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BOWLING FOUL INDICATOR

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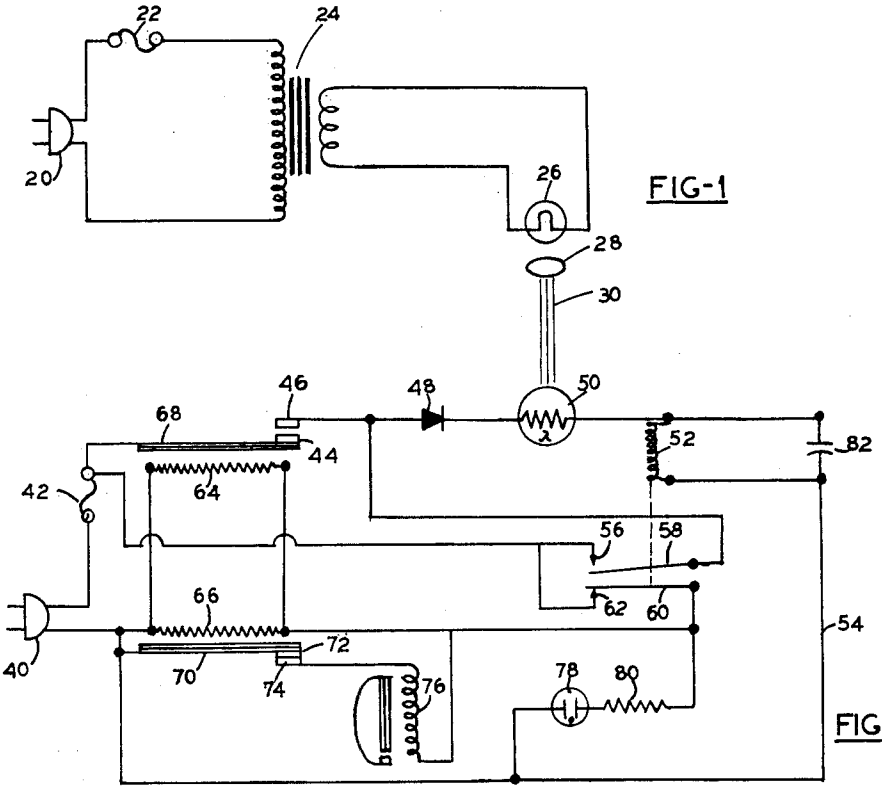

FIG-1

FIG-2

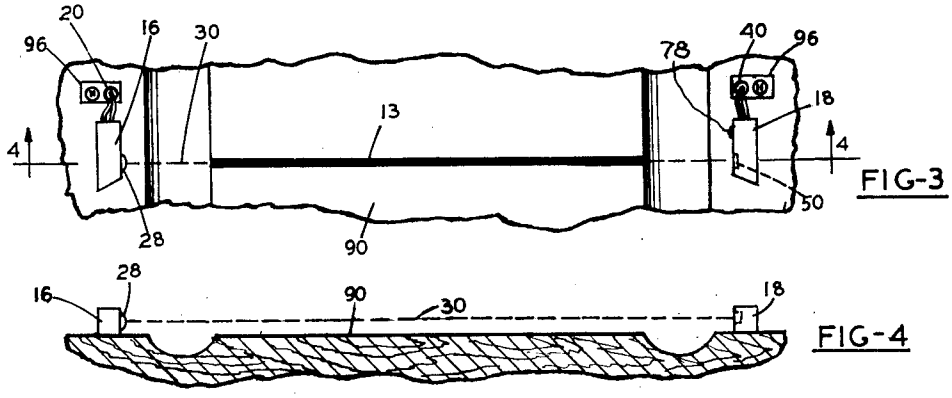

FIG-3

FIG-4

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BOWLING FOUL INDICATOR

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This invention relates to a foul indicator for bowling alleys.

In Patent #2,664,290 there is disclosed a bowling foul indicator employing a light beam at the foul line, the interruption of which for a period in excess of that required for passage of a bowling ball results in a sound indication of short duration, and a light signal of longer duration. The apparatus there shown, particularly the light beam actuated portion thereof is rather bulky, such that it is proposed therein that the light receptor alone be located at the foul line, and the remainder located in units disposed elsewhere.

