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Wichinsky et al.

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[54] **SCORING DEVICES FOR GAMES**

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[21] Appl. No.: **289,956**

Related U.S. Application Data

[63] Continuation of Ser. No. 59,991, Sept. 31, 1970, abandoned.

[52] **U.S. Cl.**.... **235/92 GA,** 235/92 R, 273/102.2 S, 340/261, 340/323

[51] **Int. Cl.** **G06m 3/08**

[58] **Field of Search**..... 235/92 GA; 340/261, 323; 273/102.2 S

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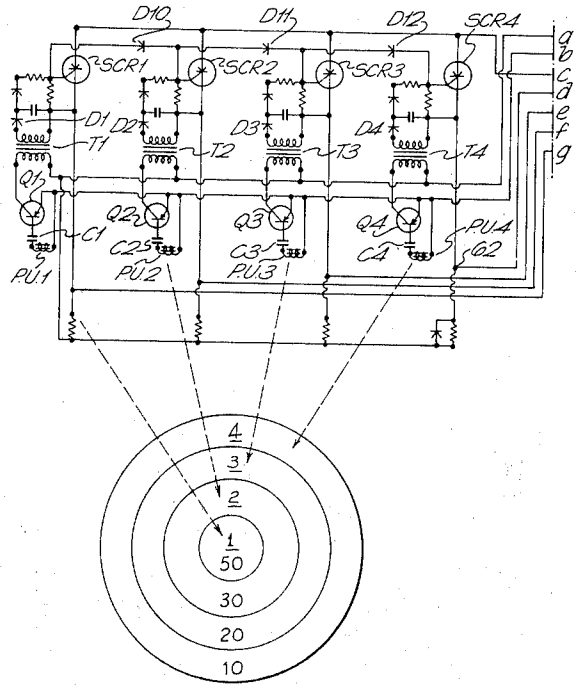
[57] **ABSTRACT**

The invention provides a device for automatically keeping the score in a game in which a vibration is established in response to the occurrence of an event to which is assigned a score. Briefly, the device includes means for detecting the vibration, for producing one or more pulses indicative of the occurrence of an event, for counting the pulses and for displaying the score assigned to that event.

10 Claims, 8 Drawing Figures



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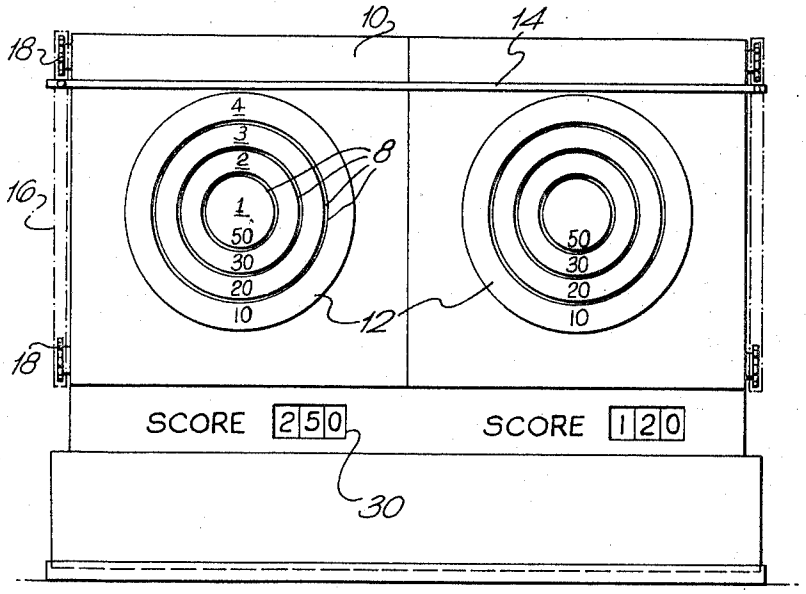

Fig. 1.

