BALL LIFTING APPARATUS FOR BOWLING ALLEYS

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This invention relates to ball lifting apparatus for bowling alleys, and more particularly to ball lifting apparatus comprising a ball lifting cage normally carried in an elevated rest position and movable through a cycle comprising lowering the cage to receive a ball and lifting the ball therein to the elevated position where the ball is discharged.

The general object of the invention is to provide an improved mechanism for lifting a bowling ball from adjacent the pit of a bowling alley to an elevated ball return track.

Another object of the invention is to provide a ball lifting cage normally supported in an elevated rest position adjacent the return track, together with means for moving the cage through a cycle comprising lowering the cage to receive a ball from adjacent the pit floor and lifting the cage to discharge the ball at the elevated position.

Another object of the invention is to provide supporting means for the cage which are yieldable to cause the cage to stop in the event it strikes an obstruction during its downward movement without affecting the operation of the cage moving means.

Another object of the invention is to provide a ball supporting cage adjacent the floor of the pit together with means for initiating operation of the cage moving means to lower the cage to receive a ball from the cradle in response to the weight of a ball on the cradle.

Another object is to provide a ball lifting cage having a ball supporting portion which is movable relative to the cage upon engagement with a ball to admit a ball into the cage.

Another object is to provide a ball lifting cage having a side plate for covering substantially the entire area of the opening through which the ball passes from the pit floor to the cage adjacent the pit floor.

Another object is to provide ball lifting apparatus having motion multiplying means for increasing the range of movement of the cage beyond the range of movement of the cage moving means.

Another object of the invention is to provide ball lifting apparatus including a ball lifting cage carried on a pivotally mounted lever arm, together with means for moving the cage through a cycle comprising pivoting the arm in one direction to lower the cage to receive a ball from adjacent the pit floor and pivoting the arm in the other direction to lift the cage to an elevated position.

Another object of the invention is to provide a ball lifting cage supported by means of a flexible cable.

Other objects and advantages will be apparent from the following detailed description taken in connection with the accompanying drawings, in which:

Fig. 1 is a side elevation of the preferred form of apparatus showing the ball elevator in ball discharge position, with parts of the adjacent bowling alleys removed;

Fig. 2 is a view similar to Fig. 1, but showing the ball elevator in ball pick-up position;

Fig. 3 is an end view partially cut away to show the structure of the apparatus;

Fig. 4 is an enlarged fragmentary view of the lower portion of the apparatus of Fig. 3;

Fig. 5 is a top plan view partially cut away to show the structure of the apparatus;

Fig. 6 is an enlarged view of a portion of the apparatus of Fig. 5;

Fig. 7 is an enlarged fragmentary view showing the ball supporting cradle and the ball pick-up means;

Fig. 8 is a side elevation of a modified form of the invention;

Fig. 9 is a rear elevation view of the apparatus of Fig. 8;

Fig. 10 is an enlarged fragmentary side elevation view of the portion of the apparatus of Fig. 8;

Fig. 11 is an enlarged fragmentary side elevation view of a portion of the apparatus of Fig. 9;

Fig. 12 is a horizontal section taken along the line 12-12 of Fig. 8;

Fig. 13 is an enlarged fragmentary side elevation view with the pick-up device in lowered position;

Fig. 14 is a vertical section through the gear box mechanism utilized in both modifications of the invention, the section being taken along the line 14-14 of Fig. 15;

Fig. 15 is a vertical section along the line 15-15 of Fig. 14;

Fig. 16 is a vertical section along the line 16-16 of Fig. 14;

Fig. 17 is a vertical section along the line 17-17 of Figs. 14 and 15.

While the invention is susceptible of embodiment in many different forms, there is shown in the drawings and herein described in detail two specific embodiments, with the understanding that the present disclosure is to be considered as exemplification of the invention and is not intended to limit the invention to the embodiments illustrated. The scope of the invention will be pointed out in the appended claims.

