United States Patent

Cornell

[15] **3,645,528**

[45] **Feb. 29, 1972**

[54] BOWLING BALL INCLUDING TUNED LOADING CIRCUIT

[72] Inventor: **William D. Cornell, Grand Haven, Mich.**

[73] Assignee: **Brunswick Corporation**

[22] Filed: **Feb. 14, 1969**

[21] Appl. No.: **799,392**

Related U.S. Application Data

[62] Division of Ser. No. 474,442, July, 1965, Pat. No. 3,447,804.

[52] **U.S. Cl.** .....**273/63 R**, 340/280, 340/258 R, 340/323, 325/66, 343/6.5 R

[51] **Int. Cl.** **A63b 37/00**

[58] **Field of Search** 273/63, 54, 58, 213; 325/66, 325/310; 46/45, 232, 233, 234, 235; 324/41

[56] **References Cited**

UNITED STATES PATENTS

3,089,702	5/1963	MacDonald	273/63 A
3,447,804	6/1969	Cornell	273/54 R
746,576	12/1903	Rice	273/63 E
2,774,060	12/1956	Thompson	324/41 X
3,068,007	12/1962	Satchell	273/63 G
3,202,742	8/1965	Bachelder et al.	273/63 G
3,351,347	11/1967	Smith et al.	273/58 G X

OTHER PUBLICATIONS

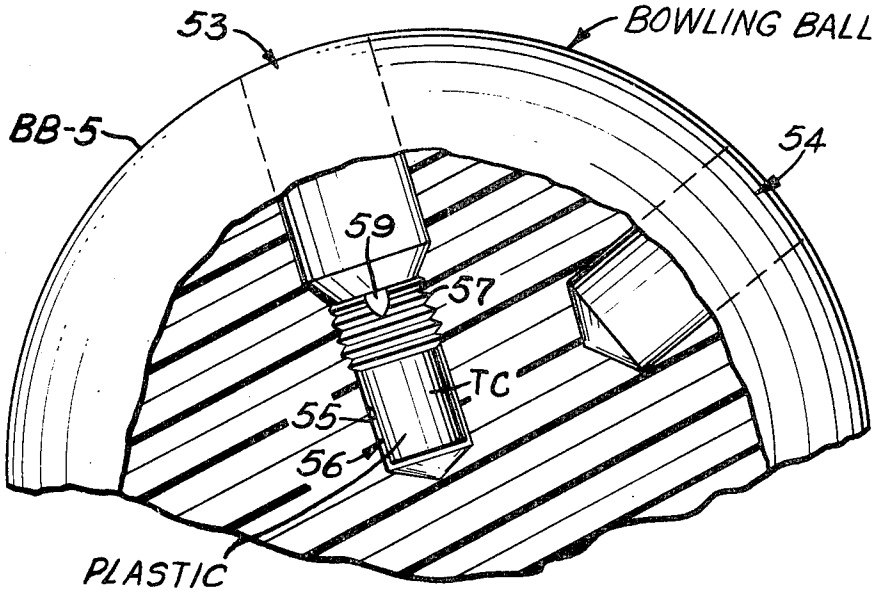
" Radio–Electronics," June, 1956, page 79.

Primary Examiner—George J. Marlo
Attorney—Hofgren, Wegner, Allen, Stellman & McCord

[57] **ABSTRACT**

A loading circuit tuned to an identifying frequency is molded within a plastic housing. The housing is threaded into a cavity located in a fingerhole of a bowling ball. The circuit includes a resistor, a capacitor and an inductance coil connected in series.

