

Sept. 23, 1947.

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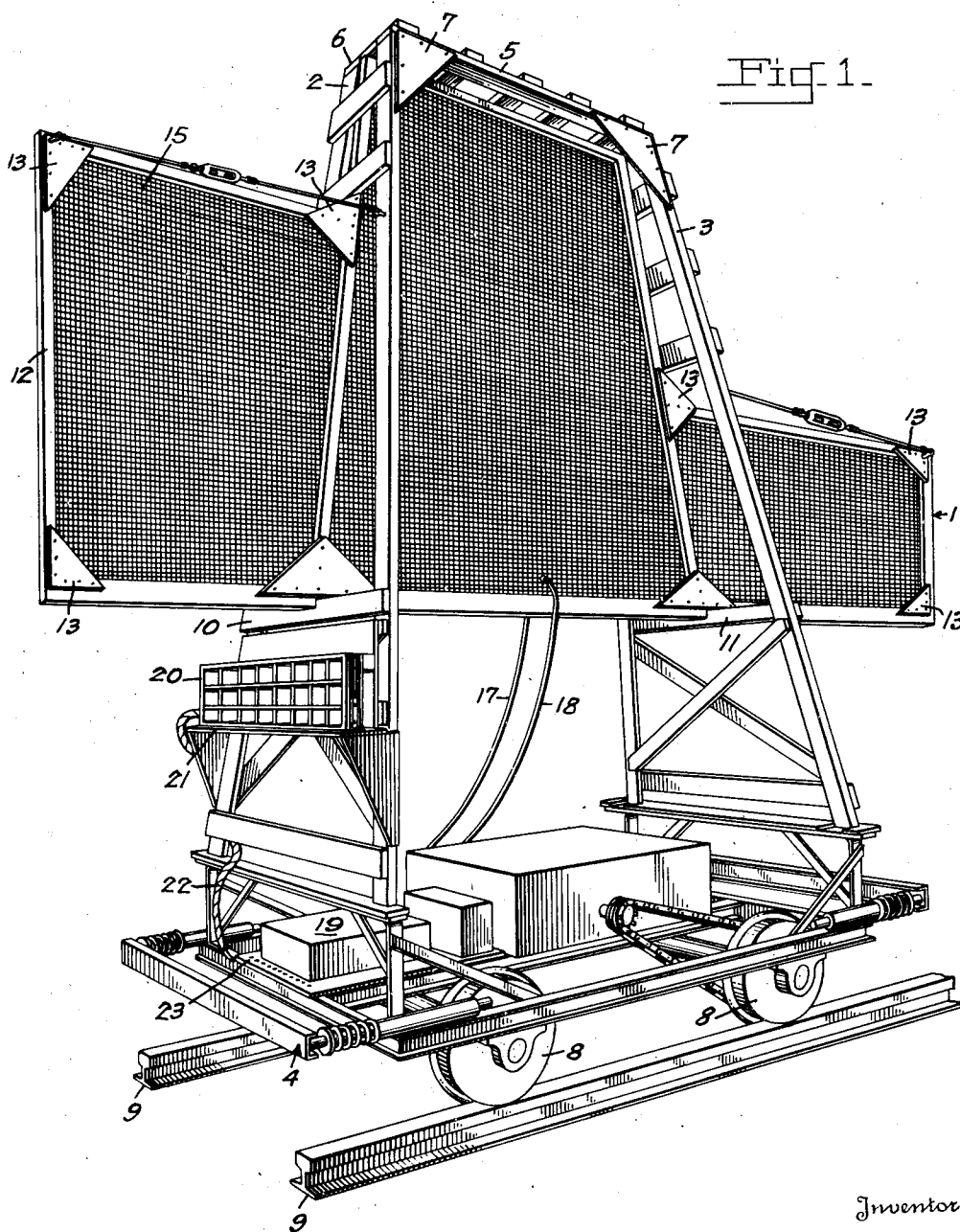
2,427,901

ELECTRIC TARGET AND CIRCUIT

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4 Sheets-Sheet 1

Fig. 1.



