

Oct. 5, 1948.

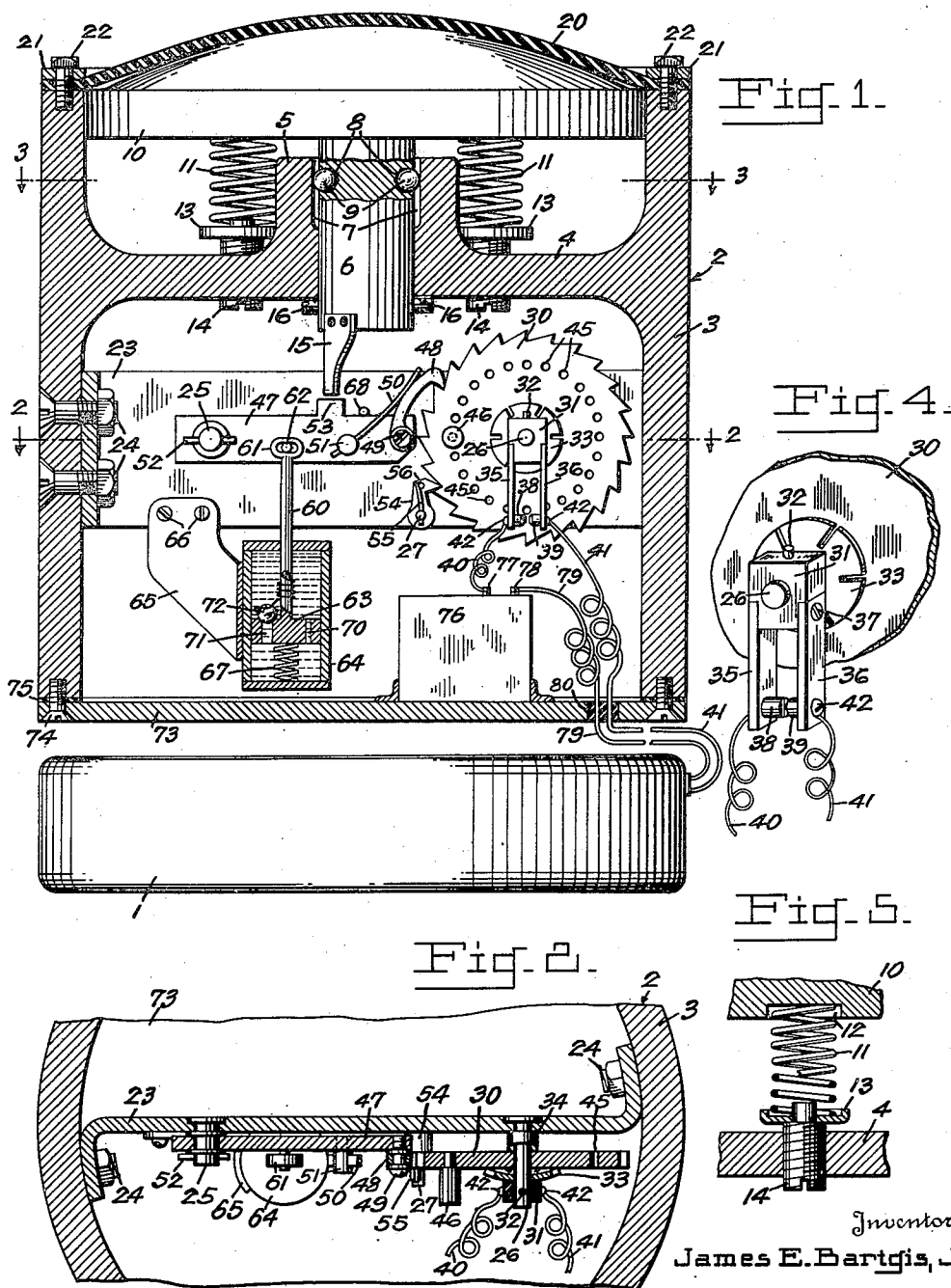
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2,450,407

MINE

Filed July 30, 1943

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 3.

