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DIRECTIONAL CHARGE EXPLOSIVE DEVICE

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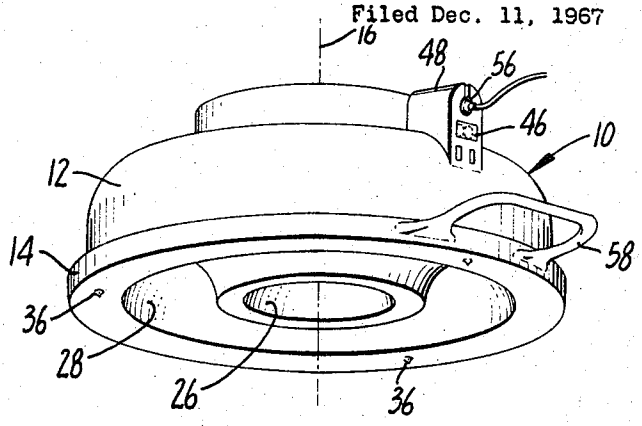

FIG. 1.

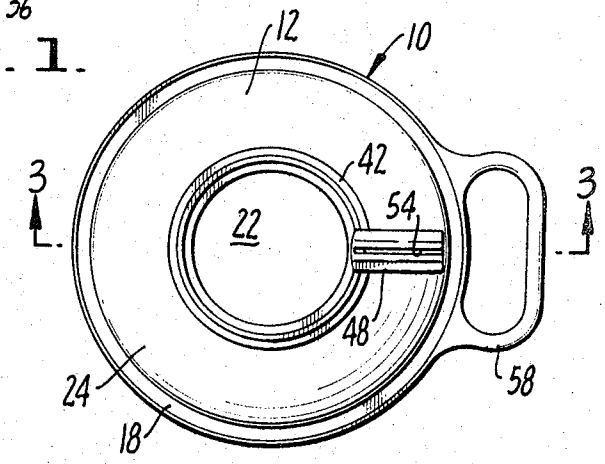

FIG. 2.

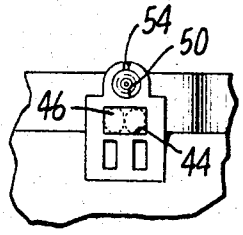

FIG. 4.

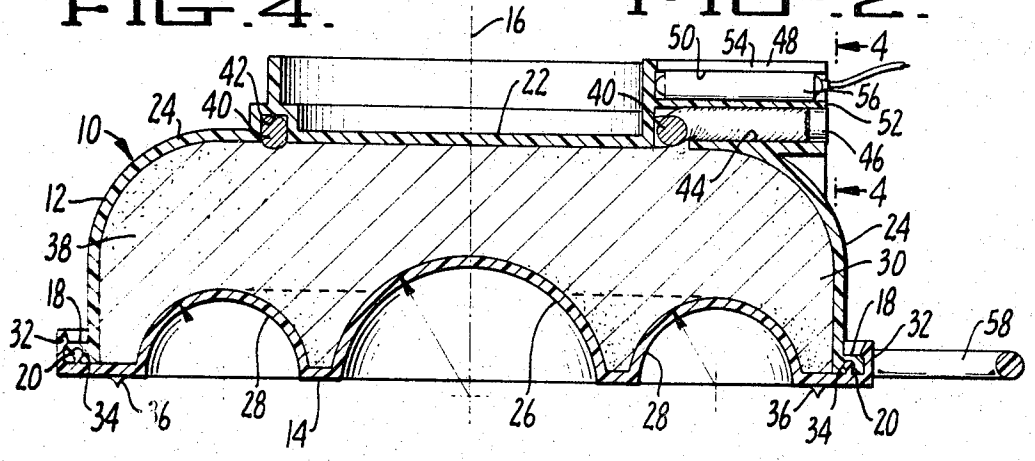

FIG. 3.

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DIRECTIONAL CHARGE EXPLOSIVE DEVICE

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ABSTRACT OF THE DISCLOSURE

A directional charge explosive device is provided with a dome-shaped casing and a bottom cover which entirely encloses the bottom of the casing and has therein a central downwardly opening circular concavity and an outer downwardly opening semi-toroidal concavity. The concavities in the bottom cover, when used in conjunction with a 360° "over-drive" detonation arrangement, direct the force of the detonated explosive charge in the desired direction.

