

DEVICE AND METHOD FOR AUTOMATED REMOVAL OF SAFETY PIN ON BOMB FUSE IN A MORTAR SYSTEM

TECHNICAL FIELD

[0001] The present disclosure relates generally to automated mortar systems, and more specifically, to a device and method for removing a safety pin from a fuse incorporated onto mortar ammunition.

BACKGROUND

[0002] A mortar is a short smooth or rifled bore gun for firing shells (technically referred to as “bombs”) at high angles. A conventional mortar is usually a simple, lightweight, man-portable, muzzle-loaded weapon with a smooth or rifled-bore metal tube fixed to a base plate with a lightweight bipod mount and a sight. Mortars are used to launch explosive shells (i.e. bombs) in high-arching ballistic trajectories. They are typically used as indirect fire weapons for close fire support with a variety of ammunition.

[0003] The Super Rapid Advanced Mortar Systems (SRAMS) is a 120mm smooth bore semi-automatic mortar which is integrated onto vehicle platforms and used as embedded organic fire support. While conventional mortar systems rely on crew manually loading mortar ammunition through the barrel’s muzzle, the SRAMS uses an ammunition loading system which assists the crew in bringing the mortar ammunition to the muzzle to be loaded into the barrel.

[0004] As a semi-automated system, the ammunition loading system requires several manual tasks to function. One must retrieve mortar ammunition, usually stored in storage racks on the vehicle, prepare the mortar ammunition for firing and subsequently load the mortar ammunition into the ammunition loading system. For firing operations, the crew needs to prepare the ammunition by selecting the correct type of mortar ammunition from the storage racks, adjust the correct number of propellant charges attached to the mortar ammunition, set a timer on the time fuses if necessary and remove the safety pin on the fuse as part of the arming of ammunition.

After these steps, the mortar ammunition can be loaded onto the ammunition loading system's tray, which then loads the mortar ammunition into the barrel to be fired.

[0005] To overcome the onerous and error prone process of preparing the mortar ammunition and loading the mortar ammunition into the ammunition loading system's tray, an Ammunition Handling System (AHS) can be used. The AHS is designed as an "add-on" assembly to the SRAMS and is assembled at the rear of the SRAMS. The AHS can hold the mortar ammunition, select the required mortar ammunition, prepare the mortar ammunition for firing and subsequently load the mortar ammunition onto an ammunition loading system to be loaded into the weapon for firing. Designed as a replacement of the mortar crew (mainly the bomb preparer and bomb loader), the AHS enables the SRAMS to be operated without a crew or with a reduced crew. As an automated system, it improves operational safety, crew protection and overall firing rates.

[0006] Using the AHS, mortar ammunition is first loaded into the magazine via a loading port located at the side of the magazine. An internal carousel contains the mortar ammunition in individual tubes, holding the respective bombs for subsequent processes. The mortar ammunition is individually inserted into each tube and the type of ammunition held by each tube is registered.

[0007] During firing operations, the type of mortar ammunition required for the fire mission is selected by the gun operator through manual controls. The carousel drive system rotates the carousel, moving the bomb tube holding the required mortar ammunition to the time fuse setter where the fuse is set as required. The carousel drive system then cycles the tube to the next position where the mortar ammunition is armed through the safety pin removal mechanism. After these two steps, the tube holding the required mortar ammunition is cycled to the transfer port where an ejector mechanism releases the mortar ammunition to the intermediate arm.

[0008] The intermediate arm holds onto the required mortar ammunition and aligns it in the azimuth of the mortar barrel. The arm then linearly extends and brings the required mortar ammunition to the ammunition loading system where the mortar

ammunition is deposited. Thereafter the mortar ammunition is loaded through the ammunition loading system into the mortar barrel and the firing is conducted. The process of loading through the intermediate arm.

[0009] After the mortar ammunition is fired off, the intermediate arm returns to the transfer port where a second mortar ammunition is transferred to it. Thereafter, the loading and firing process can be repeated.

[0010] A key step required in the automated SRAMS operation process is the need to remove the safety pin on the bomb fuse prior to loading. The safety pin is inserted on the fuse of the bomb and prevents unintended detonation of the bomb. Designs of bomb fuses are depicted in the appended drawings (e.g. FIG. 6A – 7D).

[0011] Removal of the safety pin from the fuse is a multistep, manual process. First, the circular portion of the safety pin wrapped around the fuse must be unraveled. Thereafter, a linear motion away from the fuse is required to pull the safety pin away from the fuse. Currently, the safety pin removal process is designed to be manually completed prior to loading of the bomb into the SRAMS ammunition loading system for loading and firing.

[0012] A need, therefore, exists for an improved device for automatically removing safety pin on a bomb fuse in a mortar system.

SUMMARY

[0013] The following summary is provided to facilitate an understanding of some of the innovative features unique to the disclosed embodiment and is not intended to be a full description. A full appreciation of the various aspects of the embodiments disclosed herein can be gained by taking into consideration the entire specification, claims, drawings, and abstract as a whole.

[0014] One embodiment of the invention is a system for removing a safety pin on a bomb fuse in a mortar system. This system can include (a) a pin removal unit in

contact with the bomb fuse, (b) a rotary unit connected to the pin removal unit at the top via a shaft, wherein the rotary unit rotates the pin removal unit to a predetermined position and (c) a first driving unit to engage or disengage the pin removal unit with the bomb fuse by moving the rotary unit, the shaft and the pin removal unit to a preset distance towards or away from the bomb fuse. The pin removal unit can include (a) a bush connected to the shaft, (b) a wedge profile in contact with the safety pin of the bomb fuse and (c) a spring-loaded joint positioned between the bush and the wedge profile. The spring-loaded joint holds the wedge profile to shaft and transmits the torque from the rotary drive to the wedge profile. The wedge profile can include a contact surface to rest on a surface of the bomb fuse and wedge under the safety pin and an angled surface on which the safety pin slides when the first driving unit moves the pin removal unit and engages with the bomb fuse. The rotation of the rotary unit dislodges the safety pin from the bomb fuse.

[0015] According to an embodiment, the wedge profile has a first protrusion to drive the safety pin away from the bomb fuse during the rotation by the rotary unit.

[0016] According to an embodiment, the system includes a second driving unit to pull the safety pin out from the bomb fuse after the pin removal unit is rotated to the predetermined position.

[0017] According to an embodiment, the wedge profile has a first provisioned hole to engage the safety pin and pull the safety pin out from the bomb fuse based on the rotation of the safety pin unit.