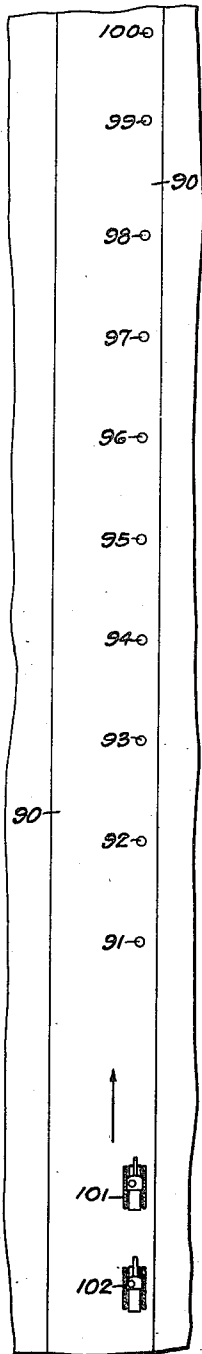
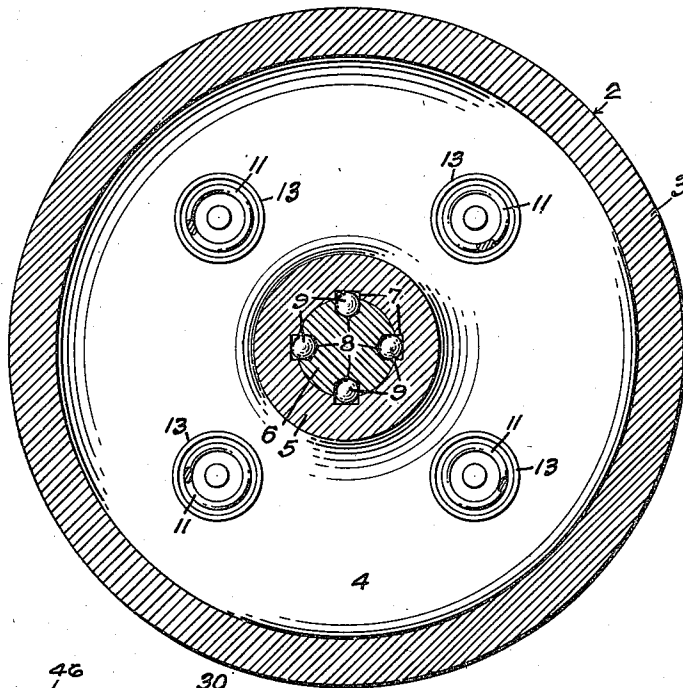


Fig. 6.

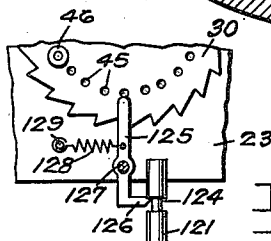


Fig. 8.

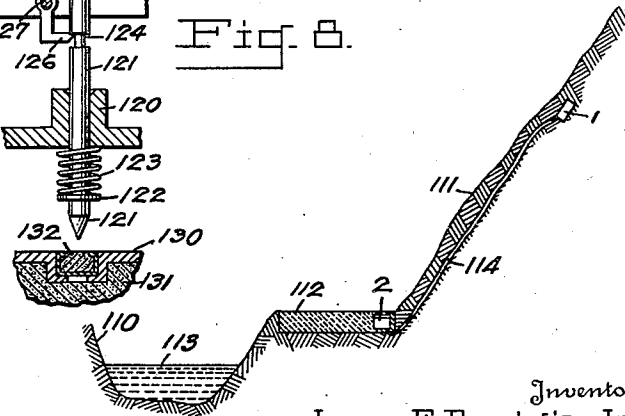


Fig. 7.

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UNITED STATES PATENT OFFICE

2,450,407

MINE

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9 Claims. (Cl. 102—8)

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

1

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 mines, such as land mines, and anti-tank mines.

Mines of the present invention may be considered as belonging to that class of mines whose explosion is initiated or brought about by impulses or pressure applied to some part of the mine, the said part usually consisting of an element which may be depressed by the pressure or weight of a vehicle passing thereover.

The term "vehicle" is used herein in a broad sense as including anything mounted for travel over road or ground on wheels or endless belts or tracks, and therefore includes all land vehicles, combat tanks, caterpillar tractors of all kinds, artillery mounted on wheels or driven endless tracks, trains, and automobiles of all kinds, such as trucks, and passenger, reconnaissance, and armored automobiles.

The land mines and anti-tank mines of the prior art are constructed in such a manner that their explosive charges explode from one impulse or upon one application of the pressure or weight of the vehicle passing thereon. That is to say, a single actuation of their depressible member or element by the vehicle is more or less immediately followed by the explosion of the explosive charge of the mine.

