AUTOMATIC BOWLING ALLEY

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The present invention relates, generally, to bowling alleys which have mechanically operative parts for setting and resetting the pins, for clearing the alley of dead pins or of all pins, in a predetermined manner, for carrying the pins cleared from the alley back thereto, for returning the ball from the back of the alley to the player's position, and for other purposes; and the invention relates further to a bowling alley which has parts automatically operative upon a transient operation such as the striking of a given part by the ball or the closing of an electric circuit by hand to handle the pins and the ball as desired in a predetermined manner.

Various objects and advantages of the invention will be obvious from the following particular description of one form of mechanism embodying the invention or from an inspection of the accompanying drawings; and the invention also consists in certain new and useful features of construction and combinations of parts hereinafter set forth and claimed.

In the accompanying drawings there is shown for purposes of illustration one form of mechanism embodying the invention, in which:

- Figure 1 is a part view in plan;
- Figure 2 is a vertical longitudinal mid-section view;
- Figure 3 is a vertical section view taken along the line 3—3 of Figure 1 looking in the direction of the arrows;
- Figure 4 is a vertical section view taken along the line 4—4 of Figure 1 looking in the direction of the arrows and showing certain parts;
- Figure 5 is a plan section view taken along the line 5—5 of Figure 2;
- Figure 6 is a plan section view taken along the line 6—6 of Figure 2;
- Figure 7 is a longitudinal section view taken along the line 7—7 of Figure 1 looking in the direction of the arrows, and showing certain parts;
- Figure 8 is a section view, showing certain parts, taken along the line 8—8 of Figure 1 and looking in the direction of the arrows;
- Figure 9 is a view taken along the line 9—9 showing a detail of the mechanism;
- Figures 10, 11 and 12 are elevation views of a certain group of parts in several operative positions;
- Figures 13 and 14 are diagrammatic representations in perspective relation of pins and balls at different stages during their movement through the mechanism of the invention, and certain parts of the mechanism;
- Figures 15 and 16 are, respectively, a side elevation view in mid-section and a plan view of an alternate form of a pin conveyor belt of the invention; and
- Figure 17 is a section view along the line 17—17 of Figure 15.

In all the above described views of the drawings, like reference characters are used to designate corresponding parts throughout.

Referring now to the drawings the reference character 1 designates a foundation on which is laid a floor 2 of a bowling alley, said floor being shown in part, at the back end of the alley, with the pins 3, 3 set thereon. Under said floor 2 and beneath said pins 3, 3 is provided a well 4 having guide-walls 5, 5 between which is slidably movable, near and down, the frame 6. In said floor 2, about the position of each of the pins thereon, is provided a set of four holes 7, 7 arranged circumferentially around the center of the position of the pin and with the inner edge of each of the holes at a distance from said center substantially equal to the radius of the pin at its greatest diameter. Fixed in said frame 6 is a plurality of pins 8, 8 one for each of said holes 7, 7 and of length such that when said frame 6 is at its upper limit of movement between said guide walls 5, 5 said pins will project above said floor 2 to a point about the point of greatest diameter of said pins 3, 3, and will serve in guiding and positioning said pins 3, 3 as they are set on said floor 2 by means and in a manner hereinafter more fully described. The relative length of said pins 8, 8 and depth of said well 4 are such that when said frame 6 is at its lower limit of movement between said guide walls 5, 5 the upper end of said pins 8, 8 will be at or below the upper end of said floor 2 whereby, when the frame 6 is raised, said pins 8 will be guided when they move through said holes 7, 7. Means for raising and lowering said frame 6 will be hereinafter fully described in conjunction with other operating and cooperating parts.

At the back end of said floor 2 beyond the position of said pins 3, 3 is a pit 9 in which is positioned a platform 10 which is hinged to the wall of said pit 9 at the side adjacent said floor 2 and with its edge at the level of said floor 2. From said floor 2 said platform 10 slopes downwardly and at
its opposite end rests on a bumper 11 of rubber or other resilient means fixed thereto. Over the position of said pins 3, 3 and said platform 10 and extending for a distance in either direction therefrom in the line of the alley is a frame work comprising front standards 12, 12', rear standards 13, 13' and connecting beams 14, 14' extending therebetween on each side of the alley. At the rear end of said platform 10 is the lower end of an endless conveyor belt 15 which, in width, extends transversely across the line of the alley and in the line of its movement, extends vertically upward from said platform 10 to a shaft 16 supported across said beams 14, 14' and about a pulley 17 carried by said shaft 16. The lower end of said belt 15 passes around a pulley 18 which is mounted to a shaft 19, which latter extends across the top of a depression 20 sunk below the floor of said pit 9. On said belt 15 is provided a plurality of outwardly projecting arms 21 which, on the side facing said platform 10, extend slightly upwardly as well as outwardly. Said arms 21, 21 are arranged in spaced apart relation in vertical rows and transverse rows and serve to catch and carry upwardly pins and balls which pass thereto from said floor 2 and platform 10, the latter being provided with a plurality of slots 22, 22 through which arms 21, 21 pass as they move upwardly past the end of platform 10. At each end of said pulley 18 said shaft 19 carries a wheel 23 having a plurality of projections 24 thereon which are adapted to engage an arm 25 fixed one at each side of said platform 10, to raise the same a short distance and then to drop it whereby, said platform 10 is given an oscillatory movement to jar the pins thereon and work them downwardly towards said belt 15 so that they come into position to be engaged by said arms 21 and carried upwardly thereby.

