

Aug. 10, 1943.

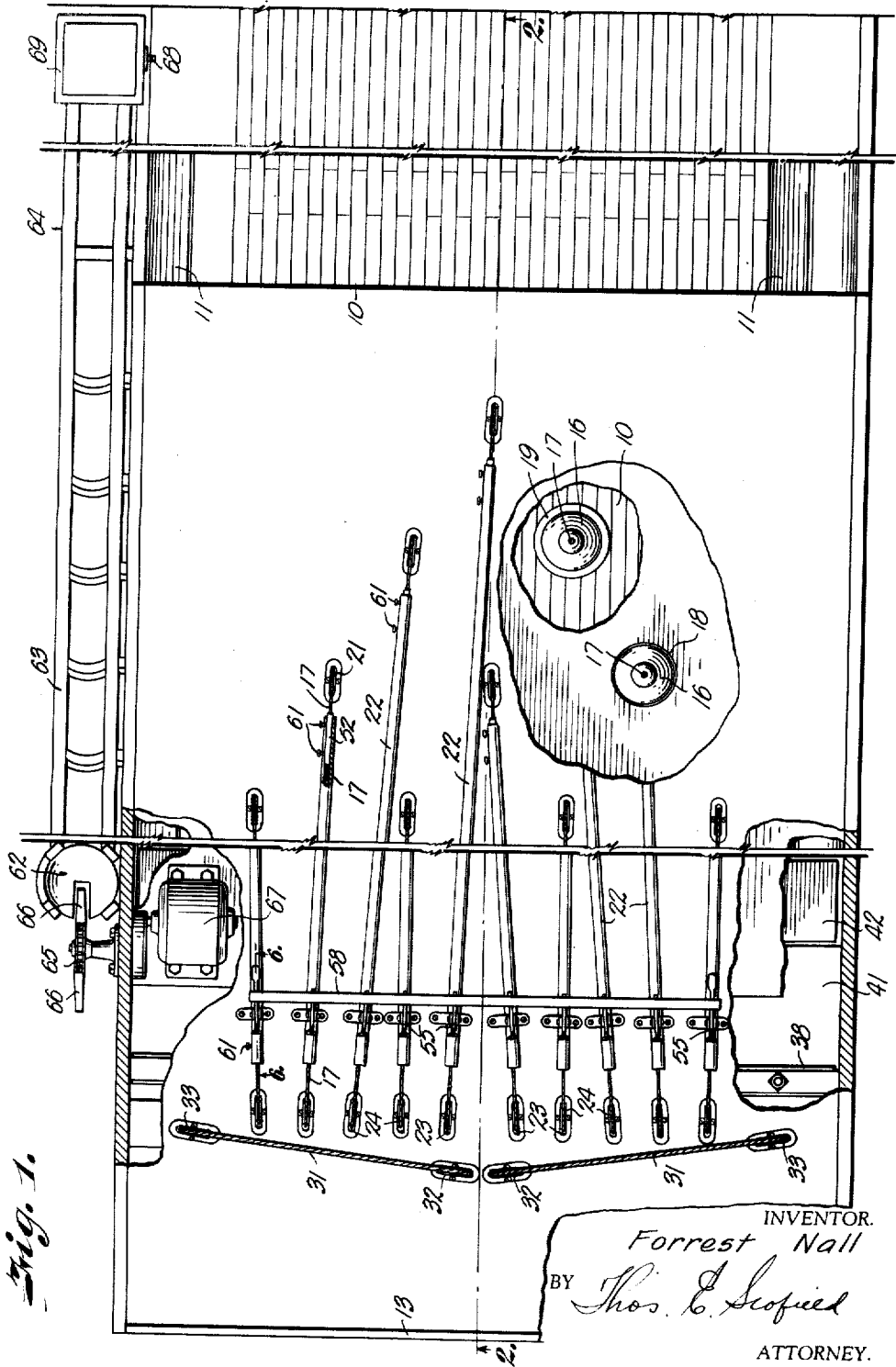
F. NALL

2,326,554

BOWLING ALLEY

Filed Jan. 2, 1942

4 Sheets-Sheet 1



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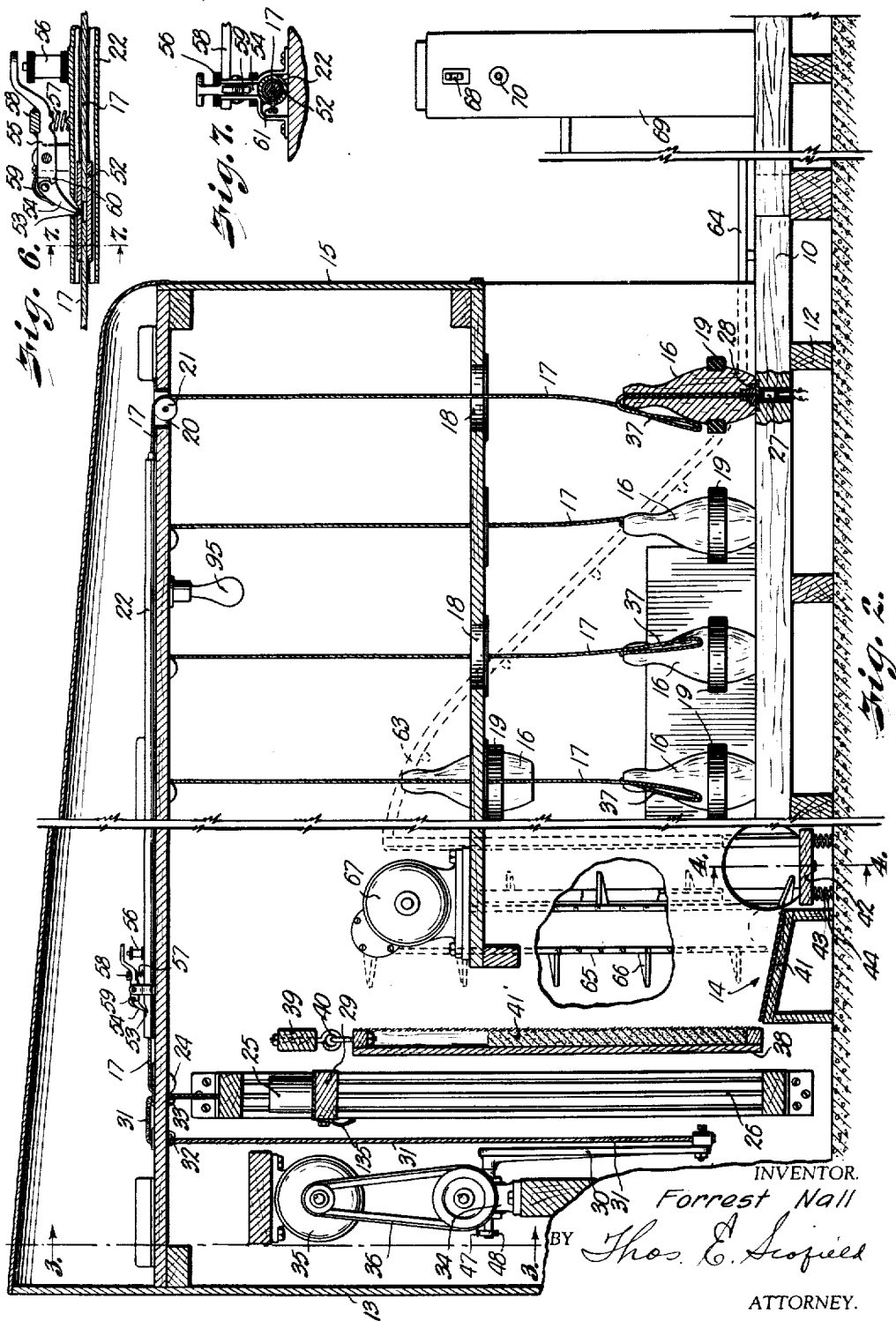
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*Fig. 3.*

