Jan. 31, 1967 W. B. CLAPHAM 3,301,558

SELECTIVELY ACTUATED BALL PATH INDICATOR

Filed Feb. 3, 1964 4 Sheets-Sheet 1

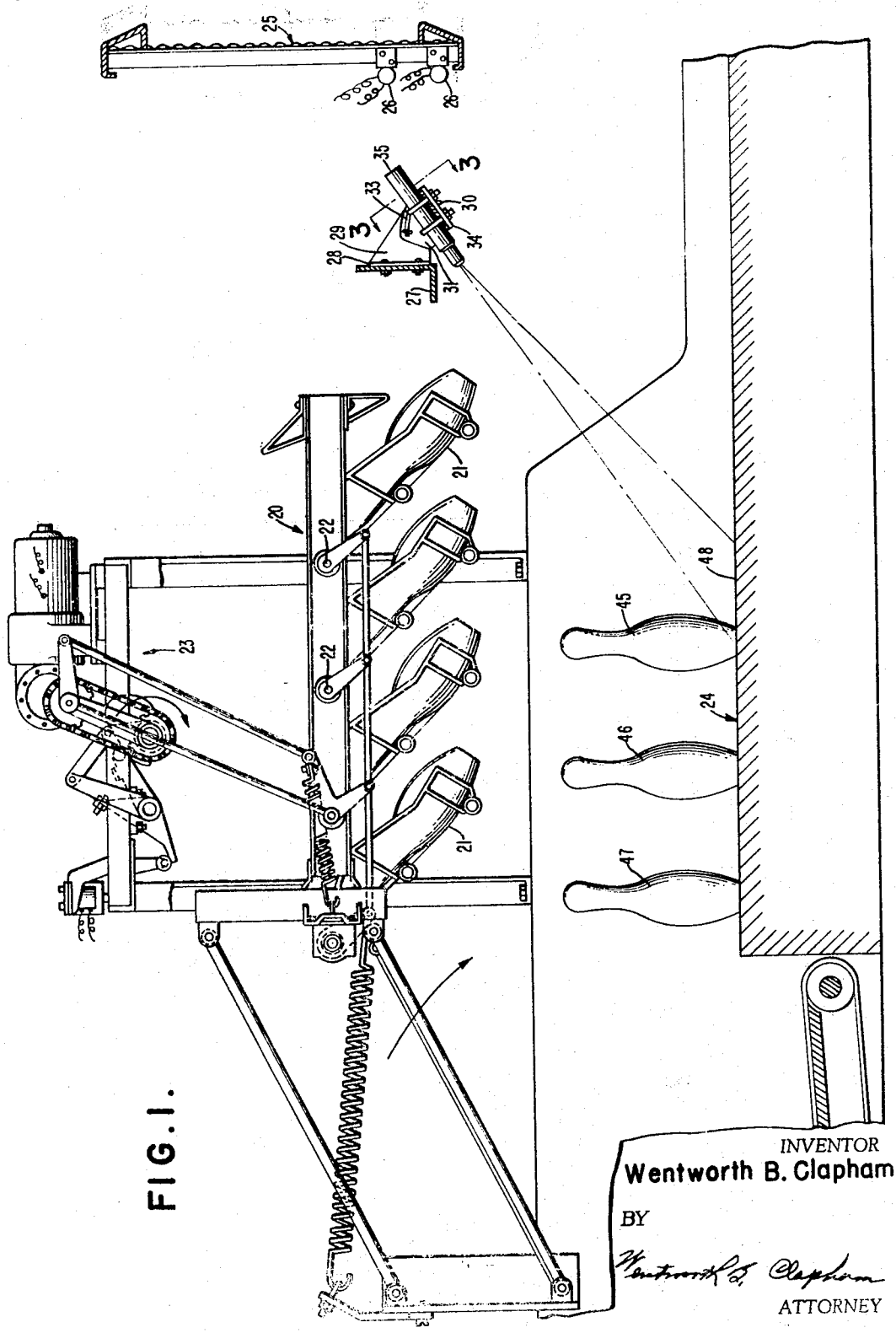


FIG. 1.

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SELECTIVELY ACTUATED BALL PATH INDICATOR

Filed Feb. 3, 1964 4 Sheets-Sheet 2

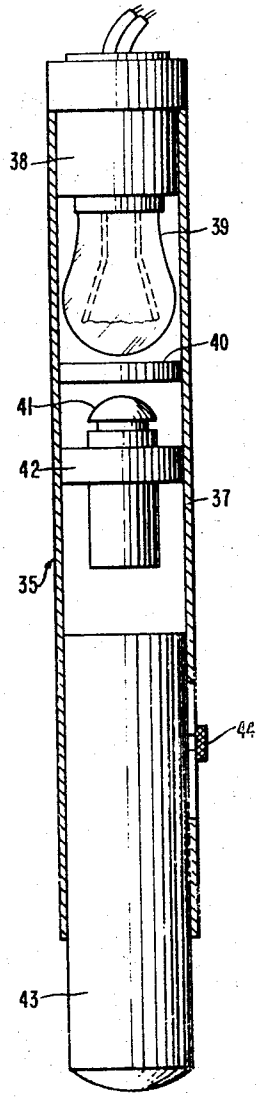


FIG. 2.