The game of bowling is played upon a smooth ball rollway at the end of which bowling pins are placed in upright position in a prescribed pattern. The player rolls a ball down the rollway with the object of striking the pins to propel both the pins and the ball off the end of the rollway into a pit, from which a pin boy usually lifts the ball and places it on an elevated portion of a ball return track which conveys the ball by gravity back to the player.

One pin boy will generally service two adjacent bowling alleys and there is generally one common ball return track disposed between these alleys. The pit floor is generally sloped forwardly (toward the players' end of the alley) so that the bowling ball and pins will bounce against the kickbacks and the pit cushion, then fall to the pit floor where they will roll to the front of the pit where the pin boy may reach them quickly. This invention provides improved mechanical means for lifting the ball and placing it on the return track for return to the bowler.

Referring now to the drawings, at the rear of a bowling alley ball rollway 1 is a pit having a forwardly sloping floor 2 below the level of the ball rollway 1, back 3 at each side of the pit and a pit cushion (not shown) at the rear of the pit are provided to keep the ball and pins within the confines of the pit. The kickbacks have a cut out portion 4 to facilitate passage of the pin boy between two adjacent pits. A ball return track 5 is provided for each adjacent pair of bowling alleys and during a game of bowling each ball which enters the ball rollway 1, by which is meant a ball which enters the pit after it has been rolled) from either alley is placed upon the rear elevated portion 5a of the return track where it rolls by gravity over the track back to the player at the other end of the bowling alley. The front portion of each kickback 3 is extended upwardly as shown at 7 above the normal level of the kickbacks, and the necessary apparatus for setting the pins (not shown) is generally mounted between the kickbacks on the elevated portion 7 thereof. It will be noted that the floor 2 of the pit is generally sloped forwardly toward the bowling alley rollway 1 so that the pins and bowling ball 6 will naturally roll toward the front of the pit where the pin boy may easily reach them to reset the pins, and to place the ball 6 upon the ball return track 5.

Referring now to the preferred embodiment of the invention disclosed in Figs. 1-7, in each pit wall an opening 9 is provided at one side through the front portion of the kickback adjacent the end of the ball rollway 1, each opening being of a size sufficiently large to admit
a bowling ball therethrough. As shown in Fig. 4 the adjacent kickbacks of two adjacent bowling alleys are each provided with such an opening 9 similarly placed in alignment. A cradle generally designated 8 is mounted in alignment with the openings 9 in the space between the backs 8d, which is about the level of the pit floor 24. One end of the cradle comprises a ball supporting structure 10 carried on a U-shaped bar 11, the rear or base portion of which is mounted for pivotal movement in a bracket 12 which is pivotally connected to the free end of a bowling alley member 21. Each forward end of the bar is turned upwardly to provide a guard as shown at 11a, and those portions of the structure including 11a which come into contact with the bowling ball 6 preferably are covered with rubber or some other yieldable material. A pivotally mounted ball trip lever 13 is provided, this trip lever having an upwardly extending bumper portion 14 for engagement with a ball 6 which rests upon the supporting structure 10. The trip lever 13 is connected to the stem portion 15 of an operating arm which is L-shaped and at its outer or base portion 15a is connected to a cable 16 for a purpose to be hereafter described.

The entire cradle assembly is held against pivotal movement about the bearing surface provided by the bracket 12 by a wing bolt 17 which is threaded thereto and opening in a bracket mounted on the floor between the kickbacks, this structure being best shown in Fig. 7. When desired to clean the cradle it is merely necessary to remove the wing bolt and pivot the entire cradle structure upwardly about the axis provided by the bracket 12.

The members 10 are adapted to receive a ball 6 which passes from either adjacent pit through one of the openings 9. When the ball is deposited on the cradle, it engages the bumper 14 and depresses the bumper and the free end of the trip lever 13, rocking said trip lever about the axis of the stem portion 15 of the operating arm. This causes the stem portion 15 of the operating arm to rotate clockwise (as the parts are shown in Fig. 4) through the action of the member 20, the end 15a and exerting a pull on the cable 16 in order to initiate operation of the device as will later be more fully described.