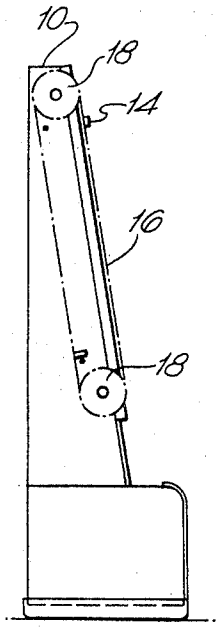

Fig. 2.

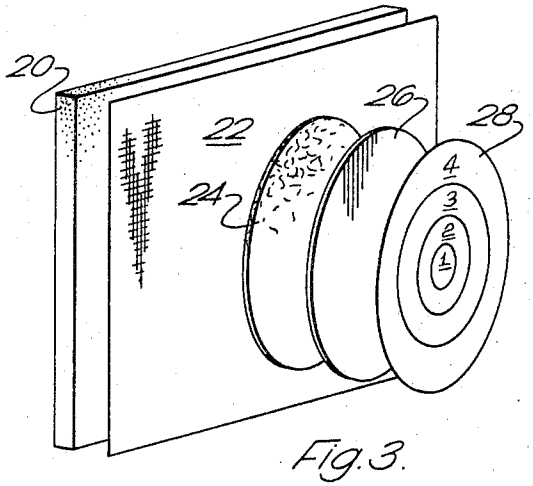

Fig. 3.

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ATTORNEYS

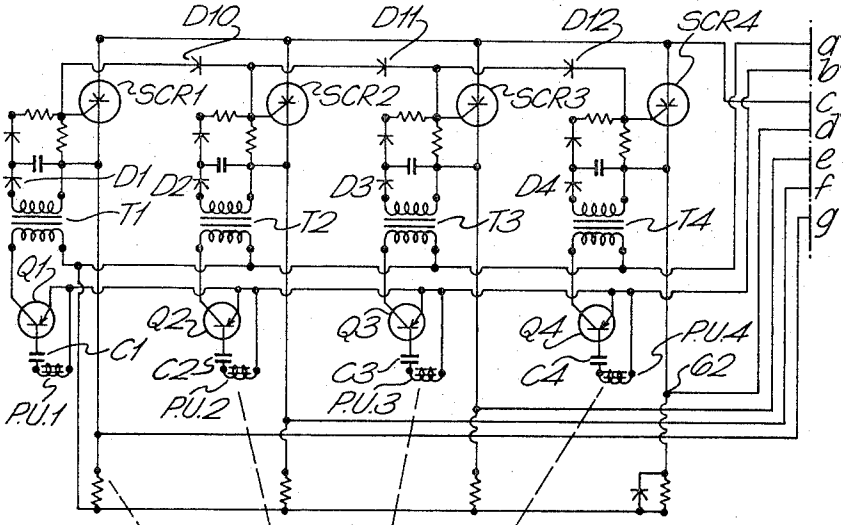
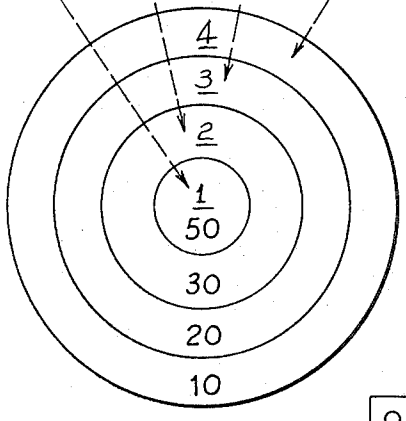

D10
D11
D12
SCR4
SCR1
SCR2
SCR3
a
b
c
d
e
f
g
D1
D2
D3
D4
T1
T2
T3
T4
Q1
Q2
Q3
Q4
C1
C2
C3
C4
P.U.1
P.U.2
P.U.3
P.U.4
G2

Fig. 4A.