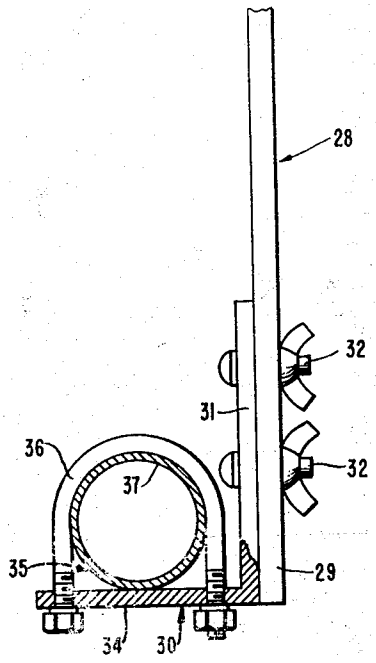


FIG. 3.

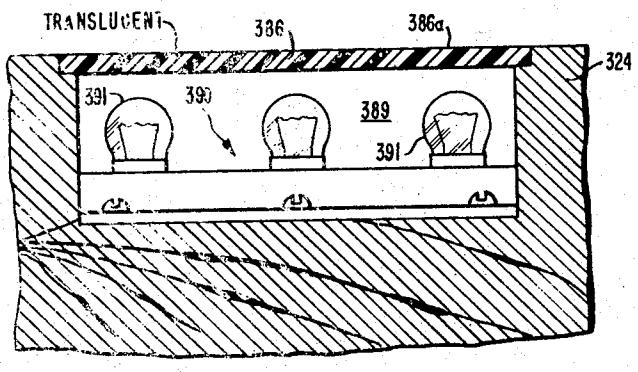


FIG. 10.

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SELECTIVELY ACTUATED BALL PATH INDICATOR

Filed Feb. 3, 1964 4 Sheets-Sheet 3

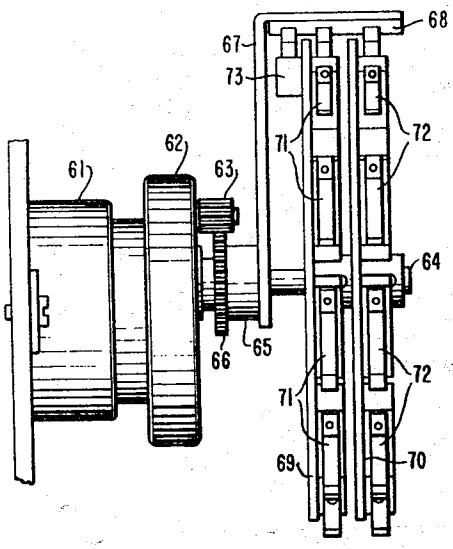


FIG.5.

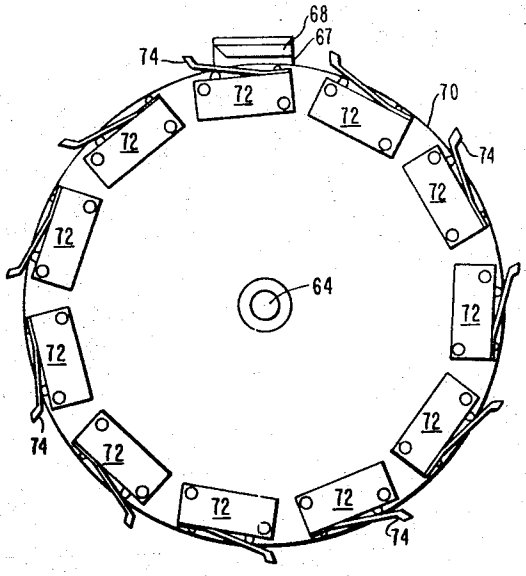


FIG.6.