It is among the objects of the present invention to provide a mine whose explosive charge may be exploded after a selected or predetermined number of passages of vehicles thereon or thereover, or after a selected or predetermined number of impulses occasioned by the passages of vehicles or other objects. Thus, mines made in accordance with the present invention may be set or adjusted so that their explosive charges explode after one or more passages of a vehicle or of vehicles thereon or thereover, at the election of the user thereof. In the tactical use of mines constructed in accordance with the present invention, the mines in large part, as explained hereinafter, are so set or adjusted that their explosive charges explode on some particularly chosen or selected impulse or passage of a vehicle succeeding the first impulse or passage.

Another object of the invention is to provide a mine which includes a counter which is actuated by or from means responsive to the passage of vehicles, or by or from impulses occasioned by the passage of objects or vehicles, whereby the number of impulses or passages are entered or

2

registered in the counter; and which includes, besides a counter, means under control of the counter for setting off an explosive charge after one or more than one actuation of the counter, at the election of the user, or as may be required or advisable from the viewpoint of military tactics.

Further objects of the invention are obvious from, or particularly pointed out in, the following detailed description of the invention.

In the accompanying drawings, which illustrate the invention, and in which the same reference characters applied to the parts indicate the same or corresponding parts,

Fig. 1 is a vertical central section of an embodiment of the invention with certain parts in elevation.

Fig. 2 is a partial cross section on the line 2—2 of Fig. 1.

Fig. 3 is a cross section on the line 3—3 of Fig. 1.

Fig. 4 is a somewhat enlarged perspective view of the electric contact means, spring washer, and a part of the ratchet wheel shown in elevation in Fig. 1.

Fig. 5 is a detail, partly in section and partly in elevation, of one of the four adjustable spring means between the depressible head or top of the mine and a fixed portion of the mine.

Fig. 6 is a plan view of a road illustrating one manner of using the mines of the present invention.

Fig. 7 is a vertical section of defile or ravine showing another manner of using the mines.

Fig. 8 is an elevation with certain parts in section, showing mechanical means which may be substituted for the electrical means in housing 3 of Figure 1.

In general, the mine of the present invention may comprise two parts, namely (1) a case or closed container 1 within which an explosive charge is enclosed, and (2) a device, referred to herein as an "exploder" for setting off said explosive, and indicated generally by the numeral 2 in Figure 1.

A primer of any suitable type, electrical, percussion or friction, is used to fire or ignite the explosive charge. The primer may be placed in a well or cavity in the container 1 or in the explosive, or otherwise closely associated with the explosive charge. Such primers are well known in the art and therefore need no detailed illustration or description here. In this description and in the claims, the primer is considered as

forming part of the explosive charge, unless the context indicates otherwise.

The exploder illustrated in Figure 1 is for use with an electrical primer; and Figure 8 illustrates mechanical means which may be substituted for the electrical means of Figure 1 for using the exploder with a percussion primer.

The exploder shown consists of a housing 3 (illustrated as cylindrical) and of the instrumentalities shown within the housing, either in the instance where electrical means, such as shown in Figure 1, are employed, or in the instance where mechanical means, such as shown in Figure 8, are employed for setting off the primer. The exploder, although cooperable or cooperating with the explosive charge and primer, is considered as a distinct device or distinct component, in this description and in the claims, whether the container 1 is near the exploder, as in Figure 1, or far removed from it, as in Figure 8, or whether the explosive charge is placed in an enlargement of housing 3, or container 1 fastened to, or formed as a part of, housing 3.

A web 4 extends across the interior of the cylindrical housing 3 at right angles to its axis, and nearer the top of said cylindrical housing than to the bottom thereof. A hole is provided through the center of this web and a boss 5 rises around said hole. Said hole and boss are machined to receive shaft or plunger 6 with a free sliding fit. Boss 5 is provided with grooves 7, and shaft 6 with recesses 8 for receiving the ball bearings 9.

The top of the shaft 6 is attached to the dome-shaped depressible head or member 10 which has a circular contour at its base. Depressible member 10 slidably fits within the cylindrical housing 3 and is depressible by the passage of a vehicle thereon or thereover. It is returnable to elevated position by the action of coil springs 11. The downward motion of head 10 is limited by the top of boss 5.

Springs 11, at their upper ends, fit within recesses 12 (see Fig. 5) on the underside of depressible member 10, and at their lower ends fit within cups 13 carried on the upper ends of tension adjusting screws 14 which engage with mating threads in web 4. By turning screws 14 to adjust the tension of spring 11, the minimum weight of vehicle effective to reciprocate shaft 6, may be varied.

