United States Patent

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[54] **COLLAPSIBLE DETONATING DEVICE FOR MINES**
9 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** ..... **102/70 S,** 102/18
[51] **Int. Cl.** **F42c 7/02,** F42c 15/14, F42c 15/18
[50] **Field of Search** 102/18, 70

[56] **References Cited**
UNITED STATES PATENTS

3,091,178	5/1963	Ono	102/70
3,175,489	3/1965	Reed, Jr.	102/18 X
3,511,182	5/1970	Hester, Jr.	102/18 X

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ABSTRACT: Pressure from an external force near the detonating device will collapse or move a triggering rod to thus rock an attached wobbler plate, which rocking will lift a U-shaped clamping claw that will pull a firing pin against the bias of a spring away from a primer to a position where the clamping claw automatically releases the firing pin so that it will move under the bias of the thus tensioned spring to strike and detonate the primer. In the normal position, the clamping claw prevents movement of the firing pin into the primer and the spring is not biased or biased only to a small degree. The wobbler plate has a clamped peripheral weakened sealing portion that breaks when the wobbler plate is subjected to a force above a predetermined magnitude.

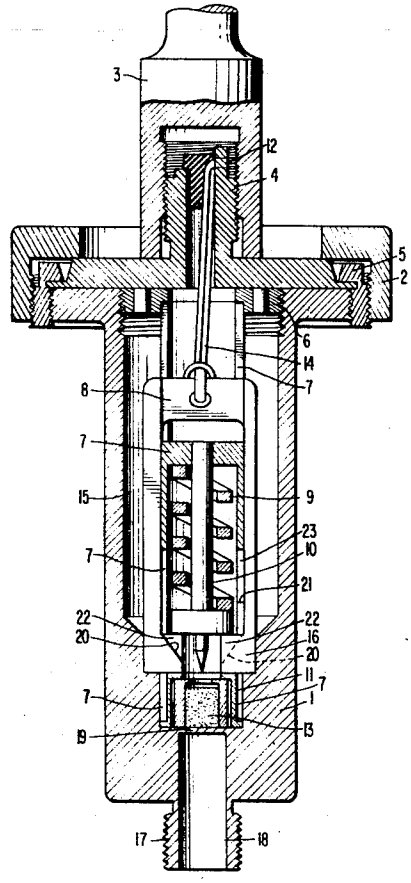
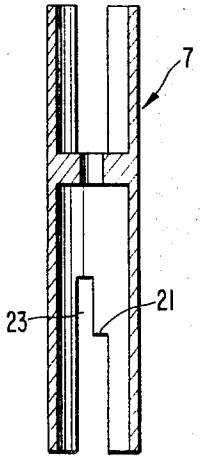