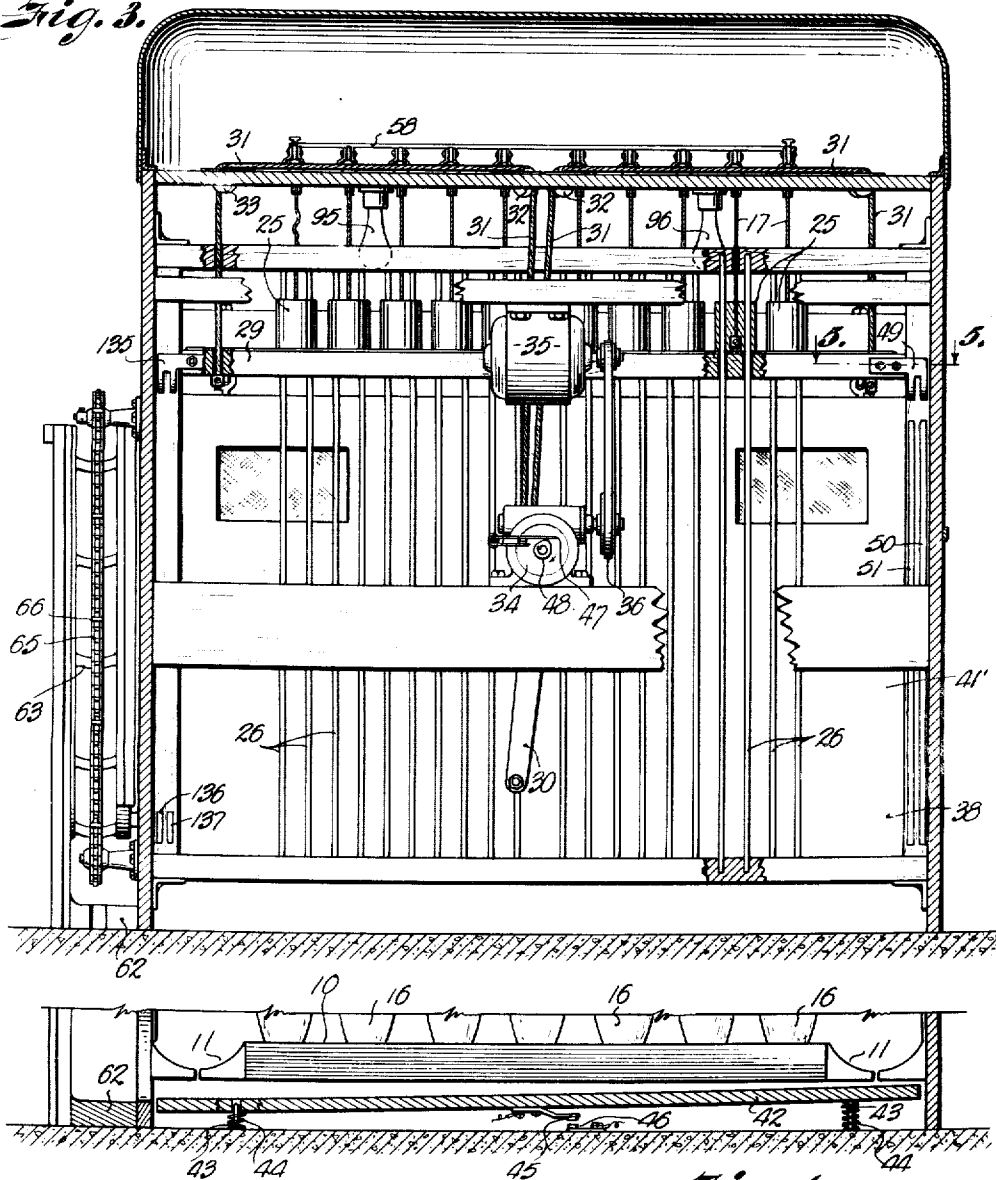


*Fig. 4.*

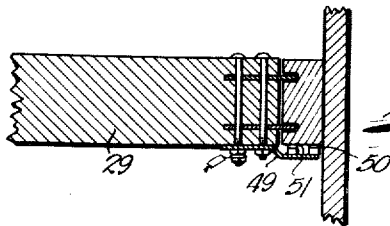


*Fig. 5.*

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