4
3
2
1
50
30
20
10

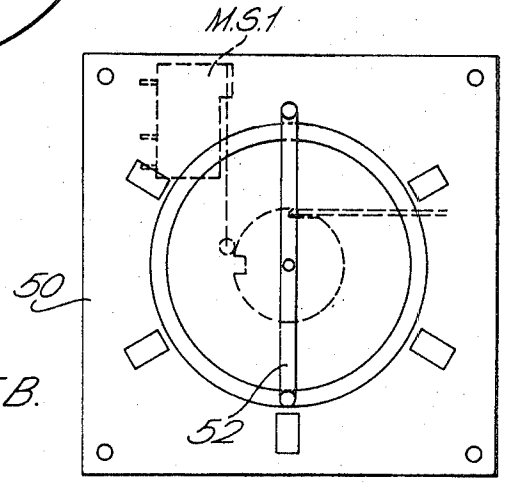

M.S.1
50
52

Fig. 5B.

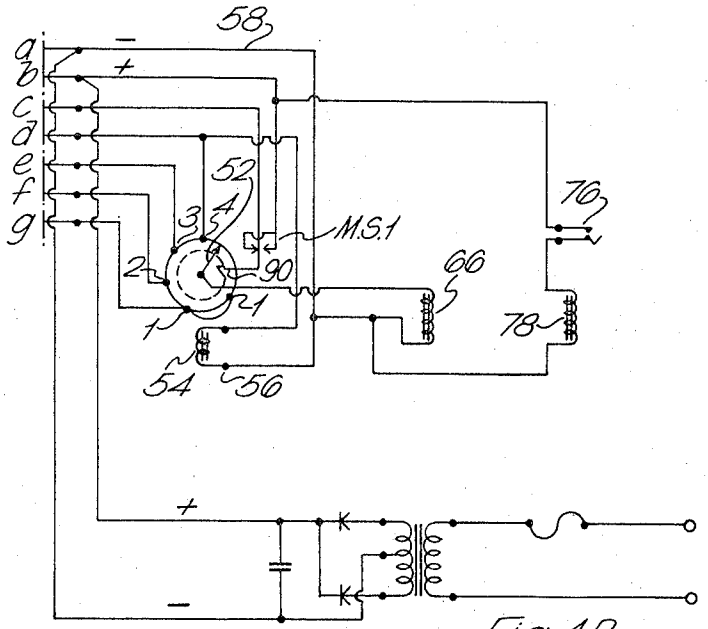

58
a
b
c
d
e
f
g
52
M.S.1
90
66
76
78
54
56
1
2
3
4

Fig.4B.

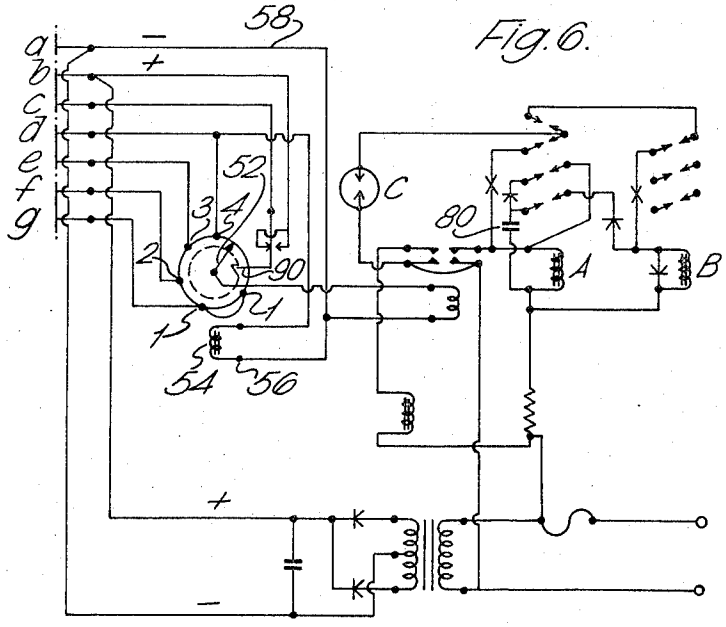

58
a
b
c
d
e
f
g
52
C
80
A
B
90
54
56
1
2
3
4

Fig.6.

