

May 25, 1943.

J. E. FLANAGAN

2,319,925

AUTOMATIC BOWLING ALLEY MECHANISM

Filed Sept. 11, 1940

12 Sheets-Sheet 1

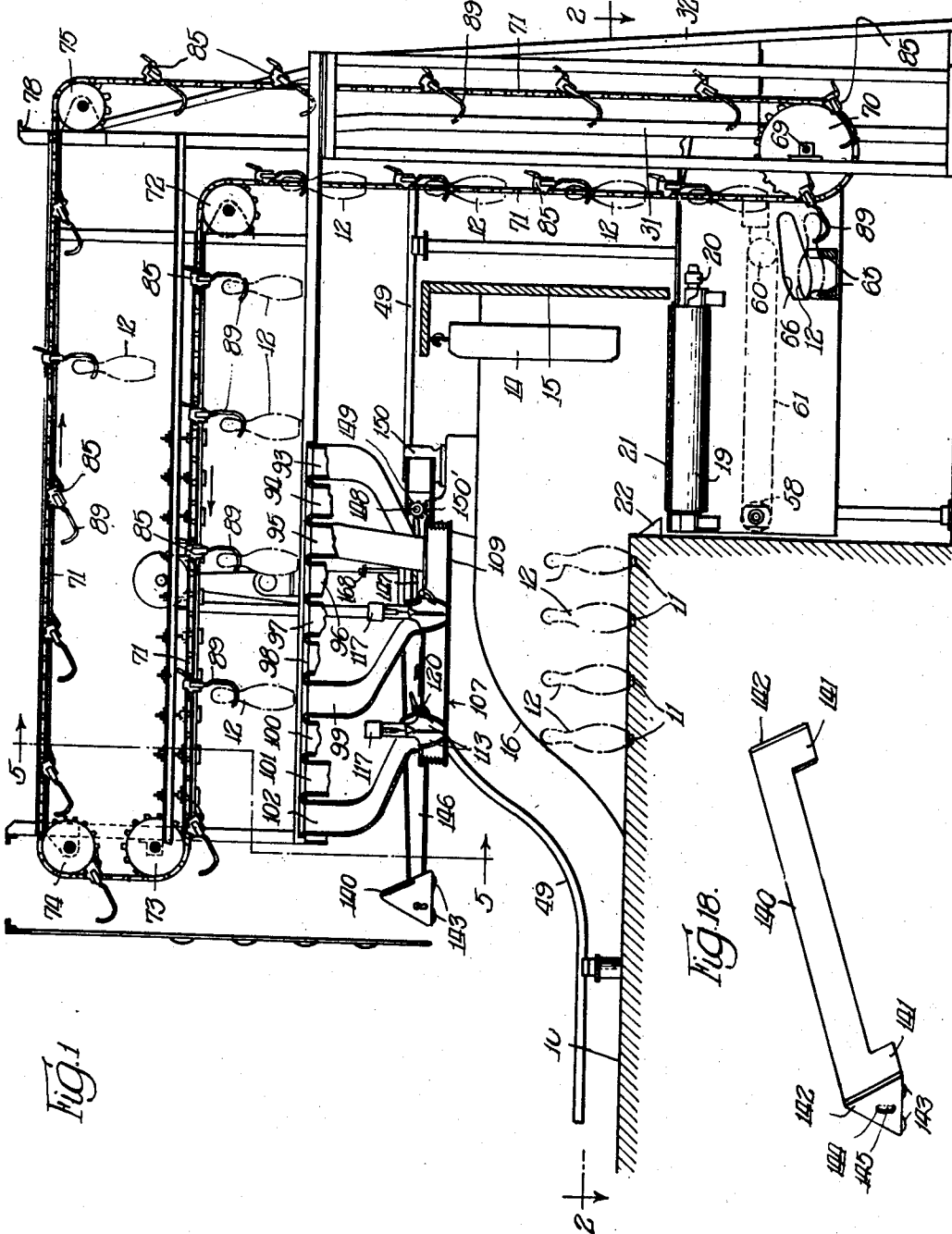


Fig. 1

Fig. 18.

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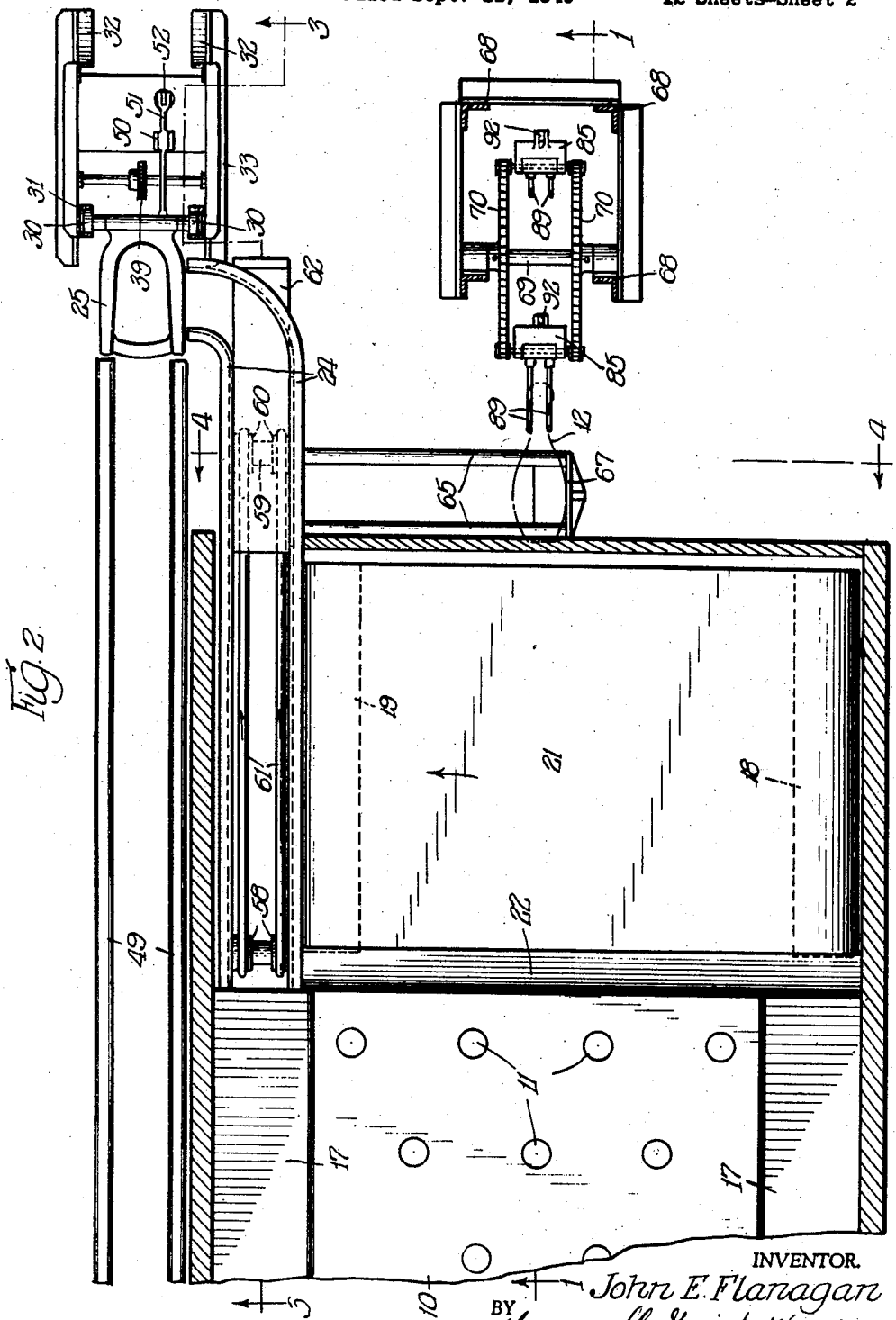
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AUTOMATIC BOWLING ALLEY MECHANISM

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12 Sheets-Sheet 2



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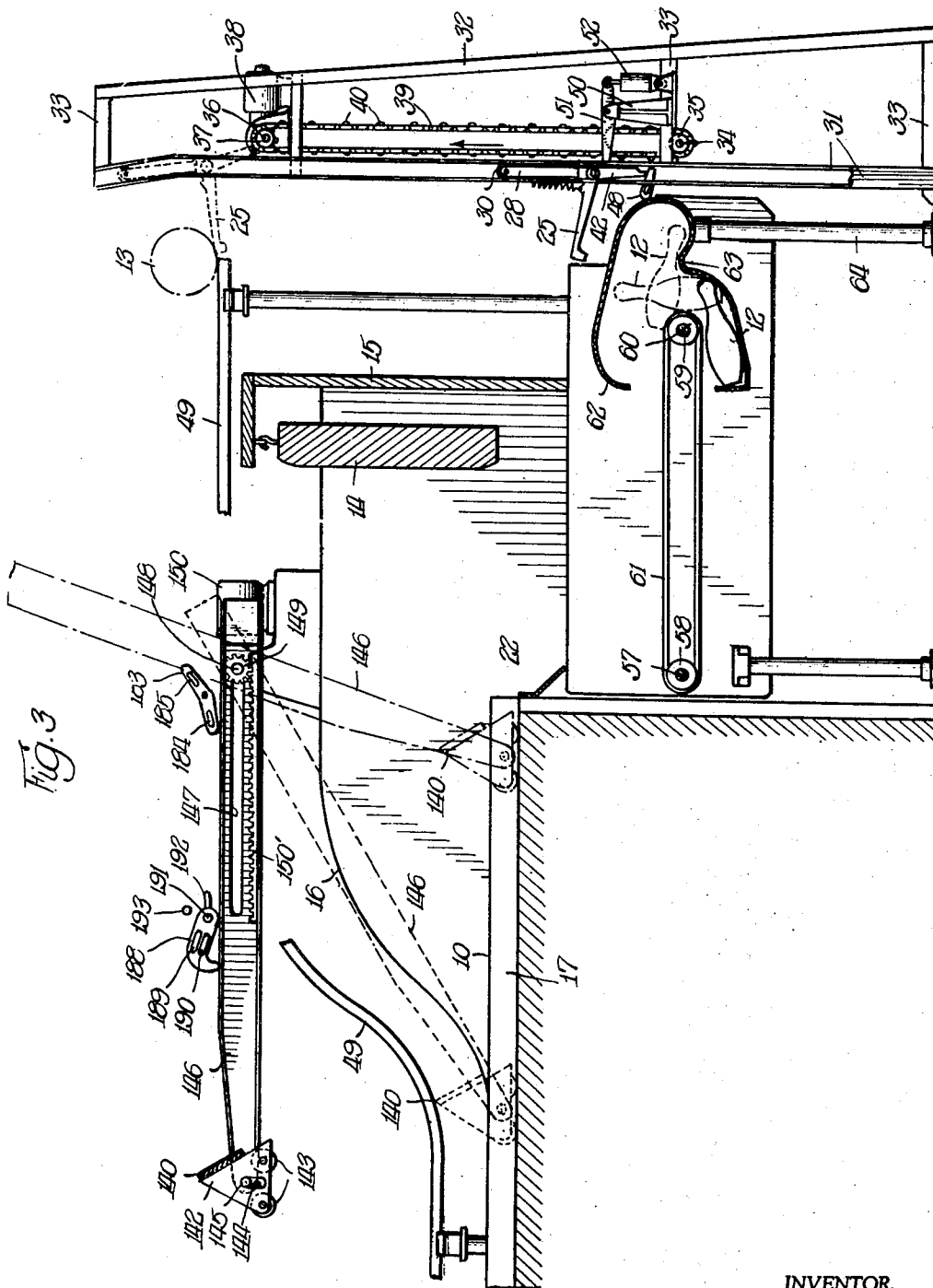
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AUTOMATIC BOWLING ALLEY MECHANISM