[0018] According to an embodiment, the wedge profile includes a second protrusion to prevent the safety pin from springing away from the bomb fuse based on the rotation of the safety pin unit.

[0019] According to an embodiment, the safety pin enters the first provisioned hole during rotation.

[0020] According to an embodiment, the second protrusion has at least one guide to

engage the safety pin during rotation.

[0021] According to an embodiment, the wedge profile includes a third protrusion to wedge the safety pin.

[0022] According to an embodiment, the safety pin is flicked outwards from the bomb fuse using at least one linear actuator.

[0023] According to an embodiment, the pin removal unit is centered and lowered into the bomb fuse using a disk-shaped guide.

[0024] According to an embodiment, the disk-shaped guide is attached to a lowering arm.

[0025] According to an embodiment, the bomb fuse is inserted into a tube assembly within a magazine of the mortar system such that the bomb fuse in the tube is orientated with safety pin end facing out of the tube.

[0026] According to an embodiment, the orientation of the safety pin is performed during the loading of the bomb into the magazine tubes.

[0027] According to an embodiment, the wedge profile is in contact with the bomb fuse when lowered into the bomb fuse.

[0028] According to an embodiment, the wedge profile is held in contact with the bomb fuse when lowered into the bomb fuse using a spring.

[0029] According to an embodiment, the wedge profile has a second provisioned hole to hold the tip of the safety pin.

[0030] According to an embodiment, the wedge profile has a vertically angled edge to serve to pull the safety pin a small distance out of the bomb fuse through a vertical

motion.

[0031] According to an embodiment, the wedge profile has a pivot to rotate the wedge profile away from the bomb fuse.

[0032] According to an embodiment, the wedge profile has a notch to ensure that during flicking of the safety pin from the bomb fuse, the safety pin remains on the wedge.

[0033] According to an embodiment, the first driving unit is a vertical driving unit.

[0034] According to an embodiment, the second driving unit is a horizontal driving unit.

[0035] Additional embodiments include a method for removing a safety pin on a bomb fuse in a mortar system. The method can include the following steps: (a) inserting, by an automatic mortar handling unit, a bomb into a tube assembly within a magazine of the mortar system, (b) lowering at a preset distance, by a first driving unit, a pin removal unit having at least one wedge profile, (c) allowing an angled surface of the wedge profile to rest on a surfaces of the bomb fuse, (d) engaging, by the first driving unit, the wedge profile on a surface of the bomb fuse, (e) rotating to a predefined position, by a rotary unit, the shaft and the pin removal unit and (f) dislodging the safety pin from the bomb fuse.

[0036] According to an embodiment, the rotary unit and second driving unit perform the following steps: (a) allowing, by the rotary unit, a first protrusion of the wedge profile to drive the safety pin away from the bomb fuse; engaging, by the rotary unit, a first provisioned hole of the wedge profile with the safety pin, (b) engaging, by the rotary unit, at least one guide of at least one second protrusion of the sedge profile with the safety pin, (c) preventing, by the guide of the second protrusion, the safety pin from springing away from the bomb fuse, (d) allowing, by the rotary unit, the safety pin to enter the first provisioned hole and (e) pulling out, by at least one second driving unit, the safety pin from the bomb fuse after the pin removal unit is rotated to the

predetermined position.

[0037] According to an embodiment the linear actuator and the first driving unit performs the steps of: (a) lowering, by the first drive unit, the pin removal unit onto the bomb fuse, (b) centering, by a disk-shaped guide, the pin removal unit into the bomb fuse, (c) holding, by a spring, the wedge profile in contact with the bomb fuse when lowered into the bomb fuse, (d) allowing, by the first driving unit, the safety pin to slide into a second provisioned hole on a third protrusion of the wedge profile, (e) lowering, by a linear actuator, a vertically angled edge of the wedge profile into the safety pin, so that the safety pin is moved a small distance out of the bomb fuse, (f) rotating, by a pivot, the wedge profile out of the bomb fuse, (g) flicking, by the wedge profile, the safety pin from the bomb fuse and (h) allowing, by a notch, the safety pin to remain on the wedge profile when the safety pin is pulled out of the bomb fuse.

[0038] According to an embodiment, the bomb fuse is inserted into a magazine of the mortar system by orienting the bomb fuse in the tube assembly with an end of the safety pin facing out of the tube and removing the safety pin using the safety pin removal unit.

BRIEF DESCRIPTION OF THE DRAWINGS

[0039] The summary above, as well as the following detailed description of illustrative embodiments, is better understood when read in conjunction with the appended drawings. For the purpose of illustrating the present disclosure, exemplary constructions of the disclosure are shown in the drawings. However, the disclosure is not limited to specific methods and instrumentalities disclosed herein. Moreover, those in the art will understand that the drawings are not to scale. Wherever possible, like elements have been indicated by identical numbers.

[0040] **FIG. 1** is a perspective view of a device for removing a safety pin from a bomb fuse in a mortar system, according to an embodiment of the invention.

[0041] **FIG. 2** is a perspective view of a pin removal unit, according to an embodiment of the invention.

[0042] **FIG. 3A** is a perspective view of a pin removal unit installed on the bomb fuse, according to an embodiment of the invention.

[0043] **FIG. 3B** is an enlarged perspective view of the pin removal unit of **FIG. 3A**, according to an embodiment of the invention.

[0044] **FIG. 4A** is a top cross-sectional view of a wedge profile of the pin removal unit of **FIG. 2**, according to an embodiment of the invention.

[0045] **FIG. 4B** is a sectional view of a wedge profile of the pin removal unit taken along A-A of **FIG. 4A**, according to an embodiment of the invention.

[0046] **FIG. 5** is a side view of a wedge profile of the pin removal unit of **FIG. 2**, according to an embodiment of the invention.

[0047] **FIG. 6A** is a perspective view of a bomb fuse, according to an embodiment of the invention.

[0048] **FIG. 6B** is a perspective view of a safety pin of the bomb of **FIG. 6A**, according to an embodiment of the invention.

[0049] **FIG. 6C** is a perspective view of a bomb fuse, according to an embodiment of the invention.

[0050] **FIG. 6D** is a perspective view of a safety pin of the bomb of **FIG. 6C**, according to an embodiment of the invention.

[0051] **FIG. 7A** is a perspective view of a bomb fuse, according to an embodiment of the invention.

[0052] **FIG. 7B** is a perspective view of a safety pin of the bomb of **FIG. 7A**, according to an embodiment of the invention.

