March 16, 1954 W. L. WELLS 2,672,340

BOWLING PIN SETTING MECHANISM

Filed Dec. 18, 1947

5 Sheets-Sheet 1

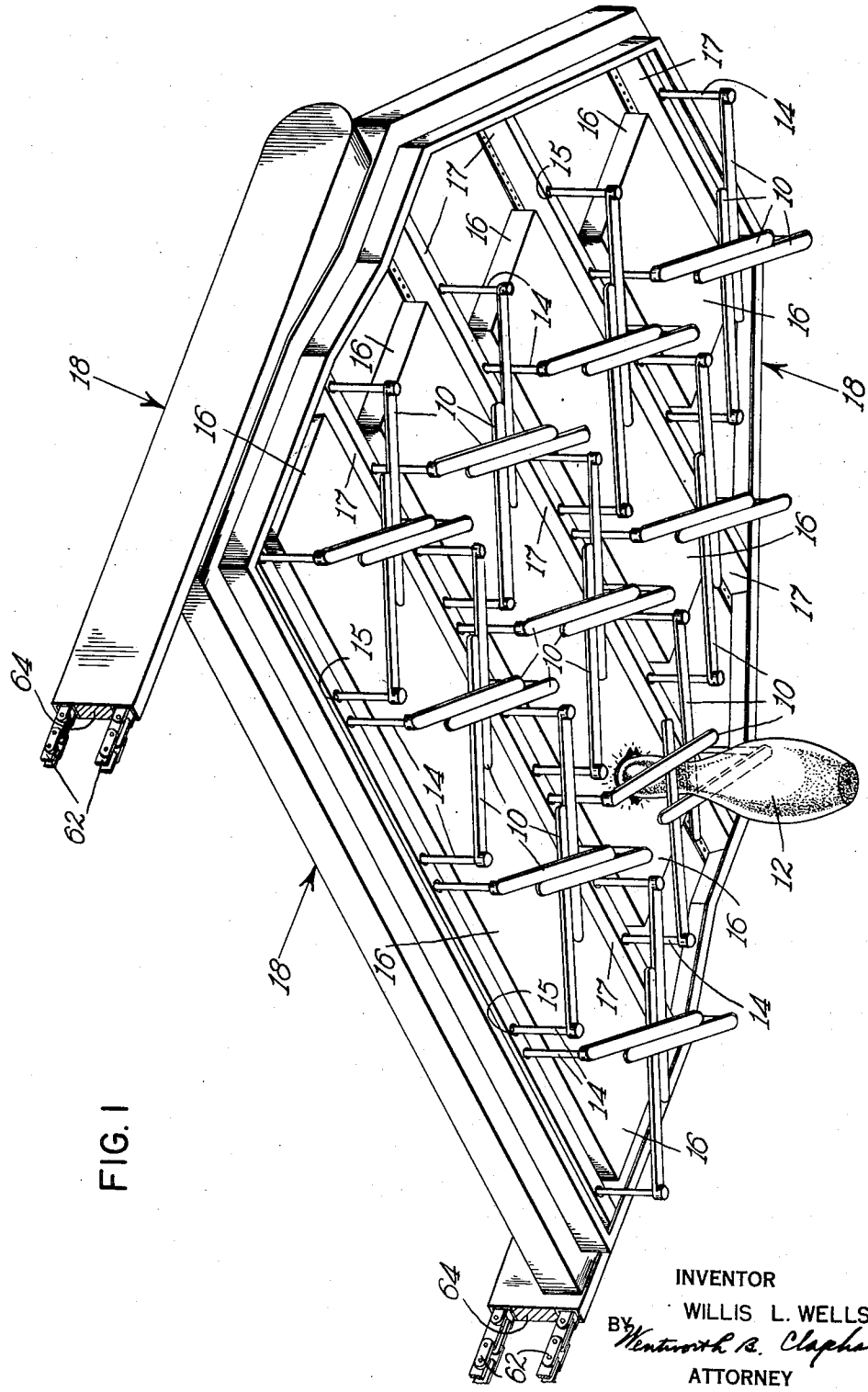


FIG. 1

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5 