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12 Sheets-Sheet 3



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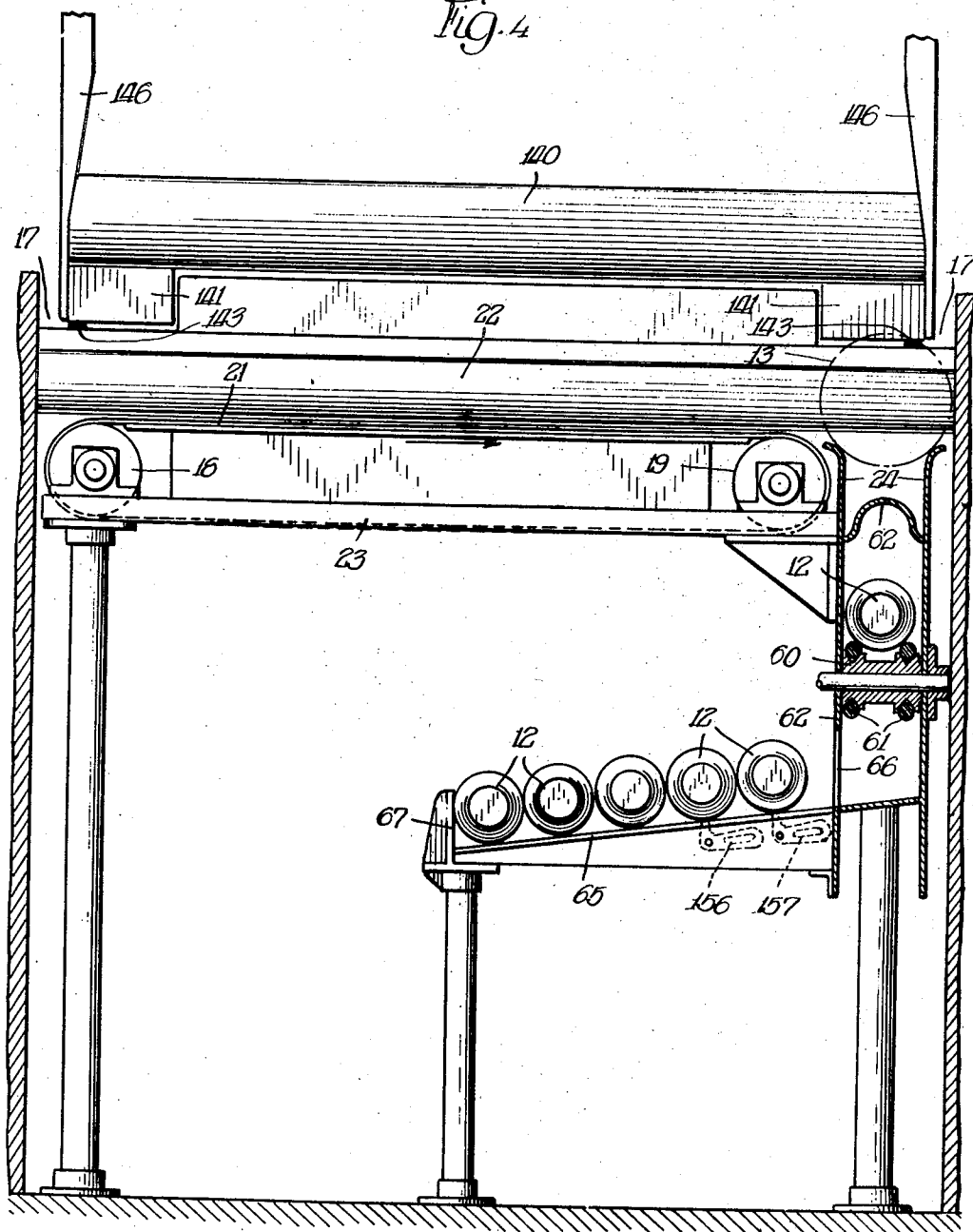
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AUTOMATIC BOWLING ALLEY MECHANISM

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Fig. 4



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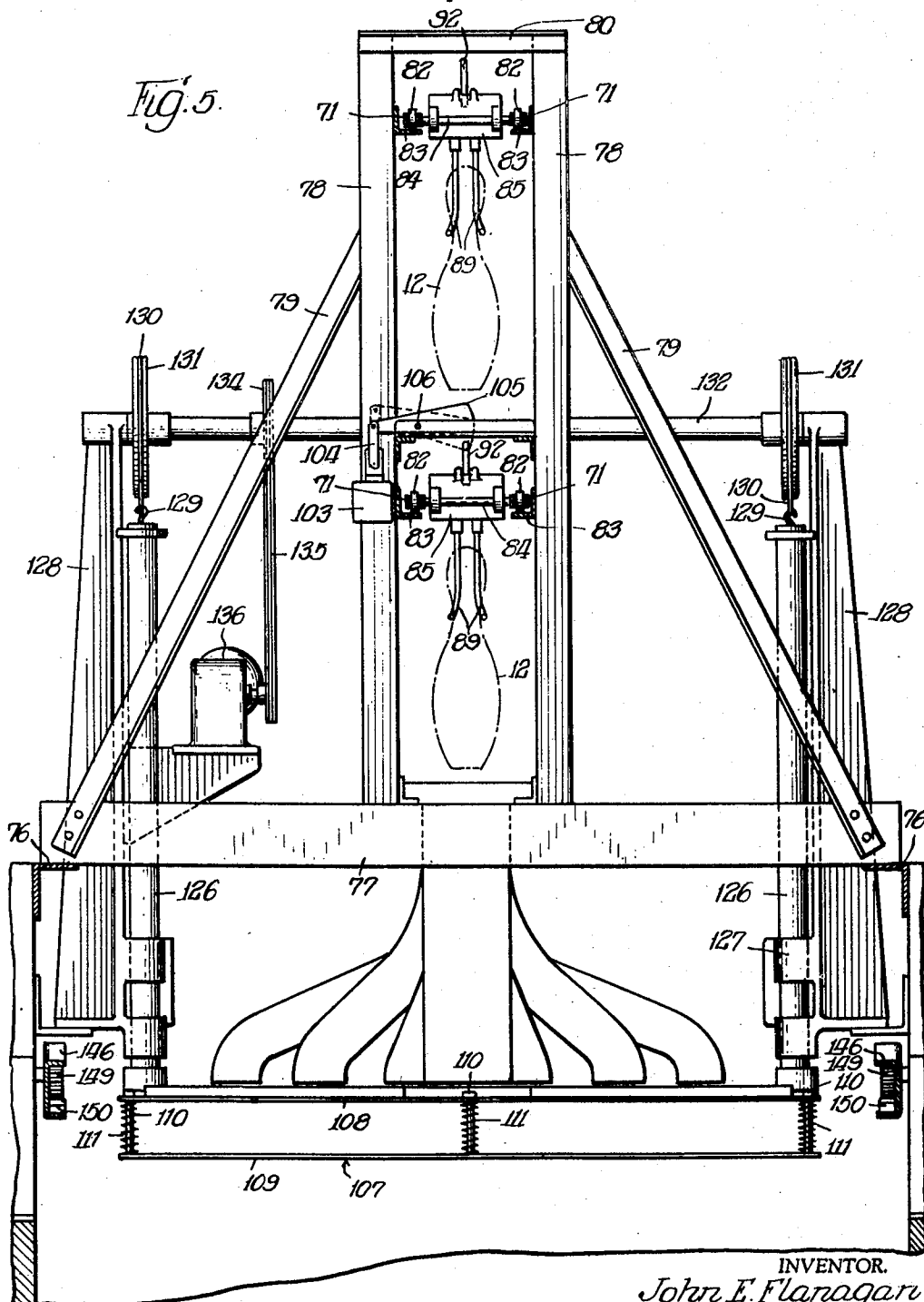
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AUTOMATIC BOWLING ALLEY MECHANISM

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Fig. 5.



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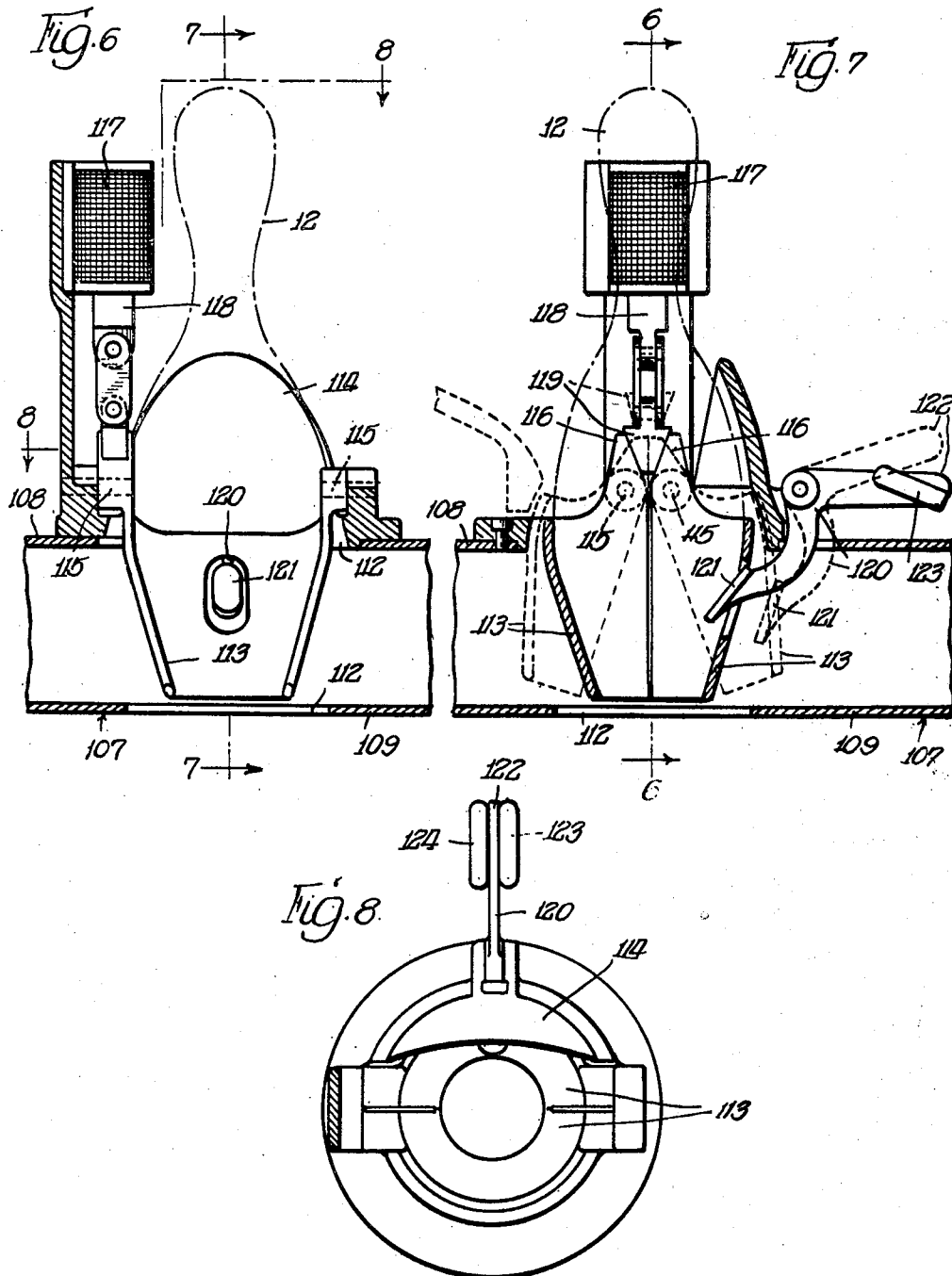
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AUTOMATIC BOWLING ALLEY MECHANISM

