

9

Description

Technical Field

The present invention relates to an arrangement in a mine which is capable of being deactivated or «neutralized» and which can be buried in the ground and which incorporates detecting means effective to detect a neutralized mine, and an initiating device which in response to the detection of a neutralization initiates the detonation of a marker firing charge or «spotter» charge arranged in the mine and capable of propelling a spotter device in the mine to the surface of the ground in which the mine is buried, therewith to indicate the location of the neutralized mine.

Background Prior Art

Such an arrangement is known to the art from for example, Swedish Patent SE-B-428 725. This earlier Patent Specification describes and illustrates an anti-tank mine which incorporates an initiator for initiating detonation of the mine, and a timing circuit which subsequent to a given time delay from the time of arming the mine, for example a time delay of 30-40 days, deactivates the mine, if the mine has not been detonated prior thereto. The mine incorporates a spotter charge which is detonated in response to the act of deactivating the mine and fires a spotter to the surface of the ground in which the mine is buried, therewith to indicate the location of the deactivated mine, the spotter being connected to the mine by means of a connecting line. The mine can then be dug from the ground and reactivated.

It is difficult, however, to dimension satisfactorily the force at which the spotter is propelled. For example, if this force is dimensioned so as also to resist hard earth layers, so that the spotter is reliably driven to the surface of the ground, the speed at which the spotter moves may be excessively high in the case of lightly or loosely packed earth layers, such as to cause the connecting line to break and the spotter to disappear, thereby making it difficult to locate the mine. If, on the other hand the mine is dimensioned for a lighter driving force, the speed at which the spotter is propelled through the ground may be too low, for example in the case of hard earth layers, for the spotter to penetrate to ground level.

Disclosure of the Invention

Consequently, the object of the invention is to provide an arrangement of the aforesaid kind which will ensure that when fired the spotter will always reach the surface of the ground in which the mine is buried, without being propelled at a speed which might cause the spotter to disappear from the site at which the mine is buried.

This object is achieved with the aid of an arrangement according to the invention having the characterizing features set forth in the preamble to Claim 1.

Further developments of the invention are set forth in the depending claims.

Brief Description of the Drawings

The invention will now be described in more detail with reference to a preferred embodiment thereof illustrated in the accompanying drawings.

Figure 1 is a longitudinal sectional view of the arrangement according to the invention. Figure 2 is a cross-sectional view taken on the line II-II in Figure 1, illustrating a screw-base forming part of the arrangement. Figure 3 illustrates the attachment of a spring forming part of the arrangement. Figure 4 illustrates the spotter during a firing sequence. Figure 5 is a block schematic illustrating the mine components intended for generating an initiating pulse for detonation of the spotter charge.

Description of a Preferred Embodiment

The arrangement according to the invention includes in general a spotter which in the illustrated embodiment comprises a spotter sleeve 1, which in Figure 1 is shown in an inactive position in a mine buried in the ground 2 (in Figure 1 the cover plate of the mine is illustrated schematically at 3), and which in Figure 4 is shown during a firing sequence, accompanied by a penetrator 4. The arrangement further includes a spotter charge 5 which fires the spotter sleeve 1 from the mine, in response to a neutralization of the mine. When fired, the spotter sleeve 1 travels through an outer sleeve 6 rigidly connected to the mine and, in the manner of a sabot, drives the forwardly located penetrator 4 out of the outer sleeve 6, through the ground 2 and up into the air.

The components forming part of the arrangement according to the invention are described in detail hereinafter.

The outer sleeve 6 is rigidly connected to the mine by means of some suitable fastener device, for example a screw or bolt joint, and comprises a cylindrical sleeve which is open at both ends and which is suitably made of high-tensile steel. The sleeve is mounted vertically in the mine, with the upper end of the sleeve opening through an aperture 3a in the cover plate 3 of the mine. The sleeve edge defining the upper open-end thereof is folded inwardly to form a folded edge 6a, which abuts the forward end of the penetrator 4.