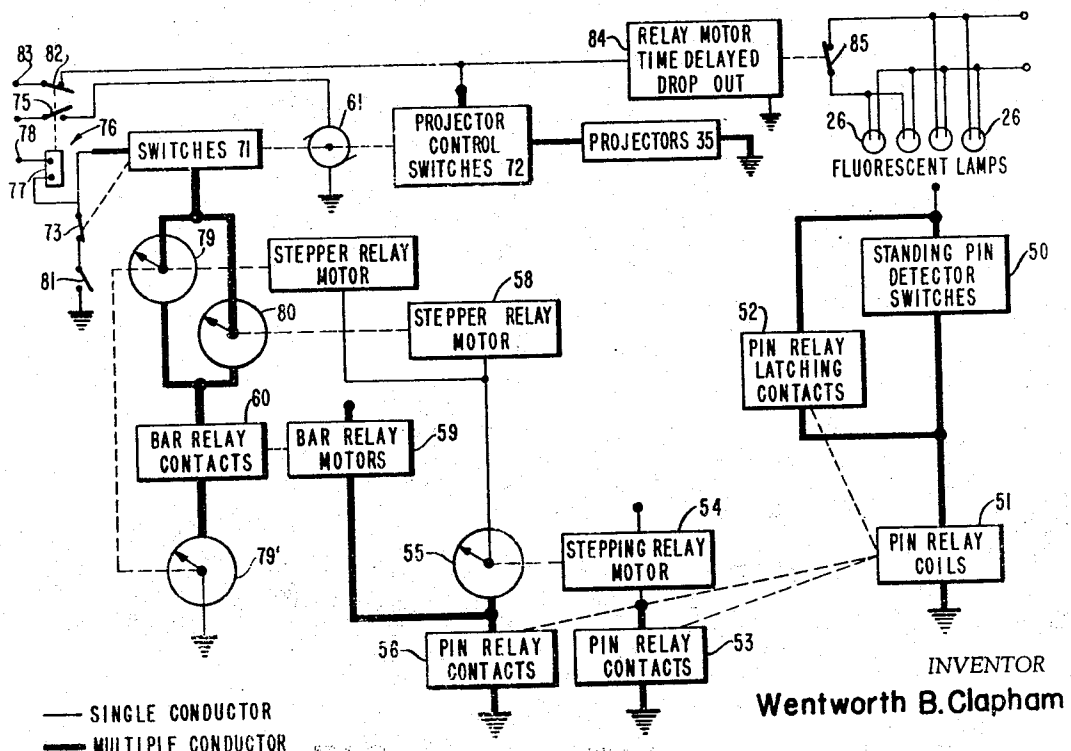


FIG. 4.

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SELECTIVELY ACTUATED BALL PATH INDICATOR

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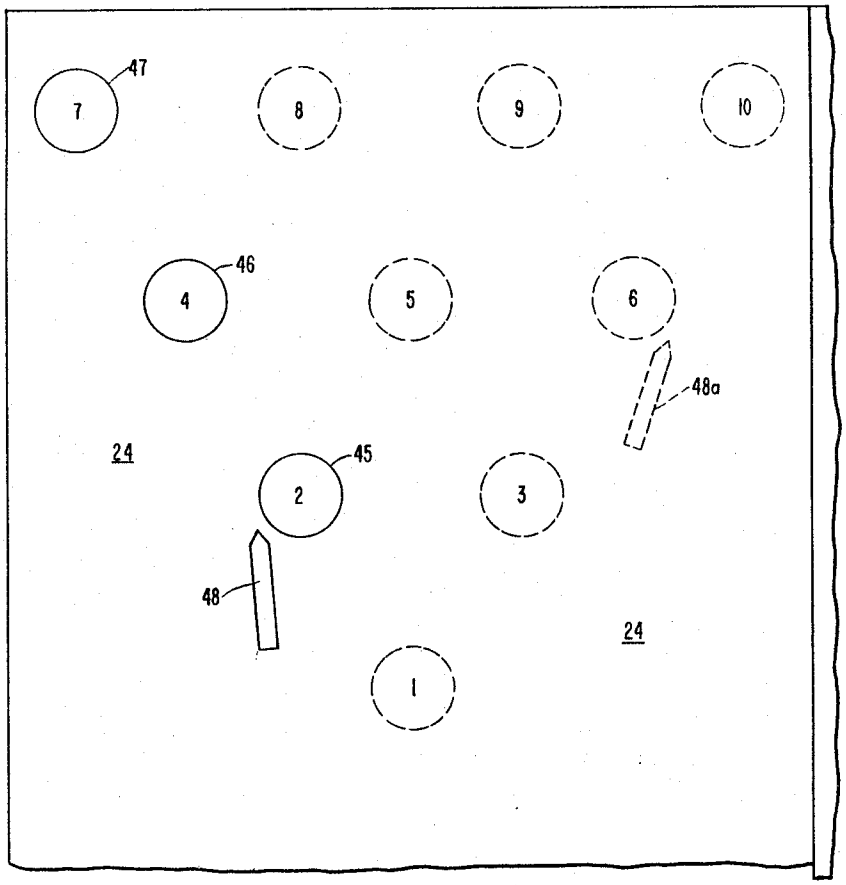


FIG. 7.

