April 30, 1968 R. CHARELL 3,380,305

BASEBALL AND BASEBALL BAT TOY

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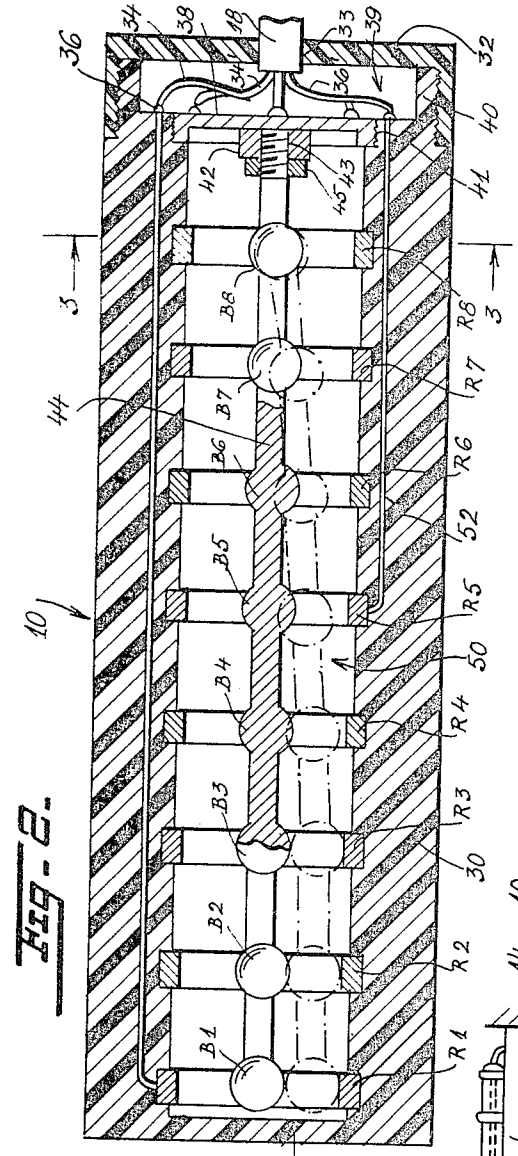


Fig. 2.

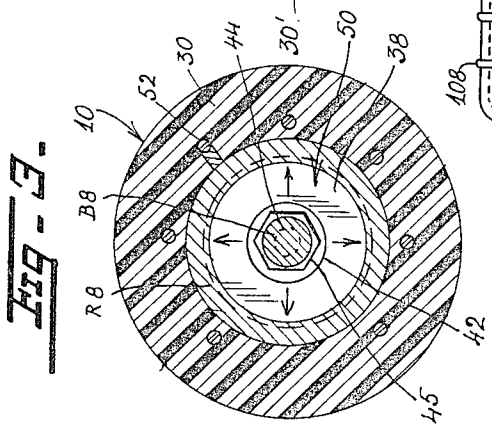


Fig. 3.

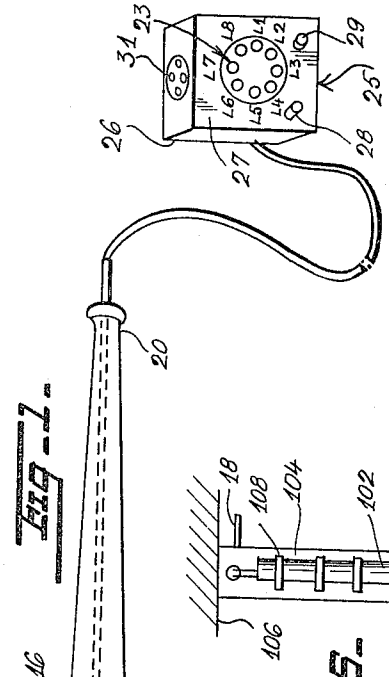


Fig. 1.

Fig. 6.

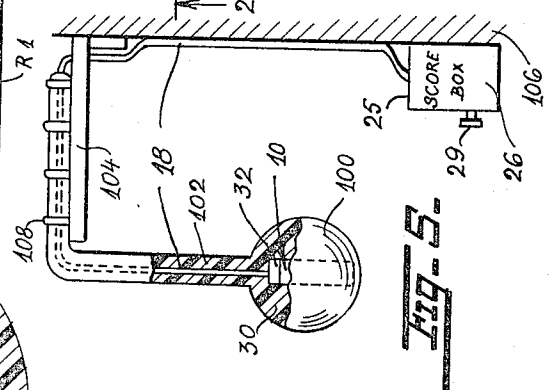


Fig. 5.