Across said beams 14, 14' and to the rear of said belt 15 there extends transversely two vertical walls 26 and 27 one behind the other with their upper edges slanting downwardly from left to right as indicated in Figure 4. Said walls 26 and 27 are spaced apart at a distance greater than the largest diameter of one of said pins 3, 3 and smaller than the diameter of balls 28 used with the pins 3, 3. The upper edges of walls 26 and 27 are below the upper end of said belt 15. From said wall 26 a row of guide bars 29 extends upwardly and to the point close to the upper end of said belt 15. Said guide bars 29 are spaced apart to permit the downward passage of said arms 21, 21 and are to receive pins and balls as they pass from said belt 15 and guide them to the position between said walls 26 and 27. Extending upwardly and backwardly from said wall 27 is a guide wall 30, which serves to prevent pins and balls from passing over the upper edge of said wall 27. In the direction of the downward inclination of the upper walls 26 and 27 the latter are continued in a turn beyond the supporting frame work and parallel with the side of the alley to the forward end of the latter, and, in parts not shown but well known, incline downwardly to deliver the balls to the player in a manner and by means well known in bowling alleys. A pair of upright beams 31, 31 extending upwardly to said beam 14 carry a platform 32 which supports a motor 33 which serves through a chain 34 and sprocket 35, and said shaft 19 to move said belt 15.

Below said walls 26 and 27 and in closely spaced relation thereto an endless conveyor belt 36 extends transversely between uprights 13 and 13', being supported thereon by the shaft 37 and pulley 38 at one side and shaft 39 and pulley 40 at the other. The said walls 26 and 27 together with the upper span of said belt 36 form a trough for receiving pins 3, 3 carried thereto by said balls 28 and moving downwardly from the bottom of this trough, which is said belt 36, is adapted to carry said pins across the alley from right to left. Said belt 36 is driven by a train of bevel gears 41, 42, shaft 43, chain 44 and sprocket wheels 45 and 46 which connect said shaft 37 to said belt 16 in driven relation. At the left end of said belt 36 is a casing 47 enclosing the same and carrying at its lower side a downwardly extending chute 48. At a point above the end of said belt 36 said casing 47 carries a spring member 49 which extends downwardly towards said chute 48 and then upwardly away from said belt 36 and serves to sort out pins carried by said belt 36 and separate them so that they will be fed one at a time to said casing 47 and chute 48. Extending from a point beneath said chute 48 to the forward part of the frame comprised by beams 12, 12 and 14 is a pair of endless belts 50 and 51 which incline upwardly toward the front and are carried respectively by the pulleys 52 and 53 and 54 and 55, which in turn are carried by the shafts 56, 57, 58 and 59, the shafts 56 and 58 being supported by a bracket 60 mounted to the front of the frame and the shafts 57 and 59 being carried by the bracket 61 mounted to the rear of the same. Said belts 50 and 51 are driven through their respective shafts and pulleys through gear 62 mounted to said shaft 37 and gear 63 meshing with the last said gears and carrying a flexible shaft 64 which connects with said shaft 59. A pair of gears 65 and 66 connect said shafts 58 and 57 in driving relation. At each end of said belts 50 and 51 a pair of idler rollers 67, 68 and 69, 70, hold the inner or adjacent spans of said belts along inclined planes with their lower edges closer together than their upper edges, whereby the inner spans of said belts 50 and 51 form a bottomless trough which inclines upwardly in a direction from the
back to the front. The distances between the upper edges of said inner spans of belts 50 and 51 is greater than the biggest diameter of said pins 3, 3 and the lower edges thereof are at a distance apart considerably less than the greatest diameter of said pins but greater than the biggest diameter of the head of the pins. It will be seen that pins 3, 3 after being carried by said belt 56 and discharged to said closure 47 and chute 48 will fall into the trough structure defined by belts 50 and 51 and will be caught thereby and will be held between said belts 50 and 51 at the portions of the greatest diameter of the pins, and, since their center of gravity are above the point of greatest diameter they will assume positions in which the hanging head downward in which they will be carried by belts 50 and 51 in their upward travel toward the front of the frame. Backing boards 50' and 51' back of said inner spans of belts 50 and 51 serve to keep the latter from moving away from each other when a pin or pins 3, 3 are between them. These boards 50' and 51' are discontinued at the upper end of the belts.

Commencing at a point forward from said chute 43 a floor guide member 71 extends forwardly and upwardly in closely spaced relation to the lower edges of said belts 50 and 51 and serves to engage pins 3, 3 and cause them to be inclined with their heads projecting backwardly and downwardly, that is to cause said pins to be carried with their base portions projecting before the heads thereof. At the upper and forward end of said guide member 71 is a chute 72 which curves downwardly and first forwardly and then backwardly and terminates at its lower end in a wall 73 which limits the movement of the pins passing through said chute 72. Adjacent said wall 73 said chute 72 has an opening 74 in the inward side wall thereof which opening is of a size to permit a pin 3 to roll there-through, and the floor of the chute 72 is inclined, at this portion, toward said opening 74 whereby a pin which has passed thereto will roll by gravity to and through said opening 74. A guide 74' extends transversely from and downwardly to a predetermined distance below said opening 74.

Below said opening 74 a belt 75 extends horizontally across said frame comprised by beams 12', 12', 13, 13' and so on. A pin rolling out of the lower end of the chute 72 will pass over said guide 74 and come to rest on said belt 75 with its base extending backwardly and its head extending forwardly. For spacing pins 3, 3 at predetermined distances from each other on said belt 75 there is provided a plurality of partitions 76, 76, and means hereinafter fully described for providing therein grooves provided for receiving said belt in successive steps to receive successive pins adjacent each other between said partitions 76, 76.