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Fig. 4 -

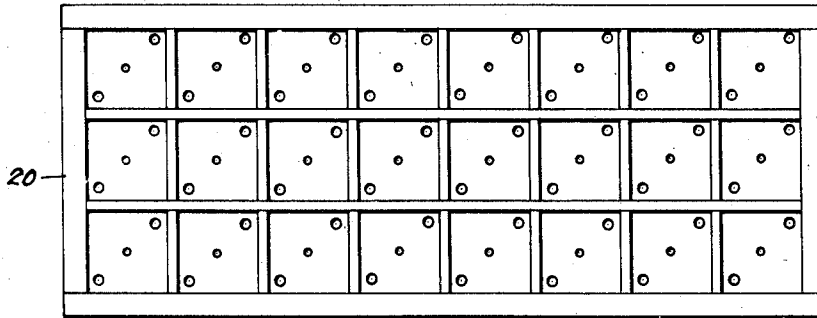


Fig. 2 -

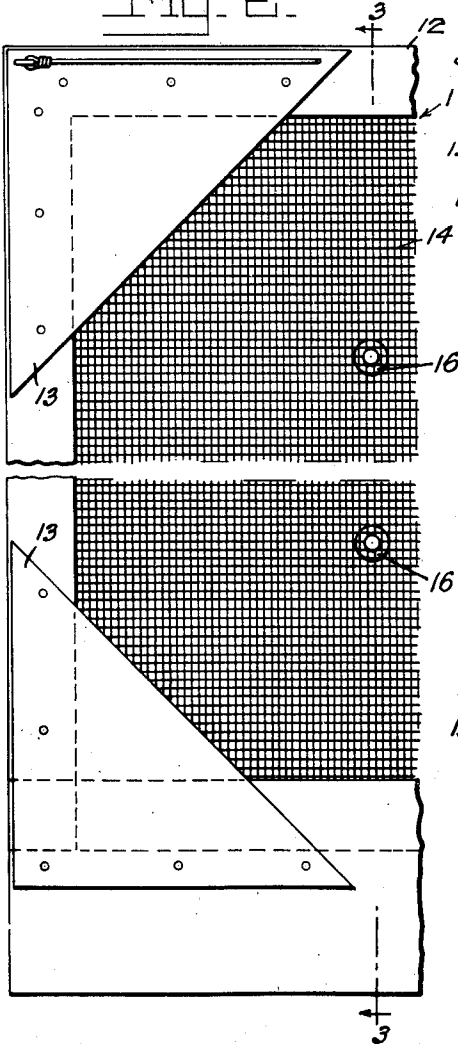


Fig. 3 -

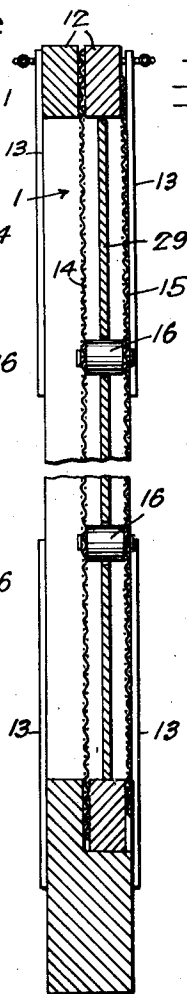
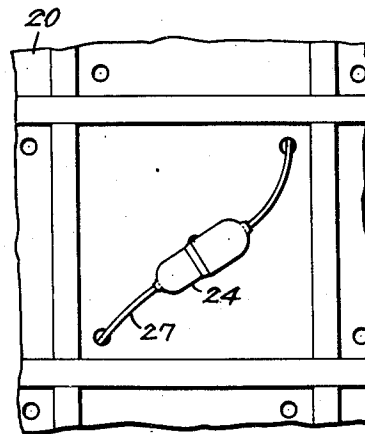


Fig. 5 -



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Fig. 6.