6 Claims, 8 Drawing Figures



Patented Feb. 29, 1972 3,645,528

4 Sheets-Sheet 1

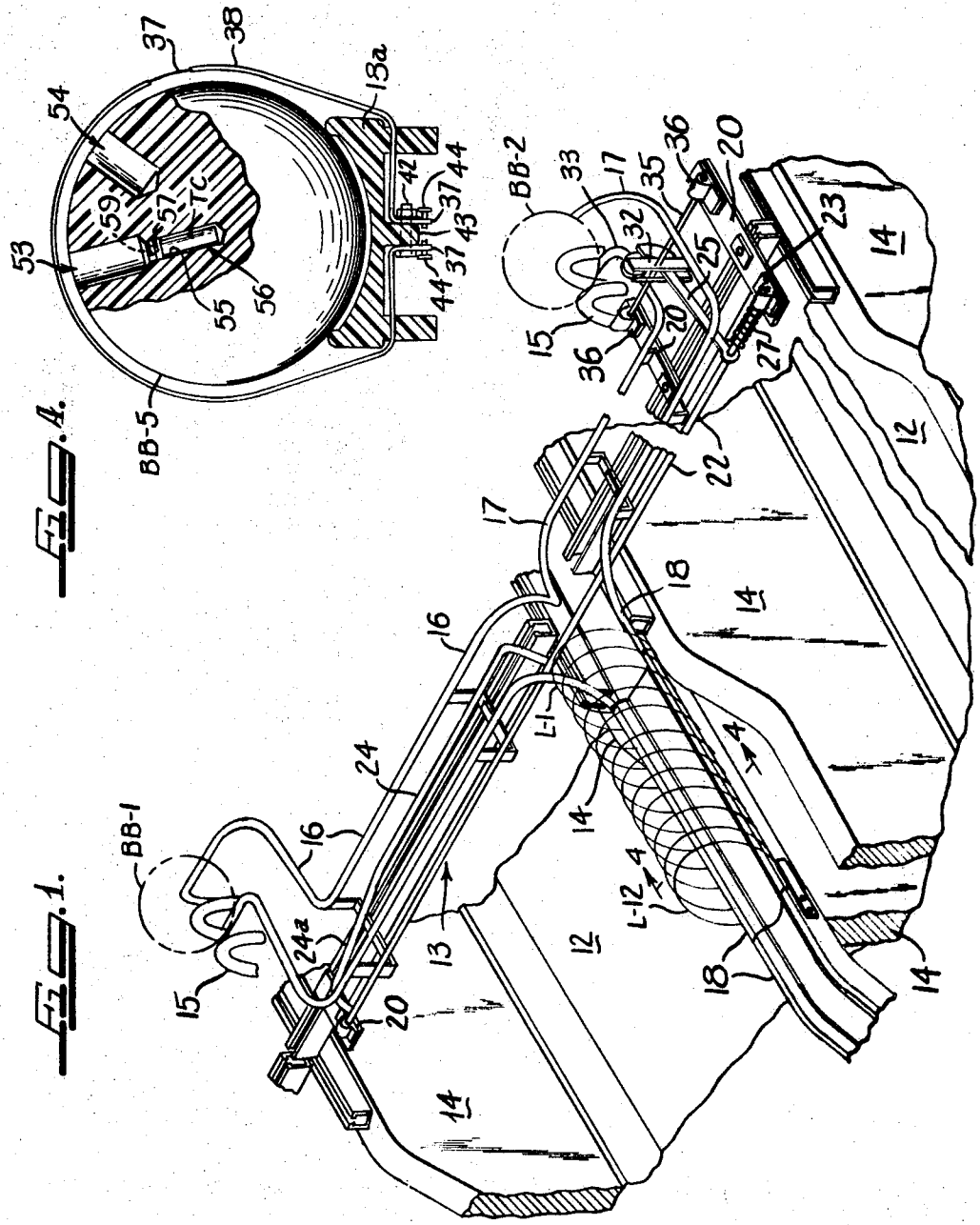


FIG. 4.

FIG. 1.

INVENTOR
WILLIAM D. CORNELL

BY Hofgren, Wegner, Allen, Stellman & McCord
Attys.

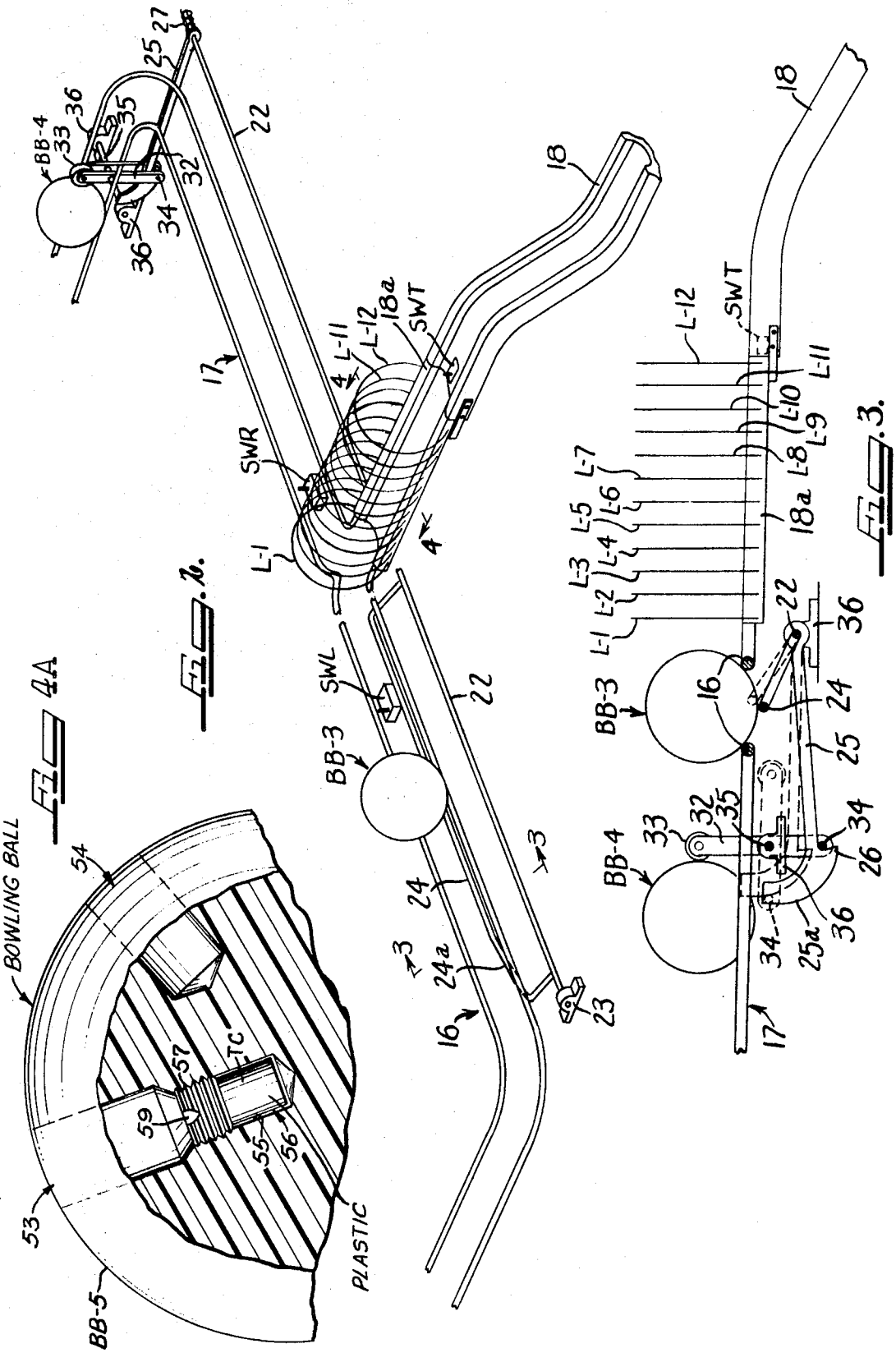


FIG. 2.

FIG. 4A

FIG. 3.

FIG. 5.

