Nov. 24, 1964 A. L. KEMP 3,158,371

APPARATUS INCLUDING A RECIPROCABLE PIN SENSING MEMBER FOR USE IN DETECTING PINFALL IN A BOWLING GAME

Filed March 14, 1962 3 Sheets-Sheet 1

Fig. 1.

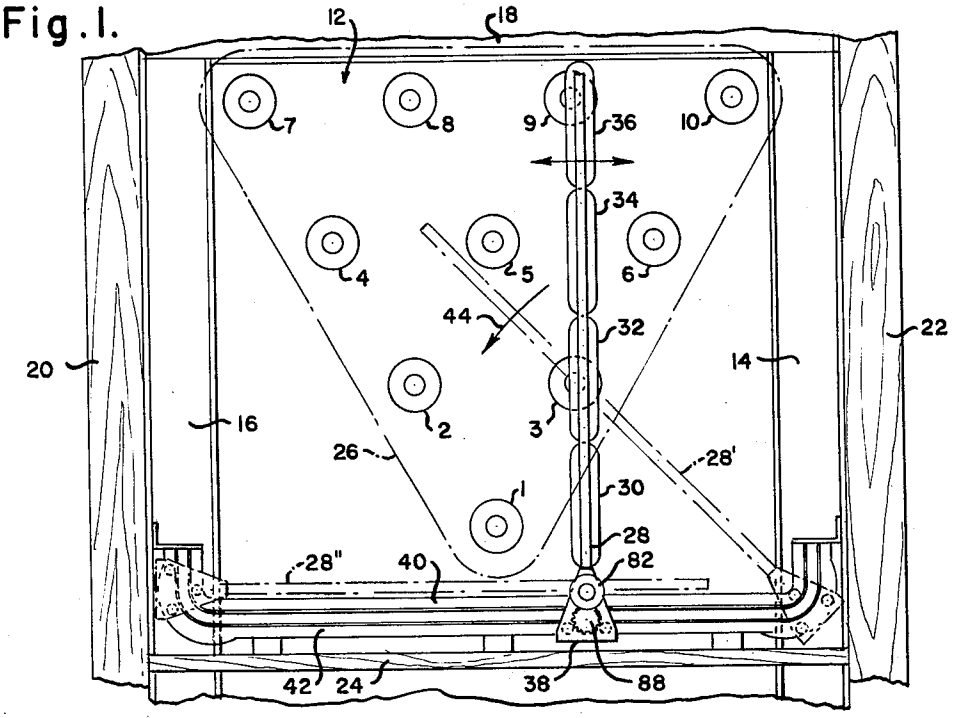
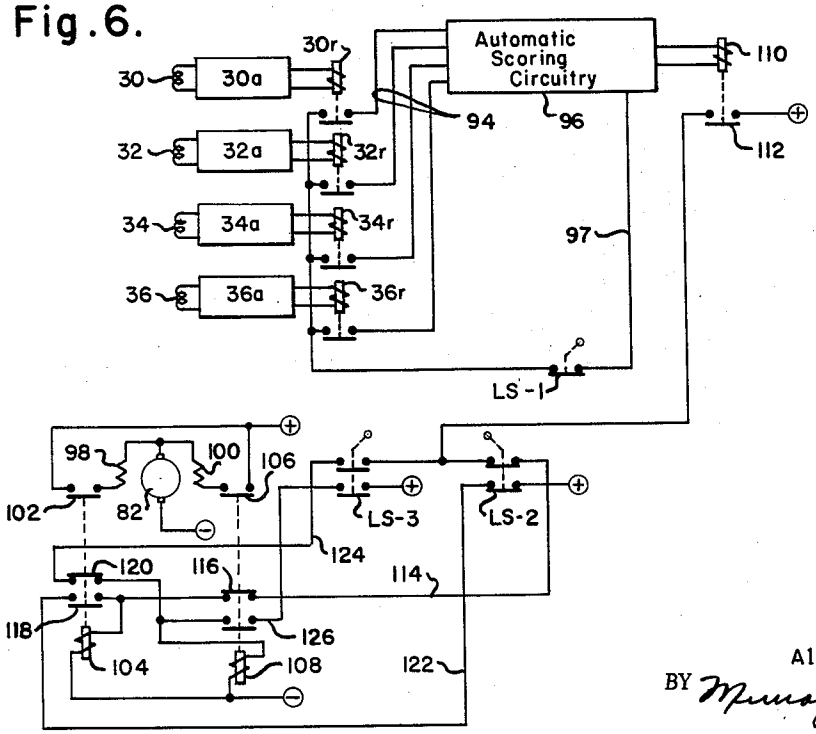


Fig. 6.



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Filed March 14, 1962 3 Sheets-Sheet 2

Fig. 2.