It will be noted that the bowling ball 6 will normally roll to the front of the pit by reason of the sloping of the pit floor 2 and, from this position the pin boy need only push or kick the ball along the front of the pit through the opening 9 onto the cradle 8. This position of the opening 9 allows the pin boy to place the ball into the opening without having to turn around or hesitate in any manner in giving the ball up.

The bowling ball return device is wholly mounted within the space generally provided between adjacent bowling alleys. One 171 of said device being readily removable to permit access to the top portions of the device arm 23 and to the return track 5. If desired removable extensions (not shown) may be provided to facilitate placing the balls on the track by hand in the event of a machine breakdown. In Figs. 1-7 the ball elevator thereof comprises an arm 17 mounted upon a pivot pin 18 which is supported upon the adjacent kickbacks to provide movement of the arm 17 about the pivot pin 18 in a vertical plane. A ball receiving cage 19 is fixedly mounted on one end of the arm and is movable therewith between the position of the cage and arm shown in Fig. 2 (characterized as a ball pick-up position) and the position shown in Fig. 1 (characterized as a ball discharge position) of the opposite side of the pivot 18 and has a counter-balancing weight 20 movably attached thereto by a set screw 20a. In operation the weight is so adjusted that the arm 17, cage 19 and arm 20 are substantially level with the pivot 18, with the cage slightly overbalancing the weight 20 so that the cage and attached arm always exert a slightly downwardly directed force about the pivot 18. The side plates 24, 25 are provided at both the top and bottom. A plate 22 is provided at the front of the cage to which the arm 17 is attached. A stationary ball supporting member 23 is provided at the front of the cage and a movable ball supporting member 24 is mounted in the front of the cage. Both of the members 23 and 24 are covered with some soft material such as leather, rubber or the like to prevent a bowling ball from coming in contact with any metal parts. The member 24 is pivoted in a bearing 25 and moves along its pivot 17 to provide sufficient clearance between the members 23 and 24 to admit a bowling ball. A hook portion 24a of the member 24 limits the pivotal movement of the member by bearing against either the plate 23 or a root of the pit floor 24. When a ball is placed on the support 10 in ball pick-up position, the cage and arm are lowered. The cage goes down over the ball with the supporting member 24 contacting the ball and pivoting upwardly between the adjacent kickbacks as it goes past the plate 22. When the member 24 is in this position, sufficient clearance between the ball supporting members is provided such that the encircling ball is admitted into the cage, the member 24 falls to its lower holding position as shown in Fig. 7, thus closing behind the bowling ball to retain the ball within the cage. The members 23 and 24 then support the bowling ball during the upward movement of the cage. The side plates 21 cover substantially the entire area of the openings 9 when the cage is in its lowered position, thus providing an important safety feature in substantially blocking the opening prior to the power driven upward stroke of the cage. Cutout portions 21a are provided in the lower sides of the plates to permit the cage to descend to its ball receiving position even though a portion of a bowling pin is extending through one of the openings 9. Furthermore, should the pinboy inadvertently have hit a ball in the cage 19, the cutout portion of the cage will prevent injury since the cage will not clamp the hand or foot against the floor. The ball elevator is operated by a motor 26 which is connected to a speed reducing gear mechanism 27 whose details are disclosed in detail herein. Lourners 27a are provided to permit air circulation to keep the gear mechanism cool. A crank 28 is connected to an output shaft 29 of the gear mechanism 27 for driving the cradle support 10 of a vertical plane about the output shaft 29 of the gear box. A link 30 is connected at one end by a pin 31 to the crank 28, and at the other end by means of a pin-and-slot connection 32 to a pivot pin 33 on the arm 17. The lever arm 17 provides for motion multiplication for increasing the range of movement of the cage beyond the range of movement of the ball elevating means. The pin-and-slot connection 32 between the bracket 171 and the link 30 allows the cage to be stopped before it reaches the bottom of its downward movement without stopping the crank 28. Very little force is necessary to stop the cage and arm near the bottom of their movement since the arm, cage and weight are substantially balanced about the pivot 18 as previously described. When the motor 26 and arm 17 is in the position of a bowling ball, the added weight of the ball forces the pin 32a into the lower extremity of the slot 32b. However, the cage and arm are from the top of the slot 32b a distance limited by movement of the pin 32a between the lower and upper extremities of the slot 32b. The slot 32b is of sufficient length to allow the cage to be moved upwardly from the position shown in Fig. 2 to a position wherein the bottom of the cage would rest above the top of the openings 9 without moving the crank 28 or link 30. Thus, should the pin boy have his hand or foot projecting through the openings 9 in the kickbacks at the time the cage is descending, the cage will be stopped in its movement upon contact with the pin boy's limb without injury thereto. This is an important safety feature of the present invention.

