

March 2, 1971

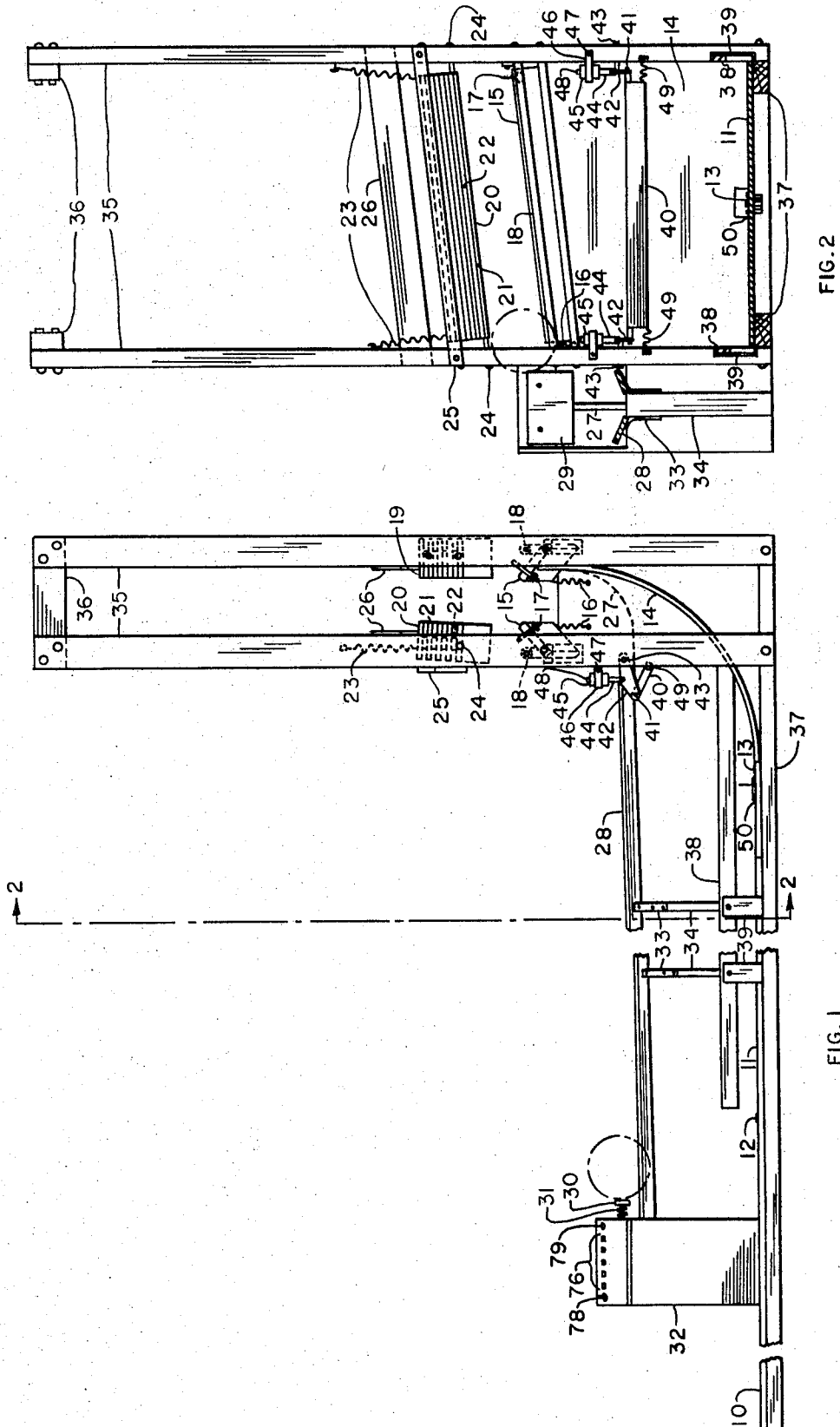
R. L. FORGACS

3,567,224

BOWLING PRACTICE GAME APPARATUS

Filed March 29, 1968

3 Sheets-Sheet 1



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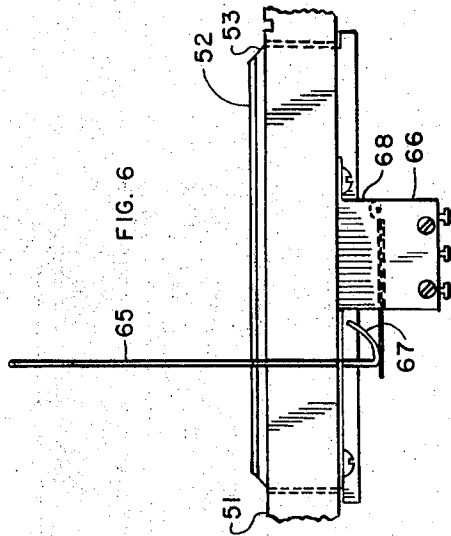
