APPARATUS AND METHOD FOR THE DEMOLITION OF OBJECTS

Filed April 30, 1965

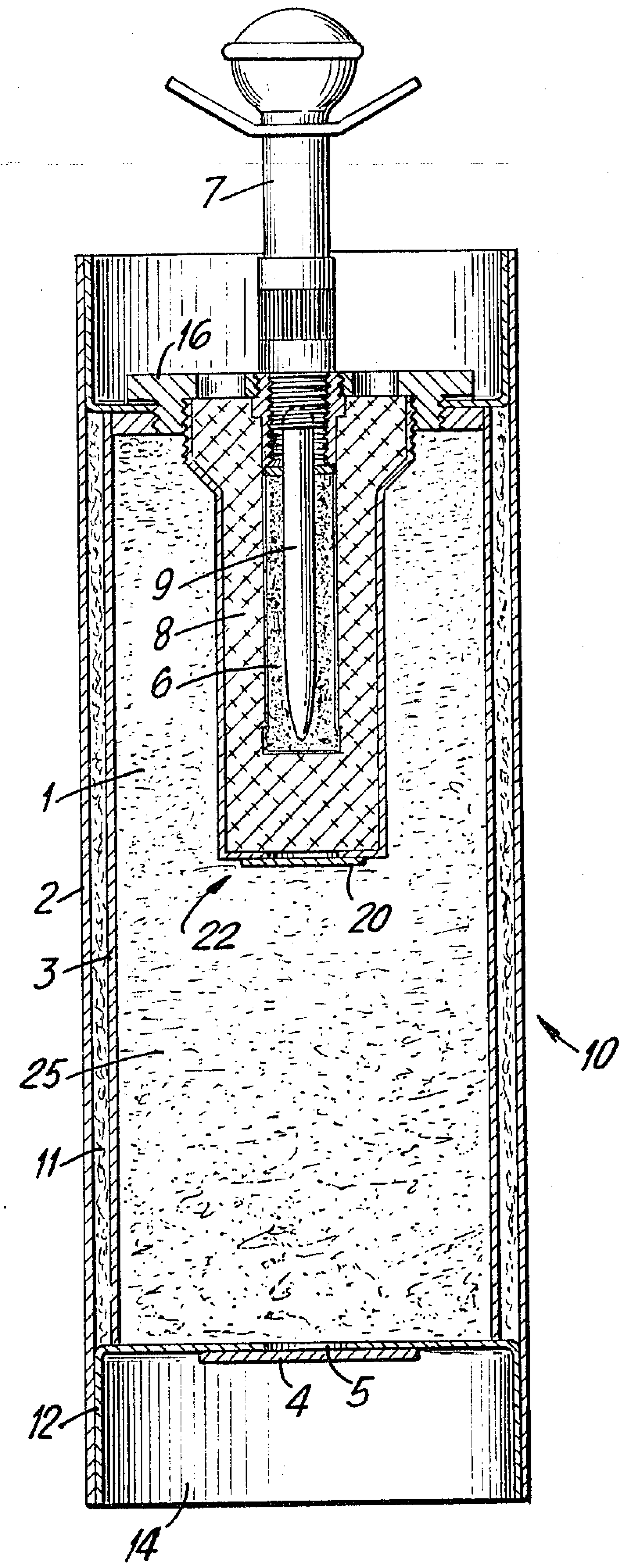

FIG. 1

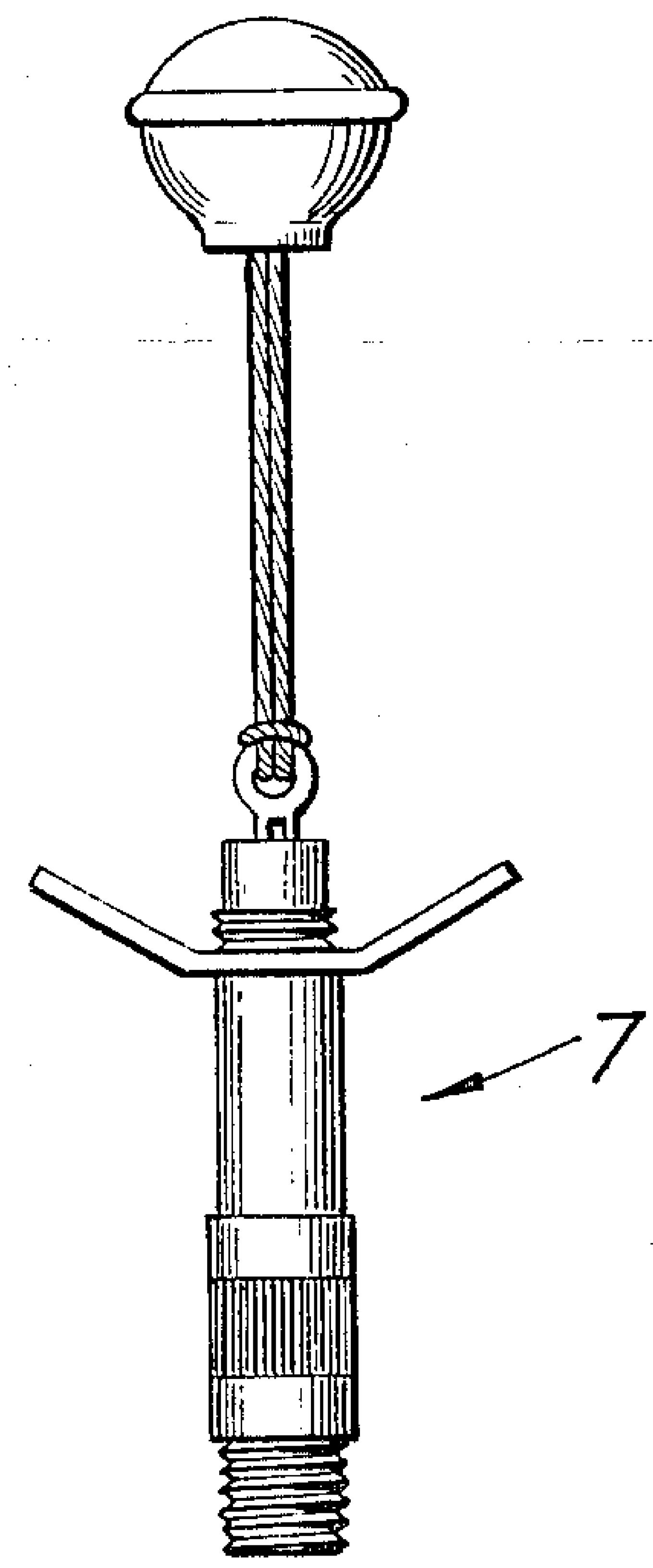

FIG. 2

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United States Patent Office

3,291,050
Patented Dec. 13, 1966

3,291,050

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Filed Apr. 30, 1965, Ser. No. 452,193
10 Claims. (Cl. 102—90)

This invention generally relates to the deliberate destruction or demolition of useful objects and is particularly directed to a method and means for rendering functional objects inoperative.

The term "object" is used herein in a broad sense and includes, for example, machines, vehicles such as trucks, tanks, airplanes and ships, and particularly refers to objects which may be of value to an enemy during wartime such as firearms, including guns, cannons and rifles.

The destruction or demolition of objects frequently becomes necessary in wartime during retreat in order to prevent such objects to fall into the hands of the enemy. Destruction or demolition is customarily accomplished by blowing up the objects in question. This prior art method for rendering inoperative objects which otherwise may be of use to the enemy, is unsatisfactory for several reasons. Thus, for example, destruction by explosive charges is noisy and dangerous and requires skill of the demolition squad. The detonation may reveal a strategic position to the enemy, and unavoidable splinter formation creates, of course, great danger to personnel. Further, destruction by explosive charges requires elaborate preparation, is relatively time consuming and necessitates evacuation of the surrounding area.

Accordingly, it is a primary object of the present invention to overcome the disadvantages of prior art procedures for rendering objects inoperative by providing a method and means for destroying the vital portions of the respective objects in a simple, effective, rapid, substantially noiseless and inexpensive manner.

Generally, it is an object of this invention to improve on the art of deliberate destruction and demolition of objects.

