

Sept. 10, 1940.

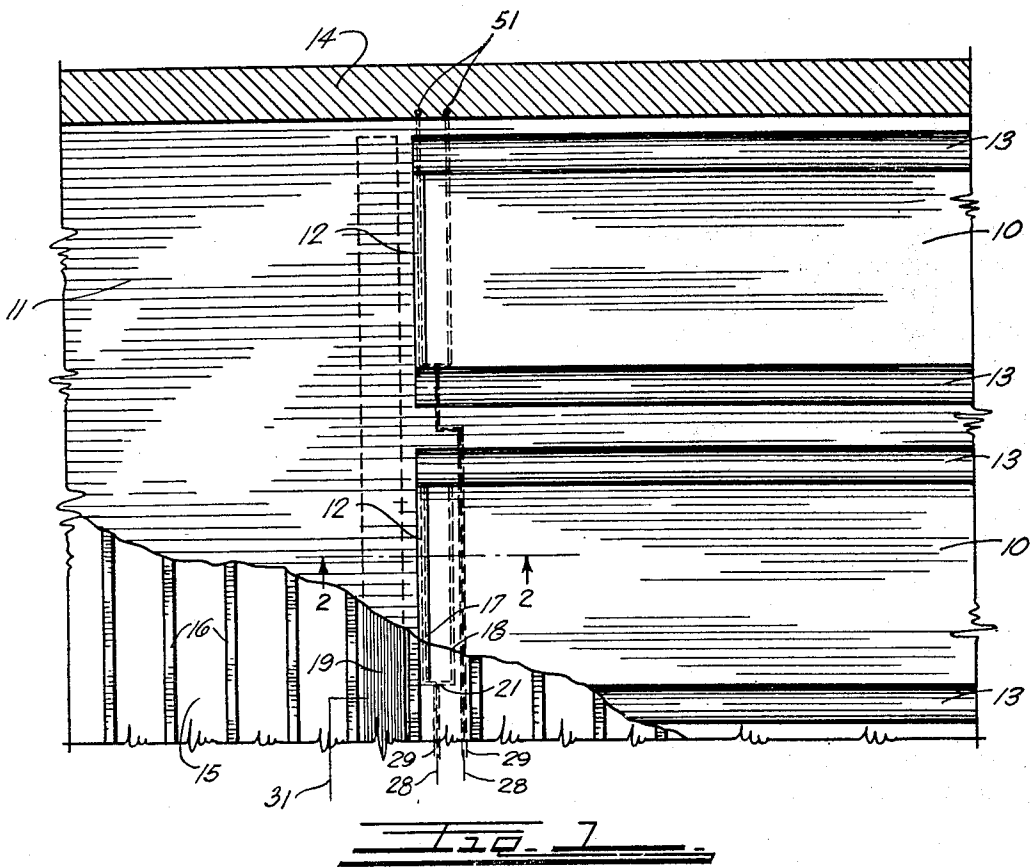
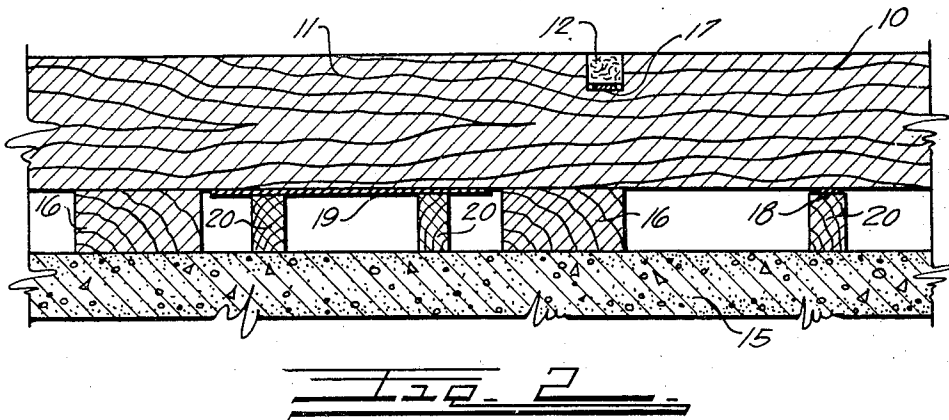
A. J. GLENDENNING ET AL