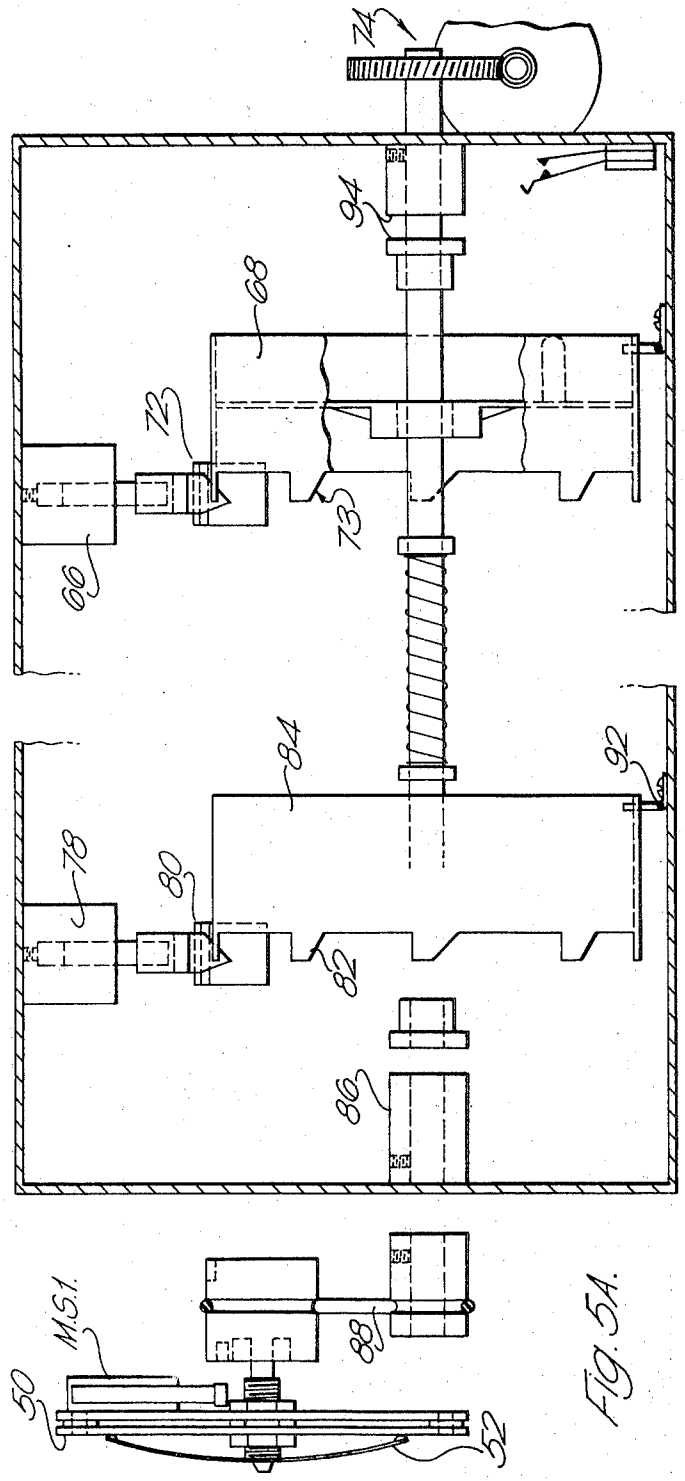


FIG. 5A.

SCORING DEVICES FOR GAMES

This is a continuation, of application Ser. No. 59,991 filed July 31, 1970 now abandoned.

The invention relates to a scoring device for games and more particularly for games in which a projectile strikes an object and in so doing establishes a vibration.

It is an object of this invention to provide a means whereby a score assigned to an event occurring in the course of a game such as the striking of a particular object, may be automatically recorded and displayed. In this way no demands are made on the player other than those required in playing the game.