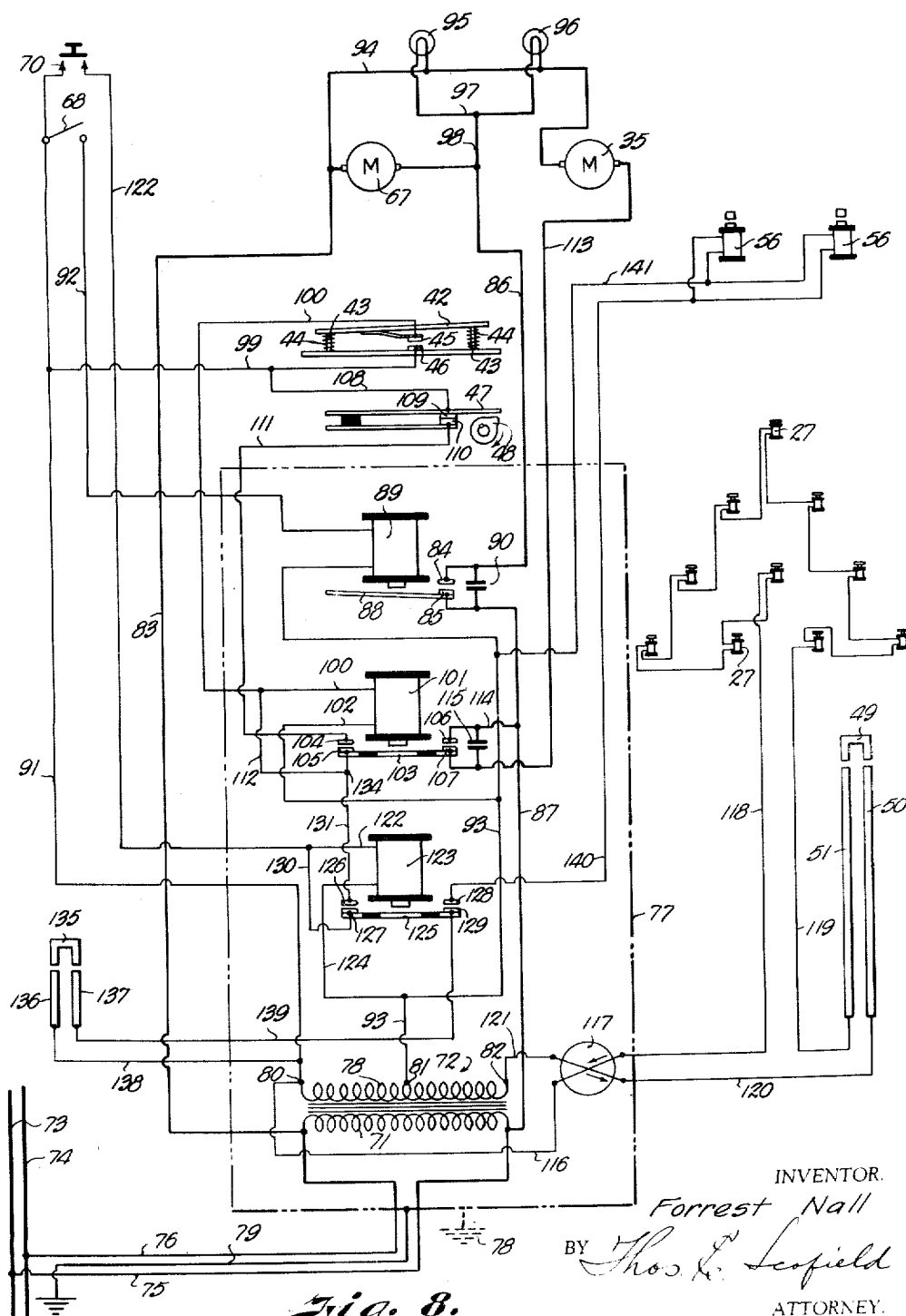
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BOWLING ALLEY