2,214,274

ELECTRIC FOUL DETECTOR FOR BOWLING ALLEYS

Filed Jan. 15, 1940

2 Sheets-Sheet 1



INVENTORS
AMES J. GLENDENNING
GEORGE S. DUNLAP
BY

ATTORNEY

Sept. 10, 1940.

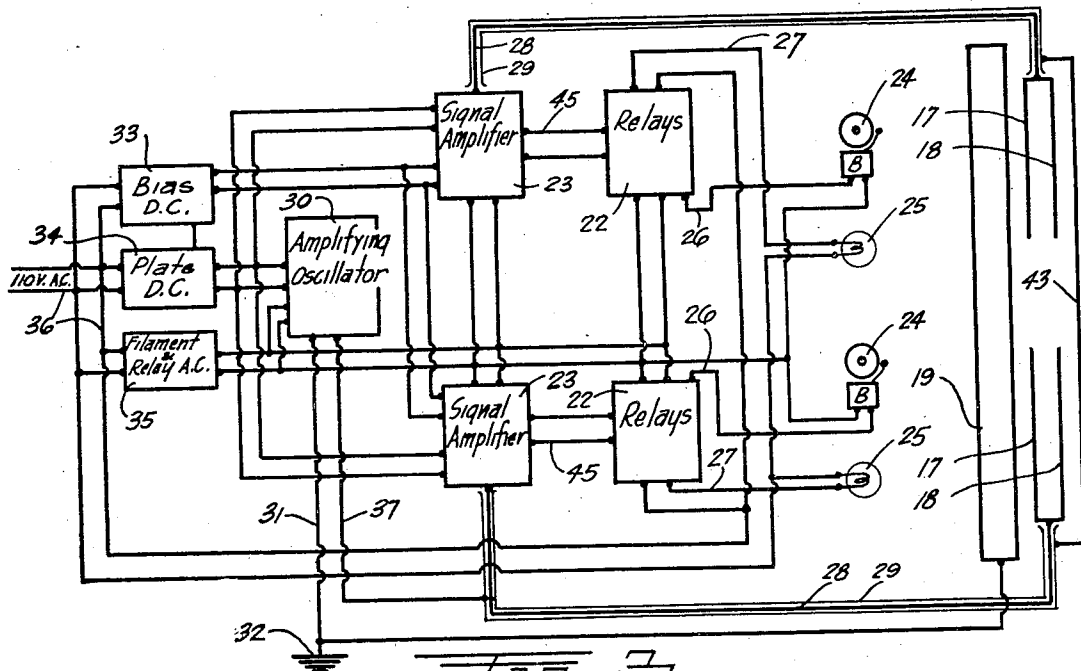
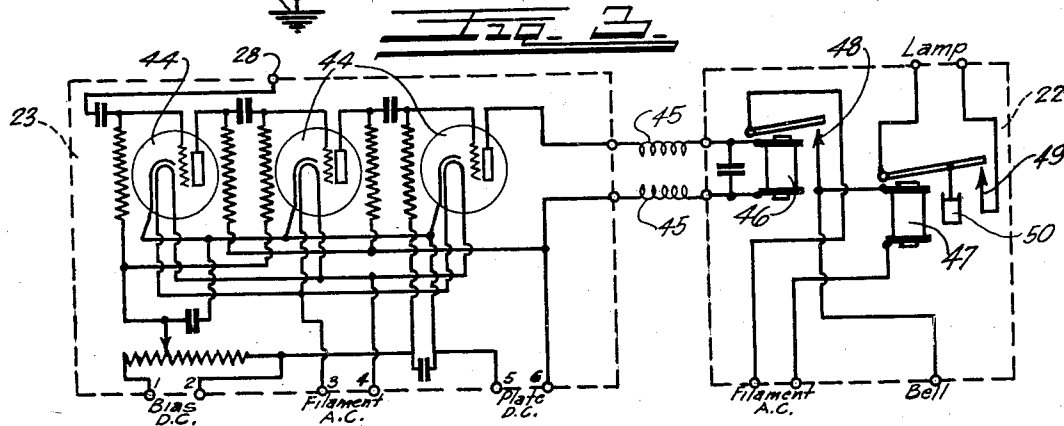
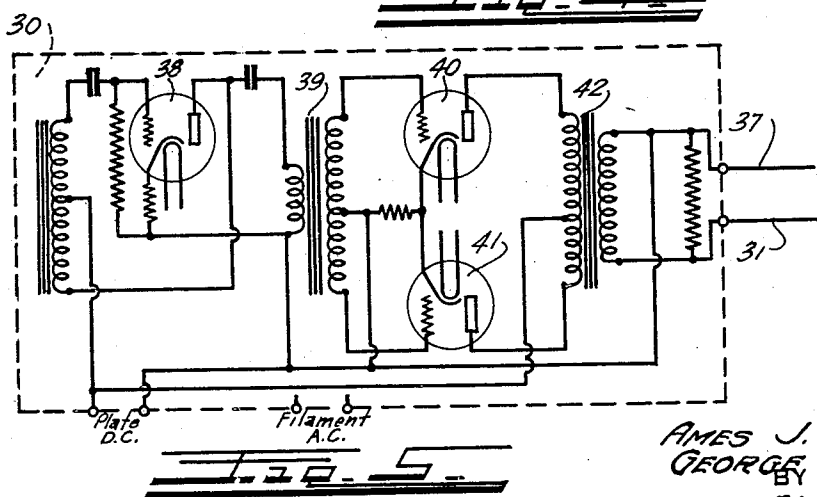
A. J. GLENDENNING ET AL