[0053] **FIG. 7C** is a perspective view of a bomb fuse, according to an embodiment of the invention.

[0054] **FIG. 7D** is a perspective view of a safety pin of the bomb of **FIG. 7C**, according to an embodiment of the invention.

[0055] **FIG. 8A** is a perspective view of an example bomb fuse with safety pin showing the process of removing the safety pin around the bomb fuse, according to an embodiment of the invention.

[0056] **FIG. 8B** is a perspective view of a bomb fuse showing the safety pin extracted from the bomb fuse, according to an embodiment of the invention.

[0057] **FIG. 9** is a perspective view of a device for removing a safety pin from the bomb fuse in a mortar system, according to an embodiment of the invention.

[0058] **FIG. 10A** is a perspective view of a wedge profile of a pin removal unit installed in the device of **FIG. 9**, according to an embodiment of the invention.

[0059] **FIG. 10B** is a side view of a wedge profile of a pin removal unit installed in the device of **FIG. 9**, according to an embodiment of the invention.

[0060] **FIG. 11A** is a top view of a wedge profile of a pin removal unit installed in the device of **FIG. 9**, according to an embodiment of the invention.

[0061] **FIG. 11B** is a side view of a wedge profile of a pin removal unit installed in the device of **FIG. 9**, according to an embodiment of the invention.

[0062] **FIG. 12A** is a perspective view of a bomb fuse before removing the safety pin, according to an embodiment of the invention.

[0063] **FIG. 12B** is a perspective view of a wedge profile of **FIG. 10A** installed in the bomb fuse of **FIG. 12A**, according to an embodiment of the invention.

[0064] **FIG. 13A** is a perspective view of a wedge profile of **FIG. 10A** installed in the bomb fuse of **FIG. 12A**, according to an embodiment of the invention.

[0065] **FIG. 13B** is a perspective view of a bomb fuse after removing the safety pin, according to an embodiment of the invention.

[0066] **FIG. 14** is a perspective view of a device for removing a safety pin from the bomb fuse in a mortar system, according to an embodiment of the invention.

[0067] **FIG. 15** is a perspective view of a pin removal unit of **FIG. 14** installed in the bomb fuse of **FIG. 12A**, according to an embodiment of the invention.

[0068] **FIG. 16A** is a perspective view of a bomb tube assembly loaded with a bomb fuse, according to an embodiment of the invention.

[0069] **FIG. 16B** is a perspective view of a bomb fuse showing orientation of the bomb fuse in the bomb tube, according to an embodiment of the invention.

[0070] **FIG. 17** is a perspective view of a pin removal unit of **FIG. 14** installed in the bomb fuse of **FIG. 12A**, according to an embodiment of the invention.

[0071] **FIG. 18** is sectional view of a device for removing a safety pin of **FIG. 14**, according to an embodiment of the invention.

[0072] **FIG. 19** is an enlarged view of a pin removal unit of **FIG. 18**, according to an embodiment of the invention.

[0073] **FIG. 20** is a side view of a device for removing a safety pin showing the pin in a mortar system, according to an embodiment of the invention.

[0074] **FIG. 21** is a side view of a device for removing a safety pin demonstrating removal of the pin, according to an embodiment of the invention.

[0075] **FIG. 22A** is a perspective view of a wedge profile of the pin removal unit of device of **FIG. 15**, according to an embodiment of the invention.

[0076] **FIG. 22B** is a top view of a wedge profile of **FIG. 22A**, according to an embodiment of the invention.

[0077] **FIG. 22C** is a side view of a wedge profile of **FIG. 22A**, according to an embodiment of the invention.

[0078] **FIG. 22D** is a side view of a wedge profile of **FIG. 22A**, according to an embodiment of the invention.

[0079] **FIG. 23** is a flowchart that describes a method for removing a safety pin from a bomb fuse in a mortar system, according to an embodiment of the invention.

[0080] **FIG. 24** is a flowchart that describes a method for removing a safety pin from a bomb fuse in a mortar system, according to an embodiment of the invention.

[0081] **FIG. 25** is a flowchart that describes a method for removing a safety pin from a bomb fuse in a mortar system, according to an embodiment of the invention.

[0082] **FIG. 26** is a flowchart that describes a method for inserting the bomb into a magazine of the mortar system, according to an embodiment of the invention.

Numerical Reference Features

The following list of index numbers and associated features is intended for ease of reference to FIG. 1 through FIG. 8 and illustrative embodiments of the disclosure:

100	–	magazine system (DM111A5 type bomb)
102	–	pin removal unit
104	–	linear bushing or bush
106	–	shaft
108	–	rotary unit
110	–	frame
112	–	first driving unit
114	–	wedge profile
116	–	spring loaded joint
112	–	first driving unit
118	–	bomb fuse
120	–	safety pin
130	–	bomb fuse (DM111A5 type bomb fuse)
132	–	safety pin
134	–	angled surface
136	–	coned surface
138	–	protrusion
140	–	bomb fuse (DM111A5 type bomb fuse)
142	–	safety pin
150	–	bomb fuse (DM93 type bomb)
152	–	straight section of safety pin
153	–	curved portion of safety pin
152	–	safety pin
160	–	bomb fuse (DM93 type bomb)
162	–	safety pin
152	–	safety pin
162	–	bomb fuse
200	–	magazine system (DM93 type bomb)
202	–	pin removal unit
204	–	shaft

206	–	shaft
208	–	rotary unit
212	–	first driving unit
214	–	wedge profile
222	–	second driving unit
252	–	protrusion
254	–	protrusion
256	–	first guide
258	–	second guide
260	–	protrusion
262	–	provisioned hole
300	–	bomb fuse
302	–	safety pin
400	–	magazine system (alternative design)
402	–	pin removal unit
404	–	mortar ammunition bomb fuse
406	–	linear actuator
408	–	lowering arm
410	–	disk-shaped guide
412	–	first driving unit
420	–	safety pin
422	–	wedge profile
426	–	first horizontal slot
428	–	second horizontal slot
442	–	provisional slot
458	–	bomb tube

DETAILED DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

[0083] The particular configurations discussed in the following description are non-limiting examples that can be varied and are cited merely to illustrate at least one embodiment and are not intended to limit the scope thereof.

[0084] The present invention includes a device and method that enable the

unmanned operation of a mortar, including the 120mm Super Rapid Advanced Mortar System (SRAMS). The device and method allow for the selection, preparation (i.e. charge removal, safety pin removal, fuse setting), loading and firing of 120mm mortar bombs on the SRAMS. The process is automated so that each step, including removal of the safety pin, can be performed without personnel.