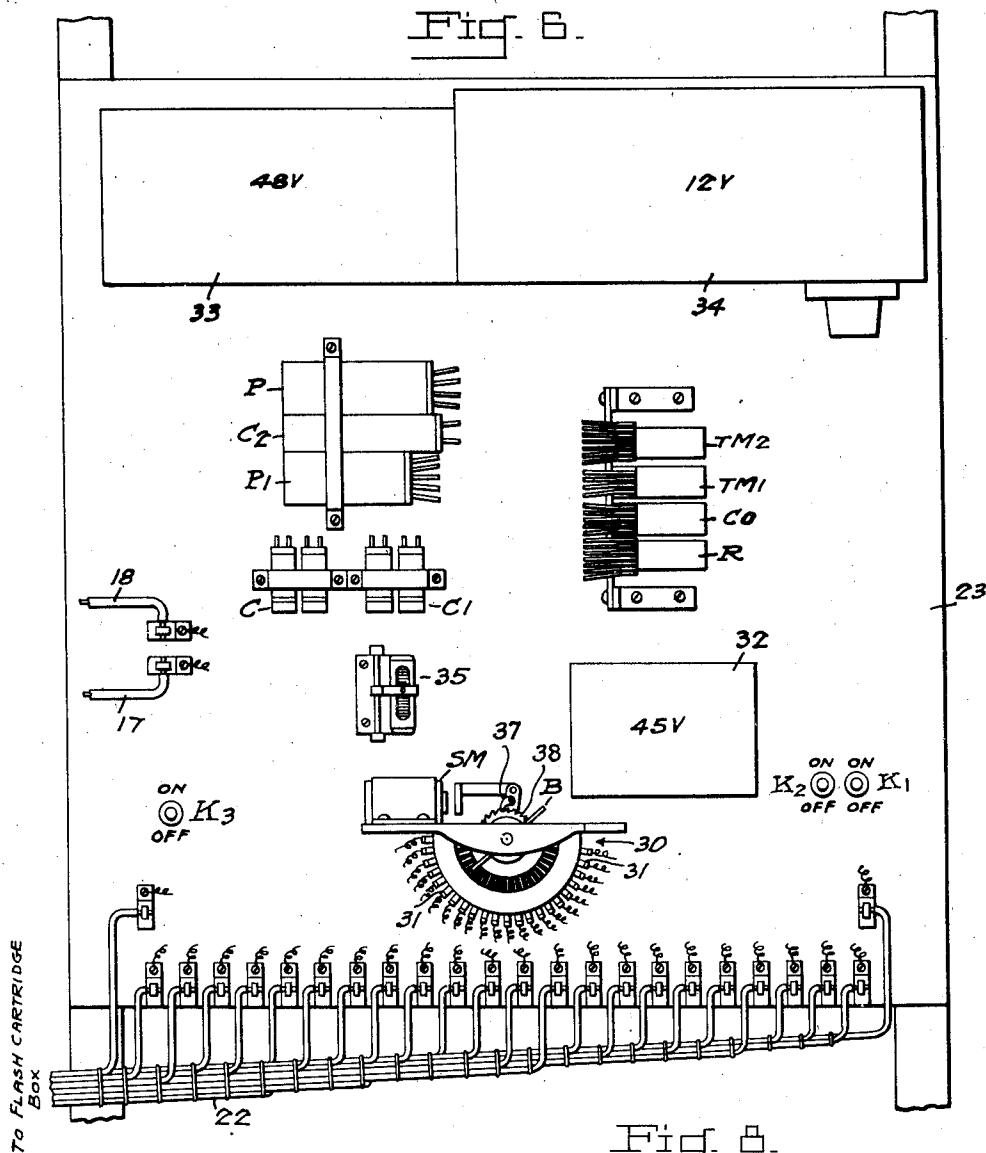


Fig. 6.

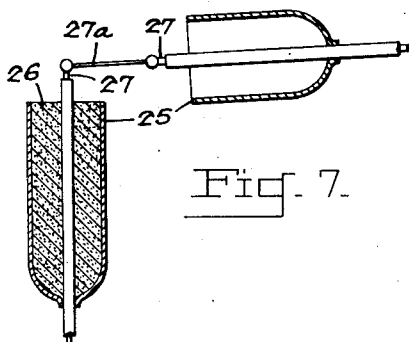
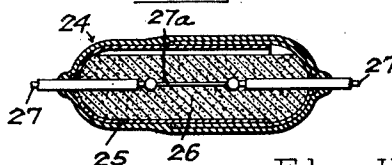


Fig. 7.



