ABSTRACT

The invention is a lighted bowling pinfall display panel located on the face of a ball return lift hood for indicating to a bowler through the means of a light pattern which bowling pins remain standing after a ball has been delivered. Indicator lights arranged to simulate pin spots are powered by a low voltage DC source mounted beneath the lift hood. Solid state circuitry mounted adjacent the indicator light brackets controls the lighting of the panel lamps and is actuated by pin detection means associated with an automatic pinsetter, or by pinfall signals from an automatic scorer.

9 Claims, 6 Drawing Figures
The invention is in the field of bowling lane equipment and specifically relates to means located on the bowler's approach end of a lane for indicating to the bowler which pins are standing at the far end of the lane. The basic concept of providing a lighted indicator at the bowler's end of the lane for the purpose of keeping score has been treated in the prior art. Reference is made to this type of indicator in U. S. Pat. No. 2,202,674, E. F. Seaman et al., and U. S. Pat. No. 2,452,288, T. R. Blanseau. One of the main problems associated with such systems of the prior art is that they were associated with and actuated by switch mechanisms imbedded in the surface of the bowling lane beneath the pin spots. Such systems have proved to be impractical and have never been widely adopted.

Another problem associated with placing a pinfall indicator in a position remote from its associated pin detection means is that of maintaining a consistent level of brightness for all the indicating lights as the number of pins down varies.

It is an objective of the invention to overcome the problems of the prior art relating to associated pin detection systems by relying upon existing pin detection systems which are not imbedded in the surface of the lane.

It is a primary objective of the invention to provide a lighted standing pin indicator in a most convenient position for reference by the bowler, that being on the face of the ball lift hood immediately adjacent the ball return rack from which the bowler will retrieve his ball just prior to bowling.

It is another objective of the invention to provide a lighted pinfall indicator in which the light intensity is adjustable and independent of the distance of the indicator from the pinfall detection means.

It is a further objective of this invention to achieve uniform brightness of display lamps independent of the number of lamps illuminated through remote low current level control and local power supply.

It is yet a further objective of the invention to provide a lighted pinfall indicator of rugged construction which can survive the vibrations and shock created by the passage of a bowling ball through the ball lift and onto its storage rack.

It is still another objective of the invention to provide a pinfall indicator which will simultaneously portray in adjacent arrays the pinfall condition on the two adjacent lanes serviced by the ball lift.

It is another and still further objective of the invention to provide a pinfall indicator having novel solid state power supply and control elements mounted in the immediate vicinity of the pinfall display.

It is yet another objective of the invention to provide a pinfall indicator particularly suited for use with a computer operated automatic electronic scoring device.

The invention is comprised basically of a lighted pinfall display panel mounted upon the face of a hood covering a ball lift connected to any type ball rack. The panel contains a replica of the triangular ten pin array upon which the pins are set at the far end of the lane. Lamps for illuminating each of the pin positions are supported by a circuit board assembly mounted behind and attached to the display panel. A rectifier mounted beneath the lift hood provides power to the lamps through light driver circuits associated with the circuit board assembly, and actuated by electrical signals from pinfall detection means.

Among the many advantages of the invention is the use of low voltage power which permits the use of longer lasting low voltage light bulbs which are less sensitive to the vibration and shock to which the display panel is subjected.

A further advantage of the invention is the close control over brilliance of the illuminating lamps achieved by placing a controllable power supply in the immediate vicinity of the lamps.

Still another advantage of the invention is its independence from any particular type of pin detection means.

A further advantage of the invention in league play is that it provides a ready means for following the other team's progress.

Other objectives, advantages and various further features of novelty and invention will be pointed out or will occur to those skilled in the art from a reading of the following specification in conjunction with the accompanying drawings.

**BRIEF DESCRIPTION OF THE DRAWINGS**

FIG. 1 is a perspective view of a ball lift hood having an illuminated pinfall indicator of the invention installed thereon.

FIG. 2 is a plan view of a cover plate for a display panel of the invention.

FIG. 3 is a vertical cross sectional view of a pinfall indicator of the invention taken along line 3—3 of FIG. 2.

FIG. 4 is a schematic wiring diagram of a pinfall indicator of the invention connected to pinsetters serviced by an automatic scoring device.

FIG. 5 is a schematic wiring diagram for a power supply for the pinfall indicator illustrated in FIG. 4.

FIG. 6 is a schematic wiring diagram for a circuit board suitable for use in the pinfall indicator of FIG. 4.

**DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT**

FIG. 1 is a perspective view of the invention, clearly showing a pinfall display panel 5 of the invention mounted upon the face 6 of a ball return hood 1 where it is most easily viewed by a bowler. The ball lift hood 1 is typically mounted upon the approach 2 to a bowling lane, and has extending therefrom a ball rack 3 onto which the bowling balls 4 are deposited by a ball lift covered by the hood 1. As a bowler retrieves his returned ball from the rack 3 he will be standing in front of a pinfall display panel 5 mounted on the front face 6 of the ball return hood 1.