[0085] This system can use an automated magazine system that cycles to the correct bomb and transfers the bomb from the magazine to the ammunition loading system on the SRAMS which then automatically loads the bomb. The invention includes a system to automatically arm the mortar ammunition as part of the ammunition preparation process. This is done before the bomb is loaded into the ammunition loading system through the transfer port and intermediate arm.

[0086] In conventional mortar systems, the mortar ammunition arming procedure is performed manually by a weapon loader. For safety purposes, the arming process is conducted at the last stage, just before the mortar ammunition is loaded into the barrel to be fired. This prevents or minimizes the possibility of unintended detonation of the mortar ammunition during vehicle mobility and mishandling of the ammunition. The present invention removes personnel from the entire process. Because “the man in the loop” is absent during the mortar ammunition preparation and loading process, the system includes an automated means of removing the safety pin from the mortar ammunition fuse.

Mortar Fuses

[0087] Mortar ammunition, as with most artillery ammunition, relies on a fuse, located at the topmost portion of the ammunition profile, to initiate the detonation of the explosives when the ammunition reaches its target. These fuses often incorporate layers of safety mechanisms to prevent the unintentional detonation of the explosives. A key safety feature, inherent in most conventional mortar ammunition fuses, is a safety pin, which physically prevents the explosive initiation chain from starting should the safety pin not be removed from the fuse assembly.

[0088] The invention addresses the removal of safety pins in two types of mortar

ammunition fuses. In general, safety pins include two sections, the first section consists of a curved section and the second section consists of a straight section. In this context, the two safety pin designs differ from each other in the first section of the bomb fuse. For example, in the DM111A5, the curve portion amounts to a helical-type curvature which wraps the fuse body in a downward spiral. Conversely, in the DM93 fuse, owing to the presence of a timer dial on the fuse, the curve portion of its safety pin is curved around the fuse body in the horizontal plane and attached the straight section of the safety pin through a flexible ring joint. Both mortar fuse safety pins are constructed out of spring steel which provides for certain elasticity when deformed.

[0089] To arm the mortar ammunition by removing the safety pin from the fuse assembly, a two-stage process is required to be performed. The safety pin must first be dislodged from the fuse body. This is done by pulling the first curved section of the safety pin away from the fuse body. Thereafter, by pulling the safety pin radially away from the fuse body, the entire safety pin can be extracted from the fuse. This arms the mortar ammunition to enable the explosives to detonate when it reaches its intended target.

[0090] **FIG. 6A** and **FIG. 6B** depict a bomb fuse **130** and a safety pin **132** wrapped around the bomb fuse **130**, respectively. **FIG. 6C** and **FIG. 6D** depict alternative views of the bomb fuse **140** and a safety pin **142** wrapped around the bomb fuse **430**, respectively. **FIG. 7A** and **FIG. 7B** also depict examples of bomb fuses **150** and a safety pin **152** wrapped around the bomb fuse **152**. **FIG. 7C** and **FIG. 7D** depict alternative views of the bomb fuse **160** and a safety pin **162** wrapped around the bomb fuse **160**. **FIG. 6A** and **FIG. 6C** depict the DM111A5 type bomb fuse and **FIG. 7A** and **FIG. 7C** depict the DM93 type bomb fuse. **FIG. 6A** and **FIG. 6C** depict the spiral-type safety pin used with the device **100** of **FIG. 1**, while **FIG. 7A** and **FIG. 7C** depict the horizontal-type safety pin used with the device **200** of **FIG. 9**.

[0091] **FIG. 8A** is a perspective view of a bomb fuse **150** with the safety pin **152** showing the process of removing the safety pin from around the bomb fuse. After lowering the pin removal unit on the bomb fuse **150**, the rotary unit rotates the wedge profile such that the curve portion **153** slides out and a straight section **151** remains

attached to the bomb fuse **150**. **FIG. 8B** is a perspective view of a bomb fuse **150** showing the safety pin **152** extracted from the bomb fuse. Further rotation of the pin removal unit pulls out the straight section **151** out of the bomb fuse **150**.

Automated Magazine System with DM111A5 type bomb fuse

[0092] In one embodiment, the system uses an automated magazine system that cycles to the correct bomb and transfers the bomb from the magazine to the ammunition loading system on the SRAMS which then automatically loads the bomb. **FIG. 1** is a perspective view of the safety pin removal system **100**. The system **100** includes a pin removal unit **102**, a rotary unit **108** and a first driving unit **112**. The pin removal unit **102** is in contact with the bomb. The bomb fuse has a safety pin that must be removed before firing the mortar system. The rotary unit **108** is connected to the top of the pin removal unit **102** via a shaft **106**. The rotary unit **108** rotates the pin removal unit **102** to the predetermined position. The first driving unit **112** is used to engage and disengage the pin removal unit **102** with the bomb fuse by moving the rotary unit **108**, the shaft **106** and the pin removal unit **102** to a preset distance toward or away from the bomb fuse.

[0093] The pin removal unit **102** has at least one bush **104** connected to the shaft **106**. The pin removal unit **102** also has a wedge profile in contact with the safety pin of the bomb fuse and a spring-loaded joint positioned between the bush **104** and the wedge profile. The spring-loaded joint holds the wedge profile to shaft **104** and transmits the torque from the rotary drive **108** to the wedge profile. The wedge profile has an angled surface that rest on a surface of the bomb fuse when the first driving unit **112** moves the pin removal unit **102** and engages with the bomb fuse. The rotation of the rotary unit **108** dislodges the safety pin from the bomb fuse.

[0094] In one embodiment the first driving unit **112** is a vertical driving unit used to move the pin removal unit **102** up and down. The vertical drive unit functions to lower and raise the rotary drive **108**, shaft **106** and the pin removal unit **102** from above the magazine to the tube and mortar ammunition. During cycling of the carousel, the rotary drive **108**, shaft **106** and the pin removal unit **102** are raised, allowing for the unimpeded movement of the tubes. When the tube holding the required mortar, ammunition is cycled to the position of the safety pin removal unit **102**, the first driving

unit **112** lowers the rotary drive **108**, shaft **106** and the pin removal unit **102** to a pre-set distance based on the bomb type to contact the fuse. It should be noted that all the elements of the device **100**, that is, the first driving unit **112**, the bush **104**, the rotary drive **108**, shaft **106** and the pin removal unit **102** are installed in a rigid frame **110**.