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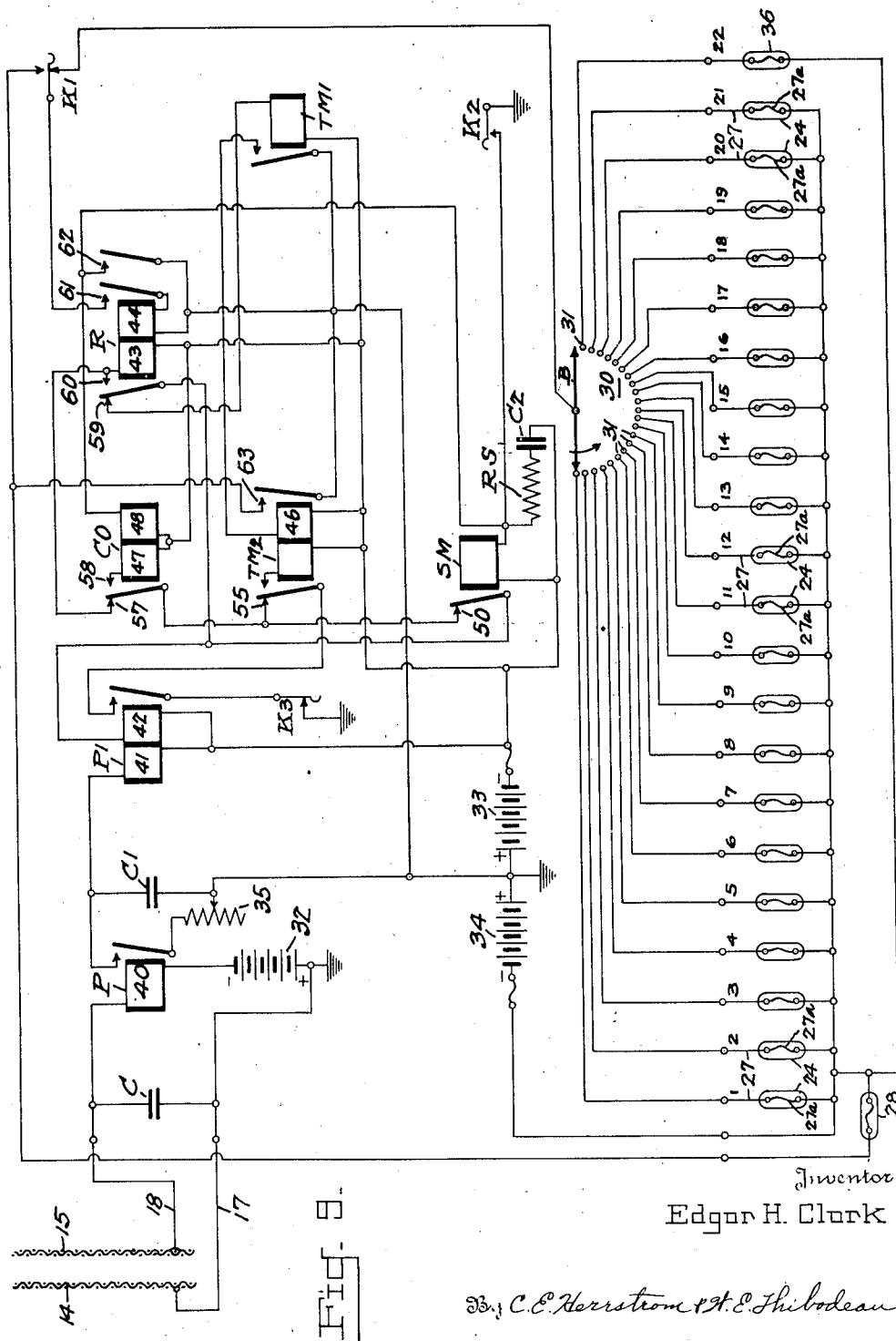
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ELECTRIC TARGET AND CIRCUIT

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UNITED STATES PATENT OFFICE

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ELECTRIC TARGET AND CIRCUIT

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11 Claims. (Cl. 273—102.2)

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This invention relates to a self-signalling target for firearm target practice.

It is an object of this invention to provide a target for automatically and instantaneously indicating hits upon a target by a suitable visual signal.

A particular object of this invention is to provide a self-signalling electric circuit for a rapidly moving target to automatically indicate a plurality of successive hits, thereby greatly facilitating the training of gunners to consistently hit moving targets, by the instantaneous demonstration to the gunner of the proper position of his gun to the moving target when a hit is scored.

The specific nature of the invention as well as other objects and advantages thereof will clearly appear from a description of a preferred embodiment as shown in the accompanying drawings in which:

Fig. 1 is a perspective view of the self-signalling target and car shown mounted on rails.

Fig. 2 is an enlarged detail fragmentary view of the target screen.

Fig. 3 is a cross sectional view taken along the plane 3—3 of Fig. 2.

Fig. 4 is a front elevational view of the cartridge box.

Fig. 5 is an enlarged detail view showing a flash cartridge mounted in the cartridge box.

Fig. 6 is a top elevational view of the circuit board contained within the circuit box showing the arrangement of the various elements therein.

Fig. 7 is an exploded view in longitudinal section showing the elements of the flash cartridge.

Fig. 8 is a longitudinal sectional view of the assembled flash cartridge.

Fig. 9 is a schematic view of the circuit utilized to electrically register hits made on the target screen.

There is shown in assembled relation in Fig. 1 a moving target embodying this invention. A target screen 1, which may resemble the silhouette of a mobile tank, is vertically mounted between two sloped A-shaped frames 2 and 3. The bottom of frames 2 and 3 are suitably secured to a small car 4. The upper ends of frames 2 and 3 are separated by suitable tie members 5 and 6. Gusset plates 7 are provided in each of the upper corners of frames 2 and 3 to rigidly connect such frames to the tie members 5 and 6. Car 4 is preferably mounted by means of flanged wheels 8 on two parallel rails 9, which may, for example, be of a narrow gage railroad type.

