 74 snaps into the armed position. Rotation of switch 89 opens the circuit to ATI solenoid 84, and plunger 85 returns to the extended position, locking interrupter 74 in the armed position. Upon receipt of a firing signal, detonators 72 are initiated, and in turn, explosive train 18 is set off.

It will be understood that various changes in the details, materials, steps and arrangements of parts may be made by those skilled in the art within the principle and scope of the invention as expressed in the appended claims.

What is claimed is:

1. A composite safing and arming mechanism for a missile launched from an aircraft having a warhead; and a rocket motor, said mechanism comprising:
 - a mechanism casing connected between said rocket motor and said warhead;
 - a port in said mechanism casing communicating with said rocket motor for allowing pressure therefrom to enter said casing;
 - means for receiving an initial signal from said aircraft attached to said mechanism casing;
 - means for initiating the rocket motor after a predetermined time attached to said casing adjacent the rocket motor; and
 - means for arming the warhead attached to said mechanism casing after receiving a predetermined amount of pressure through said port from said rocket motor.
2. A mechanism as in claim 1 wherein said receiving means comprises:
 - a pull pin connected to the aircraft and removably joined to said mechanism; and
 - a first solenoid electrically connected through a rotatable switch to maintain said pull pin in said mechanism until receipt of said initial signal.
3. A mechanism as in claim 1 wherein said initiating means includes a rotatable safety barrier that prevents passage of gases until a predetermined rotation of said barrier occurs.
4. A mechanism as in claim 1 wherein said means for arming includes a pressure piston hermetically sealed between said mechanism casing and the rocket motor so as to stroke forward after a predetermined amount of gas pressure has built up in the motor.
5. A mechanism as in claim 4 wherein said means for arming comprises:

- a plate with a bore extending through the center thereof centrally located in said casing and fixedly attached thereto;
 - an explosive train in the form of a rod extending through and rotating in said bore and leading to the warhead;
 - a safe-arm cocking lever adjacent said plate and pivotally attached to said train and rotationally attached to said pressure piston;
 - an interrupter for shielding said explosive train fixedly attached to said explosive train and having at least two openings extending therethrough to said train;
 - at least two detonators fixedly attached to said plate and connected to fire an electric impulse through said openings;
 - second spring means attached between said interrupter and said safe-arm cocking lever for transmitting rotational force from said safe-arm cocking lever to said interrupter;
 - second gear means for delaying rotation of said interrupter until after a predetermined time attached to said explosive train and said casing;
 - second electrical switching means attached to said explosive train for providing electrical power flow to said first solenoid and said detonators at predetermined times; and
 - a second solenoid electrically connected to said second switching means and fixedly attached to said plate so as to provide a removable block to said interrupter.
6. A mechanism as in claim 1 wherein said means for initiating comprises:
- a squib block having an interior and an exterior and having at least two pyrotechnic firing squibs and a centrally located aperture extending therethrough, said squib block being attached to said casing adjacent the rocket motor;
 - a perforated, rotatable barrier between the rocket motor and said squib block with a centrally located shaft extending therefrom and through said centrally located aperture;
 - first gear means for delaying rotation of said barrier shaft until after a predetermined time attached to said shaft and said squib block;
 - first electrical switching means for providing power to said squibs at a predetermined time adjacent said squibs;
 - an arm-fire cocking arm rotationally connected to said pull pin;
 - a spring keeper fixedly attached to said arm-fire cocking arm; and
 - first spring means adjacent said spring keeper having an inner end attached to said barrier shaft and an outer end affixed to said spring keeper.
7. A mechanism as in claim 6 wherein said first gear means comprises an escapement fixedly attached to said squib block and in meshing relation with a circular gear affixed to said barrier shaft.
8. A mechanism as in claim 7 wherein said first electrical switching means comprises:
- a switch deck having a plurality of electrical circuits thereon and attached to said casing; and
 - a rotating switch contact carrier adjacent said switch deck with a plurality of switch brushes thereon so as to open and close said electrical circuits.

* * * * *

[54] **ELECTRONIC SAFE ARMING AND FUZING SYSTEM**

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[73] Assignee: **Altus Corporation**, Cupertino, Calif.

[22] Filed: **Nov. 18, 1974**

[21] Appl. No.: **524,558**

[52] U.S. Cl. **102/70.2 R**

[51] Int. Cl.² **F42C 15/40**

[58] Field of Search **102/70.2 R**

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Primary Examiner—Charles T. Jordan
Attorney, Agent, or Firm—Thomas H. Williams

[57] **ABSTRACT**

An electronic safe arming and fuzing (ESAF) system using an accelerometer capable of sensing the acceleration of a missile and supplying an electric signal upon measuring a predetermined level of acceleration. The accelerometer signal is supplied to an electronic timer which upon the receipt of said signal initiates a timing circuit. A predetermined time after receipt of the accelerometer signal the timer causes a high voltage to be stored on a large capacitor. An electronic switch is connected between the capacitor and an exploding bridge wire detonator and will cause the energy stored in the capacitor to pass through the exploding bridge wire (EBW) upon receipt of a proper triggering signal from a trigger means. The EBW detonator is imbedded in a secondary explosive and causes said explosive to detonate without the aid of a primary explosive when said trigger signal is received.

6 Claims, 4 Drawing Figures

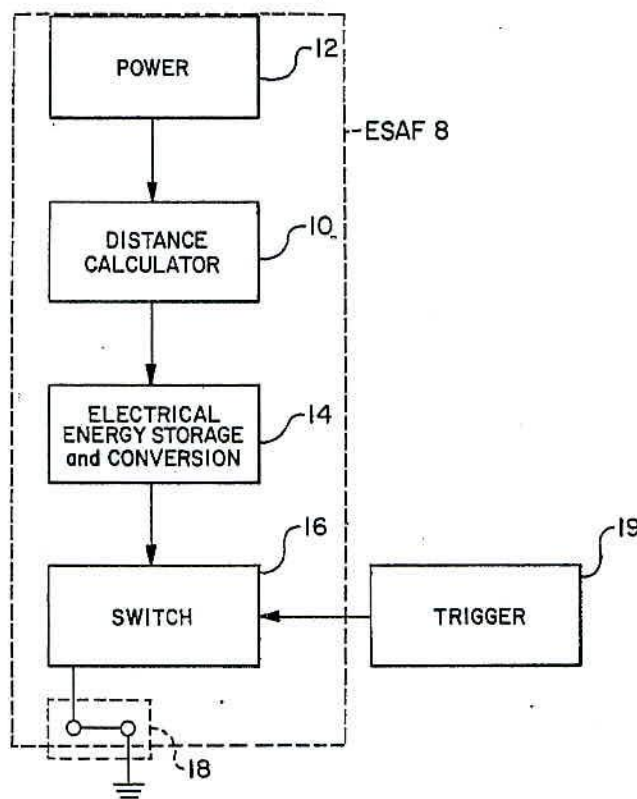


FIGURE-1

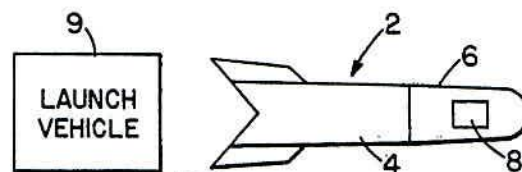
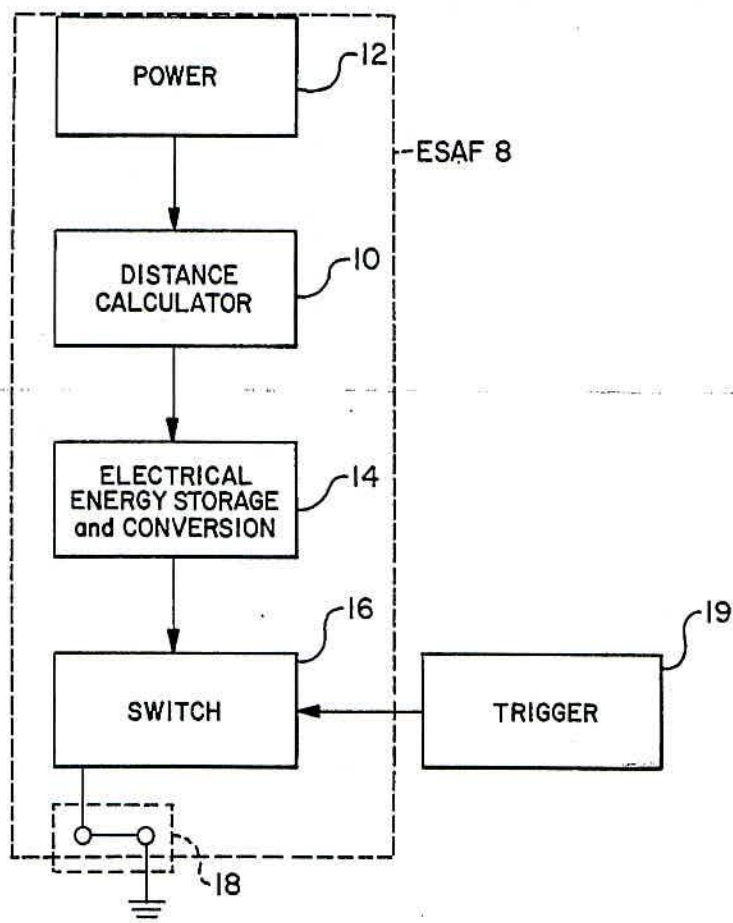
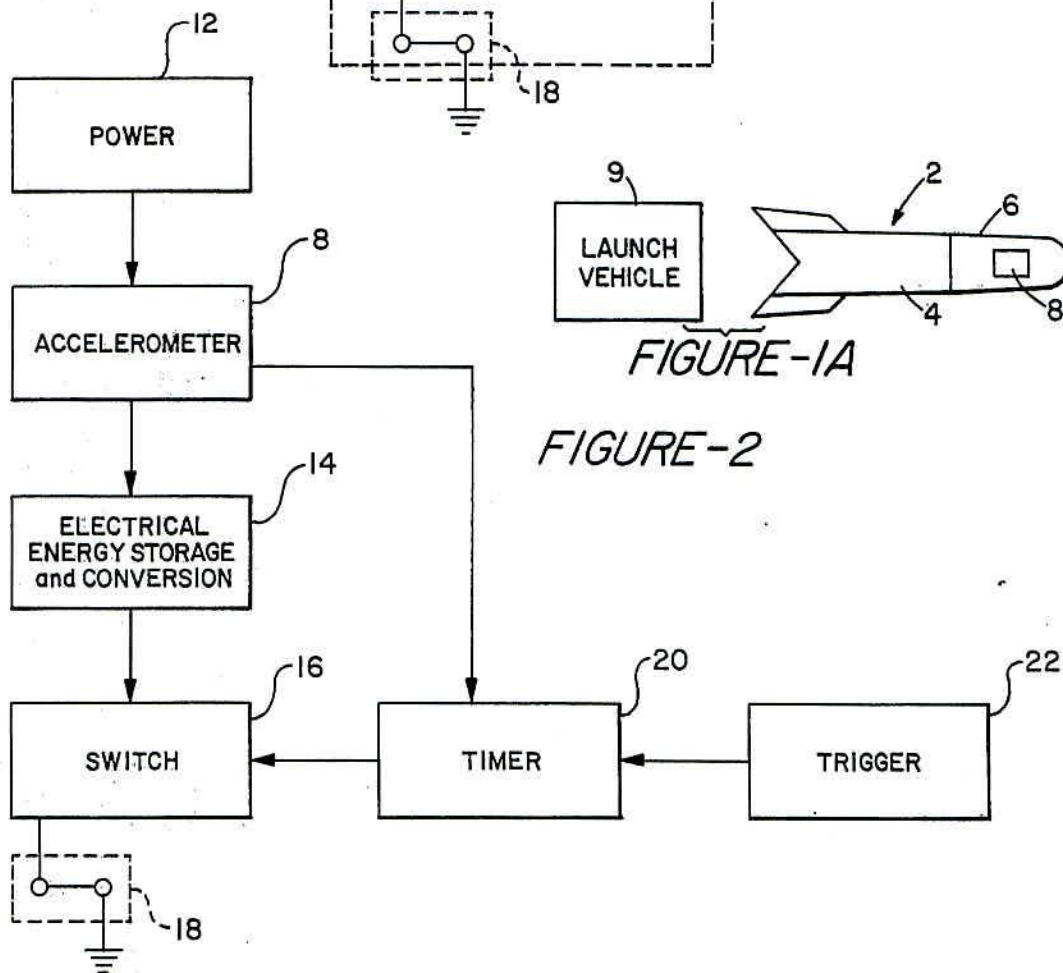


FIGURE-1A

FIGURE-2



22

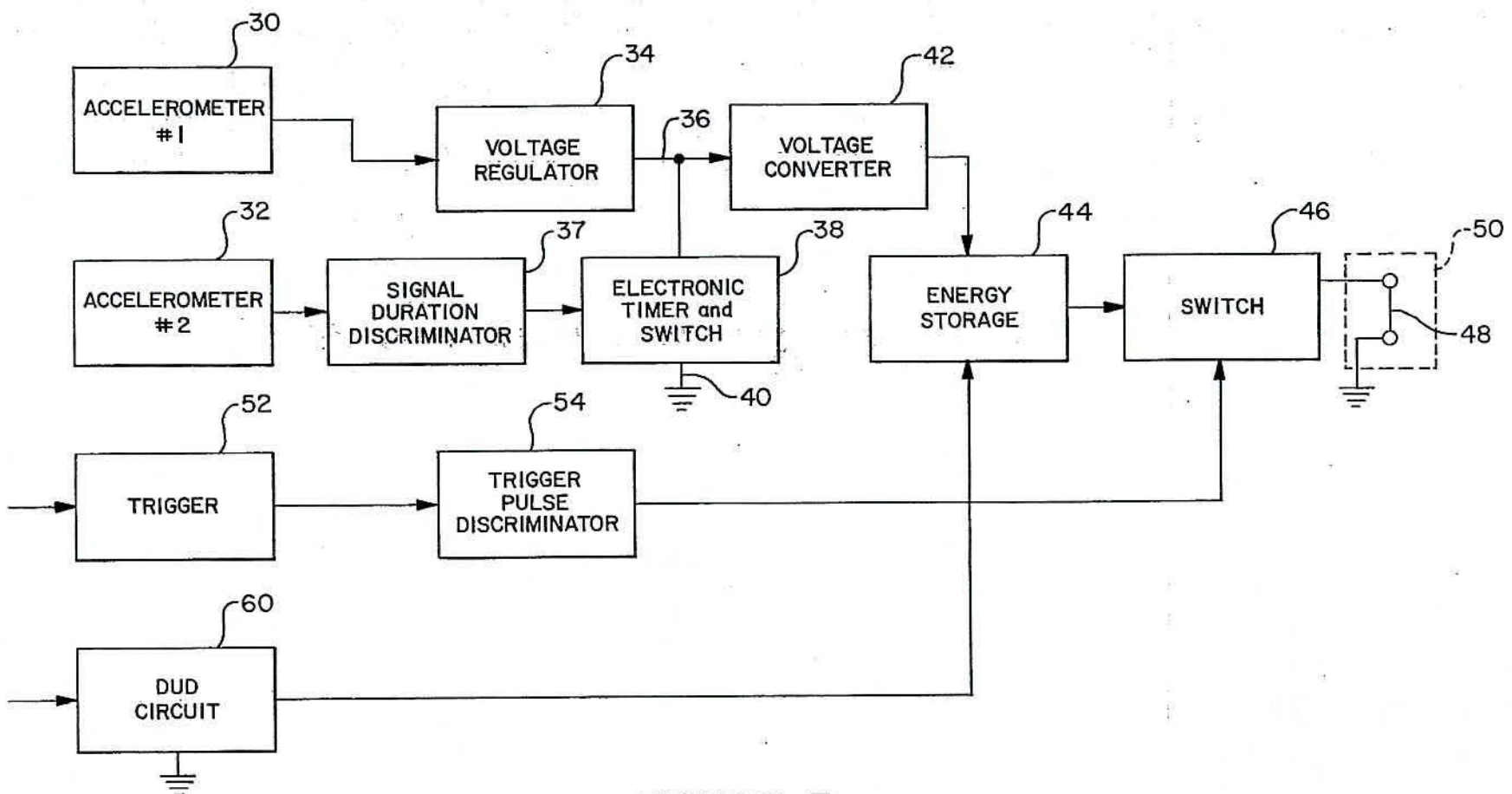


FIGURE-3

22

ELECTRONIC SAFE ARMING AND FUZING SYSTEM

BACKGROUND OF THE INVENTION

The present invention relates to safe arming and fuzing systems for the detonation of explosives and propellants. More particularly, it relates to electronic safe arming and fuzing systems.

Safe arming and fuzing (SAF) systems are extensively used in missiles. The function of the SAF is to maintain the missile warhead or rocket motor in a safe condition until the missile has separated from the launch vehicle some predetermined safe distance. At this point, the SAF arms the warhead. The SAF also fires the warhead on receipt of a trigger signal from either an external source such as a contact trigger or from a backup trigger which may be integral with the SAF device.

In missiles, the warhead is made with a secondary explosive as opposed to a primary explosive. Secondary explosives are characterized by having a very high energy output and very specific conditions for detonation. For example, it typically requires 10^7 ergs delivered in less than 1 microsecond to detonate a secondary explosive. Primary explosives, on the other hand, are very sensitive to detonation, requiring about 1000 times less energy than a secondary explosive, but have a lower energy output. Primary explosives will detonate when subjected to a spark, flame, friction, a hot wire which causes a crystal of the primary explosive to reach its ignition temperature, or mechanical shock. In contrast, secondary explosives will detonate only when subjected to a high energy shock wave. The most common way of detonating a secondary explosive is with the shock wave generated by a primary explosive.

A small charge of primary explosive and some means for causing its controlled detonation is often referred to as a primer. A good example of a primer is a blasting cap consisting of a small charge of primary explosive such as lead azide molded around a small resistance wire. When an electric current is passed through the wire, the wire heats up very fast and causes the primary explosive to detonate. If the primer is located properly with respect to a secondary explosive, detonation of the former will cause detonation of the latter. A percussion primer operates in the same manner except that impact and friction energy are used to ignite the primary explosive rather than electrical energy.

Although the use of a primer is a cheap and effective means of detonating secondary explosives, it is very hazardous. Because primary explosives are sensitive to heat and shock they are prone to exploding prematurely. For example, the mere presence of radio frequency electromagnetic energy in the area may cause the resistance wire to heat up enough to detonate the primer. In spite of the considerable hazards associated with primers, they have been and continue to be the detonator around which nearly all SAF systems are built.

In attempting to avoid the hazards of a conventional primer, existing SAF systems are built in a very special way. Fundamental to existing SAF systems is the requirement that the primer be kept "out of line" with the secondary explosive until the warhead is armed. That is, prior to arming, the primary explosive is physically separated from the secondary explosive by a heavy mechanical barrier. The arming step consists of

removing the mechanical barrier between two explosive types. This is done by the actual mechanical movement of the primary explosive from behind the barrier to a position that is in line with the secondary explosive.

This requires an actual mechanical movement of parts within the SAF system and accordingly requires the application of mechanical energy. Typically this is achieved by loading a spring from energy gained through the acceleration of the missile. For example, the missile acceleration places a force on a movable heavy weight which in turn cocks a spring. Energy in the spring may then be used to move the primer in line with the secondary explosive at the appropriate time.

The process of determining that the missile has reached a safe distance from the launch vehicle is typically achieved by sensing that the missile has been launched with the accelerometer, which in turn initiates a classic mechanical clock movement. After the clock has counted down its predetermined period of time, it trips the spring and causes the primary explosive to move into alignment with the secondary explosive. The warhead is then in an armed condition and can be fired by a trigger signal which heats the resistance wire and sets off the primary explosive.