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12 Sheets-Sheet 6



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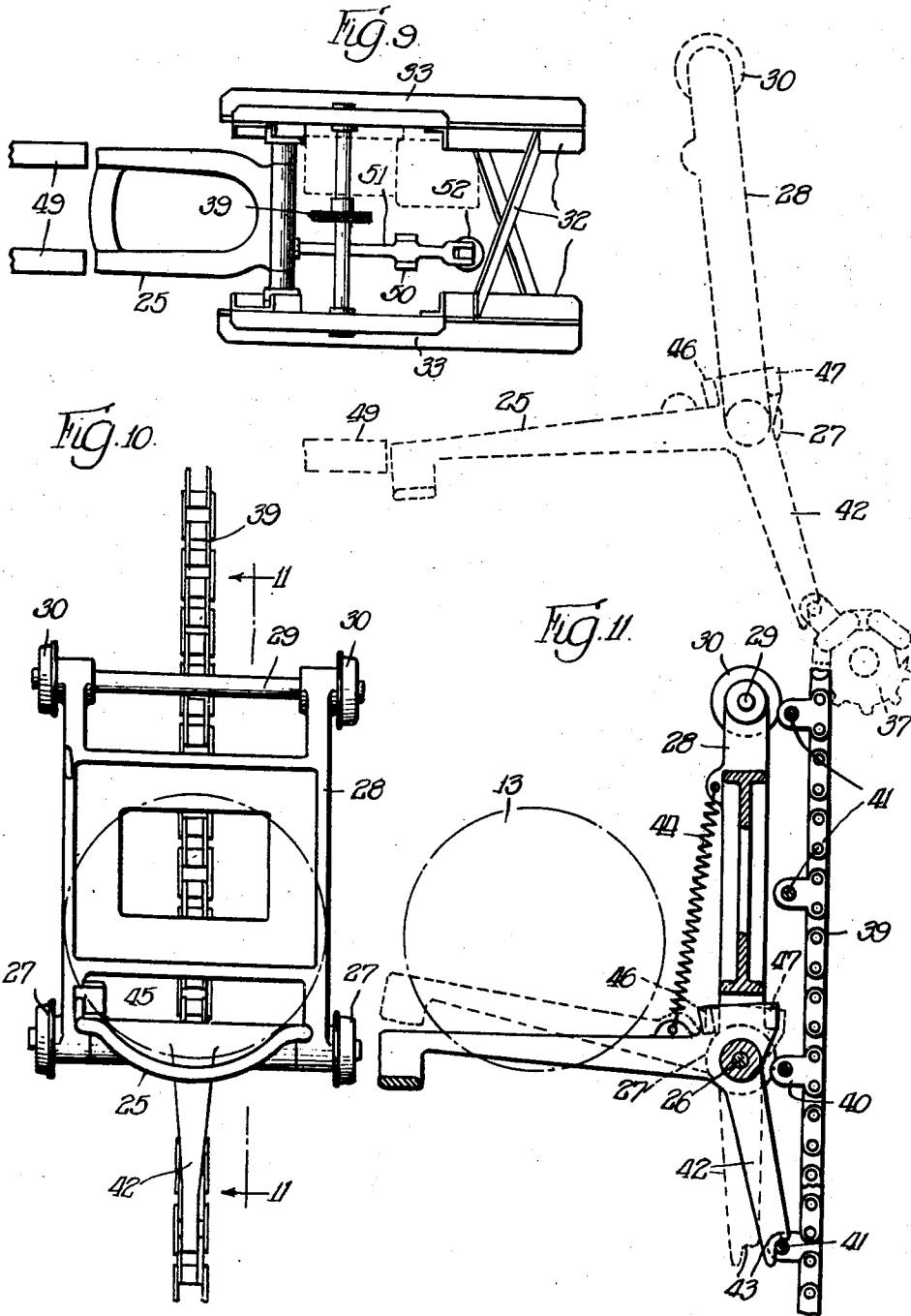
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12 Sheets-Sheet 7



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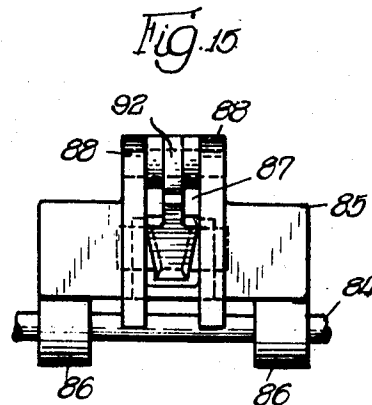
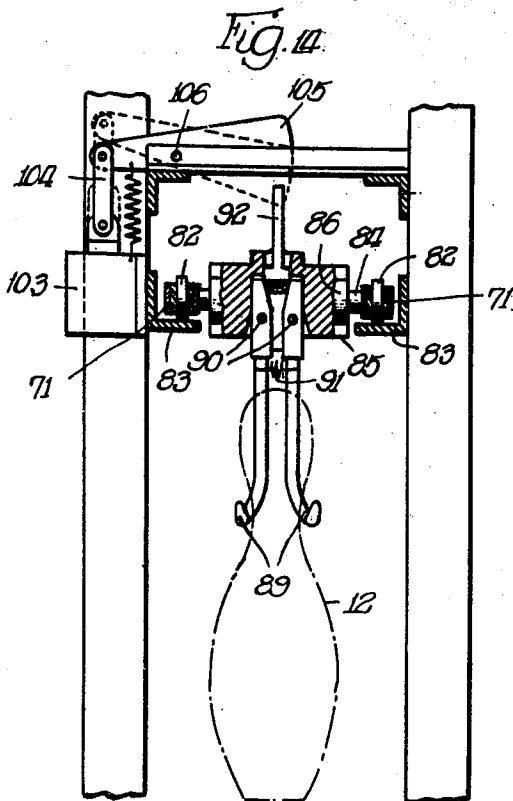
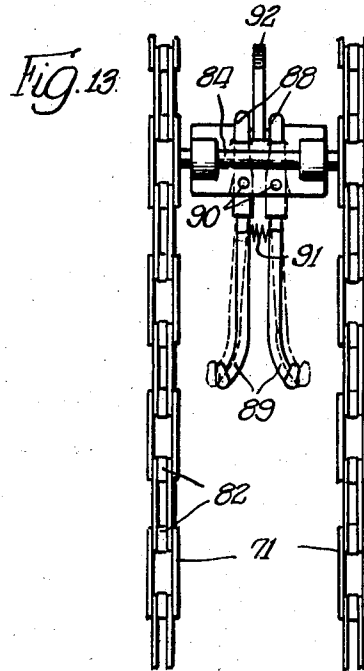
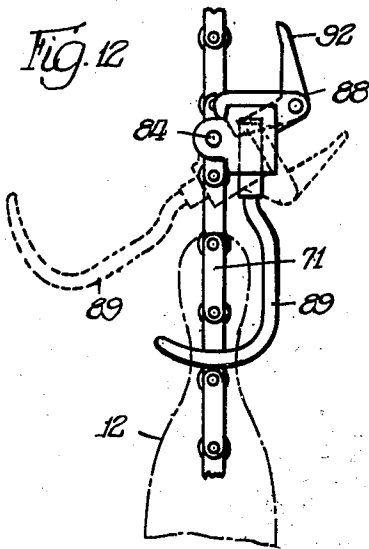
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AUTOMATIC BOWLING ALLEY MECHANISM

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12 Sheets-Sheet 8



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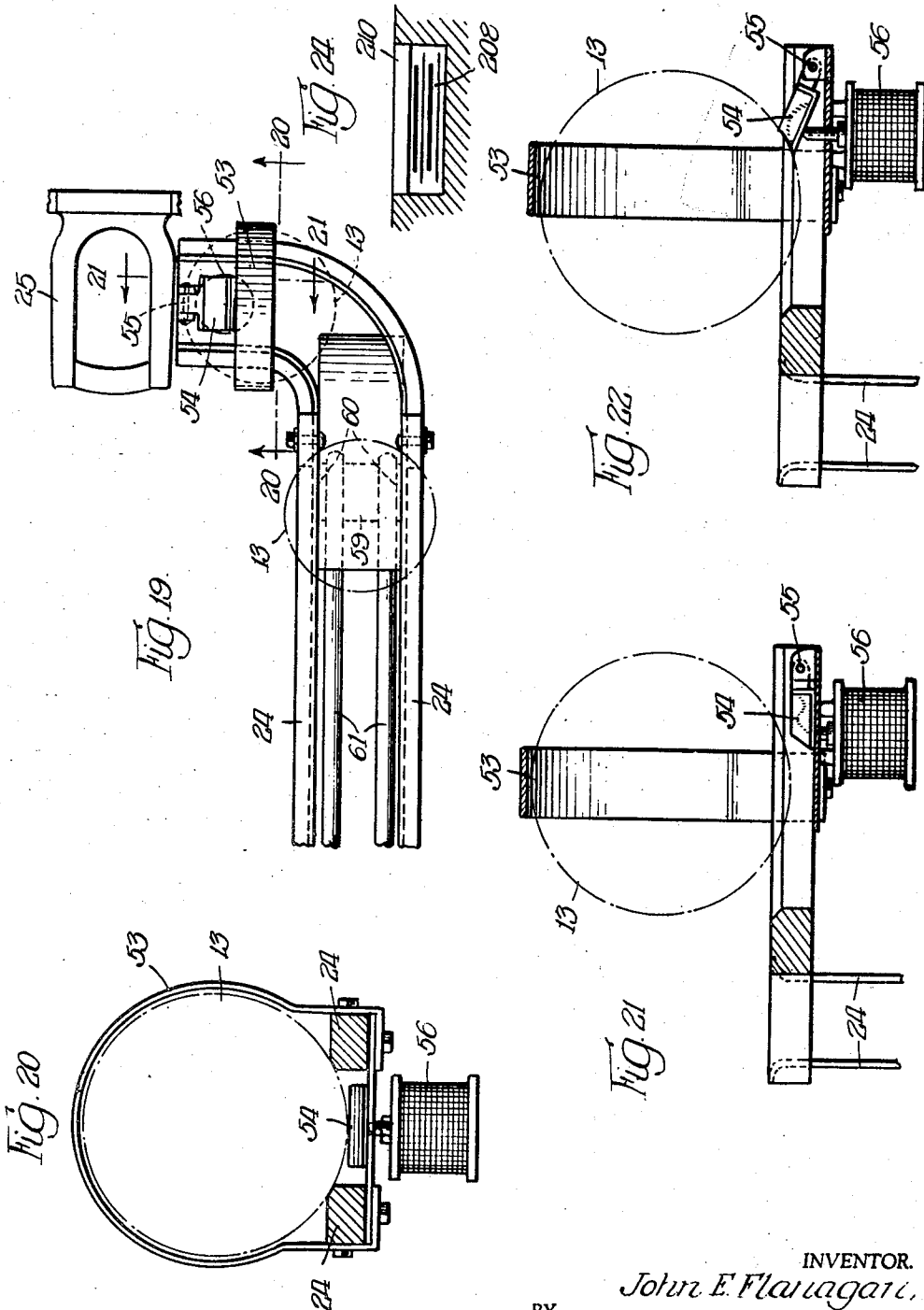
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AUTOMATIC BOWLING ALLEY MECHANISM