Said belt 75 is supported by shafts 77 and 78 which are mounted on said posts 12, 13 and 15, and 15' and on respective brackets 79, 79 and carry pulley 80 and 81 over which said belt 75 passes. On said shaft 78 is a fixed clutch member 82 and a cooperating free clutch member 83 which has formed integral therewith a gear 84. Said clutch member 83 and gear 84 are slidable longitudinally on said shaft 78. Intermediate said clutch member 83 and gear 84 is mounted a collar 85 which is limited against movement longitudinally but is movable rotatively thereon as provided by a gear and flange arrangement therebetween, which is not shown but is well known in clutch structures. On said collar 85 is a pair of diametrically opposite studs 86, 86 which extend through respective slots 87, 87 in the side members 88, 88 of a fork 89 which straddles said sleeve 85 and has its arm 89' pivoted to the lower side of said chute 72 at a point forwardly of said opening 74. Roller heads 88' on said studs 86, 86 keep the latter and said collar 85 from rotating with said clutch member 83 and gear 84. In the bottom of said chute 72 forwardly adjacent the pivot of said arm 89' is an opening 90 which is normally closed by a plate 91 fixed to said arm 89' and movable therewith on the pivot. A counterweight 92 carried by said arm 89' serves to normally hold said plate 91 in the closed position and said clutch member 83 out of engagement with said clutch member 82. A pin 3 passing said plate 91 will depress the latter and cause it and said fork 89 to move on the pivot thereof and thereby move said clutch member 83 into engaging relation with said clutch member 82 as indicated diagrammatically in Figure 7 of the drawing.

A flexible shaft 93 connected at one end to said shaft 78 and at its other end to a pinion 94 meshed with said gear 84, serves to drive the latter and thereby to drive said belt 75 when said clutch members 82 and 83 are in engagement with each other. The mass of said counterweight 92 is adjusted in relation to the impetus received from a passing pin 3 through plate 91 to hold said clutch members 82 and 83 in engagement just long enough for said shaft 78 to make one complete revolution and said pulley 80 is of such diameter that one revolution thereof moves said belt for a distance equal to the distance between adjacent ones of said partitions 76, 76. A pin 3 on passing through said chute 72 to a position on said belt 75 in a space between a pair of said partitions 76, 76 through the above described apparatus will cause said belt 75 to move to bring the next succeeding space into position under the end of said guide way 94'. The pin 3 will move fast enough, of course, to reach its proper place on belt 75 before the latter is moved to the next pin receiving position.

For receiving pins from said belt the fol-
lowing apparatus is provided. The upright beams 12, 12 have formed therein their respective inner vertical surfaces the slots 98, 98 and the vertical beams 99, 99 have corresponding vertical slots 100, 100 in their respective surfaces which face toward the front. On the face of each of said beams 12, 12 in which the slot 98 is formed is a slide plate 101 which has a guide lug (not shown) which extends into said slot 98, and on the slotted surface of said vertical beams 99, 99 are the guide plates 102, 102 having guide lugs 103, 103 which engage said slots 100, 100. Connecting said guide plates 101, 101, 102 and 102 is the horizontal frame 104 which holds said plates 101, 101, 102 and 102 in their proper positions against the faces of said vertical beams 12, 12, 99 and 99. For controlling and securing vertical movement of said frame 104 there is provided a pair of brackets 105, 105, one on each of said beams 14 and 14, and between which brackets there extends transversely the shaft 106. About said shaft 106 and between said brackets 105, 105 is a hollow shaft 107 which is rotatable therein and which, at each end, carries a pair of oppositely extending arms 108 and 109, which latter, at the upper limit of movement of said frame 104 extend vertically, arms 108, 108 extending upwardly and arms 109, 109 extending downwardly. A pair of flexible cables 110, 110 connect one to each of said arms 108, 108 at the outer ends thereof and pass over respective pulleys 111, 111 mounted on said beams 14 and 14 respectively at positions above the forward end of said frame 104 and thence downwardly to loops 112, 112 on said frame 104 to which they connect. Likewise, a pair of cables 113, 113 connect to the outer ends of said arms 108, 108, pass over respective pulleys 114, 114 on said beams 14 and 14 then extend upwardly and arms 108, 108 extend downwardly to loops 115, 115 at the rear of said frame 104. A weight 116 carried by said arm 109, serves to counter-balance said frame 104 and certain parts connected thereto whereby movement can be quickly started and stopped and changed from one direction to the other.

Between said plates 101, 101 on extension thereof above said frame 104 and above the level of said belt 75 there extends a horizontal shaft 117 which is moveable up and down with said frame 104. Said shaft 117 carries pivoted thereto a platform 118 which extends backwardly and which, at the upper limit of movement of said frame 104, has its upper transverse edge adjacent to or slightly below the level of the upper surface of said belt 75. Between each of said upright beams 12, 12 and a corresponding beam 99 is a vertical beam 119, each of which carries on its inner surface a guide member 120 having a vertical slot 121 therein which extends from a point above the upper limit of said frame 104 to the corresponding point at the lower limit of movement at said frame 104, and also an arcuate slot 122 which connects with said slot 121 at the upper limit of the latter and extends upwardly to a point a little below the corresponding beam 14 or 14. A pair of bars 123, 123 connected to said platform 118 at the sides thereof project forwardly and carry between their outer ends a shaft 124 whose respective ends fit into and are adapted to ride in said slots 121, and 122, the latter, slot 122, being curved on a radius which has its center at said shaft 117 and which extends from the center of shaft 117 to the upper limit of slot 121. It can be seen that platform 118 can be moved up and down with said frame 104, with said shaft 124 riding in said slots 121, 121 and also that when said frame 104 is at its upper limit of movement said frame 118 can be moved rotatively about said shaft 117 with the ends of said shaft 124 riding arcuately in said slots 122, 122. For controlling said platform 118 in its movement in these relations there is provided a pair of arms 125, 125 one fixed near each end of said shaft 106 and each having connected thereto a flexible cable 126 which passes over a pulley 127 mounted on a corresponding beam 14, or 14, at the point of the rear of said guide member 120 and thence downwardly and forwardly to the corresponding end of said shaft 124. Said lever 125 is longer than said arm 109 and carries a stop member 128 adapted to engage the latter whereby said arm 125 is limited in its counter clockwise movement by said arm 109. A counterweight 129 carried by said shaft 106 balances said platform 118 and makes it easy to move.