Although this approach to detonating missile warheads has proved successful and has been and is used extensively, it has several disadvantages. To start with, the required mechanical movement of the primary explosive requires that the SAF system be relatively large and heavy. The shelf life of the systems is relatively short due to the aging of lubricants. The systems require very sensitive detonators for a fast response time (in the neighborhood of 100 microseconds) and thus, are susceptible to instantaneous accidental closure of the trigger. If a missile should fail to explode after it is armed, or for some other reason, it may be desirable to disarm a missile once it is armed. To do this with a conventional SAF system is extremely dangerous since an armed conventional SAF system has a primary explosive in line with a secondary explosive so that it is subject to all of the hazards of a conventional primer. It takes mechanical energy to disarm the system. Furthermore, positive action must be taken by someone such as removing the detonator from the warhead or otherwise isolating the detonator from the next element in the explosive train. This is an exceedingly dangerous task.

A related problem with existing SAF systems is their inability to once armed be reset in flight to a disarmed condition based on external information. For example, if a missile to be used in close air support goes off course, it is desirable to disarm the missile so that it will not explode among friendly troops. Existing systems are incapable of doing this because they are usually locked in the arm position and require mechanical energy and frequently acceleration to achieve a disarm position.

It is therefore an object of this invention to provide a primarily electronic SAF system;

It is a further object of this invention to provide a SAF system that will disarm itself merely by the passage of time;

It is another object of this invention to provide a SAF system that will respond to off course signals and automatically disarm itself;

It is another object of this invention to provide an extremely small SAF system;

It is another object of this invention to provide an extremely reliable SAF system;

It is still another object of this invention to provide a SAF system that is relatively cheap to manufacture; and

Finally, it is an object of this invention to provide a SAF system that has a long shelf life.

SUMMARY OF THE INVENTION

These and other objects of the invention are achieved by an electronic safe arming and fuzing system using an electronic distance calculator to determine when a safe separation of the missile and launch vehicle has been achieved. At this time, said calculator causes relatively low voltage energy to be converted to a high voltage and stored in a storage means. The storage means is in turn connected through a switch to an exploding bridge wire. The switch, normally open, is closed by the receipt of a trigger signal and allows the high voltage to be impressed across the bridge wire embedded in a secondary explosive and thereby detonates said explosive without the aid of a primary explosive.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1A is a schematic diagram showing the setting of the present invention.

FIG. 1 is a block diagram of the basic ESAF system. FIG. 2 is a block diagram of an alternative embodiment of the invention; and

FIG. 3 is a detailed block diagram of a preferred embodiment of the invention as applied to a missile.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The setting of the invention is illustrated in FIG. 1A wherein a missile two having a rocket section 4 and a warhead section 6 with the ESAF imbedded thereon or contiguous thereto, has been launched from a launch vehicle 9 such as an aircraft, tank, ship or carriage. Referring now to FIG. 1, ESAF 8 in its basic form consists of: a power supply indicated by reference numeral 12 supplies energy to a distance calculator 10. The distance calculator, to be described in more detail later, performs the function of determining a missile's distance from a launch vehicle and prevents the flow of power to other portions of the system until a predetermined "safe" distance has been reached. Power supply 12 may be part of the ESAF or more typically it is supplied from an external supply in the missile.

After the safe distance has been reached, electrical energy is supplied from power supply 12, in this case through distance calculator 10 to electrical energy conversion and storage device 14. The storage portion of the device typically is a capacitor which is charged to some high voltage, in the neighborhood of 2000 volts. Since the power supply in a missile is usually some low DC voltage, such as 24 volts, a converter is required to step it up to 2000 volts. This is done by a conventional chopper, transformer, rectifier circuit combination, well known in the art. Energy conversion and storage device 14 is connected through a high energy switch 16 to an exploding bridge wire 18. Switch 16 is closed upon receipt of a trigger signal usually generated externally to the ESAF from a contact trigger 19. The closing of switch 16 causes the energy stored in storage device 14 to flow through exploding bridge wire 18 and thereby to detonate the explosive charge in which it is embedded.

FIG. 2 shows an alternative embodiment where the distance calculator 10 of FIG. 1 consists of an accelerometer 8 located between power unit 12 and electrical energy storage and conversion unit 14, and an electronic timer circuit 20.

If a specified acceleration is experienced for a specified time, accelerometer 8 mechanically or electrically latches and closes an electrical circuit. This allows the transfer of power from power supply unit 12 through accelerometer 8 to the remainder of the system. A Technar Inc. Model GS-5 acceleration switch is a good example of an accelerometer suitable for this purpose.

To insure that the missile reaches a safe distance from the launch vehicle, the trigger signal is locked out until a safe distance has been reached. This is achieved by the cooperative action of accelerometer 8 and timer 20. When the appropriate acceleration is detected by accelerometer 8, in addition to passing energy to energy storage device 14, a signal is also supplied to timer 20. On receipt of the accelerometer signal, timer 20 is initiated and counts down some predetermined time, whatever is deemed necessary for safe separation, at which point a circuit path is connected between trigger signal source 22 and switch 16.

At this point, the ESAF is fully armed. All that is required now to cause detonation is the generation of a triggering signal from trigger signal device 22. This would, of course, typically happen when the missile reached its target.

This embodiment would, of course, work equally well if the electronic timer circuit were located between accelerometer 8 and energy storage and conversion device 14.

An alternative embodiment of the distance calculating unit 10 consists of an accelerometer to sense acceleration of the missile and an integrator unit. Since distance is the second integral of acceleration, distance can easily be calculated. If necessary, the velocity of the launch vehicle which is known, can also be taken into account. Since the distance the launch vehicle travels is the first integral of velocity, it is easy to calculate the distance it has traveled during any time period. If the distance the launch vehicle travels from the time the missile is launched to any given point in time is subtracted from the distance the missile travels, the separation is determined as a function of time. When the safe separation is reached, the operation of the ESAF is the same as previously described in connection with other embodiments.

FIG. 3 represents an embodiment of the invention particularly useful for missiles. Referring to FIG. 3, first and second accelerometers 30 and 32 are provided. When accelerometer 30 experiences a gravitational force of sufficient magnitude, a circuit is closed and external power flows through accelerometer 30 to voltage regulator 34, whose purpose is to provide a precisely regulated output voltage at terminal 36 even though the input voltage may vary in an unknown manner over some range.

Accelerometer 32, which also closes when experiencing the same gravitational force as accelerometer 30, supplies a signal to a signal duration discriminator 37, which is well known in the art. This circuit is such that accelerometer 32 must remain closed for some predetermined period of time, for example 300 milliseconds, before a signal is passed therethrough. This avoids the possible risk of having an accidental instantaneous closing of one or both of the accelerometers

which would arm the system. In other words, the system must experience at least 300 milliseconds of boost acceleration before the next step in the arming sequence will occur. If these conditions are satisfied, a signal is supplied from discriminator 37 to electronic timer and switch circuit 38. Prior to receiving a signal from accelerometer 32, switch 38 is in a conducting mode and would conduct any voltage appearing at terminal 36 through to ground 40 so that no voltage would appear at the input terminal of voltage converter 42. Upon receipt of a signal from discriminator 37, timer 38 counts down some predetermined period sufficient to allow safe separation and then removes the short circuit from point 36 to ground and allows the voltage output of regulator 34 through to voltage converter 42. This is an additional safety feature that requires both accelerometers 30 and 32 to experience closure before the system is armed. Voltage converter 42 may be a conventional circuit for converting DC voltage at one level to DC voltage at another level. As is well known in the art, these typically involve an oscillator circuit for chopping the incoming DC voltage, a transformer for transforming the chopped AC voltage, and rectifiers for reconverting the AC voltage to DC. The output of voltage converter 42 is supplied to an energy storage device 44 which is typically a large capacitor. The output voltage would be in the neighborhood of 2000 to 3000 volts.

The output of energy storage device 44 is connected through high voltage switch 46 to an exploding bridge wire 48 imbedded in secondary explosive 50.

Switch 46 is, of course, normally open and must be able to sustain the high voltages across its terminals in the open position without discharging. Typically these switches are of the gas discharge type such as thyatrons, triggered spark gaps and the like. The signal for closing switch 46 is supplied from a triggering circuit 52. The trigger signal is passed on to trigger pulse discriminator 54 which discriminates against pulses shorter than some predetermined given period, for example 50 microseconds. This feature avoids any possible false triggering once the system is armed. If, however, the signal supplied from trigger circuit 52 meets the pulse width specifications, it is passed through discriminator 54 and causes switch 46 to close. At this point the energy stored in device 44 is dumped through exploding bridge wire 48 in a very short period of time causing detonation.

Dudiving circuit 60 provides the capability of disarming the system on receipt of some predetermined outside signal such as from the guidance system or clock (not shown). Upon receipt of a dudiving signal, dudiving circuit 60 would cause the energy in storage device 44 to be discharged to ground. For example, dudiving circuit 60 may take the form of a switch normally open but closed upon the receipt of a dudiving signal.

I claim:

1. A system for arming a warhead of a missile after said missile has reached a predetermined distance from a launch vehicle and detonating said warhead upon the occurrence of a triggering event, said apparatus comprising:

an exploding bridge wire imbedded in the explosive of said warhead;

a first system branch comprising:

first accelerometer means for detecting a predetermined acceleration force and closing a first

switch upon experiencing said acceleration force;

voltage regulator means electrically connected to said first accelerometer means such that electric energy is supplied to said regulator means when said switch is closed;

energy conversion means connected to said regulator means for converting a relatively low direct current voltage to a relatively high direct current voltage;

capacitor means connected to the output of said converter means for storing electrical energy;

switch means connected between said energy storage means and said exploding bridge wire for allowing said stored energy to pass through said exploding bridge wire upon the occurrence of said triggering event;

a second system branch comprising:

second accelerometer means for generating an output signal upon detecting said predetermined acceleration force;

electronic timer means connected to said second accelerometer, said timer means being adapted to generate an output signal a predetermined time period after receiving the output signal from said second accelerometer means; and

means interconnecting said timer means and said first system branch for preventing energy from reaching said capacitor means prior to the receipt of the output signal from said timer means.

2. The apparatus of claim 1 further characterized by a trigger pulse discrimination circuit connected to said switch means and adapted to block any triggering signal having a signal duration less than some predetermined level whereby accidental or extraneous triggering signals are avoided.

3. The apparatus of claim 1 further characterized by a signal duration discriminator connected between said second accelerometer and said electronic timer means such that signals shorter than a predetermined time are blocked whereby accidental closures of said second accelerometer are not allowed to arm said system.

4. The apparatus of claim 1 further characterized by a dudiving circuit connected to said storage device and adapted to discharge said device upon receipt of a dudiving signal.

5. An apparatus for arming a warhead of a missile after said missile has reached a predetermined distance from a launch vehicle and detonating said warhead upon the occurrence of a triggering event, said apparatus comprising:

an exploding bridge wire imbedded in said warhead; means for storing electrical energy;

switch means interconnecting said exploding bridge wire and said energy storage means capable of passing said electrical energy to said exploding bridge wire upon the occurrence of said triggering event;

energy conversion means for converting relatively low voltage electrical energy to relatively high voltage electrical energy, said conversion means operatively connected to said energy storage means;

an accelerometer for sensing acceleration of said missile and generating an output signal proportional thereto;

integrating means connected to said accelerometer for integrating said output signal and thereby sup-

plying a signal proportional to the distance said missile has traveled; and

means connecting said integrating means to said energy storage means for preventing the accumulation of electrical energy in said storage means until a predetermined distance is reached.

6. An apparatus for arming a warhead of a missile after said missile has reached a predetermined distance from a launch vehicle and detonating said warhead upon the occurrence of a triggering event, said apparatus comprising:

an exploding bridge wire imbedded in said warhead; means for storing electrical energy;

switch means interconnecting said exploding bridge wire and said energy storage means capable of passing said electrical energy to said exploding

bridge wire upon the occurrence of said triggering event;

energy conversion means for converting relatively low voltage electrical energy to relatively high voltage electrical energy, said conversion means operatively connected to said energy storage means;

an accelerometer for sensing acceleration of said missile and generating an output signal proportional thereto;

timing means connected to said accelerometer for providing an output signal a predetermined time after the receipt of said output signal from said accelerometer; and

means responsive to the output signal from said timing means for preventing the accumulation of electrical energy in said storage means prior to the receipt of said output signal.

* * * * *



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(12) **United States Patent**
Schweitzer

(10) **Patent No.:** **US 6,363,854 B1**
(45) **Date of Patent:** **Apr. 2, 2002**

(54) **MINE ALTERABLE FROM AN ARMED STATE TO A SAFE STATE**

4,854,239 A * 8/1989 Van Sloun 102/426
5,511,482 A * 4/1996 DiPietropolo 102/426
6,112,668 A * 9/2000 Woodall et al. 102/417

(76) **Inventor:** **Peter Schweitzer**, 50 Spruce Ter.,
Wayne, NJ (US) 07470

* cited by examiner

(*) **Notice:** Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.

Primary Examiner—Charles T. Jordan

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(74) *Attorney, Agent, or Firm*—Thomas L. Adams

(57) **ABSTRACT**

A mine has the ability to change from an armed state to a safe state without touching of the mine. The mine includes a case and an explosive charge in the case. Also included is a detonator located adjacent to the explosive charge. The firing of the detonator can set off an explosive chain for exploding the explosive charge. A movable firing pin in the case can strike and fire the detonator in response to pressure directed toward the case. The mine also includes a blocking member adapted to move from a retracted position to a blocking position between the detonator and the firing pin in order to prevent firing of the detonator by the firing pin. Also included is a driver for moving the blocking member from the retracted position to the blocking position without manual touching of the case.

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(52) **U.S. Cl.** **102/401; 102/426**

(58) **Field of Search** 102/401, 404,
102/406, 426, 428

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,115,834 A * 12/1963 Schwarz et al.
3,447,461 A * 6/1969 Lapof 102/8
3,667,387 A * 6/1972 Picard et al. 102/8
4,058,061 A * 11/1977 Mansur, Jr. et al. 102/8
4,712,480 A * 12/1987 Lindstadt et al. 102/427