Target screen 1 rests on two transverse cross members 10 and 11 respectively provided on each

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of the frames 2 and 3 as shown in Fig. 1. Target screen 1 comprises a wooden frame 12 which is preferably constructed of narrow wooden members and as mentioned above may assume the shape of a tank or other armored vehicle. Each of the corners of frame 12 is preferably reinforced by a gusset plate 13. Each side of frame 12 is covered with metallic screens 14 and 15 preferably of copper as shown in Fig. 3. The metallic screens 14 and 15 may be separated by a light weight panel 16 (Fig. 3) of non-conducting material such as corrugated cardboard or other sheet-like material made from waste products. Suitable cylindrical wooden separators 17 are evenly disposed throughout the area of the target screen are provided so that the metallic screens 14 and 15 may be fastened to such separators to secure the screens against displacement by the wind. The metallic screens 14 and 15 are thus separated from each other so that no electrical contact can be made between the two screens until a projectile passes thru such screens as will be described.

Two lead wires 18 and 19 connect screens 14 and 15 respectively with an indicating circuit box 20 which is mounted on the floor of car 4. The indicating circuit box 20 houses the electric circuit which will discharge suitable signals placed in a flash cartridge box 21, which is horizontally mounted on a suitable shelf 22 on frame 2. Flash cartridge box 21 is connected to circuit box 20 by a cable 23. When a projectile passes thru target screen 1 such projectile momentarily contacts both screens 14 and 15 thereby completing a circuit thru indicating circuit box 20 which effects discharge of a smoke signal contained in flash cartridge box 21. Thus a hit on the target is indicated which will be clearly visible to the gunner.

It is appreciated that the length of time a projectile is in contact with both screens 14 and 15 as such projectile passes thru screen 1 is of extremely short duration. The principal problem therefore is to devise means for recording this fast pulse. The electric circuit utilized to record such a fast pulse makes use of a large capacity condenser. Such condenser is maintained in a charged condition except for a brief instant when discharged by the projectile closure of the circuit. Upon closure of the circuit by the projectile, the condenser discharge energizes a fast operating relay which indirectly causes the explosion of a flash cartridge indicating that the target has been hit, after which a selector switch advances to the next cartridge whereupon the circuit is ready to register the next hit.

A flash cartridge 24 of the type utilized to indicate a hit on the target is shown in Figs. 7 and 8. Flash cartridge 24 comprises a split gelatin capsule 25 loaded with a suitable flash powder 26 thru which is passed a copper wire 27. Each end of capsule 25 is perforated and the wire 27 of about 20-gage is inserted thru each of the perforations in capsule 25. The ends of copper wire 27 are connected by a smaller copper wire 27a of approximately 28-gage and about 3/4" long. One half of the capsule is then filled with the flash powder 26 whereupon the halves of the capsule are joined together. The protruding ends of the wire 27 are pulled slightly to insure that the wire 27a lies within capsule 25 in order that such wire will readily burn as will be later described. This assembly is then dipped in melted beeswax or paraffin to provide a waterproof coating. Each flash cartridge 24 is mounted in flash cartridge box 20 substantially as shown in Fig. 5.

Referring to Fig. 9, there is shown a schematic drawing of the circuit utilized for electrically registering the hits made by a projectile on target screen 1. The various elements referred to in such figures are mounted on a circuit board 23 (Fig. 6) which in turn is mounted within circuit box 19.

A selector switch 30 (Fig. 6), which comprises a conventional step by step rotary selector found in telephone systems, is utilized to select successive flash cartridges 24 for discharge of such flash cartridges upon successive hits on target screen 1. With such a switch, a stepping relay SM is energized and a ratchet 37 engages a notched wheel 38 when such relay is energized and de-energized causing a contact brush B to take one step. The particular switch utilized is provided with a plurality of terminals 31 selectively and successively engaged by brush B. The brush B on the switch 30 is so arranged that when one end of the brush steps off the last terminal 31 the other end of the brush steps onto the first terminal.