2,214,274

ELECTRIC FOUL DETECTOR FOR BOWLING ALLEYS

Filed Jan. 15, 1940

2 Sheets-Sheet 2



INVENTORS
AMES J. GLENDENNING
GEORGE S. DUNLAP

R. H. Walworth
ATTORNEY

UNITED STATES PATENT OFFICE

2,214,274

ELECTRIC FOUL DETECTOR FOR BOWLING ALLEYS

Ames J. Glendenning and George S. Dunlap,
Estes Park, Colo.

Application January 15, 1940, Serial No. 313,814

2 Claims. (Cl. 273—50)

This invention relates to an electrically operated foul indicator for bowling alleys and has for its principal object the provision of a simple and efficient device which will give a positive signal when any type of foul is committed and yet which will require no change whatsoever in the bowling surface or its runway approach; which will be entirely invisible and which will not require the manual closing of electrical contacts or the actuation of any moving or mechanical parts whatsoever; and which can be quickly and easily installed on present alleys without requiring any changes of any nature in the construction thereof.

Other objects and advantages reside in the detail construction of the invention, which is designed for simplicity, economy, and efficiency. These will become more apparent from the following description.

In the following detailed description of the invention reference is had to the accompanying drawings which form a part hereof. Like numerals refer to like parts in all views of the drawings and throughout the description.

In the drawings:

Fig. 1 is a fragmentary plan view of the foul line portion of a pair of typical bowling alleys, illustrating the relative positions of the actuating members of the improved foul indicating device.

Fig. 2 is an enlarged longitudinal section through the foul line of an alley, taken on the line 2—2, Fig. 1.

Fig. 3 is a simplified circuit diagram illustrating the electrical circuits between the operating elements of the device.

Fig. 4 is a circuit diagram of the circuits employed in the foul signal amplifier and relay box of the indicator.

Fig. 5 is a similar diagram illustrating the circuits employed in the oscillator for furnishing amplified oscillating current to the device.