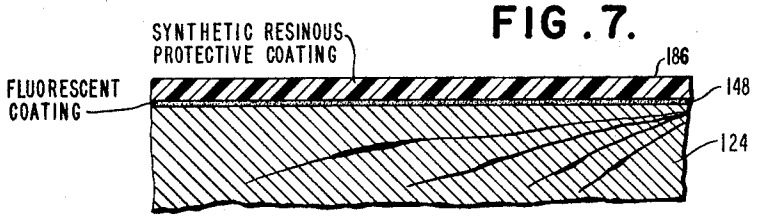


FIG. 8.

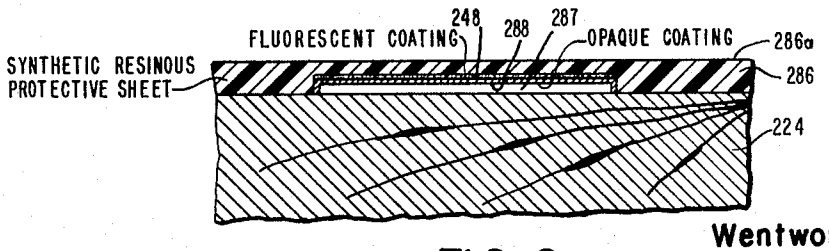


FIG. 9.

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United States Patent Office 3,301,558 Patented Jan. 31, 1967

3,301,558

SELECTIVELY ACTUATED BALL PATH INDICATOR

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Filed Feb. 3, 1964, Ser. No. 342,084
9 Claims. (Cl. 273—51)

This invention relates to ball path indicators and more particularly to improved apparatus for automatically selecting and indicating to bowlers the best path along which to roll a bowling ball to knock down the various combinations of standing pins encountered in the game of bowling.

In recent years, bowling alley installations have been equipped with devices which, in response to detection of the standing pins on the pin deck, serve automatically to display to the bowler the proper path along which the ball should be rolled to knock down the maximum number of pins. One such device is described and claimed, for example, in copending application Serial Number 166,616, filed January 16, 1962, by George A. Gruss and Arthur B. Viescas, now Patent 3,212,779, granted October 19, 1965. As proposed heretofore, apparatus of this type have employed illuminated display devices mounted above the alley bed, usually at a point in front of the masking unit for the pin spotting machine, the display device presenting for view from the players' end of the alley an illuminated facsimile of the standing pin combination and, in combination therewith, an illuminated arrow or like indication positioned to show the best path for the ball to travel. Though such apparatus have been highly successful and have achieved marked acceptance by bowlers, they have had the disadvantage that the ball path indication is displayed at a point removed from the standing pins and is not visible to the player during the act of rolling the ball.

A general object of the present invention is to devise an improved apparatus for providing a visual indication of the optimum ball path for the particular combination of bowling pins standing on the pin deck.

Another object is to provide an apparatus of the type described which presents the visual indication directly on the alley bed, so as to be visible to the player throughout the act of rolling the ball.

A further object is to provide such a device which establishes the visible ball path indication directly on the pin deck in proper relation and immediately adjacent to the standing pins.

Yet another object is to devise such an apparatus capable of presenting a ball path indicating on the alley bed by optical projection, with the projected indication being clearly visible to the player as the player rolls the ball.

Stated generally, the invention employs illuminated means for establishing arrows or like visible indications directly on the alley bed, the most advantageous embodiments being so arranged that the visible indications are made to appear immediately adjacent to the standing pins on the pin deck. Typically, the invention can employ a plurality of optical projectors arranged above the alley bed and activated selectively, in accordance with detection of the standing pins, for example, to project downwardly onto the pin deck a properly oriented, clearly visible, ball path indication. In such embodiments of the invention, the projectors are constructed and operated to yield indications which contrast with, and are clearly distinguishable from, the ambient illumination at the pin deck. Alternatively, the invention includes automatic means for reducing the ambient light during the time period when the ball path indication is needed by the player. In other embodiments of the invention, the ball path indications are applied directly to the alley bed by means of fluorescent materials, for example, so that the various indications can be activated selectively by projected radiations.