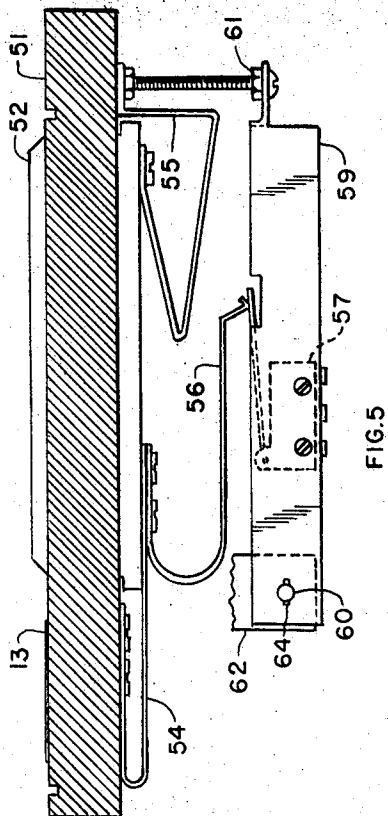
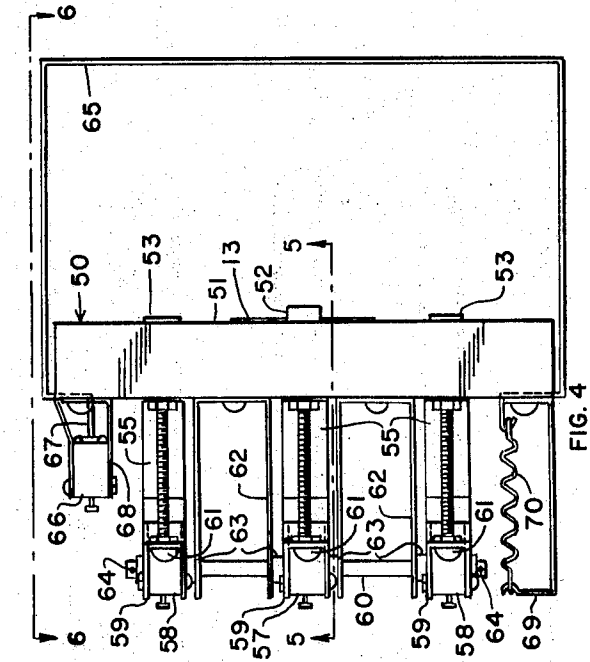
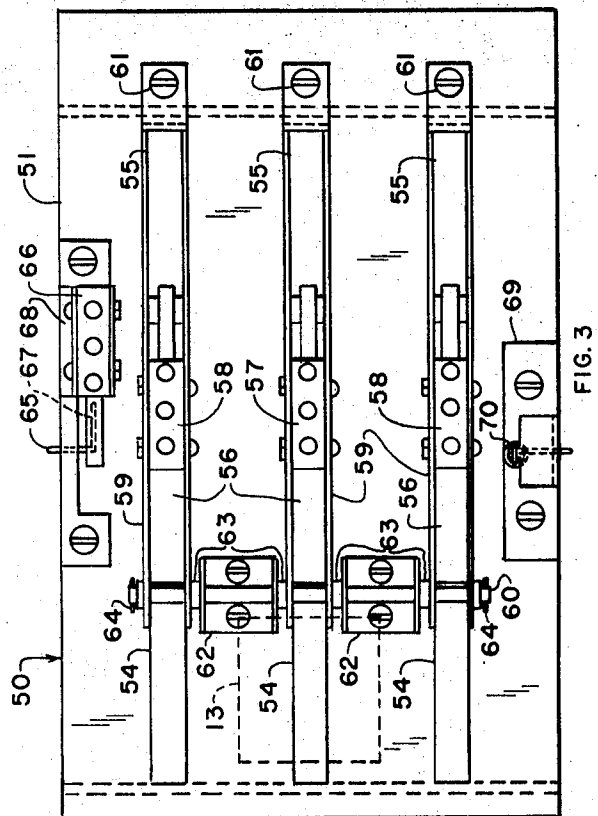
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BOWLING PRACTICE GAME APPARATUS