The motor 26 and gear mechanism 27 are operable in cycles which provide rotation of the crank 28 through 180° in each cycle. The crank 28 is pivoted upon the arm 17 and trip lever 13 pivots as hereinbefore described, pulling on the cable 16 which is connected to a lever 33 to trip a switch which starts the motor and gear mechanism 27 to provide rotational movement. As shown, the gear mechanism and motor are at rest in the position shown in Fig. 1 wherein the ball elevator is in its raised position adjacent the end of the ball return track. Upon the cage 19 being raised to the position shown in Fig. 1 to the position shown in Fig. 2 where the cage picks up a bowling ball, the cylinder and 180° of rotation of the crank 28 then returns the cradle to the position shown in Fig. 1 where the bowling ball is discharged by gravity onto the return track 5. The gear mechanism 27 is adjustable to provide any desired cycle of move-
The present invention relates to the use of a clutch mechanism in a gear box to control the rotation of the gear block through any number of degrees of rotation. In the preferred embodiment illustrated, the motor and gear mechanism are adjusted to start in the position illustrated and then rotated 90 deg, and stop it in the position in which they started. Each time a ball is deposited upon the cradle the gear mechanism is again activated to move through one cycle (360 deg of rotation of the crank) so that the elevating mechanism is operated automatically whenever a bowling ball is placed in position to be picked up by the ball receiving cage.

In the modification shown in Figs. 8-17, instead of a lever, a member 95 extending longitudinally of the alley between the kickbacks and mounted for limited pivotal movement in a vertical plane. At the forward end of the pipe 50 a rod 51 projects transversely on either side of the pipe, and each opposite end of the rod is provided with a pair of brackets 52 mounted on the floor between the kickbacks to provide a pivot mounting for the pipe. A spring (not shown) connected to the pipe at its rear end biases the rear end of the pipe upwardly, the spring tension being insufficient to support the weight of a bowling ball on the cradle. Opposite the ball openings 9 in the kickbacks a pair of U-shaped arms 53 are mounted on the pipe 50 to form the cradle. As described, the pipe 50 is connected to the gear box to initiate each cycle of operation.

The cradle, as illustrated generally at 55, is formed of two side plates 56 and 57 mounted in spaced relationship between frame members 58 and 59. The plates are each of a size sufficient to cover substantially the entire area of the ball openings 9 in the kickbacks so that when the cage is lowered the openings are blocked. A cutout portion is provided in each side plate as shown at 56a for a place to mount a handle or foot of the pin boy in the path of travel of the cage. This cutout portion also permits the cage to descend far enough to pick up the ball even if a pin project through one of the openings 9, and then the pin is pulled from the pin boy should it inadvertently be placed in the opening 9 in the kickback, although the construction is such that only the weight of the cage will be able to drop it down into the opening in the kickback so that injury to the operator or the equipment is prevented.

There is a ball holding bottom portion which is movable relative to the cage upon engagement with a ball to admit a ball into the cage. This movable portion comprises a generally U-shaped rod 63 at the rear of the cage to hold a rod 64 of the front of the cage. These rods are pivotally mounted in brackets 65, stop lugs limiting the range of pivotal movement between a horizontal ball holding position and a substantially vertical ball admitting position. The stop lugs on the rod 63 is so arranged that gravity causes the rod to fall back to its ball supporting position, while a spring 67 (Fig. 12) biases the rod 64 in horizontal position.