19 Claims, 5 Drawing Sheets

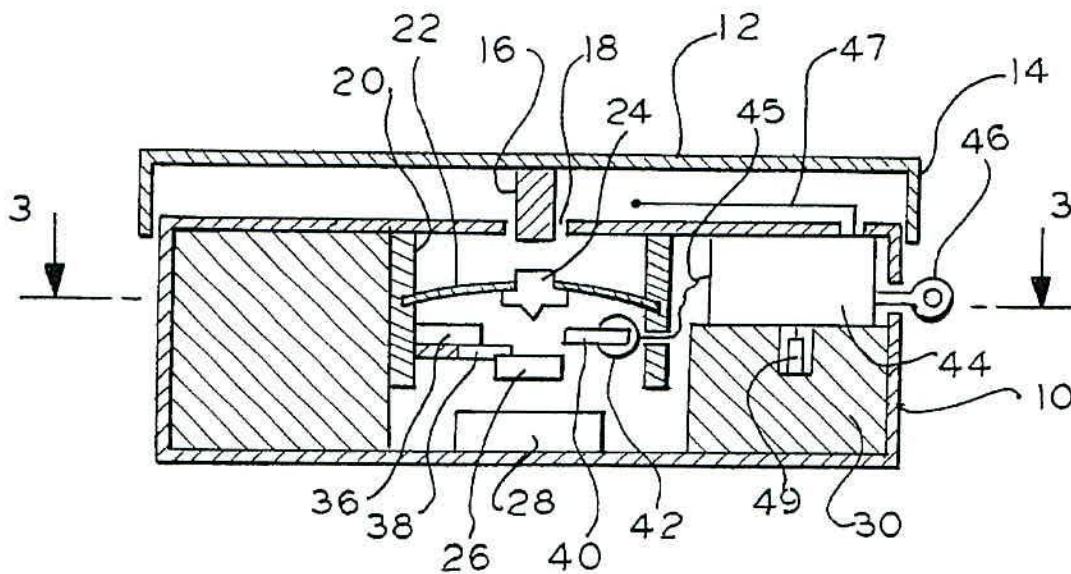


FIG. 1

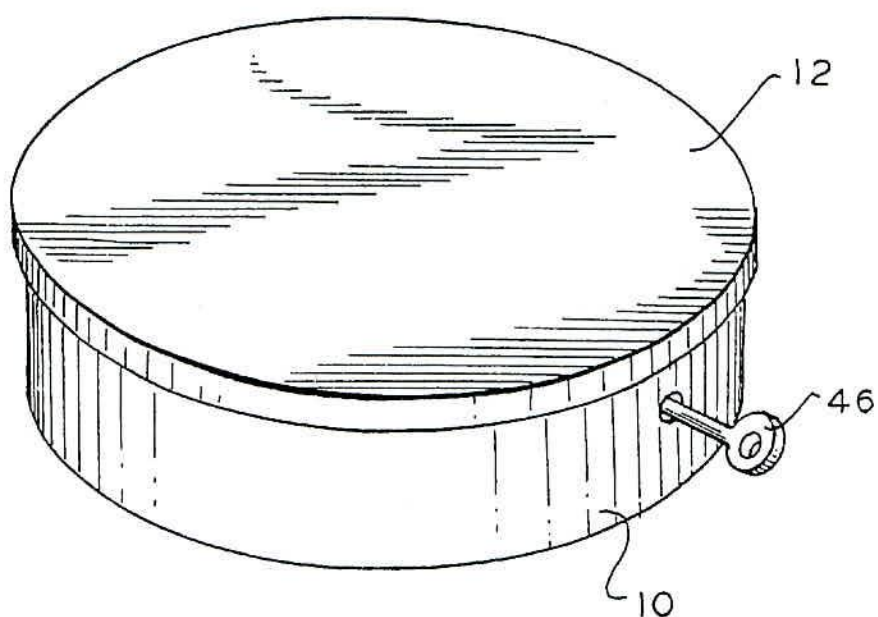


FIG. 11

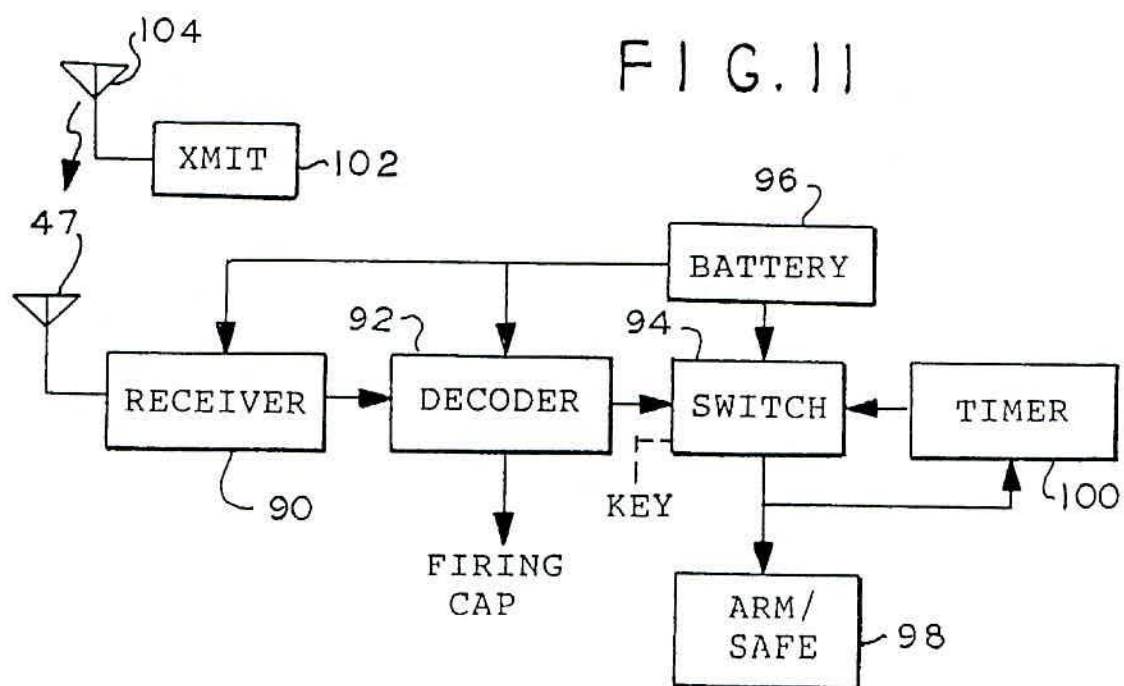


FIG. 2

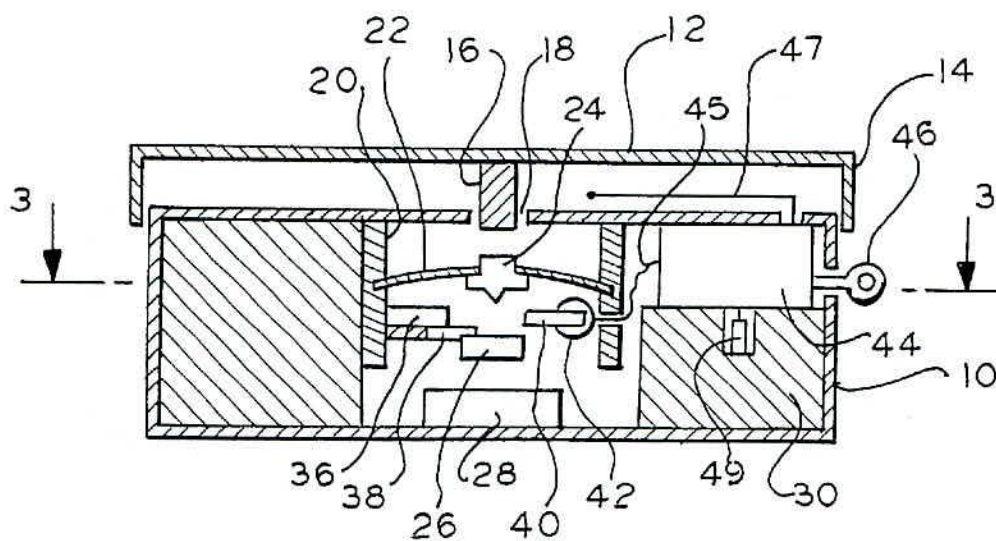


FIG. 3

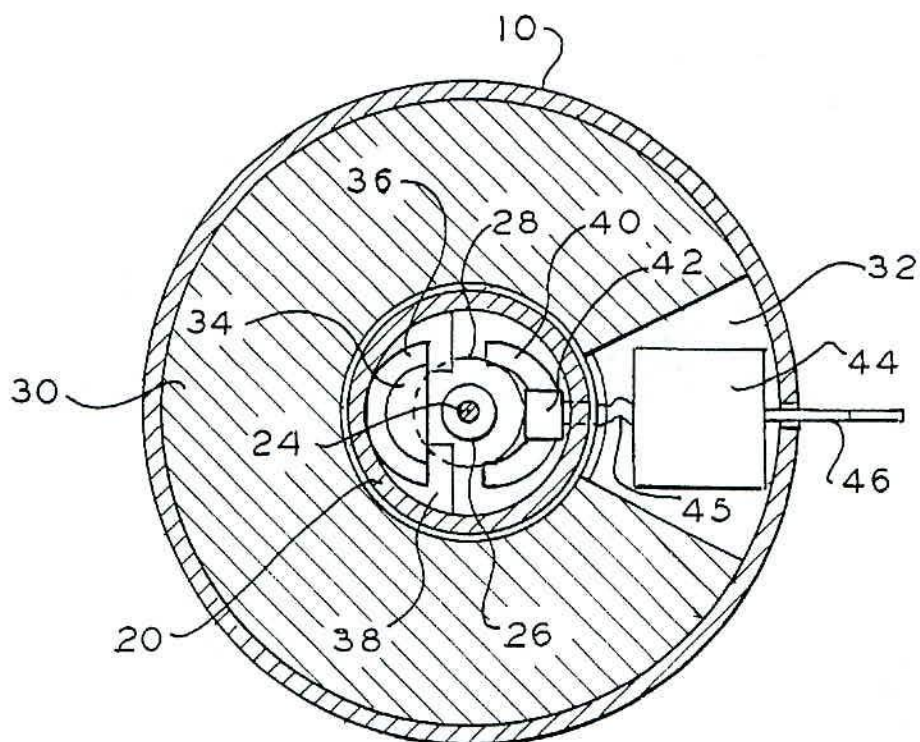


FIG. 4

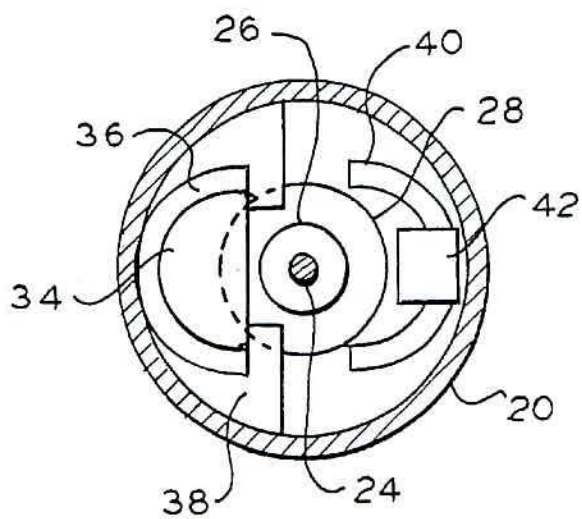


FIG. 5

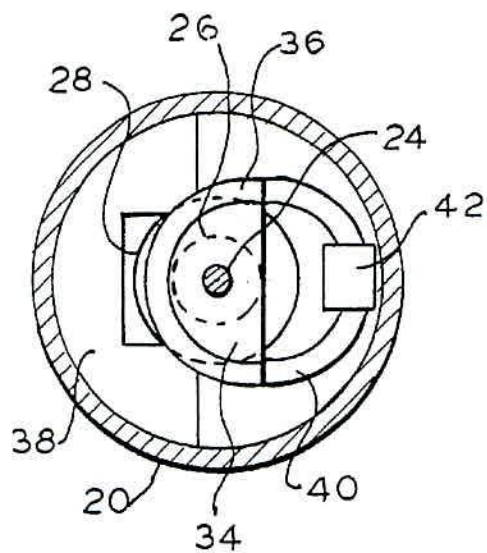


FIG. 6

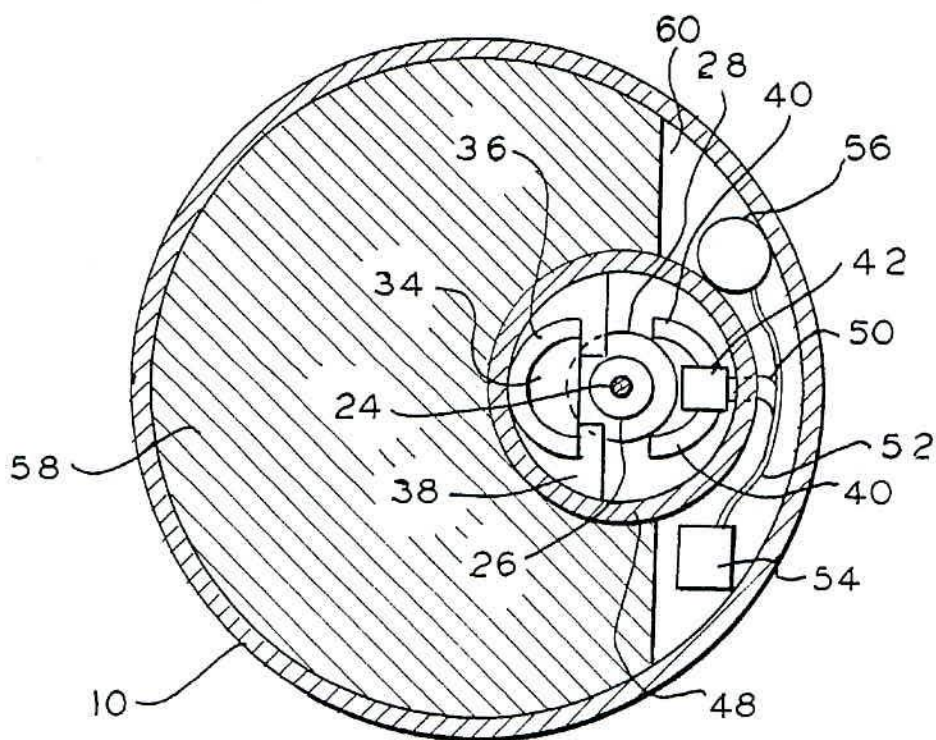


FIG. 7

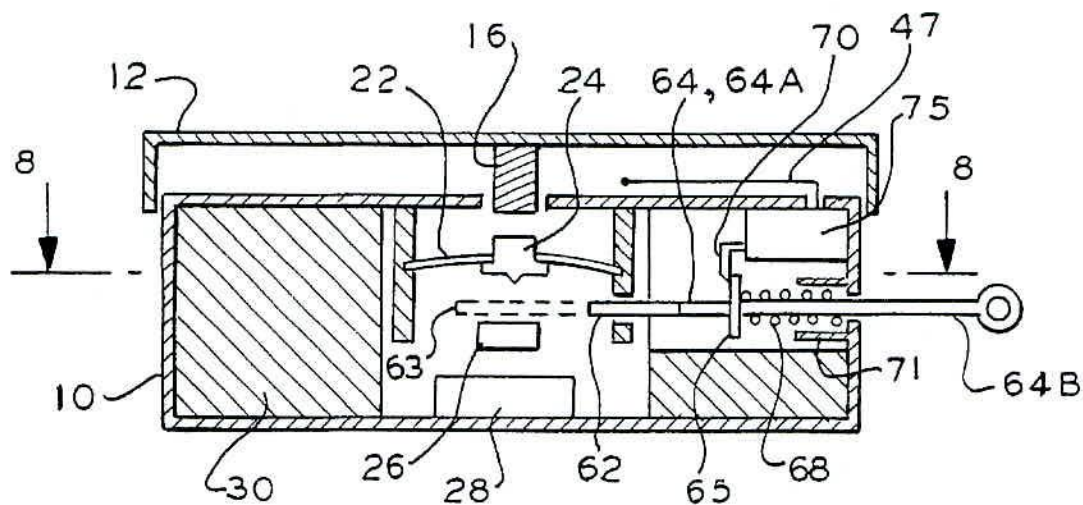


FIG. 8

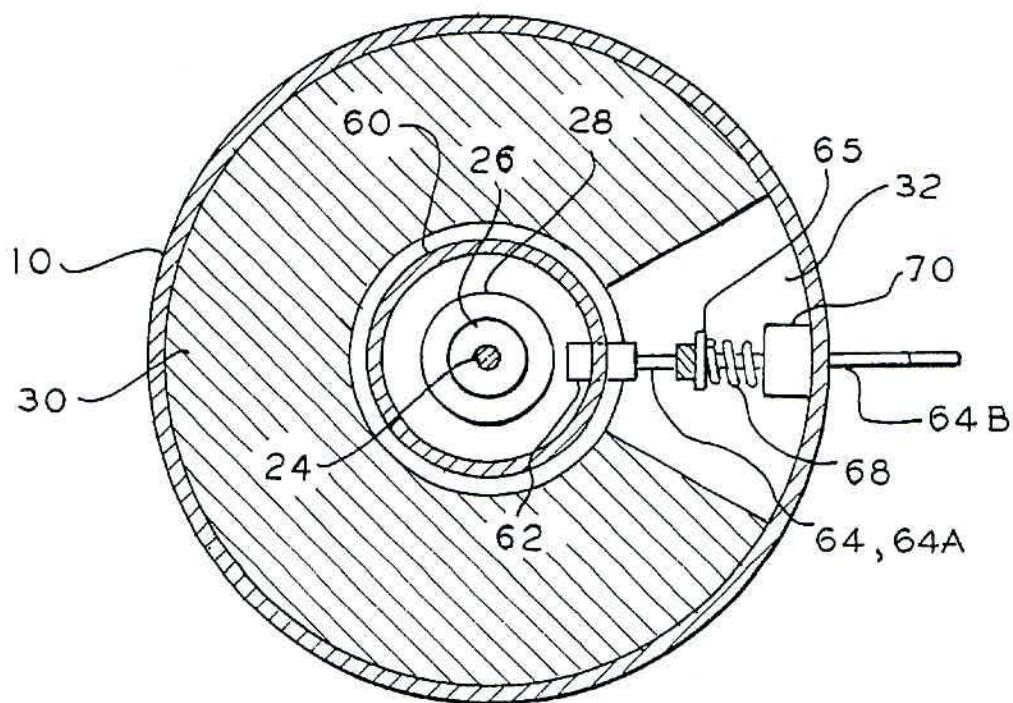


FIG. 9

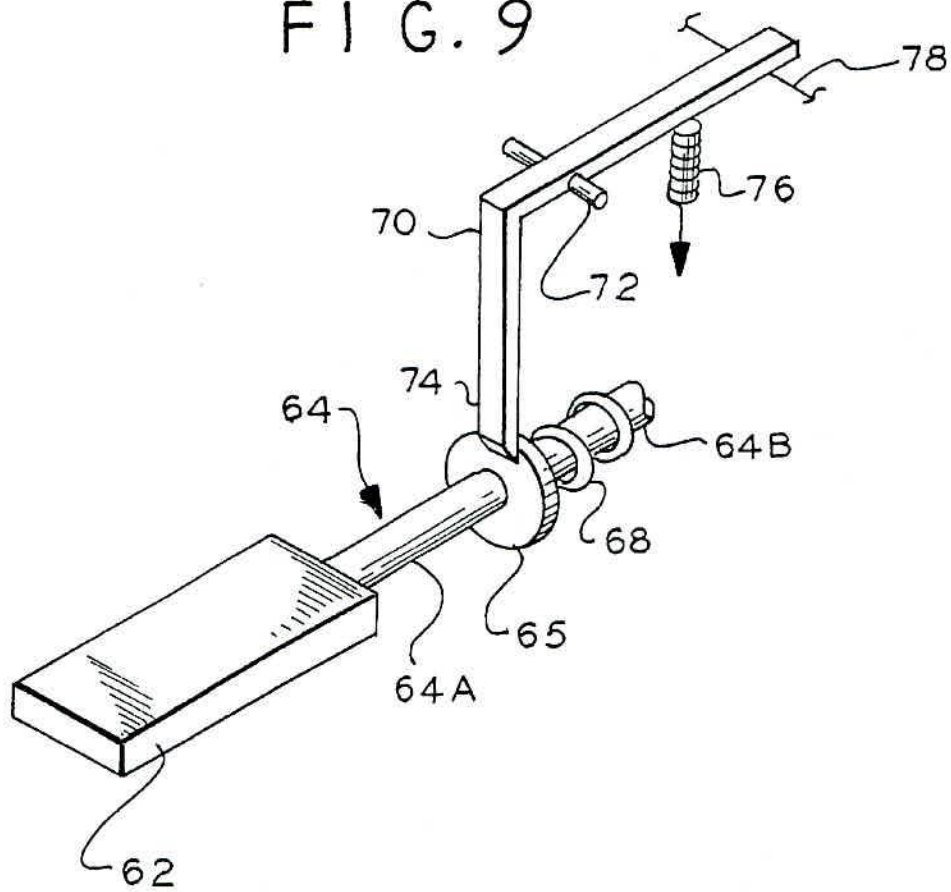
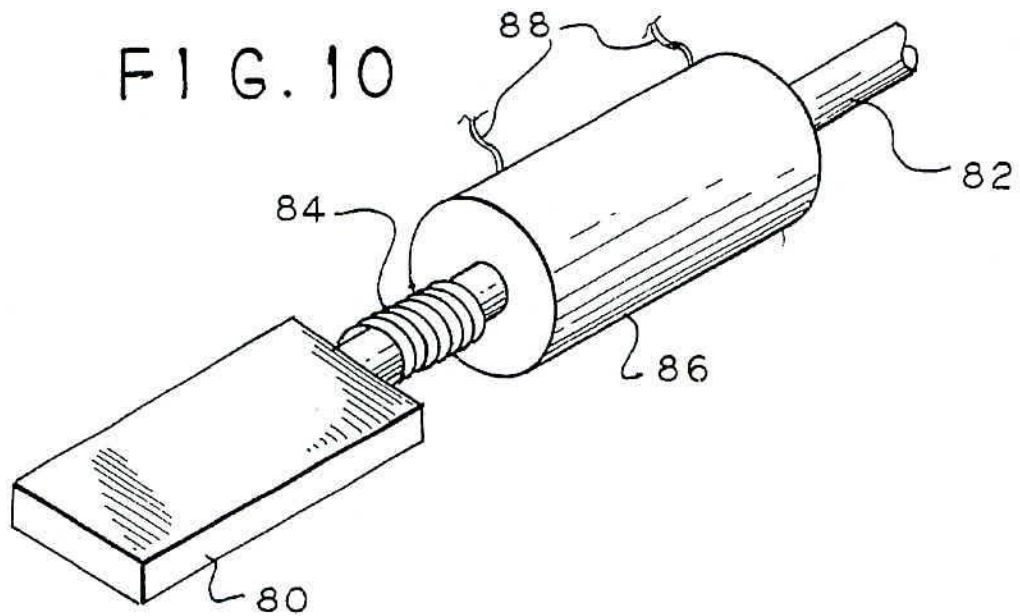


FIG. 10



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MINE ALTERABLE FROM AN ARMED STATE TO A SAFE STATE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to mines, and in particular to devices for disabling a mine.

2. Description of Related Art

Land mines are still considered a necessary part of warfare. Of course, a lingering problem is finding, and disabling or destroying the land mines after hostilities cease. While combatants may try to make maps indicating locations of land mines, these maps are often hastily made and inaccurate, or are lost in the destruction that is part of armed conflict. Oftentimes, there is simply not the resources available to devote the time needed for carefully tracking down, and extracting or detonating these mines.

In U.S. Pat. No. 5,415,103 an interrogation unit can program a land mine to set the conditions under which the land mine will detonate. The specification states that "remote communication may be performed with certain lines for activation and deactivation." Column 1, lines 16-17. The electrical firing circuit of U.S. Pat. No. 5,218,574 provides several operating modes for a land mine. In one mode, an electrolytic timing device can detonate the land mine after a predetermined delay.

These references do not disclose any mechanisms for disabling a land mine. While electronics can be fabricated to perform a variety of sophisticated functions, the mechanical process of disabling the mine is extremely important. This mechanism must be highly reliable so that it does not run the risk of detonating the mine before it is placed. On the other hand, a mechanism must also be designed to (a) avoid premature disabling, and (b) reliably disable a mine when appropriate. Because of the dangerous nature of a mine, the mechanism must be made relatively simple and must have mechanisms that are unlikely to bind, jam, or otherwise fail.

In U.S. Pat. No. 4,856,431 a directional mine is armed by inserting firing unit 6, which is locked into place by pin 15. The mine can be detonated by firing the igniter 11. After a pre-programmed amount of time, however, an electromagnet retracts pin 15 to eject unit 17, thereby disarming the mine. This reference is relatively complicated and does not show a movable element that is inserted into a blocking position to disable a land mine after it is armed.

In U.S. Pat. No. 4,712,478 slider 30 has a passage that moves into position just before detonation to create a firing path. The land mine can be neutralized by an undefined circuit that fires detonator 44 before slider 30 is in the armed position. Alternatively, the battery that operates circuit 10 can run down and disable the land mine. This reference does not disclose a blocking element that is inserted into a blocking position to disable the land mine after it is armed.

In U.S. Pat. No. 4,854,239 a munition is fired by two explosively powered pistons if they are fired in a proper sequence before a third piston is fired. Premature firing of the third piston will fracture a component, which is then elevated to indicate the munition is disabled. Again, this complicated reference does not show a blocking element for disabling a land mine after it is armed.

See also U.S. Pat. Nos. 3,667,387 and 3,994,227.

Accordingly, there is a need for a mechanism for disabling a mine in a simple and highly reliable fashion.