In the circuit shown in Fig. 9 there is disclosed an arrangement for securing relay operation from the extremely short duration circuit completed between the screens 14 and 15 by the passage of a projectile therethru. The screens 14 and 15 are connected to opposite plates of an electrolytic condenser C which is preferably of about 50 microfarads capacity. The condenser C is charged from a suitable source of direct current voltage such as a battery 32 thru the winding 40 of fast operating relay P. Suitable leads are provided in the connection between condenser C and screens 14 and 15 to insure a very low resistance connection. The condenser C will thus discharge very rapidly during the interval when the screens are connected by a projectile. As a result of such discharge sufficient charging current will flow thru the winding 40 of relay P to momentarily close its contacts. Due to the high speed of operation of relay P, its contacts generally vibrate too rapidly to permit the relay to be self-locked directly by a second winding. Thus a second relay P₁ which is somewhat slower in operation is provided having one of its coils 41 connected in series with a second electrolytic condenser C₁ across a D. C. voltage source 33 which may be a battery. The contacts of relay P are connected across condenser C₁ through a small resistance 35 which is effective to prevent a welding of the contacts of relay P together by the condenser discharge. Since the contacts of relay

P remain closed substantially longer than the circuit closure made by the projectile, the condenser C₁ will be substantially fully discharged and thus cause the operation of relay P₁ while condenser C₁ is recharging. Relay P₁ is preferably provided with a flexible spring contact (not shown) which absorbs any vibration between the contacts and therefore permits the self-locking of relay P₁ by a circuit closed thru a second winding 42. The locking circuit may be traced from the D. C. voltage source 33 thru winding 42 of relay P₁, thru contact 50 of relay SM, thru contact 55 of relay TM₂, thru contacts of relay P₁, and thru the contacts of key K₃ to ground. Obviously the normal position of the contacts of relays SM, TM₂, and the key K₃ are such as to complete the locking circuit.

The winding 43 of relay R is now energized thru a circuit traced from ground thru key K₃, contacts of relay P₁, contact 55 of relay TM₂, contact 57 of relay CO, and winding 43 of relay R to voltage source 33. Relay R is self-locking on its contact 60 when energized thru a circuit traced thru contact 60 of relay R, contact 50 of relay SM, contact 55 of relay TM₂, contacts of relay P₁, and contacts of key K₃ to ground. Relay R also locks on its right winding 44 thru its contact 61, thru the contacts of key K₁, the brush B of the selector switch 30, thru the particular flash cartridge 24 to which the brush B is connected, to the negative terminal of a source of potential 34 having its positive terminal grounded, and from ground to winding 44 of relay R. The contact 62 of relay R energizes relay CO by a circuit traced from ground thru contact 62, thru winding 48 of relay CO, to source of potential 33. Contact 62 of relay R also energizes relay SM thru a circuit traced from ground, contact 62 of relay R, thru coil of relay SM to source of potential 33. The energization of relay SM thus opens the circuits previously described thru the coil 42 of relay P₁ and coil 43 of relay R. Relay P₁ thus releases its opening contacts. Relay R remains energized thru the locking circuit on its winding 44 which has already been shown to be in series with one of the flash cartridges 24. The current thru the flash cartridges 24 is sufficient to burn the small wire therein and to explode the cartridge thus giving off a white smoke as a signal that the target has been hit. The opening of the circuit thru the flash cartridge 24 de-energizes the winding 44 of relay R returning all contacts of the relay R to their normal position. This action de-energizes relays CO and SM. The de-energization of SM operates the brush B to its next contact 31 and hence to the next flash cartridge 24. The circuit is now in a normal position and ready for the next shot. It will be noted from the foregoing description that the relay CO performs no function in the regular operation of the circuit.

In the event that a defective flash cartridge is encountered having an open circuit, the only effect is that the locking winding 44 of the relay R is not energized. However, the relay SM is momentarily energized thru contact 62 of relay R and this energization actuates the brush B to the next position and returns the remainder of the circuit to normal. Thus a defective cartridge does not interrupt the operation of the signalling circuit.

Let us assume now that a short circuit between the two screens is encountered. In such case relays P and P₁ remain operated regardless of the opening of the contacts of relay SM in ac-

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cordance with the normal procedure described above. The relay CO thus remains locked on its winding 47 thru a circuit traced from the winding, thru contact 58 of CO, thru contact 55 of relay TM₂, contacts of relays P₁ and key K₃ to ground. When relays R and SM are de-energized in their usual manner, relay TM₁ is energized thru potential source 33, thru the winding of relay TM₁, thru contact 59 of relay R, thru contact 50 of relay SM, thru contact 55 of TM₂, thru the contacts of relay P₁, thru key K₃ to ground. The energization of relay TM₁ in turn energizes relay TM₂ by a circuit traced from potential source 33 thru winding 46 of relay TM₂, thru the contacts of relay TM₁, and thence to ground. The opening of contact 55 of relay TM₂ causes the de-energization of relays CO and TM₁ to reduce the current drain from the potential source 33. Contact 63 of relay TM₂ operates simultaneously with the opening of contact 55 and completes a circuit between special flash cartridge 28 and potential source 34 whereby the special flash cartridge 28 is exploded to serve as an indication of the short circuit. The circuit is then in such condition that no further signals can be given until the trouble is cleared.