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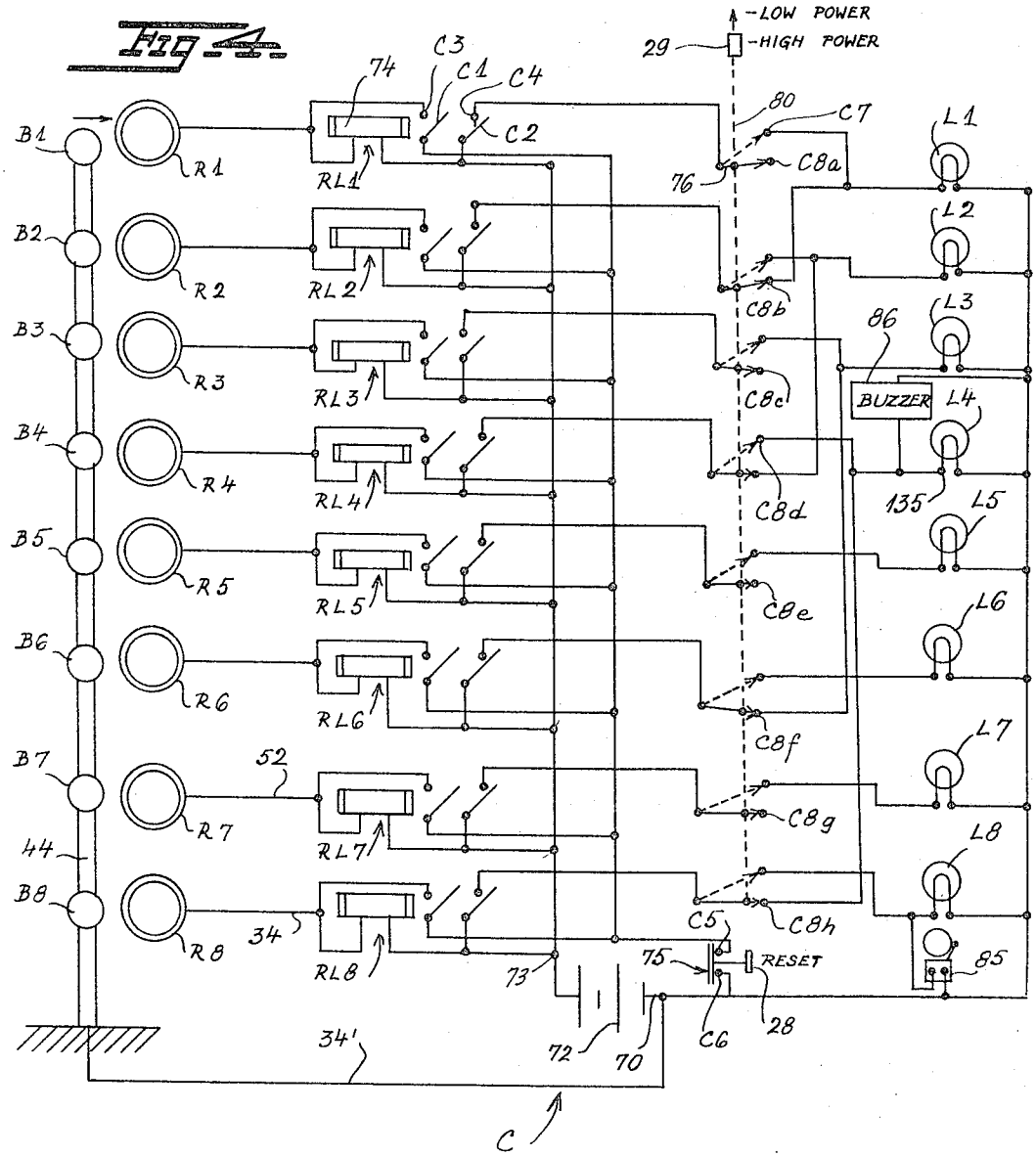
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BASEBALL AND BASEBALL BAT TOY

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Fig. 4.



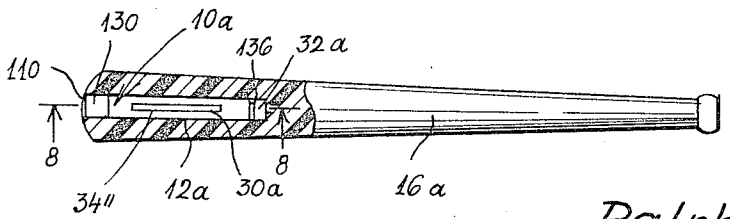


Fig. 7.

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BASEBALL AND BASEBALL BAT TOY

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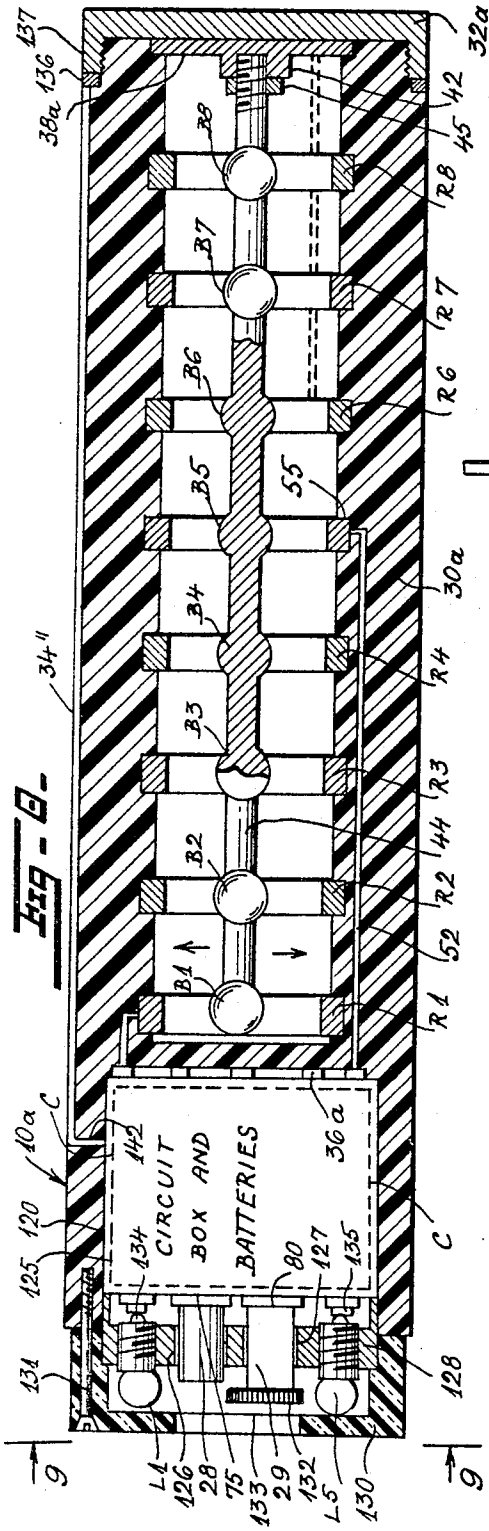


Fig-8.