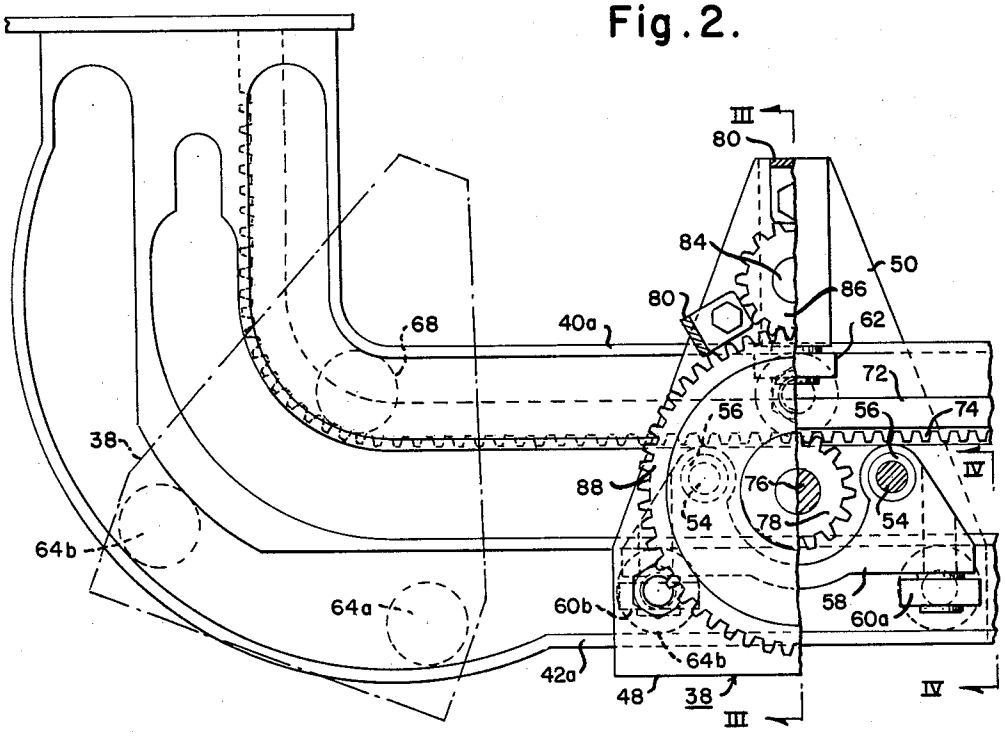
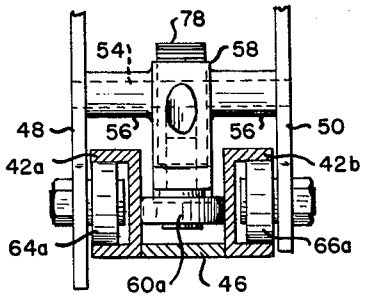


Fig. 4.



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Filed March 14, 1962 3 Sheets-Sheet 3

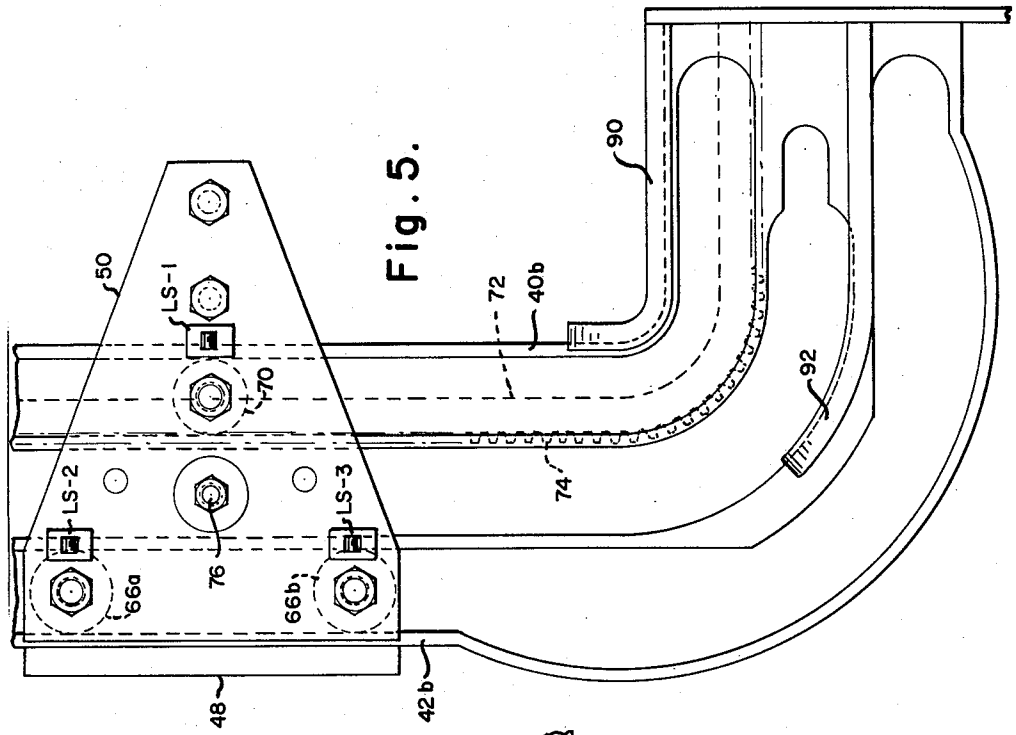


Fig. 5.