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4 Sheets-Sheet 4



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## UNITED STATES PATENT OFFICE

2,326,554

## BOWLING ALLEY

Forrest Nall, Mission, Kans.

Application January 2, 1942, Serial No. 425,403

9 Claims. (Cl. 273-44)

My invention relates broadly to bowling alleys and more particularly to a novel mechanism for automatically removing the fallen pins from the alley after each ball is rolled, for releasably holding the fallen pins in an unobstructive position, and for "spotting" all of the pins at the end of each frame.

My invention may be used in bowling alleys of all types. The pins are automatically positioned for play by electromagnets. Weighted cords attached to the pins automatically pull the same into a suitable housing after they have been knocked away from the magnets by the impact of the ball or of other pins. Considerable difficulty has been experienced, however, in that the weights either pull the pins away from the magnets before the ball is rolled or drop so rapidly after the pin is released that proper pin play is prevented.

An important object of my invention is to provide a mechanism that will delay the picking up of the fallen pins for a short time after they have been knocked over so that maximum pin play is permitted.

Another object of my invention is the provision of a mechanism of the above mentioned character that, by the actuation of weights, will raise the fallen pins only after the ball has dropped into the pit of the alley.

Still another object of my invention is the provision of a mechanism of the above mentioned character that includes a novel means for holding the fallen pins in a raised, out of the way position after the first ball is rolled.

Yet another object of my invention is the provision of a mechanism that will release the raised pins and reset all of the pins on the alley when a switch easily accessible to the players is closed.

Other objects and advantages of my invention will be apparent during the course of the following description.

In the drawings, forming a part of this specification, and wherein like numerals are employed to designate like parts;

Fig. 1 is a top plan view of a bowling alley embodying my invention, showing the cover of the housing removed, with parts broken away and parts in section for clearness of illustration.

Fig. 2 is a longitudinal sectional view, taken on the line 2-2 of Fig. 1.

Fig. 3 is a transverse sectional view, taken on the line 3-3 of Fig. 2.

Fig. 4 is a fragmentary transverse sectional view taken on the line 4-4 of Fig. 2.

Fig. 5 is a fragmentary transverse sectional view, taken on the line 5-5 of Fig. 3.

Fig. 6 is a fragmentary longitudinal sectional view taken on the line 6-6 of Fig. 1.

Fig. 7 is a transverse sectional view taken on the line 7-7 of Fig. 6, and

Fig. 8 is a diagrammatic view showing the electric circuits involved.

In the accompanying drawings, wherein for the purpose of illustration is shown a preferred embodiment of my invention, the numeral 10 designates the floor of a bowling alley. The alley is preferably of standard size and is provided with the usual gutters 11 at each side thereof. The floor comprises a plurality of longitudinally extending hardwood strips laid side by side on transverse supports 12. The top surfaces of the strips are flush to provide a smooth playing surface. This construction is best illustrated in Fig. 1.

A rear wall or partition 13 at the pin pit end of the alley is of substantially the same width as the alley and is positioned behind the pit 14. An enclosure is formed over the pin setting space by the housing 15. The pins 16 are fitted with flexible cords 17 which pass upwardly through openings 18 in the bottom of the overhanging enclosure 15. The pins are encircled with narrow rubber bands or belts 19. The openings 18 are of greater diameter than the pins but smaller than the diameter of the pins at the rubber bands 19. Thus, when a cord draws a pin upward, that portion of the pin above the band will extend through the opening 18, the band serving as a stop and preventing the pin from passing entirely through, as shown in Fig. 2. Directly above and aligned with openings 18 in the upper part of housing 15 are openings 20. Positioned in openings 20 are sheaves 21 which support the cords 17 and serve as a fairlead to tubes 22 through which the cords pass to holes 23 in which are mounted pulleys or sheaves 24 to change the direction of the cords downwardly. The depending rearward ends of each cord carries a weight 25 which is slidably mounted on vertical rods 26.