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12 Sheets-Sheet 10



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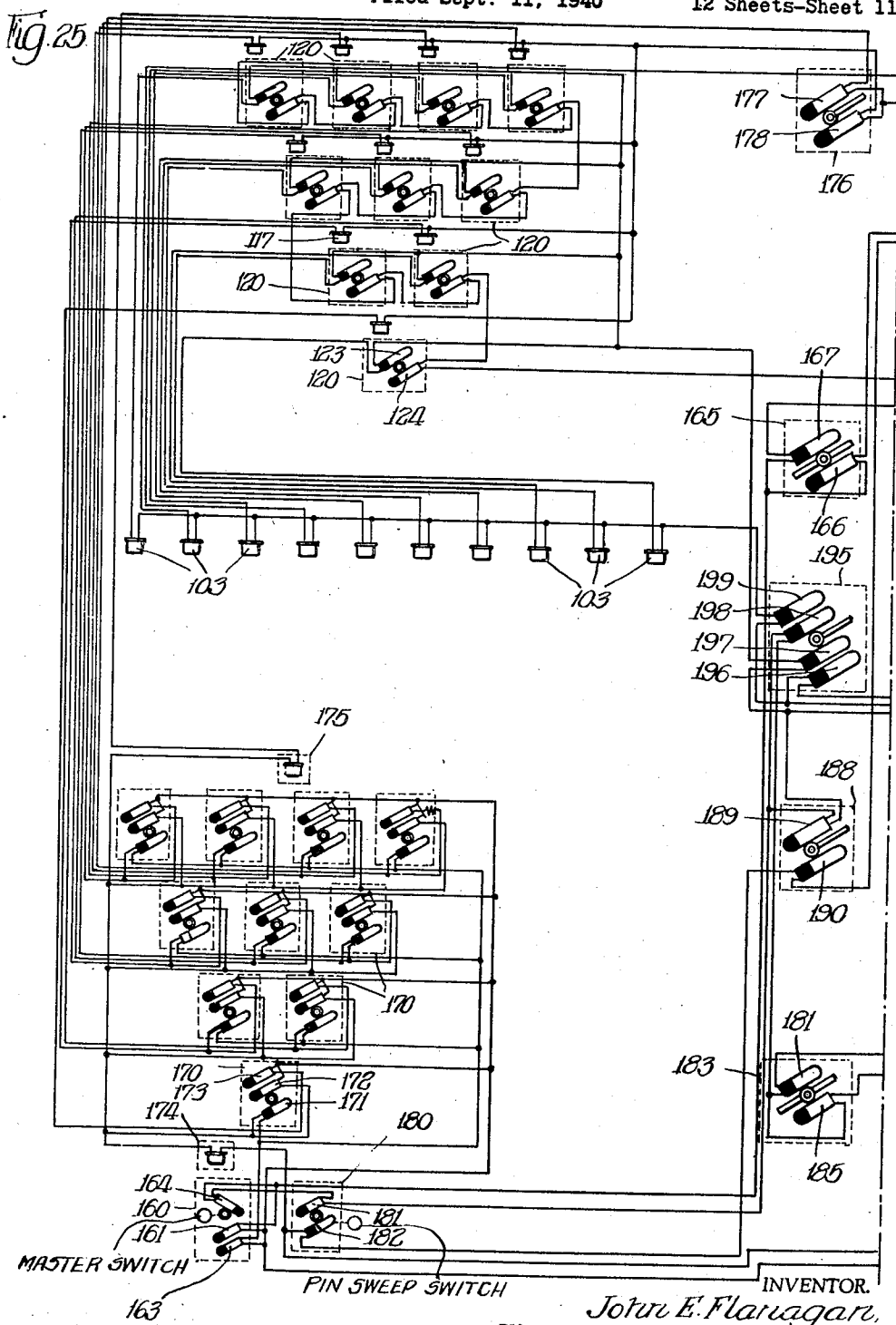
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AUTOMATIC BOWLING ALLEY MECHANISM

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12 Sheets-Sheet 11



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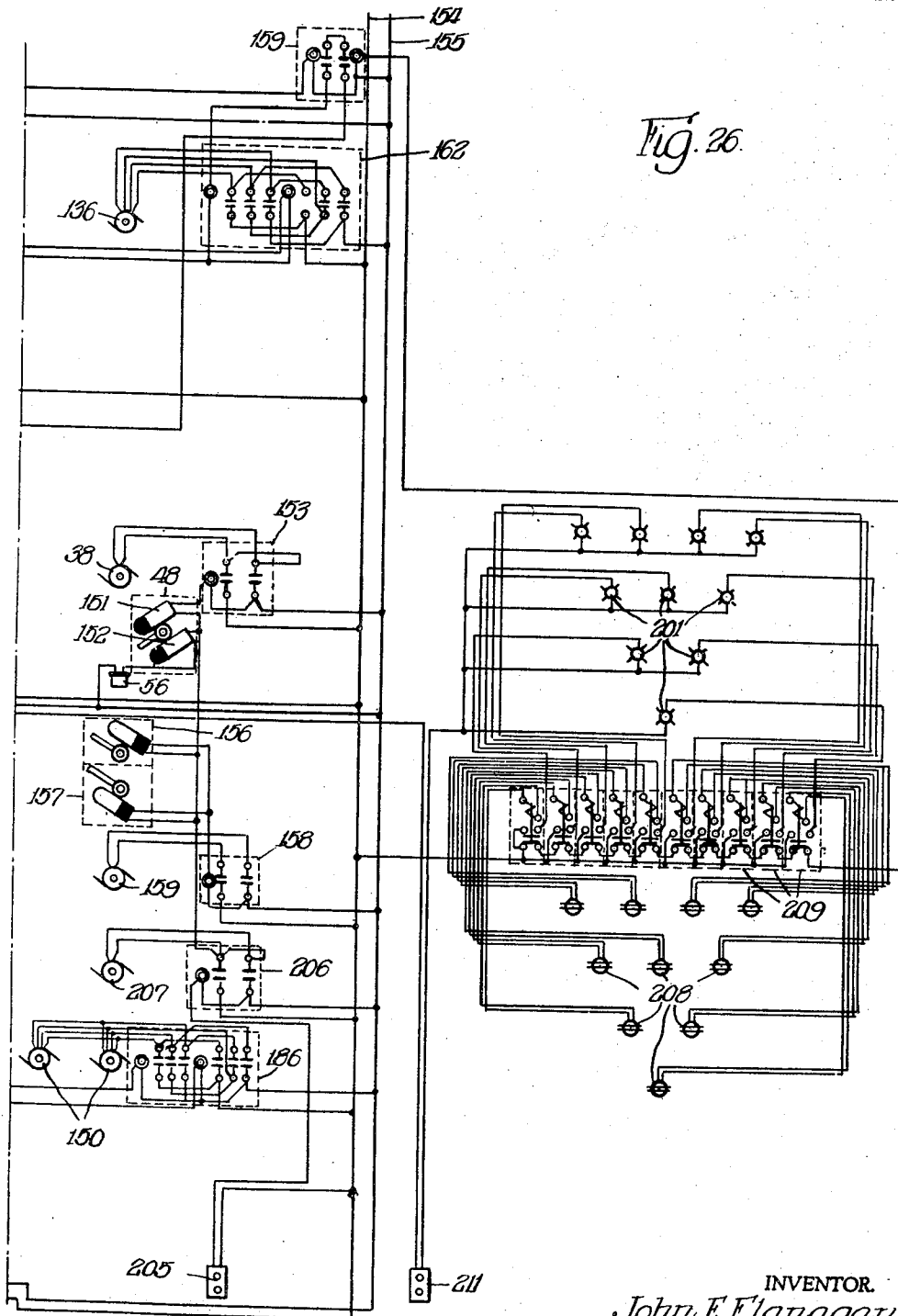
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AUTOMATIC BOWLING ALLEY MECHANISM

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12 Sheets-Sheet 12



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UNITED STATES PATENT OFFICE

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AUTOMATIC BOWLING ALLEY MECHANISM

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Application September 11, 1940, Serial No. 356,309

10 Claims. (Cl. 273-43)

The present invention relates to an improved type of mechanism for use in connection with standard bowling alleys, by which manual clearance of pins, resetting of pins, and return of balls is made unnecessary, these operations being automatic and within the selective control of the bowler.

A principal object of the invention is the provision of a complete and automatic bowling ball and pin control mechanism actuated at the will of the bowler and provided with selective control units electrically actuated and having indicating devices for accurately showing the alley position of pins which remain standing after a ball has been bowled.

An additional object of the invention is the provision of a bowling alley control mechanism having a series of functions electrically initiated and actuated by which pins remaining on an alley after a bowling ball has passed along the alley will be swept clear of the alley, pins swept clear of the alley will be automatically conveyed to a loading mechanism and thereby replaced in the desired position, and involving the return of a ball which has passed across the alley, these functions being so related as to prevent interference and to insure accurate and selective operation of the alley with respect to the placement of pins and return of the bowling ball in a rapid manner.

These and other objects will be evident upon a consideration of the following description of a preferred embodiment of the invention and by reference to the accompanying drawings, in which

Fig. 1 is a sectional view taken along line 1-1 of Fig. 2 showing the combined conveyor system, pin-setting mechanism and ball return;

Fig. 2 is a sectional view of the apparatus taken along line 2-2 of Fig. 1;

Fig. 3 is a sectional view taken along line 3-3 of Fig. 2 and shows in particular the details of the pin sweep mechanism constructed in accordance with the invention;

Fig. 4 is a sectional view of the apparatus taken along line 4-4 of Fig. 2;

Fig. 5 is an enlarged fragmentary view of the pin-setting mechanism taken along line 5-5 of Fig. 1;

Fig. 6 is an enlarged sectional view of a single pin-setting unit taken along line 6-6 of Fig. 7;

Fig. 7 is a sectional view taken along line 7-7 of Fig. 6 showing the single pin-setting unit in different operative positions;

Fig. 8 is a sectional view taken along line 8-8 of Fig. 6;

Fig. 9 is a fragmentary plan view of the ball-lifting mechanism shown in Fig. 3;

Fig. 10 is a front view of the apparatus shown in Fig. 9 with the ball hoist track momented;

Fig. 11 is a sectional view taken along line 11-11 of Fig. 10 and shows different positions of the ball-lifting mechanism;

Fig. 12 is an enlarged fragmentary view of a single pin-lifting member constructed in accordance with the invention;

Fig. 13 is a front view of the single pin-lifting unit shown in Fig. 12;

Fig. 14 is a fragmentary front view of the pin-conveying mechanism in horizontal position and shows a single pin-engaging unit about to be tripped for location of a pin in the pin-setting mechanism;

Fig. 15 is a top view of the mechanism shown in Fig. 14;

Fig. 16 is a top view of the pin-setting mechanism;

Fig. 17 is a sectional view taken along line 17-17 of Fig. 16 and showing mechanism for raising and lowering the pin-setting device;

Fig. 18 is a detailed view of the pin-sweeping bar shown in Figs. 1 and 3;

Fig. 19 is a fragmentary top view of the ball hoist showing a ball-stopping mechanism;

Fig. 20 is a sectional view taken along line 20-20 of Fig. 19;

Fig. 21 is a sectional view taken along line 21-21 of Fig. 19;

Fig. 22 is similar to Fig. 21 and shows the ball-stopping mechanism in operation;

Fig. 23 is a view of the control board by which the player performs selected functions at will;

Fig. 24 is a vertical sectional view taken through the center of one of the spots upon which a bowling pin is positioned on the alley;

Fig. 25 is a wiring diagram showing with Fig. 26 the electrical operation of the equipment; and

Fig. 26 is a wiring diagram to be taken with Fig. 25 and showing the controlled system for operating the mechanism described in connection with the other figures.

A feature of the apparatus described herein is that it is possible for the operator to automatically initiate and complete any desired functions which can be performed manually, and that such functions can be initiated and completed in any desired order. The particular mechanism by which these operations are performed is simple

in construction and sufficiently easily operated without special tutoring on the part of the player to make the device highly practical.

In general, the apparatus includes a conveyor system by which balls and pins are taken from a common position to separate conveyors, one of which re-positions the pins and the other of which returns the ball to the player.

The apparatus as shown in the drawings and with particular respect to Fig. 1 includes an ordinary bowling alley indicated generally at 10, at the rear end of which are a series of pin spots 11. It will be understood that the spots 11 are positioned in the usual manner with a head pin spot for the number one pin and three additional parallel rows having in order two, three and four pin spots for the remaining nine pins. The pins will be indicated generally at 12. The bowling ball will be indicated generally at 13.

As a ball is bowled down the alley and strikes the pins 12 it knocks them backwardly toward the rear end of the alley. A padded backstop 14 of conventional construction is provided at a point spaced from the rear of the alley to receive the impact of pins and the ball where the velocity of the pins or ball may be sufficient to carry them this distance. A rear wall 15 is provided as a positive backstop for both balls and pins, this rear wall being positioned a conventional distance behind the rear end of the alley. The sides of the alley adjacent the pins and the backstops are indicated at 16, these sides also being of conventional construction.

Between the back wall 15 and the rear end of the alley is a space which is known as a "pit" in which the bowling ball and pins are received from the rear end of the alley. Leading into the "pit" are the gutters 17 which are positioned on each side of the alley. The gutters likewise are of conventional construction.