Rollers 60 on the cage engage vertical tracks 61 to provide for vertical movement of the cage. The tracks 61 are rigidly mounted on a backing plate 62 which extends vertically between the kickbacks in a plane transverse of the alleys. A cable 68 has one end attached to a bar 69 mounted between the side plates of the cage 55, the cable passing over a pulley 70 mounted to extend through the opening in the backing plate 62. On the other side of the backing plate a sheave 71 is fixedly mounted and includes two independently rotate pulleys 71a and 71b. Another sheave 75, including three independently rotated pulleys 75a, 75b and 75c, is similarly mounted on a rod 80, a bar 81 holding the sheave 80 against rotation and in a plane parallel to the backing plate. After passing over the pulley 70 the cable 68 passes in succession over the pulleys 71a and 71b. Another sheave 75 and the cable of the end of the cable 90 is connected to a lever 92 mounted on the operating shaft of the clutch for the gear box 27 and extending transversely therefrom. A spring 93 is connected to pivot 94 and is biased by a spring 95 to disengage, while a downward pull on the cable 90 will pivot the lever 93 and rotate the clutch shaft to initiate operation of the cage moving means by the weight of the ball on the cradle.

Means are provided and are adapted to be actuated by the cage for discharging the ball from the cage onto the return track 5. This means comprises a ball discharge member 95 exciting a lever 92 and mounted in fixed relative position in a bracket 97 adjacent the upper position of the cage. As the cage rises the member 96 rides along a bearing surface 98 on the rod 69, pivoting the members 95 and 96 so that the member 95 pushes the ball out of the cage onto the return track 5 as shown in Figs. 8 and 10.

In the operation of the device, when a ball 6 passes through one of the openings 9 in the alleys, the ball is engaged on to the supporting arms 53 of the cradle, the weight of the ball rocks the cradle about the axis of the rod 51, causing a downward pull on the second cable 90, over the pulley 70, thereby rotating the lever 92 to rotate the operating shaft of the gear box clutch so that the clutch becomes engaged and the crank 94, rotates, moving the connecting rod 86 upwardly and moving the slidable sheave 75 and the upwardly sheave 71. The motion multiplying arrangement of the cable causes a six to one multiplication of movement in the apparatus illustrated, a seven inch movement of the sheave 75 resulting in about a 42 inch movement of the cage as the cage descends to a position where the rods 63 and 64 engage the ball. Upon engagement with the ball these rods pivot upwardly admitting the ball into the cage, and as the cage approaches the downward limit of movement the rods 63 and 64 fall under the ball to hold it in the cage. As the one revolution clutch is rotated beyond 180 degrees, the connecting rod 86 and the sheave 75 are moved downwardly, lifting the cage with the ball therein to the normal rest position adjacent the return track. As the cage approaches its normal elevated position the actuating member 96 rides along the bearing surface 98 of the rod 69, clearing the ball 6 from the cage, pivoting the members 95 and 96 so that the member 95 pushes the ball out of the cage on to the return track; after the clutch has completed one revolution it becomes disengaged in a manner later to be described, the motor 26 continuing to operate. In this form of the invention the openings 9 are spaced from the frame and the rollerway, while in the form of Figs. 14-17 the openings 9 are immediately adjacent the end of the rollerway.

