Oct. 21, 1947. J. B. TRAYLOR 2,429,246

SKIP FUSE FOR ANTITANK MINES

Filed Dec. 15, 1943

Fig. 1.

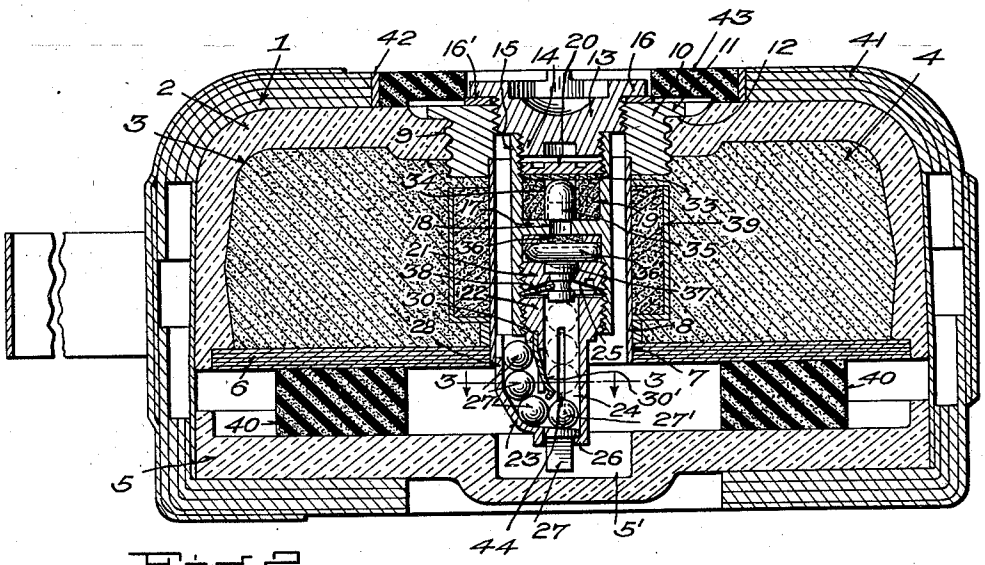


Fig. 2.

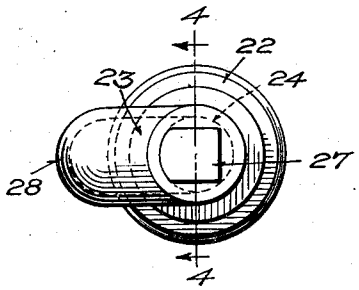


Fig. 3.

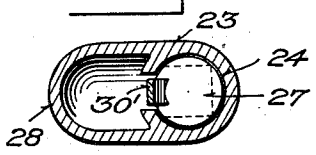
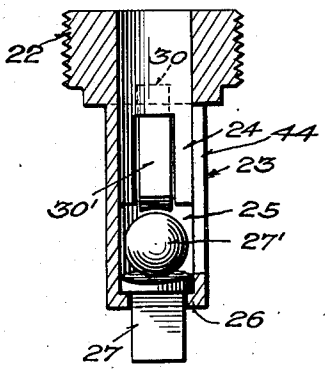


Fig. 4.



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Patented Oct. 21, 1947

2,429,246

UNITED STATES PATENT OFFICE

2,429,246

SKIP FUSE FOR ANTITANK MINES

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Application December 15, 1943, Serial No. 514,355

8 Claims. (Cl. 102—8)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

The present invention relates to a contact mine and more particularly to a skip fuse or exploder therefor. It is constructed throughout of material non-responsive to magnetic influence and, therefore, its presence cannot be detected by magnetic instruments usually employed for mine detection.

The fuse or exploder for exploding the main charge is regulable in advance to predetermine the number of impacts on ineffective operations the mine can endure prior to the operation that explodes it. It operates somewhat upon the bellows principle, with means for reestablishing the normal relative positions of the main body parts, after each impact or contact, short of the last or effective one.