SUMMARY OF THE INVENTION

In accordance with the illustrative embodiments demonstrating features and advantages of the present invention,

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there is provided a mine having the ability to change from an armed state to a safe state without touching of the mine. The mine includes a case and an explosive charge in the case. Also included is a detonator located adjacent to the explosive charge. The firing of the detonator can set off an explosive chain for exploding the explosive charge. The mine includes a movable firing pin mounted in the case for striking and firing the detonator in response to pressure directed toward the case. The mine also includes a blocking member adapted to move from a retracted position to a blocking position between the detonator and the firing pin in order to prevent firing of the detonator by the firing pin. Also included is a driver for moving the blocking member from the retracted position to the blocking position without manual touching of the case.

By employing the foregoing principles, an improved mine is achieved. In a preferred embodiment, a blocking member is slidably mounted in a mine and can move into a position between a firing pin and detonator to disable the mine. In one embodiment an electromagnet is energized with a polarity to repel a permanently magnetized element. If the electromagnet is disabled, the permanently magnetized element is drawn to the electromagnet to pull a flexible foam member in position between the firing pin and detonator.

This electromagnet can be disabled in a variety of ways. A circuit driving the electromagnet can have a timer that interrupts current to the electromagnet after a predetermined delay interval. Alternatively, a battery powering the electromagnet can simply run down. In some embodiments a radio receiver can detect and decode an encrypted command signal and then fire a firing cap to explode the mine.

In other embodiments, a spring loaded plunger can be biased to thrust a blocking member between the firing pin and detonator. A solenoid-like electromagnet, when energized, can pull the plunger and retract the blocking member to arm the mine. Again, interruption of the drive to the electromagnet will cause the blocking member to be thrust between the firing pin and detonator. In still other embodiments, a catch can hold a spring biased plunger in place until released by a separate releasing device.

BRIEF DESCRIPTION OF THE DRAWINGS

The above brief description as well as other objects, features and advantages of the present invention will be more fully appreciated by reference to the following detailed description of presently preferred but nonetheless illustrative embodiments in accordance with the present invention when taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is perspective view of a mine in accordance with principles of the present invention;

FIG. 2 is a cross-sectional, elevational view of the mine of FIG. 1;

FIG. 3 is a cross-sectional, plan view taken along line 3-3 of FIG. 1;

FIG. 4 is a detailed view of the electromagnet mechanism of FIG. 3;

FIG. 5 is a detailed view of the mechanism of FIG. 4 with the magnetized element drawn to the electromagnet;

FIG. 6 is a cross-sectional, plan view of a mine that is an alternate to that shown in FIG. 3;

FIG. 7 is a cross-sectional, elevational view of a mine that is an alternate to that shown in FIG. 2;

FIG. 8 is a cross-sectional, plan view taken along line 8-8 of FIG. 7;

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FIG. 9 is a detailed view of the blocking mechanism of FIGS. 7 and 8;

FIG. 10 is a detailed view of a blocking mechanism that is an alternate to that of FIG. 9; and

FIG. 11 is a schematic block diagram of a receiver that may be employed in the foregoing embodiments.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIGS. 1-5, a case is shown with a hollow cylindrical housing 10 covered by a vertically reciprocable cap 12. Cap 12 is a circular disk with a dependent cylindrical apron 14. A plunger 16 mounted concentrically on the underside of cap 12 and extends through a concentric hole 18 atop housing 10.

A concentric cylindrical wall 20 is attached to the ceiling inside housing 10. Fitted within an annular groove on the inside of wall 20 is a domed snap ring 22. A firing pin 24 is shown attached concentrically in snap ring 22. External pressure applied to cap 12 causes plunger 16 to descend and press against firing pin 24. Eventually, snap ring 22 inverts its shape from upwardly convex (illustrated condition) to upwardly concave. The sudden change in shape drives firing pin 24 against concentrically-located detonator 26. Detonator 26 is located above booster 28, which is located on the floor of housing 10.

The space inside housing 10 and outside wall 20 is filled with an explosive charge 30. Charge 30 has essentially a cylindrical inner and outer surface and a flat bottom. The top of the explosive charge 30 is flat as well, except for a recess 32 containing components to be described presently. While recess 32 is shown as a pie-shaped sector with radially aligned side walls, in other embodiments a different shape can be used instead.

In this embodiment a blocking member is shown as a D-shaped, flexible material 34 made, for example from polyurethane foam. Member 34 is shown attached inside the curve of a C-shaped magnetized element 36. Element 36 may be a horseshoe-type permanent magnet, although other types of magnets may be used instead. Blocking member 34/36 is slidably mounted atop shelf 38 and may be guided by appropriate guiding rails, guiding pins and the like (such guiding means not shown).

A driver is shown herein as an electromagnetic device in the form of a C-shaped magnetic core 40 encircled at its midsection by an electrical coil 42. The driver also includes a circuit contained in a subsystem 44 for driving the electrical coil 42 through wires 45. As described further hereinafter, subsystem 44 can have a timing means for controlling the time over which coil 42 is energized. Subsystem 44 will also include a battery for powering its internal circuit and the external coil 42.

Essentially, the circuit in subsystem 44 can use coil 42 to magnetize core 40 and repel magnetized element 36 to drive it to the position shown in FIGS. 3 and 4. When coil 42 is not energized, core 40 does not apply a repulsive force and therefore, magnetized element 36 is attracted to core 40 and moves from the position shown in FIG. 4 to the position shown in FIG. 5, under circumstances to be described presently.

Subsystem 44 is shown with an antenna 47 projecting through an opening in the top of housing 10. Antenna 47 lies primarily in a horizontal plane underneath cap 12. A firing cap 49 is also shown occupying a cavity in charge 30. Firing cap 49 connects to subsystem 44 and can be triggered under

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the circumstances described hereinafter. Subsystem 44 is shown with a key 46 acting as a manually operable projection for arming the mine in a manner to be described presently.

Referring to FIG. 6, previously mentioned housing 10 is shown with an internal cylindrical wall 48 that is similar to previously mentioned wall 20, except that wall 48 is positioned in an off-centered location. Located inside wall 48 are components identical to those previously described in connection with FIGS. 2 and 3, and therefore these identical components bear reference numerals identical to those used previously. A pair of wires 50 is connected through cable 52 to a subsystem 54 that is identical to previously mentioned subsystem 44 (FIG. 2 and 3), except for the use of an external battery 56, in contrast to the internal battery used in subsystem 44.

In this embodiment explosive charge 58 is more compact and is essentially cylindrical except for the sector 60 and the volume occupied by walls 48.

Referring to FIGS. 7, 8 and 9, housing 10 contains an explosive charge 30 identical to that shown in FIGS. 2 and 3. Consequently, charge 30 has an identical recess 32. Cylindrical walls 60 are concentrically located inside housing 10 and circumscribe previously mentioned booster 28, detonator 26 and firing pin 24, which are all located in the same position as previously described.

An alternate blocking member is shown as a paddle 62 made of a flexible material such as a plastic foam, and is attached to the end of shaft 64. Shaft 64 has a central flange 65 separating distal end 64A from proximal end 64B. Proximal end 64B is encircled by a compression spring 68 acting as a bias member that is part of a driver. Spring 68 together with shaft 64 slidably fit in a socket 71 mounted on an inside wall of housing 10. Proximal end 64B extends outside housing 10 to form a manually operable projection that can be manipulated for the reasons to be described presently.

A releaseable catch is shown as an L-shaped bar 70 pivotally mounted on trunnions 72. The end 74 of bar 70 is shown engaging the distal face of flange 65. The opposite end of bar 70 is shown attached to a tension spring 76 tending to rotate bar 70 and release end 74 from flange 65. This releasing motion of bar 74 is restrained by fuse wire 78 which prevents spring 76 from causing rotation of bar 70 beyond the position shown in FIG. 9, but does allow rotation in opposition to spring 76. As described further hereinafter, a pulse of current applied to fuse wire 78 will rupture the wire, thereby enabling tension spring 76 to rotate bar 70 and move end 74 away from flange 65.

A subsystem 75 (FIG. 7) is shown mounted above shaft 64 to rotatably support previously mentioned bar 70. Subsystem 75 also contains the previously mentioned circuit, including a battery and an optional timing means. Previously mentioned antenna 47 is shown connected to subsystem 75 through an upper opening in housing 10.

Referring to FIG. 10, an alternate driver is shown with a paddle 80 made of a flexible material such as a plastic foam, and attached to a shaft 82. Shaft 82 is slidably mounted inside solenoid coil 86. Compression spring 84 encircles shaft 82 between paddle 80 and solenoid coil 86 in order to urge shaft 82 out of coil 86. Solenoid coil 86 is an electromagnetic device that can be energized through wires 88 to magnetically attract and pull shaft 82 into the position shown in FIG. 10, thereby compressing spring 84. To facilitate the magnetic attraction, shaft 82 may be made of two parts with the portion to the right made of plastic or

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other non-magnetic material so that the bulk of the ferromagnetic material is contained inside solenoid coil 86 when energized as shown in FIG. 10.

Referring to FIG. 11, radio receiver 90 detects a radio signal from antenna 47 and applies the detected signal to decoder 92. Receiver 90 can detect AM or FM signals modulated in a variety of fashions, especially pulse code modulation. The signal from receiver 90 is a series of encrypted bits that are sent to decoder 92 for decoding. If a self-destruct code is received, decoder 92 sends a signal to a firing cap, for example cap 49 of FIG. 2. If a disable code is received, decoder 92 operates switch 94 to disconnect battery 96 from device 98. Device 98 may be coil 42 of FIG. 3, fuse wire 78 of FIG. 9, or solenoid coil 86 of FIG. 10.

The system of FIG. 11 can also disable itself through a timing means 100. This timer 100 may be a clock driving a counter until a predetermined count is reached, at which time switch 94 is operated. Alternatively, a charging device can be slowly charged until it reaches a threshold voltage, at which time switch 94 may be operated. In all of these arrangements, battery 96 will have a limited life. When battery 96 runs down, power can no longer be supplied through switch 94 to device 98. With the schemes described above (except for FIG. 9), the absence of power will result in disabling of the mine. Furthermore, the previously mentioned key (for example key 46 of FIG. 1) can be manipulated to set the state of switch 94.

To facilitate an understanding of the principles associated with the foregoing apparatus, its operation will be briefly described in connection with the embodiment of FIGS. 1-5 and 11. When the mine is shipped from the factory blocking member 34 is in the position shown in FIG. 5. When the mine is placed in the field, key 46 is manipulated to close switch 94 (FIG. 11). Consequently, coil 42 is energized to produce a magnetic force that repels magnetized element 36. As a result, element 36 is driven away to the position shown in FIG. 4.

This resulting condition shown in FIGS. 2 and 3 arms the mine. Consequently, pressure applied to cap 12 can depress plunger 16 to push firing pin 24. If pushed sufficiently, domed ring 22 will invert and snap firing pin 24 down against detonator 26. Consequently, detonator 26 will start off an explosive chain, and will fire booster 28. Booster 28 will fire explosive charge 30 to complete the explosion.

The mine can however, be disabled. In the simplest case, battery 96 (FIG. 11) in subsystem 44 (FIGS. 2 and 3) can run down. As a result, current no longer flows through wire 45, so that coil 42 is disabled. Consequently, no magnetic repulsive forces are generated through core 40. In response, magnetized element 36 is now attracted to core 40 and will move from the position shown in FIG. 4 to that shown in FIG. 5. Once positioned as shown in FIG. 5, firing pin 24 is isolated from detonator 26. Therefore, even if cap 12 is depressed and firing pin 24 descends, it strikes foam material 34 without further effect.

In some cases field personnel may wish to disable the mine before the battery runs down. In this case transmitter 102 (FIG. 11) can send an encoded signal over antenna 104, which is received by antenna 47 and detected by receiver 90. Depending upon the transmitted code, decoder 92 can either issue a signal to fire the firing cap or can operate switch 94. If switch 94 is operated, then battery 96 can no longer supply current to device 98, which is in this embodiment, coil 42. Therefore blocking element 34 will return to the position shown in FIG. 5 for the reasons previously given.

Alternatively, the closure of switch 94 (FIG. 11) can supply power to timer 100. After a predetermined time

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elapses, timer 100 provides an overriding signal to open switch 94 and disable device 98 to bring about the condition shown in FIG. 5.

It will be appreciated that the embodiment of FIG. 6 will operate in substantially the same fashion, except that the explosive chain will start from an offcenter position.

Also, the embodiment of FIGS. 7-9 will operate in a similar fashion with some exceptions. The mine will be shipped from the factory with the blocking member 62 in the position 63 shown in phantom in FIG. 7. When placed in the field, the operator will withdraw the exposed end 64B of shaft 64 to bring blocking member 62 to the position shown in full in FIG. 7. To accomplish this, flange 65 will push, lift, and pass the beveled face of bar end 74. To do this, bar 70 will rotate about trunnions 72 to stretch tension spring 76 and lift bar 70 off fuse wire 78.

Once flange 65 passes bar end 74, tension spring 76 rotates bar 70 back to rest on fuse wire 78. This produces the condition shown in FIG. 9 where spring 68 pushes flange 65 against bar end 74. Bar end 74 continues to fly restrain flange 65 and shaft 64 since bar 70 cannot rotate past fuse wire 78.

In this embodiment, current must be supplied through fuse wire 78 (FIG. 9) in order to release shaft 64 and blocking member 62. Accordingly, this embodiment requires a source of electrical current in order to disable the mine. An arrangement of this type may be appropriate where a high-energy electromagnetic pulse is issued near the mine.

For the embodiment of FIG. 10, the circuit of FIG. 11 will operate in the above described manner to supply or remove current from wires 88. Upon removal of current from wires 88, blocking member 80 will be deployed to prevent firing pin 24 from reaching detonator 26 (FIG. 7).

It is appreciated that various modifications may be implemented with respect to the above described, preferred embodiment. For example, the mine need not have a circular perimeter and may have a perimeter that is square, rectangular, polygonal, elliptical or shaped otherwise. While the blocking member is shown having a rectangular shape, in other embodiments this member can be cylindrical or shaped otherwise. This member may in some cases be formed from a number of separate components. Also a variety of firing pins can be used that are positioned in a number of different locations and supported by a variety of mechanisms. Furthermore, the blocking member can be moved by a variety of mechanisms deriving energy from sources such as torsion springs, elastomers, gravity, electrical charges, magnetic fields, etc. Moreover, the blocking member need not slide linearly, and may rotate or follow a curved path, in other embodiments. In addition, the disclosed electrical circuit can be modified to include fewer or more features and may be fabricated from discrete electrical components, integrated circuits, etc. Also, the various components can have different sizes and shapes depending upon the desired volume, strength, thermal stability, etc.

Obviously, many modifications and variations of the present invention are possible in light of the above teachings. It is therefore to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A mine having the ability to change from an armed state to a safe state without touching of the mine, the mine comprising:

a case;

an explosive charge in said case;

a detonator located adjacent to said explosive charge, wherein firing detonator sets off an explosive chain for exploding said explosive charge;

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- a movable firing pin mounted in said case for striking and firing said detonator in response to pressure directed toward said case;
- a blocking member adapted to move from a retracted position to a blocking position between said detonator and said firing pin in order to prevent firing of said detonator by said firing pin; and
- a driver for moving said blocking member from said retracted position to said blocking position without manual touching of said case.
2. A mine according to claim 1 wherein said blocking member includes a flexible material for isolating said detonator from said firing pin and cushioning any impact of said firing pin on said blocking member.
3. A mine according to claim 1 wherein said explosive charge has an annular shape with a recess, said driver being located at least partially in the recess in said explosive charge.
4. A mine according to claim 1 wherein said driver and said blocking member comprise:
- an electromagnetic device; and
 - a circuit connected to said electromagnetic device for driving said electromagnetic device to produce an electromagnetic force.
5. A mine according to claim 4 wherein said circuit comprises:
- timing means for interrupting said circuit and the electromagnetic force from said electromagnetic device in order to move said blocking member to said blocking position.
6. A mine according to claim 5 wherein said timing means comprises:
- a battery sized to rundown within a predetermined time in order to disable said circuit.
7. A mine according to claim 4 wherein blocking member comprises:
- a magnetized element polarized to be attracted to said electromagnetic device in order to bring together said magnetized element and said electromagnetic device, said electromagnetic device being polarized to produce an electromagnetic force for repelling said magnetized element.
8. A mine according to claim 7 wherein said magnetized element comprises
- a flexible material for cushioning any impact of said firing pin; and said electromagnetic device being stationary within said case.
9. A mine according to claim 8 wherein said electromagnetic device comprises

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- a U-shaped core, and said magnetized element being U-shaped to straddle said flexible material.
10. A mine according to claim 1 wherein said driver comprises:
- a bias member for urging said blocking member from said retracted position to said blocking position.
11. A mine according to claim 10 wherein said driver comprises:
- an electromagnetic device for moving said blocking member in opposition to said bias member.
12. A mine according to claim 10 wherein said driver comprises:
- a releasable catch for holding said blocking member in said blocking position in opposition to said bias member.
13. A mine according to claim 1 wherein said driver comprises:
- a remotely controlled receiver for actuating said driver and moving said blocking member to said blocking position.
14. A mine according to claim 13 wherein said receiver comprises:
- a decoding means for decoding a detected radio signal.
15. A mine according to claim 14 wherein said case comprises:
- a housing; and
 - a cap mounted to reciprocate on said housing, said receiver including an antenna mounted under said cap.
16. A mine according to claim 1 wherein said firing pin is located at an off-centered position in said case, and said driver being located off-center.
17. A mine according to claim 1 wherein said driver comprises:
- a remotely controlled receiver for receiving and decoding an encoded radio signal and for detonating said explosive charge.
18. A mine according to claim 1 wherein said blocking member comprises:
- a manually operable projection extending outside said case for moving said blocking member to said retracted position in order to arm the mine.
19. A mine according to claim 18 comprising:
- a domed snap ring encircling and holding said firing pin, said ring being pressure operable to reverse itself and drive said firing pin toward said detonator; and
 - a booster aligned with said firing pin and said detonator for acting as an intermediary for sustaining the explosive chain from said detonator to said explosive charge.

* * * * *

[54] **GUIDED MISSILE WARHEAD FUZE**

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[73] Assignee: **The United States of America as
represented by the Secretary of the
Navy,** Washington, D.C.