What the bowler sees on the pinfall display panel is best illustrated by FIG. 2. The face of the display panel 5 comprises a cover plate 7 upon which appears a replica of the traditional triangular array of the ten pins located at the far end of each of the bowling lanes serviced by the ball rack 3. Each pin and its position in the array is represented by a circular disc 8 upon which is...
imprinted an arabic number 9 from one to 10, traditionally associated with that particular position in the triangular array. In order to improve visibility, the general background of the cover plate 7, as well as the numbers identifying the pin positions, should be dark in color; while the remainder of the circular discs 8 representing the pin positions should be light in color. In order to further distinguish the pin positions 8 from the dark background of cover plate 7, a white border 10 may be painted around each pin disc 8.

FIG. 3 illustrates the structure of a housing 12 to which the cover plate 7, illuminating lamps 14, and a circuit board 17 are attached. Housing 12 may be set into or extend through the face 6 of the ball return hood 1, and shock mounted by suitable means. The cover plate 7 is retained substantially flush with the face 6 of the lift hood 1 by a frame 11 which may be attached to the housing 12 by screws or other suitable means. Housing 12 is preferably constructed of die cast zinc and defines a series of twenty light channels or bores 13 arrayed to align with the pin position discs 8 in the cover plate 7. Lamps 14 positioned within the channels 13 illuminate the pin spot discs 8 when activated as described below. The outer periphery 15 of the light channels 13 fall adjacent the inside of cover plate 7 so as to restrict illumination to the areas defined by the pin spot discs 8.

Circuitry for controlling the illumination of lamps 14 is contained upon a circuit board 17 which may be attached to the housing 12 by bolts 18 which pass through the board and into threaded apertures in the housing 12. Receptables 19 for the lamps 14 are mounted upon the circuit board 17 and are so positioned that when board 17 is bolted to the housing 12, one of the lamps 14 will extend into each of the twenty light channels 13.

FIG. 4 illustrates the sources of power and pinfall information required to operate the pinfall display panel 5 of the invention. Power to operate the display panel 5 is supplied from a ball lift control box 20. Pinfall information to actuate the display panel may be supplied either from the pin sensing switches mounted in the deck of an automatic pinsetter 21, as those described in U.S. Pat. No. 3,118,671 to R. Torresen et al., or from an automatic scoring device 26 such as that described in U.S. Pat. No. 3,435,120 to W. D. Cornell et al., as explained below.

FIG. 5 illustrates schematically the portions of the electrical circuitry incorporated in the ball lift control box 20. Referring to the figure, 110 volt AC power is supplied to the primary windings 30 of a transformer 31. A rectifier 32 is connected to the secondary winding 33 of transformer 31 through leads 34 and 35. Provision may be made for connecting the terminal 36 of lead 35 at various points along the secondary coil winding 33 to permit variation of the voltage impressed upon the rectifier 32. In the preferred embodiment of the invention, transformer 31 and rectifier 32 are adjusted to deliver six volts to the light driver circuits 50 of the display panel circuit board 17. Switches 43 and 44 interrupt the power lines 41 and 42 leading from the positive side of the rectifier 32 to circuitry on board 17 for the left hand and right hand display panels respectively. Switches 43 and 44 are mechanically controlled by solenoids 46 and 47 respectively which are actuated by power supplied by leads 23 and 23A to the pinsetters 21 and 21A. Activation of a pinsetter will thus automatically connect power to its associated pinfall display panel.

FIG. 6 is a schematic presentation of the circuitry upon circuit board 17. For purposes of illustration, the board is divided into two parts 49A representing the circuitry operating the right hand display panel. Each light, one through 10, on the “A” half of the illustrated circuit board 17 is controlled by a transistORIZED light driver circuit 50, each of which is connected directly to and actuated by a pin detection switch 51 located on the deck of an associated pinsetter 21. Each light located on the 49B side of the circuit board schematic is powered by a similar transistORIZED light driver circuit 55; however, on the “B” side each circuit is actuated by signals from an associated electronic scoring device 26.

The positive sides of the light driver circuits 50 and 55 are connected to the six volt positive leads 41 and 40 respectively coming from the ball lift control box 20, and the negative sides to rectifier 32 via a common lead 45.