In Fig. 1 of the drawings typical parts of a bowling alley are indicated by numerals as follows: alley bed 10, runway 11, foul line strip 12, gutters 13, and side wall 14. The usual alley is supported from a suitable sub-floor 15, which may be on wooden leveling stringers 16. The foul line strip 12 consists of a strip of dark colored fiber or wood which is mortised into the surface of the alley to divide the polished surface of the alley bed 10 from the runway 11.

To apply the improved foul indicator to an alley, the usual foul line strip 12 is removed, a first electrical pickup conductor 17, consisting of a copper wire or copper strip is laid in the

bottom of the strip receiving mortise, as illustrated in Fig. 2. The foul strip 12 is then replaced over the pickup conductor and brought flush with the alley floor. The pickup conductor could, if desired, be incorporated on or within a special foul strip but is more cheaply and easily installed as an independent member held in place in the mortise by the usual foul strip.

A second pickup conductor 18 is placed beneath the alley bed 10 parallel to the foul strip 12 and approximately six inches ahead of it. There may be more than one of these, placed approximately six inches apart and as far down the alley as necessary, to detect a foul having been made ahead of the foul line.

An energizing plate 19 is positioned beneath the runway 11, preferably between the first and second leveling stringers 16 just back of the foul strip 12. The energizing plate may be formed in any desired manner to produce a metallic electrical conducting area. It may be a metallic plate, metallic paint, a series of wires, or a metallic screen. The energizing plate extends the full width of all the alleys in the room. The pickup conductors 17 and 18 extend only the width of each alley bed. This device will work without plate 19 and in some installations may be installed without it since it is connected to earth ground and the ground may act as an energizer.

In case the indicator is being installed on present alleys the second pickup conductor 18 and the energizing plate 19 can be pushed between the alley bed and the sub-floor 15. Wooden clamping strips 20 can then be forced beneath the plate and the conductor to clamp them tightly against the bottom of the alley bed as shown in Fig. 2.

The device is operated by constantly impressing a high frequency oscillating current on the energizing plate. Since the energizing plate is grounded, the impressed current is in relation to chassis potential and not earth ground. This current flows to and is picked up by the pickup conductors 17 and 18. When a bowler stands over the energizing plate, this current is impressed on his body and when his foot passes over the first pickup conductor 17 at the foul line the bowler's body acts to shunt a small flow of current, through body capacity, to the pickup conductor 17. This increase in current is amplified sufficiently to energize the solenoid of a relay for closing a signal circuit to give an audible or visible signal that a foul has been committed.

A foul will be committed even though the foul

line is not touched, should the bowler allow his hand or other part of his body to touch the alley bed ahead of the foul line. In such a case the current flow to the second pickup conductor 18 will be increased and since both conductors are connected together by a bridging conductor 21, this will have the same effect on the operation of the signal circuit. A signal conductor 28 leads from each set of pickup conductors. The signal conductors are encased in metallic tubing or shielding 29 to prevent capacity interference at any point other than the foul line.

Any suitable circuits may be employed for furnishing the oscillating current and for transmitting the electrical impulses received by the pickup conductors into sensible signal means.

In this embodiment a relay box 22, a signal amplifying set 23, an electric bell 24, and a signal lamp 25 are employed for each alley. Relays in the boxes 22 control the bells and lamps through bell circuits 26 and lamp circuits 27, respectively.

In respect to chassis potential of the device. Current is impressed on the energizing plate 19 from a suitable amplifying oscillator set 30 through an energizing lead 31 which is grounded as indicated at 32 to establish a zero potential in relation to earth ground in order to conform with wiring regulations. The shielding 29 is grounded to the chassis of the device by means of a ground lead 37.

Direct current for the bias and plates of the tubes of the sets 23 and 30 is supplied by means of rectifying power packs 33 and 34, respectively, of the usual construction. Alternating current at reduced voltage for operating the tube filaments, the relays and the bells is supplied by a suitable transformer 35. Current for the power packs, transformer, and lamp circuits is received from the regular 110 v. house current as indicated at 36.