[22] Filed: **Dec. 8, 1971**

[21] Appl. No.: **206,216**

[52] U.S. Cl.:..... **102/81; 102/49.6**

[51] Int. Cl.²:..... **F42C 5/00; F42C 15/06**

[58] Field of Search **102/76, 77, 78, 79,
102/80, 81, 81.2, 49.6**

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Primary Examiner—David H. Brown

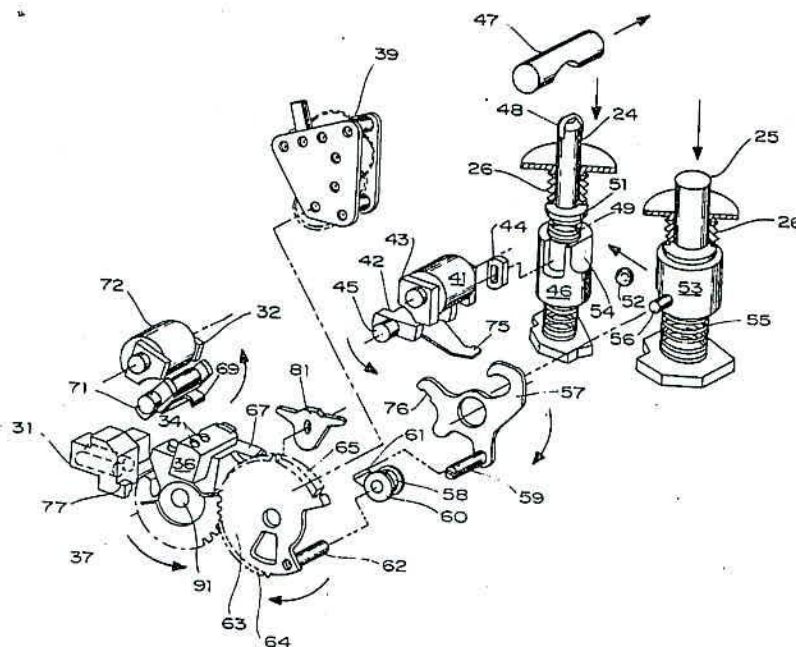
Attorney, Agent, or Firm—R. S. Sciascia; Roy Miller

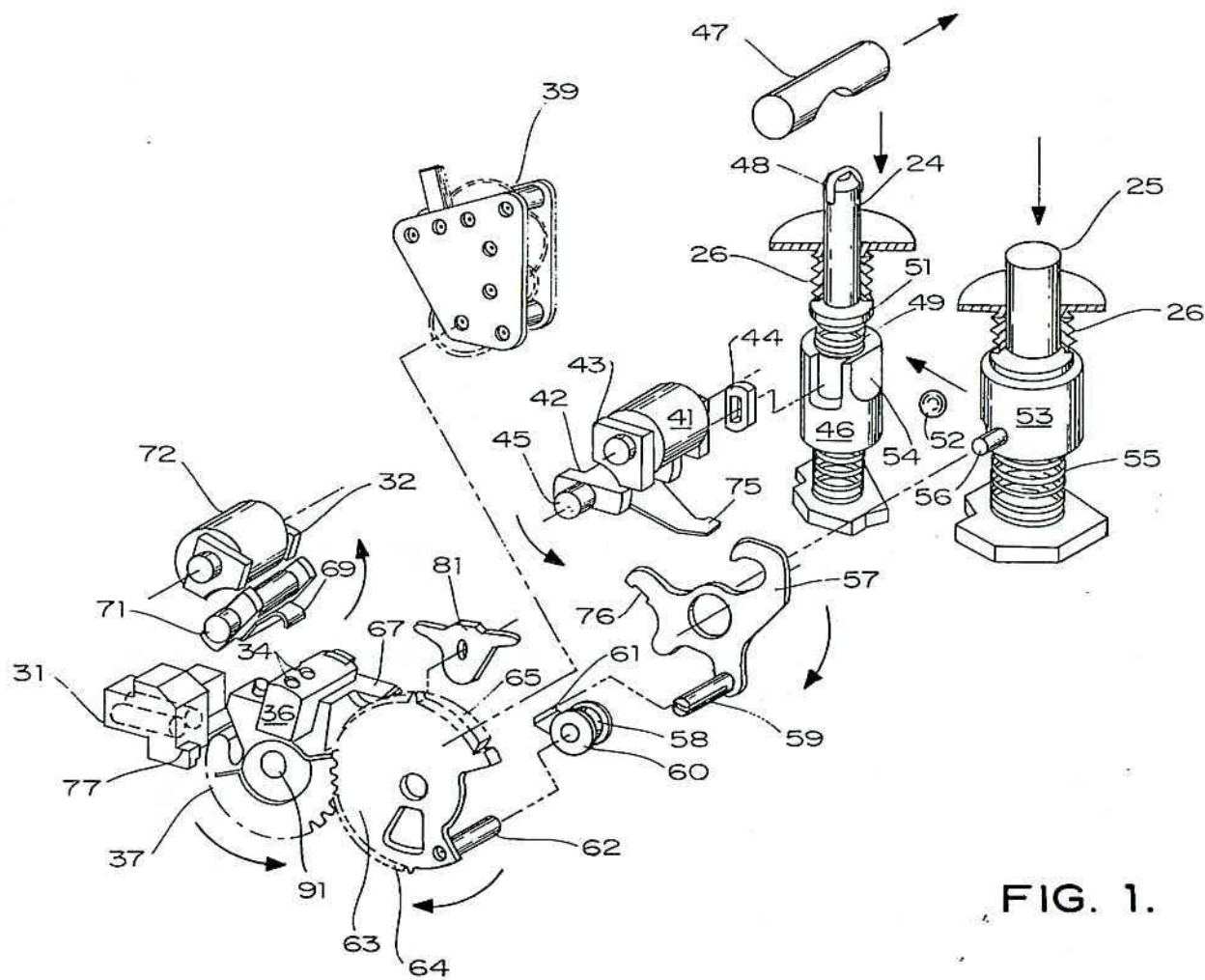
[57]

ABSTRACT

A guided missile fuze comprising a safety-arming mechanism. Upon intentional launch of the missile the explosive train of the fuze is mechanically and electrically aligned, provided prescribed launch and flight events occur and a specific time has elapsed. The first step in the arming cycle of the present invention is the transmittal of intent to launch logic to the fuze by the pilot just prior to launch. This connects power to the fuze and removes a solenoid interlock from the mechanism. At separation the movement of a rod used to enable the rocket motor initiating device removes a second mechanical interlock from the device. After separation initiation of the rocket motor causes hot gas pressure to be applied to a piston located in the rocket motor section external to the fuze and interfacing with a plunger that extends from the safety-arming mechanism. Action of the piston on the fuze plunger applies arming energy to the mechanism. The mechanism is driven to a second solenoid interlock (commit-to-arm condition) impeded by the action of an escape-ment. Completion of arming cannot occur until the second solenoid interlock is removed. The logic signal to remove this interlock is generated by the missile guidance when the missile comes in close proximity to the target.

4 Claims, 16 Drawing Figures





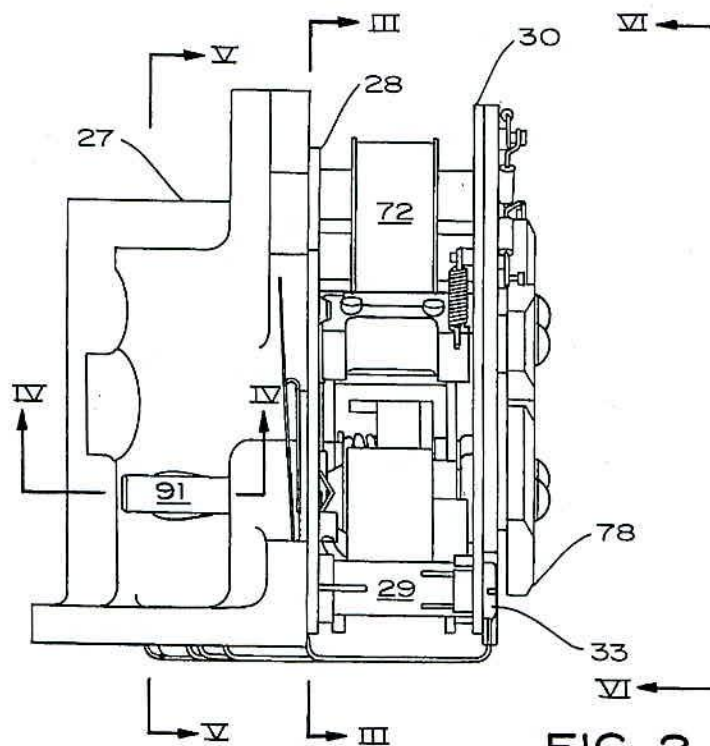


FIG. 2.

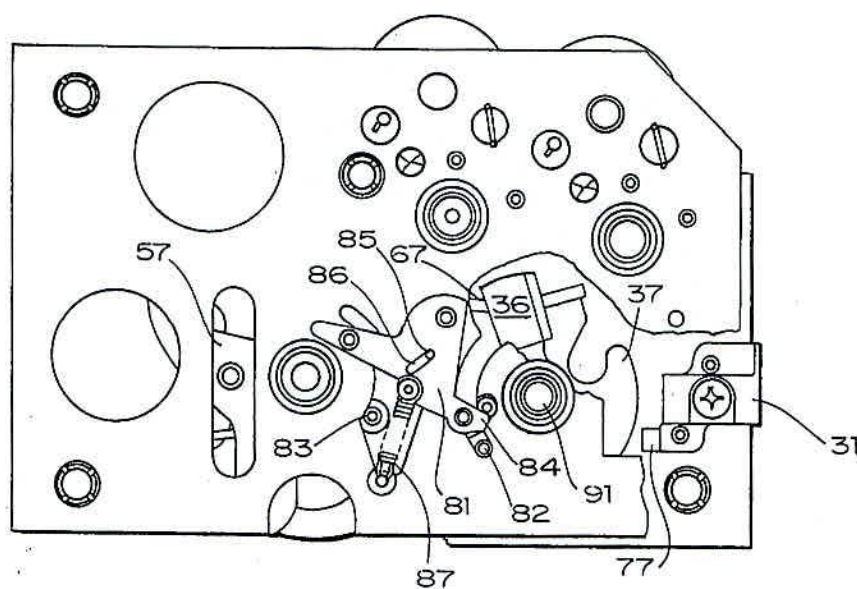


FIG 3.

FIG. 15.

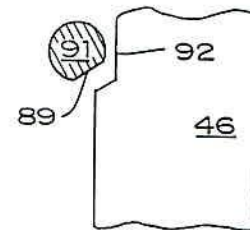
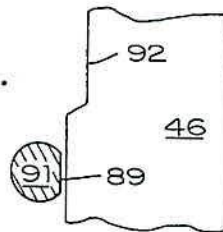


FIG. 16.

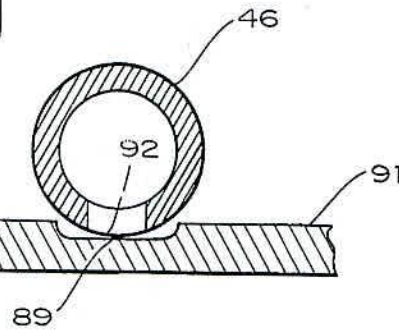


FIG. 4.

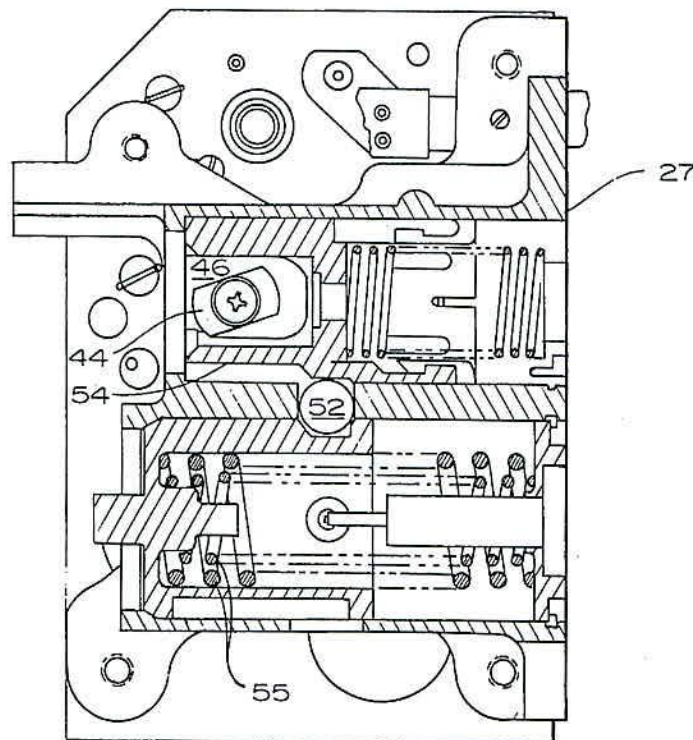


FIG. 5.

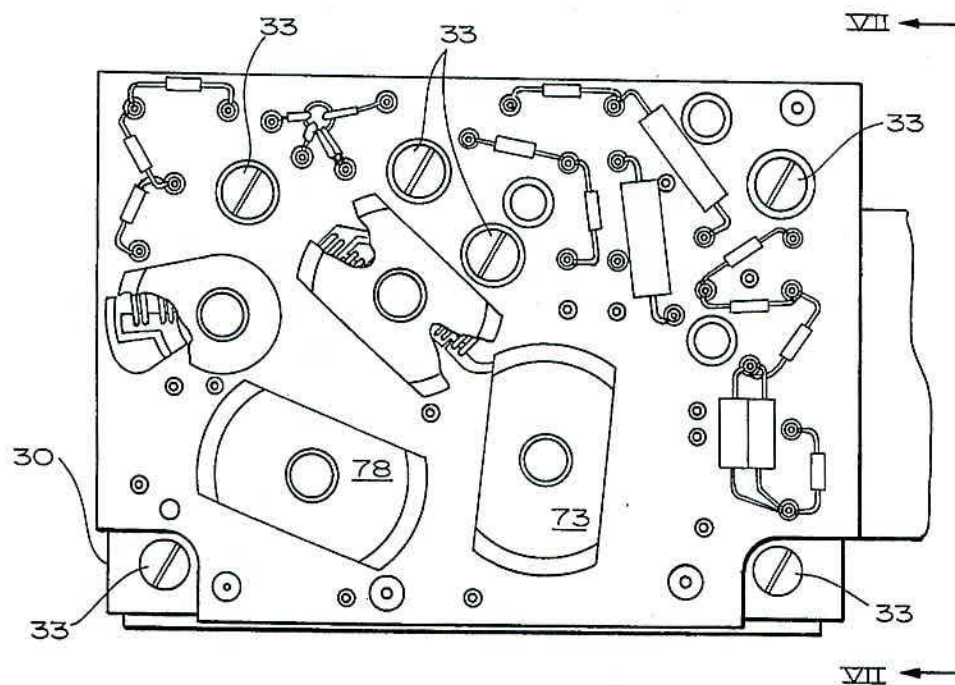


FIG. 6.

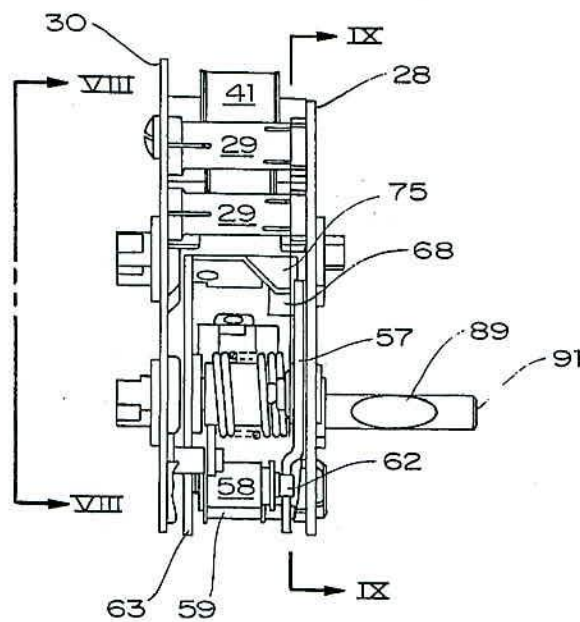
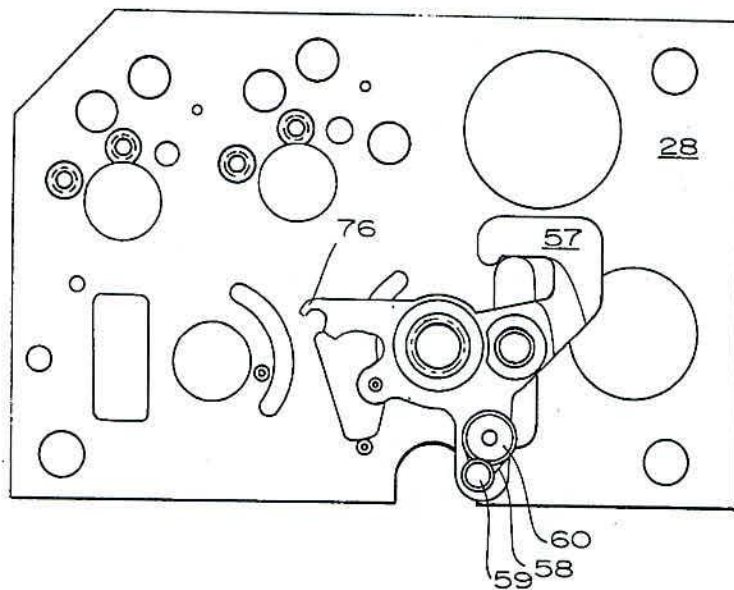
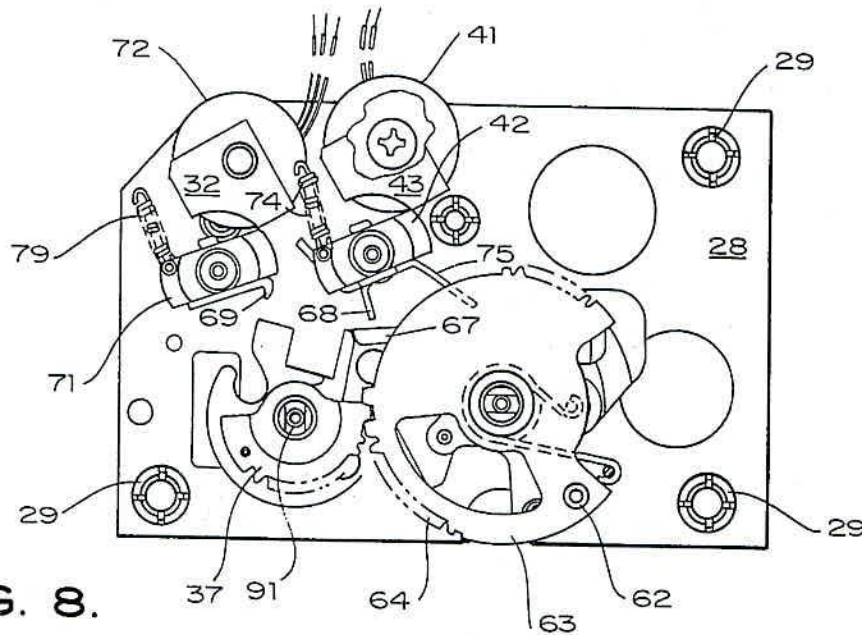


FIG. 7.



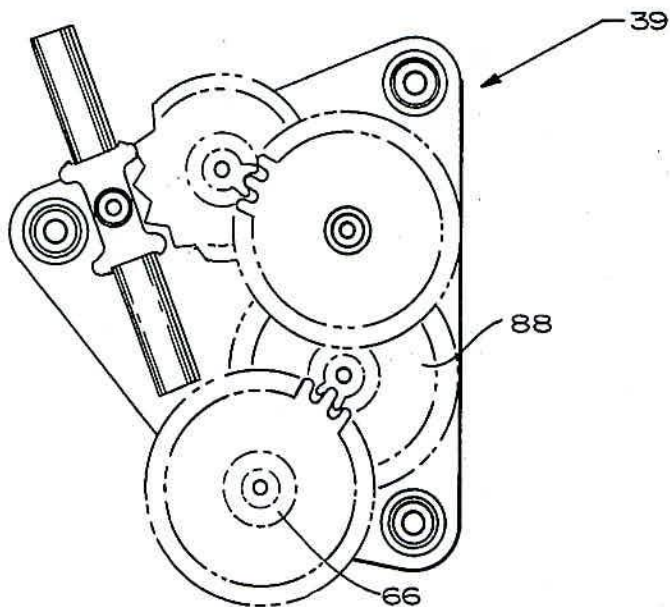


FIG. 10.

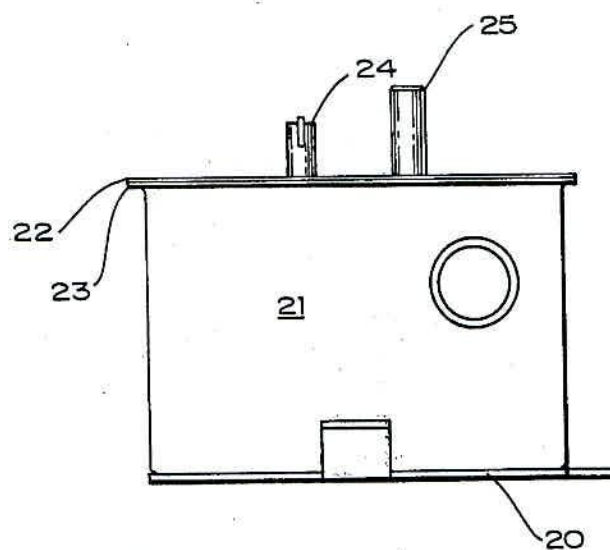


FIG. 12.