At its bottom end, the shaft 6 carries a foot or extension 15, the function of which appears hereinafter. Two lugs 16 extend out radially from the shaft 6 below the web 4 to limit the upward movement of the head 10 under the action of springs 11.

A sheet of rubber, or of other flexible water shedding or water proof material 20, closes the top of the cylindrical portion 3, passing over the depressible member 10. The rubber sheet, or sheet of other equivalent material, is secured around the top of cylindrical portion 3 by the clamping action of a ring 21 and screws 22 passing through the ring and engaging threads in holes in the end of the cylindrical portion.

A plate 23 passes diametrically across the interior of the cylindrical portion 3 below the web 4, and is secured to the wall of cylindrical portion 3 by means of bolts 24. Three pintles 25, 26 and 27 are carried by the plate 23.

A ratchet wheel 30 is mounted for rotation on pindle 26, and is rotated by pawl means hereinafter described. The pindle 26 also carries contact means for closing an electric circuit. This contact means comprises a head 31 of electrical insu-

lating material having a hole which enables it to be slid into position on said pindle as shown. The said head is fixed in position on the said pindle by means of a pin 32 passing through said head and pindle. A spring washer 33 is positioned between the insulating head 31 and the ratchet wheel 30, and urges the latter and spacer 34 (Fig. 2) towards the plate 23.

Two spring contact arms 35 and 36 of electrically conducting material are secured by means of screws 37 to head 31. Arms 35 and 36 respectively carry electrical contacts 38 and 39, which are normally open or separated in the embodiment of the invention illustrated in Fig. 1. An electrical conduit or conducting wire 40 is connected with arm 35 and contact 38, and another electric conduit or wire 41 is connected with arm 36 and contact 39. The connection of wires 40 and 41 with arms 35 and 36 and with contacts 38 and 39 may be accomplished in any suitable manner, for example by means of two screws 42. While contact arms 35 and 36 have been specifically indicated as being made of electrically conducting material, it is to be understood that they may be made of an electrically non-conducting material if the contacts 38 and 39 are respectively connected with wires 40 and 41.

Ratchet wheel 30 is provided with a series of holes 45 arranged in the form of a circle somewhat nearer the center of the wheel than the teeth of the wheel. In the embodiment of the invention illustrated in Figure 1, there are twenty-four of such holes and a like number of teeth on the ratchet wheel. A projection or stud 46 having a reduced end which may be tightly and securely placed in any one of the holes 45 is provided for pressing against the contact arm 35 in its path, when the ratchet wheel 30 is rotated sufficiently.

In the embodiment of the invention illustrated, ratchet wheel 30 is turned one tooth upon each complete depression of head 10. The downward motion or movement of head 10 is utilized to accomplish this turning of wheel 30. To this end, a lever 47 pivoted on pindle 25 and a pawl 48 pivoted on pindle 49, screwed into the lever 47, are provided. A spring 50 fixed in a stud 51, carried on the lever 47, urges the pawl 48 against the ratchet wheel. A pin 52 driven through a hole near the free end of pindle 25 holds the lever 47 thereon. As shown, the free end of the pawl 48 is positioned to engage the teeth of the ratchet wheel 30. The pawl 48 is pivoted to permit it to ride over the teeth of ratchet wheel 30 when lever 47 returns to initial position after having moved downwardly.

Upon depression of the head 10 by a vehicle, the shaft 6 and foot 15, attached thereto, move downwardly, the foot 15 pressing downwardly against the upwardly extending portion 53 of the lever 47. As illustrated, each downward movement of the foot 15, and therefore each downward movement of the head 10, moves the free end of the lever 47 and pawl 48 downwardly to rotate the ratchet wheel 30 one tooth. With the projection or stud 46 positioned initially as shown in the drawings, five depressions of the head 10 are required to close the electrical contacts 38 and 39. By placing the projection or stud 46 in a suitable one of the holes 45, the closing of the contacts 38 and 39 may be made to occur after any selected or predetermined number of downward movement of head 10, or passages of vehicles thereon or thereover, at the election of the user of the mine.

A safety dog 54 is pivoted on pindle 27 secured

5

to plate 23. A spring 55, secured at one end to the pintle 27 and acting against a stop 56 near the free end of the dog, urges the dog into engagement with the ratchet wheel between the teeth. This dog prevents accidental or backward rotation of ratchet wheel 30, while permitting rotation of it by pawl 48.