FIG. 5



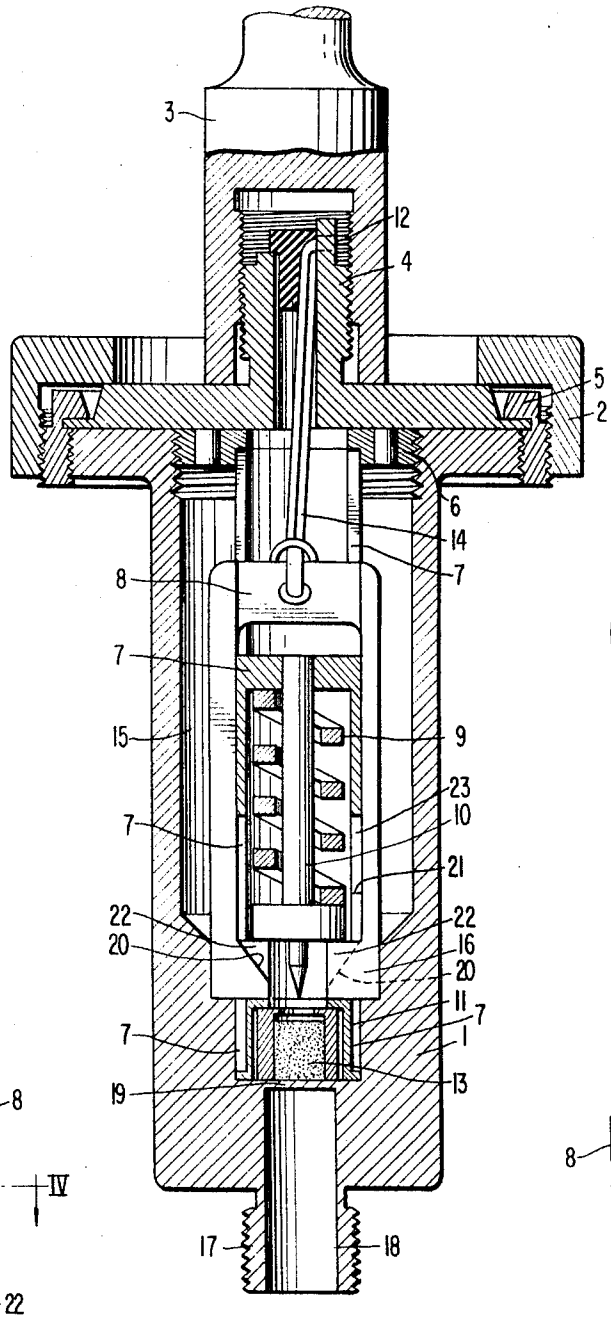


FIG. 1

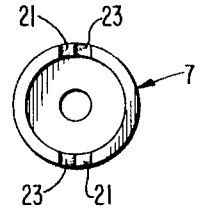
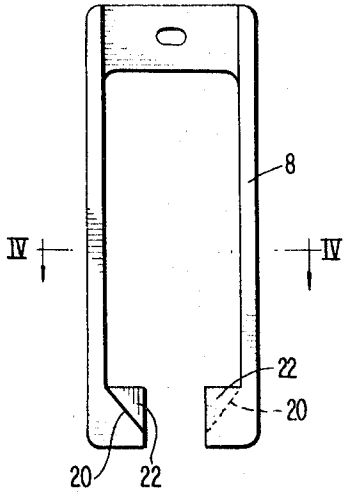


FIG. 6

FIG. 2



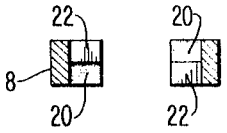


FIG. 4

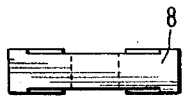


FIG. 3

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COLLAPSIBLE DETONATING DEVICE FOR MINES

BACKGROUND OF THE INVENTION

It is conventional, for triggering the detonation of mines laid under camouflage, to employ a collapsible or hinged detonator instead of a system that responds to pressure, that is, a detonator with a rod-shaped element which will buckle or collapse to initiate the detonation by releasing a firing pin that has been maintained under a spring bias toward the primer. Such a biased spring is, however, undesirable with respect to safety in transportion and handling; in addition, the spring will become weakened over a long period of time during which it is biased to its greatest extent so that in some cases the ability of the spring or the detonator to function becomes unreliable. This latter disadvantage is particularly strong with respect to a spring that is constructed of synthetic material so as to create a completely nonmetallic detonator, which cannot be detected by conventional means.

SUMMARY OF THE INVENTION

It is an object of the present invention to overcome the above-mentioned disadvantages by providing a collapsible detonator with a spring-force-actuated firing pin, which is displaceably arranged in a housing adjacent a primer. A rod-shaped triggering element will collapse or move to the side to thus tilt or rotate a wobbler disk, which is connected by way of a clamping claw to the firing pin so that as it rotates it will draw the firing pin against the bias of the spring away from the primer composition. The firing pin is held within a guiding sleeve to be axially displaceable with respect to the primer. The guiding sleeve and the clamping claw are so constructed that as the clamping claw pulls the primer pin up, it will automatically release the primer pin after the spring has been tensioned the desired amount.