Below the pit at the rear of the alley is positioned a conveyor mechanism which includes an idler roller 18 adjacent one side of the pit and a driven conveyor roller 19 on the other side of the pit. The roller 19 is driven by a suitable motor through the shaft 20. Roller 18 also may be driven if desired. Encompassing the rollers 18 and 19 is a conveyor belt 21 constructed from a suitable flexible continuous web such as reinforced canvas. This continuous conveyor belt preferably is of sufficiently heavy construction to withstand the abuse given it by the bowling ball and pins propelled against and falling upon it from the rear end of the alley. It will be observed that the conveyor belt 21 constitutes the bottom of the pit behind the alley. The belt extends substantially the entire length of the pit and operates in a direction transversely of the alley, as shown in Fig. 4. A side flange 22 is provided on the rear end of the alley to prevent the ball and pins from becoming dislodged from the edge of the conveyor. The ends of the rollers 18 and 19 are journaled in the framework 23 which is supported upon suitable standards.

A ball on the conveyor belt 21 is carried in the direction shown by the arrow in Fig. 4 to the side of the alley adjacent the driven roller 19 and from the conveyor the ball is dumped upon the spaced railings 24. These railings are spaced apart sufficiently to allow pins to drop through. They also are given a backward slant so that the ball rolls along the rails to be delivered to a ball hoist as shown in Fig. 3. The ball hoist may be positioned in any desired place, since

delivery of the ball may be effected by curving the rails in any suitable direction.

From the rails 24 the ball dumps upon the ball hoist yoke 25 which in inoperative position assumes the slightly tilted position shown in solid lines in Fig. 3. In Fig. 3 the delivery rails have not been shown in order to make clear the operation of the ball-hoisting mechanism. As the ball drops upon the yoke 25 the latter is depressed to the position shown by the solid lines in Fig. 11.

The yoke 25 is mounted on a shaft 26 in a rotatable manner. Shaft 26 carries at its ends the wheels 27. Mounted inwardly of the wheels 27 is an upwardly extending frame 28. The upper end of the frame 28 carries a shaft 29 upon the outer ends of which are mounted the wheels 30. The frame 28 is mounted to travel upwardly and downwardly in the upright track-forming frames 31. Adjacent their upper portion the track-forming frames 31 are bent forwardly as shown in Fig. 3. Brace members 32 and 33 are provided to maintain the tracks 31 in rigid position.

Extending across the skeleton framework formed by the members 31, 32 and 33 and at a point below the delivery point of the bowling ball from the track 24 is a rotatable shaft 34, this shaft being suitably journaled in bearings supported by two of the cross members 33. The shaft 34 has a chain sprocket 35 mounted at its central portion. At a point spaced upwardly from the shaft 34 there is provided a similar shaft 36 which carries a chain sprocket 37 at its central portion. The shaft 37 is journaled in brackets supported by the members 33, and is driven through suitable reducing gear by the motor 38.

Sprockets 35 and 37 carry a continuous conveyor chain 39. The details of construction of the chain 39 are shown more particularly in Figs. 10 and 11. At spaced points along the chain there are provided lugs 40 which carry cross rods 41, the purpose of which will be explained later. In the modification shown in the drawings the lugs 40 are formed as outer chain lengths provided with forward extensions. It will be seen that the conveyor chain 39 travels upwardly adjacent the track members 31.

The ball-carrying yoke 25 is provided with a rigidly attached downwardly extending leg 42, the lower end of which has a notch 43 which is adapted to engage rods 41 when in the backwardly pressed position shown by solid lines in Fig. 11. A spring 44 extends between the ball-carrying yoke 25 and the frame 28, as shown in Fig. 11, and biases the yoke toward upwardly tilted position in which the notch 43 is out of engagement with the rods 41. The weight of a ball on the yoke is sufficient to overcome the tension of the spring.

The yoke 25 is provided with a partial collar 45 adjacent its pivoted portion, and the collar 45 has stop portions 46 and 47 respectively on each side of the frame member 28 to limit the upward and downward movement of the yoke by engagement with the frame. When a ball is on the yoke the stop member 47 engages the frame and limits the downward movement of the yoke. When no ball is in the yoke the stop member 46 engages the frame 28 to limit the amount of upward movement of the yoke occasioned by the spring 44.

As a ball is delivered by the conveyor 21 to the rails 24 and from these rails to the yoke 25, the latter is pressed downwardly to the position

shown by solid lines in Fig. 11, the leg 42 thereupon releasing the two-pole switch 48, thereby rotating one of its poles to closed position and causing the motor 38 to revolve, as described more particularly later herein. The motor drives the chain mechanism of the ball hoist. With the leg 42 in the backwardly held position, one of the rods 41 will engage the notch 43 as the chain is driven and will thereby lift the ball-carrying yoke and frame 28 upwardly. Frame 28 travels in the track 31 by means of engagement of the wheels 27 and 30 with the track, so that the entire ball-lifting mechanism is moved to the position shown by dotted lines in Fig. 3. As the upraised position is reached, the chain 39 and rod 41 turn around sprocket 37, as shown in dotted lines at the top of Fig. 11. At this position the frame 28 is tilted forwardly as the rollers 30 follow a forward bend at the top of the track 31. By means of this tilting the yoke 25 is caused to slant downwardly to an extent sufficient to permit the ball to roll off the yoke onto the ball return track 49 which returns the ball to the player in the usual manner.

Upon release of the ball from the yoke the latter resumes its original upwardly tilted position and the notch 43 is released from engagement with the rod 41. Thereupon the ball-lifting yoke and frame fall downwardly along the track 31 into their initial position.

To prevent the undue jar a shock-absorbing mechanism is provided at the lower position of the ball yoke. This is shown in Fig. 3. The standard 50 carries a lever 51 having a forward arm adapted to be struck by the downwardly falling carriage 28. The rear arm of the lever 51 engages the valve rod of a dash pot 52. This mechanism cushions the fall of the ball hoist.

As the yoke returns to its downward position it opens the switch 48 and the ball hoist motor 38 is thereby stopped.

In the embodiments shown in Figs. 19 to 22 means are provided for preventing more than one ball at a time from being returned by the ball-hoisting device. Such means includes a circular band 53 positioned adjacent the track 24. The diameter of the band is made slightly larger than the diameter of a standard bowling ball. To reach the yoke 25 the ball must pass through band 53. Below the band 53 and between the tracks 24 is provided a stop member 54 which in its upraised position as shown in Fig. 22 prevents a ball from passing toward the yoke 25. The stop member is pivoted at 55 and when released falls in the downward position shown in Fig. 21 to permit the free passage of a ball along the track. Stop member 54 is raised by the solenoid 56. The latter is actuated automatically by a second pole of switch 48. Thus, when a ball falls upon the yoke 25, backward movement of the leg 42 also releases switch 48, permitting it to close and energize solenoid 56. As will be seen from Fig. 19, the band 53 is positioned adjacent the yoke 25 so that more than one ball cannot pass through the band before actuation of the stop member 54. When the yoke 25 returns to its ball-receiving position the solenoid 56 is de-energized by the opening of switch 48, thus permitting stop 54 to return to its downward position, thereby allowing the next ball to pass along the track to the yoke 25.

The pin-conveying and setting mechanism is simple in construction and operation. As pins are knocked or swept from the alley they are received by the conveyor belt 21 and are trans-

ported thereby to a side of the alley where they fall through the space between the rails 24. Beneath the rails 24 and parallel thereto is a pin-conveying belt system including a shaft 57 having mounted on it the spaced pulleys 58 and a similar shaft 59 having mounted on it the belt pulleys 60. Continuous belts 61 are carried by the pulleys 58 and 60 and are spaced apart a distance sufficiently small to prevent a pin from falling therebetween. The shaft 59 is driven by a suitable motor in a direction to effect travel of the belts 61 in the direction indicated by the arrows in Fig. 2.

At the delivery end of the belts 61 is provided a pin tumbler 62. The construction of the tumbler 62 is such as to effect proper placement of pins as shown in Fig. 3, regardless of which end of the pins is in the lead as the pin enters the tumbler. This construction is shown in particular in Fig. 3. The pin shown in horizontal position by the dotted lines in Fig. 3 represents a pin leaving the pin conveyor with the small end first. This small end progresses over the hump 63 until the large end of the pin is clear of the conveyor. The large end of the pin is heavier than the small end and the pin will reverse its direction and slide down into the position shown in full lines in Fig. 3 as the pin leaves the conveyor. If the heavy end of the pin leaves the conveyor first, the pin will tumble into the vertical position shown by the dotted lines of Fig. 3 and then into the position shown in full lines. In this case the pin will tumble before its heavy end encounters the hump 64. The pin tumbler 62 is supported by a suitable standard 64.

The pin tumbler leads to a downwardly slanting pin bin 65, and the pins roll from the position shown in full lines in Fig. 3 through the opening 66 onto the member 65. The pin bin 65 is shown as of such dimension as to receive five pins.

A stop member 67 is positioned so as to stop the first pin at a position opposite the center of the alley. From this position the pins are elevated to a pin-setting mechanism. The pin elevator includes a vertical flight for lifting the pins from the bin and a horizontal flight for carrying them to the pin-setting mechanism. The vertical flight is mounted on the frame members 68. Adjacent the stop member 67 and to the rear of the pin bin is positioned a shaft 69 upon which are mounted the spaced sprockets 70. Engaging with these sprockets are the spaced conveyor chains 71 which extend upwardly from the sprockets. A given forward or leading portion of the chains passes upwardly over the idler sprockets 72, then horizontally to a position in advance of the position of the head, or number one, pin on the alley where it engages the bottom of idler sprockets 73, to pass upwardly over the idler sprockets 74 and then backward horizontally to a position at the rear of the alley, after which it passes over the idler sprockets 75 and then downward back to the main sprockets 70. The sprockets 72, 73, 74 and 75 are carried upon a suitable framework above the alley. As shown in Fig. 5, this framework includes the L-shaped support bars 74 positioned on each side of the alley, the cross members 77, the vertical bar 78, and the brace members 79, as well as the top cross bars 80. The pin conveyor chains 71 are provided with loosely mounted wheels 82, and these wheels travel during the horizontal flights of the conveyor on the L-shaped track members 83, the

latter being mounted on the support 78 as shown in Fig. 5.

The conveyor chains are driven in the direction shown by the arrows in Fig. 1 by a suitable motor connected to the shaft 69.

The chains 71 are provided with twenty-one pin-lifting and positioning members spaced as shown in Fig. 1. Each of these pin lifters is mounted on a shaft 84 extending between the chains. The construction of the pin-carrying devices may be seen in particular in Figs. 12 to 15. Loosely mounted on the shaft 84 are castings 85. Each of these castings has spaced projecting portions 86 mounted about the shaft 84, a central opening 87, and projecting lugs 88 positioned on the opposite side of the lugs 88. Within the openings 87 are mounted a pair of pin-grasping hooks 89. These hooks are pivoted as shown at 90 within the body of the members 85. That is, the pivot pins 90 extend through the hooks 89 and into the body of the castings 85 so as to allow the hooks 89 to rotate laterally about them. A spring 91 is secured to the hooks 89 at a point slightly below the pivot pins 90, so as to bias the hooks toward an inward position. As will be seen in Fig. 14, the hooks are spaced apart sufficiently to provide for the engagement of the upper part of a bowling pin when the hooks are in their inward position. When moved to their outward position the hooks are spread apart sufficiently to allow the pin to drop. This latter position may be seen in Fig. 13, as indicated by the dotted lines.

Between the lug members 88 is mounted a weighted wedge-shaped pin-tripping member 92. The upper portion of this tripping member consists of a relatively light projecting finger, while the lower portion consists of a relatively heavy wedge portion. The wedge member 92 is tapered downwardly and backwardly, as shown in Fig. 15, and its weight balance is such that the wedge member is biased toward a position in which it locks the upper ends of the hook members 89, thereby preventing the hook members from spreading apart. Since the trip member 92 is pivoted in the lugs 88, movement of the upper end of the trip member backwardly causes the wedge 92 to be dislodged from its locking position between the upper ends of the hook members 89, so that the latter are free to spread apart. The weight of a pin is sufficient to overcome the resistance of the spring 91 and when the pin trip wedge member is released from engagement with the upper extensions of the fingers 89, the pin will be released.