The sidewise thrust produced on ratchet wheel 30 by spring washer 33 together with the drag on the ratchet wheel produced by dog 54 are sufficient under usual conditions to prevent overthrow of the ratchet wheel. However, if desired any suitable overthrow preventer known in the art of counters or adding machines may be used. To more effectively apply the tension of spring washer 33 to prevent overthrow, the spring washer may be pinned to the insulating head 31 or otherwise secured against rotation on the pintle 26, whereby the ratchet wheel 30 then rotates against the friction between the ratchet wheel and the stationary spring washer.

Means are provided to restore the lever 47 to initial position after each actuation thereof by the foot 15. This means comprises a rod 50 with a head 61 having a slot therein which loosely engages a pin 52 secured to lever 47. At the lower end of the rod 60 is a piston 63 which fits for reciprocating movement in closed cylinder 64 carried by bracket 65 secured by any suitable means, such as screws 66, to plate 23. Within the cylinder 64, between the bottom thereof and the under face of the piston, is placed a coil spring 67 which is compressed by the downward motion of the piston 63, and which urges the piston upwardly again after completion of its downward movement. As will appear from an inspection of the drawings, the downward motion of lever 47 imparts downward motion to the rod 60 and piston 63, whereby coil spring 67 becomes compressed, and the expansion of spring 67 after compression moves the piston 63, rod 60 and lever 47 upwardly. The upward movement of lever 47 is arrested by a stop 68 on plate 23. This stop is positioned to enable pawl 48, at the end of its return movement, to engage the ratchet wheel properly, as shown in Figure 1. In order that the return of said lever may be delayed or retarded, the piston 63 is provided with a bleeder hole 70 and a rapid escape hole 71 closed at the top by a spring pressed check valve 72. Cylinder 64 is filled with a liquid of low volatility, such as a hydrocarbon oil of comparatively high boiling point. As shown, both holes pass entirely through the piston, the hole 71 being considerably larger in diameter than the hole 70. The diameter of the hole 70 is comparatively small, being adjusted in diameter according to the rate at which is desired that piston 63, rod 60 and lever 47 be returned to the initial position shown in Figure 1.

When the piston 63 moves downwardly in the cylinder, the oil in the cylinder is able to pass freely upwardly through hole 71 and less freely through hole 70. This permits rapid downward motion of the lever 47. However, when the piston 63 moves upwardly under the influence of spring 67, the passage of oil downwardly through the hole 71 is arrested by the check valve 72, while the passage of oil downwardly through the hole 70 is comparatively slow on account of its small diameter. Due to this latter slow passage of oil through the hole 70, the upward motion of the piston 63 is slow or retarded, and as a consequence the return of lever 47 to its initial or starting position, for actuation of ratchet wheel 30, is delayed or retarded.

6

The above described delay or retardation in the return of lever 47 to initial position is introduced for the purpose of securing only one actuation of the lever 47 downwardly by the single passage of an automobile or other vehicle having wheels near the front and wheels or tracks near the rear. If the above delay were not introduced, the lever 47 would be in position to be actuated downwardly not only by the passage of the front wheels over the mine but also by the passage of the rear wheels or tracks, because during the interval of time between the passage of the front wheels and rear wheels or tracks of the vehicle, the head 10 would rise quickly, under the influence of spring 11, after having been depressed. The delay introduced should be sufficient to allow the rear wheels or tracks to pass over the mine before the lever 47 has returned to initial position.

The bottom of the housing or cylindrical portion 3 is closed by a bottom plate 73 secured to the end of the housing by means of screws 74. It is advantageous to place a rubber or other water excluding gasket 75 between the end of the housing 3 and the bottom plate 73.

An electric battery 76, or box for electric cells or electric storage battery, is secured in any suitable manner within the housing 3 on the bottom plate 73. The terminals of this source of electrical energy are indicated by the numerals 77 and 78. The insulated wire 49 connects terminal 77 with contact 38. An insulated electrical conductor 79 is connected with terminal 78 and passes through an insulator 80 inserted in an opening in the bottom plate 73. The insulated conductor 41 leads from the contact 39 through the insulator 80 to the exterior of the housing. The insulator 80 preferably should so fit the opening within which it is placed, and so grip the conductors passing through it, that the entrance of water within the housing will be prevented.

Those portions of the conductors 41 and 79 which are on the outside of the housing 3 are well insulated and lead to the terminals of the electric primer or detonating means within the container 1 of high explosive. The portions of the conductors 41 and 79 on the outside of housing 3 may be as long as desired, so that the container 1 may be placed, in use, near or far from the housing 3 or exploder 2.