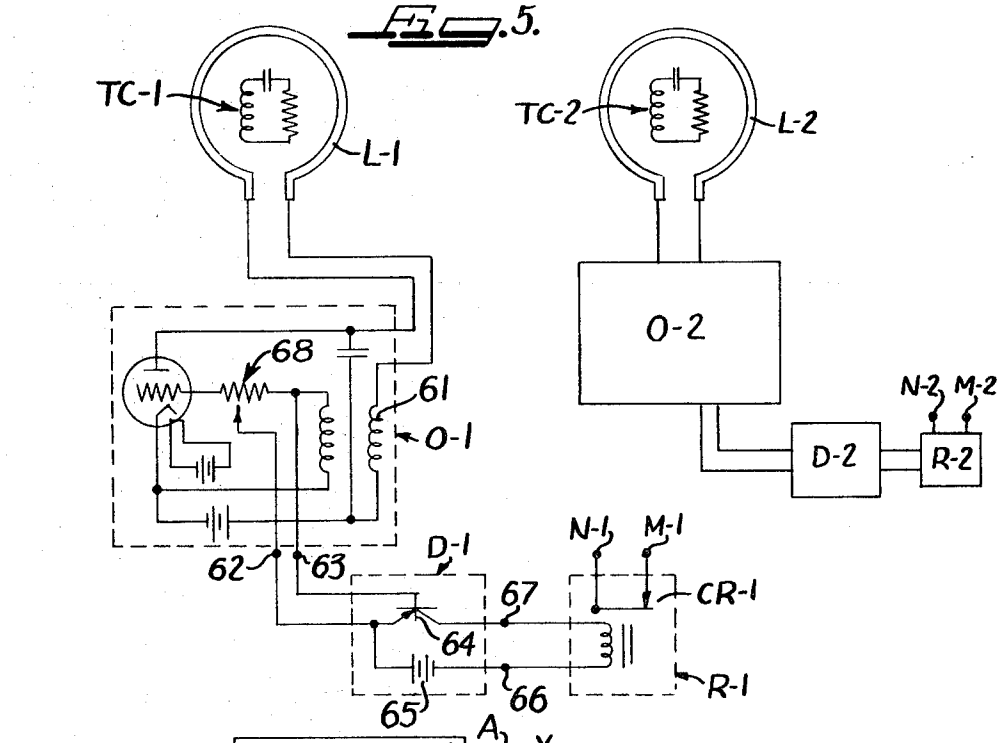

TC-1
L-1
TC-2
L-2
O-2
N-2
M-2
D-2
R-2
68
61
O-1
62
63
D-1
N-1
M-1
67
CR-1
64
R-1
65
66

FIG. 7.

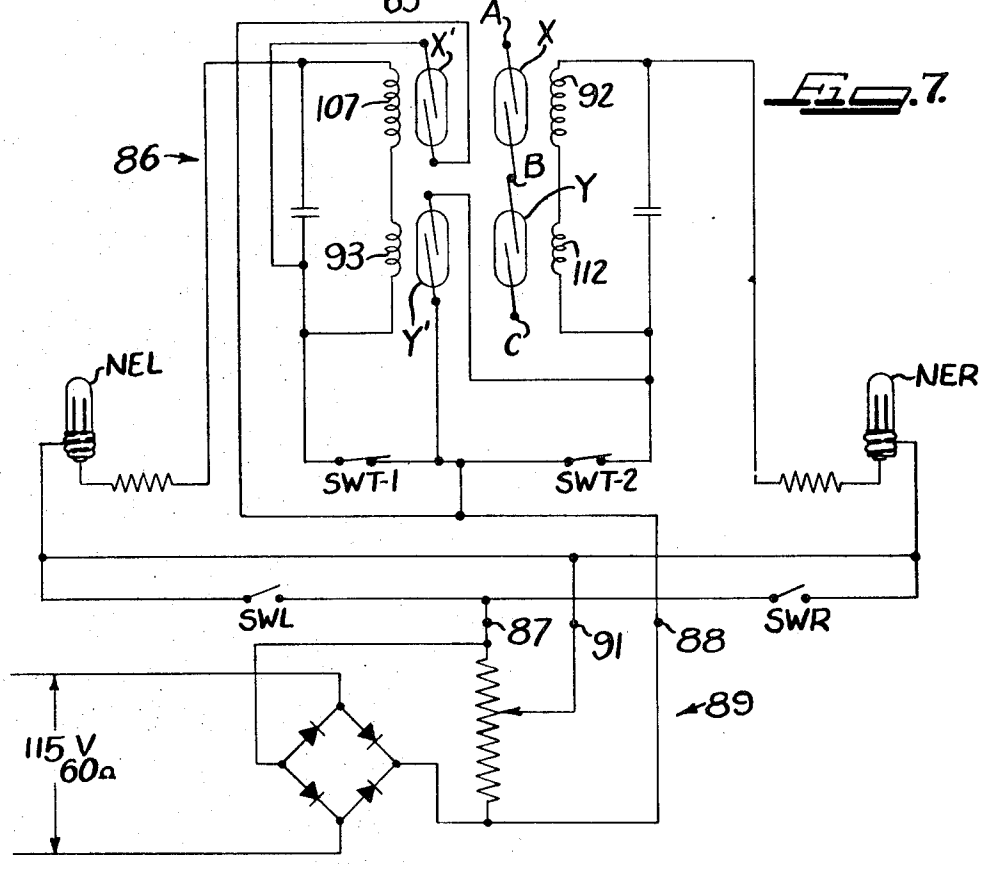
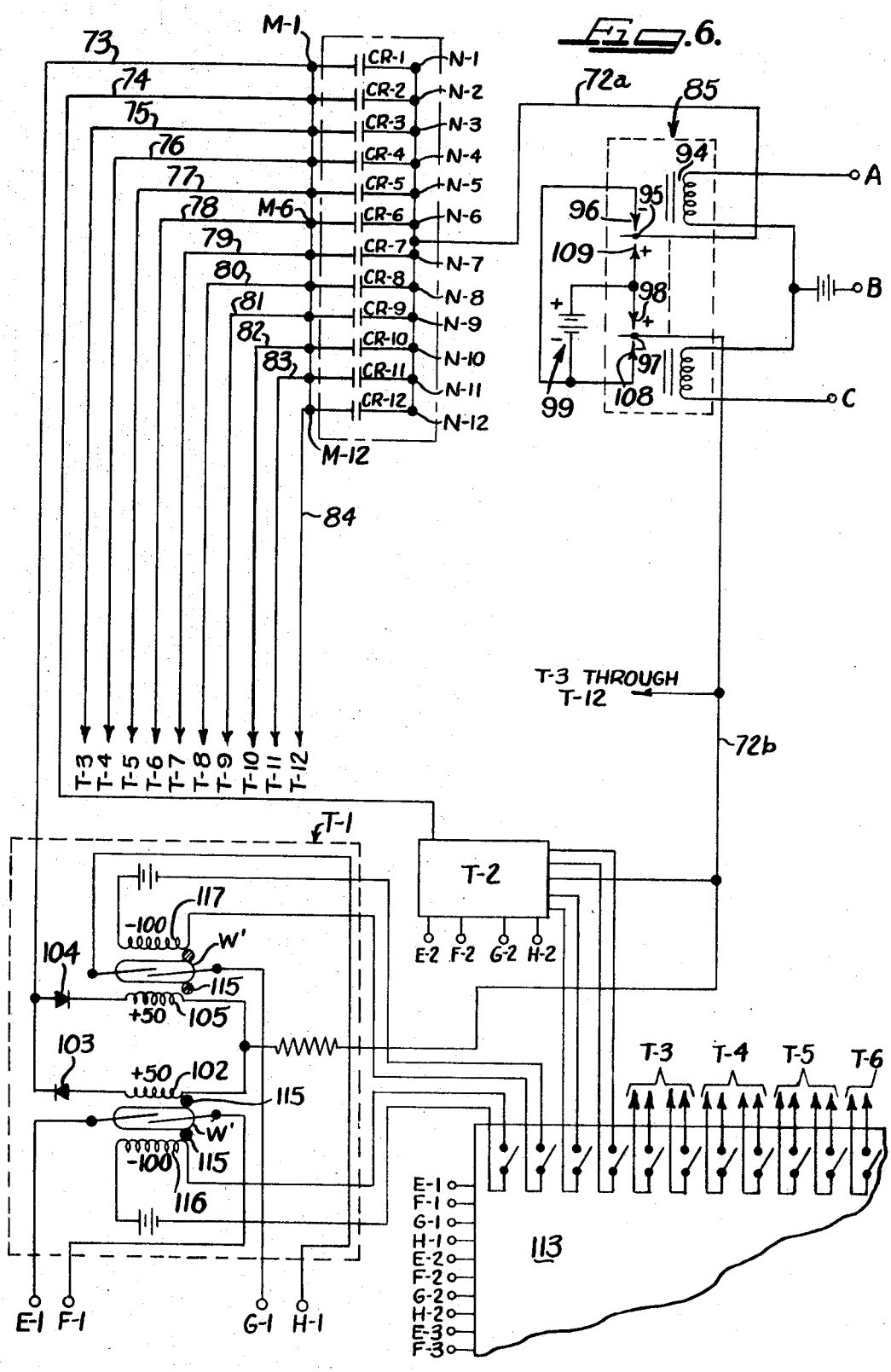