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3 Sheets-Sheet 2



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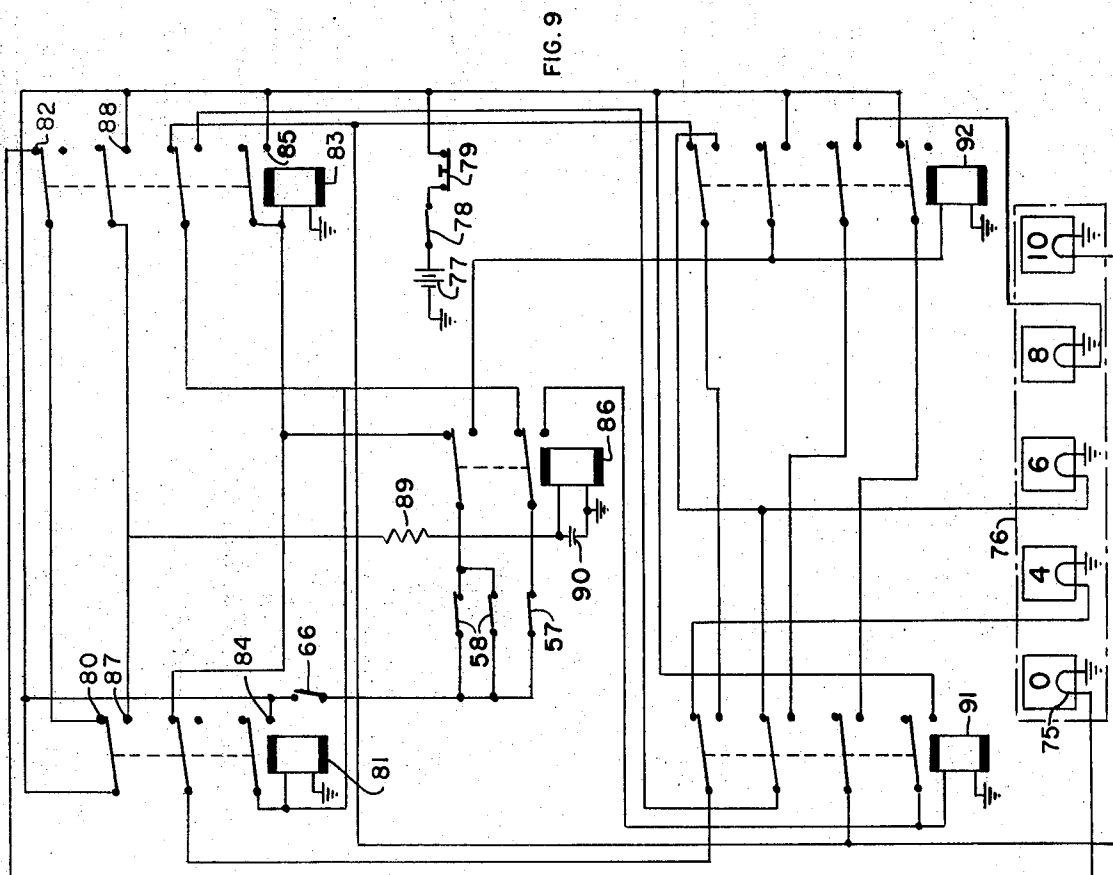
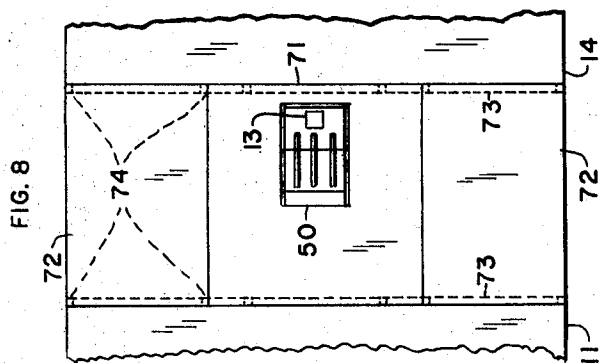
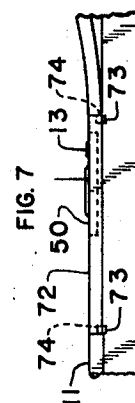
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BOWLING PRACTICE GAME APPARATUS

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3 Sheets-Sheet 3



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BOWLING PRACTICE GAME APPARATUS

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8 Claims

ABSTRACT OF THE DISCLOSURE

A bowling practice game apparatus having a transversely movable plurality of ball sensors on a sub-standard length alley spaced substantially the same distance from the foul line as the marker spots on a standard alley. Indicator lights are illuminated in response to actuation of the sensors to provide a hypothetical pinfall indication approximating actual pinfall for both first and second balls. A mechanism is provided which prevents reverse rolling balls from actuating the sensors. A curved ramp, an optional one way gate and an energy absorber at the end of the alley cooperate to return the ball to the bowler.