BACKGROUND OF THE INVENTION

Field of the invention

A directional charge explosive device unit is provided with a central concavity and an outer concavity, and a 360° "over-drive" detonation arrangement, all three being substantially concentric with the central vertical axis of the device.

Description of the prior art

The closest prior art known to applicants is Wofford et al. 3,244,102. This patent is discussed and distinguished hereinafter.

SUMMARY OF THE INVENTION

A directional charge explosive device is used to reduce large rocks, boulders, pieces of concrete and the like into fragments which can be more easily handled, positioned and removed. Many times a secondary blasting unit, such as the directional charge explosive device of this invention, only comes into usage after an initial larger detonation has blasted material from a hillside or the like.

Typical of the heretofore used secondary blasting units is a patent issued to Wofford et al., 3,244,102. The device in 3,244,102 is satisfactory for most blasting operations but the device of the present invention has improved the directional accuracy and is of improved mechanical construction. Applicants have improved the above described device by providing an improved secondary blasting unit having formed therein a central downwardly opening circular concavity as well as an outer downwardly opening semi-toroidal concavity used in conjunction with a 360° "over-drive" detonation arrangement.

It is the primary object of the present invention to provide a new and improved directional charge explosive device.

Another object of the invention is to provide a directional charge explosive device with a double seal between the casing and the bottom cover.

A further object of the present invention is to provide a plurality of downwardly opening concavities in the bottom cover to insure increased directional effect of the detonation.

A further object of the present invention is to provide a 360° "over-drive" detonation arrangement which is substantially concentric with the central vertical axis of the device.

A further object is to provide a directional charge explosive device which produces a great breaking power with the use of a small amount of explosive.

A still further object of the present invention is to provide a directional charge explosive device in which the explosive strength of the explosive filler may be altered as desired.

Still another object is to provide an improved, split-top cap holder, permitting use with various designs of detonating caps.

A final object is to provide a directional charge explosive device which produces a disruptive imploding force that disintegrates boulders and the like rather than blasting them apart.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is an isometric or perspective view illustrating the secondary blasting unit of the present invention.

FIGURE 2 is a top plan view.

FIGURE 3 is an enlarged sectional view taken substantially as indicated along line 3—3 of FIGURE 2.

FIGURE 4 is a fragmentary view taken substantially as indicated along line 4—4 of FIGURE 3 and illustrating the detonating cap cavity and the interior opening recesses.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawing, the directional charge explosive device of the present invention, generally indicated **10**, which is intended for use in any type of secondary blasting application, is provided with a domed-shaped casing **12** and a bottom cover **14**. The domed-shaped casing **12** is substantially concentric with a central vertical axis indicated by line **16** and terminates in a substantially circular lower rim **18** having a groove **20** on the lower side thereof. The casing **12** has a planar upper central portion **22** surrounded by curved walls **24**.

The bottom cover **14** has formed therein a central downwardly opening circular concavity **26** and an outer downwardly opening semi-toroidal concavity **28** in order to focus the heat and energy of the explosives into a very small area. Both of the concavities **26** and **28** are substantially concentric with the central vertical axis **16**. The focal point of convergence of concavity **26** is below the bottom cover **14** and the focal point of convergence of concavity **28** can be on the bottom cover **14** or below it as desired, thus making concavity **26** less than one half a sphere and concavity **28** at most one half a sphere. Casing **12** and cover **14** enclose a central chamber **30** and by means of lip portion **32** of the bottom cover **14**, which overlaps the circular lower rim **18** of the casing **12**, and rib **34**, which matingly fits into the groove **20**, provide a double seal between the casing **12** and the cover **14** so that the directional charge explosive device of the present invention can be used under all weather, temperature, surface and marine conditions. A plurality of pointed members **36** may be provided on the bottom cover if desired to insure positional stability of the directional charge explosive device. A material such as plastic which can be readily molded into the desired shape has been found suitable for making the casing **12** and cover **14**.

Located within the central chamber **30** is a charge of explosive filler **38** which is of the alkali nitrate category and detonates at a self-propagating rate of approximately 14,000 to 15,000 feet per second. The explosive filler **38** is of a regular commercial type and it is well known to the art. The relative weight strength or explosive equivalent of this explosive filler **38** is normally 90%. However in certain applications of this directional charge explosive device it has been found that the explosive filler **38** should have a lower relative weight strength or explosive equivalent. A detonating fuse **40** is positioned in an annular channel **42** in the casing **12** with the ends

of the fuse **40** being coterminous in a lower recess **44**. Plug **46** is provided to protect the fuse **40**. The detonating fuse **40** is commercially made and detonates at the rate of approximately 20,000 to 22,000 feet per second. As can be seen in FIGURE 3, the diameter of the annular channel **42** as measured from the vertical axis **16** is approximately equal to the mean diameter of the semi-toroidal concavity **28**.