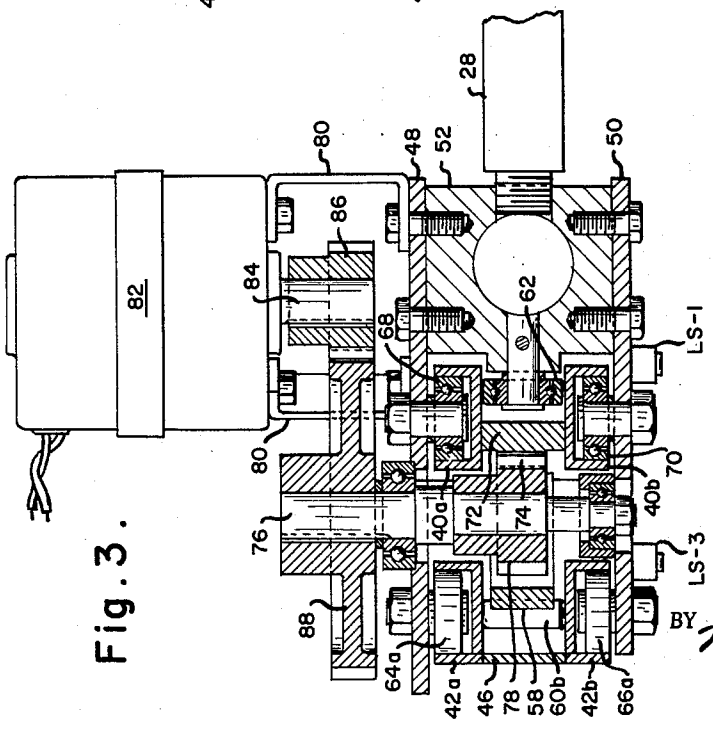


Fig. 3.

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United States Patent Office 3,158,371 Patented Nov. 24, 1964

3,158,371

APPARATUS INCLUDING A RECIPROCABLE PIN SENSING MEMBER FOR USE IN DETECTING PINFALL IN A BOWLING GAME

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Filed Mar. 14, 1962, Ser. No. 179,667
6 Claims. (Cl. 273—54)

This invention relates to apparatus for automatically detecting the number of standing pins remaining after each ball is delivered in a bowling game, the remaining pins being detected by passing electromagnetic coil means over permanent magnets imbedded in the ends of standing pins. More particularly, the invention relates to apparatus of the type described for moving the electromagnetic coil means over the tops of standing bowling pins without interfering with the operation of an automatic pin-spotter used to set the pins.

Although not limited thereto, the present invention is particularly adapted for use with an automatic scoring and totalizing system for a bowling game such as that shown in our copending application Serial No. 175,865, filed February 9, 1962, now U.S. Patent No. 3,124,355, issued March 10, 1964, or Millman et al. Patent No. 2,590,444, issued March 25, 1952. In such systems it is first necessary, in order to score or totalize the game, to obtain an accurate indication of the pinfall after each ball in the game is delivered. Various systems have heretofore been proposed for automatically detecting pinfall; however, all are subject to malfunctioning or are unreliable for one reason or another. For example, one such system heretofore proposed calls for limit switches on the gripper arms or clamps of an automatic pin-spotting machine, the idea being that if a pin is knocked down after a ball is rolled, the gripper arms for that pin will completely close when the pin-spotter recycles, thereby closing or opening a number of limit switches corresponding to the number of fallen pins. The difficulty with this method, however, is that certain ones of the pins may slide on the alley from their correctly spotted positions and still remain standing with the result that the pin-spotter may fail to grip a standing pin; or, if two pins abut each other, the pin-spotter may pick up one pin while knocking down the second. For the foregoing reasons, the use of switches on the pin-spotter is unsatisfactory for an accurate and fail-proof method for detecting pinfall.

In copending application Serial No. 134,809, filed September 7, 1961, and assigned to the assignees of the present application, there is disclosed a pinfall detecting apparatus wherein the number of pins knocked down by each ball is determined by first producing a number of electrical impulses corresponding to the number of pins left standing, and thereafter using these impulses to produce a number of signals equal to ten minus the number of aforesaid impulses. This can be accomplished by providing means in the top or bottom of each pin which can be detected electrically by a proximity device movable along a horizontal plane slightly above the tops or below the bottoms of standing pins and adapted to produce an impulse by passing over the top or under the bottom of any standing pin. The means in the top or bottom of each pin may comprise a permanent magnet, and the proximity device may comprise an electrical coil assembly, the arrangement being such that the coil assembly will cut through the lines of flux produced by the permanent magnets whereby a current impulse is induced in the coil assembly each time it passes over or under a standing pin. The permanent magnets of fallen pins, however, cannot affect the coil assembly and, hence,

will not produce current impulses. By using the current impulses in circuitry including stepping switches and relays, a number of electrical signals can be obtained equal to ten minus the number of current impulses produced by the coil assembly, these signals being equal in number to the number of fallen pins.