The present invention is directed to a circuit for accomplishing a similar result, but which is so compact as to be capable of mounting at the side of the bowling alley, at the foul line, without interfering with the game. The foul indicating apparatus is sufficiently compact so as to be capable of being housed in a small casing which may have a shart standard cord and plug for attachment to a standard 110 volt base outlet located adjacent thereto. The unit is such as to be readily replaced with hardly a moment's loss of time if found to be inoperative, and the circuit is such that on failure for any cause, other than a blown fuse or power failure (which may be eliminated), an indication thereof is rendered.

The above and other novel features of the invention will appear more fully hereinafter from the following detailed description when taken in conjunction with the accompanying drawings. It is expressly understood that the drawings are employed for purposes of illustration only and are not designed as a definition of the limits of the invention, reference being had for this purpose to the appended claims.

In the drawings, wherein like reference characters indicate like parts:

FIGURE 1 is a light beam circuit;

FIGURE 2 is a light beam sensitive signal circuit; and

FIGURE 3 is a fragmentary plan view of a bowling alley at the foul line showing the units of FIGURES 1 and 2 in position; and

FIGURE 4 is a transverse sectional view across the alley substantially at the foul line, or approximately on the line 4—4 of FIGURE 3.

Referring to the circuits, in FIGURE 1, there is shown a plug **20** for a 110 volt alternating current circuit connected through a fuse **22** to a step down transformer **24**, the secondary of which is connected to an incandescent lamp **26**, whose light is concentrated by a suitable lens and reflector system **28** into a beam **30** which is directed across the bowling alley immediately above the foul line.

In FIGURE 2 there is shown the signal circuit, which is likewise energized from a 110 volt alternating current circuit from a plug **40**, which is connected through a fuse **42** to normally open contacts **44** and **46** of a 10 second thermal time delay switch, through a rectifier **48**, a light sensitive cell **50** upon which the beam **30** is concentrated, and a relay coil **52**, having a return lead **54**. The relay is provided with contacts **56** and **58**, which are closed upon energization of the coil **52** to shunt the time delay contacts **44** and **46**. The relay is provided with further contacts **60** and **62** which are opened upon energization of the relay coil **52**. The contacts **60** and **62** are connected between the fuse **42**, and the heater resistances **64** and **66**, the heater **64** being associated with the bimetallic arm **68** actuating contacts **44** and **46** of a time delay switch, and the heater **66** being associated with the bimetallic arm **70** actuating contacts **72** and **74** of a second thermal line delay switch in circuit with a buzzer **76**, the circuit of which is under the control of relay contacts **60** and **62**. Also connected in circuit with the relay contacts **60** and **62** is a neon signal lamp **78**, with a protective resistance **80** in series therewith.

Across the relay coil **52**, is a capacitance **82** which discharges through the relay coil, when the light cell acts to open the circuit, so that the relay coil may not be instantaneously deenergized, until after the time required to discharge the capacitance has elapsed which may be in the order of one fifth of a second.

Assuming the two units are plugged in and the light beam is directed upon the light cell **50**, a circuit is initially established through relay contacts **60** and **62** to energize heaters **64** and **66**, and a circuit is also initially established to energize the buzzer **76** since contacts **72** and **74** are closed, and the neon lamp is lighted. The heater **66** acts in about 2 seconds to open the buzzer circuit, so that the buzzer signal is of about 2 seconds duration. The heater **64**, in about 10 seconds, closes contacts **44** and **46** completing a circuit through rectifier **48**, the light beam energized cell **50**, and the relay coil **52**, thereby energizing the relay to close contacts **56** and **58**, which are in shunt with contacts **44** and **46**, and thus acts as a hold in circuit. At the same time relay contacts **60** and **62** are opened, deenergizing the heaters **64** and **66**, and the neon lamp **78**. At the same time, capacitance **82** is charged. The operation thus described serves to indicate that the apparatus is in working order, since upon energization of the circuit as described, the buzzer and neon lamp function through a cycle to demonstrate that there is no circuit failure. Should the neon lamp remain lighted for more than 10 seconds, a failure is indicated.

The circuit is now prepared to perform its operation as a foul detector. If a bowler propels a ball through the light beam, the time of traverse of the ball through the beam is less than a fifth of a second. Thus the light cell is instantaneously cut off from the light beam, for a short interval, opening the circuit to the coil **52** from the 110 volt source. However, the capacitance **82** commences to discharge during this interval and thus maintains energization of the relay coil. The size of the capacitance is so chosen in relation to the resistance of the relay coil as to maintain energization for about one fifth of a second. Before the expiration of a fifth of a second, the ball has traversed the beam and the light cell is reenergized, and the relay coil is reenergized by the 110 volt source, and the capacitance brought back to full charge.