Briefly, the invention provides for a procedure according to which a flow of an extremely hot mass, such as molten metal, is directed along a defined path toward the vital elements of the object to be destroyed, whereby the hot mass fuses with the material of the object to be destroyed, or causes melting thereof, thus rendering the object inoperative.

The hot flow of mass is the end product of an exothermic reaction such as, for example, an aluminothermic reaction. In the aluminothermic reaction, a reaction mass essentially consisting of finely comminuted aluminum such as aluminum powder or shavings and the oxide of a metal, such as iron oxide, is brought to reaction by suitable igniting means, resulting in a vigorous but non-explosive exothermic reaction in which the aluminum reduces the metal oxide to the metallic state while the aluminum, in turn, is oxidized to slag forming aluminum oxide. Extremely high temperatures of about 2500° C. are developed during the reaction and the molten metal thus obtained is then directed toward selected vital areas of the object to be destroyed. The portions of the object which thus come into contact with the liquid metal melt and the material of the molten object intermingles with the liquid metal to cause fusion. The procedure takes place substantially without noise, which is of great importance for the reasons previously advanced. Further, the operation is without danger to personnel in the vicinity of the object so that no evacuation of the area has to be effected.

The invention also provides for a demolition unit for producing the molten metal in situ and to direct it toward the object to be destroyed.

This unit acts both as a storage and shipping container for the reactive mass before use and as a reactor in which the exothermic reaction takes place. The demolition unit essentially consists of a relatively thin walled casing defining a reaction chamber which latter is filled with the reactive mass. The casing is heat and pressure resistant to withstand the extremely high temperatures developing during the exothermic reaction. At least one portion of the unit, however, defines an outlet area which is normally closed by a suitable closure means. When the exothermic reaction has reached a predetermined stage, the high temperature of the then liquid reaction mass causes melting of the closure means so that the molten or liquid mass is free to exit through the outlet area and toward the object to be destroyed. The exothermic reaction is advantageously initiated by a fuse which ignites a suitable material or substance burning with a hot flame. The heat developed by the combustion of this substance in turn initiates the reaction of the reactive mass proper.

In a preferred embodiment of the invention, the outer casing of the unit is fitted with an interior insert or liner which envelops the aluminothermic mass and protects the casing from contact with the hot liquid reaction products during and after the reaction. According to the invention, this insert or liner consists of a material which takes part in the reaction of the mass to a certain extent inasmuch as it is oxidized, thereby forming a high-melting slag layer which prevents lateral break-through of the mass. Such materials are, for example, aluminum, magnesium, alloys of aluminum and magnesium, silicon, chromium or the like. The slag layer thus essentially corresponds to and serves the purpose of a mold which retains the reacting mass within its confines.

According to an optional feature of the inventive construction, lateral flow of the reacting mass may be further prevented by interpositioning a protective layer between the external casing wall and the liner. Such protecting layer may consist of silicate material as, for example, bentonite. The use of bentonite for the indicated purpose is particularly advantageous as the protective layer can then be formed in situ by introducing an aqueous slurry of bentonite powder into a space defined between the liner and the external casing. Upon solidification of the slurry, a strong protective layer is thus formed which may be additionally reinforced by incorporating thereinto glass fibers, jute or the like strengthening materials.

The exothermic reaction is preferably initiated by a delayed action friction or impact igniter.

In accordance with the invention, the outlet area of the inventive unit is located within a mounting portion by means of which the unit can be readily placed or positioned on the object to be destroyed. This mounting portion preferably includes a base or leg portion which projects beyond the outlet area and thus permits the outflowing mass to fall for a distance before actually impinging on the object to be destroyed. The destructive action of the hot mass is thereby increased.

It is of importance in the present invention that the hot mass flows uniformly and quietly and through the outlet area only without causing explosion-like phenomena. For this reason, it is important that the hot reaction mass, within the unit, does not come into contact with organic substances which burn with evolution of gases. The use of such substances is therefore avoided in the inventive construction.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had to the accompanying drawings and descriptive matter in which there is illustrated and described a preferred embodiment of the invention.

In the drawings:

FIG. 1 is a somewhat diagrammatical sectional view through one embodiment of a demolition unit for producing hot, liquid metal to be directed toward an object to be destroyed, and FIG. 2 is an elevational view of a delayed-action igniter.