A
X
X'
107
92
86
B
Y
93
112
Y'
C
NEL
NER
SWT-1
SWT-2
SWL
SWR
87
91
88
89
115 V
60∩

FIG. 6.


M-1
73
74
75
76
77
78
M-6
79
80
81
82
83
CR-1
CR-2
CR-3
CR-4
CR-5
CR-6
CR-7
CR-8
CR-9
CR-10
CR-11
CR-12
N-1
N-2
N-3
N-4
N-5
N-6
N-7
N-8
N-9
N-10
N-11
N-12
M-12
84
72a
85
94
95
96
109
98
97
99
108
A
B
C
T-3 THROUGH T-12
72b
T-3
T-4
T-5
T-6
T-7
T-8
T-9
T-10
T-11
T-12
T-1
T-2
E-2
F-2
G-2
H-2
117
-100
W'
104
115
+50
105
103
102
116
E-1
F-1
G-1
H-1
113
E-3
F-3

BOWLING BALL INCLUDING TUNED LOADING CIRCUIT

CROSS-REFERENCE

This application is a division of my copending application No. 474,442, filed July 23, 1965 now U.S. Pat. No. 3,447,804.

This invention relates to systems for detecting bowling balls and for differentiating between bowling balls during their use on a bowling lane of a bowling establishment. The invention more particularly relates to systems for identifying and differentiating between bowling balls for controlling equipment associated with the bowling lane for purposes of scoring, ball handling, or the like, during a game of bowling.

During a game of bowling, it is often desirable to identify balls bowled on a particular lane. Assuming, as is the general practice, that each bowler of a plurality, e.g., a team, bowls with his same ball throughout a game, the identity of the bowler can be established by detecting and identifying the bowler's ball. Such ball identification, e.g., when coupled with identification of the lane on which the bowler has bowled, can be used for such purposes as directing return of a ball to a particular location or attributing the correct score to a particular bowler.

With recent trends toward development of systems for automatic scoring of bowling games, it becomes important to provide an information input for a scoring system which will identify the bowler and the lane upon which he has bowled. The information should be provided in a form usable by the scoring system and should also be provided in a manner which eliminates the possibility of error in bowler and lane identity as they correlate with bowling scores computed by the scoring system. It is highly advantageous to provide the information as a result of normal bowling during a bowling game without requiring manual input of the information to the scoring system.

It is an object of this invention to provide for the identification of bowling balls in a new and useful manner during a game of bowling.

It is a further object to provide a new and useful system for coding a plurality of bowling balls with individual code means where there are differences in the code means from ball to ball sufficient for detection and differentiation of each of the balls used during the game.

More particularly, it is an object to provide signal means within a bowling ball for producing a separate signal for the particular bowling ball, and to provide a plurality of such balls in which the separate signals are discernible.

It is also an object to provide a system of the type described wherein each signal is produced by changing an externally generated signal.