The penetrator 4 comprises a cylindrical sleeve, made suitably of stainless steel, which is arranged co-axially with and within the outer sleeve 6 and which can be displaced axially in relation thereto. One end of the penetrator 4 (the lower end in the Figures) is open, while the other end thereof is closed by means of an end wall 4a having a conical inner edge. This has located centrally thereof an external grip 4b, which facilitates dismantling of the arrangement. Placed on the peripheral surface of the end wall 4a is an O-ring 4c, which is able to slide sealingly against the inner wall surfaces of the outer sleeve 6 as the spotter sleeve and the penetrator pass along the sleeve during a marker firing sequence. Provided in the wall 4a are three through-passing apertures 4d, the function of which will be described hereinafter.

The spotter sleeve 1, which may be made from a plastics material, is cylindrical in shape and is arranged within the penetrator 4 and axially displaceable relative thereto. The spotter sleeve 1 is open at one end (the bottom end), whereas the other end of the sleeve is closed by means of an end wall 1a having a forwardly facing conical edge which, during a

10

firing sequence, lies against the conical inner edge of the wall 4a.

The spotter charge 5, for example pistol powder or some other suitable powder charge, is accommodated in a container 7 which extends into the spotter sleeve 1 and which is attached, e.g. with the aid of a snap-fastener, to a screw-base 8 (illustrated separately in Figure 2) screwed firmly into the bottom end of the outer sleeve 6. A draw spring in the form of a coil spring 9 is connected at the upper end thereof to the end wall 1a of the spotter sleeve 1, and at the bottom end thereof to the screw-base 8.

Mounted in an upper end surface of the screw-base 8, which may be made of aluminium for example, is a fuse head 10 having connected thereto two electrical conductors 11 and 12, which pass through the screw-base 8 to the other end surface thereof, where they are soldered firmly to a pattern card 13 made of epoxy glass fibre. The conductors 11 and 12 are covered with an electrical insulation, and each conductor passes through a respective lead-through in the screw-base 8.

At the location where the conductors are soldered to the pattern card 13 there is provided in the screw-base a larger cavity 14 through which both conductors are drawn. The lead-through is suitably sealed with the aid of a silicone rubber seal, and to this end the cavity 14 is provided with a rough surface, so that the silicone rubber obtains a firmer grip and therewith provides a better seal. The electrical insulation provided on the conductors may be given a length which ensures that the ends of the insulations are also covered by the silicone rubber, thereby effecting a seal between the insulation and its associated conductor. Two contact sleeves 15 and 16 are soldered firmly to the pattern card 13 and connected to the two electrical conductors 11 and 13 soldered to the fuse head 10, by means of a conductor pattern on the pattern card 13. The pattern card 13 is secured to the screw-base 8 by means of a screw 17 and a tightening pin 18.

The coil spring 9 is varnished and is suitably made of a steel-grade having a low elastic limit. One end of the spring (the upper end in the Figures) is bent to form an eye, through which a screw 19 is passed and screwed into the end wall 1a of the spotter sleeve 1, therewith to fasten the spring at said one end. The screw 19 passes through a bush 20 mounted in a bore 21 passing through the end wall 1a. Formed in the forward part of the bore 21 is a hexagonal recess which accommodates a nut 22, into which the screw 19 is screwed. Located between the eye in said one end of the spring and the head of the screw 19 is a washer 23 which is given a radius such as to reduce the risk of the spring breaking when stretched.

The other end of the spring 9 terminates in a straight portion 9a having a length of about 9 mm and extending parallel with the centre axis of the spotter sleeve 1. This straight end portion 9a of the spring is anchored in a hole 24 in the screw-base 8 by means of a locking device 25 illustrated in Figure 3. This device incorporates a bore 26 with crosses the hole 24 and which has arranged therein a ball 27, which can be forced against the spring portion 9a with the aid of a screw 28 in a manner to deform said spring

portion and therewith secure it against withdrawal through the hole 24.

The fuse head 10 of the spotter charge is detonated in the manner illustrated schematically in Figure 5.