In attempting to pass a coil assembly over the tops of the pins when an automatic pin-spotter is employed, problems are encountered due to the fact that the pin-spotter and its associated actuating mechanism oftentimes fills almost the entire cross section of the alley above the pin deck. Consequently, it is difficult to provide means which will support the coil assembly for transverse movement across the pins when the pin-spotter is raised and which, at the same time, will be out of the path of the pin-spotter when it is lowered to set the pins. For example, if an attempt is made to traverse the coil assembly across the tops of the pins on guideways located behind and ahead of the pin-spotter, problems are encountered in supporting the guideway at the rear of the pin-spotter because of the extensive mechanism located in this area. In addition, even if the coil assembly is moved over into abutting relationship with the kickback plates at opposite sides of the alley when it is not in use, it will still be in the path of the pin-spotter mechanism which moves downwardly when pins are spotted. Accordingly, if the coil assembly is to be swept across the tops of the pins when a pin-spotter is used, some means must be provided for moving the coil assembly out of the path of the pin-spotter and its associated mechanism when the pin-spotter is not in use.

As an overall object, the present invention seeks to provide apparatus for sweeping a coil assembly or the like across the tops of bowling pins, which apparatus does not interfere with the normal operation of a pin-spotter used to set the pins.

More specifically, an object of the invention is to provide means for sweeping a coil assembly transversely across the tops of bowling pins with the coil assembly being parallel to the long transverse dimension of the alley as it sweeps across the pins on the alley, and for thereafter automatically rotating said coil assembly into a storage position where it is perpendicular to the long transverse dimension of the alley and out of the path of a pin-spotter used to set the pins.

In accordance with the invention, there is provided a guideway beyond the forward end of the pin-spotter extending transversely of the alley, a carriage reciprocable on the guideway, and means for suspending the coil assembly on the carriage in cantilever beam relationship. At opposite ends of the guideway adjacent the bowling alley kickbacks are curved portions each forming substantially the quadrant of a circle and bent toward the trailing or pin end of the alley whereby the coil assembly will be rotated into a position perpendicular to the alley when it reaches the opposite ends of the guideway. In this manner, the coil assembly, in moving from one end of the track structure to the other, will first be rotated from a position where it lies transverse to the alley ahead of the pin-spotter to a position where it is parallel to the alley and beneath the pin-spotter at one side thereof, then across the alley beneath the pin-spotter, and finally rotated at the opposite end of the track structure into a position where it is again perpendicular to the alley and out of the path of the pin-spotter.

The above and other objects and features of the invention will become apparent from the following detailed description taken in connection with the accompanying drawings which form a part of this specification, and in which:

FIGURE 1 is a top view of a bowling alley pin deck

incorporating the pinfall detecting means of the present invention;

FIG. 2 is a partially broken-away detailed top view of the carriage for traversing electromagnetic coils across the tops of the pins shown in FIG. 1;

FIG. 3 is a cross-sectional view taken substantially along line III—III of FIG. 2;

FIG. 4 is an end view of the apparatus of FIG. 2 taken along line IV—IV of FIG. 2;

FIG. 5 is a bottom view of the apparatus shown in FIG. 2 illustrating the arrangement of limit switches on the traversing carriage for controlling its operation; and

FIG. 6 is a schematic circuit diagram of one type of electrical control system for the carriage shown in FIGS. 1, 2 and 5.

Referring now to FIG. 1, the usual bowling alley is shown having a pin deck 12 with ten pins positioned thereon in the usual triangular configuration and numbered 1 through 10. On either side of the pin deck 12 are two gutters 14 and 16, while behind the pin deck 12 is a pit 18. On either side of the pin deck 12 are kickbacks 20 and 22 which serve, among other things, to separate adjacent bowling alleys. Extending between the kickbacks 20 and 22 is a facing board 24 which, in accordance with the usual bowling alley construction, covers an automatic pin-spotter and its associated mechanism in its raised position, but it does not extend down far enough toward the alley to obstruct the view of pins positioned thereon.

The outline of the main portion of the pin-spotter is indicated at 26. Associated with the main portion 26 is a sweep arm (not shown) which is carried on mechanisms extending over the gutters 12 and 14. The sweep arm serves to clear the pin deck 12 of bowling pins which have been knocked down. In addition, behind the main portion 26 of the pin-spotter is an extensive amount of apparatus (also not shown) for collecting and positioning the pins. Almost the entire area above the pin deck 12 is occupied by the pin-spotter proper and its associated mechanism, this mechanism being lowered during a pin-spotting operation; and as was mentioned above, the pin-spotter not only fills the entire cross section of the pin deck 12, but also it covers the gutters 12 and 14.

Adapted to pass over the tops of the pins and beneath the pin-spotter in its raised position is a bar 28 which forms a core for four electromagnetic coils 30, 32, 34 and 36 spaced along its length. In accordance with the teachings of the aforesaid copending application Serial No. 134,809, filed September 7, 1961, permanent magnets are imbedded in the tops of each of the pins 1–10, the arrangement being such that as the coils 30–36 sweep across the pins, a pulse will be induced in one of the coils for each standing pin, but not for fallen pins. If it is assumed, for example, that the first ball in a frame has been delivered and that four pins have been knocked down, six pins will remain standing with the result that the coils 30–36 will produce six electrical pulses which are subtracted from ten in circuitry such as that shown in the aforesaid U.S. Patent No. 3,124,355, to produce an indication of the number of fallen pins.