Referring to FIG. 1, the demolition unit illustrated therein is generally illustrated by reference numeral **10**. The demolition unit **10** comprises a thin-walled casing **2** of sheet metal or the like and has a cylindrical cross section.

An interior liner or insert **3** extends coaxially with the casing **2**. The liner **3** in this embodiment is of aluminum, but, as previously mentioned, magnesium, Al-Mg alloys, silicon, chromium or the like materials which are oxidizable under the reaction conditions could also be used. The liner **3** defines a space with the casing **2** which space is filled with bentonite to form a protective layer **11**. The protective layer **11** is formed in situ by pouring a slurry of bentonite powder and water into the space and permitting the slurry to solidify. Fiber glass, jute or other reinforcing materials may also be incorporated into the slurry to strengthen the layer **11**.

It will be noted that the liner **3** in its bottom region defines an opening or outlet area **5** and a mounting portion generally referred to by reference numeral **12**. The mounting portion **12** is in the form of a flange or base, coextensive with the bottom of the casing **2**, and projects beyond the outlet or exit **5** to form a flow or free-fall space **14** for material exiting through the outlet **5**. The outlet **5** is closed by a sheet metal or the like thin plate **4**.

A reactive mass in powder form indicated by reference numeral **1** is lodged within the cavity **25** defined by the liner **3**. The reactive mass is of a nature such that, upon ignition, a non-explosive exothermic reaction takes place, resulting in a liquid reaction product of extremely high temperature. In the present embodiment, the mass **1** is an aluminothermic mixture comprising finely divided aluminum and iron oxide. As previously noted, the liner **3** is interrupted at at least one area preferably adjacent its bottom region in order to define one or several exit areas **5**. The thickness of the sheet metal of the casing **2** is chosen so that it is strong enough to support the liner **3** and the mass **1**. The material of plate **4** is, however, not capable of withstanding very high temperature. The flange or mounting portion **12** may be placed on an object to be demolished and the unit will thus be self-supporting thereon. The casing **2** is closed partly by the upper extremity of the liner **3** and partly by a cover **16** as indicated at the top of FIG. 1. The cover **16** supports a box-like capsule **22** whose outer defining walls are of a material which melts or burns at relatively low temperatures. The capsule has a bottom opening **20** of low melting material. The capsule box **22** is lined with a layer of solid aluminothermic mass indicated by reference numeral **8**. A quantity of combustible material **6** is placed on the layer **8**. The material **6** is easily ignitable and burns with a hot flame. Such material may, for example, consist of barium peroxide and aluminum. A body **9** of readily ignitable solid substance is imbedded within the material **6**. The body **9** is compressed from aluminum powder and an oxygen-liberating substance. Such oxygen-liberating substances are, for example, dinitrates, dichlorates of alkali metals and alkaline earth metals. A fuse or igniting means **7** projects into the capsule **22** and is in direct contact with the body **9**.

The fuse or igniting means **7** is in the form of a delayed action friction or impact igniter which is shown in greater detail in FIG. 2. FIG. 2 thus illustrates such igniter upon unscrewing of its cap with the tear-off strip. Such delayed action friction or impact igniters are available on the market, for example, in Germany under the designation DM 47/6. Generally, such igniters are actuated by the tearing off of the strip which tensions and releases a spring. The spring in turn causes an impact bolt to strike an ignitable substance which thus is ignited and, in turn, causes ignition of a second ignitable substance. The latter substance, after a predetermined delay period of, for example six seconds, causes ignition of the body **9**.

The operation of the demolition unit is as follows:

When the fuse **7** is actuated in the manner referred to, the body **9** is ignited and combustion thereof under the development of heat thus takes place. The burning of the body **9** causes, in turn, combustion of substance **6** which initiates the aluminothermic reaction within the solid layer **8**. The aluminothermic reaction of the layer **8** proceeds under the development of considerable amounts of heat causing melting or burning of the outer walls of the capsule and of the plate **20**. The reacting aluminothermic mass of the layer **8** thus comes into direct contact with the aluminothermic powder **1** within the space **25**, initiating the aluminothermic reaction of said mass. The reaction gradually progresses and proceeds toward the outlet area **5**. The aluminothermic reaction is exothermic and the aluminum is oxidized to aluminum oxide while the iron oxide is reduced to iron in molten form. Temperatures up to 2500° C. are reached. As the mass **1** is enveloped by the aluminum liner **3**, the latter is oxidized to form a slag layer of Al_2O_3 which prevents lateral flow or spreading of the mass. The provision of the layer **11** additionally minimizes the risk of lateral flow. However, as soon as the molten metal reaches the outlet area **5**, the sheet metal plate **4** melts and the liquid iron flows into the space **14** and from there toward the object (not shown) on which the unit has been placed with its mounting area. The molten, extremely hot metal may be thus directed toward vital operational elements or portions of the object to be destroyed, such as gears, trackways, engines and the like, thereby causing melting of such elements and/or fusing thereof with the molten metal. The object in question is thus rendered inoperative. The flow is smooth and quiet as contact with organic, gas evolving substances is avoided. Due to the space **14**, the mass falls freely through that space before striking the object to be destroyed.

The thickness of the sheet metal plate **4** is preferably dimensioned so that it melts only after the aluminothermic reaction has been completed. Portion **4** may constitute a separate plug member or closure means inserted into an opening of the liner melting at a predetermined temperature. It will also be realized that the shape of the cartridge-like unit can be adapted to the requirements. Further, the flange portion **12** may be replaced by a different mounting means for facilitating mounting or attachment to the object to be destroyed.

The demolition procedure proceeds substantially without noise, which is of great advantage for the reasons previously advanced. The demolition charge, that is the molten mass is prepared in situ within a very short period of time. The entire unit can be easily manipulated, is safe to transport and the danger of splinter formation is removed.

While specific embodiments of the invention have been shown and described in detail to illustrate the application of the inventive principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. A demolition unit for producing a flow of a hot metallic mass capable of destroying an object to be demolished, comprising in combination:

(a) a thin-walled casing having a top end and a bottom end;

(b) a liner arranged within said casing and defining a reaction space;

(c) an aluminothermic mass arranged within said reaction space, said mass being capable of exothermically reacting to produce a hot liquid metallic mass;

(d) said liner being of a material which takes part in said reaction and forms upon reaction a high-melting slag layer;

(e) means for initiating the exothermic reaction of said aluminothermic mass;

(f) said unit including an outlet area adjacent said bottom end;

(g) closure means normally closing said outlet area and being of a material which melts below the temperature of said hot liquid metallic mass, and

(h) mounting means on said casing adjacent said bottom end and extending beyond said outlet area for mounting said unit in a substantially upright position on an object to be demolished with the outlet area being vertically spaced from said object,

whereby upon initiating said exothermic reaction said hot liquid metallic mass is formed within said reaction space, said mass causing melting of such closure means to flow by gravity through said outlet area, to fall through the space between the outlet area and the object to strike said object.

2. A demolition unit as claimed in claim 1, wherein said liner is of a material selected from the group consisting of aluminum, magnesium, aluminum-magnesium alloys, silicon and chromium.

3. A demolition unit for producing a flow of a hot metallic mass capable of destroying an object to be demolished, comprising in combination:

(a) a thin-walled casing having a top end and a bottom end;

(b) a linear of a material selected frm the group consisting of aluminum, magnesium, aluminum-magnesium alloys, silicon and chromium, arranged within said casing and defining a reaction space;

(c) an aluminothermic mass arranged within said reaction space, said mass being capable of exothermically reacting to produce a hot liquid metallic mass;

(d) a delayed action igniting means for initiating the exothermic reaction of said aluminothermic mass;

(e) said unit including an outlet area adjacent said bottom end;

(f) closure means normally closing said outlet area and being of a material which melts below the temperature of said hot liquid metallic mass, and

(g) mounting means on said casing adjacent said bottom end and extending beyond said outlet area for mounting said unit in a substantially upright position on an object to be demolished with the outlet area being vertically spaced from said object,

whereby upon initiating said exothermic reaction said hot liquid metallic mass is formed within said reaction space, said mass causing melting of such closure means to flow by gravity through said outlet area, to fall through the space between the outlet area and the object to strike said object.