An electronic timing circuit 29 is arranged to send an electric pulse (indicated by the arrow A) to an initiator in the form of a detonation pulse generator 30 after a pre-set length of time has lapsed, for example 40 days, provided that the mine has not been exploded prior to the expiration of this time period. The generator 30 therewith delivers an electric pulse (indicated by the arrow B) to a force generator 31 (e.g. a motor) which causes (indicated by the arrow C) a detonator rotor 32 to turn from an armed position to a disarmed position. When the rotor 32 is located in its disarmed position, an activator in the form of a switch 33 is activated and closes an electric circuit from the detonating pulse generator 30 to the fuse head 10 of the spotter charge.

The fuse head 10 therewith ignites the powder charge 5, generating a pressure build-up which urges the spotter sleeve and the spring 9 against the inner wall of the penetrator 4, the gas pressure causing the penetrator to fracture the folded edge 5a of the outer sleeve 6 and to be shot from the mine, and also through any camouflaging material that may have been placed over the mine. This firing sequence is illustrated in Figure 4. During a first stage of the firing sequence, movement of the penetrator 4 is accompanied by the spotter sleeve, and since the spring 9 is attached to the spotter sleeve 1 and also to the screw-base 8, which is anchored to the mine via the outer sleeve 6, the spring will begin to extend and stretch, when the penetrator, and therewith also the spotter sleeve, has reached a point at which the gas pressure is relieved, i.e. during a second firing phase, the spring 9 attempts to withdraw the spotter sleeve from the penetrator 4. The spring 9 therewith also functions as a separating means for separating the sleeve 1 from the penetrator 4.

Gas under high pressure also flows through the afore-mentioned three aperture 4d in the end wall 4 and into a space 34 located between the end walls 1a and 4a (c.f. Figure 4), thereby to prevent the creation of a partial vacuum in the penetrator as the spotter sleeve is withdrawn therefrom. It will be understood that if the creation of a partial vacuum were to be permitted, the suction force generated thereby would prevent smooth separation of the penetrator from the spotter sleeve and cause the spring to be torn off. When the pressurized gas flows through the apertures 4d there can be obtained a pressure of mutually equal magnitude on both sides of the end wall 4a. When the pressure externally of the penetrator subsequently falls rapidly away, the enclosed pressure will assist in ejecting the spotter sleeve from the penetrator.

Upon leaving the ground, the penetrator 4 flies into the air at high speed, while the spotter sleeve 1 and the withdrawn spring 9, the bottom end of which is constantly held anchored to the screw-base 8, fall onto the ground in the close vicinity of the buried mine. The spring remains in its extended shape due to the low elastic limit of the material from which it is made (when a material passes its elastic limit, it is no



longer elastic and will not therefore return to its original shape and dimensions).

Claims

1. An arrangement in a mine which is capable of being deactivated and which is intended for burial in the ground, including detecting means (33) operative to detect a deactivation of the mine, initiator means (30) adapted to initiate detonation of a spotter charge (5) incorporated in the mine in response to the detection of a deactivation, and a spotter (1) which is arranged to be driven by the detonated charge from the mine to the surface of the overlying ground, in order to disclose the location of the mine, characterized in that a penetrator (4), which is intended to drive a pathway through the ground to facilitate passage of the spotter (1), is arranged forwardly of the spotter as seen in its direction of travel, said spotter being capable of driving the penetrator in said direction during a first phase of the spotter firing sequence; and in that the arrangement further includes a separating device (9) which is intended to separate the spotter from the penetrator during a second phase of the firing sequence.

2. An arrangement according to Claim 1, characterized in that the separating means comprising a spring (9) which is connected at one end to the spotter (1) and at the other end to the mine (8).

3. An arrangement according to any one of the preceding claims, characterized by means for providing the gases generated by the spotter charge (5) access to an area (34) located between the penetrator (4) and the spotter (1), such as to cause a gas-pressure build-up in said area, said gas-pressure being effective to assist in the separation of the spotter from the penetrator.

4. An arrangement according to any one of the preceding claims, characterized in that the penetrator (4) and the spotter (1) are arranged to be ejected together from a cylindrical sleeve (6) arranged in the mine.