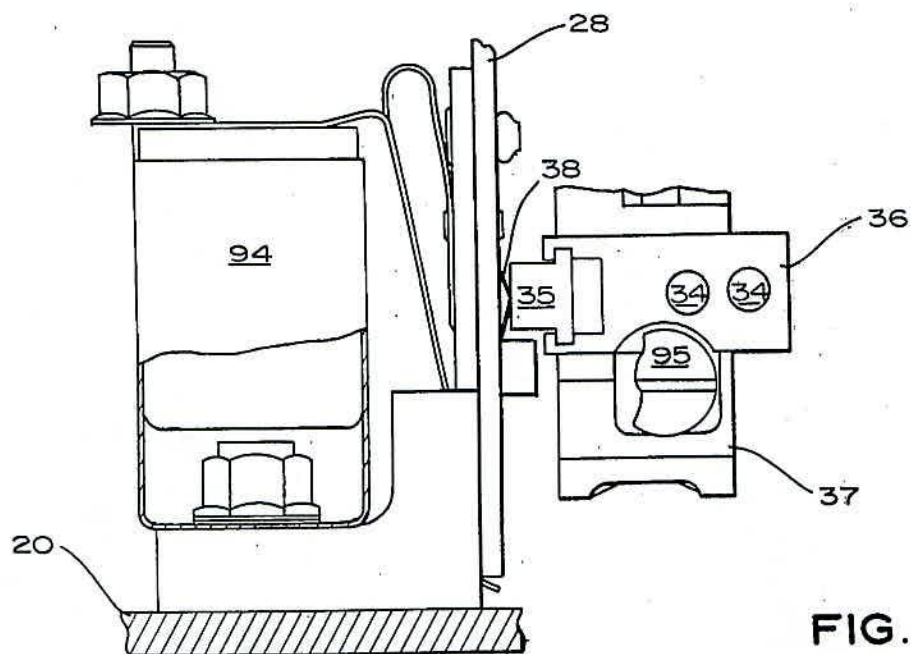


FIG. 11.

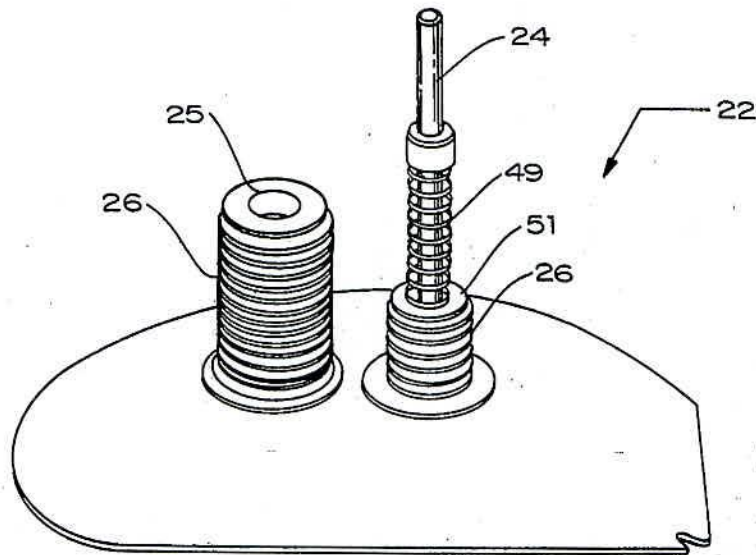


FIG. 13.

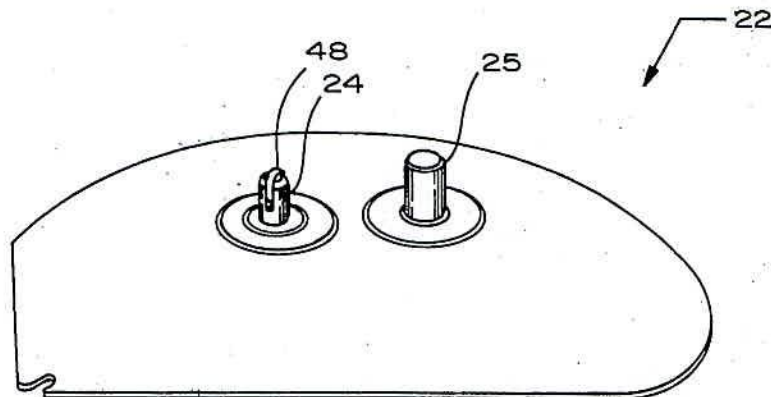


FIG. 14.

GUIDED MISSILE WARHEAD FUZE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to safety-arming devices for use in fuzes.

2. Description of the Prior Art

Many fuzes have been developed for specific missile application. Each were designed to meet the individual missile flight and function parameters. In many cases modification to existing devices have satisfied the fuzing requirements for advanced or new missiles. The functional parameters of the present missile, however, required the design and development of a new fuze to meet the post launch arming requirements of a low acceleration missile.

SUMMARY OF THE INVENTION

The invention is an electromechanical arming device incorporating provisions for a constant time delay for arming under omnidirectional high g loadings and in-line-out-of-line mechanical and electrical circuitry features.

The arming cycle of the present invention includes the transmittal of intent to launch logic to the fuze by the pilot just prior to launch. This event connects power to the fuze and removes a solenoid interlock from the mechanism. At separation, the movement of a rod used to enable the rocket motor initiating device removes a second mechanical interlock from the device. After separation, initiation of the rocket motor causes hot gas pressure to be applied to a piston. This piston is located in the rocket motor section external to the fuze and interfacing with a plunger that extends from the safety-arming mechanism. Action of the piston on the fuze plunger applies arming energy to the safety-arming mechanism. The safety-arming mechanism is driven to a second solenoid interlock (commit-to-arm position) impeded by the action of an escapement. Completion of arming cannot occur until the second solenoid interlock is removed. The logic signal to remove this interlock is generated by the missile guidance when the missile comes in close proximity to the target.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is an exploded view of the invention;

FIG. 2 is a back end view of the invention;

FIG. 3 is a view in the direction of arrows III — III with the plunger housing assembly removed;

FIG. 4 is a cross sectional view in the direction of arrows IV — IV of FIG. 2;

FIG. 5 is a view partly in cross section in the direction of arrows V — V of FIG. 2;

FIG. 6 is a front side view in the direction of arrows VI — VI of FIG. 2;

FIG. 7 is a front end view looking in the direction of arrows VII — VII of FIG. 6 with the plunger housing assembly, circuit board, rotary switches and escapement removed;

FIG. 8 is a front side view looking in the direction of arrows VIII — VIII of FIG. 7 with the front frame assembly removed;

FIG. 9 is a partial section view in the direction of arrows IX — IX of FIG. 7;

FIG. 10 is an elevational view of the escapement assembly;

FIG. 11 is an elevational view of the detonator carrier in the armed position;

FIG. 12 is an elevational view of the container for the fuze;

FIG. 13 is a perspective view of the bottom of the container cover assembly;

FIG. 14 is a perspective view of the top of the container cover assembly;

FIG. 15 is a cross sectional view in the direction of arrows XV — XV of FIG. 4 when the fuze is in the safe condition; and

FIG. 16 is a cross sectional view similar to FIG. 15 but with the fuze not in the safe condition.

DETAILED DESCRIPTION OF THE INVENTION

The mechanism is mounted on stainless steel base plate 20 (FIG. 12) and is enclosed by "D" shaped housing 21 which is attached and hermetically sealed to base plate 20 and to cover assembly 22 by means of seam or overlapping-stitch welding along the upper flange 23. The mechanical input elements, (launch ramp actuator rod 24 and gas piston plunger 25) are hermetically sealed to the cover by means of bellows 26. These elements are guided into the plunger housing 27 which is machined from an aluminum casting. The mechanism is contained between two stainless steel side plates 28, 30 spaced by pillars 29, explosive lead block 31 and solenoid stators 32, 43.

Plunger housing 27 is mounted directly on base plate 20 and the mechanism assembly is cantilevered to the plunger housing by means of attaching screws 33 passing through pillars 29.

Detonators 34 and detonator contacts 35 are contained in a cartridge-type detonator carrier 36 which is installed in arming rotor 37 as one of the last assembly operations. In the safe position the detonators are confined and electrically isolated from all circuitry.

The detonator electrical leads are attached to detonator contacts 35 which provide circuit continuity upon arming by contacting stationary wiper-contact fingers 38 attached to rear side plate 28.

Arming rotor 37 has an approximate 105° rotation divided into two increments:

The first increment is timed and provides for a safe separation of the missile from the launching aircraft and culminates in the commit-to-arm position at the active transfer initiate (ATI) stop 69. Upon receipt of the ATI signal, the ATI stop is removed and the second increment of rotation occurs, the majority of which is not retarded. This results in snap action of the arming rotor to the fully armed position. The detonator out-of-line condition at the ATI stop insures complete out-of-line safety. The snap arming allows a minimum time in which the firing train is in the gray or unsafe out-of-line condition during the arming cycle.

All rotary elements in the fuze mechanism are statically balanced to help provide immunity against g loading, thereby reducing required functional forces and decreasing the functional time variance of the mechanism.

The fuze operates in the following manner:

Immediately prior to launch of the missile from the aircraft, an intent-to-launch (ITL) signal, originating from the aircraft, is applied to ITL solenoid 41, causing ITL solenoid rotor 42 to rotate through approximately 20° with respect to ITL solenoid stator 43. This in turn rotates the interlock sleeve sear 44, attached to the solenoid rotor shaft 45, disengaging sear 44 from inter-

lock sleeve 46. Additionally, the ITL latch 68 attached to ITL solenoid rotor 42 disengages from integral step 67 of arming rotor 37.

During ejection of the missile from the aircraft, a launch ramp cam 47, located outside the fuze, is actuated and applies a force to rotating cam follower 48, attached to the end of actuator rod 24. Actuator rod 24, collar 51, and compression spring 49 transfer the force developed by the launch ramp cam 47 to interlock sleeve 46. Depression of interlock sleeve 46 frees interlock ball 52 which, in the safe condition, is held between interlock sleeve 46 and gas piston plunger 53 by locking ramps 54, preventing depression of the gas piston plunger 53. With the interlock sleeve fully depressed, interlock ball 52 disengages gas piston plunger 53.

Immediately after launch, the rocket motor of the missile ignites and pressure developed by the rocket motor is used to generate a force external to the fuze which is applied to gas piston plunger 53. The gas piston plunger is preloaded in its initial position with a force of approximately 80 pounds by two nested compression springs 55. If the operation of the rocket motor is normal, the force generated is sufficient to overcome the nested springs and the gas piston plunger is depressed. The plunger is held in the depressed position as long as sufficient pressure is maintained by the rocket motor.

Depression of the gas piston plunger and attached cocking arm drive pin 56 rotates cocking arm 57 through approximately 75°.

During rotation of cocking arm 57, spring 58 is unwound from teflon spool 60. The spring is coupled to cocking arm 57 by means of an integral split pin 59, which captures the formed end 61 of the spring.

Unwinding of spring 58 from teflon spool 60 results in a force which draws spool 60, and in turn the spool mounting drive pin 62, in the direction of cocking arm 57. Since pin 62 is located near the periphery of timer drive gear 63, this force results in torque which causes the timer drive gear to rotate.

Gear segment 64 on timer drive gear 63 engages arming rotor 37, and gear segment 65 on the timer drive gear engages the pinion 66 of escapement assembly 39. The escapement assembly retards drive gear 63 and the mechanically coupled arming rotor 37 in their rotation toward the armed position.

ATI latch 69 is attached to ATI rotor 71 of ATI solenoid 72. After the arming rotor 37 rotates approximately 64° toward the armed condition, integral step 67 is engaged by the ATI latch and further rotation toward the armed position is prevented.

Immediately before the arming rotor reaches the ATI latch, the ITL solenoid is deenergized by rotary switch 73 (FIG. 6) attached to the timer drive gear. Extension spring 74 applies a restoring torque to the ITL solenoid rotor, so that when the solenoid is deenergized, the ITL solenoid rotor and the attached ITL latch are returned to their initial position. In this position, tang 75 on the ITL latch engages the cocking arm at 76 and prevents the return of the cocking arm to its initial position. After the rocket motor burns out and rocket motor pressure is lost, the gas piston plunger returns to its initial position independently of the cocking arm. With the cocking arm locked in position by the ITL latch, the timer drive spring 58 remains extended, and driving torque to the arming rotor is maintained. The mechanism is now in the commit-to-arm position.

Upon receipt of the ATI signal, ATI solenoid 72 is energized and ATI rotor 71 with attached ATI latch 69 rotates through approximately 20°. This action disengages the ATI latch from the arming rotor and the arming rotor continues its rotation toward the armed position, still at the rate determined by the retarding effect of the escapement assembly.

After approximately 4° of rotation of the arming rotor past the ATI stop, the segment of teeth in the timer drive gear engaging the escapement assembly terminates contact with the escapement assembly resulting in rapid rotation (snap action) of the arming rotor through the remaining 37° to the armed position. The rate of rotation is limited only by the spring driving torque, friction, and inertial moments of the rotating components.

Detonator carrier 36 containing two electric detonators 34 is attached to the arming rotor 37 by means of an attachment screw 95. When the arming rotor reaches the armed position, the detonator carrier engages a projection 77 of the lead block 31 and further rotation of the arming rotor is prevented. When the armed position is attained, switch 78 driven by the arming rotor disconnects the power supply to the ATI solenoid. The ATI solenoid rotor is returned by the restoring torque exerted by return springs 79. The attached ATI latch engages the arming rotor and locks it in the armed position.

In the armed position, electric detonators 34 are connected to the fuze circuitry by means of a two-pole switch with fixed contacts attached to the detonator carrier assembly. The mating contact fingers 38 of this switch are attached to the rear frame so that the detonators are electrically isolated from the fuze circuitry until the armed position is reached.

An additional safety feature of this invention is provided by fail-safe lever 81. If timer drive gear 63, arming rotor 37 and cocking arm 57 move together as they would if the timer drive gear movement were not restricted by escapement 39, or if gas piston plunger 53 is depressed slowly due to improper rocket motor action, fail-safe lever 81 will not be rotated in a normal manner and will block arming rotor 37 thus preventing arming of the fuze. The addition of this safety feature guarantees proper separation of the missile from the launcher has occurred before the missile can be armed.

The fail-safe lever accomplishes this by the placement of stop and actuating pins relative to the fail-safe lever. During normal arming fail-safe lever 81 is rotated out of the way of pin 82 located on arming rotor 37 by the action of pin 83 located on cocking arm 57. This allows normal functioning of the mechanism. If loss of escapement restriction or slow functioning of the gas piston plunger occurs, the lower end 84 of fail-safe lever 81 is captured between stationary pin 85 mounted on rear frame 28 and the arming rotor pin 82 before 83 can contact the fail-safe lever and in turn blocks the movement of the mechanism. Elongated pivot hole 86 in the fail-safe lever and spring 87 allow full travel of the cocking arm 21 and associated pin 83 without additional rotation of the arming rotor.

Other fail-safe features include:

1. An overriding positive-engagement clutch 88 in the escapement assembly to prevent damage to the escapement by a rapid backup of the gas piston plunger, cocking arm and timer drive gear caused by a loss of rocket motor pressure prior to reaching the

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commit-to-arm position or malfunction of test equipment.

2. A stop 67 on the arming rotor that functions in conjunction with ITL solenoid latch 68 causing locking of the mechanism in the event of power loss to the ITL solenoid during the initial phase of arming.

3. A flattened extension 89 of arming rotor shaft 91 engages the interlock sleeve 46, when the interlock sleeve is in the up position, preventing the arming rotor from rotating out of the safe position. A flattened portion 92 of the interlock sleeve has been removed so that when the interlock sleeve is fully depressed, arming rotor 91 may rotate into removed portion 92.

4. Electrical indication of safe or armed condition provided by two switches located on switch carriers 73, 78 that are normally closed in the safe position. One of the switches (safe indicator) opens when the fuze mechanism starts to move and the other (armed indicator) opens when the fuze reaches the armed position.

The ITL solenoid rotor, that locks the fuze in its safe position, is actuated by a bifilar wound coil (U.S. Pat. No. 3,380,008) that has a shorted secondary winding. Shorting the secondary winding reduces to an acceptable level the inductive voltages generated during opening of the solenoid disconnect switch when actuation is no longer required.

The ATI solenoid rotor that prevents complete fuze arming utilizes a bifilar wound coil similar to that used for the ITL solenoid except the secondary winding is switched in parallel with the primary winding for a short period of time and then shorted. With the primary and secondary windings in parallel, additional starting torque is provided. When the solenoid disconnect switch opens at completion of fuze arming, the shorted secondary winding suppresses the induced voltages.

We claim:

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1. A fuze for a guided missile comprising:
a detonator carrier;

a gas piston plunger for supplying a transferring force from a combustion chamber of said guided missile;
a constant force spring wound about a spool and operatively coupled to said plunger for storing energy for positioning said detonation means in an armed position;

means for extending said spring from said spool;
a pin extending through the center of said spool and being freely rotatable within said spool;

said pin being attached near the periphery of and being parallel to the axis of a timer drive gear for causing said spring to drive said gear as said spring rewinds about said spool; and

means for limiting the dissipation of said energy at a constant rate for delaying the time required by a predetermined amount before arming said fuze.

2. The device of claim 1 wherein said energy dissipation limiting means comprises:

an escapement; and

said escapement is driven by said drive gear.

3. The device of claim 2 wherein:

said detonator carrier comprises gear means;

said gear means being driven by said drive gear;

whereby said detonator carrier is positioned in an armed position.

4. The device of claim 2 further comprising:

means for preventing said carrier from moving to a "commit-to-arm" position if said spring fails to extend while said drive gear is rotated;

whereby said carrier will not move to a "commit-to-arm" position in the event of low combustion chamber pressure from the missile or the absence of said escapement.

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US 20010017090A1

(19) **United States**(12) **Patent Application Publication**
Zehnder et al.(10) Pub. No.: **US 2001/0017090 A1**(43) Pub. Date: **Aug. 30, 2001**(54) **FUSE DEVICE FOR A MORTAR SHELL**(30) **Foreign Application Priority Data**

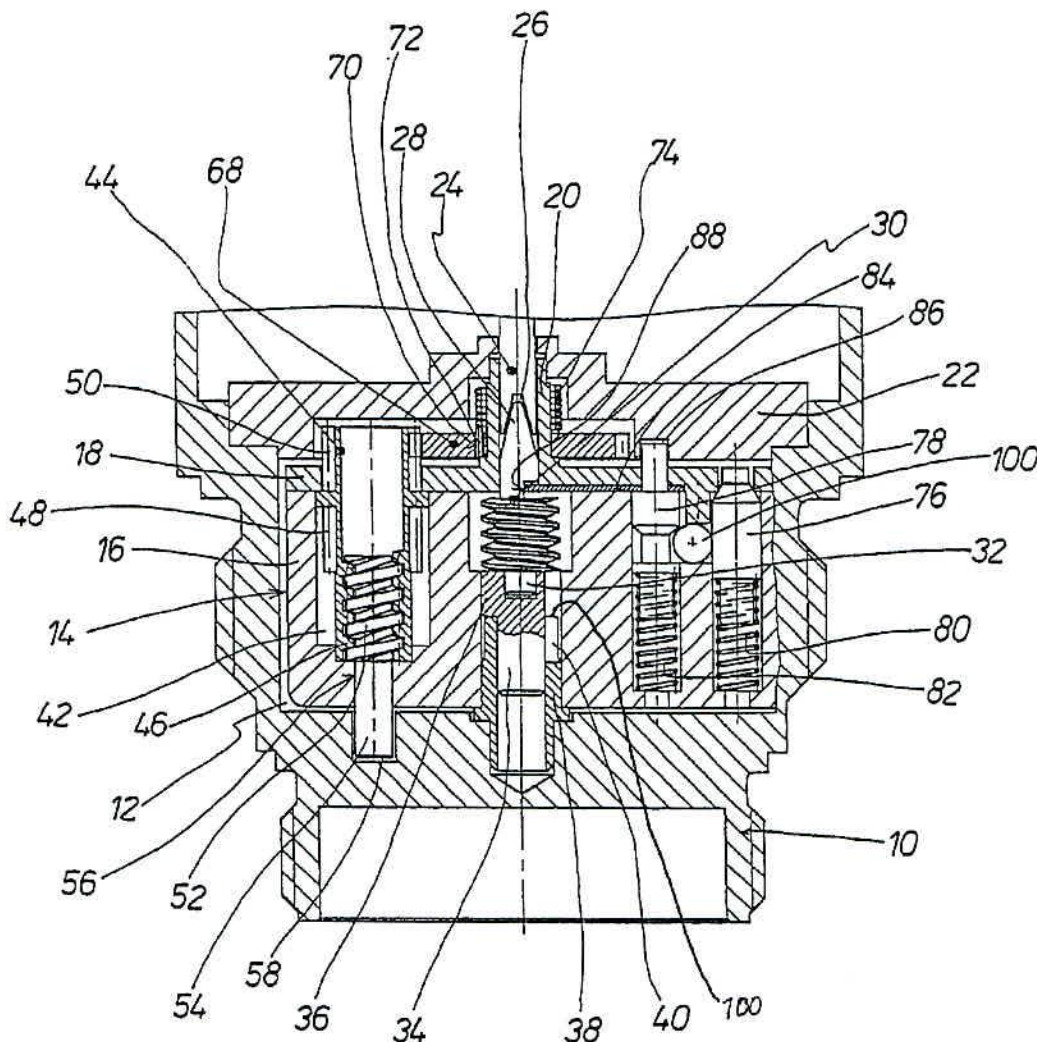
Jan. 5, 2000 (DE)..... 100 00 177.7

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Honi, Aichhalden-Rothenberg (DE);
Horst Moosmann, Schramberg (DE)**Publication Classification**(51) Int. Cl.⁷ **F42C 15/32**(52) U.S. Cl. **102/223**(57) **ABSTRACT**

A fuse device for a mortar shell includes an impact weight carrying a detonation charge and arranged to impact against a firing pin when the mortar shell strikes a target. A safety arm locks the impact weight against movement toward the firing pin in a safety position. The safety arm is movable out of locking relationship with the impact arm to establish an armed condition of the fuse device. Energy for moving the safety arm is stored in a spring. That energy is stored after the mortar shell has been launched, because an impeller is rotated by an air flow generated by the moving mortar shell, and that impeller rotation is transmitted to the spring to store energy.