Yet another object of this invention is to provide coding means which may be removably carried by each of a plurality of balls and which are interchangeable between the balls, each coding means being distinguishable from each other.

A still further object is to provide coding means such as that set forth in the preceding paragraph, which coding means comprise an electrical loading circuit.

Other objects and advantageous features of the present invention will be apparent to those in the art from the following description and from the drawings, in which:

FIG. 1 is a perspective view of a portion of a pair of adjacent lanes at a bowling establishment, indicating location of components of a system in accordance with the principles of the present invention;

FIG. 2 is a schematic showing of a system as illustrated in FIG. 1, in more simplified form, for clarity of understanding;

FIG. 3 is a section along line 3—3 of FIG. 2;

FIG. 4 is a section along line 4—4 of FIG. 1, showing mounting of loop members illustrated in FIG. 2 and also illustrating a bowling ball, adapted in accordance herewith, disposed within a loop and shown partially cutaway for better illustration of internal ball structure;

FIG. 4A is an enlargement of the cutaway section of FIG. 4, and

FIGS. 5 through 7 are wiring diagrams of the electrical circuitry of the illustrated form of ball detection system.

While this invention is susceptible of embodiment in many different forms, there is shown in the drawings and will herein be described in detail a specific embodiment of the invention with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the embodiment illustrated.

It is to be understood that the ball detection system of the present invention is capable of use in combination with a bowling lane or a pair of adjacent bowling lanes in a bowling establishment. Each lane may advantageously be equipped with automatic pinsetting devices of the type commercially available and well known to those in the art. In such a bowling lane, the ball is normally bowled by the bowler from the bowler's end of the lane over a lane surface, indicated by reference numeral 12, toward a pit area, indicated generally at 13. Although the bowler's end of the lane is not shown, such structure normally identified with a bowler's end may be used in accordance herewith.

As the ball progresses over surface 12 toward the pit 13, it encounters the pin setup on surface 12, normally in the area between kickbacks 14 separating each lane setup and pit from the next adjacent lane setup and pit. The pinsetting equipment receives the ball from the pit 13 and elevates the ball above kickbacks 14, the pinsetter elevator discharge being shown at 15. Balls BB–1 and BB–2 are shown at respective ball discharges 15 in FIG. 1. The ball then proceeds over guide or branch tracks 16 or 17, depending upon the pit from which the ball was elevated. The guide tracks join at a Y-junction with a common ball return track 18 which extends to the bowler's end of the lane for return of balls to the bowlers. In the system shown, one common track 18, mounted above adjacent kickbacks 14, is provided for each of the two adjacent bowling lanes. Thus, the ball detecting system which will be described in accordance herewith will be a ball detecting system useful for two adjacent lanes. It will be apparent from the description herein that the principles of the system can be readily adapted for one lane or for a plurality of lanes greater than two.

Referring now to FIGS. 1–3, and especially FIGS. 2 and 3, a plurality of separate loops L, i.e., L–1 through L–12, are mounted to surround the ball path over a nonmagnetic portion 18*a* of the common ball track 18. A blocking system is provided for blocking a ball from one of the branch or guide tracks in such cases where a ball from the other branch or guide track is approaching the common track 18, so that the first ball to enter the array of loops L will progress completely through the array prior to entry of a second ball from the other branch or guide track.

The blocking system is of the type providing a right-of-way on one branch track while blocking possible interfering balls on the other branch track. The system includes an elongate shaft 22 pivotally mounted by suitable means 23 supported from suitable framework 20. The shaft 22 extends along portions of both branch tracks 16 and 17. A rail member 24 is secured by a pair of arms to shaft 22 for pivoting with shaft 22. Rail member 24 is disposed between the rails of track 16 to be depressed by a ball passing over track 16, thereby pivoting shaft 22 and rail 24 from the phanton position of FIG. 3 to the full line position, in a counterclockwise direction. Rail 24 has an inclined portion 24*a* for camming the rail 24 downward as the ball rolls over track 16.

Mounted at the other end of shaft 22 for pivoting therewith is a latch member 25 having a latching end 26. Latch member 25 is normally biased in a clockwise direction by a torsion spring 27 around shaft 22 secured at its ends to latch member 25 and suitable framework 20. Shaft 22, secured to latch member 25, is thereby also biased in a clockwise direction as viewed in FIG. 3, carrying rail 24 to the phantom position. The

weight of a ball, e.g., ball BB–3, is sufficient to overcome spring 27 and pivot latch 25 downward.

A blocking member 32 is disposed between the rails of track 17 and comprises a pair of spaced arms, held in spaced disposition at one end by a pin 34 and at the other end by a shaft, on which a roller 33 is rotatably mounted. The arms are pivotally mounted by means of a shaft 35 impaling the arms between roller 33 and pin 34 and appropriately mounted by brackets 36, supported by framework 20. The lower end of blocking member 32 is weighted to normally hang down.

As best seen in FIG. 3, with latch 25 biased by spring 27 to its normally raised position, shown in phantom, as a ball, e.g., BB–4, rolls over return track 17, ball BB–4 engages roller 33 and pivots the blocking member 32 in a clockwise direction, under the weight of the ball. The ball thereupon proceeds over track 17 to track 18.

However, if a ball, e.g., BB–3, has moved onto rail 24 prior to ball BB–4 reaching latching roller 33, real 24 has been depressed against the urging of spring 27, pivoting latching member 25 downward with latching end 26 hooking over pin 34 of blocking member 32. In such instance, as ball BB–4 approaches roller 33, blocking member 32 is held by latch 25 against pivoting and ball BB–4 is stopped against roller 33. As the ball BB–3 on rail 24 proceeds beyond rail 24 and onto common track 18, rail 24 is released and latch 25 is raised by spring 27, thereby unlatching blocking member 32. The weight of ball BB–4, with ball BB–4 resting on an inclined portion of track 17, is sufficient to pivot blocking member 32 in a clockwise direction as viewed in FIG. 3 and ball BB–4 thereupon proceeds over branch track 17 and onto common track 18.