Operation.—Figure 1 of the drawing shows the position of the various parts of the device ready to receive the first impulse or passage of a vehicle and with the stud 45 so set on the ratchet wheel 30 to effect explosion of the explosive charge in container 1 upon the occurrence of the fifth impulse or vehicle passage. Upon the depression of head 10, shaft 6 and foot 15 are depressed. Foot 15 presses lever 47 downwardly and this movement of lever 47 causes pawl 48 to turn ratchet wheel 30 one tooth. After passage of the vehicle, lever 47 returns to its normal or initial position very slowly under the action of coil spring 67 pressing upwardly beneath the piston 63. The upward motion of piston 63 is communicated to rod 60 which connects with lever 47 as heretofore described. In the return motion of lever 47, the pawl 48, being pivoted on the lever 47, rides backwardly over the ratchet wheel, and when lever 47 again reaches its normal position, the pawl 48 under the influence of spring 50 engages behind the tooth to the immediate rear of the one with which it had been in engagement on the preceding downward motion of lever 47.

After the passage of the vehicle over the head 10, the latter, under the influence of springs 11,

is again raised to undepressed position, and is thereby made ready to actuate lever 47, through shaft 6 and foot 15, when the lever 47 reaches its normal starting position. It will be observed, that this single passage of a vehicle only moves the ratchet wheel one tooth so that the contacts 38 and 39 remain open, owing to the fact that stud or projection 46 still does not press against contact arm 35. Four more actuations of lever 47 are required to cause projection 46 to press against contact arm 35 to close contacts 38 and 39 with the internal setting of projection 46 illustrated in the drawing. When contacts 38 and 39 meet, or are closed, an electric current flows through wires 41 and 79 and through the electric primer or detonating means in the container 1 of high explosive and initiates the explosion of the latter. By properly choosing the hole 45 into which the stud 46 is positioned, the explosion may be caused to occur after the passage of any selected number of vehicles or after any selected number of actuations of actuating lever 47.

Figure 6 illustrates one manner in which mines made in accordance with the invention may be employed. In this figure, a road is indicated by the numeral 90. Ten mines 91 to 100 inclusive are planted along one side of the road at any desired or suitable distances apart, for example at distances apart of fifty to one hundred yards. Two combat tanks 101 and 102 of a column of ten or more are assumed, for the purposes of illustrating an application of the invention, to be approaching the planted mines. In this application of the invention the container 1 containing the high explosive is placed near, either below or beside, the exploder 2. The lug or projection 46 of mine 91 is so positioned in relation to the contact arm 35 that the contacts 38 and 39 will be closed upon ten actuations of the lever 47. Therefore mine 91 explodes after ten passages of a vehicle thereon. In a similar manner mine 92 is set to explode by nine passages of a vehicle thereon, mine 93 by eight passages, mine 94 by seven passages, mine 95 by six passages, mine 96 by five passages, mine 97 by four passages, mine 98 by three passages, mine 99 by two passages, and mine 100 by one passage.

In the ideal situation the tanks pass in succession over each of the ten mines, and each of the ten mines would explode under a tank. The leading tank 101 actuates each of the mines 91 to 99 inclusive once, exploding mine 100 as it passes thereon. In the meanwhile tank 102 has passed over mines 91 to 98 inclusive, actuating each a second time. Mine 99, having already been actuated once by tank 101, explodes when tank 102 passes thereover. In like manner, mine 98 explodes when it is passed over by the third tank; mine 97 when passed over by the fourth tank, and so on until all ten mines are exploded, and this may be nearly simultaneous.

Under actual warfare conditions it is not expected that this ideal situation will frequently obtain. The operation of the mines under an ideal situation has been given more for the purpose of illustrating the application of the invention than for illustrating what may be expected to take place under battle or warfare conditions.

In warfare, other situations or conditions may be expected to exist. For example the following is more representative of actual warfare application of the mines. Consider, for example, a tank group consisting of twelve combat tanks in a column, and from fifty to one hundred yards

apart from each other, proceeding along a road mined with ten mines according to the invention as explained above in connection with Figure 6. The column of tanks is assumed to be moving in the direction indicated by the arrow in Figure 6. It is also assumed that the tanks are preceded by motorcycles and followed by maintenance and supply vehicles.