When a pin is engaged by the finger portions of the hook members 89 the assembly assumes the position shown in full lines in Fig. 12. That is, the weight of the pin is sufficient to place and maintain the pin-carrying unit in substantially vertical position. After a pin is released the weight balance of the casting 85 and the trip member 92 is such that the center of gravity is above the shaft 84 so that the hooks 89 will assume and remain in the tilted position shown in dotted lines in Fig. 12 until it again picks up a pin from the bin 65.

The operation of the pin-lifting and positioning mechanism is as follows. As shown in Fig. 1, the pin-lifting mechanism is so positioned that as the chains 71 are moved forward, unloaded pin-lifting hooks 89 at the rear of the unit are carried around the sprocket 70. In their initial upward travel the pin engaging ends of the hooks receive the narrow neck portion of a pin in the

bin which is in the path of travel of the hooks at that point. As the upper end of the pin is larger than this narrow neck portion, continued travel of the conveyor causes the hooks 89 to grasp the pin and to lift it from its position in the bin. Thereupon the weight of the pin causes the hooks to assume the position shown in their upward travel in Fig. 1. After a pin is carried away from the pin bin in the manner described, the remainder of any pins in the bin will roll downwardly by gravity, placing the pin next following the one so removed in position to be engaged by the next following unloaded hook. In this manner pins brought to and placed in the bin by the belts 61 and the tumbler 62 are removed in order from the bin and conveyed into position for delivery to the pin-positioning mechanism to be described hereinafter.

Positioned directly beneath the lower horizontal flight of the pin conveyor, between the sprockets 72 and 73, are a series of pin chutes 93, 94, 95, 96, 97, 98, 99, 100, 101 and 102, the mouths of these chutes being in alignment beneath and parallel to said lower horizontal flight. The mouth of each chute is a closed ring, large enough in diameter to permit a pin to pass through freely in vertical position. Below the mouth and along its full length the chute is open at the top forming a trough of substantially U-shaped section. The discharge ends of said chutes lead to the pin-setting mechanism.

Above the mouth of each of the chutes 93 to 102 is a pin-tripping unit of the type shown in Figs. 5 and 14. Each of such units includes a solenoid 103 having an upwardly extending link connection 104 to which is secured one end of the trip 105. The latter is pivoted at an intermediate point to the frame structure as shown at 106. The free and lighter end of the trip 105 is positioned above and in the path of travel of the pin conveyor in its lower horizontal flight. In its downward position the free end of the trip member 105 is positioned to engage the upwardly extending finger of the trip member 92 of the pin carrier unit. Normally the free end of the trip is the upward position shown by the solid line in Fig. 5. When it is desired to release a pin above any selected one of the chutes 93 to 102 the solenoid of that particular chute is actuated to cause depression of the free end of the trip member 105 so that the trip member 92 of the next pin-conveying unit which comes along will strike the trip member 105 and cause the wedge to be released from its position between the hooks 89, thereby releasing the pin of that unit and allowing it to fall into the selected chute.

If there is no occasion for the releasing of a pin from the pin conveyor into any chute, that pin simply continues its travel on the conveyor until needed. Twenty-one in the system are sufficient to insure maximum speed of operation. When a player is ready to bowl his first ball the pin conveyor unit and the pin-setting unit between them will hold a full complement of pins. Thus a complete set of pins may be positioned on the alley without waiting for return of the pins which are in bins. Since the lifting of a pin from the pin bin depends upon the angular position of the hooks 89 as shown in Fig. 12, the return to pin-pick-up position of a pin which has not been set by the conveyor does not interfere with pins in the bin. A pin will not be lifted from the bin until an empty hook is available.

After a pin has been released by dislodgment

of the pin trip wedge 92 from between the upper ends of the hooks 89 the offset weight of the pin-conveying unit causes the hooks again to assume the angular position of Fig. 12 and the wedge again slips into position between the upper ends of the fingers 89. To prevent the possibility of the wedge member sticking between these fingers or being prevented from returning to its desired position, the wedge is tapered downwardly as well as backwardly. After release of a pin, gravity with the assistance of the spring 91 causes the fingers immediately to assume their inward position and this makes it unnecessary for the wedge 92 to force its way into the proper locking position.

By the mechanism described a pin in any pin-conveying unit can be deposited in any one of the chutes by operation of the solenoid above that chute.

The pin chutes 93 to 102 lead to the ten positions of a pin-setting carriage indicated generally at 107. Preferably, these chutes lead in order to the one to ten positions for the pins as to be set up.

The pin-setting carriage includes an upper plate 108 and a lower plate 109 spaced from the upper plate by means of bolts 110. The bolts 110 are rigidly secured to the lower plate 109 and are mounted in loose openings in the upper plate 108 so that the plates may be compressed toward each other, the upper heads of the bolts being pushed upwardly above the upper plate 108 upon this action. The spring members 111 resist compression of the plates 108 and 109 together and bias the lower plate toward its fully extended position away from the upper plate.

The upper plate 108 and the lower plate 109 are provided with a series of openings 112 in positions corresponding to the positions of the numbers one to ten pins. In the openings of the upper plates are mounted pin-receiving and setting units, the construction of which may be seen from Figs. 1, 6, 7, 8, 16 and 17. These units include the complementary downwardly tapering shell portions 113. The members 113 are shaped to embrace the lower end of a pin from a position adjacent the widest diameter of the pin, as will be seen in Figs. 6 and 7. In their closed position these shells receive a pin from their respective chutes and hold the pin in a position above the spot on the alley upon which it is desired to set pin. As a pin reaches the lower end of a chute, its forward end strikes a dished stop 114 which is mounted on the plate 108 on the far side of the shell unit and at right angles to the line of opening between the shell portions 113 and 114, so that the pin in leaving the chute strikes against the stop 114 which is so designed as to up-end the pin and direct it properly into the pin-receiving and setting unit provided for that chute. In up-ending, the upper end of the pin is projected through the open upper portion of the chute. By having the chute open at the top of a sharp turn at the lower end of the chute is made possible. The members 113 are pivoted adjacent their widest portion as shown at 115 on opposite sides of the pin-setting unit. The lower plate 109 in its downward position is slightly below the lower end of the members 113 so that the latter are free to open up about the pivots 115 to release a pin held by the members 113.

The shells 113 are provided with upper adjacent edges 116 which provide an upwardly tapering opening between the shells and above the pivots 115. Above each of these openings on one

side of the shells is provided a solenoid 117 having a downwardly extending shaft portion 118 provided with a wedge member 119 on its lower end. The wedge member 119 in the downwardly extended position of the shaft 118 is positioned in the opening between the complementary edges 116 of the two shell members, thereby preventing the shell members from spreading apart to release a pin. When the solenoid is actuated and the shaft member 118 is raised upwardly, the wedge member 119 assumes the position shown in dotted lines in Fig. 7 and the edges 116 are free to come together. The weight of a pin held in the shell members 113 is sufficient to cause these members to rotate apart into the position shown in dotted lines in Fig. 7 to release a pin.

Pivotaly mounted on each of the stop members 114 is a trip finger switch member 120 having a lower portion 121 extending through one of the shell members 113 and a weighted outwardly extending arm 122 which biases the contact portion 121 toward the position shown in full lines in Fig. 7. On the outer arm 122 of the member 120 are mounted the mercury switches 123 and 124, as shown in Fig. 8.

The opening between the lower ends of the shells 113 is large enough to allow the upper end of a bowling pin to pass but small enough to retain the lower end of the pin in the manner described. When a pin is positioned between the two shell members the contact end 121 of the member 120 is pressed outwardly and the mercury switches are in upwardly raised position. When the pin has been released from the shells by operation of the solenoids 117 the weight of the arm 122 is such as to cause it to assume the position shown in Fig. 17 in which the mercury switches are in reversed or downward position.

On opposite sides of the carriage 107 are mounted the upwardly extending shafts 126. These shafts pass through the bearing brackets 127 of the upwardly extending support frames 128, the latter being positioned on L-shaped supports which are secured to the sides of the alley.

The upper ends of the shafts 126 are provided with the hook members 129 to which are attached cables 130. The cables 130 pass about pulleys 131, and the latter are rigidly mounted on a shaft 132 which is journaled in the upper ends of the frame members 128, as shown in Fig. 5. The opposite ends of the cables 130 are provided with counterweights 133 which approximate the weight of the pin carriage unloaded, plus the weight of five pins.

The shaft 132 also has rigidly attached sprockets 134 about which passes the chain 135, the latter being driven by a motor 136.

The apparatus also is provided with a pin and ball-sweeping mechanism by which the alley may be cleared. This mechanism is shown in particular in Figs. 1, 3, and 18 and includes a sweeping member 140 of the type shown in Fig. 18. The sweeping member 140 is a transversely extending triangular shaped frame member having end portions 141 shaped to fit into the gutters on each side of the alley. The end plates 142 of the member 140 are provided with wheels 143 upon which the pin-sweeping mechanism rides as it is dragged along the alley. The member 140 operates, as stated, by being dragged along the rear end of the alley to dump pins or a ball from the alley or gutters onto the conveyor 21. The ends 142 are provided with slots 144 through which extend the pins 145 of the arms 146, these arms

acting to operate the sweeping member 140 through a cyclic operation.

Along the other end of the arms 146 are provided the longitudinally extending slots 147. The shafts 148 extend through the slots 147. Shafts 148 also carry small gears 149 which mesh with the racks 150 on the arms 146. Two motors 150 drive the shafts 148 through suitable reducing gear.

The operation of the pin-sweeping mechanism is as follows. The normal position of the arms 146 is as shown in full lines in Fig. 3. When it is desired to clear the alley of pins or a ball the motors 150 are operated so as to rotate the gears 149 in a counterclockwise direction from the position shown in Fig. 3. Since the shafts 148 are at the ends of the slots 147 this rotation of the shafts 148 causes the gears 149 to rotate the arms 146 downwardly into the initial position shown in dotted lines in Fig. 3 in which the pin-sweeping mechanism has been moved to a position in engagement with the alley, it being understood that the wheels 143 operate in the gutters of the alley. Thereafter the continued counterclockwise rotation of the gears 149 causes the rack bars 150 to travel, thereby moving the arms 146 upwardly while pressing the sweeping unit against the gutters. This movement causes the sweeping unit to pass backwardly along the alley to the substantially vertical position shown in Fig. 3 at the end of the alley in which all pins and balls will have been dislodged from the alley onto the conveyor 21. In this latter position the left ends of the slots 147 will have been reached.

The mechanism described hereinbefore is operated by an electrical system which includes initiating switches such as push buttons, control circuits and switches therefor, and operating circuits responsive thereto for the automatic operation of the entire mechanism in proper relation and without interference. The electrical system is shown in Figs. 25 and 26, the right-hand side of Fig. 25 fitting the left-hand side of Fig. 26 as a complete wiring diagram.

The drawings illustrate the apparatus in a condition ready for setting pins on the alley, the pin sweep mechanism in horizontal retracted position, and the pin carriage raised.

The operation of the ball hoist is as follows:

The bowled ball is conveyed to the ball hoist, as described hereinbefore, and the ball is lifted to the return rails 49. As the ball-lifting yoke 25 falls back to its down position its under leg engages the two-pole mercury switch 48 and pulls it past neutral position. The switch 48 is a two-pole safety interlocking limit switch mounted adjacent the base of the ball hoist, and the mercury switches 151 and 152 of the switch are held in normal position by gravity. The yoke 25 releases the switch 48 from the position shown in Fig. 3 when a ball is received on the yoke and reverses the switches 151 and 152. In Fig. 26 the switch 48 is shown in the same position as in Fig. 3, the units 151 and 152 being open.

The mercury switch 152 makes and breaks one side of a circuit to the ball stop solenoid 53 as shown in Fig. 26 and in the manner described heretofore. Thus, after a ball has been transferred to the yoke 25 the ball stop mechanism is actuated to prevent another ball from passing to the ball elevator until the ball on the yoke 25 has been deposited upon the return rails and the yoke 25 has returned to its normal position.

The mercury switch 151 makes and breaks one side of a start and stop control circuit to the

two-pole magnetic ball hoist motor contactor 153, the ball hoist motor being indicated at 38. When a ball drops upon the yoke 25 the switch 151 closes the circuit to the contactor 153 and the latter closes the circuit to the ball hoist motor 38 which operates the conveyor chain 39 to lift the ball to the return rails, the yoke 25 then being released from the conveyor and dropping back into contact with the switch 48 to reverse it and to open the circuit to the contactor 153 to stop the ball hoist motor.