The drive mechanism includes the motor 26 and the gear box 27 which will now be described with reference being had to Figs. 14-17. The motor 26 is connected by means of a belt 100 (Figs. 3, 5, 8 and 10) to a pulley 101 on the input shaft 102 of the gear box 27. As illustrated herein the motor is supported in antifriction bearings 103 and 104. Loosely supported on the shaft by means of bushes 105 and 106 is a worm 107. This worm meshes with a worm wheel 108 which is keyed to the output shaft 29. The worm wheel 108 is rotatably supported in the casing by antifriction bearings 109 and 110 on an axis transverse to that of the shaft 102. The outer end of the shaft 29 carries the crank 28 the tenon of which is a splined fit to engage the driven shaft of the clutch mechanism which comprises a coiled clutch spring 111, a portion of which circumscribes a cylindrical clutch face 112 on the worm 107, and the remainder of which circumscribes a cylindrical clutch face 114 on an annular bushing 115 which is secured to the shaft 102, as by a key 116. Externally the spring is surrounded in part by an annular member 117 fixed to the outer end of the shaft 29 and connected at right angles to the collar of the spring and anchored in the slot 121 cut in the adjacent portion of the worm (Figs. 14, 15 and 17). The clutch spring 111 is normally coiled so as to wrap around and engage the clutch surfaces 112 and 114 of the worm portion 113 and the
bushing 115 respectively, and thereby form a clutch between said parts which causes the worm to rotate with the shaft 102. It is possible to release the clutch by engaging a side position of the cam 123 of the clutch spring (Figs. 16 and 17), thus causing the spring to unwind from drive contact with the parts 113 and 115. A braking action for the worm is obtained by the engagement of the parts 117 and 119, respectively, and thereby form a clutch between said parts which causes the worm to rotate with the shaft 102. The arm 124 has an upwardly extending portion 128 which is normally positioned in the path of the end 123 of the clutch spring to unwind it from the parts 113 and 115. The control shaft 125 carries a second arm 129 and a coiled spring 130 is connected intermediate the free end of the arm 129 and an adjustable screw device 131 supported in the casing wall to maintain the arm 124 in the position shown in Figs. 15 and 16.

The arm 129 has a projecting portion 132 (Figs. 14 and 15) which is engageable by a cam 133 secured to the worm 101, and when rotating in a clockwise direction the projection 132 of the arm 129 is momentarily withdrawn from its position in front of the end 123 of the clutch spring. Due to its normal tendency to contract, the clutch spring then engages the parts 113 and 115 and drives the worm 107 with the shaft 102. As soon as the worm rotates sufficiently to rotate the cam 133 in a clockwise direction as shown in Figs. 17, 19, sufficiently to move the circular arcuate path of the cam beyond the range of the support operating means; and means for initiating operation of the support operating means by the weight of a ball on the cradle.

We claim:

1. Apparatus for lifting a bowling ball to an elevated return track disposed between a pair of spaced adjacent bowling alleys, each alley having a pit at the rear end thereof with a side kickback having an opening near the front of the pit through which a bowling ball may roll from the pit floor into the space between the pits, comprising: a ball elevating mechanism operable by a motor, a crank connected to said ball elevating mechanism and rotateable in a vertical plane and a link pivotally connected to said crank and having a pin and slot connection with said arm for moving the arm and cage through said arcuate path upon rotational movement of said crank, said arm and cage being substantially balanced about said pivot; a bowling ball deposited in said crank.

2. Apparatus for lifting a bowling ball to an elevated return track disposed between a pair of spaced adjacent bowling alleys, each alley having a pit at the rear end thereof with a side kickback having an opening near the front of the pit through which a bowling ball may roll from the pit floor into the space between the pits, comprising: a ball elevating mechanism operable by a motor, a crank connected to said ball elevating mechanism and rotateable in a vertical plane and a link pivotally connected to said crank and having a pin and slot connection with said arm for moving the arm and cage through said arcuate path upon rotational movement of said crank, said arm and cage being substantially balanced about said pivot; a bowling ball deposited in said crank.
said crank, said operating means being operable in separately started cycles, said cycles each providing movement of said cage and arm to transfer one bowling ball from said pick-up position with said turn track, and means for starting said operating means upon one cycle including mechanism triggered by the weight of a bowling ball deposited in said crank.

6. Apparatus of the character claimed in claim 5, wherein said crank is pivotally mounted and readily releasable locking means are provided for holding said crank in said bowling ball receiving position, said crank being pivoted to one out of the way position when the locking means are released.

7. An automatic ball return for a bowling alley, comprising:

a. A housing mounted on a base, including a horizontally disposed arm pivotally located between the kickbacks of adjacent bowling alley pits to provide swinging movement of the arm in a vertical plane between a lower position and a raised position, a ball rolling into said arm in said raised position being adapted to be moved operably by said housing to provide swinging movement of the arm in the path of said cage, and operating means for moving said arm and cage to elevate a ball from said pick-up position to the discharge position including, a rotatable crank connected to a power means and a link connecting said crank and arm, said link having a pin and slot connection to the elevated arm and said arm being substantially balanced about said pivot to allow the arm and cage to be stopped readily in their downward movement without stopping said operating means.