Among the outstanding features of novelty, so far as I am now advised, is the firing device comparable in function to that element in fuses designated as the firing pin. This is made in a plurality of components, ineffectively arranged in the first instance, that is to say, that the prearrangement of the components or increments is such that the multi-part firing device will not be long enough to contribute its part in the explosion of the mine until after the mine has been impacted or contacted a predetermined number of times.

The general object of the invention is to produce a mine that will be reliable in operation, safe to handle, and, as intimated, one that cannot be located by magnetic instruments usually employed for detecting the presence of mines.

It is to be understood that the word "operation" used throughout the following specification and in the claims is intended to describe the movements of the mine sections to and from each other preliminary to the last or exploding operation, during which preliminary operations certain parts of the mine are being conditioned for the final or exploding operation.

In the drawings:

Figure 1 is a central vertical section of the mine, the parts being in normal position, there being shown in dotted lines positions of a number of components of the firing device, the dotted components with the lowermost one in full lines, showing the line-up for the effective operation of the mine.

Figure 2 is a bottom plan view of the holder for the components of the firing device.

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Figure 3 is a section of the holder on the line 3—3 of Figure 1.

Figure 4 is a section of the holder on the line 4—4 of Figure 2.

The numeral 1 designates the main body of the mine which comprises an inverted cup-shaped section 2 having a chamber 3 for the main explosive charge 4, and a lower dish-shaped section 5, having a central depression or sump 5', the sections being preferably of porcelain or some other substantial non-magnetic material. The bottom of the upper section is closed by a laminated disk 6, of cardboard or like material, of sufficient stamina to properly confine the explosive charge and to stand the pressure incident to depressing the upper section toward the lower one against the means for returning said upper section to normal position after being depressed in some operation of the mine short of the final one.

The disk 6 has a central opening 7 which receives the lower end of a cylinder 8 extending upwardly to a point near the underside of the cup-shaped section 2, the cylinder being of plastic material or other non-magnetic material of sufficient integrity to cooperate in sustaining its part of the strains imposed upon the mine in the various stages of its contemplated use.

The upper section 2 is provided with an internally threaded central opening 9 partially closed by a threaded plug 10 formed with a flange 11 engaging an annular shoulder 12 in a depression in the top of said section. The plug 10 is internally threaded to receive the externally threaded closure plug 13 which has a reduced threaded portion 14 received in the threaded upper end of a cylindrical fuse housing 15, the threads in the housing extending below those necessary for the attachment of the closure plug, for a purpose that will presently appear. The plug 13, like the plug 10, is provided with a flange 16 which bears upon a compressible disk 16' interposed between the flange and the top of the plug 10.

The fuse housing is H-shaped in section, thus providing a floor or partition 17 which is provided with a flash passage 18 therethrough communicating at its upper end with a chamber 19 formed by the walls of the housing and a removable threaded disk 20, the threads of which disk occupy the extended threads of the fuse housing.

The lower part of the housing below the floor 17 is internally and somewhat extensively threaded as shown, the threads extending short of the floor. The lower part of the housing is occupied uppermostly by a threaded thimble 21 having a

central shouldered aperture, near its lower end, the bottom of the thimble being cone-shaped. Below the thimble the housing receives the threaded head 22 of the firing device holder 23. This holder has a central bore 24 opening at its upper end into a shallow cone-shaped chamber 25. The lower end of the holder has a flange 26 which forms a seat for the lowermost element 27 of the multi-part firing pin, which component is the one to whose length is added other components, in this case a plurality of balls 27', preferably of glass or agate. A lateral integral extension 28 open at its upper end communicates at its lower end with the holder and forms a pocket for the balls 27'. The wall of the holder is recessed as indicated at 30 for the passage of a spring finger 30' whose lower end extends through the recess into the bore of the holder, the finger serving to hold the ball in the bore of the holder after it has been forced from the bottom thereof by the element 27. The space below the lower end of the finger and the bottom of the pocket is such as to permit the passage of a ball past the end of the finger out on to the top of 27 in position to be forced upwardly upon the upward movement of said element 27, when movement is effected by the contact of said element with the bottom of the sump 5', in the porcelain section 5, as will more fully appear in the description of the operation.