4. A demolition unit for producing a flow of a hot metallic mass capable of destroying an object to be demolished, comprising in combination:

(a) a thin-walled casing having a top end and a bottom end;

(b) a liner of material selected from the group consisting of aluminum, magnesium, aluminum-magnesium alloys, silicon and chromium, arranged within said casing and defining a reaction space, said liner being spaced from said casing;

(c) an aluminothermic mass arranged within said reaction space, said mass being capable of exothermically reacting to produce a hot liquid metallic mass;

(d) means for initiating the exothermic reaction of said aluminothermic mass;

(e) said unit including an outlet area adjacent said bottom end;

(f) closure means normally closing said outlet area and being of a material which melts below the temperature of said hot liquid metallic mass;

(g) mounting means on said casing adjacent said bottom end and extending beyond said outlet area for mounting said unit in a substantially upright position on an object to be demolished with the outlet area being vertically spaced from said object, and

(h) a protecting layer arranged in the space between said linear and said casing,

whereby upon initiating said exothermic reaction said hot liquid mass is formed within said reaction space, said mass causing melting of such closure means to flow by gravity through said outlet area, to fall through the space between the outlet area and the object to strike said object, said liner reacting to form a slag layer which prevents lateral flow of said hot metallic mass toward said casing.

5. A unit as claimed in claim 4, wherein said protecting layer comprises a silicate material.

6. A unit as claimed in claim 4, wherein said protecting layer comprises bentonite.

7. A demolition unit for producing a flow of a hot metallic mass capable of destroying an object to be demolished, comprising in combination:

(a) a thin-walled casing of sheet metal having a top end and a bottom end;

(b) a linear of a material selected from the group consisting of aluminum, magnesium, aluminum-magnesium alloys, silicon and chromium, arranged within said casing and being spaced therefrom, said liner defining a reaction space;

(c) an aluminothermic mass arranged within said reaction space, said mass being capable of exothermically reacting to produce a hot liquid metallic mass;

(d) means for initiating the exothermic reaction, said means including a wall-defined box member arranged at least partially within said reaction space, a substance capable of burning under development of heat arranged within said box member and a delayed-action fuse for igniting said substance, the walls of said box member being at least partly of a material which is demolished at a temperature below the temperature of said burning substance;

(e) said unit including an outlet area adjacent said bottom end;

(f) closure means normally closing said outlet area and being of a material which melts below the temperature of said hot liquid metallic mass, and

(g) mounting means on said casing adjacent said bottom end and extending beyond said outlet area for mounting said unit in a substantially upright position on an object to be demolished with the outlet area being vertically spaced from said object,

whereby upon initiating said exothermic reaction said hot liquid metallic mass is formed within said reaction space, said mass causing melting of such closure means to flow by gravity through said outlet area, to fall through the space between the outlet area and the object to strike said object, said linear being oxidized by the reaction to form a slag layer which prevents lateral flow of said hot metallic mass toward said casing.

8. A unit as claimed in claim 7, wherein the space between said linear and said casing is filled with bentonite.

9. A unit as claimed in claim 7, wherein the substance in said box member includes a solid body of aluminum

powder and an oxygen-liberating material, said body being in contact with said delayed-action fuse.

10. A demolition unit for producing a flow of a hot metallic mass capable of destroying an object to be demolished, comprising in combination:

(a) a thin-walled casing having a top end and a bottom end;
(b) a liner of aluminum arranged within said casing and defining a reaction space;
(c) an aluminothermic mass arranged within said reaction space, said mass being capable of exothermically reacting to produce a hot liquid metallic mass;
(d) means for initiating the exothermic reaction of said aluminothermic mass;
(e) said unit including an outlet area adjacent said bottom end;
(f) closure means normally closing said outlet area and being of a material which melts below the temperature of said hot liquid metallic mass, and
(g) mounting means on said casing adjacent said bottom end and extending beyond said outlet area for mounting said unit in a substantially upright position on an object to be demolished with the outlet area being vertically spaced from said object,

whereby upon initiating said exothermic reaction said hot liquid metallic mass is formed within said reaction space, said mass causing melting of such closure means to flow by gravity through said outlet area, to fall through the space between the outlet area and the object to strike said object, said aluminum linear being oxidized by the reaction to form an Al_2O_3 slag layer which prevents lateral flow of said hot metallic mass toward said casing.

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