As shown in Fig. 2, the pins 16 are spotted by electromagnets 27. When the electromagnets are energized they attract a soft iron core 28 in the bottom of the pins and hold the pins in place on the floor of the alley. In the past, it has generally been the practice to provide weights that were not sufficiently heavy to pull the pins vertically from the magnets, and only when the pin was released from the magnet's attraction

was the weight sufficient immediately to pull the pin upwardly. It is obvious that if the weights are free to drop when the pins are released from the magnets, proper pin play is prevented. To circumvent this objectionable feature, I have provided a lift bar 29 which is vertically slidable on the rods 26 and in its upward movement raises weights 25. The lift bar is raised and lowered by means of a revolving arm 30. Cords 31 attached to the end of the arm pass upwardly through the top of the housing and over sheaves 32 and 33. The opposite ends of cords 31 are attached to the ends of lift bar 29. The arm 30 is rotated by a reduction gearing 34 which is driven by motor 35 through belt 36. Normally, the arm 30 hangs downward in a vertical depending position, which raises the lift bar 29 and holds all of the weights in a raised position. It will be observed that, in this position of the weights, cords 17 are provided with substantial slack as at 37 in Fig. 2. Thus, when the weights 25 are elevated, the pins will have a substantial play when struck by the bowling ball or by another pin. This freedom of action is necessary if the pins are to simulate the movement of unattached pins.

When the first ball is rolled, the pins have been set and properly spotted on the alley. Electromagnets 27 are unenergized and weights 25 are held in an elevated position by lift bar 29. Assume that five pins are knocked over by the first ball and that the ball strikes the swinging panel 38 and drops into the pit 14. The panel 38 is suspended from a transverse support 39 by eye-bolts 40. A bag of sand, felt or other shock absorbent 41 covers the front of the panel and provides a suitable medium for absorbing the impact of the ball. After striking the panel, the ball drops onto a platform 41, which is inclined forwardly, to roll the ball onto the floating contact board 42. As best shown in Fig. 4, the contact board extends the full width of the pit. Vertical pins 43 are slidably received in openings in the board and, surrounding the pins to yieldably hold the contact board in a raised position are coil springs 44. The springs at one end of the board are slightly longer than those at the other end so that the board is normally tilted toward one side of the alley.

When a ball or pin 16 drops onto the floating contact board 42, the contacts 45 and 46 are closed. As will be hereinafter described in detail, contacts 45 and 46 are electrically connected to motor 35 so that closing of the contacts energizes the motor and causes the arm 30 to rotate. As explained, upward movement of arm 30 lowers the lift bar 29 and rotation of arm 30 to a lowered position raises the bar 29. A normally closed switch arm 47 mounted on the housing of the reduction gearing 34 is opened by a cam 48 as the arm 30 completes one revolution. The switch arm 47 breaks the circuit through motor 35 and stops arm 30 in its normal lowered position illustrated in Fig. 2.

As the lift bar 29 moves downwardly on rods 26, the support for the weights 25 is removed and all of the weights will be lowered. The initial movement of the weights will take up the slack 37 in the cords. After the bar has moved downwardly for a short distance and before the slack 37 is entirely taken up, a contact 49 carried thereby engages contact strips 50 and 51 to close a circuit in which the electromagnets 27 are interposed. As the lift bar 29 continues to move downwardly, the weights attached to the fallen pins

will pull these pins upwardly into openings 18. The weights attached to the standing pins will be suspended by reason of the magnetic attraction of the electromagnets 27. As the weights attached to the fallen pins move downwardly, the cords attached thereto move rearwardly through tubes 22. As best illustrated in Figs. 6 and 7, each of the cords is provided with a catch member in the nature of a notched sleeve 52. When the weights are in the fully lowered position, apertures 53 in tubes 22 register with the notches in the sleeves and permit engagement of pawls 54 with the notches in the sleeves. Pawls 54 are pivotally mounted on latch members 55 and are urged into the sleeve notches by spring arms 59. This prevents the cords from sliding forwardly in tubes 22 when the weights are lifted. Each of the sleeves 52 carries a threaded stud 61 which slides in a registering slot in the tube 22 to prevent the sleeve from rotating in the tube and to assure proper alignment of the notch with pawl 54.

Latch members 55 with accompanying mechanism are pivoted above each of the tubes 22 and all of the latch members are connected and synchronized by a transverse bar 58. One arm of each latch member pivotally carries a pawl 54 while only the endmost latch members have forwardly projecting arms extending above and arranged to contact solenoids 56. Coil springs 57 hold the arms raised when the solenoids 56 are deenergized.

It may thus be seen that as sleeves 52 move rearwardly in tubes 22, they will be engaged by the pawls 54 and pivot the same upwardly against the action of springs 59. When the notches in the sleeves register with the apertures in the tubes, springs 59 will cause the pawls to drop into the notches and prevent the forward movement of the sleeves. If, however, the solenoids 56 are energized, all of the latch members will be pivoted against the action of springs 57 and, due to the contour of the lugs 60 formed on latch members 55, the pawls will be raised out of engagement with the notched sleeves. Thus, when the weights 25 are raised by lift bar 29, the fallen pins will be held in the raised position by latch and pawl mechanism described. When the lift bar 29 reaches the upper limit of its travel, contact 49 will disengage from contact strips 50 and 51 to again deenergize electromagnets 27.

