

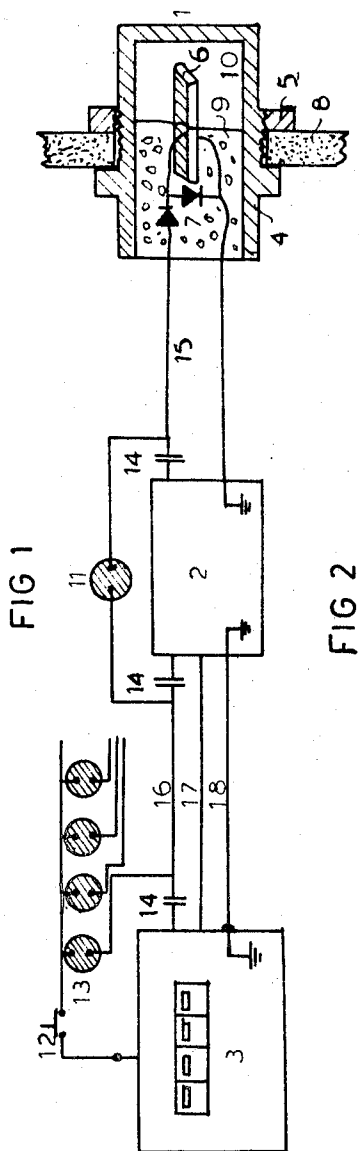
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MEANS FOR COUNTING SHOTS HITTING A TARGET

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In witness
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MEANS FOR COUNTING SHOTS
HITTING A TARGETMatti G. Wilska, Vantaa, Martinkyla, Finland, assignor
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7 Claims. (Cl. 273—102.2)

ABSTRACT OF THE DISCLOSURE

An arrangement for recording and counting shots impinging upon a target. A piezo-electric element secured to the target, becomes actuated whenever a shot impinges on the target. The mechanical actuation of the piezo-electric element is converted into an electrical signal which is transmitted to a remotely-located counter. The counter registers the electrical signal and thus maintains a record of the shots impinging on the target. Through appropriately interconnected rectifiers and amplifiers, the circuit rectifies the signal generated by the piezo-electric element, and at the same time, permits a test signal or control signal to bypass the piezo-electric element. The arrangement permits a test or control signal to be applied for determining whether the transmission lines leading to and from the piezo-electric element, are in proper operating condition.

This invention relates to a means that will register shots hitting a target, particularly targets situated on the ground, the shots being fired from an airplane.

Different kinds of "hit" counters are known in prior art. These counters use a microphone as a hit indicator head that will announce a hit when a bullet or missile produces a shock wave. Such devices have inter alia the defect that for example the noise or the shock wave produced by the airplane tends to affect the operation of the counter.

The object of this invention is to provide a reliable hit counter for targets without the above mentioned defect. This is achieved by the construction according to claim 1, characterized by the novelty features specified therein.

The invention will be more fully set forth in the following description with reference to the accompanying drawings.

In the drawings:

FIG. 1 shows the device diagrammatically,

FIG. 2 shows a target having mounted thereon the indicator heads of the invention.

In FIGURE 1 the indicator head is designated with the reference number 1. It consists of a bushing like covering 4 and elements therein, namely a piezoelectrical means 6 and a current rectifying means 7 consisting of two semiconductor diodes. These elements are cast into a solid filler partially filling the covering 4 but leaving one of the two ends of the piezoelectrical means 6 free in a covered, gas-filled enclosure. A shock at right angles to it will then bring to a fast decaying vibrating state. The piezoelectrical means consists of a bar of lead zirconate silvered on both sides.

In the indicator, the current rectifying means 7 cast into the filler are provided for two purposes. In the first place they are adapted to rectify and sum up the decaying pulses given by the piezoelectrical means put in vibration because of the shot hitting the target. In the second place the rectifying means will allow the passage of a direct control current through the indicator head. As the piezoelectrical means are electrically nonconducting the control current will bypass it through the diodes.