From a consideration of the triangular configuration of pins shown in FIG. 1, the necessity for a plurality of coils on the bar 28 will be understood. That is, it can be seen from FIG. 1 that the number 1 pin is directly in front of the number 5 pin. Similarly the number 2 pin is directly in front of the number 8 pin, and the number 3 pin is directly in front of the number 9 pin. If a single coil were swept across the tops of the pins, a single current impulse would be induced in the coil for both of the pins 2 and 8, both of the pins 1 and 5, and both of the pins 3 and 9, meaning that if all pins were standing, only seven current impulses would be produced by the single coil; whereas it is desired to produce ten impulses. With the arrangement of the coils shown in FIG. 1, however, none of the pins covered by any one coil are aligned with other pins covered by that same coil so that the cumulative number of impulses produced by the four coils will always be ten, assuming that all of the pins are left standing. Of course, if certain ones of the pins are knocked down after a ball is delivered, only the cumulative number of impulses corresponding to the number of pins left standing will be produced by the coils. Furthermore, even though certain ones of the pins may slide on the deck to positions where they are directly in front of other pins, the correct number of impulses will always be produced. This is more fully explained in the aforesaid copending application Serial No. 134,809, filed September 7, 1961.

The present invention is primarily concerned with means for sweeping the bar 28 and the coils 30–36 carried thereby transversely across the pin deck. As was mentioned above, extensive mechanism for the pin-spotter is carried over the pit 18, and also covers the gutters 12 and 14. Consequently, although a rail or guideway may be suspended transversely of the alley in front of the pin-spotter, it is exceedingly difficult to find space for suspending a second guideway behind the pin-spotter. Furthermore, even if rails or guideways at the forward and trailing ends of the pin-spotter could be provided, no space is available for storage of the bar 28 and its coils 30–36 when the pin-spotter is lowered, even if the bar be positioned immediately adjacent the kickback 20 or 22.

In accordance with the present invention, the bar 28 and the coils carried thereby are suspended from a carriage 38 in cantilever beam relationship, this carriage 38 being movable along guideways or tracks 40 and 42 both located at the forward end of the pin-spotter and carried on the facing board 24. As shown, the opposite ends of the guideways 40 and 42 form substantially quadrants of a circle, the arrangement being such that as the carriage 38 and the bar 28 carried thereby traverse the main portion of the guideways 40 and 42 between their curved portions, the bar 28 will extend parallel to the bowling alley and sweep transversely across the pins. When, however, the carriage 38 reaches the curved portion at the right end of the guideways 40 and 42 as viewed in FIG. 1, for example, the bar 28 will be rotated in a counterclockwise direction as indicated by the arrow 44 and the dotted outline of the bar 28'. Continued movement of the carriage 38 around the curved portions of the guideways 40 and 42 will cause the bar 28 to assume a position wherein it is perpendicular to the long transverse dimension of the bowling alley as indicated by the dotted outline 28'' (the carriage and bar now being at the opposite ends of the guideways for the case assumed). In this position, it will be noted that the bar 28 and the coils carried thereby are out of the path of the pin-spotter such that the pin-spotter is free to cycle and be lowered downwardly toward the pin deck. After the pins are spotted and a ball is delivered, however, the carriage 38 may be traversed from one side of the guideways 40 and 42 to the other, in which process the bar 28 and coils carried thereby are first rotated from the position indicated by the dotted outline 28'' to a position where they are parallel to the long transverse dimension of the alley, then transversely across the alley, and finally rotated at the opposite ends of the guideways 40 and 42 into a position where the bar 28 and the coils carried thereby are again perpendicular to the long transverse dimension of the alley and out of the path of the pin-spotter preparatory to a succeeding cycle of operation of the pin-spotter. All of this is accomplished while supporting the bar 28 at one end only in cantilever beam relationship and at the same time moving the bar completely out of the path of travel of the pin-spotter after the pins 1–10 have been scanned.

Referring now to FIGS. 2, 3 and 4, it will be seen that the one guideway 42 includes an upper guideway 42*a* and a lower guideway 42*b* interconnected by means of

member 46 which is welded or otherwise securely fastened to the two guideways and also fastened to the facing board 24 shown in FIG. 1. In a similar manner, the guideway 40 includes an upper guideway 40*a* and a lower guideway 40*b*. The carriage 38 includes upper and lower plates 48 and 50 which, as best shown in FIGS. 3 and 4, are interconnected by means of a spacing block 52 (FIG. 3) at the forward end of the plates, and by means of dowels 54 (FIGS. 2 and 4) at the central portion of the carriage 38. Carried between tubular spacers 56 on the dowels 54 (FIGS. 2 and 4) is a member 58 which supports a pair of rollers 60*a* and 60*b*, which rollers are rotatable about horizontal axes and movable in the space between guideways 42*a* and 42*b* as shown in FIGS. 2 and 3. In a somewhat similar manner, a single roller 62 is carried by the spacing block 52 at the forward end of the carriage, which roller 62 is also rotatable about a horizontal axis and movable between the spaced guideways 40*a* and 40*b*. Carried on the plate 48 are a pair of rollers 64*a* and 64*b* movable within the upwardly extending flanges of the guideway 42*a*. Similarly, a pair of rollers 66*a* and 66*b* (FIG. 5) are provided for movement between the downwardly extending flanges of guideway 42*b*. At the forward end of the carriage 38 are similar rollers 68 and 70 carried on the plates 48 and 50, respectively, and adapted for movement within the upwardly extending flanges of guideway 40*a* and the downwardly extending flanges of guideway 40*b*, respectively. As shown in FIG. 3, the bar 28 is threaded into an opening provided in the spacing block 52, however, any other suitable means may be employed for suspending the bar on the carriage in cantilever beam relationship.