In order that the manner in which the foregoing and other objects is achieved an accordance with the invention can be understood in detail, particularly advantageous embodiments of the invention are described hereinafter with reference to the accompanying drawings, which form a part of this specification, and wherein:

FIGURE 1 is a side elevational view of a portion of a bowling pin spotting machine with a ball path indicating apparatus in accordance with one embodiment of the invention applied thereto;

FIGURE 2 is a longitudinal sectional view, with parts shown in elevation, of an optical projector useful in the ball path indicating apparatus of this invention;

FIGURE 3 is a sectional view taken on line 3—3, FIGURE 1;

FIGURE 4 is a schematic block diagram of the electrical control system forming part of the ball path indicating apparatus;

FIGURE 5 is a side elevational view of a rotary switching device employed in the ball path indicating apparatus;

FIGURE 6 is an end elevational view of the rotary switching device of FIGURE 5;

FIGURE 7 is a top plan view of the pin deck of the apparatus of FIGURE 1, illustrating the manner in which ball path indications are projected thereon;

FIGURE 8 is a fragmentary vertical sectional view, greatly enlarged, of a portion of a pin deck constructed in accordance with another embodiment of the invention;

FIGURE 9 is a fragmentary sectional view, similar to FIGURE 8, in accordance with another embodiment of the invention; and

FIGURE 10 is a fragmentary vertical sectional view of a portion of a pin deck constructed in accordance with still another embodiment of the invention.

The embodiment of the invention illustrated in FIGURES 1–7 is shown as applied to a bowling alley installation including a bowling pin spotting machine having a spotting mechanism of the type disclosed in U.S. Patent 2,755,089, issued July 17, 1956, to John Zuercher, and including a horizontal table or frame **20** on which are mounted ten spotting cups **21**. The spotting cups are arranged in the usual triangular plan and each cup is mounted to swing about the horizontal axis of one of the shafts **22**. Vertical movement of frame **20** upwardly and downwardly is accomplished by the drive means indicated generally at **23** and the same mechanism causes oscillation of shafts **22** in such fashion that, as the frame descends, the cups swing downwardly to pin-depositing position and, during upward travel of the frame, are always swung back to their initial positions, as seen in FIGURE 1.

The frame **20** is disposed directly above the pin deck **24** of the alley bed. A masking unit, indicated generally at **25**, is mounted in front of the pin spotting machine in a position spaced well above the alley bed. A plurality of conventional fluorescent lamps **26** are mounted behind the masking unit and so positioned as to direct light onto the pin deck. The fluorescent lamps **26** provide a preponderant proportion of the total ambient light falling on the pin deck and on the bowling pins standing thereon.

At a point above the alley bed and spaced rearwardly from the masking unit **25**, there is provided a crossbeam **27** which is rigidly mounted in any suitable fashion on the supporting frame for the pin spotting machine. Fixed to beam **27** and projecting forwardly therefrom are eleven mounting brackets **28** each having a forwardly extending web **29** to which is adjustably secured a projector-supporting bracket indicated generally at **30**. The webs **29** are flat and vertically disposed. Brackets **30** each include a flat

web **31** which is disposed in face-to-face engagement with the corresponding web **29** and is secured thereto, as by bolts and wing nuts **32**, FIGURE 3. Each such bolt extends through a circular opening in web **29** and an arcuate slot **33**, FIGURE 1, in web **31**.

Each bracket **30** also includes a flat web **34** which projects laterally from web **31** and to which is secured a projector, indicated generally at **35**. Typically, each projector **35** may be attached to the corresponding web **34** by the U bolts **36**.

Any suitable optical projector capable of projecting an intense, sharply defined, elongated image can be employed in accordance with the invention. As illustrated in FIGURE 2, each projector **35** can comprise a tubular cylindrical housing **37** closed at one end by a combination closure plug and lamp-receptacle indicated generally at **38** and accommodatintg electric lamp **39**. Immediately in front of lamp **39**, a circular color filter disk **40** is embraced and fixedly retained by housing **37**. Immediately adjacent to color filter **40**, and on the side thereof opposite lamp **39**, there is provided in housing **37** a conventional condensing lens system **41** which includes a transversely arranged diaphragm **42** having a light-transmitting opening corresponding in shape to the desired image, typically an arrow. The end of housing **37** opposite lamp **39** accommodates a conventional projection or objective lens system **43** which is adjustable axially relative to housing **37** and is fixed in adjusted position by the locking screw **44**.

Referring to FIGURE 1, it will be understood that each projector **35** is supported by brackets **28** and **30** in a selected position such that the image established on the pin deck **24** by the projector bears a predetermined relation to one of the several combination of standing pins which may be encountered during bowling. Comparing FIGURES 1 and 7, it will be noted that bowling pins **45**, **46** and **47** are shown as standing in the 2-position, the 4-position, and the 7-position, respectively. The particular projector **35** shown in FIGURE 1 is positioned to establish the projected image **48**, FIGURE 7, immediately adjacent to pin **45** and properly oriented to indicate the optimum ball path for knocking down the combination of pins **45–47**. As will be apparent in more detail hereinafter, the crossbeam **27** supports eleven of the projectors **35**, each precisely oriented to project onto the pin deck a different optimum ball path indication, such as the image **48***a*, FIGURE 7, the projectors being selectively operated in accordance with the particular combination of standing pins encountered.