BACKGROUND OF THE INVENTION

This invention relates to bowling practice apparatus and more particularly to apparatus which will permit spot bowling practice in a limited area and which incorporates automatic scoring means.

In many sports, a student of the game may improve his skill by practicing the execution of the various moves, deliveries or swings peculiar to the sport in facilities provided for the purpose, e.g., golf driving ranges for golfers. Practice apparatus for bowlers is relatively non-existent, other than the normal game facilities of commercial bowling alleys, with the result that bowlers have difficulty developing consistent execution of the delivery, cannot repetitively practice a particular conversion attempt nor can they observe their delivery technique in a mirror for self-analysis. Extensive practice sessions at commercial bowling alleys are limited by cost, overcrowding at prime times, and the travel time and distance to available alleys. These problems could be alleviated by the availability of practice apparatus in the individual home.

Various previous bowling games have incorporated a multiplicity of switches in proximity to the alley surface covering the entire width of the normal pin field to sense the exact position at which a ball enters the hypothetical pin field, thereby permitting the sensors to produce scoring results equivalent to that which would be obtained with a similarly delivered ball on a real alley. The primary disadvantage of such an arrangement is that to establish conformity between the practice and real alley situations it is necessary to employ the same foul-line-to-pin distance, 60 ft., in the practice situation as exists on the real alley. If a shorter than standard distance is employed, a lateral angular error of any given number of degrees in the actual trajectory compared to the desired trajectory will yield a different lateral displacement error at the pins, real or simulated, in the real and practice situations. Therefore the desired equivalence between the two situations would not be obtained. The required total length of this previous automatic scoring practice alley, 60 ft. of alley plus 15 ft. of approach plus approximately 6 ft. for pins, pit and backstop, prevents the installation of such a practice alley in all but a few percent of homes. Even where the space is available, the required length is costly.

A second major disadvantage of the previous attempts

to provide practice alleys, wherein sensors cover the entire width of the normal pin field, is that in order to determine the position of the ball with sufficient precision to determine the exact direction in which struck pins would fly, which is necessary for accurate scoring simulation, a very large number of sensors is required with a corresponding increase in cost, complexity and maintenance problems.

A third problem with using a shorter than standard alley with the aforementioned schemes is that a bowler who practices frequently while aiming at objectives which are at a different range than those which will be aimed at when actually bowling may become so conditioned to the incorrect distance that his consistency on a standard alley may decrease rather than increase as a result of the practice.

All of the aforementioned difficulties are solved in the present invention which accommodates the practice of spot bowling. Spot bowling is a well known preferred bowling technique in which the bowler attempts to deliver the ball over a selected spot in the alley, usually facilitated by contrasting colors of wood markers in the surface of standard bowling alleys, typically about 13 ft. past the foul line. From experience, the bowler knows which combination of spot over which the ball should roll and point of origination of delivery is required to result in delivery of the ball to a desired point in the pin field. Thus once these proper combinations are learned, the entire game is reduced to nothing more than developing a consistent delivery in which the ball is rolled over a marker spot approximately 13 ft. from the foul line. A common error committed by spot bowlers is to peek at the pins when the bowler should be observing whether or not the ball is passing over the selected spot. If a practice situation were available in which no pins were visible at delivery, it would facilitate formation of the habit of concentrating on the delivered ball's relation to the selected spot.

From the preceding discussion, it becomes apparent that the length of a spot-bowling practice alley which would substantially duplicate conditions present in an actual alley need be only approximately 15 ft. for approach plus 13 ft. from foul line to spot plus 3 ft. for a backstop, making it possible to fit in the great majority of home basements rather than a few percent. Very few closely spaced sensors can be utilized to monitor the miss distance between the ball path centerline and marker spot centerline. The information from the miss distance sensors can be processed to yield a hypothetical pinfall count which will be generally representative of that obtainable on a standard alley with a corresponding miss distance between ball and a properly selected marker.

The cost of the present apparatus is greatly reduced compared to those utilizing full size alleys because of the reduced alley length and the reduced number of sensors required. In addition, cost is minimized by employing an automatic ball return which utilizes no external energy source such as a motor. One form of the present invention incorporates a one-way gate to implement ball return; another form dispenses with the gate and most of the ball return apparatus.