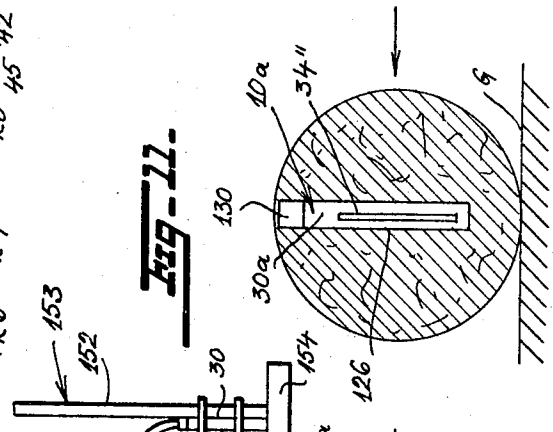


Fig-11.

Fig-12.

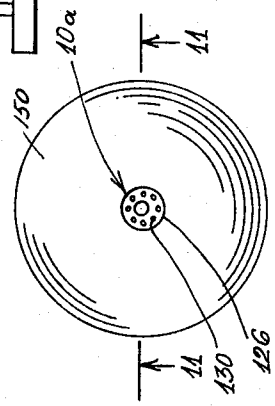


Fig-10.

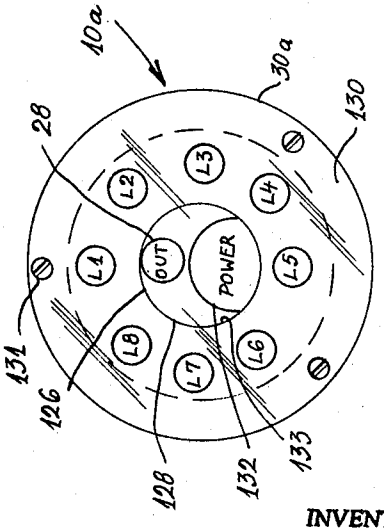


Fig-9.

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BASEBALL AND BASEBALL BAT TOY

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Fig. 13.

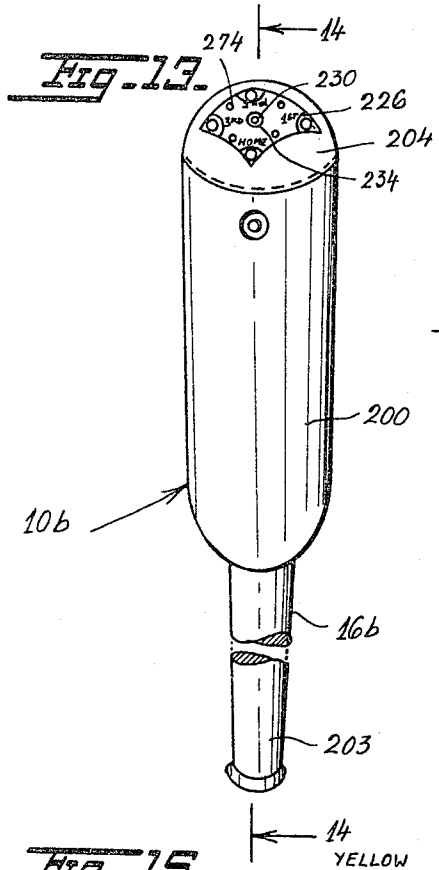


Fig. 14.

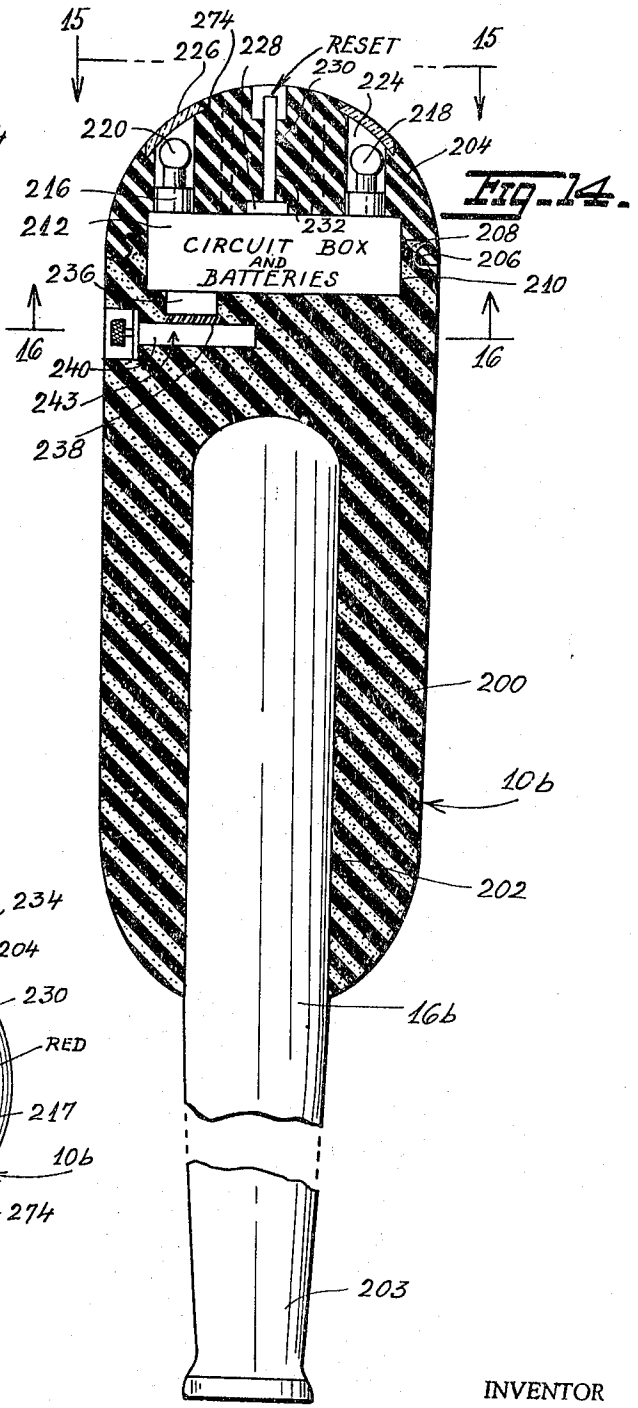
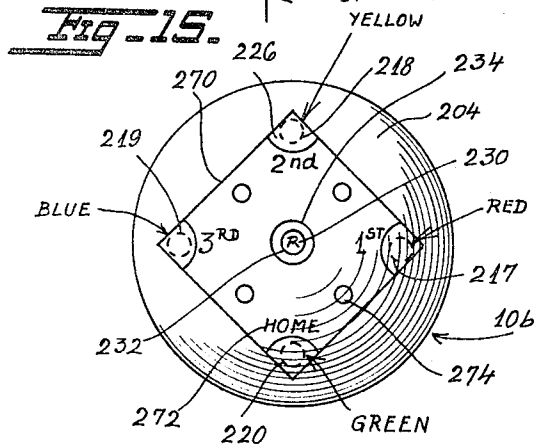