In order to accomplish selective energization of the eleven projectors **35**, an electrical system of the general type disclosed in the aforementioned Patent 3,212,779 is employed. As shown diagrammatically in FIGURE 4, this system operates in conjunction with a conventional bowling pin spotting machine and employs a plurality of standing pin detector switches each mounted on one of the pin cups of the spotting machine in the general fashion shown, for example, in U.S. Patent 2,983,510, issued May 9, 1961, to Roy E. Blewitt, Jr.

In FIGURE 4, the ten standing pin detector switches are indicated at **50**, the contacts of each switch being connected in series with the actuating coil of a different one of ten pin relays, these actuating coils being indicated generally at **51**. Accordingly, when the table **20** of the pin spotting machine is lowered, any standing pin will engage and actuate to its closed position the corresponding one of the pin detector switches **50** and closing of this switch will complete a circuit to energize the corresponding one of the pin relay actuating coils **51**. Each relay **51** includes a set of normally open contacts connected in parallel with the respective one of the pin detector switches **50**. These normally open contacts, indicated at **52**, serve as latching contacts to maintain the pin relay coils energized beyond the temporary closing of the pin detector switches.

The number of pin relays energized as a result of actuation of the standing pin detector switches is counted by a stepping relay which in turn simultaneously advances two additional stepping relays one position for each energized pin relay. Thus, the pin relays include contacts, indicated generally at **53**, each connected in series with the stepper relay motor **54**. Accordingly, stepper relay motor **54** commences its sequential operation whenever any of the contacts **53** are closed. The stationary contacts of the contact set **54** of the stepper relay which includes motor **54** is connected to ground via a different one of a set of contacts **56** of the pin relays. Two additional stepper relay motors **57** and **58** are connected in parallel between suitable supply terminals and the movable contact of contact set **55**. Accordingly, each stepwise actuation of contact set **55** simultaneously pulses the stepper relay motors **57** and **58**.

The circuit includes a plurality of bar relays, the actuating motors of the bar relays being indicated at **59** and the contacts of the bar relays being indicated at **60**. Each bar relay motor **59** is provided with an energizing circuit which includes in series a different one of the pin relay contact sets **56**. Accordingly, the bar relay motors **59** are energized selectively in accordance with energization of the pin relays.

The ultimate control function of the circuit illustrated in FIGURE 4 is accomplished via a rotary switching device shown in detail in FIGURES 5 and 6. This switching device comprises a synchronous driving motor **61**, FIGURES 4 and 5, and a speed reduction mechanism **62** including an output or driving pinion **63**. The switching device includes a fixed shaft **64** on which is journalled a hollow shaft **65**. Shaft **65** carries a gear **66** which is meshed with pinion **63**. Shaft **65** also carries a radially projecting actuating arm **67** which terminates in actuating cam structure **68**. Rigidly carried by stationary shaft **64** are two circular switch-supporting discs **69** and **70**. Fixedly secured to disc **69**, and arranged in a circular series extending adjacent to the periphery of the disc, are eleven normally closed snap-type switches **71**. Similarly, carried by disc **70** are eleven normally open snap-type switches **72** which are employed as projector control switches. An additional, normally closed, snap-type switch **73** is secured to disc **69**, being located on the opposite side of that disc from the switches **71**. Corresponding ones of the switches **71** and **72** occupy the same angular positions, as will be evident from FIGURE 6. Switch **73** is angularly aligned with a particular one of the switches **72** so that switch **73** and the particular one of switches **72** with which it is aligned will be actuated simultaneously.

Switches **71–73** are of conventional type, being provided with spring actuating arms **74** having offset free end portions normally disposed in the path of travel of the cam structure **68**. Accordingly, as the motor **61** is driven, actuating arm **67** and its cam structure **68** rotate continuously so that the cam structure sweeps successively across the several actuating arms **74** and thus sequentially actuates each of the switches **71** and simultaneously actuates the corresponding or aligned one of the switches **72**.

Motor **61** is energized via a supply circuit including, in series, the normally open contacts **75** of a relay indicated generally at **76**, FIGURE 5. The actuating winding **77** of relay **76** is connected between a supply terminal **78** and ground via any of a plurality of parallel circuits each including a different one of the switches **71**, a different one of the several movable contacts in stepper relay contact set **79** or one of the several movable contacts of stepper relay contact set **80**, one of the bar relay contacts **60**, and one of the several fixed contacts and the movable contact of a second stepper relay contact set **79′** forming part of the stepper relay operated by motor **57**. Alternatively, winding **77** can be connected to ground via a circuit including the series combination

of switch 73 and a normally open switch 81, switch 81 being so associated with the pin spotting machine as to be closed only when resetting of the pin spotting machine is initiated.

Contact set 79 includes five movable contacts and five sets of fixed contacts, while contact set 79' includes a sixth set of fixed contacts and a single movable contact. Contact set 80 includes six movable contacts and six sets of fixed contacts.