SUMMARY OF THE INVENTION

With the above in mind, it is an object of this invention to provide spot-bowling practice apparatus which is of greatly reduced length compared to standard alleys, making installation in the average sized home or other relatively small buildings possible and greatly reducing the cost.

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Another object is to provide bowling practice apparatus which will yield scoring indications which depend on the accuracy with which practice balls are rolled toward a target which is comparably displaced from the foul line as are the marker spots in a standard alley. Various types of scoring indicators can be accommodated such as digital readouts or illuminated pin replicas, bowler's view or plan view.

Another object is to provide bowling practice apparatus which permits economy in the number of sensors required for scoring purposes. It will be obvious to those skilled in the art of position measurement that various types of sensors could be accommodated such as contacting type, photoelectric, capacity sensing, sonic, ultrasonic, pneumatic, and pressure sensing.

Another object is to provide bowling practice apparatus which dispenses with pins, their cost, maintenance, handling setting up, and noise producing properties.

Another object of the invention is to provide bowling practice apparatus which will permit the use of a mirror, along with pictures of correct delivery form at the various stages of the delivery to facilitate improvement in form on delivery.

With the foregoing objects in mind, the invention comprises the arrangement and combination of parts to be described and claimed. The invention is not intended to be restricted to the exact details of construction disclosed or proposed, but to illustrate a practical embodiment of the invention, the accompanying drawings are submitted.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation of a spot-bowling practice alley embodying the features of the present invention;

FIG. 2 is a vertical transverse section on the line 2—2 of FIG. 1;

FIG. 3 is a plan view, from below, of the sensor assembly which incorporates the marker spot or target;

FIG. 4 is a front elevation of the same;

FIG. 5 is a vertical transverse section of the sensor assembly on the line 5—5 of FIG. 4, with material beyond the central treadle omitted for clarity;

FIG. 6 is a side elevation, as viewed from line 6—6 of FIG. 4, of the mechanism for preventing alley-returned balls from actuating the scoring circuitry;

FIG. 7 is a side elevation of the section of the alley incorporating the sensor assembly;

FIG. 8 is a plan view of the same;

FIG. 9 is a schematic of the scoring circuitry.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now more specifically to the drawings, the illustrated embodiment of the invention includes an approach 10, generally equivalent to a standard bowling alley approach in surface characteristics; length and/or width may be reduced somewhat for economy of space or cost if desired. A typical construction material for the approach 10 would be wood or equivalent. Extending from one narrow end of the approach 10 is an elongated flat alley 11 which is of the same width as the approach 10 and of similar construction. The length of the alley 11 is typically about 13 to 15 ft. or about the same distance that normally exists on a conventional alley between foul line and the marker spots embedded in the alley. Separating the approach 10 and the alley 11 is a foul line 12. The target spot 13 is a spot on or in the alley 11 surface near the far end of the alley 11. Its width is roughly comparable to that of a marker spot on a conventional alley, and the color contrast is at least comparable.

The end of the alley 11 is attached to a curved ramp 14 which converts a portion of a delivered ball's kinetic energy to potential energy in anticipation of ball return.

The ramp 14 is constructed with a surface which will not damage a ball such as wood, rubber or plastic supported by a strong frame material such as metal or wood. The radius of curvature of the ramp is small enough to

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insure that the minimum ball velocity required to insure its attaining the top of the ramp is not too high, yet not so great an unduly large force is exerted on the ramp by a swiftly rolled ball. Two feet is a typical value of ramp radius of curvature.

The ramp 14 is surmounted by a one-way gate 15 which permits a ball to rise through it but not to fall through it. Thus any ball which has risen through the gate 15 is trapped atop it and proceeds to roll along the top of the gate 15 which slopes downward to one side. The gate 15 is constructed with a rigid core such as steel covered by a shock absorbent material such as rubber. The gate 15 halves are angled to minimize energy absorption when struck by a ball thereby maximizing trapping probability and also minimizing the probability that a ball which lands atop the gate 15 before it has completely closed will force the gate 15 open. Springs 16 and gravity cooperate to keep the gate 15 normally closed. Adjustable stops 17 are provided to permit orientation of the gate 15 halves at the optimum angle when the gate 15 is at rest. Barriers 18 are provided to limit gate 15 travel when struck by a ball. Situated above the gate 15 is a fixed absorber 19 and a pivotable absorber 20 which cooperate to absorb excess energy from a swiftly delivered ball. A ball rising into the absorber elements 19, 20 will after exhausting its kinetic energy, descend relatively slowly through the absorber elements 19, 20 and drop onto the gate 15 halves. The absorber elements 19, 20 are constructed of interleaved wide flexible elements 21 such as rubber and narrow rigid elements 22 such as wood. The pivotable absorber 20 is oriented in its optimum position by springs 23 about a pivot 24. A stop 25 is provided to prevent excessive rotation of the pivotable absorber 20 on impact. Guides 26 above the absorber elements 19, 20 keep any ball with sufficient energy to rise above the top of the absorber centered in case the absorber elements 19, 20 are of marginal stopping ability due to wear or other causes.