The motorcycles, being comparatively light vehicles, will not be able to actuate any of the mines, owing to the fact that the springs 11 under the depressible head 10 have been chosen strong enough to resist any actuation of the mines by vehicles as light as motorcycles. Tank No. 1 of the column of tanks will proceed along the mined road, actuating perhaps three of the ten mines. It will be assumed that tank No. 1 gets through the described mine field without becoming a casualty. Tank No. 2, it will be assumed, actuates three of the mines and happens also to actuate mine 100. Mine 100 having been set to explode upon one actuation, tank No. 2 becomes a vehicular casualty when it actuates mine 100. Tank No. 3, at about one hundred yards behind tank No. 2, will likely actuate mine 99, which, it will be assumed has already been actuated once by a preceding tank. Tank No. 3 therefore becomes a casualty from the explosion of mine 99. By this time the remainder of the twelve tanks are in the mine field and are attempting to turn around and go back. The results of this operation will probably be that three or four of the remaining tanks become casualties and the group of tanks and other vehicles disorganized and looking for another avenue of approach. At any event, the assumed mine field will separate and disorganize the group of tanks and other vehicles.

Figure 7 illustrates another application of the mines of the present invention. In this figure the numerals 110 and 111 indicate steep slopes of a defile or ravine. A road 112, at the base of slope 111, runs along the stream 113. One or more exploders 2 of the present invention may be planted in the road 112 at the foot of slope 111, while the container 1 of each, containing the explosive charge, is planted some distance up the slope. Each exploder 2 is connected with the primer or detonator of each container 1 by electrical conductors 41 and 79 (see Figure 1) and represented by a cable 114 in Figure 2. Vehicles passing on the roadway actuate the exploders 2 planted in the road 112; and the exploders 2 may be set, as above explained, to set off the explosive in containers 1 after a selected number of actuations thereof. The explosion of the explosive in container or containers 1 produces an artificial avalanche which descends upon the road producing casualties of personnel and vehicles, and division of the column of vehicles, if some have passed before production of the avalanche.

The manner in which the mechanical means illustrated in Figure 8 may be substituted for the electrical means shown in Figure 1 will now clearly appear. Referring particularly to Figure 8, numeral 23 indicates the plate 23 of Figure 1, but in this instance extended somewhat below the ratchet wheel. Ratchet wheel 30, holes 45, and stud or projection 46 in Figure 8 correspond to similarly numbered parts in Figure 1. Within the housing 3 (see Fig. 1) is fixed a guide 120 (see Fig. 8) for firing pin 121. Near the pointed end of firing pin 121 is fixed a collar 122. A coil spring 123 is placed on the firing pin between the

collar 122 and the guide 120. A shoulder 124 is formed on the firing pin near the end opposite the pointed end. A latch 125, having a hook portion 126, is pivoted on a pintle 127 fixed on plate 23. A coil spring 128, attached at one end to the latch 125, and at the opposite end to a pin 129, fixed to plate 23, urges the hook 126 of the latch 125 beneath the shoulder 124, thereby holding firing pin in elevated position (as shown in Fig. 8) and spring 123 under compression.

Still referring to Figure 8, the numeral 130 indicates a part of a container which holds an explosive charge 131. A percussion primer 132 fits in a well in the container 132 at a position opposite the point of the firing pin 121. In this instance the explosive charge is placed in an enlargement of housing 3 or attached thereto in a suitable manner. In Figure 8, the stud or projection 46 is set to explode the mine upon the fourth actuation of ratchet wheel 30, assuming, of course, that the figure represents the starting position of the ratchet wheel. Upon the occurrence of the fourth actuation of the ratchet wheel, the stud 46 presses against the latch 125; whereupon the hook portion 126 is removed from beneath the shoulder 124 and the firing pin, under the influence of spring 123, strikes the primer 132, setting off the explosive 131.

It is to be observed from the foregoing detailed description and mode of operation of the mines of the present invention, that the ratchet wheel 30, lever 47, and pawl 48 constitute a counter which counts the number of passages of vehicles or impulses occasioned by the passage of vehicles or other objects, and that means for exploding the charge contained within the container 1 is under the control of the counter. While a specific form of counter, specific means under control of the counter for exploding the charge and specific means responsive to the passages of vehicles or to impulses have been described, it is to be understood that the invention is not confined to the use of these specific means, because other means accomplishing the same function may be used without departing from the invention, as will be understood by the person skilled in the art. Nor is the use of the means for retarding the return of lever 47 absolutely necessary for the practice of the invention, since the extra actuations of the counter, which may be occasioned by elimination of the retarding means, may be taken into account in setting the counter to set off the explosive charge at the desired time.