The detonating device is particularly shock resistant because the clamping claw normally blocks movement of the firing pin toward the primer composition.

Preferably, the rocker disk is provided along its periphery with at least a plurality of projections that are weakened breaking elements designed to break or rupture when a predetermined force has been applied to the rocker disk to thereby allow the rocker disk to rotate or tilt about its rim. A clamp nut member is employed to clamp the projections tightly against the housing and is preferably externally threaded to a flange on the housing. With this construction, there is a considerable degree of safety with respect to pressure applied to the triggering element in that the force required to break the projections must first be overcome before the wobbler disk will rotate.

Further safety is obtained during handling and storage only by providing a further safety clamping nut that is threadably connected to an external thread on the clamp nut member so that it will overlap the rim of the main body portion of the wobbler disk or plate to completely prevent its rotation.

BRIEF DESCRIPTION OF THE DRAWING

Further objects, features and advantages of the present invention will become more clear from the following detailed description of the drawing, wherein:

FIG. 1 is an axially cross-sectional view taken through the detonating device of the present invention;

FIG. 2 is a view of a clamping claw as it is shown in Figure 1;

FIG. 3 is a top plan view of the clamping claw of Figure 2;

FIG. 4 is a cross-sectional view taken along line IV–IV of Figure 2;

FIG. 5 is an axial cross-sectional view taken through the guiding sleeve but on an axial plane rotated 90° with respect to the plane of Figure 1; and

FIG. 6 is a bottom view of the guiding sleeve of Figure 7.

DETAILED DESCRIPTION OF THE DRAWING

The housing 1 of the detonating device encloses the main portions of the detonator and has an annular externally threaded flange at its upper end. A safety clamping nut 2 tightly clamps a tipping assembly against the upper flange of the housing 1, which tipping assembly comprises a rodlike triggering element 3, only the lower portion of which is shown in the drawing, and a threadedly attached rocker disk or wobbler plate 4. The wobbler plate 4 is provided with at least a plurality of weakened, reduced thickness, projections on its periphery that are clamped against the upper flange of the housing 1 by means of the overlying portion of a clamp nut member 5, which nut member 5 is threadedly attached to the threaded exterior of the housing flange. The nut member 5 is provided with an external thread for threadedly receiving the previously mentioned safety clamping nut. Preferably, the projections clamped by the clamp nut member 5 are in the form of an annular rim so that such clamping will form a tight seal for the interior of the housing 1.

Below the wobbler plate 4, a threaded disk 6 is threaded into the interior of the housing 1 to clamp and hold in place a cylindrical guiding sleeve 7, which guiding sleeve is shown in more detail in Figures 5 and 6. As shown in Figures 1 and 5, the upper portion of the guiding sleeve 7 is provided with diametrically opposed longitudinally extending slots that receive therein the web portion of a clamping claw 8, which clamping claw 8 is shown in more detail in Figures 2—4. The central portion of the guiding sleeve 7 is provided with a transverse web having a central axial bearing bore. A helical spring 9 is concentrically received within the lower portion of the guiding sleeve 7 to abut at its upper end against the transverse web of the guiding sleeve 7 and at its lower end against an annular collar on the lower end of a firing pin 10. The upper portion of the firing pin 10 is provided with an integral shaft guidingly received in the bearing in the web of the guiding sleeve 7 for axial guiding movement. The lowermost end of the guiding sleeve 7 annularly engages an annular external flange on the primer receiving casing 11 to tightly clamp the casing 11 against the bottom of the hollow interior of the housing 1. The primer 13, including a suitable primer composition held within a primer cap, is clamped in this manner by the casing 11.

A flexible link between the wobbler plate 4 and the clamping claw 8 is provided by a cord 14, or the like, that is tied to the web portion of the clamping claw 8 and secured at its upper end 12 to the hollow threaded projection of the wobbler plate 4 by passing through a transverse bore and being wedged by a sealing plug that is forced into the interior of the wobbler plate 4 prior to threading on the triggering element 3.