According to this invention a scoring device for games comprises a plurality of vibration transducers corresponding to a plurality of events which may occur during the course of a game and connected to a common pulse generator which is in turn connected to a counter the arrangement being such that, in operation, a transducer produces an output in response to a vibration indicative of the occurrence of one event and the pulse generator is activated in response to the output of the transducer to produce one or more pulses representative of that event, the pulses being counted by the counter.

Conveniently the pulse generator comprises a number of switches corresponding to the plurality of transducers each switch when triggered by the output of a transducer being adapted to apply a voltage to at least one terminal of a rotary switch having a rotatable arm for scanning the switch.

The switches may be silicon controlled rectifiers or other semi-conductor devices in which case the output of a transducer may be rectified and applied to the gate of the silicon controlled rectifier to effect triggering of the rectifier when an event occurs.

In a preferred embodiment of the invention the pulse generator comprises "n" switches where "n" is a number corresponding to the plurality of transducers and wherein (n+1−x) switches are triggered in response to an output of the "x" transducer, where "x" is any number from 1 to n. Conveniently, this is achieved by connecting the gate of the "x^{th}" silicon controlled rectifier, to the "x^{th}" transducer and, via a forward biased diode, to the gate of the $(x+1)^{th}$ rectifier.

The invention will now be described by way of example with reference to the accompanying drawings of which:

FIG. **1** shows a Front Elevation of two targets.

FIG. **2** shows a Side Elevation of FIG. **1.**

FIG. **3** shows an Exploded View of a target with the insulating rings omitted.

FIG. **4A** and **4B** shows a Circuit Diagram of the Scoring Device, the insulating rings being omitted from FIG. **4A.**

FIGS. **5A** and **5B** show details of a Counter and Rotary Switch, and

FIG. **6** shows a Circuit Diagram of an alternative form of Counter.

The cabinet **10** of FIG. **1** contains two targets **12,** each comprising a series of separate concentric target areas. A score is assigned to each of the concentric areas. As is the normal practice the centre area, or bullseye, is assigned the highest score and the outer areas have progressively lower scores.

The concentric areas comprise members **1, 2, 3** and **4** of steel or other such magnetic material and the projectiles intended for use with the target include a permanent magnet. In this way the projectiles, normally in the form of darts having a magnetic tip, strike the target and adhere to it.

FIG. **2,** an end elevation on AA in FIG. **1,** shows that the target is inclined to the vertical. A wiper bar **14** mounted on two parallel chains **16** driven by sprockets **18** is used to wipe the target and thereby remove the adhering darts. The sprockets **18** are driven by a reversible motor actuated, for example, by the deposit of a coin in a slot and causing the motor to drive the wiper bar downward until a micro-switch is operated to reverse the direction of the wiper bar until finally the motor is switched off when the bar strikes a limit switch.

A block of "CELETX" **20,** approximately ½ inch thick, is mounted on the face of the cabinet **10** and a sheet of canvas **22,** a layer of felt **24** and a layer of a plastics material **26,** each 1/16 inch thick are arranged between the block **20** and the series of separate concentric steel target members **1, 2, 3** and **4,** each 0.020 inch thick, as shown in FIG. **3.** This target assembly is constructed such that the individual members are separated by spaces **8,** and the elements **20, 22, 24** and **26** provide vibration insulation so the members may vibrate independently. The members are of different sizes and for this reason vibrate at different frequencies when struck.

In use a player throws a dart toward the target and if the dart strikes a member in the target then that member vibrates at a characteristic frequency which is detected by a scoring device and the score associated with that particular member is displayed by the counter **30.** When a player has used all his darts then the total score is displayed by the counter **30** and the wiper is operated to clear the target for the next player.

The scoring device includes one "pick-up" or transducer associated with each of the concentric members for detecting the particular vibration of the member and producing a signal whose frequency is proportional to that vibration. The signal is amplified by a tuned amplifier, rectified, and subsequently employed to apply a D. C. signal to each of one or more terminals of a rotary switch so that as a rotating arm within the switch passes each of the terminals in turn a counter associated with the switch is operated in response to the presence of a D. C. signal at one or more of the terminals to register a score appropriate to the vibrating ring.