It will be seen that the ball return mechanism is automatically operative and independent of the action of the bowler.

The entire electrical equipment is operated from the trunk lines 154 and 155, which may be any convenient source of electrical energy. For example, the trunk line may be an ordinary municipal 110 volt or 220 volt supply line. Reference numerals have not been added to the particular lines passing from these trunk lines, since these lines are conventional and adequately shown by the wiring diagram.

The switch 48 operates upon a relatively small current which is sufficient to actuate the contactor 153 to connect the ball hoist to an operating current which does not have to pass through the mercury switches.

Assuming the thrown ball has knocked all of the pins from the alley onto the conveyor these pins and ball will be transferred by the normally operating conveyor belt 21 to the side of the alley, as described before. The pins pass through the pin tumbler and onto the pin bin 65. The pin bin is shown as being large enough to receive five pins. Beneath the pin bin 65 there are positioned two switches 156 and 157. Each of these switches is a single pole safety interlocking limit switch mounted in the base of the pin storage bin, and the switches are connected in parallel to make and break one side of a control circuit to the two-pole magnetic conveyor contactor 158 shown in Fig. 26. This contactor is a two-pole magnetic switch which is effective to operate the pin conveyor motor 159 connected to shaft 59. Switches 156 and 157 each carries a single mercury unit which is held in a downward direction by gravity when a pin is not in the fourth or fifth position in the pin bin. When a pin occupies the fourth or fifth position in the pin bin the corresponding switch is depressed and reversed. A pin in the fourth position in the pin bin will reverse the switch 156 and a pin in the fifth position in the bin will reverse the switch 157. As long as a pin is on both of the switches 156 and 157 the current to the contactor 158 is broken and the pit conveyor does not operate. This prevents a piling up of pins in the pin bin in the event the pin conveyor mechanism does not remove them fast enough. By using the two switches 156 and 157 connected in parallel and positioned in the manner shown the momentary operation of the pit conveyor motor by reason of a pin rolling across the switches 156 and 157 is prevented.

This control of the pit conveyor by the number of pins in the pin bin also will be seen to be independent of the action of the operator or bowler.

The pin conveyor operates continuously and removes the pins from the bin 65, as described heretofore. These pins are initially lifted vertically and then along the horizontal flight above the chutes 93 to 102. The operating mechanism is such as to cause a pin to be tripped above any

chute leading to a pocket in the pin carriage which is not occupied by a pin. On the pin carriage, as has been stated, there are twin switches 123, 124. When any particular pin has been released from the pin pockets of the carriage the arm 120 is depressed and the switches 123 and 124 are reversed, thereby causing the corresponding solenoids 103 to be actuated into the position shown in dotted lines in Fig. 14 so that the trip member 105 will release the next pin which comes by this position. As a pin is received by the pocket in the carriage following this operation the corresponding arm 121 is pressed outwardly and the switch 120 is reversed, the spring on the solenoid 103 then returning it to inoperative position so that another pin will not be released in that particular chute until the corresponding pin in the pin carriage has been released.

The individual pin-carrying pockets on the pin carriage 107 also are provided with the solenoids 117 as described heretofore. The mercury switch 123 makes and breaks one side of the circuit to the corresponding trip solenoid 103 to prevent dumping of pins into the individual pin pockets of the carriage 107 when such pockets already contain a pin. The mercury switches 124 of the ten units 120 are in series connection and make and break one side of a circuit to the two co-acting single pole magnetic contactors 159 which control the circuits to the pin set carriage motor 136 and a master switch to be described later herein, so that the pin set carriage is prevented from being lowered unless completely loaded with pins.

Again, the operation of filling the pin carriage with pins is automatic and beyond the control of the bowler. So long as any individual pin pocket or basket in the pin carriage is empty, the corresponding trip member will cause the release of a pin from the pin conveyor immediately to fill the pocket, and the pin carriage motor will be prevented from operating until ten pins have been loaded in the carriage.

With the pin carriage full of pins, the pin-setting operation is initiated by the bowler turning the master switch 160 counterclockwise, thereby completing the circuit through the mercury switch 161 of the master switch to the pin carriage motor contactor 162, the latter being a three-pole reversing magnetic contactor or switch which makes and breaks the circuit to the pin carriage motor 136, as shown in Fig. 26. The motor 136 then lowers the pin carriage to a position adjacent the floor or alley.

The master switch 160 has the two mercury switches 161 and 163 which are made when the master switch is turned clockwise from the position shown in Fig. 25, and a third mercury switch 164 which is broken upon such turning, and vice versa.

Pivotaly mounted slightly above the upper position of the pin carriage 107, is a two-pole reversing limit switch arm 165, as shown in Fig. 17. This switch has the mercury switches 166 and 167 mounted on it so as to reverse upon opposite motion of the switch. As the pin carriage is lowered the stop member 168 on one of the shafts 126 comes in contact with the switch arm 165 and moves it from the position shown in full lines to the position shown in dotted lines in Fig. 17. This action reverses the mercury switch 166, thereby reversing the current to the pin carriage motor 136 and causing it to reverse its direction of rotation so as to raise the carriage to its up position.

The other mercury switch 167 mounted on switch arm 165 is reversed by the action described and this switch completes the control circuit to the two co-acting single pole magnetic contactors 159 which make and break the circuit to the solenoids 117 of the pin carriage, thereby raising the wedge members 119 and discharging the pins in the pin basket upon the appropriate pin spots of the alley in the manner shown in Fig. 7. As before stated, the solenoids 117 are returned to the position shown in Fig. 6 by release of the pins and consequent reversal of the switch arm 120.

As the pin carriage travels back to its upward position the stop member 169 mounted on the cable 130 adjacent the counterweight 113 engages the right-hand side of the switch arm 165 and moves it from the position shown in dotted lines to the position shown in full lines in Fig. 17. This reversal in position reverses the mercury switches 166 and 167, thereby breaking the circuit to the pin carriage motor to stop the pin carriage in upraised position and returning the switch 167 to its position for the next cycle of operation. Thus, the pin setting cycle is complete and the carriage again is ready for the receipt of additional pins, as determined by the switch arm 120 of the empty individual pin holders of carriage 107.

In case the bowler desires to set only a limited number of pins on the alley instead of the full number, the desired switch units 170 for the individual pins are operated and the master switch 160 thereafter is rotated in a counterclockwise direction rather than clockwise. The switch units 170 are mounted on a control board adjacent the bowler, along with the master switch 160, and each unit has the mercury switches 171, 172 and 173.

The switches 170 are shown in a normal or neutral position. The mercury units 171 are normally in closed position and the switches are connected to one side of the circuit to the solenoids 117 which control the tripping operation for releasing pins upon the alley. In Fig. 25 the switches 170 are set for a ten pin set up. In conditioning the units 170 for setting an individual pin, the selected pin switch 170 is moved in a clockwise direction. This clockwise motion breaks or opens the switch 171 so that the circuit through this switch cannot be used for actuating the solenoids 117. The clockwise motion of the switch 170 causes the unit 173 to be closed and this unit completes the circuit to the individual solenoid 117 of the pin which it is desired to set.

The switch unit 117 also is closed upon rotation of the member 170 clockwise and this switch 172 closes one side of the circuit to a lockout solenoid 174. This solenoid when so actuated prevents the master switch 160 from being rotated in a clockwise direction and permits only rotation in the counterclockwise direction in which the master switch effects the setting of the individual selected pins, the buttons 170 for which have been pressed for individual set-up.

The master switch 160 then is rotated in a counterclockwise direction after the individual pin buttons 170 have been pressed and the pin set carriage is lowered. Upon reaching its lower limit of travel the individual release solenoids 117 are actuated and only the individual selected pins will be discharged.

When the individual pin switch 170 is operated in a clockwise manner the switch unit 172 also

closes one side of the circuit to a return to neutral trip solenoid 175. This solenoid returns the individually pushed buttons 170 to their normal position after completion of the individual pin-setting cycle of operation.

The other side of the circuit to the trip solenoid 175 is made through the switch 176. The switch 176 has two mercury switch units 177 and 178, the former of which makes and breaks the circuit to the return to neutral solenoid 175.

The mercury switch units 172 on the individual pin buttons 170 also make one side of the circuit to the return to neutral solenoid 175. Thus, when the pin basket gets to its lowered position and the switch 176 has been tripped, the circuit to both sides of the return to neutral solenoid 175 is made and the individual switches 170 immediately are returned to their normal position as shown in Fig. 25. The switch 176 is returned to the normal position shown in Fig. 25 by gravity as soon as the pressure of the lug 168 is removed by the raising of the carriage.

By returning the individual pin buttons 170 to their neutral position the solenoid 175 thereby causes the solenoid 174 to be returned to its normal position, to release the lockout on the master switch, it being understood that reversal of the switches 170 to the normal position breaks the circuit to the solenoid 174 through the mercury switch 172.

The switch 176 is mounted adjacent the downward path of travel of the lug 168. This switch normally is held in one position by gravity and is reversed by contact with the lug 168 in the manner shown in dotted lines in Fig. 17 when the pin basket is in down position. This switch is a two-pole safety interlocking limit switch and has a mercury switch 177 which makes and breaks one side of the circuit to all of the pin basket trip solenoids 117 to return the solenoids to the position shown in Fig. 17, regardless of the number of pins which have been released from the basket or carriage. The action of this switch is the same regardless of whether one or all the pins have been set.

Thus, to set all of the pins, all that is necessary to do is to rotate the master switch 160 in a clockwise direction, and to set any number of individual pins, all that is necessary to do is to rotate the master switch 160 in a counterclockwise direction after having pressed the desired number of the buttons 170.

After a ball has been bowled and one or more pins remain on the alley, the pin sweep mechanism may be actuated by operation of the switch 180 on the control board. This switch has two mercury switch units 181 and 182. The switch unit 181 makes and breaks the circuit to the mercury switch unit 184 of two-pole reversing limit switch 183 which is mounted adjacent the alley sweep arm 147, as shown in Fig. 3. The switch 184 makes and breaks one side of the control circuit to the three-pole reversing magnetic contactor or switch 186, and the latter makes and breaks the operating circuit to the alley sweep motors 150. The arms 146 of the alley sweep then are moved through the operating cycle described heretofore. The rotation of the arms 147 to their final position as shown in dotted lines in Fig. 3 causes the switch 183 to be reversed when the arm reaches its vertical position at the completion of the sweeping operation. This reversal breaks switch 184 and makes switch 185. The switch 185 makes the circuit to the opposite or reverse side of the magnetic contactor

186, thereby reversing the motors 150 and causing the return of the arms 146 to their inoperative horizontal position. When the sweep arms 146 are returned to their horizontal position the switch 183 again is returned to its normal position as shown in full lines in Fig. 3 to set the circuit for another cycle of operation.

The pin sweep switch 180 also has the mercury switch unit 182 which normally is in closed position to complete one side of a circuit to the reversing contactor 162 of the pin set carriage motor 136. When the pin sweep switch 180 is actuated to initiate the pin-sweeping operation the mercury unit 182 is moved into open position so as to break the circuit to the contactor 162 for the pin carriage motor, thereby preventing the pin carriage motor from being operated during the sweeping operation. Thus, interference between the pin carriage and the sweep arm is made impossible.

Mounted adjacent the horizontal position of the arms 146 is a two-pole safety interlocking limit switch 188 which is provided with the mercury switch units 189 and 190. In its upper position the arm 146 maintains the switch 188 in the position shown in Fig. 3. As the arms 146 rotate downwardly during the sweeping operation the switch 188 reverses by gravity about its pivot portion 191, the limit of movement by gravity being set by the stop member 192 engaging a fixed stop member 193. The downward movement of the pin sweep arms 146 as initiated by the bowler in turning the switch 180 on the control board causes a reversal of the switch 188 so that the mercury unit 189 closes to complete the circuit to the pin sweep motors, thereby allowing the bowler to remove his hand from the push button switch 180. That is, the switch unit 188 takes the place of the switch 180 during the remainder of the operation of the pin sweep mechanism.