Interconnecting the guideways 40*a* and 40*b* is a stationary bar 72 (FIGS. 2 and 3) having a gear rack 74 formed on its one edge. As can be seen in FIG. 2, the gear rack 74 extends throughout the entire length of the guideways 40 and 42 as well as the curved portions at the opposite ends thereof. Carried in bearings supported on the plates 48 and 50 is a vertical shaft 76. Keyed to the shaft 76 is gear 78 which meshes with the gear rack 74, the arrangement being such that as the gear 78 rotates in one direction, the carriage 38 will be caused to traverse the guideways in one direction; whereas rotation of the gear in the opposite direction will cause the carriage 38 to traverse the guideways 40 and 42 in the opposite direction.

Carried above the plate 48 on brackets 80 is an electric motor 82 having a downwardly depending shaft 84. Keyed to the shaft 84 is a pinion gear 86 which meshes with a gear 88 keyed to the top of shaft 76 such that as the motor 82 rotates, the gears 86 and 88 will also rotate to, in turn, rotate the gear 78 and cause the carriage 38 to be traversed on track structures or guideways 40 and 42.

With reference now to FIG. 2, it will be noted that, as shown by the dotted outline, the carriage 38 will move around the curved portion at the end of guideways 40*a* and 42*a* with the gear 78 engaging the rack 74, this rack also forming the quadrant of a circle in this area. The outside flange of the guideway 42*a* is flared outwardly as shown in order to permit the rollers 64 to move outwardly as the carriage and the bar carried thereby are rotated from a position extending parallel to the long transverse dimension of the alley to a position perpendicular thereto.

In FIG. 5 is will be noted that the lower guideways 40*b* and 42*b* are identical to guideways 40*a* and 42*a* shown in FIG. 2 whereby the carriage 38 will be caused to rotate through an arcuate path of travel. Three limit switches LS–1, LS–2 and LS–3 are provided on the bottom plate 50 of the carriage 38. The limit switch LS–1 is adapted to engage a cam surface 90 at each end of the guideways 40 and 42 (only one cam surface being shown in FIG. 5). The positioning of the cam surface 90 is such that the limit switch LS–1 will be engaged to open its normally closed contacts just before the carriage 38 and the bar 28 carried thereby begin their arcuate path of travel at either end of the guideways. The limit switch LS–3, on the other hand, is adapted to engage a cam surface 92 which extends over a portion of the arcuate section of guideways 40 and 42. With reference to FIG. 5, it will be noted that the limit switch LS–3 will be contacted by cam surface 92 when carriage 38 reaches the curved portion at one end of the guideways and begins its arcuate path of travel. The cam surface 92 at this end of the guideways, however, will not engage the limit switch LS–2. The limit switch LS–2, on the other hand, will be engaged by a corresponding cam surface 92 on the opposite end of the guideways 40 and 42; however, this second cam surface will never engage the limit switch LS–3.

The limit switches LS–1, LS–2 and LS–3 are employed to control the operation of the apparatus, a suitable circuit for so controlling the apparatus being shown in FIG. 6. With reference to FIG. 6, the coils 30, 32, 34 and 36 are each connected to an amplifier 30*a*, 32*a*, 34*a* and 36*a*, respectively. The outputs of the amplifiers 30*a*–36*a* are, in turn, connected to relays 30*r*–36*r*, each having a pair of normally open contacts thereon. With the arrangement shown, each relay 30*r*–36*r* will be energized to momentarily close its contacts when a pulse is induced in its associated coil 30–36. If, for example, the number 1 pin is standing while the bar 28 is swept across the top of the pin deck, a pulse will be induced in coil 30 to energize relay 30*r* once; if one pin is standing in the second row of pins, relay 32*r* will be energized once, if three pins are standing in the third row, relay 34*r* will be energized three times, and if two pins remain standing in the fourth row, relay 36*r* will be energized four times. The resulting pulses on leads 94 are applied to automatic scoring circuitry 96 such as that shown in the aforesaid U.S. Patent No. 3,124,355; however, before the leads 94 can be energized, the limit switch LS–1 must be closed to complete a circuit from the other sides of the relay contacts back to the automatic scoring circuitry 96 through lead 97.