8. Apparatus for lifting a bowling ball to an elevated return track disposed between a pair of spaced, adjacent bowling alley, each alley having a pit at the rear end thereof with side kickbacks, comprising: an arm mounted on a pivot supported on adjacent kickbacks, each arm supported by a pivot in a vertical plane about the pivot between a lower ball pick-up position removed from an end of the ball return track and a raised ball discharge position adjacent the end of the ball return track, said cage having a bottom opening through which the ball is admitted to the cage, a top opening through which the ball is discharged onto the return track and means operable to return a ball in the cage after admission through the bottom opening.

9. Apparatus for lifting a bowling ball to an elevated return track disposed between a pair of spaced, adjacent bowling alley, each alley having a pit at the rear end thereof with side kickbacks, comprising: an arm mounted on a pivot supported on adjacent kickbacks between the pits, a ball receiving cage carried on the free end of said arm and movable with the arm about said pivot through an arcuate path in a vertical plane between a lower ball pick-up position and a raised ball discharge position adjacent the end of the ball return track, said cage having a bottom opening through which the ball is admitted to the cage, a top opening through which the ball is discharged onto the return track and means operable to return a ball in the cage after admission through the bottom opening, and power means for imparting said movement to said arm and cage, said arm and cage being substantially balanced about said pivot and adapted to be stopped readily in their downward movement without stopping said power means.

10. A ball-return mechanism for use with the pits of a pair of adjacent bowling alley and a common ball-return track extending between the alleys having an elevated portion adjacent the pits, comprising, in combination, a ball elevator having an arm mounted on a horizontal pivot supported between and perpendicular to the kickbacks of said alleys, said arm being adapted to be moved operably by reason of the deposit of a ball from either adjacent alley in said pick-up position to actuate said ball elevator to lift a ball from the pick-up position to the ball-return track.

11. A ball-return mechanism for use with the pits of a pair of adjacent bowling alley and a common ball-return track extending between the alleys and having an elevated portion adjacent the pits, comprising, in combination, a ball elevator having an arm mounted on a horizontal pivot supported between and perpendicular to the kickbacks of said alleys, said arm being adapted to be moved operably by reason of the deposit of a ball from either adjacent alley in said pick-up position to actuate said ball elevator to lift a ball from the pick-up position to the ball-return track.
apparatus for lifting a bowling ball to an elevated ball-return track, comprising, in combination, a ball supporting cradle adjacent to the floor of the pit; a ball lifting cage having a ball holding portion which is movable relative to the remainder of the cage upon engagement with a ball to admit the ball into the cage; and a flexible cable connected at one end to said cage for supporting the cage in an elevated rest position adjacent said return track; and means for moving the cage through a cycle comprising lowering the cage to receive a ball from said cradle and lifting the cage with the ball therein to said elevated position, said cage being anchored at its bottom and being arranged to provide motion multiplying means for increasing the range of movement of the cage moving means.

Apparatus for lifting a bowling ball to an elevated ball-return track track from adjacent the pit floor of a bowling alley track from adjacent the floor of a bowling alley pit having a side wall with an opening through which a ball may roll from said pit floor, comprising in combination a ball supporting cradle adjacent said opening for receiving balls which roll therethrough; a ball lifting cage having a side plate providing a closure member covering substantially the entire area of said opening when the cage is adjacent the pit floor, the bottom of said cage comprising horizontally extending fingers pivotally mounted about an axis extending from said cradle and upwardly engaging with a ball as the cage descends to admit said ball into the cage, said fingers being biased in horizontal position so that they fall back under the ball and for the reducing means coupled to said clutch for supporting said cage in an elevated rest position adjacent said return track; and support operating means for moving the cage through a cycle comprising lowering the cage to receive a ball from said cradle and lifting the cage with the ball therein to said elevated position.