The combination of contact sets 79, 79' and 80 constitutes a memory device in which the total number of standing pins, as detected by switches 50, is stored. The bar relays, including contacts 60, establish the locations of the standing pins. The combination of contact sets 79, 79' and 80, with bar relay contacts 60, provide a single energizing circuit, including only one of the switches 71, for the actuating winding 77 of relay 76. Accordingly, the motor 61 is energized only until actuating arm 67 attains an angular position such that cam structure 68 engages and opens the particular one of switches 71 included in the energizing circuit so provided. At that point, only a particular one of the projector control switches 72 will be engaged and closed by the cam structure 68.

Such opening of the particular one of switches 71 results in deenergization of winding 77, so that normally open contacts 75 of relay 76 are opened and motor 61 is deenergized. Simultaneously, contacts 82 of relay 76 return to their normally closed position, completing a circuit from supply terminal 83 to the particular one of projectors 35 determined by the one of projector control switches 72 which is maintained closed by cam structure 68.

Closing of contacts 82 also completes the circuit to a relay motor 84 which is effective, when energized, to open contacts 85 which are connected in series with one-half of the total number of fluorescent lamps 26 which provide the ambient light for the pin deck area. Accordingly, so long as relay motor 84 remains energized, the total ambient light will be reduced by fifty percent, making the image projected by the energized projector 35 more evident to the player. Relay motor 84 is of a conventional time delayed drop-out type constructed to accomplish self-deenergization within a predetermined time period. Relay motor 84 is designed to drop out automatically after a time period on the order of 10–18 seconds, for example, to assure that the reduction in ambient light will persist for a time adequate for the player to roll the ball.

From the foregoing, it will be evident that the control system illustrated in FIGURE 4 is effective to activate a particular one of the projectors 35 in accordance with the combination of standing pins which occurs. Thus, for the combination of standing pins shown in FIGURES 1 and 7, the proper projector 35 will automatically be activated to establish on the pin deck the indication 48, FIGURE 7, of the optimum ball path for knocking down the existing combination of standing pins. Referring to FIGURE 7, it will be seen that the projected indication 48 is established in immediate proximity to the standing pin 45, the location of the projected indication being approximately at the desired point of impact between the ball and the appropriate standing pin. Establishing the ball path indication in this fashion has the distinct advantage of providing the player with a guide which is clearly visible throughout the entire act of rolling the ball and which is so located that the player need not first look at the displayed indication and then look away from the indication in order to see the pins toward which the ball is to be rolled.

In the embodiment of the invention just described, the projected image 48 is clear and distinctly evident to the player because the light from the appropriate projector 35 is both markedly stronger than the ambient light and of a distinctly different color, this having been accomplished by provision of the color filter 40, FIGURE 2. Further, the time delayed relay motor 84, FIGURE 4, has operated automatically to decrease the number of the fluorescent lamps 26 which are energized during rolling of the ball, so that the amount of ambient light is markedly reduced during this time.

Rather than employing projectors constructed to project well defined images in a distinctive color, as just described, the projectors can be employed simply to activate a fluorescent image applied directly to the pin deck. Thus, as seen in FIGURE 8, the image 148 can be painted directly on the surface of the pin deck 124 in a suitable fluorescent coating material, a very thin layer of synthetic resinous material then being applied over the pin deck, as indicated at 186, to protect the fluorescent images. Typically, layer 186 can be in the form of a film of polyethylene on the order of a few thousandths of an inch thick, the film being cemented to the pin deck. Alternatively, layer 186 can be established as a very thin coating of polyethylene or the like. In all events, the layer 186 is essentially transparent so that, once the image 148 has been caused to fluoresce or luminesce as a result of being subjected to radiant energy from the appropriate one of the projectors 35, the image will then be visible through the protective layer or coating 186. It will be understood that the image 148 can be established by means of any suitable luminescent material and that the light or radiant energy provided by the projectors will be selected in accordance with the particular characteristics of the fluorescent or luminescent material.

Referring now to FIGURE 9, another embodiment of the invention is shown which requires that the pin deck 224 be cut away slightly so that its upper surface lies in a plane slightly lower than the surface of the alley proper. A strong, wear-resistant, transparent sheet 286 of synthetic resinous material is then cemented over the entire surface of the pin deck and is of such thickness that the upper face 286*a* thereof lies in the same plane as the surface of the alley proper. Sheet 286 is provided with a plurality of downwardly opening recesses 287, each such recess being located in a different one of the several positions to be occupied by the various optimum ball path indications. Each recess 287 has the desired plan configuration for the ball path indication, and a fluorescent or luminescent coating 248 is applied to the entire horizontal wall of the recess. An opaque coating 288 is then applied over the lower surface of the luminescent coating 248. Employing the arrangement illustrated in FIGURE 9, the projectors 35 are constructed to project onto the location of the luminescent coating 248 a suitable light or other activating energy to cause the coating 248 to luminesce, so that the image will then be visible to the player through the transparent synthetic resinous material of sheet 286.