[0095] The system **100** can be positioned above a magazine and access the individual mortar ammunition stored in the respective bomb tube via an access hole on the top of the magazine. The pin removal unit **102**, that includes the wedge profile attached through a spring-loaded joint, is then rotated via the rotary drive **108**. A linear bushing or bush **106** attached to the base frame guides the rotation motion. The pin removal unit **102** can be rotated two rounds to ensure that the start of the safety pin is picked up by the wedge to be pulled out of the fuse.

[0096] **FIG. 2** is a perspective view of a pin removal unit **102**, according to an embodiment of the invention. The pin removal unit **102** includes a wedge profile **114** and a spring loaded joint **116**. The wedge profile **114** serves as the main component to remove the safety pin from the mortar ammunition and arms the ammunition. The pin removal unit **102** has the wedge profile **114** in contact with the safety pin of the bomb fuse and the spring loaded joint **116** positioned between the bush **104** and the wedge profile **114**. The spring loaded joint **116** holds the wedge profile **114** to shaft and transmits torque from the rotary drive to the wedge profile. **FIG. 3A** is a perspective view of a wedge profile in contact with the bomb fuse **118** for removing a safety pin **120**. **FIG. 3B** shows an enlarged view of the wedge profile **114** of the pin removal unit **102**. The safety pin **120** is also depicted.

[0097] **FIG. 4A** shows a top view of a cross-section of a pin removal unit. **FIG. 4B** is a sectional view of the pin removal unit taken along A–A plane.

[0098] The wedge profile **114** includes a protrusion **138** from a circular cylinder as shown in **FIG. 5**. This protrusion **138** functions as the main working surface which dislodges the safety pin from the fuse body through the rotational motion. An angled surface **134** on the front edge of the protrusion functions to drive the curved section of

the safety pin away from the fuse body during its rotation. An internal coned surface **136** functions to contact the fuse and aligns the rotational motion with the safety pin removal process. It should be noted that the design of the wedge profile **114** shown in disclosed embodiments is not limited to the particular design as shown. Alternative designs that allow alterations in length of protrusion **138**, position and angle of the angled surface **134** can be used to properly function with safety pins of different shapes and sizes.

[0099] Now referring to the **FIG. 1** and **FIG. 2**, the spring loaded joint **116** which holds the wedge profile **114** to the shaft **106** and transmits the torque from the rotary drive **108** is included in pin removal unit **102**. The spring loaded joint **116** includes a set of springs that apply a downward force on the wedge profile **114**. This ensures that the wedge profile **114** can self-align, even if the wedge profile **116** is lowered over the safety pin at the start of the rotation motion. Hence, the spring loaded joint **116** ensures that the wedge profile **114** comes into contact with the start of the safety pin on the angled surface **134** and with further rotations to ensure full engagement with the safety pin. The contact is necessary to dislodge the safety pin.

[00100] Now referring to **FIG. 1** and **FIG. 3A**, the safety pin removal process starts after the pin removal unit **102** is lowered and contacts the bomb fuse **118** on the mortar ammunition. The pin removal unit **102** is then rotated in a clockwise direction for several revolutions. Such process, together with the spring-loaded joint mechanism, ensures that the contact surface (also referred as internal coned surface **136** of **FIG. 4B**) of the wedge profile **114** is wedged under the start of the safety pin **120**, regardless of the starting point of rotation of the wedge profile and start of the safety pin **120**. With the contact surface of the wedge profile **114** wedged under the start of the safety pin **120**, further rotation results in the circular section of the safety pin **120** sliding on angled surface (angled surface **134** of **FIG. 4A**) of the wedge profile **114**. Due to the shape of the safety pin **120**, as the sliding proceeds, a resultant compounded radial force is acted upon the safety pin and the straight section of the safety pin **120** is dislodged from the fuse.

Automated Magazine System (DM93 type bomb)

[00101] **FIG. 9** is a perspective view of a system **200** for removing a safety pin from the bomb fuse in a mortar system, according to another embodiment of the invention. With reference to the fuse type of **FIG. 7A** and **FIG. 7C**, the inclusion of a ring joint between the curved section and the straight section of the safety pin introduces an additional degree of freedom and necessitates additional inclusions in the removal process of the safety pin. Similar to the device **100** of **FIG. 1**, the device **200** of **FIG. 9** includes a pin removal unit **202**, a rotary unit **208** and a first driving unit **212**. The device additionally has a second driving unit **222** and uses a different design for the pin removal unit **202**. Here, the pin removal unit **202** is in contact with the bomb fuse. The bomb fuse has a safety pin that must be removed before firing. The rotary unit **208** is connected to the top of the pin removal unit **202** via a shaft **206**. The rotary unit **208** rotates the pin removal unit **202** to the predetermined position. The first driving unit **212** can engage and disengage the pin removal unit **202** with the bomb fuse by moving the rotary unit **208**, the shaft **206** and the pin removal unit **202** to a preset distance toward or away from the pin removal unit **202**.

[00102] The pin removal unit **202** has at least one bush **204** connected to the shaft **206**. The pin removal unit **202** also has a wedge profile in contact with the safety pin of the bomb fuse and a spring-loaded joint positioned between the bush **204** and the wedge profile. The spring-loaded joint **216** holds the wedge profile **214** to shaft **204** and transmits the torque from the rotary drive **208** to the wedge profile **214**. The wedge profile **214** has an angled surface that rest on a surface of the bomb fuse when the first driving unit **212** moves the pin removal unit **202** and engages with the bomb fuse. The rotation of the rotary unit **208** dislodges the safety pin from the bomb fuse.

[00103] In one embodiment, the first driving unit **212** is a vertical driving unit that moves the pin removal unit **202** upward and downward. The vertical drive unit can lower and raise the rotary drive **208**, shaft **206** and the pin removal unit **202** from above the magazine to the tube and mortar ammunition. During cycling of the carousel, the rotary drive **208**, shaft **206** and the pin removal unit **202** are raised, allowing for the unimpeded movement of the tubes. When the tube holding the required mortar, ammunition is cycled to the position of the safety pin removal unit **202**, the first driving unit **212** lowers the rotary drive **208**, shaft **106** and the pin removal unit **202** to a pre-

set distance based on the bomb type to contact the fuse. It should be noted that all elements of the device **200**, that is, the first driving unit **212**, the bush **204**, the rotary drive **208**, shaft **206** and the pin removal unit **202** are installed on the rigid frame **210**.