FIGS. **4A** and **4B** show a circuit diagram of a preferred form of scoring device, the operation of which will now be described in more detail with reference to those figures.

The FIG. **1** shows a target having four separate concentric steel members **1, 2, 3** and **4** corresponding to scores of **50, 30, 20** and **10** respectively. Associated with each of these rings is a vibration transducer or "pick-up" **PU1, PU2, PU3** and **PU4** respectively shown in FIG. **4A.** The output from each coil is amplified by a single stage transistor amplifier (e.g. **C1, Q1**) and passed by means of a transformer (**T1**) to a rectifying circuit including a diode (**D1**) and a smoothing circuit. The D. C. signal produced is fed to the gate of a Silicon Controlled Rectifier (**SCR1**) which is arranged to conduct whenever a signal appears at the gate and thus operates as a switch. The gate of **SCR1** is connected to the gate of **SCR2** via a diode **D10** so as to trigger **SCR2**

whenever SCR1 is triggered. However the diode D10 acts to prevent the triggering of SCR1 when SCR2 is triggered by a signal at the gate of SCR2 resulting from a vibration of concentric steel member 2. In a similar manner the gate of SCR2 is connected via diode D11 to the gate of SCR3 and the gate of SCR3 is connected via diode D12 to the gate of SCR4.

Thus when SCR1 is triggered all of the silicon controlled rectifiers are triggered but, at the other extreme following a vibration of the concentric member 4 only SCR4 is triggered.

In general, it can be said that (4+1−x) switches are triggered in response to an output of the x^{th} transducer where x is any number from 1 to 4.

The cathode of SCR4 is connected to terminal 4 of the Rotary Switch 50 shown in FIG. 4B which continues from FIG. 4A where indicated along lines *a–f*. The cathode of SCR3 is connected to terminal 3, the cathode of SCR2 is connected to terminal 2 and the cathode of SCR1 is connected to two linked terminals 1 of the rotary switch 50.

The rotating arm 52 of the rotary switch 50 is driven by a motor 54, the terminals of which are indicated at 56. The negative terminal is connected to a negative supply rail 58 and the positive terminal is connected to a terminal 62 in the cathode of SCR4. Terminal 62 is only positive with respect to the negative supply rail when SCR4 is conducting and therefore the motor 54 will only drive the rotating arm 52 to scan the switch when SCR4 is conducting viz. when a score has been made.

During scanning of the rotary switch the rotating arm 52 connects the coil of a brake solenoid 66 to each terminal, and therefore the cathode of each SCR, in turn. Thus the solenoid is energised if that SCR is conducting.

FIG. 5A shows a partly exploded view, and FIG. 5B shows an end view, of a counter and rotary switch having a stop lever 72 mounted upon the arm of solenoid 66 and against which rests one of ten equally spaced protrusions 73 formed on the circumferential edge of one face of a disc 68. The stop lever 72 thereby prevents displacement of the disc until the solenoid 66 is energised.

When, for example, a dart strikes the concentric member 1, SCR1 is energised and five terminals of the rotary switch are "live." The rotating arm scans the switch and thereby causes the solenoid 66 to be energised five times which in turn permits the disc 68 to be displaced under the action of a drive motor 74 through five positions. The disc 68 is numbered from 0 – 9 in correspondence with the ten protrusions 73 and the middle digit of the counter 30 of FIG. 1 is rotated through five positions (e.g. to read "0").

The circuit diagram FIG. 4B shows a switch 76 operated by the disc 68, when that disc is displaced between positions "9" and "0" to energise a second solenoid coil 78. When energised the second solenoid withdraws a stop lever 80 out of engagement with protrusions 82 thereby permitting displacement of a second numbered disc 84 to increase by one the value of the left hand digit of the counter display 30 shown in FIG. 1 (e.g. from "2" to "3").