Below the closure plug 13 in the fuse housing is the threaded removable disk 20 which holds in position a disk 33 of suitable primer material, which in turn rests upon an annular booster pellet 34 seated on the floor 17 of the housing. In the center of the pellet is a detonator 35 communicating with a primer charge 36 contained in an opening in the top of the thimble 21. A transverse bore in the thimble receives a capsule 36'', stabilized in the bore by a suitable cement. The capsule is in position to be crushed upon operation of the firing element 37, whose head is supported in the shouldered aperture in the thimble. The lower portion of this firing element extends slightly into the open upper end of the bore of the holder in position to be engaged by the uppermost ball or component of the firing device in that operation of the mine that is to be the effective one. A spring washer 38 engaging a groove in the piston body, holds the piston head seated in its aperture in the thimble.

Surrounding the cylinder 8 is an annular receptacle 39, open at its upper end and receives an additional booster charge of suitable explosive material adapted to be set off by the charge in the fuse holder.

As stated at the outset the mine operates upon the bellows principle, in that the upper and lower sections are moved in relation to each other, and means is required to restore the sections to normal position in an operation short of the one in which the mine is exploded. For this purpose, there is interposed between the laminated disk 6 and the lower section 3, a ring 40 of sponge rubber or other resilient material which may be replaced by a spring made of some non-magnetic material.

The upper and lower sections are suitably spaced apart and are virtually entirely surrounded by a suitable number of layers of canvas 41 or other suitable flexible non-magnetic material that will allow the sections to be moved toward each other, or in the manner of intended operation, the top section moved toward the lower one, responsive to a pressure upon the top of the mine

such as that produced by the weight of a vehicle, and to limit their movement in the opposite direction, in operations short of the final one.

Space is left between the cylinder 8 and the fuse housing so that the fuse unit may be readily inserted in the mine, and to make the plugs 10 and 13 conveniently available the canvas stops considerably short of the center of the top of the upper section, and its inner boundary is preferably defined by a ring 42 seated on the top section. Within the ring is a rubber ring 43, the interior of which is occupied by the upper plug 13, with no part of the plug extending above the ring.

The main charge may be of any suitable explosive, and also the primer materials. The booster pellet and detonator 35 may employ conventional ingredients; the contents of the capsule may be an acid component and the primer material associated closely therewith may be a compound ignited by contact with sulphuric acid as is well known in the art, and obviously the multi-part firing device shown may be employed to actuate any suitable primer for initiating explosions or for starting powder trains etc.

An appropriate number of firing device components, balls in the present embodiment of the invention, are placed in the pocket in the extension 28, the number determining the number of ineffective operations the mine will endure before the final or exploding one. The lowermost ball, by gravity, rolls out upon the firing element 27, there to stay until the upper section of the mine is depressed, when the element 27 striking the bottom of the sump 5' will force it upwardly above the spring finger 30. Obviously, in succeeding operations like that just explained, the balls will be built up in the bore 24 until they span the distance between the lower and upper firing elements 27 and 37, when upon the succeeding operation of the mine, it will be exploded.

As stated, the mine is made of non-magnetic material throughout and will, preferably, where feasible be made of plastic. However, the upper and lower sections will preferably be made of porcelain or like material with insulating properties and offering such resistance to the explosion as to fragment destructively. The components of the firing device will preferably be of glass or agate and of such weight and smoothness as to assure that they fall quickly, by gravity, to position to be fed into operative position.

The mine illustrated is arranged to be exploded on the fourth impact, there being four balls in the holder. Should it be desired to have it explode on some other impact within the range of the number of balls in the holder, the fuse housing will be removed and the element 27 manually manipulated to feed a number of balls into alignment with the elements 27 and 37. In order that one may see the number of balls so fed, I provide a narrow elongated slot 44 in the holder. Ordinarily this manual manipulation will not be necessary, since the order of explosion will be taken care of in the first place, but in some emergency or in the force of changed plans, such variation in the exploding order might be desirable.