[00104] The device **200** is located above the magazine and accesses the individual mortar ammunition stored in the respective bomb tube via an access hole on the top of the magazine. The pin removal unit **202**, consisting of the wedge profile attached through a spring-loaded joint, is then rotated via the rotary drive **208**. A linear bushing or bush **206** attached to the base frame **210** guides the rotation motion. The pin removal unit **202** is rotated two rounds to ensure that the start of the safety pin is picked up by the wedge and is pulled out of the fuse. A second driving unit **222**, for example, a horizontal driving unit can be included **200** to facilitate pulling out the safety pin out of the fuse in the horizontal direction by moving the entire mechanism forward.

[00105] **FIG. 10A** is a perspective view of a wedge profile **214** of a pin removal unit **202** installed in the device **200** of **FIG. 9**, according to an alternative embodiment of the invention. The wedge profile **214** of **FIG. 10A** is similar to that of wedge profile **114** of **FIG. 1** but with additional features to cater for the additional degree of freedom that the safety pin sections introduce.

[00106] A protrusion **260** from a half circle cylinder acts to contact the start of the safety pin for the pin removal process as the wedge profile **214** is rotated. Provisions, in the form of two additional protrusions **252** and **254**, prevent the safety pin from springing away from the fuse body while rotating the wedge profile **214**. A provisioned hole **262** on protrusion **260** with an angled entry, serves to hold the safety pin during the rotation-pin removing process. The two additional protrusions **252** and **254** have guides **256** and **258** to engage the safety pin during rotation and prevent the safety pin from springing away from the fuse body during rotation of the wedge profile **214**.

[00107] **FIG. 10B** is a side view of a wedge profile **214** of a pin removal unit **202** showing one additional protrusion **254**, and the provisioned hole **262** on the protrusion **260**. **FIG. 11A** is a top cross-sectional view of a wedge profile **214** showing the protrusion **260** and additional protrusions **252** and **254**. Similarly, **FIG. 11B** depicts a

side view of an example wedge profile **214** of the pin removal unit **202** showing two additional protrusions **252** and **254** with the guides **256** and **258**.

[00108] As with wedge profile **214**, the pin removal unit **202** is lowered when the tube carrying the mortar ammunition is cycled to the safety pin removal port. The pin removal unit **202** is lowered to the pre-set distance and contacts onto the mortar ammunition fuse. With the pin removal unit **202** contacting the bomb fuse, the wedge profile **214** is rotated and the protrusion **260** can contact the start of the safety pin. Further rotation clockwise of the pin removal unit **202** can wedge the profile under the start of the safety pin and drive the start of the safety pin into the provisioned hole **262**.

[00109] **FIG. 12A** is a perspective view of a bomb fuse **300** before removing the safety pin **302**. **FIG. 12B** is a perspective view of a wedge profile **214** of the pin removal unit of **FIG. 10A** installed in the bomb fuse of **FIG. 12A**. Also depicted are the provisioned hole **262** and protrusions **260** and **252**.

[00110] **FIG. 13A** is a perspective view of a pin removal unit of **FIG. 10A** installed in the bomb fuse of **FIG. 12A** rotated using the rotary device. The wedge profile **214** is rotated further until the wedge profile protrusion **260** is in line with the straight portion of the safety pin at the ring joint position of the safety pin **302**. At this point, the entire mechanism is actuated forward to a pre-set distance with the second driving unit or linear drive **222** which pulls the safety pin **302** horizontally out of the bomb fuse mechanism, arming the ammunition. The wedge profile **214** has two additional protrusions **252** and **254** with the guide **256** and **258** to engage with the safety pin and allow smooth rotation of the safety pin unit. **FIG. 13B** is a perspective view of a bomb fuse **300** after the safety pin **302** has been removed.

[00111] **FIG. 12B** and **FIG. 13A** illustrate the two-part process. First the pin removal unit is lowered to contact bomb fuse **300**, then the pin removal unit is rotated such that the safety pin **300** enters into the provisioned hole **262** of the protrusion **260**. Rotation of the pin removal unit is guided using two additional protrusions **252** and **254** with the guide **256** and **258**. When the end of the rotation is reached, the pin removal unit is moved linearly forward to pull out safety pin.

[00112] It should be noted that the rotary unit can rotate the pin removal unit to the predetermined position. The predetermined position depends on the length of the safety pin. The first driving unit lowers the pin removal unit on the bomb fuse and the distance lowered by the first drive depends on the length of the safety pin. Similarly, the second driving unit is moved horizontally based on the size of the safety pin inserted into the bomb fuse.

[00113] **FIG. 14** is a perspective view of a device **400** for removing a safety pin **420** from the bomb fuse in a mortar system, according to another embodiment of the invention. The device **400** provides an alternate concept in the removal of the safety pin **420** from a mortar ammunition bomb fuse **404**. The concept relies on a wedging and a flicking motion, first to catch hold of the loop end of the safety pin and then to pull the straight body of the pin out of the fuse.

[00114] **FIG. 15** is a perspective view of the pin removal unit **402** of **FIG. 14** installed in the bomb fuse of **FIG. 12A**. Similar to device **100** and **200**, the entire mechanism resides above the magazine attached to a lowering arm **408**. It is lowered to the bomb fuse **404** during the fuse arming process being. A disk-shaped guide **410** of diameter, for example, 122mm, ensures that the entire device **400** is centered as it is lowered into the bomb tube as the guide contacts the inner surface of the bomb tube. A wedge profile **422**, functions to wedge between the curved portion of the safety pin and the fuse body before being flicked outwards through the use of a linear actuator **406**. It should be noted that the first driving unit **412** as depicted in device **100** or **200** of **FIG. 1** or **FIG. 9** can be used to lower the pin removal unit **402** via the lowering arm **408**.

[00115] **FIG. 16A** is a perspective view of a bomb tube assembly **450** loaded with a bomb fuse **404**, according to an alternative embodiment of the invention. The device **400** of **FIG. 14** relies on the mortar ammunition being orientated with an end of the safety pin **420** facing out of the bomb tube **458** as shown in **FIG. 16A**. Orientation must be done during the loading of the mortar ammunition into the magazine tubes. **FIG. 16B** shows the orientation of the bomb fuse **404** in the bomb tube **458**.

[00116] **FIG. 17** is a perspective view of a pin removal unit **402** of **FIG. 10A** installed in the bomb fuse **404** of **FIG. 12A**, according to an alternative embodiment of the invention. As the entire pin removal unit **402** is lowered, the wedge profile **422** will come into contact onto the side of the fuse body. A spring **424** is held along with horizontal slots **426** and **428** provides a constant outwards force to ensure that wedge profile **422** is in complete contact with the fuse body when moved down. As the wedge profile moves down, the safety pin is flicked out from the bomb fuse.