Said platform 118 carries ten boots 130, 130 one above the position of each of the ten pins 3, 3 on said alley floor 2. Said boots 130 are vertically moveable. Said platform 118 is at the lower limit of its rotative movement about said shaft 117, and in this position of platform 118 with respect to said shaft 117 said boots will remain in the vertical position during the up and down movement of said frame 104. From the front side of each of said boots 130, 130 there extends upwardly and forwardly a trough 131 which at its upper end lies horizontally and terminates at the forward edge of said platform 118. Said troughs 131, 131 at their upper ends are aligned in side by side relation with their adjacent sides common and forming partitions 131' adapted to be registered with said partitions 76, 76 on said belt 75, and at their intermediate portions said troughs 131, 131 are smoothly curved to define ways for guiding said pins 3, 3 in easy movement from said belt 75 to respective ones of said boots 130, 130 (see Figs. 1 and 2).

For transferring pins from said belt 75 to said troughs 130 there is provided a mech-
anism which is operated by the rotative movement of said platform 188 on shaft 117 and which comprises a transverse shaft 132 which extends from a bearing 133 mounted on a cross bar 134 mounted between beam 12 and its corresponding beam 12, to an opposite bearing 132' mounted on a corresponding cross bar 134' mounted between beam 12 and its corresponding beam 12'. On said shaft 132, one near each end thereof, is set a bushing 133 which carries an arm 136 which latter projects downwardly and has pivoted to its lower end one end of a connecting arm 137 which at its other end in turn is pivotally connected to said platform 118 through an arm 138 fixed thereto. Set on said shaft 132 by the set screws 139, 139 and between said bushings 135, 135 is the long sleeve 140 which carries a row of ten arms 141, 141 spaced apart and positioned to register in and to move back and forth from spaces 76', 76' between said partitions 76, 76 to said chutes 131 at the forward ends thereof and vice versa. The arm 141 nearest said chute 73 registers in the space 76' which is next to said chute and with the chute 131 which is on the left end of the row, looking from front to the rear of the alley. As shown in Fig. 2, when said frame 104 is at its upper limit of movement and said platform 118 is at its downward limit of rotative movement thereon about shaft 117 then said arm 136 extends vertically downward and said arms 141, 141 register in said chutes 131, 131 (see also Fig. 1). When said platform 118 moves rotatively upwardly about said shaft 117 to its upper limit it causes said arms 141, 141 to rotate backwardly to a position in which their lower ends are at the forward ends of said spaces 76', 76' ready to receive pins 3, 3 in a position back of them, and when said platform 118 is lowered rotatively said arms 141, 141, are moved backwardly to wipe said pins 3, 3 from said spaces 76', 76' on belt 75 to said chutes 131, 131, in which they will slide downwardly into and through said boots 134, 134 and thence onto said floor 2 between respective sets of said rods 8, 8 which latter at this stage are in the position in which they project above said floor 2.

For raising and lowering said frame 6 synchronously with the rotative lowering and raising of said platform 118 there is provided a pair of cables 142 and 143 connected to each side of said frame 6 at points beyond the gutters of the alley and extending upwardly to a frame 144 mounted above said platform 118 and movable vertically up and down between the guide members 145, 145, 145, 145 of which there are two pairs mounted one pair to each side of the main supporting frame structure. Above said movable frame 144, one at each side thereof, is a pulley 146 through which passes a cable 147 which has one end connected to the center of said frame 144 and its other end connected to the outer end of an arm 148 which is fixed to a sleeve 149, one at each end of shaft 132, and extends therefrom in a direction diametrically away from said arms 141, 141. It will be seen that when said platform 118 is raised rotatively about shaft 117 then said frame 6 will be allowed to fall to carry said pins 8, 8 down with their upper end below the level of floor 2 and that when said platform 118 is lowered rotatively then said frame 6 will be raised to bring said pins 8, 8 above the floor into position to receive and guide pins 3, 3 fed thereto through said boots 130, 130.

For preventing balls thrown down the alley from reaching the pin position of the alley when said platform 118 is at its lower limit of rotative movement thereon is provided a V-frame 149 which extends across the alley with its ends pivoted one to each of said beams 12, 12 and with its point toward the front of the alley. A pair of cables 150, 150 connect each with one end on the bottom of said platform 118 at the front end thereof and passing over a pulley 151 mounted to a respective one of said plates 101, 101 and thence to one side of said V-frame 149 where it is connected. When said platform 118 moves to the lower rotative position said V-frame 149 falls by gravity into position on said floor 2 where it will deflect a ball coming down the alley, and when said platform 118 moves to its upper rotative position said V-frame 149 is drawn upwardly rotatively by means of said cables 150, 150 to clear the alley and permit the passage of balls thereunder.