The mine may be made responsive to the passage of objects other than vehicles by a choice of springs 11 with suitable constants or physical characteristics. For example, the springs 11 may be chosen weak enough to permit the depression of head 10 and actuation of the counter by the weight of a man. Thus, the exploder or component 2, may be set to cause explosion of the mine after a selected number of soldiers or ranks of soldiers have depressed the head 10 by walking thereon.

I claim:

1. An exploder comprising means depressible by the pressure engendered by the passage of a vehicle thereover, means for restoring said depressible means to undepressed position after depression thereof, contact means for closing an electric circuit for exploding an explosive, and means actuated step by step by the successive movements of said depressible means for closing said contact means, said last mentioned means being adjustable to close said contact means only

by a pre-selected depression of said depressible member.

2. An exploder comprising means depressible by the passage of a vehicle, means for restoring said depressible means to undepressed position after depression thereof, contact means for closing an electric circuit for exploding an explosive, means for closing said contact means including a ratchet; pawl means movable to and fro along said ratchet for actuating said ratchet and actuated by the movement of said depressible means, said pawl means during its movement in one direction actuating said ratchet and returning to starting position after actuation of said ratchet; and means for retarding the return of said pawl means to said starting position after actuation of said ratchet.

3. A land mine comprising a depressible member adapted to be directly depressed by the pressure engendered by the passage of a vehicle thereover and returning to an undepressed position after depression thereof, an explosive; and means mechanically and directly actuated from the motion of said depressible member, for detonating said explosive upon the occurrence of a predetermined plurality of depressions of said depressible member.

4. In a land mine component, a reciprocable member adapted to be directly reciprocated by the pressure produced by successive passages of vehicles thereover, wheel means, first means directly operated by reciprocation of said member to move said wheel means step by step, second means movable in a predetermined path by and in response to movement of said wheel means, and third means lying in said path and operable by said second means, to detonate an explosive charge, said second means being adjustable relatively to said wheel means whereby to selectively vary the number of reciprocations of said member necessary to operate said third means.

5. In a mine component, a housing, a member in said housing adapted to be reciprocated by successive passages of vehicles thereadjacent, ratchet means movably mounted within said housing, pawl means in said housing and mounted to be actuated by reciprocation of said member to thereby advance said ratchet means, an abutment movable in a path fixed relatively to said housing by and in response to advance of said ratchet means, detonating means including a part positioned in said path to be operated by said abutment, said detonating means and said abutment being relatively adjustable along said path whereby to selectively vary the number of reciprocations of said member necessary to cause said abutment to engage said part and thereby operate said detonating means.

6. A mine component comprising a housing having means forming a guideway, a plunger reciprocable in said housing and along said guideway, said plunger adapted to be reciprocated by successive passages of a vehicle thereadjacent, a ratchet wheel journaled in said housing, pawl means positioned to be actuated by said plunger to thereby rotate said wheel step by step, an abutment adapted to be fixed to and in circumferentially adjusted position about said wheel, said means for detonating an explosive charge positioned in the path of said abutment to be operated thereby after a selected number of reciprocations of said plunger as determined by the adjustment of said abutment on said wheel.

7. A delayed action land mine component com-

11

prising a casing having an opening in its top, a head closing said opening, said head being mounted in said casing for depression in response to pressure externally applied thereto, resilient means urging said head to undepressed position, plunger means connected for movement with said head, counter means in said casing adapted to be directly operated one step at a time by each respective movement of said plunger means, and means under control of said counter for detonating an explosive only upon the occurrence of a pre-selected number of depressions of said head.

8. In a delayed action land mine component, a casing having an opening in its top, a head closing said opening and depressible from a first to a second position in response to the force exerted by a vehicle moving thereover, spring means urging said head to said first position, plunger means connected for movement with said head, a ratchet wheel journaled in said casing, pawl means operated by said plunger means and operating said wheel step by step in response to respective depressions of said head to said second position, and means settable with respect to said wheel to detonate an explosive charge by and upon a pre-selected operation only of said wheel.

9. In a delayed action mine, a casing having an opening in its top, plunger means reciprocable within said opening and depressible by the pressure of a vehicle passing thereover, spring means

12

urging said plunger means to undepressed position, a lever pivoted in said casing and adapted to be pivoted by depression of said plunger means, a wheel journaled in said casing, means carried by said lever to advance said wheel step by step in response to successive actuations of said plunger means, a stud carried by said wheel and movable in an arcuate path therewith about the pivot axis thereof, and detonating means adapted to be engaged and operated by said stud, said stud and detonating means being relatively adjustable about the axis of said wheel to vary the number of depressions of said plunger means necessary for detonation.

JAMES E. BARTGIS, JR.

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