The switch unit 190 normally is closed when the pin sweep arms are in horizontal position and maintains the circuit between the switch 182 and the pin set carriage motor contactor 162. As the arm 146 lowers, this switch 190 reverses to break the circuit to the pin set carriage motor contactor, thereby preventing operation of the pin set carriage during the operation of the alley sweep mechanism. This prevents any possibility of the pin set carriage being lowered into interference with the alley sweep member. Thus the unit 190 has the same function as the switch unit 182.

Mounted adjacent the position of upper travel of the lug 168 on the shaft 126 is a four-pole safety interlocking limit switch 195 which has the normal position shown in dotted lines in Fig. 17 and which is provided with mercury switch units 196, 197, 198 and 199. In this normal lowered position the switch is supported by the stop member 200, and as the lug 168 is raised to its upper position by the raising of the carriage, the switch 195 then assumes the position shown in full lines in Fig. 17. The movement between these limits reverses the mercury switches 196, 197, 198 and 199.

The switch unit 196 makes and breaks one side of the circuit to the ten pin signal lights 201 which are mounted in such position as to be observable by the bowler. These signal lights are positioned in positions corresponding to the pin spots on the alley and are suitably identified so that the bowler can observe which pins remain standing on the alley after the bowling operation.

The mercury switch 197 makes and breaks one side of the circuit through the unit switches 123

to all of the pin trip solenoids 103. When the carriage is in upraised position the switch 197 is closed and the circuit to the pin trip solenoids is completed. Reversal of the switch 197 by lowering of the pin carriage breaks the circuits to the pin trip solenoids so as to prevent the tripping of any pin from the conveyor chain while the carriage is in its operation.

The mercury switch 198 normally closes one side of the circuit through mercury switch 184 to the alley sweep motors and breaks the circuit upon lowering of the pin carriage so that it is not possible to operate the pin sweep motors during the operation of the pin set carriage.

The mercury switch 199 makes and breaks the side of the circuit to all pin trip solenoids 103 opposite the side of the circuit in which the units 197 are interposed. When the carriage is in up position the circuit to this side of the solenoids is made, thereby permitting pins to be tripped, but as the carriage is lowered and the switch 195 reverses the mercury switch 199 the circuit to the pin trip solenoids 103 is broken, thereby preventing operation of the pin trip solenoids if the pin set carriage is in motion or is not in its fully up position ready to receive pins.

The particular function of this switch 199 is to prevent any possibility of pins being released from the pin hoist conveyor during the time of travel upward or until pin set carriage is in the fully up position. This is desirable, since when pins are released from the pin baskets to the alley at the limit of down travel the individual solenoid trip switches mounted in the pin baskets are restored to on or receiving position. Therefore, if this switch were not interposed it would be possible to release pins from the pin hoist during that time of travel.

Operation of the pin hoist, pit conveyor and ball hoist motors is initiated by pressing the toggle switch 205, this switch closing the circuit to the two-pole magnetic contactor 206 which controls the operation of the pin hoist motor 207.

Positioned immediately below each of the ten pin spots on the alley is a photoelectric cell indicated at 208. These cells each generates a current for operation of the corresponding ten single pole double throw magnetically operated relays 209. It will be understood that a suitable transparent covering will be used for the photoelectric cells 208, as indicated at 210 in Fig. 24. So long as a pin is on one of the spots 208 the photoelectric cell will be inactive and the circuit to the corresponding relay 209 will be broken. When the circuit to the relays 209 is broken, the circuit from the relays 209 to the corresponding signal lights 201 will be made, thereby causing these lights to show the presence of a pin on the spot. A suitable toggle switch 211 may be used to control the lighting circuit.

It will be noted that the circuit from the relays 209 leads to the contactor 159. This circuit is in series from each of the relays 209, and when any one of the relays 209 is in inactive position by reason of a pin being on the corresponding pin spot, the circuit to the coacting contactor 159 is broken, and the pin set carriage cannot be operated.

It will be recognized that the above structure has many operative and safety features which make it possible to encounter interference between the various operating elements.

The bowler must maintain the master switch in contact during the down movement of the pin carriage, which eliminates the possibility of the

bowler throwing a ball during the function of setting pins on the alley.

The pin set carriage cannot be operated if the pin sweep unit is in operation or if it is not in fully retracted position. The pin set carriage cannot be operated if one or more pins remain on the alley, or if all of the pin baskets of the pin set carriage are not loaded. This prevents the possibility of mechanical damage to either the pin sweep unit or to the pin set carriage, and also compels the bowler to operate the apparatus properly.

The pin sweep unit cannot operate if the pin set carriage is in operation or is not in fully up position.

The pin conveyor belts will not operate if the pin storage bin is not fully loaded. This prevents an excess number of pins passing through the pin tumbler unit until the pin hoist conveyor has caught up or is ready to receive pins. By providing each of the operating units with safety interlock features, correct operation of the time mechanism by the bowler is assured and injury or damage to the mechanical unit or to the electrical system is prevented.

Additionally, the bowler is enabled to exercise wide discretion as to what the set-up mechanism is to do. Further, he is accurately advised at all times as to the condition of the alley with respect to the number and position of pins on the alley.

The mechanism has been described for the purpose of explaining the invention and it will be seen that many departures from the particular structure shown are possible within the scope of the invention as defined in the appended claims.

I claim:

1. A bowling alley operating mechanism, comprising a pin conveyor, a pin-aligning member, means for receiving pins from said aligning member, a pin hoist including a pin-gripping device operative to convey pins from said receiving member to a position above the bowling alley, and means for stopping said pin conveyor when a predetermined number of pins are in said receiving member.

9. A bowling alley operating mechanism, comprising a pin conveyor, a pin-aligning member, a pin bin for receiving pins from said aligning member, a plurality of switches adjacent said pin bin in position to be tripped by pins moving into said bin, and means actuated by said switches for actuating said conveyor when less than a predetermined number of pins are in said bin and for stopping said conveyor when said predetermined number of pins are in said conveyor.

3. A bowling alley operating mechanism, comprising a pit conveyor, a pin-aligning member, means for receiving pins from said aligning member, a pin hoist operative to convey pins to a position above the bowling alley, a pin-setting basket, means including pin trip solenoids for loading pins from said conveyor in said basket, an alley sweep mechanism, means including a switch unit associated with said pin-setting basket and controlled by actuation of said alley sweep mechanism for preventing operation of said pin-setting basket during the operation of said sweep mechanism, means including a switch unit associated with said sweep mechanism and controlled by actuation of said basket for preventing operation of said sweep mechanism during operation of said pin-setting basket, and means including a switch unit associated with said pin trip solenoids con-

trolled by the actuation of the pin-setting basket for preventing operation of said loading means during operation of said basket.

4. A bowling alley operating mechanism, comprising a pin conveyor operative to carry pins to a position above the bowling alley, photo-electric cells positioned beneath the ten pin spots of the alley, a pin-setting basket adapted to move downwardly into pin-setting relation with respect to said spot, and means including relays in series with a motor control contactor and associated with said cells and controlled thereby actuated by said cells for preventing operation of said basket when one or more pins are on said spots.

5. A bowling alley operating mechanism, comprising a pit conveyor, means including a pin-gripping device for hoisting pins from adjacent said conveyor along a longitudinal line above the alley, a pin-setting basket beneath said line, chutes extending from said line to each of ten pin-receiving pockets in said basket, switches on the pin-receiving pockets of said basket and trip solenoids adjacent the upper portions of said chutes for tripping a pin from said gripping device when the switch on the pin basket shows the absence of a pin in any of said pockets.

6. A bowling alley operating mechanism, comprising a pit conveyor, a continuously operating pin hoist for conveying pins from adjacent the rear of the bowling alley to a position above said bowling alley, a pin-setting basket beneath said conveyor, means for moving said basket upwardly into pin-receiving position and downwardly into pin-setting position, pin-receiving pockets on said basket, chutes extending from adjacent each of said pockets to positions to receive pins from said conveyor, trip solenoids adapted to trip a pin from said conveyor when the corresponding pin-receiving pockets of said basket are empty, switches on said pockets for actuating said solenoids when a pin is not in the corresponding pocket, a master switch and circuit therefor for initiating the operation of said pin-receiving basket to set all of said pins, a requisite number of individual pin-setting switches operative to set selected pins from said basket, additional switch means for operation of said basket in connection with said individual switch means, means for preventing operation of said individual switch means during the operation of said master switch, means for preventing the operation of said master switch during the operation of said individual switch means, means including switches carried by said pockets on said basket for preventing the operation of said basket when less than a full number of pins are positioned therein, and means for preventing the operation of pin-tripping solenoids during the operation of said pin basket.

7. A bowling alley operating mechanism, comprising a pit conveyor, a pin hoist for conveying pins from adjacent the alley to a position above said alley, a pin-setting basket positioned below said conveyor and having individual pin-receiving pockets, chutes for conveying pins from said conveyor to said pockets, an alley-sweeping mechanism, and operative electrical circuits for driving said mechanism, said circuits including switches for selectively setting the desired individual pins upon the alley, a switch for set-

ting all of the pins on the alley, switches for loading the basket with a full quota of pins, means for preventing operation of said basket when one or more pins are on the alley, means including a switch unit associated with the sweep mechanism and controlled by actuation of said basket for preventing operation of the alley sweep mechanism during operation of the pin-setting mechanism, means including a switch unit associated with said pin-setting basket and controlled by actuation of said alley sweep mechanism for preventing operation of the pin-setting mechanism during operation of the alley sweep mechanism, a means for preventing loading of said basket with pins during the operation of said basket.

8. A bowling alley operating mechanism, comprising a pit conveyor, a pin-setting mechanism movable upwardly into pin-receiving position and downwardly into pin-setting position adjacent the bowling alley, a pin sweep mechanism adjacent said pin-setting mechanism, said pin sweep mechanism including side arms joined by a transverse sweeping arm and means for moving said arms through a sweeping operation in which the arms are lowered to a position in which said transverse arm is adjacent the alley and then moved backwardly adjacent the rear of the alley, and a plurality of switches consisting of a two-pole reversing limit switch mounted adjacent said sweep arm operated by the movement of said sweep arms for stopping the motion of said arms in their backward position, returning said arms to their initial inoperative position, and a second switch unit mounted adjacent said arm for maintaining the operation of said arm and preventing the operation of said basket during the operation of the sweep mechanism.

9. A bowling alley operating mechanism, comprising a pit conveyor, a pin-setting basket positioned above the alley and movable into an upper pin-receiving position and downwardly into a pin-setting position, individual pin pockets on said basket, said pockets including pivoted side portions adapted to support a pin when in retracted position and to release a pin when in outwardly expanded position, solenoids for maintaining said pockets in retracted position when said basket is not in pin-setting position and for releasing said pins when said basket is in its downward pin-setting position, switches on said pockets carried by said basket operative to indicate the presence or absence of a pin in said pockets, and means actuated by said switches for loading said pockets with pins when said pockets are empty and said basket is in its upward position.

10. A bowling alley operating mechanism, comprising a pin conveyor for carrying pins to a position above the bowling alley, a pin-setting basket having pin-embracing and releasing means, pin trip solenoids for loading pins from said conveyor to said basket, means including a switch unit associated with said pin trip solenoids controlled by the actuation of the pin-embracing and releasing means of said pin-setting basket, and means for preventing operation of said loading means during operation of said basket.

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CERTIFICATE OF CORRECTION.

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May 25, 1943.

JOHN E. FLANAGAN.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 5, first column, line 53, for "dished" read --disked--; line 63, after the word "top" strike out --of--; page 9, second column, line 46, for the numeral "9" read --2--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 5th day of October, A. D. 1943.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)

DISCLAIMER

2,319,925.—*John E. Flanagan*, Chicago, Ill. AUTOMATIC BOWLING ALLEY MECHANISM. Patent dated May 25, 1943. Disclaimer filed May 1, 1945, by the inventor.

Hereby enters this disclaimer to claim 1 of said patent.

[*Official Gazette June 12, 1945.*]