Correspondence Address:

Alan E. Kopecki, Esq.

BURNS, DOANE, SWECKER & MATHIS,
L.L.P.**P.O. Box 1404****Alexandria, VA 22313-1404 (US)**(21) Appl. No.: **09/754,208**(22) Filed: **Jan. 5, 2001**

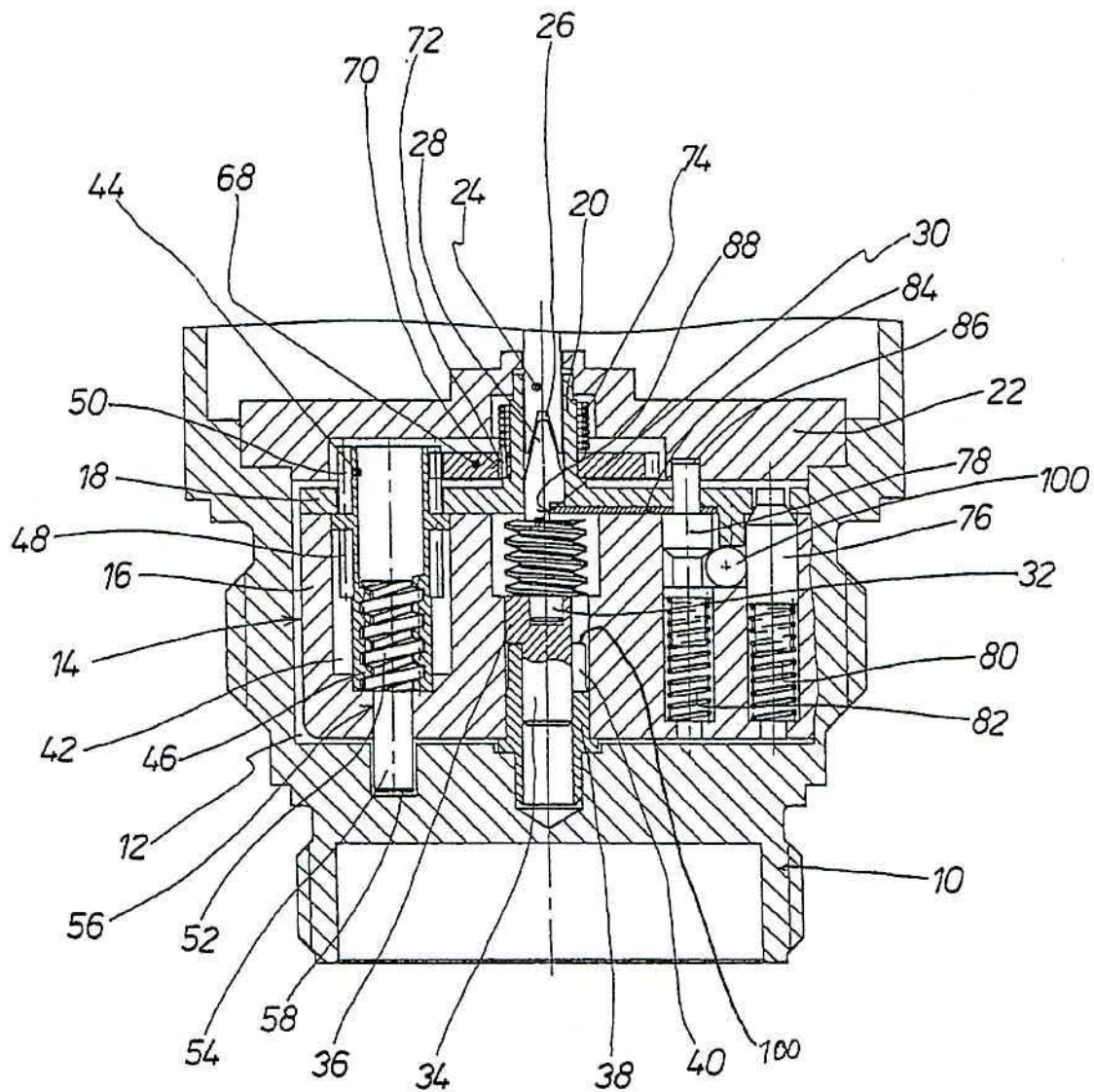


FIG. 1

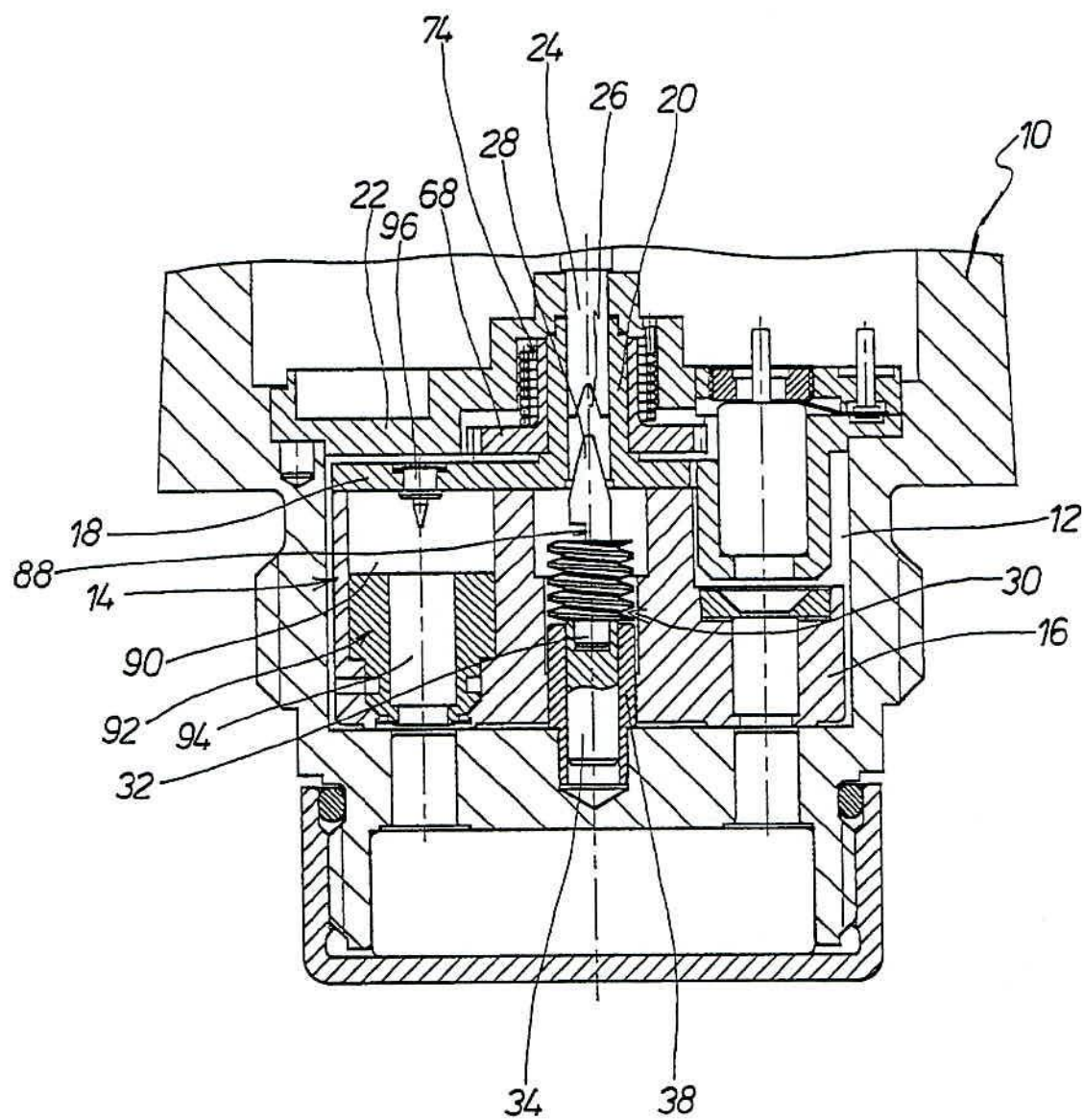


FIG. 5

FIG. 6

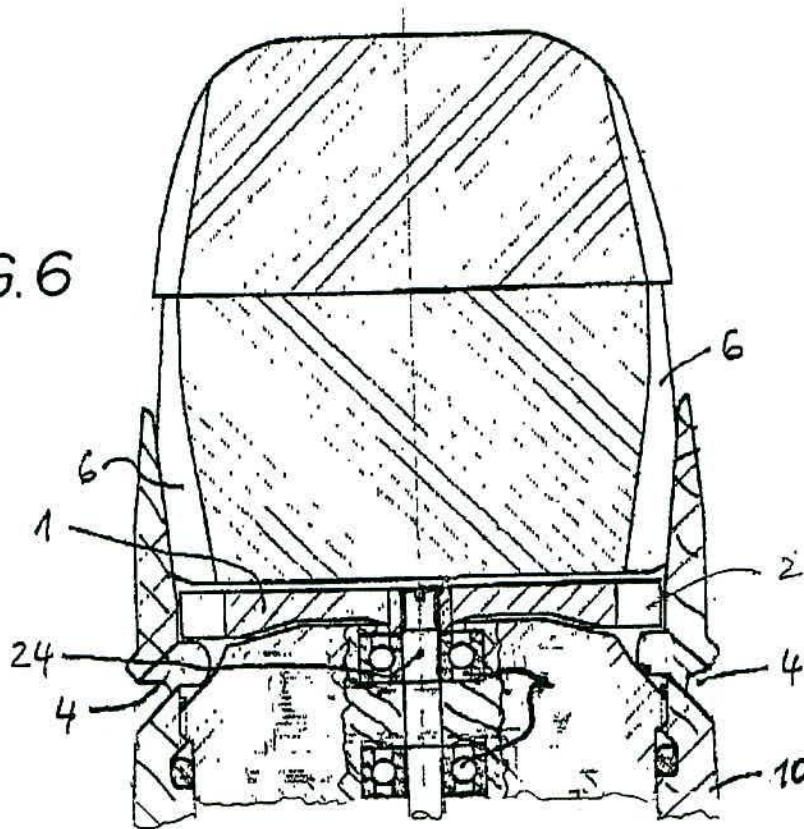


FIG. 7

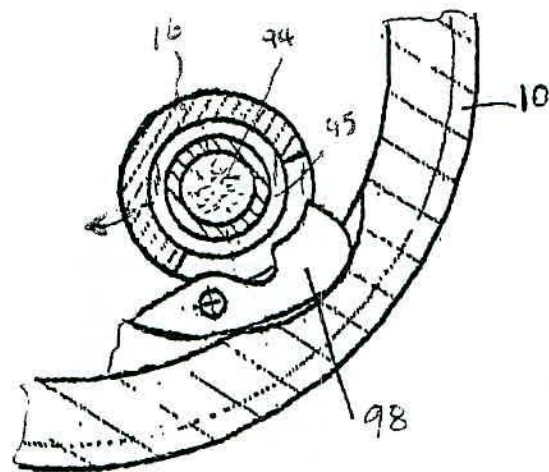
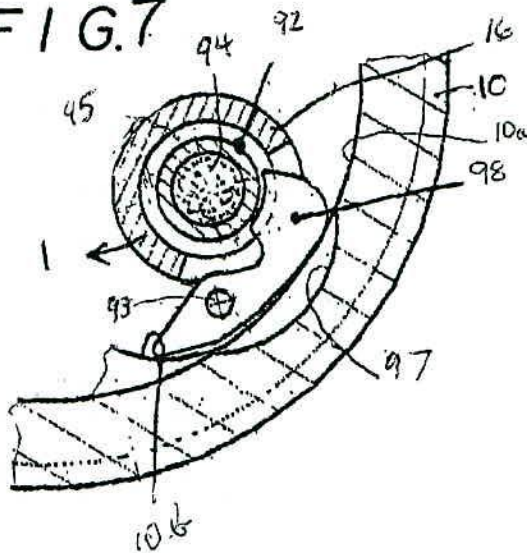


FIG. 8

FUSE DEVICE FOR A MORTAR SHELL

[0001] This application claims priority under 35 U.S.C. § 119 and/or 365 to German Patent Application Serial No. 100 00 177.7 filed in Germany on Jan. 5, 2000; the entire content of which is hereby incorporated by reference.

BACKGROUND OF THE INVENTION

[0002] The invention relates to a fuse device, in particular for a mortar shell.

[0003] Known mortar shells use fuse devices having a spring device which is fitted into the respective fuse device in a mechanically pre-stressed or pre-biased condition. Those known fuse devices are set from the safe position into the armed or live position by means of the pre-biased spring device. The mechanical energy which is stored in the mechanically biased spring device in the safe position adversely influences the safety of the fuse device.

[0004] In consideration of those factors, the object of the present invention is to provide such a fuse device in which preferably no mechanical energy (or only a relatively small amount of mechanical energy) is stored in the spring device in the safe position, so that the safety properties in the safe position of the fuse device are substantially improved.

SUMMARY OF THE INVENTION

[0005] In accordance with the invention, a fuse device for a mortar shell includes a safety element movable from a safety position to an armed position, a spring for producing such movement, and a spring-stressing mechanism for storing energy in the spring to produce the movement. The spring-stressing mechanism comprises an impeller arranged in an air flow path and rotated by an air flow generated in the flow path in response to travel of the mortar shell toward a target. The impeller is operably connected to the spring for stressing the spring in response to being rotated by the air flow.

[0006] The fuse device according to the invention has the advantage that no (or very little) mechanical energy tending to arm the device is pre-stored in the spring device in the safe position of the fuse device so that the safety properties are at an optimum. The mechanical biasing of the spring device which is necessary to set the fuse device from the safe position into the armed position is effected only after leaving the barrel from which the mortar shell is launched, by means of the impeller, by virtue of a suitable operative connection of the impeller to the spring device, which spring device can be in the form of a coil torsion spring.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] Further details, features and advantages will be apparent from the description hereinafter of an embodiment by way of example illustrated in the drawing of the fuse device according to the invention for a mortar shell which is shown in section. In the drawing:

[0008] FIG. 1 is a view in longitudinal section through a rear portion of a fuse device according to the invention, in a safety position,

[0009] FIG. 2 is a view in cross-section through the fuse device,

[0010] FIG. 3 is another view in cross-section through the fuse device, along a section plane spaced axially from that of FIG. 2,

[0011] FIG. 4 is a view in longitudinal section similar to FIG. 1 to show the safe position of the fuse device,

[0012] FIG. 5 is a view in longitudinal section similar to FIG. 4 to show the armed position of the fuse device,

[0013] FIG. 6 is a view in longitudinal section through a front portion of the fuse device,

[0014] FIG. 7 is an enlarged fragmentary view taken along line VII-VII in FIG. 4 showing a safety lever in a safety position, and

[0015] FIG. 8 is a view similar to FIG. 7 after the safety lever has been moved out of the safety position.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT OF THE INVENTION

[0016] Described below is a preferred embodiment of a fuse device for a mortar shell, wherein a spring employed to transform the fuse device into an armed state is not pre-stressed prior to launching of the mortar shell, but rather becomes stressed after launch by the action of a rotary impeller 1 (FIG. 6) that is rotated by the action of an air flow generated by the motion of the launched mortar shell. That rotation is transmitted to the spring by a rotation transmitting mechanism, or arming drive (described in detail below), in order to wind up the spring and store energy therein.

[0017] FIG. 1 shows a rear end portion of a mortar shell having an outer casing 10 which forms a receiving space 12 for a fuse device 14. The fuse device 14 includes a safety device housing 16 fixed to a plate 18 having a central sleeve 20. The central sleeve 20 of the plate 18 and a cover 22 which closes the receiving space 12 serve to support a shaft 24 whose front end is connected to a rotary impeller 1 (see FIG. 6). The shaft 24 is provided at its rear end remote from the impeller with a wedge-shaped slot 26 into which a corresponding wedge-shaped coupling portion 28 of a worm 30, projects in positively locking (i.e., drive-transmitting) relationship, in the safe position of the fuse device, whereby rotation of the impeller is transmitted to the worm 30.

[0018] The worm 30 includes a mounting trunnion 32, located remotely from the wedge-shaped coupling portion 28, and seated for rotation in a blind hole formed in an entrainment member 34. The worm 30 is a self-locking worm capable of rotating in only one direction. The entrainment member 34, formed with a radially outwardly projecting nose 36, is rotationally supported in a fixed sleeve 38 provided with a slot 40. The nose 36 of the entrainment member 34 rests against a front surface 100 of the sleeve 38 in the safety position of the fuse device (see FIG. 1) to keep the coupling portion 28 of the worm disposed within the slot 26 of the shaft 24. But, the nose 36 becomes disposed in the slot 40 in the sleeve 38 to uncouple the worm from the shaft 24 in the armed position of the fuse device 14, as will be explained. That is, the entrainment member is connected to the housing 16 so as to be rotatable therewith (when the housing 16 rotates to establish an armed condition of the fuse device), but the entrainment member is capable of moving axially relative to the housing 16 when the nose 36 becomes aligned with the slot 40.

[0019] The impeller 1 includes outer blade tips 2 that are disposed in an air flow path 4a, 4b formed in the casing 10. Once the mortar shell has been launched, an air flow travels through the flow path and causes the impeller to rotate; that rotation is transmitted to a spring 74, by a mechanism to be described, to stress the spring 74.

[0020] A toothed sleeve 44 of the arming drive is rotatably supported in a mounting space 42 of the housing 16. The toothed sleeve 44 has a female screwthread portion 46 and two external gear rings 48 and 50. A screwthread portion 52 of an arming shaft 54 is screwed into the female screwthread portion 46. The arming shaft 54 extends, in a condition of being prevented from rotating, through a through hole 56 in the housing 16 and terminates within a blind hole 58 of the casing 10 to prevent the housing 16 from rotating relative to the casing 10.