If the bowler should obstruct the light beam with his foot or apparel, the light beam is obstructed for a period in excess of one fifth of a second, since it is a fact that the bowler's motion or stance in obstructing the light beam is relatively slow. The capacitance **82** thus has time to discharge to a point below the level of that required to maintain relay energization, whereupon contacts **56** and **58** open, and contacts **60** and **62** close. Immediately, the buzzer signal commences, and heaters **64** and **66** are energized, and the neon light is illuminated. The thermally actuated contacts **72** and **74** are opened in about 2 seconds, and the thermally actuated contacts **44** and **46** are closed in about ten seconds. When the latter occurs the relay is reenergized, assuming the beam is no longer obstructed, and the contacts **60** and **62** opened, and the hold in contacts **56** and **58** closed. The circuit is thus restored in readiness to indicate a subsequent foul.

Each foul is thus indicated instantly by the audible buzzer signal **76** of 2 seconds and the 10 second neon light signal **78**.

Each of the circuits of FIGURE 1 and FIGURE 2 are

contained in small housings 16 and 18 respectively mounted on opposite sides of the bowling alley 90 as shown in FIGURE 3. The light beam 30 is located closely and directly above the foul line 13. Each unit is independently plugged into a convenient 110 volt outlet which may be a double outlet as at 96 for accommodating the unit of an adjacent alley. Each of units 16 and 18 is readily and quickly replaceable with another unit, the instant any failure is indicated so that no delay in the game is necessary should any components of the circuits fail.

In practice the rctifier 48 may be a silicon point contact diode rectifier, the impedence of the relay coil 52 in the order of 10,000 ohms, and the capacitance 82 about 5 microfarad. The neon lamp may be protected with a resistance 80 of about 18,000 ohms. The light sensitive cell may be a cadmium sulphide cell, such as RCA #7163, having a resistance of one megohm, when dark, which is reduced to 4000 ohms in response to the light beam 30. While a neon signal lamp is referred to, other forms of signals may be provided, up to the current carrying capacity of contacts 60 and 62. The buzzer may be so mounted in the casing 18, which may be a metal shell, as to resonate or amplify the audibility thereof.

It will be seen that the normal operation of the current requires only sufficient current to energize the relay, which is extremely small and the current required to illuminate the lamp 26 is likewise small.

While various specific examples are given to illustrate and facilitate the practice of the invention, such examples are merely illustrative. While a single form of the invention is disclosed, it will be understood that the invention is not limited thereto. As various changes in the construction and arrangement may be made without departing from the spirit of the invention, as will be apparent to those skilled in the art, reference will be had to the appended claims for a definition of the limits of the invention.

What is claimed is:

1. A bowling foul indicator for actuation by interruption of a light beam projected across a bowling alley adjacent the foul line for a time interval greater than that required for the passage of a ball through the beam, comprising a unitary device having a first circuit having terminals for connection to a source of alternating current comprising contacts of a normally open-when-cold thermally actuated time delay switch in a series circuit with a rectifier, a light sensitive cell conductive in response to radiant energy of a foul line light beam, and a relay coil, the latter having a capacitance in shunt therewith, relay coil actuated contacts closed only on coil energization in shunt with said delay switch contacts; a second circuit comprising relay actuated contacts open only on relay coil energization, in a series circuit with an indicator, said second circuit being connected in parallel with said first circuit, and a heater for actuating said time delay switch connected in shunt with the indicator of said second named circuits.

2. A bowling foul indicator for actuation by interruption of a light beam projected across a bowling alley adjacent the foul line for a time interval greater than that required for the passage of a ball through the beam, comprising a unitary device having a first circuit having terminals for connection to a source of alternating current comprising contacts of a normally open-when-cold thermally actuated time delay switch in a series circuit with a rectifier, a light sensitive cell conductive in response to radiant energy of a foul line light beam, and a relay coil, the latter having a capacitance in shunt therewith, relay coil actuated contacts closed only on coil energization, in shunt with said delay switch contacts; a second circuit comprising relay actuated contacts open only on coil energization, in a series circuit with an indicator, said second circuit being connected in parallel with said first circuit, a heater for actuating said time delay switch connected in shunt with the indicator of said second named circuit, and a second normally closed-when-cold thermally actuated time delay switch having an actuating period less than that of said first named delay switch and, having its heater in parallel with the first named heater, and its contacts in a series circuit with an indicator connected in parallel with said first named indicator.