The necessity for limit switch LS–1 will become apparent when it is considered that a pulse will be induced in the coils each time they sweep across the top of a standing pin. In other words, if limit switch LS–1 were not provided, pulses would be induced in the coils during the arcuate path of travel of the bar 28 at opposite ends of the guideways 40 and 42 as well as during transverse movement of the bar 28 across the pin deck. Thus, in the absence of the limit switch LS–1, a false indication of the number of standing pins would be obtained since certain of the pins would be counted three different times: First, when the bar is swung outwardly over the pin deck, secondly, as it sweeps transversely across the pin deck, and lastly, when it is rotated back to its perpendicular position at the other end of the guideways 40 and 42. By providing the limit switch LS–1, however, pulses cannot be applied to the automatic scoring circuitry during the arcuate travel of the bar 28 at the opposite ends of the guideways 40 and 42, thereby insuring that a single pulse will be induced in the coils for each standing pin.

One type of control system for the motor 82 is shown in FIG. 6. For the particular embodiment of the invention shown, the motor 82 comprises a reversible direct current motor having two windings 98 and 100 thereon. The winding 98 is adapted for connection to a source of positive voltage to energize motor 82 and rotate it in one direction when contacts 102 of control relay 104 are closed. Similarly, the winding 100 is adapted to be energized to rotate the motor 82 in the opposite direction when contacts 106 of control relay 108 are closed.

Connected to the automatic scoring circuitry 96 is a relay 110 which is energized to close its contacts 112 after each ball is delivered in a bowling game. The manner

in which the relay 110 is energized will be understood by reference to the aforesaid U.S. Patent No. 3,124,355. Specifically, it will be seen by reference to that patent that the relay 110 may be energized each time the timer motor of the automatic scoring circuitry 96 cycles, this occurring after the rolling or delivery of each ball in a game. Let us assume, for example, that the carriage 38 is in its extreme left-hand position as viewed in FIG. 1. Under these circumstances, limit switch LS–3 will be open while limit switch LS–2 will be closed. Consequently, a circuit is now completed through contacts 112 on relay 110 and contacts on limit switch LS–2 to lead 114 which, in turn, is connected through normally closed contacts 116 on relay 108 to the energizing coil for relay 104, thereby momentarily energizing this relay to close its contacts 102 and 118 while opening its contacts 120. When contacts 118 are closed, a holding circuit is provided for the relay 104 through the contacts 118, lead 122 and a second set of contacts on limit switch LS–2, which are now closed, to a source of positive voltage. Thus, once an initial pulse is received on lead 114 in response to energization of relay 110, the relay 104 will pull in and will remain energized until limit switch LS–2 is opened. When relay 104 is energized in this manner, its contacts 102 close to cause the motor 82 to rotate in one direction to traverse the carriage 38 from left to right as viewed in FIG. 1. The motor 82 will remain energized to rotate in a direction to cause the carriage to traverse from left to right until the limit switch LS–2 opens, and this occurs when the carriage 38 reaches the right end of guideways 40 and 42 such that limit switch LS–2 will contact the cam surface 92 at the right end of the guideways. Actually, the limit switch LS–2 will be opened by contacting the cam surface 92 before the carriage 38 reaches its extreme limit of travel, however, the arrangement is such that when the limit switch LS–2 opens, the carriage 38 and the bar 28 carried thereby will have enough momentum to cause them to swing into a position where the bar is perpendicular to the alley and out of the path of the pin-spotter mechanism.

When the relay 104 was initially energized with the carriage 38 at the left end of the guideways as viewed in FIG. 1, the limit switch LS–3 was open due to the fact that it was engaged by the cam surface 92 at the left end of the guideways. Consequently, since the limit switch LS–3 was open at this time, the relay 108 could not be energized. Furthermore, when limit switch LS–3 opened upon passage over the cam surface 92, the relay 104 was already energized to open its contacts 120 and thereby prevent energization of relay 108.

When the carriage 38 is at the right end of the tracks or guideways 40 and 42, however, the situation is reversed with limit switch LS–3 being closed and limit switch LS–2 being open. Consequently, when relay 110 is energized upon delivery of the next ball, the relay 108 will be energized through contacts on limit switch LS–3, lead 124 and contacts 120 on relay 104, which are now closed since this relay is not energized. When relay 108 is thus energized, it will be held energized upon closure of its contacts 126 in much the same manner as the relay 104 was held energized. In addition, when relay 108 is energized, it closes its contacts 106 to cause the motor 82 to rotate in the opposite direction whereby the carriage 38 will be caused to traverse the guideways 40 and 42 from right to left as viewed in FIG. 1. This action will continue until the carriage reaches its extreme left position, whereupon limit switch LS–3 will open to break the circuit to relay 108 and complete the cycle.

Although the invention has been shown in connection with a certain specific embodiment, it will be readily apparent to those skilled in the art that various changes in form and arrangement of parts may be made to suit requirements without departing from the spirit and scope of the invention.