Fig. 15.



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BASEBALL AND BASEBALL BAT TOY

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Fig. 16.

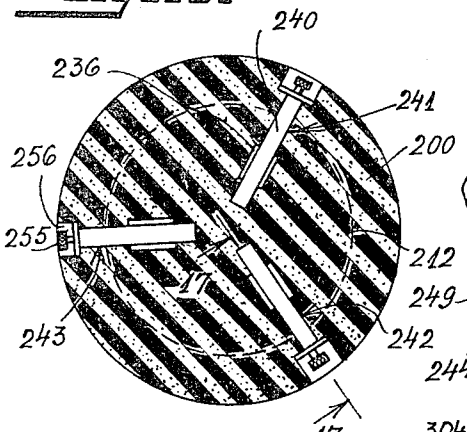
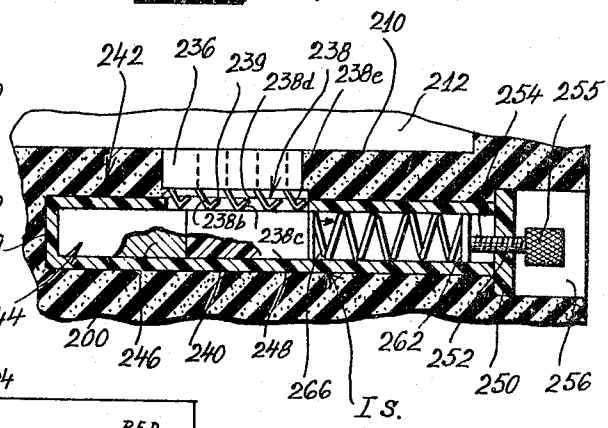


Fig. 17.



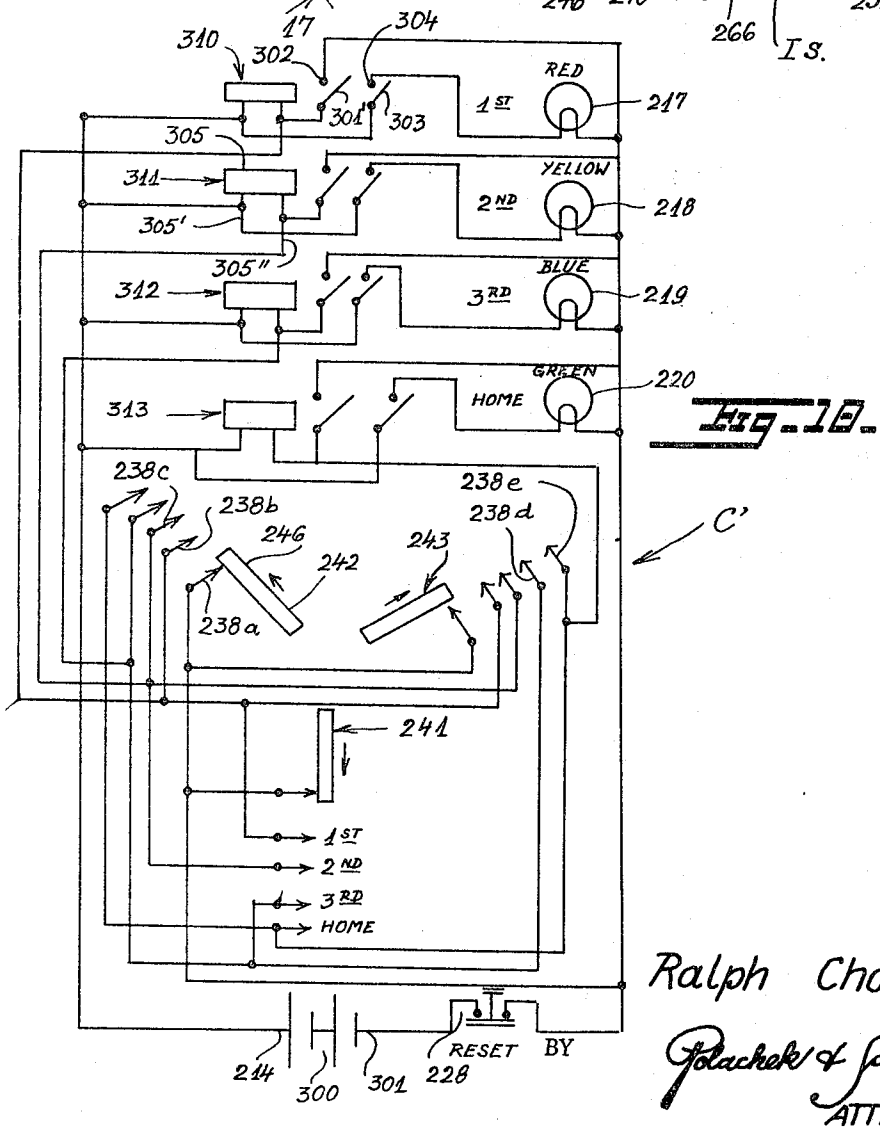


Fig. 18.