The special flash cartridge 28 comprises a so-called smoke pot which is capable of producing a large volume of smoke and will burn for a considerable length of time to permit the gunners ample opportunity to observe such signals. The smoke emitted from the flash cartridge 28 is preferably a yellow color to more readily differentiate from the white color of the regular flash cartridge signals 24. An electrically fired squib (not shown) is utilized to ignite the special flash cartridge 28.

Another special flash cartridge 36 is connected to the last terminal 31 of a selector switch 30 to emit a special signal signifying that all of the flash cartridges 24 have been exploded and that such cartridges must be renewed before any further signals can be given.

When the cartridges 24 are to be renewed the key K₁ is turned to its off position to make the target safe. This transfers the winding 44 of relay R from a circuit in series with the regular cartridges 24 to the special cartridge 28 which is preferably in a different location from the regular cartridges. After flash cartridges 24 have been renewed, key K₁ is restored to its normal position. In the event key K₁ is left in the non-operating position, the next shot will explode the cartridge 28 to emit the special trouble signal indicating that this condition exists.

If batteries are utilized as potential sources 32, 33, and 34, key K₃ is provided to permit the replacement of the batteries. When battery 32 or 33 is disconnected, the associated condensers C and C₁ respectively may be completely or partially discharged and when a new battery is connected, relay P₁ or both P and P₁ will be operated while the condensers are recharging. This would cause an unnecessary explosion of a cartridge 24 if the circuit were not opened by key K₃. Key K₃ is of course closed after the battery has been connected.

A key K₂ is provided to advance the selector switch 30 to any desired point. Condenser C₂ and resistance RS bridge around relay SM for the purpose of absorbing energy when the circuit is opened in order to protect the various contacts affected. The resistance RS prevents a rush of current from the discharge of the condenser C₂

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from welding the contacts together on the next contact closure.

From the foregoing description it is apparent to those skilled in the art that a target simulating rapidly moving objects is provided which will positively register hits made by the gunners and that such hits can be readily observed by the gunners at the firing point. Further, the target and circuit herein described is relatively simple and inexpensive to maintain.

I claim:

1. A signalling system comprising a pair of contact members arranged to be successively momentarily electrically connected, a large capacity condenser, a direct low resistance path from each of said contact members to opposite plates of said condenser, a source of direct current potential and a fast operating relay in series with said condenser, whereby the partial discharging of said condenser by momentary connection of said contact members produces operation of said relay, a second large capacity condenser arranged to be charged by a second source of D. C. potential thru the coil of a second fast operating relay, said second condenser being connected across the contacts of said first relay whereby said second condenser is at least partially discharged by operation of said first relay and said second relay is operated by the recharging of said second condenser, a plurality of signalling elements, a stepping switch constructed to successively engage said signalling elements, electrical means for energizing one of said signalling elements thru said stepping switch, said electrical means arranged to be energized by operation of said second relay, and a third relay constructed to advance said stepping switch to the next successive signalling element, said third relay being connected to be energized in response to the energization of the preceding signalling element.

2. A signalling system as in claim 1 wherein said signalling elements comprise smoke producing cartridges, each cartridge having an electric fuse element arranged to be energized by said electrical means.

3. A signalling system comprising a pair of contact members arranged to be momentarily electrically connected, a large capacity condenser, a direct low resistance path from each of said contact members to opposite plates of said condenser, a source of direct current potential and a fast operating relay in series with said condenser, whereby the partial discharging of said condenser by momentary connection of said contact members produces operation of said relay, a first signalling means energized by said fast operating relay, a second signalling means, and means for energizing said second signalling means upon occurrence of a continuous shorting connection between said contact members.

4. A signalling system comprising a pair of contact members arranged to be momentarily electrically connected, a large capacity condenser, a direct low resistance path from each of said contact members to opposite plates of said condenser, a source of direct current potential and a fast operating relay in series with said condenser, whereby the partial discharging of said condenser by momentary connection of said contact members produces operation of said relay, a first smoke producing cartridge, electrical means for discharging said first cartridge in response to operation of said relay, a second smoke producing cartridge constructed to pro-

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duce a smoke of color distinct from said first cartridge, and relay means for discharging said second smoke producing cartridge upon occurrence of a continuous shorting connection between said contact members.