For clearing the alley of pins and wiping them onto said platform 10 in pit 9 there is provided a pair of horizontal arms 152 and 153 one pivoted at each side of the alley at the back end thereof and fitting into a forwardly extending recess 154. The vertical shafts 155 and 156, respectively, support said arms 152 and 153 for rotational movement in horizontal planes. Said shafts 155, and 156 extend downwardly through said floor 2 into a transverse pit 157 where they carry at their respective ends the bevel gears 158, 158 which latter are interconnected in driving relation by the cooperating bevel gears 158, 159 and the transverse shaft 160 which rides in the bearings 161, 161 mounted to the walls of said pit 157.

Said shaft 156 extends upwardly through the main supporting framework to a point above said beam 14' where it carries a horizontal disc 163 which has thereon a stud 163 positioned off center. A stop member 164 mounted on said beam 14' and extending over disc 162 into operative relation with said stud 163 serves to limit the movement of said shaft 156 in the counterclockwise direction looking at the plan of Fig. 1; and a spring 165, mounted about said shaft 156 and fixed thereto at one end and to said beam 14' at its other end, 150.
tend to rotate said shaft 156 in the counterclockwise direction and hold said stud 163 against said stop 164. A horizontal shaft 166 mounted at one end on a bracket bearing 186 on said bracket 14 carries a disc 169 which is a pin 170 which is in operative relation with said pin 163 to drive the latter when shaft 168 is rotated as hereinafter described. Adjacent the outer side of said bearing 186 shaft 168 carries a gear 171 which engages a quadrant gear 172 (see Fig. 2) pivoted on the bracket 173 on said beam 14, by the shaft 174 which latter carries a short crank arm 175 pivotally connected to the rod 176 which at its other end is pivotally connected to the arm 177 which is several times as long as said arm 176 and is fixedly mounted to the horizontal shaft 178 which latter extends between said beams 99, 99 and is mounted for rotation thereon.

At its end near said beam 14' said shaft 178 carries a pawl 179 which rides over the rim of a wheel 180 which is aligned therewith and mounted on standards 180', 180' on said beam 14'. Said wheel 180 carries on its rim a plurality of pairs of uniformly spaced apart cam studs 181 and 182. A stud 181 of a given pair is spaced apart from the stud 182 of the next adjacent pair at a distance twice as great as are the studs 181 and 182 in a given pair. Said wheel 180 is mounted for free rotation on a shaft 183 on said beam 14' and has fixed thereto and concentric therewith on the same shaft a wheel 184 which carries, extending radially from its rim, a series of sets of studs 185, 186 and 187 circumferentially arranged, each stud in equally spaced apart relation to the next adjacent ones. The number of sets of studs 185, 186, 187 is equal to the number of sets of said cam studs 181, 182 and the stud 185 of each set is equally spaced circumferentially between the corresponding studs 181 and 182. Said studs 185, 186, and 187, in a given set, are arranged successively clockwise in the order named and are of successively graduated length radially stud 185 being the longest and stud 186 being the shortest. On its inner face said wheel 180 carries a toothed clutch member 188 adjacent which is the cooperative clutch member 189 which is slidable on said shaft 183 and has on its opposite end the end cam 190. Rotatable on said shaft 183 is a second end cam 191 which is in operative relation with said end cam 190 to push the latter toward said clutch member 188 to engage clutch member 189 therewith.

For driving said cam 191 there is provided a motor 192 which connects therewith through the sprocket 193, driving chain 194 and sprocket 195, which latter is mounted to said cam 191. Connected to said motor 192 is a time switch 196 which has a conductor cable 197 for connection to a suitable source of current (not shown) and a second conductor cable 198 which connects to a switch 199 mounted above said pit 9, and has an actuating rod 200 which projects forwardly therefrom and has a spring 201 which holds said switch 199 normally open. A wide board 202 pivoted on the beams 203, 203 by the shaft 204 extends downward and across the alley above pit 9 and in front of said switch 199 in operative relation to said rod 202 to actuate the latter to close switch 199 when said board 202 is moved backwardly about its pivot. Said board 202 is of such a length that when it hangs normally down a ball passing over platform 10 from the alley will strike it and cause it to move against rod 200 and close said switch 199, and at an inward position of said rod 200 in which the switch is closed the lower edge of said board 202 will be far enough from said platform 10 to permit the passage of the ball thereby to the said pins 21, 21 on said belt 15.

In operative relation to said studs 185, 186, 187 there is a pin 204 mounted on the crank arm 205 carried by the transverse shaft 206 which carries a sprocket wheel 207 over which passes a sprocket chain 208 which at its other end passes over the sprocket wheel 200 mounted to said shaft 106. This arrangement provides progressive rotational movements of said shaft 106 through arcs of unequal length for successive movements of said shaft 206, as said studs 185, 186, and 187 successively engage said pin 204, whereby the operation of the setting mechanism as hereinafter fully described, is attained.

Referring now more particularly to Figures 2, 10, 11, and 12 said boots 130, 130 are open at the bottom and extend above their point of juncture with said chutes 131, 131. Across the inside of each of said boots 130, 130 there extends a shaft 210 journaled in the walls of the boot and having one end projecting outside thereof as shown in Fig. 2. On said outwardly projecting end of shaft 210 is fixed a forwardly and downwardly projecting arm 211, shown in Fig. 2 and indicated diagrammatically in Figs. 10, 11 and 12. Slidable pivotally to the outer end of said arm 211 is a rod 212 which at its upper end has a slot 213 through which extends a pin 214 on said arm 211. Said rod 212 extends downwardly through a guideway 215 and terminates in an enlarged foot 216, and said guideway 215 is pivoted on the arm 217 which extends from the side of boot 130 near the bottom of the latter.