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Patented Apr. 30, 1968

3,380,305

BASEBALL AND BASEBALL BAT TOY

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Filed June 13, 1966, Ser. No. 557,199
2 Claims. (Cl. 73—379)

ABSTRACT OF THE DISCLOSURE

This invention concerns an appliance or device which can be installed in a bat, racquet, club, ball or other implement used in a game to measure and indicate the magnitude of striking force applied to the implement.

A principal object of the invention is to provide a device responsive to an impact applied in any direction in a field of 360° to measure the force of impact.

Another object is to provide a device of the character described including an omnidirectional, multicontact inertia switch for actuating indicating circuitry.

A further object is to provide an impact responsive device which can be installed in or on a game implement to measure quantitatively an applied force.

Another object is to provide an impact responsive device as last mentioned with means for connecting the same to external indicator means.

Still another object is to provide an apparatus including an impact responsive device and associated indicating means and circuitry all embodied in a compact self-contained unit.

For further comprehension of the invention and of the objects and advantages thereof, reference will be had to the claims in which the various novel features of the invention are more particularly set forth.

In the accompanying drawings forming a material part of this disclosure:

FIGURE 1 is a side view of an impact responsive device embodying the invention shown installed in a bat, part of the bat being broken away, the device being connected to an associated indicating assembly shown in perspective.

FIG. 2 is an enlarged longitudinal central sectional view of the impact responsive device taken on line 2—2 of FIG. 1.

FIG. 3 is a cross-sectional view taken on line 3—3 of FIG. 2.

FIG. 4 is a diagram of an electric circuit including parts of the device and indicating assembly of FIG. 1.

FIG. 5 is a side view, partially in section, of a striking ball apparatus embodying the invention.

FIG. 6 is a top view of part of the apparatus of FIG. 5.

FIG. 7 is a side view of another device embodying the invention, shown installed in a bat, part of the bat being broken away.

FIG. 8 is an enlarged longitudinal central sectional view taken on line 8—8 of FIG. 7, through the device per se.

FIG. 9 is an end view of the device of FIGS. 7, 8.

FIG. 10 is a top view of a kickball embodying the invention.

FIG. 11 is a cross-sectional view taken on line 11—11 of FIG. 10.

FIG. 12 is a side view of a croquet mallet equipped with a device embodying the invention.

FIG. 13 is an oblique side view of another impact responsive device embodying the invention, shown mounted on a bat, part of which bat is broken away.

FIG. 14 is an enlarged longitudinal sectional view taken on line 14—14 of FIG. 13.

FIG. 15 is a top plan view taken on line 15—15 of FIG. 14.

FIG. 16 is a cross-sectional view taken on line 16—16 of FIG. 14.

FIG. 17 is a further enlarged fragmentary sectional view taken on line 17—17 of FIG. 16, and

FIG. 18 is a diagram of an electric circuit employed in the device of FIGS. 13–17.

Referring first to FIG. 1, there is shown a game apparatus including an impact responsive device 10 secured in an axial bore 12 extending inwardly from the outer end 14 of a bat 16. An electric cable 18 extends out of one end of the device 10 and through an axial passage 19 which is an extension of bore 12. The cable passes outwardly of the other end of the bat through handle 20 and terminates at a scoring or indicating device 25 embodied in a cabinet 26. This device has a plurality of indicating lamps 23 designated L1–L8 respectively and arranged in a circle on the front panel 27 of the cabinet. Two control or operating buttons 28, 29 designated RESET and POWER are also provided at panel 27. On top of the cabinet is a louvered opening 31 for emitting the sound of an audible signaling device inside the cabinet. The cabinet is located some distance away from the bat in order to provide a player free use and movement of the bat. The device 25 provides visual and aural indications of acceleration force applied to the bat in swinging at a ball and/or the striking force of the bat on impact with the ball.

The construction of device 10 is best shown in FIGS. 2 and 3 to which reference is now made. The device 10 comprises a hollow cylindrical plastic casing 30 closed at one end by wall 30' and open at the other end. The open end is closed by a cap 32 screwed on the right end of the casing as clearly shown in FIG. 2. Cable 18 extends through a central opening 33 in cap 32. This cable includes a plurality of insulated wires 34 connected to electric terminals 36 in the casing. A small chamber 39 is defined between a circular plate 38 and cap 32 inside of the tubular end 40 of casing 30. Plate 38 is seated in a recess 41 formed in the casing. Plate 38 has a threaded nipple 42 in which is screwed the threaded end 43 of a flexible, spring metal rod 44. A locknut 45 is engaged on the threaded end of the rod and holds it securely to the nipple 42, so that the rod extends axially of cylindrical chamber 50 inside the casing. The rod is formed with a plurality of spaced, generally spherical beads B1–B8. Bead B1 is formed on the free end of the rod.

A plurality of metal rings R1–R8 are partially embedded in the wall of the casing and extend radially into the chamber 50. The rings are spaced from each other axially of the casing and are all parallel to each other and perpendicular both to the axis of the casing and to the axis of rod 44. The rings are electrically isolated from each other because casing 30 is made of electrical insulative plastic material. Electrical conductors 52 are respectively connected to the several rings. These conductors extend through the body of casing 30 in the axial direction and terminate at different terminals 36. Wires 34 are connected to the terminals 36 respectively. One wire 34' is connected to a central terminal 36' attached directly to plate 38. The other terminals 36 are clear of plate 38 and surround this plate at the left end of chamber 39.