When the ball drops onto the tilted contact board 42, it will roll to one side of the alley and onto the ledge 62. An elevator is provided for lifting the ball from the ledge and depositing it on the raised rearward end 63 of the return track 64. The elevator comprises an endless chain 65 having projecting fingers 66. The endless chain is behind the ledge 62 so the fingers 66 will pass under the ball and lift it onto the end 63 of the return track. The timing is such that the elevator will remove the ball to separate contacts 45 and 46 before arm 30 completes its revolution. The endless chain is operated by a motor 67. This motor is connected to a power source through a toggle switch 68 shown in Fig. 8 and mounted on the post 69 at the players' end of the alley.

Before the play is begun the toggle switch 68 is closed to start motor 67. This motor operates continuously throughout the game so that the endless chain 65 will pick up every ball that is thrown and immediately return the same to the players.

As above described, after the first ball is rolled

in any frame, the ball or a pin will drop on contact board 42 to close contacts 45 and 46. Closing of the contacts will energize motor 35 and cause arm 30 to rotate through one complete revolution. This movement of arm 30 will lower and raise lift bar 29. With the lowering of the lift bar, weights 25 are lowered and the fallen pins will be raised and held in a raised position by the latch and pawl mechanism shown in Fig. 6 and Fig. 7. After the arm 30 has made one complete revolution, cam 48 will open switch arm 47 to deenergize motor 35.

In order that all of the pins may be respotted at the end of each frame, I provide a push button switch 70 on the post 69, easily accessible to the players. After the operation of the pin lifting mechanism, switch 70 is closed and the operation of the mechanism is repeated. Switch 70 then closes a circuit through solenoids 56 releasing pawls 54 and disengaging them from the notched sleeves 52. Therefore, when the mechanism operates through switch 70, all of the cords are free to slide forwardly in their respective tubes 22 when the weights 25 move upwardly. The electromagnets 27 beneath the pins are energized to center the pins when they are lowered onto the alley.

Referring now to Fig. 8 which illustrates diagrammatically the electric circuits of the mechanism hereinabove described, I desire to operate the device from a 110 volt source of current supply. However, some of the circuits carry only 24 volts and other circuits only 8 volts. Transformer 72 supplies the proper voltage to the respective circuits. The electrical apparatus is mounted in a box secured to wall 13, the box being designated by broken line 77. In view of the fact that certain of the mechanism within the box is supplied with 110 volt current, I prefer to connect the box to a ground 78 through a neutral conductor 79. The primary coil 71 of transformer 72 is connected to conductors 73 and 74 of a 110 volt line by conductors 75 and 76. The secondary coil 78 of the transformer supplies current to both an 8 volt circuit and a 24 volt circuit. Three taps 80, 81, and 82, are therefore provided. The circuits connected to taps 80 and 81 carry 8 volts and the circuits connected to taps 80 and 82 carry 24 volts.

One terminal of the elevator motor 67 is connected to the primary coil of transformer 72 by conductor 83. The other terminal of motor 67 is connected to the primary coil of the transformer through normally open contacts 84 and 85 by conductors 86 and 87. Contact 85 is carried by a pivoted switch arm 88 which is operated by relay 89. A condenser 90 is interposed between conductors 86 and 87 to prevent arcing between contacts 84 and 85. Relay 89 is energized when toggle switch 68 is closed. The relay operates on an 8 volt circuit. Conductor 91 connects tap 80 of the transformer to one terminal of switch 68. The other terminal of the switch is connected to relay 89 through conductor 92 while conductor 93 connects the relay 89 to tap 81 of the transformer.

When switch 68 is closed, current will flow from the secondary coil of the transformer through conductor 91, switch 68, conductor 92, relay 89, and conductor 93, back to the transformer. Relay 89 is then energized to operate switch arm 88. This switch arm closes contacts 84 and 85 and current will flow from the primary coil of the transformer through conductor 83, motor 67, conductor 86, contacts 84, 85 and con-

ductor 87 back to the transformer. Therefore, when switch 68 is closed, the elevator motor will be continuously operated. Current will also flow through conductor 94, flood lights 95 and 96, and conductors 97 and 98. The flood lights are mounted in the overhanging portion of the housing to illuminate the pins during the playing period.

When the ball or a pin drops onto the floating contact board 42, contacts 45 and 46 are closed. Current will then flow from the secondary coil of the transformer through conductor 91, conductor 99, contacts 45, 46, conductor 100, relay 101, conductor 102, and conductor 93, back to the transformer. When relay 101 is energized, it will actuate the switch arm 103 to close contacts 104, 105, and contacts 106, 107. Current may then flow from the secondary coil of the transformer along conductor 91, conductor 99, conductor 108, through the normally closed contacts 109 and 110 through conductor 111, contacts 104, 105, conductors 112 and 100, through relay 101, thence along conductors 102 and 93, back to the transformer. Cam 48 rotates in the direction of the arrow in Fig. 8 so that normally closed contacts 109, 110 will remain closed until the lift bar actuating arm 30 makes one complete revolution. After the arm completes its revolution, switch arm 47 will be actuated by the cam to separate contacts 109 and 110 to break the above circuit. Thus, when the elevator removes the ball from floating contact board 42 to separate contacts 45 and 46, the current will continue to flow through contacts 109 and 110. After relay 101 has been energized to operate switch arm 103 by closing of contacts 45, 46, the current may flow through contacts 104 and 105 to maintain relay 101 energized until the circuit is broken by separation of contacts 109 and 110.