Whenever a ball on track 17 passes and pivot blocking member 32 down while latch 25 is released, pin 34 on blocking member 32 is carried beneath an extension 25*a* of latch 25 to block latch 25 from being depressed. This holds rail 24 raised and blocks any ball on track 16 entering rail 24 so that the ball from track 17 proceeds completely through loops L–1 through L–12 prior to arrival of the ball from track 16 to the first of loops of L–1 through L–12. Thus, in the ball blocking system illustrated, the first ball to arrive at a particular point has the right-of-way over a ball on the other track and delays the other ball enough to pass completely through loops L–1 through L–12 prior to entry of the other ball into the loops.

It will be noted in FIGS. 2 and 3 that, as the balls on tracks 16 and 17 approach track 18, they pass over switches SWL and SWR respectively. Switches SWL and SWR are normally open switches which are momentarily closed by passage of a ball thereover, the ball engaging an upstanding actuator arm for closing the switch. Each of switches SWL and SWR is spring-loaded so that after passage of the ball the switch reopens. The ball then proceeds onto track 18 and rolls over nonmagnetic portion 18*a* while rolling through the loops L–1 through L–12.

The loops L–1 through L–12 comprise a portion of the ball detection system provided in accordance herewith. Each of the loops L is individually mounted as illustrated in FIG. 4. Each loop includes a central, electrically conductive stiff wire 37 encased in an electrically insulating sheath 38, of phenolic resin coating or the like. The loops are mounted by electrically nonconductive or insulating bolts 42 to a rib 43 on the bottom of the nonconducting and nonmagnetic track section 18*a*. Each loop L is disposed to surround the ball path so that the ball passes through the loop during its return over track section 18*a*. Each loop also includes a pair of lead terminals in the form of electrically conductive screws 44 which are threadedly connected with the wire portion 37. The sheath 38 is scraped away to provide a conductive surface of wire portion 37 opposite the head of screw 44. The wire portion 37 of each loop may be generally flat to provide good rigidity and better bearing surface for attaching lead wires between wire 37 and screw 44.

As the ball leaves the last of loops L, i.e., L–12, the ball trips switch SWT, a normally closed double pole switch which is spring-loaded toward closed position and is momentarily opened by engagement of an upstanding actuator arm with a ball passing thereover.

In general, the switches SWL and SWR function as lane identification switches for identifying the left and right lanes respectively. Signals from momentary closure of the switches are fed to a holding system where the lane identification is memorized, as will be seen. As the ball passes through the loops L–1 through L–12, its identification is established and a signal can then be given for identifying both the lane and ball. Tripping of switch SWT cancels the lane identification signal from the lane identification holding system.

As one feature of the present invention, there is provided a coding means for a ball or a plurality of separate coding means for a plurality of separate balls. Each coding means is comprised of a signal system for giving a signal detectable by one of the loops L–1 through L–12. In the system shown, the signal is detected as a change in a signal generated by an oscillator 0–1 through 0–12 (only 0–1 and 0–2 being shown in FIG. 5), the change resulting from the presence of the coding means in the form of a tuned loading circuit TC carried within the bowling ball.

Referring now to FIGS. 4 and 4A and the ball BB–5 illustrated therein, it is seen that the ball includes a pair of fingerholes 53 and 54 and a cavity 55 continuing from one hole for receiving a loading circuit device 56. A loading circuit portion of the device, diagrammatically shown in FIGS. 4 and 5 at TC, e.g., TC–1 or TC–2, includes a resistor, an inductance coil and a capacitor in complete series circuit. The circuit components may be molded in a body of plastic material for convenient insertion. The loading circuit device 56 includes a male threaded base portion 57 supporting and carrying the loading circuit portion TC. The male threaded base portion 57 is removably received in a female threaded portion at the entry of cavity 55 below fingerhole 53. A screwdriver slot or allen head socket 59 is provided in base portion 57 to facilitate threading so that the loading circuit device can be removably secured in cavity 55.

It is to be understood that a plurality of balls such as ball BB–5 described above, can be provided as a set of balls in accordance herewith. Preferably, 12 balls are provided with loading circuits T–1 through T–12, the loading circuit of each of which is detectable by a respective one of the loops L–1 through L–12 and attentive equipment. The 12 balls permit bowling by two teams of five bowlers each plus a pace bowler for each team, with the teams alternating between two lanes in the illustrated system. For example, the balls BB–1 through BB–5, referred to hereinabove, and seven additional balls may each be provided with a loading circuit tuned to a different frequency.

Turning now to the wiring diagrams of FIGS. 5–7, it is to be understood that although less than 12 each of the tuned loading circuits TC, loops L, oscillators O, amplifiers D, relays R, relay contacts CR and signal differentiating system sections T are illustrated, the total particular system described includes 12 of each which may be referred to herein and differentiated from each other by number suffixes 1 through 12 on the respective letter designations. Further, in the system, there are 12 each of terminals E, F, G and H in the signal differentiating system T and the same number of corresponding terminals in the scoring system. It is intended that each terminal having the identical designation, including identical suffix of 1–12, is interconnected. Also, in the signal differentiating system T, it is to be understood that contacts V–1 through V–12 and V′–1 through V′–12, in the scoring system are operated by relays or the like (not shown) in a computation or control section of a scoring system, and are connected by suitable wiring to the respective sections T–1 through T–12, i.e., having the same numerical suffix, as is shown for contacts for V–1 and V′–1 in section T–1. Contacts A, B and C in FIG. 6 are connected to contacts A, B and C respectively in FIG. 7.

Referring to FIG. 5, each loading circuit TC is tuned to a frequency for cooperation with one of the oscillator circuits, including a loop L and an oscillator o in the detection system, to increase the oscillator induction coil current. The frequencies of the tuning circuits differ from each other an amount discernible by the oscillator system. Since frequency is dependent on the product of inductance and capacitance, either the inductance or capacitance or both will vary between the loading circuits TC–1 through TC–12. Such variance in frequency by changing inductance and capacitance is in accord with the formula:

$$F=\frac{1}{2\pi\sqrt{LC}}$$

where F is frequency in cycles per second, L is inductance in henries and C is capacitance in farads. Also the inductance coils of each of the various oscillators are tuned to frequencies at which a maximum power transfer is achieved to the proper and corresponding loading circuit so that the induction coil **61** (of which the corresponding loop L forms a portion) of only one oscillator O is loaded by each loading circuit TC.