3. A bowling foul indicator for actuation by interruption of a light beam projected across a bowling alley adjacent the foul line for a time interval greater than that required for the passage of a ball through the beam, comprising a unitary device having a first circuit having terminals for connection to a source of alternating current comprising contacts of a normally open-when-cold thermally actuated time delay switch in a series circuit with a rectifier, a light sensitive cell conductive in response to radiant energy of a foul line light beam, and a relay coil, the latter having a capacitance in shunt therewith, relay coil actuated contacts closed only on coil energization, in shunt with said delay switch contacts; a second circuit comprising relay actuated contacts open only on coil energization, in a series circuit with an indicator, said second circuit being connected in parallel with said first circuit; a heater for actuating said time delay switch connected in shunt with the indicator of said second named circuit; a second normally closed-when-cold thermally actuated time delay switch having an actuating period less than that of said first named delay switch and, having its heater in parallel with the first named heater, and its contacts in circuit with an indicator connected in parallel with said first named indicator; said capacitance, and the impedence of said coil being matched so as to discharge said capacitance in a period of time less than the actuating period of said second delay switch upon said light cell being rendered non-conductive.

4. A bowling foul indicator for actuation by interruption of a light beam projected across a bowling alley adjacent the foul line for a time interval greater than that required for the passage of a ball through the beam, comprising a unitary device having a first circuit having terminals for connection to a source of alternating current comprising contacts of a normally open-when-cold thermally actuated time delay switch in a series circuit with a rectifier, a light sensitive cell conductive in response to a beam of radiant energy directed across the foul line of a bowling alley and a relay coil, the latter having a capacitance in shunt therewith, relay coil actuated contacts closed only on coil energization, in shunt with said delay switch contacts; and a second circuit comprising relay actuated contacts open only on coil energization, in a series circuit with an indicator, said second circuit being connected in parallel with said first circuit; and a heater for actuating said time delay switch in about 10 seconds time connected in shunt with the indicator in said second named circuit; a second normally closed when cold thermally actuated time delay switch having an actuating period of approximately two seconds and, having its heater in parallel with the first named heater, and its contacts in a series circuit with a sound indicator connected in parallel with said first named indicator; said capacitance, and the impedence of said coil being matched so as to discharge said capacitance in about a fifth of a second upon said light cell being rendered non-conductive.

5. A bowling foul indicator for actuation by interruption of a light beam projected across a bowling alley adjacent the foul line for a time interval greater than that required for the passage of a ball through the beam, comprising a unitary device having a first circuit having terminals for connection to a source of alternating current comprising contacts of a normally open-when-cold thermally actuated time delay switch in a series circuit with a rectifier, a light sensitive cell conductive in response to radiant energy, and a relay coil, the latter having a capacitance in shunt therewith, relay coil actuated contacts closed only on coil energization, in shunt with said delay switch contacts; a second circuit comprising relay actuated contacts

open only on coil energization, in a series circuit with an indicator, said second circuit being connected in parallel with said first circuit; and a heater for actuating said time delay switch connected in shunt with the indicator of said second named circuit; said capacitance and the impedence of said coil being matched so as to discharge said capacitance in a fraction of the time of actuation of said delay switch upon said light cell being rendered non-conductive.

6. A bowling foul indicator adapted to operate on the interruption of a light beam projected across a bowling alley adjacent the foul line thereof, which comprises in combination, a light sensitive cell responsive conductively to a light beam, a relay having a coil, and normally open, and normally closed contacts when the relay coil is de-energized, a capacitance connected across said coil, and said coil being connected to said cell and an alternating current terminal, two thermostatic time delay switches each having actuating heater resistances connected in parallel and with one side connected to said terminal, one of said delay switches having contacts normally closed when cold and opening after a brief interval, and the other having contacts normally open when cold, and closing

after a relatively longer interval, a second alternating current terminal connected through the normally open contacts of the relay through a rectifier to said light sensitive cell, and said normally open relay contacts being connected across said other time delay switch contacts, and sad normally closed relay contacts being connected between the other side of said heater resistances and said second terminal, a signal device connected to the other side of said heater resistances and to said first terminal through the contacts of said one time delay switch, and a second signal device connected between the other side of said heater resistances and said first terminal.

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