I claim:

1. A contact mine comprising a pair of relatively movable spaced sections, one of which contains an explosive charge, resilient means normally holding said sections in spaced relation, a fuse carried by one of the sections and including a primer and a firing element, a firing device carried by one of the sections and comprising a plurality of separate components, a predetermined

number of which are adapted to be successively brought into alignment with said firing element until said components span the space between the last fed component and said firing element, and means carried by one section arranged to feed said components successively toward said firing element upon the movement of said sections toward each other.

2. A contact mine comprising a cup-shaped upper section adapted to receive the main explosive charge and a lower section spaced from the former, resilient means between the sections for spacing them and returning the upper section to normal position after its depression toward the lower section, a fuse in the upper section having a primer charge and formed with a hollow extension, an upper firing element in the fuse adjacent the primer charge, and a second firing element reciprocable in the lower end of said hollow extension, said lower element arranged to be reciprocated by contact with the lower section, and an additional firing device comprising separate components between the upper and lower firing elements but normally out of line therewith, said additional components being adapted to be fed by the lower firing element successively into alignment with said upper firing element upon the reciprocation of the lower element until the additional components span the space between the last fed components and the upper firing element to complete the firing means.

3. A contact mine comprising upper and lower relatively movable sections, the upper section adapted to receive the main explosive charge, resilient means spacing said sections apart and for returning the upper section to normal position, a removable plug in the top of the upper section, a fuse housing carried by said plug and extending in proximity to said charge, said housing formed with a transverse partition intermediate its ends and having a flash passage therethrough, a booster charge and a primer charge seated on the upper side of said partition, a thimble below the partition and having an axial opening therethrough communicating with the flash passage, a firing element in the lower part of the opening and a priming charge in the upper part, said thimble being further provided with a transverse bore having therein a capsule of frangible material and containing a primer igniting fluid, said capsule being adapted to be ruptured by the firing element, a hollow extension carried by said housing and having a pocket at one side thereof opening into the lower part of said extension, a second firing element reciprocable in the lower part of the extension, and a predetermined plurality of balls in the pocket arranged to be fed consecutively toward the upper firing element by a succession of contacts between the lower firing element and the lower mine section until the space between the upper and lower firing elements is spanned by said balls whereby to explode the mine upon its succeeding operation.

4. The invention of claim 3, characterized in that the hollow extension of the fuse housing has a spring finger extending into the path of movement of the firing device components to support the components when they have been fed beyond the end of the finger.

5. The invention of claim 3, characterized in that the upper and lower sections have suitably secured thereto a covering of flexible material securing the internal parts of the mine in proper relative position and permitting the bellows-like action of the mine in operation.

6. A contact mine comprising a pair of spaced sections, means connecting said sections for movement toward and from each other, resilient means urging said sections into spaced relation, a fuse carried by one said section and including a primer and a firing element, a plurality of separate components mounted in a channel between said sections, and means between said sections including a pin spaced from said firing element and movable by and in response to relative movement of said elements, to successively feed said components into the space between said firing element and pin whereby to fill said space and mechanically transmit to said firing element a final one only of a predetermined number of movements of said pin.

7. In an explosive contact mine, a pair of sections, means connecting said sections for guided movement toward and from each other, resilient means urging said sections into spaced relation, detonator means in one element and including a firing element, a firing pin spaced from said element and movable in response to relative movement of said sections, a plurality of balls, and means for feeding said balls individually into the space between said pin and element by and in response to relative movement of said elements to fill said space and thereby mechanically connect said pin and element and detonate the mine only after a predetermined number of relative movements of said sections.

8. A contact mine comprising a pair of relatively movable sections, a normally spaced detonator and firing pin in said mine, a series of balls in said mine, and means responsive to relative movements of said sections to feed said balls into the space between said detonator and firing pin to thereby mechanically connect said pin with said detonator after a predetermined number only of said movements.

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