As the ball BB–1 to BB–12 having the proper tuned loading circuit of TC–1 through TC–12 passes through the proper coil loop of L–1 to L–12, the presence of the ball loading circuit causes a power transfer from the loop L to the loading circuit. Each loop L is connected into the induction system of the proper oscillator O of a series of oscillators 0–1 to 0–12 to comprise a portion of the inductance coil **61**. Each oscillator is of a structure resembling a grid dip meter with the exception that a portion of coil **61** is provided in the form of external loop L and a microammeter from across terminals **62** and **63** has been eliminated. Terminals **62** and **63** are instead connected to the input of the proper amplifier D of the series of amplifiers D–1 through D–12.

Each of amplifiers D–1 through D–12 includes a normally conductive transistor **64** which becomes nonconductive upon application thereto of a voltage above a known level. Transistor **64** is used for completing a circuit from a direct current source **65** to the amplifier output terminals **66** and **67**, which circuit is broken by transistor **64** whenever the voltage applied thereto is above the conductive voltage level of the transistor. The corresponding relay of relays R–1 through R–12 is connected across terminals **66** and **67** for energization by source **65** while transistor **64** is conductive.

Each oscillator O is set to proper frequency by placing the proper loading circuit TC in the loop L of the oscillator and adjusting the variable resistance **68** in the grid circuit to a value providing a voltage across terminals **62** and **63** above the level at which transistor **64** becomes nonconductive, so that transistor **64** is nonconductive while the proper loading circuit is present. The adjustment of resistance **68** should be such that, with the loading circuit TC removed, the voltage across terminals **62** and **63** is below the level at which transistor **64** becomes nonconductive, so that transistor **64** is conductive in the absence of loading circuit TC in loop L and nonconductive when loading circuit TC passes near or through loop L.

During ball detection, the oscillators 0–1 through 0–12 in the detection system are constantly operating with a low current in the inductance coil **61**, including loop L. When the proper loading circuit TC is near or passes through the proper loop L, the loading circuit has been so tuned as to provide maximum power transfer thereto from the proper loop L. A high current flow results in the loading circuit, and the resulting load on the oscillator increases the current in the inductance coil to a high level. As a result, the voltage across resistor **68** and terminals **62** and **63** increases, rendering transistor **64** nonconductive, thereby deenergizing the relay R, resulting in making the CR contacts of the proper one of relays R–1 through R–12, thereby giving a signal identifying the ball, e.g., for ultimate use by a scoring system or a ball return control system.

The contacts CR–1 through CR–12 for the respective relays are identified in FIG. 6. In the system illustrated, one contact terminal of each relay contact is connected to a common line **72***a* as at N–1 through N–12, and the other contact terminal is connected as at M to a separate one of input leads **73** through **84** to one of a plurality of signal differentiating systems T–1 through T–12, each of which functions to change the incoming signal to an output signal which identifies not only the ball bowled but also the lane it was bowled on. The common line **72***a* is connected through a signal modifier system **85** which completes a circuit between any closed relay contact and the appropriate signal differentiating system section T–1 through T–12 via line **72***b* in such a manner as to indicate to the appropriate signal differentiating system the identity of the lane on which the ball was bowled. Input information used by the signal modifier system **85** is received at contacts A, B and C from a lane memory system **86** (FIG. 7) which functions to remember the lane from which the ball is being returned until the ball is detected by one of detector loops L. The lane memory system receives an input lane identity signal from either of switches SWL or SWR, depending on the lane on which the ball has been bowled.

Turning to FIG. 7 and the lane memory system **86** illustrated therein, assuming a ball has been bowled on the right lane, the ball, during return from the pit, progresses over branch track **17** and momentarily closes switch SWR (FIGS. 2 and 7). The momentary closing of switch SWR results in a DC voltage higher than the firing voltage being applied to neon tube NER by connecting tube NER across the higher voltage output terminals **87** and **88** of power source of supply **89**. Although this circuit immediately breaks with opening of switch SWR, tube NER remains lit due to the normally applied DC voltage from the lower voltage terminals **91** and **88** of power supply **89**.

The contacts X, X′, and Y and Y′ are contacts of a magnetic reed switch of a type commercially available. The contacts are normally open. In the switch illustrated, it requires a flux of at least +100 ampere turns to close contacts Y and Y′ and a negative flux of at least −50 ampere turns to open the Y and Y′ contacts. Also, it requires a negative flux of at least −100 ampere turns to close contacts X and X′ and a positive of at least +50 ampere turns to open contacts X and X′.

With the tube NER lit, about −125 ampere turns of flux are applied through coil **92** on magnetic reed switches X and X′, thereby closing reed switches X and X′ while magnetic reed switches Y and Y′ remain open because +100 ampere turns of flux are required to pull in Y and Y′ by their coil **93**. Closing of contacts X and X′ completes the circuit between contacts A and B in FIG. 6 energizing the coil of relay **94** to thereby close contacts **95** and **96** and contacts **97** and **98** to place the positive side of DC power source **99** on common line **72***b* and the negative side of source **99** in circuitry with line **72***a*.

As the ball proceeds over the common return track **18** and through the loops L–1 through L–12 (FIGS. 2 and 5), the appropriate loop and oscillator system detects the ball with the corresponding tuned circuit in the manner described above and closes the appropriate relay contact CR (FIG. 6). Thus, because common line **72***b* is positive and the appropriate one of lines **73** to **84** is negative, the magnet **102** of the appropriate differentiating system T is energized through blocking diode **103** to close magnetic reed switch contacts W to give a readout signal at terminals E and F, giving the identity of the ball, depending upon which of signal differentiating system sections T–1 through T–12 was actuated by the corresponding circuitry through lines **73** to **84** and relay contact CR, and further giving indication that the ball is being returned from the right lane in that right lane reed switch W is closed rather than left lane magnetic reed switch W′. Blocking diode **104** blocks energization of coil **105** so reed switch W′ does not close.