When a ball lights atop the gate 15 it rolls along the top of the gate 15 supported between the two gate 15 halves to the chute 27. The chute 27 may be constructed of any material which will not damage a ball, such as wood or plastic, of any shape which will produce a smooth, low energy loss conversion of potential energy to kinetic energy, to permit the ball to emerge along a ball return rail 28. A decelerating element 29 of some flexible material such as rubber may be provided at the chute 27 exit if the emergent velocity of the ball is excessive. Ball return rail 28 can be constructed of wood or equivalent material and is sloped gently downward toward the foul line end of the alley 11 to insure that all balls will come to rest near the foul line 12. A flexible stop 30 is provided at the foul line end of the ball return rail 28 to absorb the shock of a returning ball. A flexible material such as rubber is employed as the contact material and a spring 31 may be provided if desired for greater cushioning. The ball return rail 28 is connected between the chute 27 and a scoring console 32 and is connected by brackets 33 to supports 34.

Studs 35 are utilized to support the ball arresting apparatus described and are fastened together at the top by connecting bars 36 which are normally secured to the ceiling or wall. The lower ends of the studs 35 are bolted to the stringers 37 which also support the approach 10 and the alley 11.

Bumper rails 38 are placed along each side of the alley 11 from near the foul line 12 to the nearest stud 35 to prevent errant balls from leaving the alley 11. The bumper rails 38, of wood or comparable construction, are supported by brackets 39 which are secured to the stringers 37.

In the event that a bowler delivers a slow ball with insufficient energy to rise through the one-way gate 15, it will roll back down the ramp 14 and return to the bowler. Though the average bowler can stop such a ball manually, it is advantageous to reduce the velocity of an

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alley-returned ball to ease the task of stopping the ball. An optional accessory is shown in FIGS. 1 and 2 which absorbs a portion of the energy of an alley-returned ball in the following manner: The decelerator gate 40 pivots on an axle 41 which is mounted in brackets 42. The brackets 42 in turn can pivot about their mounting bolts 43. The brackets 42 are also attached to connecting rods 44 which emanate from internal pistons of adjustable air damping dashpots 45 of standard design which utilize an internal one-way valve to yield damping of the push stroke and negligible damping of the pull stroke. The dashpots 45 are secured by mounting brackets 46 and bolts 47 to a stud 35. Damping adjustment screws 48 are provided on the dashpots 45. The decelerator gate 40 is supported in an undeflected position by springs 49 at an angle of approximately 30 degrees from the perpendicular to the ramp 14 surface such that a ball moving up the ramp 14 will cause the decelerator gate 40 to pivot about the axle 41 with slight energy absorption. A ball moving down the ramp 14 will however tend to become jammed between decelerator gate 40 and ramp 14 because of the gate 40 angle. The brackets 42 will pivot about mounting bolts 43 but at a reduced rate due to the restraining influence of the dashpots 45. The ball will thus be delayed during the time it takes the decelerator gate 40 to move out of the way. Construction materials for the decelerator gate 40 can be similar to those suggested for one-way gate 15.

Although ball return to the bowler via the alley 11 is less elegant than via the ball return rail 28, it is apparent that a more economical apparatus would result if all balls were returned via the alley 11. By lowering the energy absorption element to a position above the ramp 14 where the velocity attainable by a reverse rolling ball is low enough that manually stopping a reverse rolling ball becomes no problem, it would be possible to eliminate the one-way gate 15, its springs 16, the adjustable stops 17, the chute 27, the ball return rail 28, the decelerating element 29, the flexible stop 30, and elements labeled 40 through 49 associated with the decelerator gate 40.

The sensor assembly 50 which incorporates means for sensing the miss distance between the target spot 13 centerline and a bowled ball path centerline is shown in detail in FIGS. 3 and 4 with clarifying views of portions of the assembly shown in FIGS. 5 and 6.