The right hand digit of counter 30 has a constant value of "0" since any combination of the scores 50, 30, 20 and 10 must have a right hand digit of "0".

A scoring device may be mains or battery operated and to reduce the power required in operation of the latter the counter and rotary switch may be driven by the same motor. A mains device may include counters such as standard Bally or other solenoid driven "steppers" operating a stack of switches to properly advance the counters A & B shown in FIG. 6 and reset the counters to zero when a reset switch C is activated. FIG. 6 continues from FIG. 4A along lines a–f as indicated.

The motor driven counter shown in FIG. 5 is designed to operate at very low current drain and is used in place of the solenoid steppers which are more suited for use in mains operated devices. The discs 68 and 84 are clutch driven so that whenever the motor 74 is operated to rotate shaft 86 then the arm of the rotary switch is driven, at a speed slower than the shaft, by a belt drive reduction 88. A cam 90 on the rotary switch shown in FIG. 4 operates micro-switch MS1 after one turn to cut-off the silicon controlled rectifiers and thus the motor supply in preparation for the next dart. The drive motor 74 is reversible to reset the counter 30 to zero and two spring wires 92, one associated with each disc, are mounted on the base of the counter 30 as shown in FIG. 5A to catch in a notch in each disc at the zero position and to hold the discs at zero as the clutch system 94 slides. The clutch system acts to turn the numbered discs when they are released and otherwise to slip so that the rotatable arm 52 may be displaced when the discs are locked.

What is claimed is:

1. In a target game apparatus which has a plurality of target areas to each of which a score is assigned, improved scoring means comprising, in combination:

a separate individually vibratable member covering the whole of each target area, each said vibratable member having a predetermined individual frequency of vibration different from that of all other vibratable members in the apparatus;

insulating means separating each individually vibratable member from all the other vibratable members whereby each individual vibratable member vibrates with its own predetermined individual frequency of vibration when struck in the course of a game so that striking the target in any particular area during the course of a game will always produce the same frequency of vibration which is characteristic of that area;

means for sensing the vibrations generated on each occasion that a target area is struck in the course of a game and for producing a particular electrical response characteristic of the particular individual frequency produced by the vibrating member that has been struck:

and means for converting said electrical response into a humanly intelligible indication of a score which corresponds to the score assigned to the struck target area.

2. The apparatus of claim 1 in which each vibratable member is associated with a corresponding transducer which produces an output in response to vibration of said member, and in which the means for providing an indication of a score includes a common pulse generator connected to all said transducers, and activated to produce different numbers of pulses dependent upon the transducer output that activates it, and a counter for counting said pulses.

3. A device according to claim 2 wherein the pulse generator comprises a number of switches corresponding to the plurality of transducers, each switch when triggered by the output of a transducer being adapted to apply a voltage to at least one terminal of a rotary switch having a rotatable arm for scanning the switch.

4. A device according to claim 3 wherein the switches comprise silicon controlled rectifiers.

5. A device according to claim 4 wherein the output of each transducer is rectified and fed to the gate of a silicon controlled rectifier.

6. A device according to claim 3 wherein the rotatable arm and the counter are driven by a common motor.

7. A device according to claim 2 wherein the pulse generator comprises "n" switches where "n" is a number corresponding to the plurality of transducers and wherein $n+1-x$ switches are triggered in response to an output of the x^{th} transducer where "x" is any number from 1 to n.

8. A device according to claim 7 wherein the output of each transducer is rectified and fed to the gate of a silicon controlled rectifier and wherein the gate of the x^{th} silicon controlled rectifier is connected via a forward biased diode to the gate of the $(x+1)^{th}$ rectifier and to the x^{th} transducer.

9. A device according to claim 8 wherein the cathode of each silicon controlled rectifier is connected to at least one terminal of a rotary switch.

10. A device according to claim 2 wherein the counter comprises a solenoid energized by each of the pulses to permit the displacement of a numbered disc.

* * * * *