Considering FIGS. 2 and 7, if a ball has also been bowled on the left lane and is being returned from the left lane immediately after the right lane ball, as close as permitted by the ball blocking system, switch SWL is closed, lighting tube NEL, which is held in due to the holding voltage of the normal cir-

cuit across terminals **88** and **91** after SWL opens. If normally open switch SWT-2 has not been tripped yet by the ball from the right lane, none of the contacts X, X', Y or Y' is altered and the signal modifier system **85** (FIG. **6**) remains actuated in its position indication right lane ball return to the signal differentiating system T, i.e., with common line **72***b* connected to the positive side of the DC source. Assuming that the ball from the left lane is detected by its appropriate loop L, when the ball from the right lane opens normally closed switch SWT-1 and SWT-2 momentarily, tube NER is extinguished since switch contact Y' is still open. However, contact X' is still closed and tube NEL is not extinguished. With tube NEL lit, a flux of about +125 ampere turns is applied through coil **93** on reed switch Y and Y' closing Y and Y'. The positive flux of about +125 ampere turns applied through coil **107** is sufficient to open switches X and X'. Tube NEL holds in through normally closed switch SWT-1. Closing of contacts Y and Y' reverses signal modifier system **85**, since B and C are now closed and A and B are open, resulting in closing contacts **97** and **108** and contacts **95** and **109** (FIG. **6**) to apply the negative side of power source **99** on common line **72***b* and the positive side of power source **99** through line **72***a* and any closed relay contact CR to the appropriate section T-1 through T-12 of the signal differentiating system T. This results in closing magnetic reed switch contact W' through blocking diode **104** and coil **105** in the signal differentiating system section corresponding to the ball detected to signal left lane identification for the detected bowled ball at terminals G and H. Diode **103** blocks coil **102**.

If the right lane ball had already tripped and opened SWT-2, tube NER would have been extinguished prior to lighting NEL and the system would function in a similar manner as previously described for the right lane ball.

Also in similar manner, subsequent balls are detected and signals, indicating the identity of the ball and the identify of the lane from which the ball is being returned, are created. Negative flux of −125 ampere turns is applied to reed switch contacts Y and Y' via coil **112** to open these contacts, if closed, each time contacts X and X' are closed by negative flux from coil **92**.

The system described above is capable of providing signals for indicating to a computer the identity of both bowler and lane. Accordingly, the switch contacts W and W' (FIG. **6**) in the signal differentiating system sections T-1 through T-12 are intended to be wired as bowler identity switches through terminals E-1 through E-12, F-1 through F-12, G-1 through G-12 and H-1 through H-12 into the circuit of a scoring system, as indicated by the respective terminals on scoring system **113**, to cause the scoring system to receive pinfall information from the proper bowling lane pit and to award the pinfall information which has been received to the proper bowler, e.g., after score values have been computed from the pinfall information.

In each of sections T-1 through T-12 of the signal differentiating system, the contacts W and W' are contacts of magnetic reed switches. Each reed switch is normally open and is closed responsive to a magnetic flux of 100 ampere turns or higher. A magnetic flux of at least 50 ampere turns is necessary to maintain the switch contacts closed after they have been moved to closed position. A ringlike permanent magnet **115** is provided for each switch W and W' biasing the switch to 75 ampere turns, sufficient to hold the switch closed after it has been closed. The coils **102** and **105** are in phase with the respective biasing permanent magnets **115**. For initially closing contacts W and W', coil **102** or **105**, upon energization, supplies an additional 50 ampere turns, giving a total above the 100 ampere turns needed for closing. After coil **102** or **105** is deenergized, magnet **115** holds the contact closed so that the ball and lane information are thereby stored for use by the scoring system whenever the scoring system is ready to use the information. In order to reopen the switch contact, i.e., after coil **102** or **105** is deenergized, it is necessary to overcome the effect of the permanent magnet and, for this purpose, a negative flux of −100 ampere turns can be applied by a reset coil **116** or **117** by closing the respective contacts or switches V or V', illustrated as in scoring system **113**. The contacts V and V' may be closed, for example, by a computer portion of the scoring system after all necessary data has been assimilated, to cancel the computer input signal at contacts E and F or G and H.

The system described herein may additionally or alternatively be used for directing return of bowling balls to bowling ball storage positions in a ball rack and for releasing balls in sequence from the rack during return of a prior ball, such as that described in copending application, Ser. No. 358,759, now U.S. Pat. No. 3,501,147 entitled Bowling Ball Return Apparatus, filed by D. F. Uecker on Apr. 10, 1964, and assigned to the assignee of this application.

I claim:

1. A self-identifying bowling ball comprising a ball body having a recess therein, means within said identifying body for electrically identifying said ball from other like balls in response to external electrical interrogation, said electrical identifying means comprising an electrical loading circuit including a capacitor and an inductor and being responsive only to inductive excitation at a preselected identifying frequency, and means for retaining said loading circuit within the recess in said ball body including a housing containing said loading circuit and means for retaining said housing within said recess.

2. The ball of claim **1** wherein said electrical loading circuit includes a resistor, said inductor is an inductance coil, and said capacitor, resistor and inductance coil are in a complete series circuit.

3. The ball of claim **2** wherein said electrical loading circuit is molded within said housing and wherein said housing is removably retained within said ball body.

4. A ball according to claim **3** wherein said housing includes a male threaded portion and said ball body recess includes a mating threaded female portion in which said male portion is received.

5. A bowling ball according to claim **4** wherein said ball body has at least one fingerhole therein and said female threaded portion comprises an extension of said fingerhole.

6. A coded bowling ball according to claim **5** wherein said housing is formed of a plastic material and said electrical loading circuit is molded within said plastic material.

* * * * *