As shown in FIGURE 1 the pulse from the indicator

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head is amplified in a transistor amplifier 2 and is then led to a counter and indicator means 3. Between the amplifier and the trench where the counter is situated there is a signal wire 16, a wire 17 for supplying operating power and a ground wire 18. The signal wires 15 and 16 are provided with capacitors 14 for preventing the direct control current from coming to the counter and the amplifier. The signal wire 16 is connected through a gas glow discharge lamp 13 and a contact switch 12 to a direct control current source having for example a voltage of 300 volts. Ignition voltage for the gas glow discharge lamp is approximately 100 volts. Each indicator head has its own gas glow discharge lamp situated beside the lamp 13. The control current will by pass the amplifier 2 through the gas glow discharge lamp 11, which will ignite, when the current is switched on with the switch 12.

FIGURE 2 shows a target with four boards 8 and hence with four indicator heads 1. From every indicator head goes a signal wire 15 to an amplifier and further to a counter.

Every board 8 in the target has a small hole into which the indicator head 1 is mounted and tightened by means of a flange on the bushing-like covering and a nut 5.

When a bullet or missile hits the board it will cause the piezoelectrical means to send along the attached wires an electrical pulse that after being amplified can be detected in the counter. The counting and indicating means 3 can be miles away from the target.

The working condition of the device can be checked by connecting a direct current to the control circuit by the switch 12. The control current will pass through the gas glow discharge lamp 13, the wire 16, the gas glow discharge lamp 11, the wire 15 and the diodes 7 and back through the ground wire if the wires are in working order and the ignition of the gas glow discharge lamp 13 will indicate that the two wires and the indicator head are in working order. By connecting the control voltage with the poles reversed, even a possible short-circuit in the wires leading to the indicator head can be detected. The gas glow discharge lamp 11 does not affect the amplifier adversely when there is no control current, as it has an igniting voltage that is higher than the signal voltage.

The foregoing description shows the arrangement according to the invention in principle only. It can of course be varied to fit the circumstances within the scope of the following claims.

I claim:

1. An arrangement for counting shots impinging on a target comprising, in combination, a target member located in the path of said shots so that shots directed against said target member may impinge thereon and apply a shock to said target member; a piezo-electric element secured to said target member for converting shocks applied to said target member by said shots into electrical signals; a housing secured to said target member and partially filled with solid filler material and partially filled with gas, one end of said piezo-electric element being embedded in said solid filler material and the other end of said piezo-electric element being exposed to said gas; and counting means connected to said piezo-electrical element for receiving and counting the electrical signals generated by said piezo-electric element resulting from shots impinging upon said target, so that said counting means registers the hits on said target member; conductor means connecting said counter to said piezo-electric element; and means in circuit with said conductor means and said piezo-electric element for determining that said conductor means are in working order.

2. An arrangement as defined in claim 1 including amplifying means connected between said piezo-electric element and said counting means for amplifying said electrical signals generated by said piezo-electric element.

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3. An arrangement for counting shots impinging on a target comprising, in combination, a target member located in the path of said shots so that shots directed against said target member may impinge thereon and apply a shock to said target member; a piezo-electric element secured to said target member for converting shocks applied to said target member by said shots into electrical signals; counting means connected to said piezo-electric element for receiving and counting the electrical signals generated by said piezo-electric element in response to the shocks applied to said piezo-electric element resulting from shots impinging upon said target, so that said counting means registers the hits on said target member; amplifying means connected between said piezo-electric element and said counting means for amplifying said electrical signals generated by said piezo-electric element; first rectifying means connected between said piezo-electric element and said amplifying means; and second rectifying means connected in parallel with said piezo-electric element so that said electrical signals generated by said piezo-electric element from said shocks are rectified and a direct-current path prevails through said rectifying means bypassing said piezo-electric element.

4. The arrangement as defined in claim 3 including a housing secured to said target member and being partially filled with solid filler material and partially filled with gas, said rectifying means and one end of said piezo-electric element being embedded in said solid filler material and the other end of said piezo-electric element being exposed to said gas.

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5. The arrangement as defined in claim 4 wherein said piezo-electric element is an elongated rod-shaped element.

6. The arrangement as defined in claim 3 wherein said rectifying means are semi-conductor diodes.

7. The arrangement as defined in claim 3 including a gas glow discharge lamp connected in parallel with said amplifying means for permitting an electrical test signal applied to said arrangement, to bypass said amplifying means.

References Cited

UNITED STATES PATENTS

3,056,932	10/1962	Wood	310—8.1 X
3,158,372	1/1964	Ohlund et al.	273—102.2
3,099,447	7/1963	Isenberg et al.	273—52

FOREIGN PATENTS

1,147,507	6/1957	France.
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