The amplifying oscillator circuit is standard for supplying an oscillating frequency in the high audio range. Briefly, it consists of a vacuum tube 38, which with its associated circuit acts as an oscillator to supply high-frequency current to a transformer 39 which amplifies the current and supplies the grid circuits to two or more amplifying tubes 40 and 41. The amplified current is then fed to the primary of a step-up transformer 42. One side of the secondary of the latter transformer is connected through the lead 31 to the energizing plate 19. The other side is connected to the negative side of the plate power supply for the oscillator tube and to the shielding 29. The shielding 29 for all of the signal conductors 38 is electrically connected together by a common connector 43.

The foul signal sets 23 each comprise a typical amplifying circuit employing suitable amplifying tubes 44. The signal conductor 28 of each alley is connected to the input grid circuit of the first amplifier tube of the tubes 44 whereby the increase in voltage therefrom is greatly amplified. In actual practise, the tubes 44 are biased to give a plate current cut-off when no one is in a fouling position so that when a foul is made, the increase in current in the plate circuit of the tubes increases from zero to the maximum for the given input signal. The plate output of each signal amplifying set is carried to its associated relay box 22 through suitable relay energizing leads 45. The relays may be mounted on the same chassis as the signal amplifiers, oscillator and power supplies.

Each relay box contains a primary relay 46 and a secondary relay 47. The primary relay closes a contact 48 which is in circuit with the solenoid of the secondary relay 47 and which is also in circuit with the signal bell 24 for that alley. Therefore the first result of the increased potential due to the commission of a foul is to cause the primary relay to close the bell circuit and to actuate the secondary relay 47. The latter closes a contact 49 in circuit with the foul indicating lamp 25 of that alley. The relay 47 is of the delayed opening type having an escapement or dash pot such as diagrammed at 50 which will hold the contact 49 closed after the supply contact 48 has opened. Thus, when a bowler leaves the fouling position, the bell will cease to operate but the lamp will remain illuminated for a preset interval.

Since the energizing plate 19 is connected to an earth ground at 32, and since one side of the secondary of the step-up transformer 42 is connected to the sheath of the signal conductor 28 while the other side of the secondary is connected to the negative of the plate supply, the metal chassis for the equipment in the oscillator amplifier will be above ground potential by the amount of voltage across the energizing transformer secondary. For this reason the chassis must be insulated from its metal cabinet. The cabinet however may be grounded to earth.

In some alleys, the side wall 14 is so close to the end alley that a foul may be committed by the bowler's hand on the wall. To indicate such fouls, the two pickup conductors at the end alley may be continued upward within or on the side wall 14, as indicated at 51, so that any contact with the wall beyond the foul line, by the bowler's hand or body will give an audible and visible foul indication.

While a specific form of the improvement has been described and illustrated herein, it is desired to be understood that the same may be varied, within the scope of the appended claims, without departing from the spirit of the invention.

Having thus described the invention, what is claimed and desired secured by Letters Patent is:

1. A foul indicator for bowling alleys comprising: a pickup conductor positioned parallel to the foul line of the bowling alley; a metallic energizing conductor positioned adjacent the bed of the runway near said foul line; means for impressing a high frequency oscillating current on said energizing conductor so that the capacitative effect of the bowler's body will transfer current from the energizing conductor to the pickup conductor; means for amplifying the current received by the pickup conductor; and means actuated by the amplified current for giving an indication of the increase in voltage.

2. A foul indicator for bowling alleys comprising: a pickup conductor positioned parallel to the foul line of the bowling alley; a metallic energizing conductor positioned adjacent the bed of the runway near said foul line; means for impressing a high frequency oscillating current on said energizing conductor so that the capacitative effect of the bowler's body will transfer current from the energizing conductor to the pickup conductor; means for amplifying the current received by the pickup conductor; a relay in circuit to be actuated by the amplified current; and a signal circuit closed by said relay.

AMES J. GLENDENNING.
GEORGE S. DUNLAP.