In use of the device, a player will hold bat 16 by its handle and will swing the bat at a thrown ball in the usual manner as in playing baseball. Initially as the player swings at the ball, the rod 44 will flex in one direction radially of the casing and the first bead B1 will contact ring R1 due to acceleration of the bat from a stationary position. Thereafter, when the bat strikes a ball

thrown or held in the path of movement the bat, the force of deceleration of the bat will cause the rod **44** to flex in another radial direction so that one or more beads of the rod will contact their associated rings. The number of rings which will be contacted by the beads will depend on the force of impact of the bat with the ball. For example beads **B1–B3** are shown in dotted lines contacting rings **R1–R3** respectively. If the force of impact is great enough all the beads will contact all of the rings respectively. This mode of operation of the device **10** is utilized in the scoring or indicating device **25**. FIG. 4 to which reference is now made, shows the electric circuit C of the system, including parts of both devices **10** and **25**, by which circuit the indicating functions of the system are performed.

In circuit C is shown schematically the electrically conductive rod **44** including spaced beads **B1–B8** normally spaced from electrically conductive rings **R1–R8**. Wires **34** are connected to the respective rings. Wire **34'** is connected from rod **44** to one terminal **70** of a battery power supply **72** which will be mounted in cabinet **26** shown in FIG. 1 along with other parts of circuit C which will now be described. Circuit C includes a plurality of electromagnetic relays **RL1–RL8**. Each relay has a coil **74** which actuates two movable contacts **C1, C2** to close with two fixed contacts **C3, C4** respectively. One end of each coil is connected to one of wires **34** and to contact **C3**. The other end of each coil is connected to a movable contact **C2** and to terminal **73** of the battery **72**. The movable contact **C1** of each relay is connected to one contact **C5** of pushbutton switch **75** which is the RESET switch. This switch has operating arm or button **28**. Switch contact **C6** is connected to battery terminal **70**. The fixed contact **C4** of each relay is connected to a different pole **76** of a multiple pole, double throw switch **80**. This switch has operating arm or button **29**. The switch has HIGH POWER and LOW POWER positions. In LOW POWER position, each pole **76** is closed with fixed contact **C7** of the switch which is connected to one terminal of one of lamps **L1–L8**. The other terminal of each lamp is connected to battery terminal **70**. A bell or other electrically operable audible signal device **85** is connected across lamp **L8**. A buzzer **86** is connected across lamp **L4**.

Switch **80** has contacts **C8*a*–C8*h*** which are closed with poles **76** respectively in the HIGH POWER position of the switch. Only certain ones of these contacts are connected to selected ones of the lamps. In circuit C, contacts **C8*a***, **C8*c***, and **C8*g*** are open circuited. Contacts **C8*b***, **C8*d***, and **C8*h*** are connected respectively to lamps **L1–L4** respectively. The lamps may be arranged to emit different colored light to facilitate their visual identification. Circuit C is shown in alert condition ready for operation, with switch **80** in HIGH POWER position, so that in effect lamps **L5–L8** are deactivated during operation of the system.

Suppose now that a player swings the bat **16**. At first, only bead **B1** will contact ring **R1** and relay **RL1** will be activated. The contacts of this relay will close, but lamp **L1** will not light because relay contact **C8*a*** is open circuited. Now toward the end of the swing of the bat, it strikes a ball. The impact will cause the rod **44** to swing laterally to the rings so that two or more of the beads contact the rings. If the force of impact is so hard that all the beads contact the rings, then in the arrangement of the circuit shown, all the relays will become energized. As the ball leaves the bat after impact, rod **44** will vibrate for a time and some beads may contact the rings repeatedly but they will have no further effect on the circuit because all the relays remain energized. This is because contacts **C1** and **C3** close holding circuits through the battery and relay coils to keep the relays energized. Only lamps **L1–L4** will light. Buzzer **86** will sound when lamp **L4** lights. If the force of impact had been less only lamps **L1**, or **L1** and **L2**, or **L1, L2**, and **L3** would have lighted. Then the buzzer **86** would not sound.

The switch **80** may be thrown to LOW POWER position to obtain a showing of a greater range of impact forces, and of the force of swing of the bat even if no impact is made. In this switch position all the lamps are connected to the switch contacts **C7** and poles **76**. Now if bead **B1** contacts ring **R1**, lamp **L1** will light since the circuit is closed through contact **C8*a***. If the acceleration of the bat is not sufficient to cause bead **B1** to contact ring **R1** then lamp **L1** will not light. The flexibility of the rod **44** can be such that at maximum acceleration force with no subsequent impact of the bat on a ball, two or more lamps, **L1–L4** for example, may light. Then if the bat strikes a ball one or more other lamps **L5–L8** will light depending on which beads **B5–B8** contact rings **R5–R8**. By this arrangement progressive indications are obtained of both acceleration force and impact or deceleration force.

The apparatus described makes it possible to monitor and measure a batter's striking power. Various scoring points or credits can be allowed for lighting the different lamps. After each swing of the bat, the numbers of lighted lamps will be noted. Then the batter or a scorekeeper will press button **28** momentarily. This will cause all lights to go out and stop the sounding of the buzzer and bell if any one or both are actuated. This occurs because opening the normally closed switch **28** opens the holding circuits **C1, C3** of the relays to deactivate them. The circuit C then returns to alert position as shown in FIG. 4 ready for the next swing of the bat.

In FIGS. 5 and 6 is shown another application of the invention. The device **10** is installed in a ball **100** which is suspended by a flexible cord **102**. The device **10** extends diametrally of the resilient ball and assumes an axially vertical position. Cable **18** extends upwardly through cord **102**. Cord **102** is supported on a horizontal bracket arm **104** supported on a vertical wall **106**. Clamps **108** hold the cord. Cable **18** extends out of the cord at its distal end and terminates at scoring device **25** mounted on wall **106**. The ball **100** can be struck with a bat or club or even by hand. The force of impact will be indicated by lamps **L1–L8** of the device and by the audible signals of the bell and buzzer. The game apparatus of FIGS. 5, 6 employ the same circuit C as shown in FIG. 4, no further description of its mode of operation being required, since this has been covered in detail above.