[0021] As can be seen from FIG. 2 the worm 30 is operatively connected in torque-transmitting relationship with the external gear ring 48 of the toothed sleeve 44 of the arming drive by means of a connecting device 60. The device 60 includes a connecting shaft 62 which has at one end thereof a gear ring 64 meshing with the worm 30, and at the other end portion remote therefrom has a worm 66 meshing with the external gear ring 48 on the toothed sleeve 44.

[0022] An output drive gear 68 which is supported rotatably on the central sleeve 20 of the plate 18 (see FIG. 1), is in meshing engagement with the second external gear ring 50 of the toothed sleeve 44 of the arming drive. The output drive gear 68 is formed for example with an arcuate slot 70 which is concentric with respect to the shaft 24 and which has an arcuate opening angle of about 30 degrees. Projecting into the arcuate slot 70 is a rear end portion 72 of a spring 74 which is preferably in the form of a coil torsion spring. The front end portion of the spring device 74 is fixed to the cover 22.

[0023] A first arming pin 76 and a second arming pin 78 are axially movably mounted in the housing 16. The first arming pin 76 is urged forwardly towards the plate 18 by means of an associated coil compression spring 80 and the second arming pin 78 is similarly urged by means of an associated coil compression spring 82. The second arming pin 78 extends through a holder in the form of a safety plate member 84 disposed between the housing 16 and the plate 18 and extends through the plate 18 into a blind hole 86 in the cover 22.

[0024] The worm 30 is formed with a bevel surface 88 against which the safety plate member 84 bears in positively locking relationship in the safety position of the fuse device 14 in order to prevent rotary movement of the worm 30. The safety plate member 84 is held in that position by the arming pin 78.

[0025] An impact weight 92 carrying a detonator 94 is mounted in a receiving space 90 of the housing 16 (see FIGS. 1, 7 and 8). The housing 16 carries a safety arm in the form of a safety lever 98 which is mounted for rotation about a pin 93. In the safety position of the fuse device, the safety lever is engaged within an annular slot 95 of the impact weight 92, to prevent the impact weight from moving forwardly toward a firing pin 96 that is fixed to the plate 18 in alignment with the impact weight 92. The safety lever is

held within the slot 95 by a safety spring (e.g., a tension spring (not shown)). In order to release the lever 98 from the impact weight, the housing 16 must be rotated. When that occurs, and the housing approaches an end of its rotary movement (i.e., in a counterclockwise direction as viewed in FIG. 7), the lever 98 becomes located next to a recess 97 formed in an inner surface 10a of the casing 10. As the housing 16 reaches its terminus (FIG. 8), an end of the lever 98 rides along a cam surface 10b fixed to the inner surface 10a, causing the lever 98 to be swung into the recess 97 and exit the slot 95 to release the impact weight 92 for movement toward the firing pin when the mortar shell impacts against a target.

[0026] The mode of operation of the fuse device 14 is as follows:

[0027] 1) Safe Position:

[0028] In the safe position the first and second arming pins 76 and 78 and the arming shaft 54 are in the positions shown in FIG. 1. The spring device 74 is in a non-stressed condition, that is to say little or no energy is stored in the spring device 74. The safety plate member 86 is in a position wherein it blocks rotation of the shaft 24 and is held in that position by means of the second arming pin 78. In the safe position the impact weight 92 is held fast at a spacing from the firing pin 96 by means of the safety lever 98 (see FIG. 4).

[0029] 2) Armed Position:

[0030] When the mortar shell is fired from a barrel, firstly the first arming pin 76, due to inertia, moves in a rearward direction to compress the associated coil compression spring 80 so that the ball 100 between the first and second arming pins 76 and 78 can move towards the right in FIG. 1. That releases the second arming pin 78, subsequently to the releasing of the first arming pin 76, enabling the pin 78 to move under inertia in a rearward direction to compress its associated coil compression spring 82. When that happens, the second arming pin 78 moves out of the blind hole 86 in the cover 22 and out of the plate 18 and out of the safety plate member 84 and thereby releases the safety plate member 84.

[0031] That means that the shaft 24 and the worm 30 are no longer prevented from rotating. The shaft 24 can therefore be rotated as air impinges against the impeller 1. The worm 30 is thereby rotated by the shaft 24. As the worm 30 rotates, it drives the connecting device 60 which, in turn, rotates the gear 48 of the sleeve 44. The sleeve 44 thus rotates, causing the non-rotatable arming shaft 54 to be driven forwardly, due to the screw thread connection 52 between the arming shaft 54 and the sleeve 44. As a result, the arming shaft 54 is moved away from the hole 58. Also, as the sleeve 44 rotates, its gear 50 rotates the gear 68 to which one end of the spring 74 is connected. Since the lower end of the spring is disposed in the slot 70 of the gear 68, the gear 68 will rotate slightly, e.g., about thirty degrees before that spring end begins to rotate with the gear 68. Since the opposite end of the spring 74 is fixed to the cover 22, the spring will be tightened and stressed as the gear 68 rotates. By way of example, the impeller 1 performs about 600 revolutions, during which the spring device 74 is mechanically stressed. Eventually, the arming shaft 54 is moved out of the hole 58, thereby rendering the housing 16 rotatable.

[0032] The now fully wound spring 74 exerts a rotary counter force against the gear 50 via the gear 68, but since the gear 50 cannot rotate reversely, the spring force causes the housing to rotate in a direction to cam the lever 98 out of locking relationship with the impact weight 92 (see FIG. 8). The housing 16 is rotated by the spring 74 until the housing engages a fixed stop surface (not shown) to prevent further rotation.

[0033] The rotation of the housing 16 also produces rotation of the entrainment member 34 for an angular distance sufficient to bring the nose 36 into alignment with the slot 40. Now there is no force for keeping the coupling portion 28 of the worm within the slot 26 of the shaft 24. The worm thus walks downwardly (axially) along the gear 64, whereupon the nose 36 enters the slot 40, and the worm moves out of driven relationship with the shaft 24, so that the shaft 24 can rotate freely. In the armed condition the entrainment member 34 arrests the safety device housing 16.

[0034] The arcuate slot 70 in the output drive gear 68 serves to ensure an improved start-up performance on the part of the fan wheel shaft 24 because the spring device 74 is only mechanically stressed after the output drive gear 68 has rotated for example through about 30 degrees of angle.

[0035] It is possible for the spring 74 to be pre-stressed in a manner applying a pre-bias tending to rotate the housing in a direction for keeping the lever 98 in locking relationship with the impact weight 92 (i.e., in a clockwise direction as viewed in FIG. 7). Thus, once the housing is released for rotation, its initial rotation will serve to eliminate such pre-bias. In that case the end portion 72 of the spring device 74 can be fixed to the output drive gear 68. The start-up performance can also be improved as desired by such a slight mechanical biasing effect in the opposite direction of rotation; in that case however, as in known fuse devices, the spring device would be mechanically biased, even if only relatively slightly.

[0036] Although the present invention has been described in connection with a preferred embodiment thereof, it will be appreciated by those skilled in the art that additions, modifications, substitutions and deletions not specifically described may be made without departing from the spirit and scope of the invention as defined in the appended claims.

What is claimed is:

1. A fuse device for a mortar shell including a safety element movable from a safety position to an armed position, a spring for producing such movement, and a spring-stressing mechanism for storing energy in the spring to produce the movement, the spring-stressing mechanism comprising an impeller arranged in an air flow path to be rotated by an air flow generated in response to travel of the mortar shell toward a target, the impeller operably connected to the spring for stressing the spring in response to being rotated by the air flow.

2. The fuse device according to claim 1 further including a rotation transmission mechanism actuable for transmitting rotation from the impeller to the spring to stress the spring, and a holder for holding the rotation transmission mechanism against actuation and for releasing the rotation transmission mechanism for actuation in response to firing of the mortar shell.

3. The fuse device according to claim 1 wherein the holder comprises a safety plate held by arming pins in a position for

preventing actuation of the rotation transmission mechanism, the arming pins arranged to release the safety plate in response to firing of the mortar shell.

4. The fuse device according to claim 1 further including an impact weight carrying a detonation charge in alignment with a firing pin, the safety element comprising an arm movable out of locking relationship with the impact weight.

5. A mortar shell comprising:

an impeller mounted to be rotated by an air flow generated in response to movement of the mortar shell upon being launched;

a safety arm movable between a safety position and an arming position;

a coil torsion spring having a fixed end and a movable end;

a spring-stressing mechanism having a drive input end connected to the impeller and a drive output end connected to the movable end of the spring for storing energy in the spring in response to rotation of the impeller;

a safety arm moving mechanism connected between the spring and the safety arm to move the safety arm to its arming position in response to a release of energy from the spring;

a firing pin; and

an impact weight carrying a detonation charge and being arranged to be released for movement toward the firing pin when the safety arm is moved from its safety position to its arming position.

6. A fuse device for a mortar shell comprising:

an outer casing;

a firing pin disposed within the outer casing;

an impact weight carrying a detonation charge and arranged within the outer casing to impact against the firing pin in response to a launched mortar shell impacting against a target;

a housing disposed in the casing for rotation;

a safety arm mounted on the housing and arranged in a safety position for preventing the impact weight from moving into impacting relationship with the firing pin, the safety arm being moveable to a release position in response to rotation of the housing permitting such movement of the impact weight;

an arming shaft arranged for movement between a first position preventing rotation of the housing, and a second position releasing the housing for rotation;

a shaft-moving mechanism actuable for moving the arming shaft from the first position to the second position;

actuating mechanism for actuating the shaft-moving mechanism comprising:

an impeller mounted on the casing to be rotated by an air flow generated in response to travel of the mortar shell toward the target,

a rotation transmission mechanism for transmitting rotation of the impeller to the shaft-moving mechanism for actuating the shaft-moving mechanism,

- a safety pin arrangement for preventing the rotation transmission mechanism from actuating the shaft-moving mechanism until the mortar shell has been launched and for enabling the rotation transmission mechanism to actuate the shaft-moving mechanism in response to launching of the mortar shell, and
- a spring arranged to store energy in response to the transmission of rotation from the impeller to the shaft-moving mechanism, and for releasing the stored energy to rotate the housing in response to a releasing of the housing for rotation.
7. The fuse device according to claim 6 wherein the rotation transmission mechanism comprises a worm operably connected to the impeller to be rotated thereby, a gear connected to the arming shaft for displacing the arming shaft in response to rotation of the gear, and a drive arrangement for transmitting rotation from the worm to the gear.
8. The fuse device according to claim 7 wherein the gear comprises a first gear; there being a second gear connected to the first gear for movement therewith; a third gear arranged to be rotated by the second gear; the spring

comprising a coil torsion spring including a first end connected to the third gear to be rotated thereby, and a second end anchored against rotation.

9. The fuse device according to claim 8 wherein the third gear includes a slot, the first end of the spring disposed in the slot, wherein stressing of the spring is delayed until the third gear rotates by a predetermined angle.

10. The fuse device according to claim 8 wherein the worm and the third gear are coaxial with respect to an axis of rotation of the impeller.

11. The fuse device according to claim 10 wherein the first and second gears are rotatable about a common axis arranged parallel to the axis of rotation.

12. The fuse device according to claim 7 wherein the impeller is fixed to a rotary drive shaft arranged to rotate the worm, the worm being axially movable away from the drive shaft to break a drive connection therewith in response to rotation of the housing by a predetermined angle.

* * * * *



Industria y Comercio
SUPERINTENDENCIA

DELEGATURA PARA LA PROPIEDAD INDUSTRIAL
FORMULARIO PARA OTORGAR PODER A ABOGADO
EN LOS TRÁMITES DE PROPIEDAD INDUSTRIAL

1. Datos del otorgante:

☐ Persona Natural

☒ Persona Jurídica

Nombre: Industria Militar - INDUMIL

Representante Legal: ALEJANDRO NAVAS RAMOS

Tipo de empresa: ☐ Micro ☐ Pequeña ☐ Mediana ☒ Otra: EICE

Documento de identificación: ☐ C.C. ☐ C.E. ☒ NIT ☐ Otro Número: : 899.999.044-3

Nacionalidad / País de constitución	Dirección y Domicilio del otorgante	
Colombia	Calle 44 No. 54-11, CAN, Bogotá	
Dirección Electrónica	No. Fax	Número Telefónico
<u>notificaciones@munozab.com</u>	2481211	7496888

2. Datos del apoderado:

Loía Pol Elvire Kandelaft

C.E. 423178

233326 del C. S. de la J.

Apellidos y Nombre

Documento de identificación

Tarjeta Profesional

Nacionalidad / País de constitución	Dirección del apoderado	
Colombiana	Carrera 5 No. 66-17	
Dirección Electrónica	No. Fax	Número Telefónico
<u>notificaciones@munozab.com</u>	2481211	7496888

☒ Autorizo expresamente a la Superintendencia de Industria y comercio para que todas las comunicaciones sean enviadas a través de la dirección de correo electrónico.

2.1. Datos del apoderado:

Diego Muñoz Marroquín

7.688.292 de Neiva

134.000 del C. S. de la J.

Apellidos y Nombre

Documento de identificación

Tarjeta Profesional

Nacionalidad / País de constitución	Dirección del apoderado	
Colombiana	Carrera 5 No. 66-17	
Dirección Electrónica	No. Fax	Número Telefónico
<u>notificaciones@munozab.com</u>	2481211	7496888

☒ Autorizo expresamente a la Superintendencia de Industria y comercio para que todas las comunicaciones sean enviadas a través de la dirección de correo electrónico.

2.2. Datos del apoderado:

Arieth Aroca Almanza

Apellidos y Nombre

36.718.415 de Santa Marta

Documento de identificación

123.758 del C. S. de la J.

Tarjeta Profesional

Nacionalidad / País de constitución		Dirección del apoderado	
Colombiana		Carrera 5 No. 66-17	
Dirección Electrónica		No. Fax	Número Telefónico
notificaciones@munozab.com		2481211	7496888

X Autorizo expresamente a la Superintendencia de Industria y comercio para que todas las comunicaciones sean enviadas a través de la dirección de correo electrónico.

3. Actuaciones en cuestión:

Este poder concierne:

X Todas las solicitudes y/o registros actuales y futuros del otorgante.

☐ La(s) siguiente(s) solicitud(s) y/o registro(s):

4. Alcance del poder:

X Confiero expresamente al apoderado todas las facultades legales para que represente mi(s) interés(es) en la(s) actuación(es) señalada(s) en el punto 3 de este documento, incluyendo:

- ✓ Desistir de la(s) solicitud(es) y de las demás actuaciones.
- ✓ Renunciar a los derechos del registro de signos distintivos o de nuevas creaciones.
- ✓ Sustituir en los mismos términos en que aquí se le confiere el presente poder.
- ✓ Transigir.
- ✓ Recibir.
- ✓ Conciliar
- ✓ Interponer recursos.
- ✓ Contestar oposiciones.

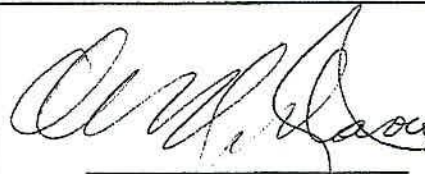
5. Firma:

ALEJANDRO NAVAS RAMOS

Nombre del firmante

3.181.530

Cédula de Ciudadanía



FIRMA

DECRETO

MINISTERIO DE GUERRA
SECRETARIA GENERALMinDefens.
Ministerio de Defensa Nacional

RVADO

DECRETO NUMERO 3135-BIS DE 1954

EL MINISTERIO DE DEFENSA NACIONAL
Es fiel copia tomada de su original

28 OCT 1954

Fecha

Firma

Luis Manuel Neira Nuñez

Secretario General

Por el cual se reforma y adiciona el Decreto Número 2862 del 31 de octubre de 1953 sobre composición y dotaciones del Servicio de Material de Guerra.

EL PRESIDENTE DE LA REPUBLICA DE COLOMBIA,

en uso de sus facultades legales y de las especiales que le confiere el Artículo 22 de la Ley 102 de 1944,

D E C R E T A :

ARTICULO 1º.- Suprímese de la Sección 7ª del Artículo 2º del Decreto 2862 de 1953: LA DIRECCION DE LA INDUSTRIA MILITAR, que continuará funcionando con personería jurídica autónoma como institución oficial, quedando facultado el Gobierno para transformarla en empresa semi-oficial, cuando concurriera a su financiación el capital privado nacional o extranjero y quedará integrada por las siguientes reparticiones:

- 1)- Fábrica de Material de Guerra y Maestranzas Militares
- 2)- Fábrica de Pólvoras y Explosivos
- 3)- Fábrica de Municiones
- 4)- Siderúrgica Militar
- 5)- Guerra Química
- 6)- Academia Politécnica, y
- 7)- Escuela de Aprendices.

ARTICULO 2º.- Para su funcionamiento y dirección, constitúyase la siguiente Junta Directiva:

Vocales con voto:

Ministro de Guerra (Presidente de la Junta)
Comandante General de las Fuerzas Armadas (Vicepresidente de la Junta)
X Jefe del Estado Mayor General de las Fuerzas Armadas
Cuartel Maestre General
Gerente de la Siderúrgica Nacional de Paz de Río
Director del Servicio de Material de Guerra.

Vocales sin voto:

Gerente de la Industria Militar
Sub-Gerente de la Industria Militar
Secretario.

PARAGRAFO.- La Junta Directiva sesionará por lo menos dos veces al mes.

MINISTERIO DE DEFENSA NACIONAL

IMPRESA DEL ESTADO MAYOR GENERAL

ARTICULO 3º.- La Dirección de la Industria Militar tendrá la siguiente dotación y asignación de personal:

Un (1) Gerente, sueldo según grado	
Un (1) Sub-Gerente, sueldo según grado	
Un (1) Secretario General.....	\$ 800.00
Un (1) Adjunto especial Secretario.....	\$ 450.00
Tres (3) Adjuntos Terceros-Mecanotaquígrafos a razón de \$ 332.00 cada uno.....	\$ 996.00
Cuatro (4) Ingenieros Civiles o Asesores Técnicos contratados a \$1.400.00 cada uno.....	\$ 5.600.00
Un (1) Arquitecto proyectista.....	\$ 1.200.00
Dos (2) Adjuntos primeros, Dibujantes Primeros, a \$ 395.00 cada uno.....	\$ 790.00
Un (1) Adjunto Cuarto - Mecanógrafo-archivero..	\$ 297.00

PARAGRAFO 1º.- La Fábrica de Material de Guerra y Maestranzas Militares y la Guerra Química, tendrán las dotaciones y asignaciones fijadas por los Decretos 2862 de 1953 y 291 de 1954; las demás reparticiones de la Industria Militar serán motivo de organización posterior.

PARAGRAFO 2º.- Mientras dure la etapa de las instalaciones, los sueldos de que trata este Artículo serán cubiertos por el presupuesto del Ministerio de Guerra. Posteriormente la Junta Directiva fijará la planta de personal y asignaciones.

ARTICULO 4º.- El capital de la industria estará formado por las existencias de inventario y el fondo rotatorio de la Fábrica de Material de Guerra y Maestranzas Militares, mas las partidas que fije el Gobierno para las compras de los equipos e instalaciones a que haya lugar.

ARTICULO 5º.- El presente Decreto empezará a regir desde la fecha de su expedición.

COMUNIQUESE Y CUMPLASE.

Dado en Bogotá, a 28 OCT 1954

S. Rojas

CARLOS VILLAVECES
MINISTRO DE HACIENDA Y CREDITO PUBLICO.

MinDefensa
Ministerio de Defensa Nacional

EL MINISTERIO DE DEFENSA NACIONAL
Es fiel copia tomada de su original

Fecha 27 FEB 1955

Firma Luis Manuel Neira Nuñez
Secretario General

BRIGADIER GENERAL GABRIEL PARIS CG.
MINISTRO DE GUERRA.

PRESIDENCIA DE LA REPUBLICA
Manuel Lombardi
Auxiliar de la Secretaría General de la Presidencia

FEATURA
Grupo Archivo General

DIA 23 MAR 1955

Coordinador Grupo Archivo General