The target spot 13 is affixed on the surface of a base block 51 in line with a center treadle 52. Side treadles 53 are located approximately one inch to each side of the center treadle 52. The treadles 52, 53 are supported by suspension springs 54, 55 and are also fastened to actuating springs 56 which actuate snap-action switches 57, 58 when appropriate treadles 52, 53 are depressed. Treadle 52, 53 construction is such that a relatively soft upper material such as plastic contacts the ball but a high density lower material such as brass provides sufficient mass in the treadles 52, 53 that the combination of the high treadle mass with relatively low spring constants for the suspension springs 54, 55 results in a considerable increase in the duration during which the snap-action switches 57, 58 are depressed over the time that a fast moving ball contacts the treadles 52, 53. This makes it possible for the snap-action switches 57, 58 to activate standard relays rather than requiring special fast response relays.

The snap-action switches 57, 58 are supported by brackets 59 pivoting on a rod 60 and adjustable vertically by screw and nut combinations 61. The amount an individual treadle 52, 53 extends above the alley 11 surface is preset and the amount the treadle must be depressed to actuate a switch 57, 58 is adjusted to insure that if the miss distance between centerlines of ball path and center treadle 52 is between zero and x inches, only the center treadle switch 57 is actuated. For a miss distance between x and y inches, both center treadle switch 57 and one side treadle switch 58 are actuated. For a miss distance between y and z inches, only a side treadle switch 58 is

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actuated. Typical values for x , y and z are $\frac{1}{2}$, 1 and $1\frac{1}{2}$ respectively. The rod 60 supporting the switch brackets 59 is itself supported by brackets 62 affixed to the base block 51. Spacers 63 are placed between the brackets 62 on the rod 60 and pins 64 secure the rod 60 in place.

In the event that a weakly delivered ball does not possess sufficient energy to enter the one-way gate 15, the ball will roll back down the ramp 14 raising the possibility of depressing one or more of the treadles 52, 53 to create a false score readout. Apparatus is provided in the sensor assembly 50 to prevent errors from this source. Actuator 65 is employed to permit a reverse rolling ball to open a normally closed deactivate switch 66 via a cam 67, thereby deactivating the treadle switches 57, 58. A bracket 68 is provided for mounting the deactivate switch 66 which also secures one end of the actuator 65 in place. Another bracket 69 receives the other end of the actuator 65 and in addition secures one end of a spring 70 which keeps the actuator in a vertical position when not deflected. In FIG. 6, most elements behind the deactivate switch 66 are omitted for clarity.

To permit the target spot 13 to be moved laterally to various desired positions on the alley, the sensor assembly 50 containing the target spot 13 is mounted in a laterally movable section 71 of the alley 11 as shown in FIGS. 7 and 8. Flanking sections 72 of the alley 11 are shown on either side of the central section 71. All three sections 71, 72 are movable laterally on steel rails 73. Magnets 74 mounted in the sections 71, 72 prevent unintentional lateral or vertical movement of the sections 71, 72 by their attraction to the steel rails 73. For maximum lateral displacement, both side sections 72 may be placed to the same side of the central section 71.

The manner in which the closure of the treadle switches 57, 58 produces readout of hypothetical pinfall counts after each ball is rolled may be observed by referring to FIG. 9. Before the first ball of a frame depresses a treadle, a lamp 75 illuminates the number 0, in the frame pinfall indicator 76 due to current supplied by the battery 77 through the power switch 78, the normally closed rerack push button switch 79 and normally closed contacts 80 of the first ball, center treadle relay 81 and normally closed contacts 82 of the first ball, side treadle relay 83.

If the first ball of a frame depresses the center treadle 52, the center treadle switch 57 is momentarily closed and the first ball, center treadle relay 81 is energized and locks itself in via one set of normally open contacts 84. Similarly if the first ball of a frame depresses a side treadle 53, a side treadle switch 58 is momentarily closed and the first ball, side treadle relay 83 is energized and locks itself in via a set of normally open contacts 85. Depending on what combination of switches 57, 58 were closed, a predetermined pinfall count will be indicated by illuminated numerals and in addition, after a short time delay, the ball counter relay 86 will be energized via either normally open contacts 87 of the first ball, center treadle relay 81 or normally open contacts 88 of the first ball, side treadle relay 83. The aforementioned time delay is controlled by a series resistor 89 and a shunt capacitor 90 in the ball counter relay 86 coil circuit. The time delay is made long enough that even a slowly rolled ball will have left the treadle 52, 53 before the ball counter relay 86 pulls in to set up the circuits for the arrival of the second ball. After the ball counter relay 86 has pulled in, if the next ball thrown depresses the center treadle 52, momentary closure of the center treadle switch 57 will result in energization of the second ball, center treadle relay 91 which locks itself in; similarly if the second ball depresses a side treadle 53, momentary closure of a side treadle switch 58 will result in energization of the second ball, side treadle relay 92 which locks itself in. It can be seen by examination of the circuit schematic of FIG. 9 that the various possible combinations of energized and deenergized treadle relays 81, 83, 91, 92 results in readout of various frame pinfall counts. In particular, the follow-