FIG. 7 shows a modification of the invention in which device **10*a*** has a wholly self-contained system including indicating means. The device **10*a*** is mounted in axial bore **12*a*** of a bat **16*a***. The outer end **110** of the device is exposed at the open or left end of bore **12*a***. FIGS. 8 and 9 show details of construction of device **10*a*** in which parts corresponding to those of devices **10** and **25** having identical structure and functions are identically numbered.

In device **10*a*** flexible rod **44** is mounted in nipple **42** of plate **38*a*** which is secured in place at one end of cylindrical casing **30*a*** by screw cap **32*a***. At the other end of the casing is a compartment **120** in which is a box **125** containing batteries and other parts of circuit C shown in FIG. 4. Rings **R1–R8** are connected via individual conductors **52** to the relays **RL1–RL8** in circuit C. These relays are contained in box **125** along with the batteries **72** and switches **75** and **80**. Operating button **28** of switch **75** extends slidably through a hole **126** in a metal plate **128** held in the other end of the casing by a transparent plastic cap **130** held by screws **131** screwed on this end of the casing. Operating arm **29** of switch **80** extends through hole **127** in plate **128**. The arm **29** terminates in a knurled knob **132** which facilitates turning the arm **29**. Switch arms **28** and **29** are reached through a hole **133** in the end of cap **130**. Lamps **L1–L8** are screwed into plate **128** which is electrically connected in circuit with the batteries in the box **125** as shown in FIG.

4. Central terminals **134** of the lamps are in contact with circuit terminals **135**. These terminals are connected to contacts C7 of switch **80** in circuit C; see FIG. 4. Conductors **52** extend longitudinally of the casing to terminals **36***a* connected in circuit with the relays of circuit C. Rod **44** is in an electric circuit including plate **38***a*, end cap **32***a*, a metal ring **136** abutting flange **137** of cap **32***a*, and an electrical conductive strip **34''** seated in a longitudinal recess **142** in the casing. Strip **34''** extends radially inward of the casing at its end **142**, to the circuit box. Strip **34''** performs the function of wire **34'** in circuit C to connect rod **44** to terminal **70** of batteries **72**. Lamp designations L1–L8 are inscribed on the end face of cap **130**. The lamps are visible through the transparent end of the cap **130**.

Device **10***a* and the indicating means operate in the same manner as described for device **10**. The player looks at the lighted lamps in the end of the device in bat **16***a* to see his score after swinging the bat. He operates switches **75** and **80** at the bat instead of at the separate indicating device **25** shown in FIG. 1. If replacement of batteries or servicing of the circuit is required, the cap **130** can be removed by removing screws **131** which hold the cap on the casing. This provides access to lamps L1–L8 which can be removed and replaced without removing plate **128**. The plate **128** can be removed along with the circuit box **125** after cap **130** is removed to provide access to the interior of the circuit box. Bell **85** and buzzer **86** can be provided in circuit box **125** or can be omitted from the circuit if desired. Device **10***a* has the advantage of being entirely self-contained and requiring no remote indicating device. Also, the external cable **18** of device **10** is omitted.

FIGS. 10 and 11 show device **10***a* installed in a bore **12***b* in kickball **150**. The device extends diametrally of the ball with its indicating end at cap **130** facing upwardly. The device extends diametrally of the ball which may be placed on the ground G for kicking in a direction angularly to the axis of the device for producing an impact measuring indication.

FIG. 12 shows device **10** with its cable **18**, attached to the shaft **152** of a croquet mallet **153**. When the head **154** of the mallet strikes a croquet ball, an impact indication will be obtained at remotely located indicating device **25**, shown in FIG. 1. Alternatively, device **10***a* can be mounted on shaft **152** if a self-contained impact indicating system is desired.

The devices **10** and **10***a* can be installed in other game and athletic devices. They can be mounted in or on the handles of tennis racquets, on football tackling dummies, on golf clubs, squash racquets, etc. They can even be mounted on an arm of a player of handball, basketball, jai alai, lacrosse, baseball, etc. They can be mounted on the leg of a football player, or a player of soccer or rugby.

What has been provided herein is an appliance of rather general application for use in the sport field wherever an impact occurs whose magnitude it is desired to measure.

In FIGS. 13–17 is shown another impact indicating device **10***b* removably mounted on a generally cylindrical bat **16***b*. The device **10***b* has a resilient lightweight rubber or plastic body **200** which is rather cylindrical in form. It has a central axial bore or cavity **202** extending inwardly from one end to engage the outer end of the bat leaving bat handle **203** projecting out of body **200**. On the other end of the body **200** is removably mounted a cap **204**. This cap is made of rubber or other flexible material. The cap has an internal circumferential bead **206** which engages removably under and around a bead **208** formed at the top of body **200**. In the top of body **200** is a cavity **210** in which is secured a circuit box **212** containing circuit components including batteries of the circuit of the device. The circuit is shown in FIG. 18 and is explained in detail below.

Mounted on top of the circuit box are four lamp holders **216** carrying removable lamps **217–220**. The lamps project into bores **224** formed in cap **204**. Resilient, transparent plastic lenses **226** which may be colored differently from each other are set in the outer ends of the bores **224**. A switch **228** used for resetting purposes is mounted on the circuit box. The switch has an operating shaft or button **230** extending upwardly through a bore **232** in the cap. The outer end of button **230** is exposed in a cavity **234** where the button can be reached manually for operation.