Each of the aforementioned light driver circuits 50 or 55 includes a transistor 60, the collector 61 of which is connected to an indicator lamp 14 and the emitter 62 of which is connected to the positive side of rectifier 32 via lead 41 or 42. The base 63 is connected to the positive side of rectifier 32 through a resistor R—1, and to ground through a resistor R—2 and either a pin detecting switch 51 or a scorer light driver circuit 52. Actuation of the light driver circuits 50 and 55 by either switch 51 or circuit 52 closes current path to base 63 rendering the transistor 60 conductive and permitting current to flow through the associated lamp 14. In the absence of an electronic scorer the pin detection switches 51 on a pinsetter are initially open after setting a full set of pins. Switches 51 are closed by pins standing when the pinsetter cycles after the first ball, and remain closed until cycle and re-spot after the second ball when they are again all opened. In such installations the display panel 5 will indicate pins standing after the first ball only. In scorer installations pins standing after the second ball will also be detected and displayed, as the scorer must of necessity know which pins are standing after the second ball has been delivered.

In installations of the invention including an automatic electronic scoring system, such as that described in the aforementioned Cornell patent, the light driver circuits 55 may be completed by signals generated by the scorer. In the past pin standing information has appeared in lighted displays appearing on a masking shield positioned immediately in front of the pinsetter at the far end of the lane. Lights on the shield representing standing pins were powered by electrical signals from the scorer. In the installation of the invention illustrated by FIG. 4 and represented by the lower half 49B of FIG. 6, these same electrical signals, here referred to as light driver power, are utilized to complete the light driver circuits 55 illustrated in FIG. 6. This light driver power is carried by leads 25 from the scorer 26 to the pinsetter 21A and from the pinsetter 21A to the base 64 of transistor 52 by lead 22, causing transistor 52 to conduct and connect light driver circuit 55 to ground. It can be appreciated that
each of the lamps of the display panel 5 is controlled by a separate light driver circuit 50 or 55.

An alternative arrangement contemplated in the invention is to direct light control signals directly from the scorer 26 to the pinfall display circuit board 17. In this configuration the control signals from the scorer could be at a power consistent with computer logic levels. No substantial change in the basic circuitry would be required as the level of power used to control the light driver circuits 55 is already maintained at the logic level by selection of an appropriate value of R-2 for the six volt power supply.

The invention thus provides a distinct and convenient visual reference to pins standing after the bowler's ball has been rolled, it eliminates errors which may be due to poor eyesight or peculiar alignment of pins which makes it difficult for the bowler to clearly see.

While the principles of the invention have been described in connection with the above specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of the invention.

We claim:

1. A pinfall indicator for visually indicating which pins of an array of bowling pins are standing upon a bowling lane, comprising:

   means for sensing which of said bowling pins are standing,

   means responsive to said pin sensing means for supplying electrical signals representative of pinfall,

   a hood for a bowling ball return lift positioned at the approach end of a bowling lane, and

   means mounted on said hood for visually indicating which of said array of bowling pins are standing at the far end of the bowling lane, including a pinfall indicator panel having a plurality of visually distinguished areas each representing a particular one of said pins,

   means to illuminate said indicator panel including means to illuminate each of said areas individually, and

   means for selectively supplying electrical power individually to each of said area illuminating means, and

   control means responsive to said means for supplying electrical signals representative of pinfall for controlling said electrical power means, whereby those areas corresponding to pins standing are illuminated.

2. The device of claim 1 wherein said means for selectively supplying electrical power to each of said area illuminating means individually, and said means for controlling said electrical power means are positioned substantially adjacent to said illuminating means so that the power supply line to each of said illuminating means is sufficiently short that each of the areas is illuminated with substantially equal intensity irrespective of the total number of such areas illuminated.

3. The device of claim 2 wherein said area illuminating means comprise low voltage elements and said means for supplying electrical power to each of said area illuminating means comprises a low voltage power supply, whereby said illuminating means are long lived and resistant to damage by vibration.

4. The device of claim 3 wherein said means for controlling said electrical power supply means comprise transistorized light driver circuits.

5. The device of claim 4 wherein said transistorized light driver circuits are responsive to pinfall signals at the logic power level from said pinfall signal supply means.

6. The device of claim 5 wherein said means for supplying electrical signals representative of pinfall comprises an automatic scoring device.

7. The device of claim 6 wherein said pinfall indicator panel is positioned above the ball exit of said ball return lift hood.

8. The device of claim 7 wherein said pinfall indicator panel includes visually distinguishable areas representative of the arrays of bowling pins standing on each of two adjacent bowling lanes served by a ball return lift covered by said hood.

9. The device of claim 1 wherein said means for visually indicating which of said array of bowling pins are standing comprises a housing adapted to fit within a recess in the top front surface of said hood, a plurality of tubular light directing channels in said housing each conforming in cross section and axial position to one of said pin identifying areas, and means securing said indicator panel upon the outer face of said housing with said pin indicating areas in register with said light directing channels; said means to individually illuminate said areas comprising a light positioned within each of said channels, and wherein said means for controlling said power supply means comprises a solid state circuit board affixed to said housing adjacent the inner ends of said light directing channels.

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