The various strengths of the explosive filler **38** that may be used in the directional charge explosive device are cap-sensitive explosives and do not require dynamite as a booster. The explosive fillers when properly initiated, have considerably more power than the standard dynamites. To get the maximum efficiency, it is essential that the peak velocity of the explosive fillers be reached as quickly as possible. This is accomplished by using the proper initiation device for the particular explosive.

As can be seen in FIGURE 2, the annular channel **42** allows the fuse **40** to have a 360° shape. This generates a force wave which travels at several times the speed of sound within the 360° loop when the fuse **40** is detonated. This creates a tremendous shock to the localized area thereby creating an efficient "over-drive" detonation mechanism for the explosive filler.

The term "over-drive," as used in the industry, describes that property of explosives which enables them to detonate at a rate greater than their self-propagating detonation rate. For example, an explosive which detonates at the rate of 22,000 feet per second (detonating fuse) is set off in contact with another explosive which detonates at the rate of 15,000 feet per second (explosive filler) then this 15,000 feet per second explosive will detonate at a rate higher than 15,000 feet per second but somewhat lower than 22,000 feet per second.

Therefore, by using this principle the detonation velocity of the explosive filler can be increased from approximately 15,000 feet per second to over 18,000 feet per second as desired. In addition, this method of detonation of the explosive filler greatly improves the results of the new directional charge explosive device of the present invention.

Radial boss **48** on the upper portion of the casing **12** houses the lower recess **44** and the upper exterior opening cavity so with frangible walls **52** separating the recess **46** and the cavity **50**. The cavity **50** is provided with slit **54** in order to allow spreading or flaring when detonating caps **56** of various sizes are inserted into it. Handle **58** is provided for ease in handling.

In actual operation and after the directional charge explosive device is properly positioned on or near the target object, the detonating cap **56** is ignited. The force of the detonating cap **56** ruptures the frangible walls **52** and in turn detonates the ends of the detonating fuse **40**. The detonating fuse **40** then causes detonation of the explosive filler **38** to take place along the path of the annular channel **42**, thus providing an instantaneous accelerated detonation of the filler **38** which results in a vortiginous propagation front which in turn accentuates the toroidal blast of the device **10**.

Due to the focal point of the convergence of the plural concavities, the energy of the explosion is transmitted within the target object causing the target object to fail from implosion resulting from the explosion of the directional charge explosive device positioned on the periphery of the target object. Since an implosion is created, there is no danger that men and/or machinery will be damaged by flying rocks and debris. In addition, there is a tremendous saving in the cost of labor, time and equipment in that no drilling operation precedes the utilization of the directional charge explosive device of this invention.

In numerous actual field tests, the device of this invention has been able to average over one cubic yard of breakage per pound of explosive filler.

We claim:

1. A directional charge explosive device comprising:

(a) a dome-shaped casing substantially concentric with a central vertical axis, said casing terminating in a substantially circular lower rim,

(b) a planar bottom cover mounted on said lower rim and entirely enclosing the bottom of said casing, said casing having formed therein a central downwardly opening circular concavity having its focal point of convergence below the plane of the bottom cover and an outer downwardly opening semi-toroidal concavity having its focal point substantially in the plane of the bottom cover, both of said concavities being substantially concentric with said central vertical axis and the peripheral edges of both concavities being in substantially the plane of the bottom cover;

(c) a radial boss on the upper portion of said casing, said boss being formed with an exterior opening cavity to receive a detonating cap, and an interior opening recess alongside said cavity and separate therefrom by frangible walls;

(d) an explosive charge in said casing; and a circular detonating fuse in said casing and extending substantially 360° in contact with said charge, said circular fuse being substantially concentric with said central vertical axis, the ends of said detonating fuse terminating in said recess.

2. The directional charge explosive device of claim **1** wherein the exterior opening cavity has a slit whereby the cavity can be spread so that detonating caps of various sizes may be inserted therein.

References Cited

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