Extending downwardly from the circuit box are three terminal blocks **236** each carrying five spring contacts **238**; see FIGS. 14, 16 and 17. Each set of spring contacts projects into lateral opening **239** formed in the tubular insulated casing **240** of an inertia switch. There are three such switches **241**, **242** and **243** provided as shown in FIG. 16. Inside each of the inertia switches is an axially movable massive plunger **244** having an electrically conductive cylindrical metal section **246** and an insulated cylindrical section **248** joined to it. The metal section is located at the innermost part of the casing near closed end **249**. Each casing is disposed radially of the body **200** and the three casings are disposed 120° apart. The casing is closed by a plug or disk **250** which may be secured to the outer end of the casing **240**. The disk **250** has a threaded hole **252**. An adjustment screw **254** is rotatably engaged in hole **252**. The head **255** of the screw is located in a cavity **256** extending inwardly from the outside of body **200**. The head **255** of each screw can be reached manually for turning the screw.

A coil spring **266** in each casing **240** bears against the plunger **244** in a direction axially of the casing. The outer end of the spring is secured to a movable disk **262** which bears against the rounded end of screw **254**. It will be apparent that when the screw is turned to advance inwardly of the casing the tension in the spring **266** will increase and more force will be required to displace the plunger **244** in the radially outward direction of the device.

One contact **238***a* of the five contacts **238** contacts the electrically conductive section **246**. The other four contacts **238***b*–**238***e* contact the insulated section **248**. When the plunger **244** is moved axially to its fullest extent radially outward of the body **200** to compress fully spring **260**, then all five contacts **238** will contact section **246**. With lesser force applied, less than five contacts will contact section **246**.

The top or outer end of the cap **204** is inscribed with a diamond pattern **270** simulating a baseball diamond best shown in FIGS. 13 and 15. Corners of the diamond have indicia **272** representing first, second and third bases, and home plate. If desired screws **274** may be provided, removably anchored in the top of the circuit box **212** to supplement of the hold of the cap through beads **206**, **208** on the body **200**. The lamps **217–220** are located under the lenses **226** which may have any colors; red, yellow and blue for first, second and third bases, and green for home plate.

FIG. 18 shows circuit C' employed in the device **10***b*. This circuit in many respects is similar to circuit C of FIG. 4. It will be noted that reset switch **228** is a normally closed pushbutton switch which is connected in series with batteries **300**. Terminal **301** of the batteries is connected via switch **228** to each of the three spring contacts **238***a* which normally contact movable conductive section **246**. Terminal **201** is also connected to one terminal of each of lamps **217–220** and to fixed contact **302** in each of four relays **310**, **311**, **312** and **313**.

Each relay has two movable poles or contacts **301'**, **303** and two fixed contacts **302** and **304**. The relay contacts are normally open. Contact **304** of each relay is connected to the other terminal of each lamp respectively. The positive terminal **214** of the batteries is connected to one end **305'** of the coil **305** of each relay and to movable relay contact **303**. Relay contact **301'** of each relay is connected to the other end **305''** of the relay coil

and to each of the three contacts **238***b* which is most closely spaced from the section **246** of each inertia switch **241, 242, 243** when the section **246** is fully retracted into casing **240.**

Each of the three contacts **238***c* is connected the end **305″** of the coil of relay **311.** Each of the three contacts **238***d* is connected to the end **305″** of the coil of relay **312.** Each of the three contacts **238***e* is connected to the end **305″** of the coil of relay **313.**

In operation of the device **10***b* including circuit C′, all lamps are initially extinguished because the relays are all de-energized. Suppose now that the bat **16***b* carrying device **10***b* is used to strike a pitched ball. If the force of impact is great enough, the plunger **244** of at least one inertia switch will move axially outward in casing **240** so that section **246** contacts each of spring contacts **238.** Then all relays will become energized through the conductive section **246** bridging contacts **238.** Contacts **301′, 302** will close with contacts **303, 304** of each relay and all the lamps will light. As the springs **260** in the inertia switches restore the displaced plungers to normal retracted positions, the circuit between contacts **238***a* and the other contacts **238***b*–**238***e* will open, but the energized relays will remain energized due to the closure of contacts **301′, 302** in a holding circuit. Thus, those lamps which light will remain lighted to indicate the batter's score which may range from a "one base hit" to a "home run." If only one of the contacts **238***b* were reached by any conductive section **246,** then only relay **310** will become energized to light lamp **217** and indicate the batter reached "first base." In any case, all the lighted lamps can be extinguished by actuating the reset switch **228.** Momentary opening of this switch deactivates any energized relays and alerts the circuits C′ for the next play.

The adjustment screws **254** can be screwed outwardly to set the device for scoring hits with lesser applied force than when the screws are turned inwardly. Thus, the screws **254** will be turned outwardly for use by children and will be turned inwardly for adult batters.

While I have illustrated and described the preferred embodiments of my invention, it is to be understood that I do not limit myself to the precise constructions herein disclosed and that various changes and modifications

may be made within the scope of the invention as defined in the appended claims.

What is claimed is:

1. A device mountable on a bat for indicating the magnitude of an impact, comprising a cylindrical body having an axial cavity at one end for receiving an engaging said bat, a cap at the other end of said body, lamps disposed in a diamond shaped pattern in said cap and exposed to the exterior of the cap, a plurality of generally cylindrical inertia switches disposed in circumferentially spaced radial array in said body, movable conductive elements in said switches, springs in the switches urging the conductive elements radially inward of said body, a plurality of spaced contacts at each switch for contact by a movable conductive element when the element is moved against spring tension upon application of striking force to said body in a direction radially thereof, and electric circuitry connecting said lamps and respective spaced contacts of the switches for lighting a number of lamps depending on the magnitude of applied force.

2. A device as recited in claim **1,** wherein said circuitry comprises relays in circuit with the lamps, said relays having holding means to keep lighted those lamps which light upon application of said striking force manually reset switch means carried by said body and connected in circuit with the relays to de-energize any relays which remain energized after said striking force is applied, and manually settable adjustment means for adjusting the tension in the springs, so that different predetermined magnitudes of applied striking forces will be required to light the lamps depending on the setting of the adjustment means.

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