In the boot 130 a pair of grasping fingers 218 and 219 are provided on said shaft 210, finger 218 being fixed to said shaft 210, finger 219 being free for rotation thereon; and a tension spring 220 connected across said fingers 218, 219 tends to hold them pressed against each other in a closed relation. A compression spring 221, bearing at one end 120.
end against said finger 219, near the latter's pivot end, and at the other end against the upper part of said boot 130 adjacent thereto, tends to hold said finger against a pin 222 which latter is fixed to the wall of boot 130 and is aligned with a slot 223 in said finger 219. In this position said fingers 218, 219 are symmetrically aligned with the vertical axis through said shaft 210. At the juncture of a boot 130 with its chute 131 there is provided an upper slot 224 and a lower slot 225 to permit the movement of said finger 218 pivotally beyond the confines of said boot 130, and, likewise, at the opposite side of boot 130 there is provided a slot 226 to permit a similar movement of said finger 219. On the outer side of the side wall of said chute 131 is a spring 227 which tends to hold an inwardly extending latch pin 228 in an engageable relation with a lateral projection of said finger 218 (not shown) when the latter has passed thereby and has been released to be moved by said spring 200, and said latch pin 228 is beveled so that the weight of a bowling pin 3 against said finger 218 will move the latter and cause it to press said latch pin 228 outwardly against the pressure of spring 227 and thereby leave said finger 218 free to be returned by said spring 220 to its normal position.

In the use and operation of the apparatus of the invention, in the normal position, said weights 116 hold said frame 10 at its upper limit of vertical movement on said posts 12, 12' and 119, 119 and said weight 129 holds said platform 118 at its upper limit of rotational movement on said shaft 117. In this position of the parts said V-frame 149 is up and said guide pins 8, 8 are down, and one of said studs 186 is in operative relation to said pin 204. The pins 3, 3 are set up in the usual manner on the alley and said conveyor 15 is rotated by means of said motor 33.

A ball 28 is then rolled down the alley and passes to said conveyor 15 which picks it up and delivers it to the top edge of said walls 26, 27 which are inclined transversely and around to the front of the alley in parts not shown which deliver a ball to the player in the conventional and well known manner. On its way it is assumed said ball 28 strikes some of the pins and knocks them down and also strikes said board 202 and moves it pivotally whereby said rod 200 is actuated to close said switch 199 which in turn causes said time switch 196 to be closed, which latter through said motor 192 and cam members 190, 191 and clutch members 189, 189 rotates said wheel 180 whereby said stud 186 actuates said pin 204, and thereby said shaft 206 and therefore said platform 118, against the force of gravity on said weights 129 whereby said boots 130, 130 are brought down over respective ones of said pins 3, bringing the outwardly curved bottom ends of said fingers 218, 219 against the top of the pin whereby they are spread apart against the tension of said spring 220. Said stud 186 causes this movement to proceed until the curved ends of said fingers reach the neck of the pin in which position they are held by the tension of spring 220 in gripping and lifting relation. At this point said stud 186 passes from engagement with said pin 204 and allows the weights 129 to raise said platform 118 and lift such of said pins 3, 3 as have been left standing and have been gripped by respective fingers 218, 219. At this point one of said studs 189 comes into operative relation with said pawl 178 and lifts the latter and shaft 206 is actuated whereby said shaft 166 is rotated far enough to bring said pin 170 into engagement with pin 165 whereby said shaft 156 is rotated and arms 152 and 153 will sweep dead pins onto said platform 10 whence they pass to said conveyor 15 which carries them and discharges them through the space between said walls 26 and 27 and to said conveyor 36 which carries and discharges them to said chute 48, said spring member 49 serving to separate the pins so that they will pass one by one. When the pins 3, 3 fall from chute 48 and pass to a position between said belts 50, 51 the force of gravity will move them to a position which they are head down, and the backing walls 50' and 51' will hold said belts 50, 51 from spreading from the weight of said pins 3, 3. Said belts 50, 51 are being driven by said motor 33, as is also conveyor 36, and the handling of the pins as they are discharged from the forward end of belts 50, 51 will be fully described after the resetting of the picked-up pins is described.

Just after said arms 152, 153 complete the pin sweeping movement said stud 182 passes from engaging relation with said pawl 179 and said spring 165 rotates said shaft 156 to bring said arms 152, 153 back into their normal position. Wheel 180 continues to rotate and brings a stud 185 into engagement with said pin 204 whereby said frame 104 and platform 118 are both moved down to their lower limit of movement whereby the boots 130 are brought down to the floor as shown in Fig. 12. Before this position is reached the rod 212 has engaged the floor and rods 8, 8 have been moved up through the floor into pin guiding position. Through engagement with the floor the rod 212 moves the finger 218 into engagement with the holding latch pin 228 whereby the pin 3 is released in the reset position. Continued movement of the wheel 180 causes stud 185 to pass from engagement with the pin 204 whereby weights 116 and 129 move frame 104 and platform 118 into their normal raised positions. At this point the time switch 192 becomes inoperative, automatically and the alley is ready for bowling at the pins left standing after the first ball. This time period of operation of said time
switch 192 is predetermined and is synchronized with engagement of stud 186 with said pin 204 and of stud 182 with pawl 179. A successive time period is synchronized with the operation of studs 185 and 187 with pin 204 and of stud 181 with pawl 179. When the next ball is rolled down the alley, possibly knocking down more pins, it strikes said pivoted board 202 to actuate said switch rod 200 and passes to conveyor 15 to be returned to the player in the manner above described. The actuation of said switch rod 200 closes switch 199 which causes the actuation of said time switch 196 for the operation of said motor 192 for the second time phase during which said wheel 180 is again moved in the clockwise direction for the following series of steps. At the first part of this movement said stud 181 operates said pawl 179 to again wipe the alley in the manner above described, but this time all the pins on the alley are cleaned off including those standing. These pins pass to conveyors 15, 30 and belts 50, 51 as above described. Meanwhile, between the two described operations of said wiping arms 152, 153, said belts 50, 51 have been carrying pins 3, 3 to said conveyor 73 on which they have been placed as hereinafter described and in which manner the pins will be continued to be fed after the second wiping of the pins from the alley until all the pins are on said conveyor 75, the time of operation being included in said second phase of operation of said time switch 196 which is for a period predetermined to be long enough for all the pins to reach said conveyor 75 before said pin 185 becomes operative to actuate the mechanism to set the pins. The second phase of said time switch is to be understood to be interrupted between the operation of said stud 181 and stud 185 by a commutator mechanism, not shown but well known in the art, to give time for all the pins to reach conveyor 75.