As soon as contacts 45 and 46 are closed by dropping of the ball into the pit of the alley to energize relay 101, current will also flow from the primary coil of the transformer through conductors 83 and 94, through motor 35, along conductor 113, through contacts 107 and 106, and along conductors 114 and 87 back to the transformer. A condenser 115 is interposed in conductors 113 and 114 to prevent arcing between contacts 106 and 107.

Thus, as soon as the switch in the pit of the alley is closed, motor 35 will be operated and relay 101 will be energized to operate switch arm 103. Operation of switch arm 103 will close the contacts 104, 105 and contacts 106, 107. The switch in the pit of the alley will be opened as soon as the elevator removes the ball. However, current will continue to flow to the relay through cam controlled contacts 109 and 110 and contacts 104, 105 will complete a holding circuit through the relay.

As soon as motor 35 is energized, lift bar 29 will be lowered to move contact 49 into engagement with the contact strips 50 and 51. Current may then flow through the electro-magnets 27 which operate on a 24 volt circuit. Current flows from the tap 80 on the secondary coil of the transformer, along conductor 116, through rectifier 117, along conductor 118, through each of the electromagnets 27 which are connected in series, along conductor 119, through contacts 51, 49, 50, along conductor 120, through rectifier 117, and along conductor 121 to tap 82 of the transformer. Therefore, as soon as the lift bar begins its downward travel, and before the pins are lifted from the floor of the alley, the electromagnets will

be energized to hold the pins standing on the alley. Only the fallen pins are raised when the lift bar is lowered. The rectifier 117 converts the alternating current supplied to the transformer to direct current for the electromagnets.

It may thus be seen that dropping of the ball or a pin into the pit of the alley will close contacts 45 and 46. The motor 35 will immediately be energized to lower the lift bar. After the lift bar has been lowered for a short distance, the electromagnets are energized to hold the standing pins. The motor will continue to operate until lift bar actuating arm 30 makes one complete revolution. One revolution of the arm 30 will cause the lift bar to first lower and then raise weights 25. When the weights are lowered, the fallen pins will be raised to an unobstructing position and held in this position by the latch and pawl mechanism. As the lift bar approaches the upper limit of its travel, contact 49 will separate from contact strips 50 and 51 to deenergize the electromagnets. As arm 30 completes its revolution, cam 48 will separate contacts 109 and 110 to stop the mechanism. It will be observed that the above operation is automatic and that no effort or attention is required of the players other than manipulation of switch 68 at the beginning of play.

After the second ball is rolled, the above operation will be repeated.

When it is desired to reset the pins, push button 70 is pressed by one of the players. Current then flows from the transformer along conductor 91, through switch 70, along conductor 122, through relay 123 and along conductors 124 and 93 to the transformer. When relay 123 is energized, it will operate switch arm 125 to close contacts 126, 127 and contacts 128, 129. As soon as contact arm 125 is operated, current also flows through conductor 130, through contacts 126, 127, along conductors 131, 112 and 100, through relay 101 and along conductors 102 and 93 to the transformer. As soon as relay 101 is energized, contact arm 103 will be operated to close contacts 104, 105 and contacts 106, 107. As contact arm 103 is operated, current flows from the transformer along conductor 91, conductor 99, conductor 108, through contacts 109, 110, along conductor 111, through contacts 104, 105, along conductors 112 and 100, through relay 101, and along conductors 102 and 93 to maintain relay 101 energized after switch 70 is released. The current will divide at point 134 and flow along conductor 131 through contacts 126, 127, along conductors 130 and 122, through relay 123 and along conductors 124 and 93 to the transformer to also maintain relay 123 energized after switch 70 is released. Operation of contact arm 103 will also permit current to flow through motor 35 as hereinabove described.

As soon as motor 35 is energized, arm 30 will begin to rotate upwardly to lower lift bar 29. When the lift bar moves downwardly a sufficient distance to bring contact 49 into engagement with contact strips 50 and 51, the electromagnets will be energized in the manner described. When the lift bar 29 approaches the lower limit of its travel, contact 135 carried thereby will engage the relatively short contact strips 136 and 137. As soon as this occurs, current will flow from the transformer along conductor 138, through contacts 136, 135 and 137, along conductor 139, through contacts 128, 129, along conductor 140, through solenoids 56 and along conductors 141 and 93, back to the transformer. It will be ob-

served that solenoids 56 are connected in parallel to conductors 140 and 141. Therefore, as the lift bar approaches the lower limit of its travel, solenoids 56 will be energized to operate latch members 55 to disengage the latches 54 from sleeves 52. The solenoids 56 will remain energized until the lift bar completes its downward travel and moves upwardly a sufficient distance to disengage contact 135 from contact strips 136 and 137. By the time this occurs, the notched sleeves 52 will have moved forwardly and out of engagement with latches 54. When the solenoids 56 are deenergized, the latch members 55 will be pivoted to the normal position by springs 57. Latches 54 do not move downwardly far enough to grip the cords. In setting the pins electromagnets 27 remain energized until the pins 16 contact the floor of the alley. As the lift bar 29 continues to move upwardly, contact 49 will disengage contact strips 50 and 51 to deenergize the electromagnets. When the lift bar reaches the upper limit of its travel, cam 48 will separate contacts 109 and 110 to prevent further flow of current through any of these circuits.