Sheets-Sheet 2

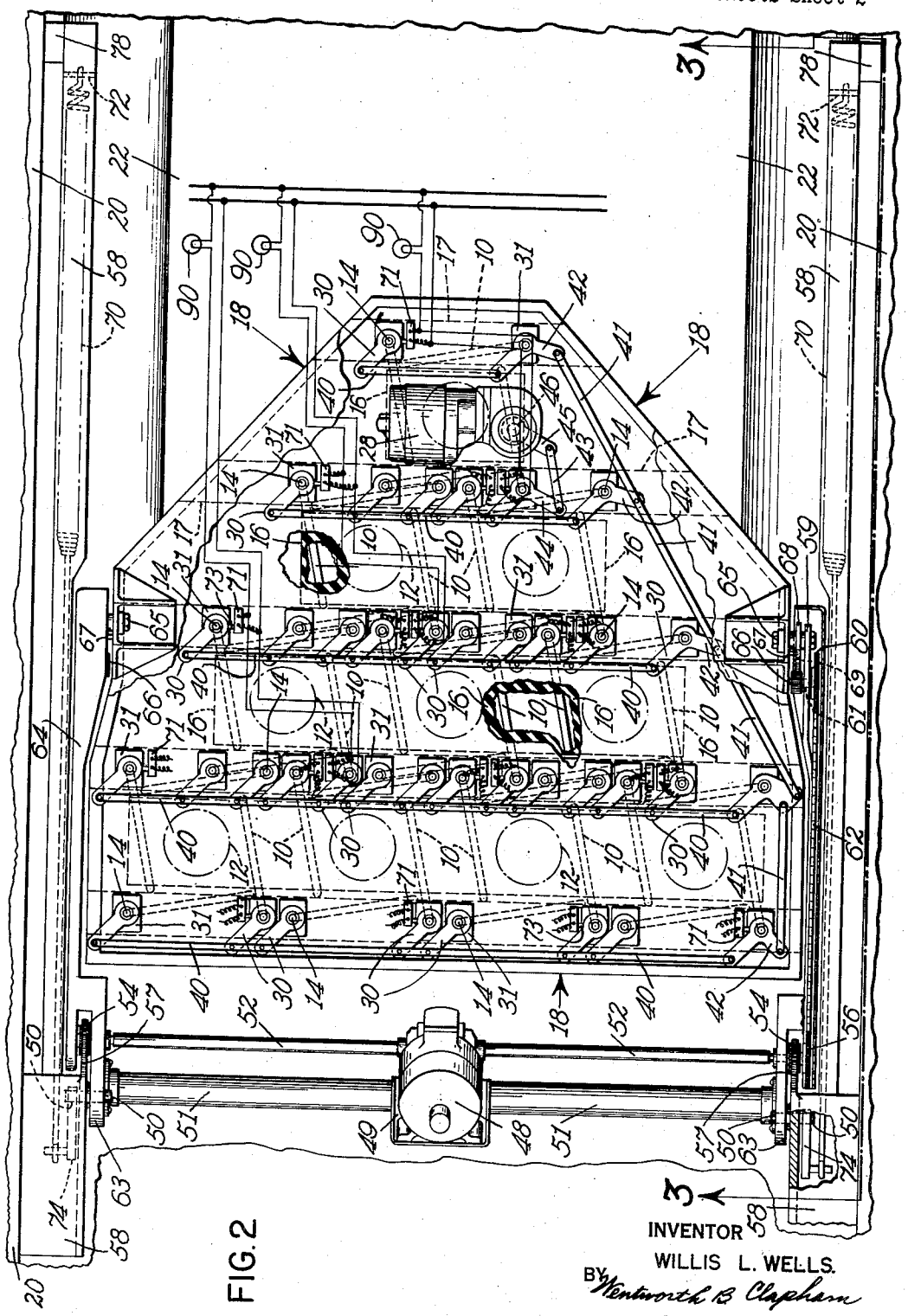


FIG. 2

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FIG. 4

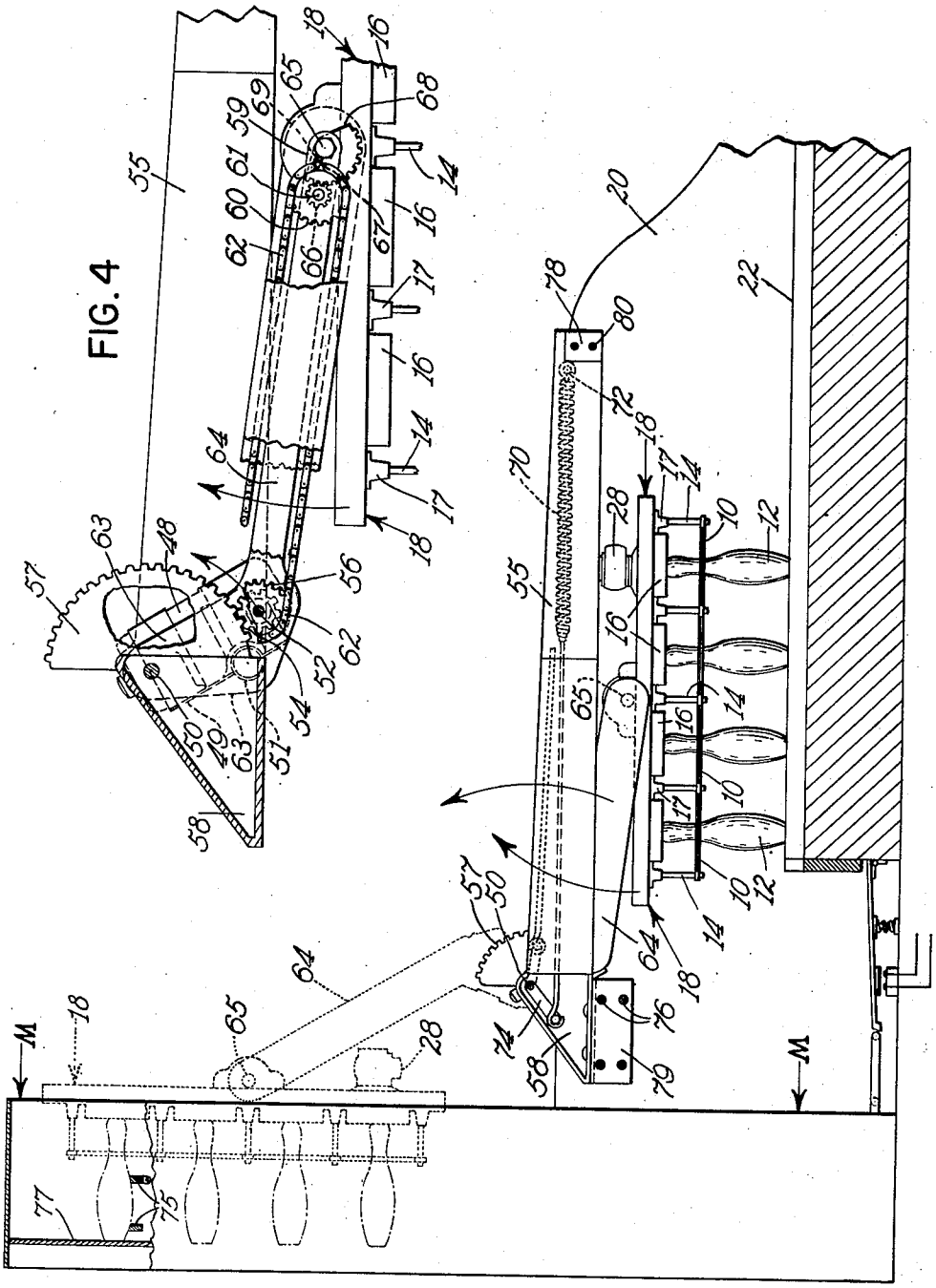