The pins 3, 3 as they pass from conveyor 36 to said belts 50 and 51 are separated from each other by said spring member 9 so that they are spaced apart from each other on said belts 50 and 51. As each of said pins 3, 3 moves with belts 50, 51 it strikes said guide member 71 and is tipped with its head end extending backwardly so that when it reaches the upper end of said belts 50, 51 it is dropped therefrom base first into said chute 72 from which it rolls through said opening 74 and over guide 74' onto said belt 75 between a pair of partitions 76, 76 thereon.

As each pin 3 passes through said chute 72 it trips said plate 91 and thereby said arm 89 is actuated and clutch member 82 is moved into engagement with clutch member 82 and shaft 78 is rotated through one revolution to bring the next space between partitions 76, 76 below said guide 74' to receive the next pin 3 which comes along. In the manner described successive pins 3, 3 pass and take their position in a continuous row on said belt 75. Said second phase time interval of said time switch 196 is predetermined to be long enough for ten pins to pass on said belt 75 after the second ball goes through the alley, that is after said time switch 196 is set into operation the second time.

At the end of said second time phase the second step thereof becomes operative and said armature (not shown) completes contact for said motor 192 which, upon being energized, actuates said shaft 183 and one of said studs 187 is rotated into contact with said pin 204 whereby said weight 118 is raised in clockwise rotation and platform 118 through gravity rotates about shaft 117 into the position shown in Figure 2. Simultaneously said arms 141, 141 are rotated counter-clockwise and sweep the pins 3, 3 from said belt 75 into said troughs 131, 131 85 of platform 181 down which they slide and thence through said slots 130, 130 and onto the alley floor, between the respective positioning pins 8, 8 which have been raised when platform 118 was lowered. As the pins 3, 3 pass through slots 130, 130 they un latch and push said fingers 213, 213 from said catch pins 228, 228 whereby said fingers 213, 213 are released for action and control by said springs 220, 220 for further repetition of the phases of operation as above described. The said second step of the second phase of operation of said time switch 196 ends with the passing of said stud 187 past said pin 204, whereupon said weight 118 raises said platform 118 rotatively into its uppermost position and out of the way of the pins and balls on the alley. The alley is now ready for use again, the pins 3, 3 being spotted in place thereon, and the apparatus is in normal position for a ball to pass through and ready for a repetition of the pin setting operations, as above described.

The diagrams in Figures 13 and 14 indicate the several stages in the movement of the pins from the alley, through the pin setting apparatus, and back to the alley, and illustrates the manner in which the pins 3, 3 assume the inverted position on belts 50, 51 both in the case where they approach the latter head foremost and also base foremost. The path of the ball 28 is shown in Figure 13.

In Figures 15, 16 and 17 is illustrated, somewhat diagrammatically, an alternate form of conveyor somewhat similar to that comprising said belts 50, 51 and in which a pair of flat belts 250 and 251 are mounted with their surfaces in the same plane and are spaced apart at a distance greater than the diameter of the head of a pin 3 but less than the greatest diameter of the body thereof. Said belts 250, 251 are mounted similarly to belts 50, 51 and are driven by shafts 252 and 253 which carry pulleys 254, 254 and 255, 255 respectively. A pair of guide members 259.
256, 256 keep the pins 3, 3 from falling off the belts 250, 251 when they drop thereunto from said chute 48 and a pair of lateral guides 257, 257 keep said belts 250, 251 from spreading apart under the weight of pins 3, 3. When desired said belts 250, 251 can be supported underneath by rolls or by battens 258, 258 extending for sufficient length to keep the belts from excessive sag under the weight of pins 3, 3.

The mid-portion of said shaft 252 serves to tip the heads of the pins backwardly so that they are discharged base foremost into the chute 72.

I claim:

1. In a pin setting machine for a bowling alley, a set of chutes hinged on an axis transverse to the line of the alley and adapted for movement on said axis back and forth between a position in which it is inclined upwardly from said axis and a position in which it is inclined downwardly from said axis, automatic means for moving said chutes back and forth between said positions, and means for delivering pins in sets to said chutes.

2. In a pin setting machine for a bowling alley, a set of chutes hinged on an axis transverse to the line of the alley and adapted for movement on said axis back and forth between a position in which it is inclined upwardly from said axis and a position in which it is inclined downwardly from said axis, means for moving said chutes back and forth between said positions, and means to deliver pins in sets to said chutes.

3. In a pin setting machine for a bowling alley, a set of chutes hinged on an axis transverse to the line of the alley and adapted for movement on said axis back and forth between a position in which it is inclined upwardly from said axis and a position in which it is inclined downwardly from said axis; automatic means for moving said chutes back and forth between said positions; and automatic means to deliver pins in sets to said chutes, last said means being interconnected with said moving means whereby the said delivering means is operative when said chutes are in the downwardly inclined position.