ing combinations of treadles depressed will produce the indicated frame pinfall readout where C represents a center treadle depressed, S represents a side treadle depressed and CS represents both a center and side treadle depressed simultaneously: Readout after first ball—C-10; CS-6; S-4. Readout after both balls—CS, C-10; CS, CS-8; CS, S-6; SC-10; S, CS-6; S, S-4. The preceding summary of frame pinfall count as a function of miss distance is generally representative of the results to be expected in an actual game employing the spot bowling technique on a standard bowling alley as well as for a practice game with the present invention. When bowling a practice game with the described apparatus, whenever a bowler finishes a frame, that is after the first ball when it is a strike, otherwise after the second ball, he records his frame pinfall count on a scoresheet on the scoring console 32 and then presses the rerack button 79 which returns the readout to 0 in preparation for the next frame.

I claim:

1. In bowling apparatus, the combination of a sub-standard length alley separated from an approach by a foul line, a target placed in the immediate vicinity of the alley surface at substantially the same distance past the foul line as the marker spots are placed on a standard alley, means to sense the miss distance between target centerline and the centerline of the path of a ball rolled over the alley, such means including a plurality of actuation zones giving different outputs, additional means responsive to said sensing means to provide a hypothetical pinfall indication including an indication of zero, an indication equivalent to ten and at least one intermediate value substantially equivalent to that which would be obtained for the same miss distance on a standard alley between the ball path centerline and the centerline of a correctly selected marker spot target.

2. In bowling apparatus, the combination of a sub-standard length alley separated from an approach by a foul line, a target placed in the immediate vicinity of the alley surface at substantially the same distance past the foul line as the marker spots are placed on a standard alley, means to sense the miss distance between target centerline and the centerline of the path of a ball rolled over the alley, a ball counter element, and additional means to produce a hypothetical pinfall indication which for a first ball of a normally allotted pair depends solely on miss distance between target centerline and first ball path centerline, but for any required second ball of a normally allotted pair depends on the miss distance between target centerline and second ball path centerline in addition to the results achieved with the first ball.

3. Apparatus as set forth in claim 1, in which the means for sensing miss distance and for producing a hypothetical pinfall indication include a central element aligned with the target and actuable by the ball, means operable through the action of said central element to respond to passage of the ball in the actuation area of said central element, a plurality of side elements disposed to both sides of the central element and actuable by the ball, means operable through the action of the individual side elements to respond to the passage of the ball in the actuation areas of the individual side elements, and logic elements capable of determining a hypothetical pinfall count in accordance with the responses of the

aforementioned means responsive to the passage of the ball in the actuation areas of the individual central and side elements.

4. Apparatus as set forth in claim 2 in which the means for sensing miss distance and for producing a hypothetical pinfall count include a central element aligned with the target and actuable by the ball, means operable through the action of said central element to respond to passage of the ball in the actuation area of the central element, a plurality of side elements disposed to both sides of the central element and actuable by the ball, means operable through the action of the individual side elements to respond to the passage of the ball in the actuation areas of the individual side elements, a ball counter element actuable by the first response of any of the aforementioned responsive means, and logic elements capable of determining a hypothetical pinfall count in accordance with the disposition of the ball counter element and with the responses of the aforementioned means responsive to the passage of a ball in the actuation areas of the individual central and side elements.

5. Apparatus as set forth in claim 4 in which the ball counting element is a bistable device whose operation is delayed by time delay means to permit a ball with the minimum expected velocity to leave the actuation area before the logic elements become responsive to the arrival of the second ball.

6. In bowling ball sensing apparatus, the combination of a target, means to sense the miss distance between the target centerline and ball path centerline, and additional means actuable by the ball which deactivates the miss distance sensor while the ball passes in a direction opposite from the normal direction.

7. Apparatus as set forth in claim 1 in which the target and miss distance sensing means are transversely movable to enable practicing with the target located at a multiplicity of positions laterally on the alley.

8. In bowling apparatus, the combination of an alley, a target and miss distance sensor in the immediate vicinity of the alley surface, energy absorption means in the path of the ball past the target capable of returning a fraction of the ball's original energy to the ball after absorbing its forward momentum to yield a reverse rolling ball, and means actuable by the ball to inhibit the response of the miss distance sensor to the reverse rolling ball.

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200—61.11; 273—48, 54