5. A signalling system comprising a pair of contact members arranged to be successively momentarily electrically connected, a large capacity condenser, a direct low resistance path from each of said contact members to opposite plates of said condenser, a source of direct current potential and a fast operating relay in series with said condenser, whereby the partial discharging of said condenser by momentary connection of said contact members produces operation of said relay, a second large capacity condenser arranged to be charged by a second source of D. C. potential thru the coil of a second fast operating relay, said second condenser being connected across the contacts of said first relay whereby said second condenser is at least partially discharged by operation of said first relay and said second relay is operated by the recharging of said second condenser, a plurality of smoke producing cartridges, each having an electrical discharging fuse, a stepping switch constructed to successively engage said cartridges, the last of said cartridges being constructed to produce a distinctive smoke, electrical means for discharging one of said smoke producing cartridges thru said stepping switch, said electrical means arranged to be energized by operation of said second relay, and means for advancing said stepping switch to the next successive smoke producing cartridge in response to the discharge of said preceding cartridge.

6. A signalling system comprising a pair of contact members arranged to be successively momentarily electrically connected, a large capacity condenser, a direct low resistance path from each of said contact members to opposite plates of said condenser, a source of direct current potential and a fast operating relay in series with said condenser, whereby the partial discharging of said condenser by momentary connection of said contact members produces operation of said relay, a second large capacity condenser arranged to be charged by a second source of D. C. potential thru the coil of a second fast operating relay, said second condenser being connected across the contacts of said first relay whereby said second condenser is at least partially discharged by operation of said first relay and said second relay is operated by the recharging of said second condenser, a plurality of smoke producing cartridges, each having an electrical discharging fuse, a stepping switch constructed to successively engage said cartridges, the last of said cartridges being constructed to produce a distinctive smoke, electrical means for discharging one of said smoke producing cartridges thru said stepping switch, said electrical means arranged to be energized by operation of said second relay, means advancing said stepping switch to the next successive smoke producing cartridge in response to discharge of said preceding smoke producing cartridge, a special smoke producing cartridge constructed to produce a smoke distinct from all other cartridges, and relay means for discharging said last mentioned cartridge upon occurrence of a continuous shorting connection between said contact members.

7. A signalling system comprising a pair of contact members arranged to be successively mo-

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mentarily electrically connected, a first relay means arranged to be energized by momentary connection of said contact members, a plurality of signalling elements, a stepping switch constructed to successively engage said signalling elements, electrical means for energizing one of said signalling elements thru said stepping switch, said electrical means arranged to be energized by operation of said first relay means, a second relay means constructed to advance said stepping switch and normally energized in response to energization of said signalling elements, and auxiliary means for energizing said second relay means in the event of an open circuit in any one of said signalling elements to advance said stepping switch to the next successive signalling element.

8. A signalling system comprising a pair of contact members arranged to be successively momentarily electrically connected, relay means arranged to be energized by momentary connection of said contact members, a plurality of signalling elements, a stepping switch constructed to successively engage said signalling elements, electrical means for energizing one of said signalling elements thru said stepping switch, said electrical means arranged to be energized by operation of said relay means, and means for advancing said stepping switch to the next successive signaling element in response to energization of said preceding signalling element, said signalling elements comprising smoke producing cartridges, each cartridge having an electric fuse igniter, the last of said successive cartridges being constructed to produce a smoke distinct from the other cartridges.

9. A signalling system comprising a pair of contact members adapted to be momentarily electrically connected, a condenser connected across said contact members, a first source of direct current potential and a fast operating relay in series with said condenser, whereby the partial discharging of said condenser by momentary electrical connection of said contact members produces operation of said relay, a second source of potential, a first signalling element energized from said second source of potential by operation of said relay, a second signalling element, relay means for energizing said second signalling element from said second source of potential upon occurrence of a continuous shorting connection between said contact members, and a two position key connected in the system, said key arranged in its normal position to connect said first signalling element to said second source of potential and in the other position to connect said second signalling element to said second source of potential thru operation of said fast operating relay whereby operation of said second signalling element indicates either the occurrence of a shorting connection between said contact members or that said key is not in its normal position.

10. A hit indicating target comprising a support structure, a pair of spaced wire screens on said support structure defining a target and arranged to be momentarily electrically connected by passage of a projectile therethru, a plurality of explosive, smoke producing cartridges mounted on said support structure, electrical means mounted on said support structure for discharging said cartridges successively, and means responsive to the passage of a projectile thru said screens for energizing said electrical means in

succession, whereby visual indications of hits are produced immediately adjacent the target.

11. The combination defined in claim 10 plus a special cartridge mounted on said support structure capable of producing a smoke distinct from that produced by said plurality of cartridges, and electrical means for discharging said special cartridge responsive to the occurrence of a continuous shorting connection between said screens.

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