In accordance with yet another embodiment of the invention, the projectors 35 can each be replaced by a plurality of electric lamps in the general fashion illustrated in FIGURE 10. Thus, the pin deck 324 is provided at each location for the optimum ball path indications with an upwardly opening recess 389 within which is mounted a lamp assembly 390. Lamp assembly 390, in this embodiment, includes three incandescent lamps 391 connected in parallel. The open top of recess 389 is covered by a rigid, wear-resistant, translucent plate 386 which is inset into the pin deck 324 and secured rigidly thereto, the upper surface 386*a* of plate 386 being flush with the surface of the pin deck, as shown. The parallel combination of the lamps 391 for each of the lamp assemblies 390 is connected in the circuit of FIGURE 4 in place of a different one of the projectors 35, so that the control system will then be effective to selectively energize the lamps of the various lamp assemblies 390 in accordance with the particular combination of standing pins detected by the switches 50. Simultaneous energization of the lamps 391 of any one of the assemblies 390

will direct a strong light upwardly through the corresponding translucent plate **386**, providing an indication which will be visible to the player. Advantageously, each of the plates **386** has the desired plan configuration for the optimum ball path indication, again typically an arrow.

Though particularly advantageous embodiments of the invention have been chosen for illustrative purposes, it will be understood by those skilled in the art that various changes and modifications can be made therein without departing from the scope of the invention as defined in the appended claims.

What is claimed is:

1. In a bowling alley installation, apparatus for visually indicating to the players the optimum path along which the ball is to be rolled to knock down a combination of standing pins, comprising

a plurality of optical devices each arranged to establish directly on the bowling alley bed an illuminated indication closely adjacent a combination of standing pins to indicate a predetermined point of entry a ball should have when entering said combination which is visible to a player standing at the approach end of the alley bed and has a predetermined orientation relative to a different combination of standing pins; and

control means operative in response to the rolling of a ball for selectively activating a selected one only of said optical devices to maintain said image adjacent said combination of standing pins for view by the player while the player rolls a succeeding ball.

2. In a bowling alley installation of the type including an alley bed having at one end a pin deck and at the other end a player's approach area, and a bowling pin spotting machine operative to spot and respot bowling pins in predetermined positions on the pin deck, the combination of a ball path indicating apparatus comprising

a plurality of optical devices each constructed to establish on the pin deck a ball path indication in the form of an image illuminated in such color an intensity as to be visible to a player standing at the approach end of the alley bed,

each of said optical devices being so arranged as to establish its respective image in a location on the pin deck which is in at least close proximity to the optimum point of ball impact for knocking down a particular combination of standing pins encountered in bowling;

pin sensing means associated with the pin spotting machine and operative to detect the number and location of pins standing on the pin deck; and

electrical means connected to respond to said pin sensing means and selectively activate said optical devices to establish the optimum ball path indicating image for the particular combination of standing pins detected by said pin sensing means, said electrical means operating to maintain such image throughout that time period when the player rolls the ball.

3. A bowling alley installation in accordance with claim **2** and wherein

each of said optical devices is a projector mounted above the pin deck.

4. A bowling alley installation in accordance with claim **2** and wherein

each of said optical devices is mounted above the pin deck and includes means for projecting onto the pin deck an image of a color distinctly different from the ambient light falling on the pin deck.

5. A bowling alley installation in accordance with claim **2** and comprising

means overlying the pin deck and carrying luminescent material in the locations at which said images are to be established,

said optical devices being operative to selectively excite said luminescent material.

6. A bowling alley installation in accordance with claim **2** and wherein

each of said optical devices is located in the alley bed and comprises

light conductive means forming part of the surface of the pin deck, and

light means disposed below said light conductive means and operative, when energized, to illuminate said light conductive means.

7. A bowling alley installation in accordance with claim **2** and further comprising

light means for accomplishing overall illumination of the pin deck, and

control means for automatically decreasing the intensity of the illumination provided by said light means during the time period when the player rolls the ball.

8. In a bowling installation, the combination of

an alley bed including a pin deck on which bowling pins are to be placed in predetermined positions;

a plurality of luminescent images disposed at the surface of said pin deck and each arranged to indicate, when excited, the optimum ball path for a different combination of standing pins encountered in bowling; and

means for selectively exciting said luminescent images.

9. A bowling alley installation in accordance with claim **8** and wherein

said pin deck comprises a thin surface sheet of transparent material, and

said luminescent images are carried by the lower surface of said sheet.

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