[00117] **FIG. 18** is cross-sectional view of device **400** of **FIG. 14**. **FIG. 19** is an enlarged sectional view of an example pin removal unit **402** shown in **FIG. 18**, according to another embodiment of the invention.

[00118] **FIG. 20** is a side view of a system **400** placed or lowered on the bomb fuse **404** before removing a safety pin **420** from the bomb fuse in a mortar system, according to an embodiment of the invention. Similarly, **FIG. 21** is a side view the system **400** after removing a safety pin **420** from the bomb fuse in a mortar system. As shown in **FIG. 20**, the device **400** is lowered onto the bomb fuse **404** such that the wedge profile **422** engages with the safety pin **420** at an end where safety pin body is attached to the bomb fuse **404**. As shown in **FIG. 21**, the safety pin **420** is flicked out of the bomb fuse **404**. The working of the device **400** shown in **FIG. 20** and **FIG. 21** are explained along with the wedge profile **422** shown in **FIG. 22A**, **FIG. 22B**, **FIG. 22C** and **FIG. 22D**.

[00119] **FIG. 22A** is a perspective view of an example wedge profile **422** of the pin removal unit **402** of device **400** of **FIG. 14**, according to an embodiment of the invention. When the pin removal unit **402** is lowered onto the bomb fuse **404**, the wedge profile **422**, comes in contact with the fuse body and is wedged between the safety pin and the fuse body. The tip of the safety pin **420** will slide into a provisioned slot **442**. As the wedge profile **422** is lowered further by activating the linear actuator **406**, a vertically angled edge **448** shown in **FIG. 22D**, serves to pull the safety pin a small distance out of the fuse body through the vertical motion. **FIG. 22B** is a top view of the wedge profile **422** of **FIG. 22A**. **FIG. 22C** and **FIG. 22D** are side views of a wedge profile of **FIG. 22C**, according to an embodiment of the invention.

[00120] After the pin removal unit **402** is lowered to a pre-set depth, the linear actuator can be activated which results in a connector **432** connecting the linear actuator and the pin removal unit **402**, being actuated downward. The downward motion can cause the wedge profile **422** with pivoted point to be rotated out as shown in **FIG. 21**. As shown in **FIG. 22A**, the wedge profile **422** has provisions in the form of a notch **444** and **446** to ensure that during the flicking motion, the safety pin **420** remains on the wedge profile **422** and that the flicking motion is able to pull out the fuse.

[00121] It should be noted that for the current set of fuses used with the mortar system, the curved section of the safety pin wraps around the fuse body in a helical clockwise manner. This requires a clockwise rotational motion to dislodge the safety pin section. With a different fuse type that has a counterclockwise circular section, a counterclockwise rotational motion coupled with a mirror of surface can be introduced to perform a similar task.

[00122] To allow the present invention to cater to two distinctly different mortar fuses with different safety pin designs, two separate mechanisms are included in the AHS to address the mortar ammunition arming requirements. The wedge profile of **FIG. 1** caters to the spiral type of safety pin (e.g. a DM111A5 type bomb fuse), while wedge profile of **FIG. 9** caters to the horizontal type safety pin (for, e.g. a DM93 type bomb).

[00123] **FIG. 23** is a flowchart that describes the steps in a method **500** for removing a safety pin from the bomb fuse in a mortar system according to an embodiment of the invention. As at step **502**, an automatic mortar handling unit is used to insert a bomb into a tube assembly within a magazine of the mortar system. As at step **504**, a first driving unit is used to lower a pin removal unit having at least one wedge profile. Then, an angled surface of the wedge profile is allowed to rest on a surface of the bomb fuse, as at step **506**. The first driving unit is used to engage the wedge profile on a surface of the bomb fuse, as at step **508**. Then as at step **510**, a rotary unit rotates to a predefined position, the shaft and the pin removal unit. And finally, as at step **512**, the safety pin is dislodged from the bomb fuse.

[00124] FIG. 24 is a flowchart that describes the steps in a method **600** for removing a safety pin from the bomb fuse in a mortar system, according to another embodiment of the invention. As at step **602**, the rotary unit allows a first protrusion of the wedge profile to drive the safety pin away from the bomb fuse. Then as at step **604**, a first provisioned hole of the wedge profile is engaged with the safety pin. Then as at the step **606**, the rotation of the rotary unit engages at least one guide of at least one second protrusion of the wedge profile with the safety pin. The guide of the second protrusion prevents the safety pin from springing away from the bomb fuse, as at step **608**. As at step **610** the rotary unit allows the safety pin to enter the first provisioned hole. Finally, as at step **612**, at least one second driving unit is used to pull out the safety pin from the bomb fuse, after the pin removal unit is rotated to the predetermined position.

[00125] FIG. 25 is a flowchart that describes the steps in a method **700** for removing a safety pin from the bomb fuse in a mortar system, according to another embodiment of the invention. As at step **702**, the first drive unit is used to lower the pin removal unit onto the bomb fuse. Then as at step **704**, a disk-shaped guide will center the pin removal unit into the bomb fuse. As at step **706**, a spring positioned above the wedge profile holds the wedge profile in contact with the bomb fuse when the pin removal unit is lowered into the bomb fuse. The first driving unit allows the safety pin to slide into a second provisioned hole on a third protrusion of the wedge profile, as at step **708**. Then as at step **710**, a linear actuator is used to lower a vertically angled edge of the wedge profile into the safety pin such that it moves a small distance out of the bomb fuse. As at step **712**, a pivot in the connector of the pin removal unit rotates the wedge profile out of the bomb fuse. Then as at step **714**, using a notch to allow the safety pin to remain on the wedge profile when the safety pin is pulled out of the bomb fuse. Finally, as at step **716**, the wedge profile flicks the safety pin from the bomb fuse.

[00126] FIG. 26 is a flowchart that describes the steps in a method **800** for inserting the bomb into a magazine of the mortar system with the safety pin orientated in the correct manner during ammunition replenishment of the AHS, according to an embodiment of the invention. Before implementing the method **700** of **FIG. 25**, the method **800** of **FIG. 26** is performed to prepare the bomb fuse in certain orientation to allow the proper flicking of the safety pin from the bomb fuse. As at step **802**, the bomb

fuse in the tube assembly is oriented at an angle such that an end of the safety pin is facing out of the tube. Then as at step **804**, once the bomb fuse is properly oriented in the tube, the safety pin removal unit is used to remove the safety pin.