The preferably cylindrical housing 1 is manufactured with a first axially extending chamber forming bore 15 that joins at its lower end with a second reduced diameter chamber forming bore 16, which is thefeafter followed by the bore for the primer 13, casing 11 and the substantially same diameter bottom portion of the guiding sleeve 7. At its lower end, the exterior of the housing 1 is provided with an axial extension 17 having an external thread for securement to the main body portion of the mine. The interior of the extension and the immediately adjacent portion of the housing 1 is provided with a central ignition channel bore 18 having at its upper inside end a diaphragm 19 sealing this end with respect to the primer 13.

As shown in Figures 1, 2, 3 and 4, the axially extending leg portions of the clamping claw 8 extend along the exterior of the guiding sleeve 7 and are provided at their lower ends with inwardly extending abutment fingers 22 that are slidably received within corresponding diametrically opposed slots 23 in the lower portion of the guiding sleeve 7 as shown more clearly in Figures 5 and 6. The fingers 22 are prevented from moving out of the slots 23 by the adjacent abutting walls of the chamber bore 16. The abutment fingers 22 are interposed between the annular collar of the firing pin 10 and the primer

assembly 13, 11 as well as suitable annular shoulders on the interior of the housing 1 so that in the normal transport and storage position of Figure 1, the abutment fingers 22 will prevent movement of the firing pin 10 downwardly into the primer 13. As shown in Figure 4, the top portion of the left-hand leg and the bottom portion of the right-hand leg are provided with transversely extending abutment surfaces for engagement with the annular collar of the firing pin 10, while the lower surface of the left-hand leg and the upper surface of the right-hand leg are provided with steeply inclined cam surfaces 20. Axially aligned with each of the cam surfaces 20, there are corresponding and cooperating cam edges 21 in the slots of the guiding sleeve 7.

OPERATION

When the detonating device of the present invention is to be used, the threaded extension 17 is screwed into a suitable cooperating mine, the safety clamping nut 2 is removed and the entire unit is camouflaged at a suitable place. If the treads of a tank, or a similar object to be combated, engages the rodlike triggering element 3, it will collapse or tilt to thus rock the wobbler plate 4 about its rim after the projections that are clamped by the clamp nut member 5 have been broken or ruptured. The triggering element 3 may be a single rod extension or a telescoping member. With rocking of the wobbler plate 4 about its rim, the flexible coupling member 14 will draw the clamping claw axially upward as it is guided by the stationary guiding sleeve 7. With movement of the clamping claw axially upwardly, the firing pin 10 will be entrained by engagement of the abutment surfaces of the fingers 22 with the collar of the firing pin to thus draw the firing pin 10 upwardly and compress the spring 9. After the abutment fingers 22 move out of the chamber bore 16, the cam surfaces 20 will engage the corresponding cam edges 21 of the guiding sleeve 7 to thus cam the legs of the U-shaped clamping claw outwardly and ultimately completely out of engagement with the annular collar of the firing pin 10 so that at this raised position of the firing pin 10, it will be released to drive downwardly under the influence of the thus compressed spring 9 into the primer 13 for detonation thereof. Thereafter, the detonating flash produced by the primer 13 will rupture the diaphragm 19 and travel through the ignition channel 18 into the land mine for detonating the main charge therein. The diaphragm 19 may be either integral with the casing 1 in a homogeneous single piece manner or it may be a separate item attached thereto.

Preferably, all of the elements of the detonating device are constructed of a synthetic material, that is particularly a non-metallic material to escape detection.

While a single embodiment has been shown and described in detail for purposes of illustration, further modifications, embodiments and variations are contemplated within the spirit and scope of the present invention.