Patentansprüche

1. Anordnung in einer Mine, die deaktiviert werden kann und die zum Eingraben in den Boden vorgesehen ist, aufweisend eine Detektiereinrichtung (33), die zum Detektieren einer Deaktivierung der Mine eingesetzt ist, eine Auslöseeinrichtung (30), die zum Auslösen der Detonation einer Aufklärerladung (5) angepaßt ist, die in der Mine als Antwort auf die Detektion einer Deaktivierung enthalten ist, und einen Aufklärer (1), der so angeordnet ist, daß er durch die detonierte Ladung aus der Mine zur Oberfläche des darüberliegenden Bodens getrieben wird, um den Minenort anzuzeigen, dadurch gekennzeichnet, daß ein Durchdringer (4), der einen Passierweg durch den Boden bahnen soll, um den Durchgang des Aufklärers (1) zu erleichtern, vorne auf den Aufklärer in seiner Bewegungsrichtung aufgesetzt ist, wobei der Aufklärer dazu imstande ist, den Durchdringer in diese Richtung während einer ersten Phase der Auf-

klärerabfeuerungssequenz zu treiben; und daß die Anordnung weiterhin enthält eine Trenneinrichtung (9), die dafür vorgesehen ist, den Aufklärer von dem Durchdringer während einer zweiten Phase der Abfeuerungssequenz zu trennen.

2. Anordnung nach Anspruch 1, dadurch gekennzeichnet, daß die Trenneinrichtung eine Feder (9) aufweist, die mit einem Ende mit dem Aufklärer (1) und am anderen Ende mit der Mine (8) verbunden ist.

3. Anordnung nach einem der vorhergehenden Ansprüche, gekennzeichnet durch eine Einrichtung, die für die von der Aufklärerladung (5) erzeugten Gase einen Zugang zu einem Raum (34) verschafft, der zwischen dem Durchdringer (4) und dem Aufklärer (1) angeordnet ist, so daß ein Gasdruckaufbau in diesem Raum verursacht wird, wobei der Gasdruck mitwirkt bei der Trennung des Aufklärers von dem Durchdringer.

4. Anordnung nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß der Durchdringer (4) und der Aufklärer (1) angeordnet sind, um zusammen aus einer zylindrischen Büchse (6), angeordnet in der Mine, ausgestossen zu werden.

Revendications

1. Dispositif dans une mine pouvant être désactivée et destinée à être enterrée dans le sol, comprenant des moyens de détection (33) fonctionnant pour détecter la désactivation de la mine, des moyens de déclenchement (30) destinés à déclencher l'explosion d'une charge d'un dispositif repéreur (5) incorporée dans la mine, en réponse à la détection de la désactivation, et un repéreur (1) monté de manière à être entraîné par l'explosion de la charge pour passer de la mine à la surface du sol située au-dessus, de manière à indiquer la position de la mine, dispositif caractérisé en ce qu'un pénétrateur (4), destiné à percer un chemin de passage dans le sol pour faciliter le passage du repéreur (1), est placé, comme indiqué, en avant du repéreur dans sa direction d'avancement, ce repéreur étant capable d'entraîner le pénétrateur dans cette direction pendant une première phase de la séquence de mise à feu du repéreur; et en ce que le dispositif comprend en outre un dispositif de séparation (9) destiné à séparer le repéreur du pénétrateur pendant une seconde phase de la séquence de mise à feu.

2. Dispositif selon la revendication 1, caractérisé en ce que les moyens de séparation comprennent un ressort (9) relié par une extrémité au repéreur (1) et par l'autre extrémité à la mine (8).

3. Dispositif selon l'une quelconque des revendications précédentes, caractérisé en ce qu'il comprend des moyens permettant aux gaz produits par la charge de repéreur (5) d'accéder à une zone (34) située entre le pénétrateur (4) et le repéreur (1), de manière à produire l'établissement d'une pression de gaz dans cette zone, cette pression de gaz servant à aider la séparation entre le repéreur et le pénétrateur.

4. Dispositif selon l'une quelconque des revendications précédentes, caractérisé en ce que le pénétrateur (4) et le repéreur (1) sont montés de manière à être éjectés ensemble d'un manchon cylindrique (6) placé dans la mine.



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