Apparatus for lifting a bowling ball to an elevated ball-return track which is disposed adjacent a bowling alley having a pit and spaced kickbacks comprising, a pivot pin supported on one of said kickbacks forwardly of the pit and an end of the ball return track, a ball holding portion on said pin and extending rearwardly from the pin, a ball receiving cage fixedly mounted on the free end of said arm and movable with the arm in an arcuate path between a lower ball pick-up position removed from said end of the ball return track and a raised ball discharge position adjacent end of the ball return track wherein the ball may roll from the cage through the ball return track comprising, in combination, a ball supporting cradle adjacent to the floor of the pit, a ball lifting cage having an open top movable between a lower ball receiving position and an upper ball discharging position adjacent said return track, means operable to receive a ball from said cradle and lifting the cage with the ball therein to said elevated position, said cage being anchored at its bottom and being arranged to provide motion multiplying means for increasing the range of movement of the cage moving means; and means operable to retain a ball in the opening in the top of the cage to permit the gravity release of the ball and means operable to retain the ball in the cage after admission thereof through said first opening.

Apparatus for lifting a bowling ball from adjacent the pit floor of a bowling alley track to an elevated ball-return track, comprising, in combination, a ball support cage comprising horizontally extending fingers pivotally mounted about an axis extending from said cradle and upwardly engaging with a ball as the cage descends to admit said ball into the cage, said fingers being biased in horizontal position so that they fall back under the ball and for the reducing means coupled to said clutch for initiating operation of the cage moving means by the weight of the ball on the cradle; and means actuated by said cage for discharging the ball from said cage onto said return track.

Apparatus for lifting a bowling ball from adjacent the pit floor of a bowling alley to an elevated ball-return track, comprising, in combination, a ball support cage comprising horizontally extending fingers pivotally mounted about an axis extending from said cradle and upwardly engaging with a ball as the cage descends to admit said ball into the cage, said fingers being biased in horizontal position so that they fall back under the ball and for the reducing means coupled to said clutch for initiating operation of the cage moving means by the weight of the ball on the cradle; and means actuated by said cage for discharging the ball from said cage onto said return track.

Apparatus for lifting a bowling ball from adjacent the pit floor of a bowling alley to an elevated ball-return track, comprising, in combination, a ball supporting cradle adjacent to the floor of the pit; a ball lifting cage having a ball holding portion which is movable relative to the remainder of the cage upon engagement with a ball to admit the ball into the cage; and a flexible cable connected at one end to said cage for supporting the cage in an elevated rest position adjacent said return track; and means for moving the cage through a cycle comprising lowering the cage to receive a ball from said cradle and lifting the cage with the ball therein to said elevated position, said cage being anchored at its bottom and being arranged to provide motion multiplying means for increasing the range of movement of the cage beyond the range of movement of the movable pulley; and means operable for discharging the ball from said cage onto said ball-return track.

Apparatus for lifting a bowling ball from adjacent the pit floor of a bowling alley to an elevated ball-return track, comprising, in combination, a ball support cage comprising horizontally extending fingers pivotally mounted about an axis extending from said cradle and upwardly engaging with a ball as the cage descends to admit said ball into the cage, said fingers being biased in horizontal position so that they fall back under the ball and for the reducing means coupled to said clutch for initiating operation of the cage moving means by the weight of the ball on the cradle; and means actuated by said cage for discharging the ball from said cage onto said return track.
cage after admission thereof through said first opening.

24. Apparatus for lifting a bowling ball from adjacent the pit floor of a bowling alley to an elevated ball return track, comprising in combination, a ball supporting cradle adjacent the floor of the pit; a ball lifting cage having a ball holding underside which is movable relative to the remainder of the cage upon engagement with a ball to admit the ball into the cage; means for supporting said cage in an elevated rest position; support operating means for moving the cage through a cycle comprising lowering the cage to receive a ball from said cradle and lifting the cage with the ball therein to said elevated position; and means for initiating operation of the support operating means by the weight of a ball on the cradle.

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