I claim as my invention:

1. Apparatus for passing a standing-pin sensing member over the tops of bowling pins on a bowling alley pin deck with the sensing member extending parallel to the long dimension of the alley as it passes over the pins, and for automatically pivoting said sensing member inwardly into a position perpendicular to the long dimension of the alley when the sensing member reaches an edge of the alley in its pass thereacross comprising, in combination, track means having a straight portion extending transversely across the alley at one end of the pin deck and having curved portions at its opposite ends bent toward the other end of the pin deck, a carriage reciprocable on said track means, and a standing-pin sensing member supported on the carriage above said bowling pins, the arrangement being such that when the carriage moves across the straight portion of the guideway, the sensing member will extend parallel to the long dimension of the alley, whereas when the carriage reaches each curved portion, the sensing member will be rotated into a position wherein it extends transverse to the alley.

2. Apparatus for passing a standing-pin sensing member over the tops of bowling pins on a bowling alley pin deck with the sensing member extending parallel to the long dimension of the alley as it passes over the pins, and for automatically pivoting said sensing member inwardly into a position perpendicular to the long dimension of the alley when it reaches an edge of the alley in its pass thereacross comprising, in combination, track means having a straight portion extending transversely across the forward edge of the pin deck and having curved portions at its opposite ends each forming substantially a quadrant of a circle and bent toward the trailing end of the alley, a carriage reciprocable on said track means, and a standing-pin sensing member supported on the carriage in cantilever beam relationship above said bowling pins, the arrangement being such that when the carriage moves across the straight portion of the track means, the sensing member will extend parallel to the long dimension of the alley; whereas when the sensing member reaches each said curved portion of the track means it will be rotated inwardly into a position wherein it extends perpendicular to the long dimension of the alley.

3. Apparatus for passing a standing-pin sensing member over the tops of bowling pins on a bowling alley pin deck with the sensing member extending parallel to the long dimension of the alley as it passes over the pins, and for automatically pivoting said sensing member inwardly into a position perpendicular to the long dimension of the alley when it reaches an edge of the alley in its pass thereacross comprising, in combination, track means having a straight portion extending transversely across the alley and having curved portions at its opposite ends each forming substantially a quadrant of a circle and bent toward the trailing end of the alley, a gear rack extending parallel to said track means and adjacent thereto, said gear rack also having a straight portion extending transversely across the alley and having curved portions at its opposite ends each forming substantially a quadrant of a circle and bent toward the trailing end of the alley, a carriage reciprocable on said track means, gear means on the carriage adapted to engage said gear rack, motor means on the carriage for rotating said gear means whereby the carriage will be caused to traverse the track means when the motor means rotates the gear means, and a standing-pin sensing member supported on the carriage in cantilever beam relationship above said bowling pins, the arrangement being such that when the carriage moves across the straight portion of the track means, the sensing member will extend parallel to the long dimension of the alley, while when the carriage reaches each said curved portion, the sensing member will be rotated inwardly into a position extending perpendicular to the long dimension of the alley.

4. Apparatus for sweeping a standing-pin sensing mem-

ber over the tops of bowling pins on a bowling alley pin deck with the sensing member extending parallel to the long dimension of the alley as it passes over the pins, and for automatically pivoting said sensing member inwardly into a position perpendicular to the long dimension of the alley when it reaches an edge of the alley in its pass thereacross comprising, in combination, track means having a straight portion extending transversely across the alley and having curved portions at its opposite ends each forming substantially a quadrant of a circle and bent toward the trailing end of the alley, a carriage reciprocable on said track means, a standing-pin sensing member supported on the carriage in cantilever beam relationship above said bowling pins, motor means for driving said carriage along the track means, and limit switch means for deenergizing said motor means when said carriage reaches each said curved portion and the sensing member is rotated into a position extending transverse to the alley.

5. In bowling apparatus comprising means for sweeping electromagnetic coil means across the tops of bowling pins on a bowling alley pin deck with the coil means extending parallel to the long dimension of the alley as it sweeps across the pins and for automatically pivoting said coil means inwardly into a position perpendicular to the long dimension of the alley when it reaches an edge of the alley in its sweep thereacross; the combination of a plurality of pins, permanent magnet means in the top of each of said pins adapted to produce an electrical pulse in said coil means as it sweeps across the tops of the pins, electrical utilization means adapted to be connected to said coil means, track means having a straight portion extending transversely across the alley and having curved portions at its opposite ends each forming substantially a quadrant of a circle and bent toward an end of the alley, a carriage reciprocable on said track means, means for suspending said coil means on the carriage in cantilever beam relationship, and switch means for disconnecting said coil means from the electrical utilization means at all times except when the coil means extends parallel to the long dimension of the bowling alley.

6. In apparatus for sweeping standing pin detecting elements across the tops of bowling pins positioned on the pin deck of a bowling alley; the improvement comprising an elongated substantially horizontal bar having a plurality of standing pin detecting elements spaced along its length, and apparatus for sweeping said bar and the pin detecting elements carried thereby transversely across the tops of said pins comprising a pair of horizontally-spaced guideways extending across said alley at one end of the pin deck, a carriage reciprocable along said guideways, means for suspending the bar and the detecting elements carried thereby on the carriage in cantilever beam relationship, anti-friction devices on said carriage movable on the respective guideways and arranged to support said carriage such that the weight of the bar and detecting elements carried thereby in cantilever beam relationship will not materially impede movement of the carriage along said guideways, and means including a motor device for causing said carriage to traverse the guideways.

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