I claim:

1. A detonating device, comprising: a housing; a percussion sensitive primer mounted in said housing; a spring within said housing; a firing pin in said housing mounted for movement against the bias of said spring from a first normal position adjacent said primer toward a second position spaced a greater distance from said primer than said first position; means responsive to an external force for rotating providing tipping movement thereof with respect to said housing; entrainment means connected between said means for rotating providing tipping movement and said firing pin for moving said firing pin against the bias of said spring from said first position to said second position in response to rotation tipping movement of said means for rotating external force responsive means, and automatically releasing said firing pin at said second position so that said spring will drive said firing pin into said primer for detonation.

2. The detonating device of claim 1, adapted to be used for mines, wherein said external force responsive means for rotating providing tipping movement includes a rod-shaped triggering element extending away from said housing in a manner adapted to be engaged by an external force producing mass, and a wobbler plate drivingly connected to said triggering member and mounted on said housing for tiling movement; a guide sleeve guiding said firing pin movement axially between said positions; said entrainment means for moving said firing pin including a clamping claw engaging said firing pin in said first position to prevent movement of said firing pin toward said primer, and flexible means drivingly connecting said clamping claw to said wobbler plate.

3. The detonating device of claim 2, wherein said housing has an outwardly extending flange; said wobbler plate having integral weakened portions around its circumference; a clamp member mounted on said flange to clamp said weakened portions therebetween; said weakened portions, said flange and said clamp member constituting means for preventing tipping of said wobbler plate at forces thereon below a predetermined force and for effecting breaking of said weakened portions to permit tipping motion of said wobbler plate above predetermined force.

4. The detonating device of claim 3, wherein said clamp member is a nut provided with threads on its interior threadably engaging said flange and with threads on its exterior; said wobbler plate having a main body portion interior of said weakened portions; a safety clamping nut threaded on said exterior threads of said clamp member and clamping said wobbler plate main body portion securely against said flange to prevent unintentional detonation, and said safety clamping nut being adapted for removal prior to using the detonating device.

5. The detonating device of claim 3, wherein said weakened portions constitute an integral annular thin rim annularly clamped against said flange by said clamp member sealing the interior of said housing.

6. The detonating device of claim 2, wherein said guide sleeve is stationarily mounted with respect to said housing and has at least one cam edge; said clamping claw including an abutment engaging said firing pin between said firing pin and said primer, and further including a cam follower surface to engage said sleeve cam edge during movement of said clamping claw and firing pin from said first position to said second position for caming said abutment out of its position between said firing pin and said primer to thus release said firing pin.

7. The detonating device of claim 6, wherein said guiding sleeve is substantially cylindrical and axially aligned with said primer; said guide sleeve having diametrically opposed longitudinally extending slots at its end opposite from said primer, separate diametrically opposed longitudinally extending slots at its end adjacent said primer, and a central web portion provided with an axially extending guide bearing; said firing pin including a shaft extending through said guide bearing at its end opposite said primer and a collar engaging the interior walls of said cylindrical sleeve at its end adjacent said primer; said spring being a coil spring concentric with said firing pin shaft and extending between said sleeve web and said firing pin collar; said clamping claw being substantially U-shaped with a web portion diametrically extending through said slots in said sleeve at the end opposite from said primer, and spring leg portions axially extending along diametrically opposite sides of said sleeve toward said primer terminating in inwardly extending guide fingers guidingly received within said slots at the end adjacent said primer; each of said fingers having said abutment and said cam follower surface; each of said slots at the end adjacent said primer having said cam edge axially aligned with respective ones of said cam follower surfaces.

8. The detonating device of claim 7, including a substantially cup-shaped primer enclosing casing holding said primer against said housing and provided with an outwardly extending annular flange; said guide sleeve engaging said casing outwardly extending annular flange and clamping it tightly against said housing; a disk threaded in said housing and

clamping the end of said guide sleeve opposite from said primer.

9. The detonating device of claim 1, wherein said housing has an axially extending externally threaded hollow extension provided with an ignition channel in its interior and being adapted for threading engagement into a main powder charge housing; said housing having a homogenously integral diaphragm sealing the interior of said housing and closing the interior of said ignition channel immediately between said primer and said threaded extension.