4. In a pin setting machine for a bowling alley, a set of chutes hinged on an axis transverse to the line of the alley and adapted for movement on said axis back and forth between a position in which it is inclined upwardly from said axis and a position in which it is inclined downwardly from said axis; automatic means for moving said chutes back and forth between said positions; automatic means to deliver pins in sets to said chutes, last said means being interconnected with said moving means whereby the said delivering means is operative when said chutes are in the downwardly inclined position; and means for moving said set of chutes vertically toward and away from the alley.

5. In a pin setting apparatus for a bowling alley having a pit at the rear of the alley, a vertical pin conveyor extending upwardly from said pit and adapted to discharge the pins therefrom at an elevated position; a transverse conveyor adapted to receive pins from said vertical conveyor adjacent said elevated position and adapted to discharge pins at a lateral position; a longitudinal conveyor comprising a pair of belts arranged in trough shaped relation adapted to receive pins from said transverse conveyor adjacent said lateral position and a bottom member operative with said longitudinal conveyor to discharge pins base foremost at a forward position; a chute adapted to receive pins adjacent said forward position and to deliver them base rearmost; a second transverse conveyor positioned over the alley and adapted to receive pins delivered by said chute and having thereon means defining pin receiving spaces; means for moving said conveyor in a direction away from said chute and over said alley; a set of pivoted chutes aligned with last said conveyor and hinged on an axis transverse to line of the alley and adapted for movement on said axis back and forth between a position in which it is inclined upwardly from said axis, and a position in which it is inclined downwardly from said axis; and means for transferring pins from last said conveyor to said set of chutes.

6. In a pin setting apparatus for a bowling alley having a pit at the rear of the alley, a vertical pin conveyor extending upwardly from said pit and adapted to discharge the pins therefrom at an elevated position; a transverse conveyor adapted to receive pins from said vertical conveyor adjacent said elevated position and adapted to discharge pins at a lateral position; a longitudinal conveyor adapted to receive pins from said transverse conveyor adjacent said lateral position and to discharge pins base foremost at a forward position; a chute adjacent said forward position and to deliver them base rearmost; a second transverse conveyor positioned over the alley and adapted to receive pins delivered by said chute and having thereon means defining pin receiving spaces; means for moving said last said conveyor in a direction away from said chute and over said alley; a set of pivoted chutes aligned with last said conveyor and hinged on an axis transverse to line of the alley and adapted for movement on said axis back and forth between a position in which it is inclined upwardly from said axis, and a position in which it is inclined downwardly from said axis; means for transferring pins from last said conveyor to said set of chutes; and means for moving said set of chutes up and down about its transverse axis.

7. In a pin setting apparatus for a bowling alley having a pit at the rear of the alley, a
vertical pin conveyor extending upwardly from said pit and adapted to discharge the pins therefrom at an elevated position; a transverse conveyor adapted to receive pins from said vertical conveyor adjacent said elevated position and adapted to discharge pins at a lateral position; a longitudinal conveyor comprising a pair of belts arranged in trough shaped relation spaced apart at the bottom a distance greater than the diameter of the head of a pin and less than the diameter of the body of a pin and spaced apart at the top a distance greater than the diameter of the body of a pin, said longitudinal conveyor being adapted to receive pins from said transverse conveyor adjacent said lateral position and to discharge said pins at a forward position; means for inclining pins on said conveyor with their base foremost at said forward position; a chute adapted to receive pins adjacent said forward position and to deliver them base rearmost; a second transverse conveyor positioned over the alley and adapted to receive pins delivered by said chute and having thereon means for defining pin receiving spaces; means for moving last said conveyor to carry pins thereon in a direction away from said chute and over said alley; a set of pivoted pin delivering chutes aligned with last said conveyor and hinged on an axis transverse to line of the alley and adapted for movement on said axis to and from a position in which it is inclined downwardly from said axis toward said alley; and means for transferring pins from last said conveyor to said set of chutes. 8. In a pin setting machine for a bowling alley, a set of pin chutes mounted over the alley and longitudinally aligned with one another for part of their length and curving downwardly, with their ends arranged in spaced relation similar to that in which the pins are set, each of said chutes terminating in a longitudinal boot at its lower end, means for moving said set of chutes vertically up and down, and means for rotating said set of chutes about a transverse axis. 10. In a pin setting machine for a bowling alley, a set of pin chutes mounted over the alley and longitudinally aligned with one another for part of their length and curving downwardly, with their ends arranged in spaced relation similar to that in which the pins are set, each of said chutes terminating in a longitudinal boot at its lower end, means for moving said set of chutes vertically up and down, and means for rotating said set of chutes about a transverse axis; a plurality of sets of positioning rods movable upwardly through the alley and aligned each set with one of said boots, said plurality of sets of boots being interconnected to said set of chutes and movable thereby, whereby said positioning rods are movable upwardly when said chutes are moved downwardly and vice versa.

12. A conveyor for moving bowling pins,
comprising a pair of members movable longitudinally together and spaced apart at their pin receiving portions at a distance greater than the diameter of the head of a given pin and less than the greatest diameter of said given pin.

13. A conveyor for moving bowling pins, comprising a pair of belts movable together and spaced apart at their pin receiving portions at a distance greater than the diameter of the head of a given pin and less than the greatest diameter of said given pin.

14. A conveyor for moving bowling pins, comprising a pair of flat belts arranged in side by side relation with one edge of each one lower than the opposite edge of the same, and with the lower edges of the two belts spaced apart from each other at a distance less than the diameter of the head of a given pin and with upper edges of the two belts spaced apart at a distance greater than the greatest diameter of said given pin.

In testimony that I claim the invention set forth above I have hereunto set my hand this 27th day of August, 1928.

WILLIAM WHITE.