It is to be understood, however, that current will flow continuously through the elevator motor 67 and flood lights 95 and 96 until the toggle switch 68 is manually opened.

It may thus be seen that I have accomplished the objects of my invention. I have provided a mechanism which is essentially simple and compact. The mechanism is automatically operative to remove the fallen pins while those left standing can be continued in play. After the second ball is rolled, the mechanism is again automatically operated to remove additional pins which have fallen. To reset the pins at the end of a frame, it is only necessary for a player to close switch 70. The switch 70 need be closed for only an instant to permit relays 101 and 123 to be energized. The mechanism thereafter automatically performs the operation of releasing the raised pins and spotting the same on the alley.

It is to be understood that the form of my invention herewith shown and described is to be taken as a preferred example of the same and that various changes in the size, shape and arrangement of parts may be resorted to without departing from the spirit of my invention or the scope of the appended claims.

Having thus described my invention, I claim:

1. In a bowling alley, bowling pins, cords attached to the pins, weights carried by the cords, a movable lift bar supporting the weights, a catch member carried by each of the cords, a latch for each of the catch members, and means rendered operative by movement of said lift bar for simultaneously disengaging all of said latches from the catch members.

2. In a bowling alley of the type including pins, cords attached to the pins and weights carried by the cords, a lift bar supporting the weights, a catch member carried by each of the cords, a latch for each of the catch members, contacts adapted to be closed by the lift bar at a predetermined point in its travel, and electromagnetic means for simultaneously disengaging all of the latches from the catch members electrically connected to the contacts.

3. In a bowling alley of the type including pins, cords attached to the pins and weights carried by the cords, a movable lift bar supporting the weights, a catch member carried by each of the cords, a latch for each of the catch members, contacts adapted to be closed by the lift bar at

a predetermined point in the travel of said bar, a manually operated switch, and electromagnetic means for disengaging the latches from the catch members electrically connected to the contacts through the said switch.

4. In a bowling alley, bowling pins, normally deenergized electromagnets for holding the pins on the alley cords attached to the pins, weights carried by the cords, a vertically movable lift bar supporting the weights, a motor for actuating the lift bar, a normally open switch in the pit of the bowling alley, and an electrical circuit including said motor and said switch, the arrangement being such that the switch will be closed by a ball or pin falling into the pit to operate the motor, and an electric circuit including said electromagnets and a switch, the switch being closed by the lift bar during its initial movement to energize the electromagnets.

5. In a bowling alley of the type including pins, cords attached to the pins and weights carried by the cords, means for raising and lowering the weights, a motor for actuating the said means, a transformer having a primary and a secondary coil, a normally open switch, an electric circuit connecting the switch and motor to the primary coil of the transformer, a normally open second switch in the pit of the alley adapted to be closed by a pin or ball falling into the pit, a relay for closing said first switch, and an electric circuit connecting a second switch and the relay to the secondary coil of the transformer.

6. In a bowling alley of the type including pins, normally slack cords attached to the pins and weights carried by the cords, a movable lift bar for normally holding the weights in a raised position, catch members carried by the cords, latches engageable with the catch members when the fallen pins are raised, and normally deenergized electromagnetic means adapted to be energized by movement of the lift bar for holding the standing pins, the arrangement being such that said electromagnetic means will be energized before the slack is taken from the cords.

7. In a bowling alley of the type including pins, normally slack cords attached to the pins and weights carried by the cords, a normally raised vertically movable lift bar supporting the weights, normally deenergized electromagnetic means adapted to be energized by movement of the lift bar to hold the standing pins, a motor for actuating the lift bar, a normally open switch in the pit of the bowling alley, an electric circuit including the electromagnetic means, the motor and the switch, the arrangement being such that the switch will be closed by a ball or pin falling into the pit to operate the motor which in turn lowers the lift bar and raises the fallen pins and that the electromagnetic means will be energized before the slack is taken from the cords, and means for holding the fallen pins in a raised position.

8. A bowling alley, bowling pins, cords attached to the pins, weights carried by the cords, a bar supporting the weights, a motor for raising and lowering the bar, a latch mechanism for holding the pins in a raised position, a normally open switch in the pit of the alley adapted to be closed by impact with a ball or pin, said switch being electrically connected to the motor so that closing of the switch will operate the motor to actuate the bar, and means responsive to movement of the bar for releasing the said latching means.

9. A bowling alley of the type including pins, cords attached to the pins and weights carried by the cords, a bar supporting the weights, a motor for raising and lowering the bar, a releasable latching mechanism for holding the pins in a raised position, a normally open switch in the pit of the alley adapted to be closed by impact with a ball or pin, said switch being electrically connected to the motor so that closing of the switch will operate the motor, a manually operated switch, and means rendered operative by closing of the manually operated switch and responsive to movement of the bar for releasing said latching means.

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