[00127] The present invention provides an automated means of removing the safety pin from the mortar ammunition fuse, and hence the whole automated super rapid advance mortar system is automated.

[00128] It will be appreciated that variations of the above disclosed and other features and functions, or alternatives thereof, may be desirably combined into many other different systems or applications. Also, various presently unforeseen or unanticipated alternatives, modifications, variations or improvements therein may be subsequently made by those skilled in the art which are also intended to be encompassed by the following claims.

[00129] Although embodiments of the current disclosure have been described comprehensively in considerable detail to cover the possible aspects, those skilled in the art would recognize that other versions of the disclosure are also possible.

CLAIMS

What is claimed is:

1. A device for removing a safety pin from a bomb fuse on a mortar bomb comprising:

a pin removal unit in contact with the bomb fuse;

a rotary unit connected to the pin removal unit via a shaft, wherein the rotary unit rotates the pin removal unit to a predetermined position;

a first driving unit to engage or disengage the pin removal unit with the bomb fuse by moving the rotary unit, the shaft and the pin removal unit to a preset distance towards or away from the bomb fuse; and

wherein the pin removal unit comprises:

at least one bush connected to the shaft;

a wedge profile in contact with the safety pin of the bomb fuse; and

at least one spring-loaded joint positioned between the bush and the wedge profile, wherein the spring-loaded joint holds the wedge profile to the shaft and transmits torque from the rotary unit to the wedge profile,

wherein the wedge profile comprises:

a contact surface to rest on a surface of the bomb fuse and wedge under the safety pin; and

an angled surface on which the safety pin slides when the first driving unit moves the pin removal unit and engages with the bomb fuse,

wherein rotation of the rotary unit dislodges the safety pin from the bomb fuse.

2. The device of claim 1, wherein the wedge profile has a first protrusion to drive the safety pin away from the bomb fuse during the rotation by the rotary unit.

3. The device of claim 1 further comprising a second driving unit to pull the safety pin out from the bomb fuse after the pin removal unit is rotated to the predetermined position.

4. The device of claim 3, wherein the wedge profile has a first provisioned hole to

engage the safety pin and pull the safety pin out from the bomb fuse.

5. The device of claim 4, wherein the wedge profile comprises a second protrusion to prevent the safety pin from springing away from the bomb fuse based on the rotation of the safety pin unit.

6. The device of claim 5, wherein the second protrusion has at least one guide to engage the safety pin during rotation.

7. The device of claim 1, wherein the wedge profile comprises a third protrusion to engage the safety pin.

8. The device of claim 1, wherein a disk-shaped guide is attached to a lowering arm.

9. The device of claim 7, wherein the wedge profile is held in contact with the bomb fuse when lowered into the bomb fuse using a spring.

10. The device of claim 9, wherein the wedge profile further comprises a second provisioned hole to hold a tip portion of the safety pin.

11. The device of claim 10, wherein the wedge profile further comprises a vertically angled edge to pull the safety pin out of the bomb fuse through a vertical motion.

12. The device of claim 11, wherein the wedge profile has a pivot to rotate the wedge profile away from the bomb fuse.

13. The device of claim 12, wherein the wedge profile has a notch to secure the safety pin on the wedge.

14. The device of claim 1, wherein the first driving unit is a vertical driving unit.

15. The device of claim 3, wherein the second driving unit is a horizontal driving unit.

16. A method for removing a safety pin on a bomb fuse in a mortar system comprising steps of:

inserting, by an automatic mortar handling unit, a bomb into a tube assembly within a magazine of the mortar system;

lowering at a preset distance, by a first driving unit, a pin removal unit having at least one wedge profile;

allowing an angled surface of the wedge profile to rest on a surface of the bomb fuse;

engaging, by the first driving unit, the wedge profile on a surface of the bomb fuse;

rotating at a predefined angle, by a rotary unit, the shaft and the pin removal unit; and

dislodging the safety pin from the bomb fuse.

17. An automated system for removing a safety pin on a bomb fuse in a mortar system comprising:

a) a pin removal unit,

b) a rotary unit,

c) a first driving unit, and

d) a second driving unit,

wherein the rotary unit is connected to a top portion of the pin removal unit with a shaft;

wherein the rotary unit rotates the pin removal unit to a predetermined position;

wherein the first driving unit engages the pin removal unit with the bomb fuse by moving the rotary unit, the shaft and the pin removal unit to a preset distance toward the bomb fuse, and

wherein the safety pin is removed by rotation of the pin removal unit by the second driving unit.

18. The automated system for removing a safety pin on a bomb fuse in a mortar

system of claim 17,

wherein the pin removal unit further comprises a wedge profile that contacts with the safety pin of the bomb fuse,

wherein a spring-loaded joint holds the wedge profile to the shaft and transmits the torque from the rotary unit to the wedge profile,

wherein the wedge profile has an angled surface that engages with the bomb fuse; and

wherein rotation of the rotary unit dislodges the safety pin from the bomb fuse.

19. The automated system for removing a safety pin on a bomb fuse in a mortar system of claim 17, wherein the mortar system uses a DM111A5 type fuse.

20. The automated system for removing a safety pin on a bomb fuse in a mortar system of claim 17, wherein the mortar system uses a DM93 type fuse.

21. An automated method of removing a safety pin on a bomb fuse in a mortar system comprising steps of:

- a) rotating the pin removal unit to a predetermined position using a rotary unit,
- b) engaging the wedge profile on the pin removal unit with the bomb fuse by moving the rotary unit,
- c) rotating the rotary unit to dislodge the safety pin from the bomb fuse,

wherein a spring-loaded joint holds the wedge profile to the shaft and transmits the torque from the rotary unit to the wedge profile,

wherein the wedge profile has an angled surface that engages with the bomb fuse, and

wherein the wedge profile has an angled surface that engages with the bomb fuse.

22. The automated method of removing a safety pin on a bomb fuse in a mortar system of claim 21,

wherein a second driving unit is used in the step of rotating the rotary unit

to dislodge the safety pin from the bomb fuse.

23. The automated method of removing a safety pin on a bomb fuse in a mortar system of claim 21,

wherein a disk-shaped guide is used in the step of engaging a wedge profile on the pin removal unit with the bomb fuse by moving the rotary unit.

24. An automated method of removing a safety pin on a bomb fuse in a mortar system using the device of claim 1.