FIG. 3

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BOWLING PIN SETTING MECHANISM

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FIG. 5

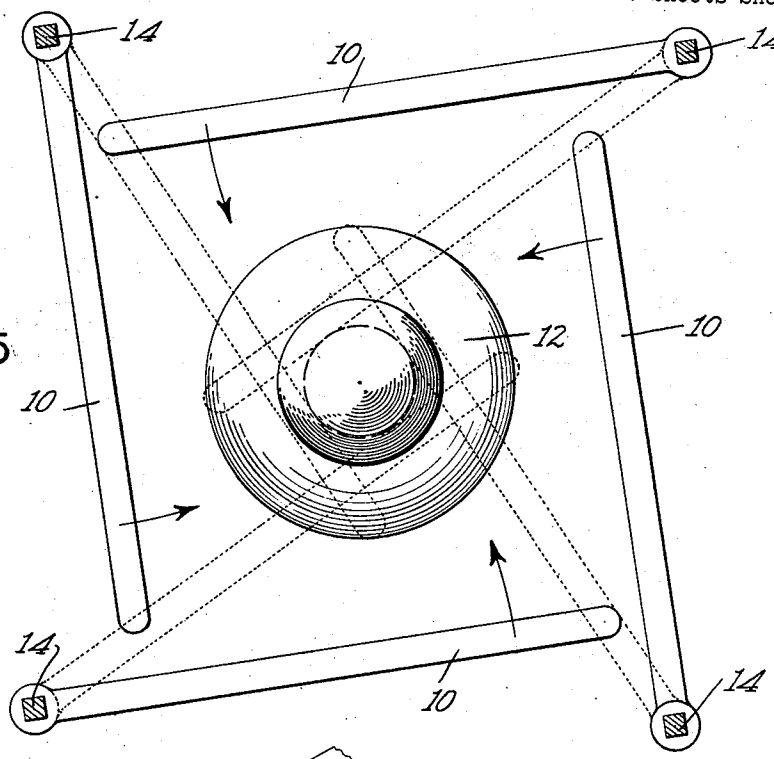
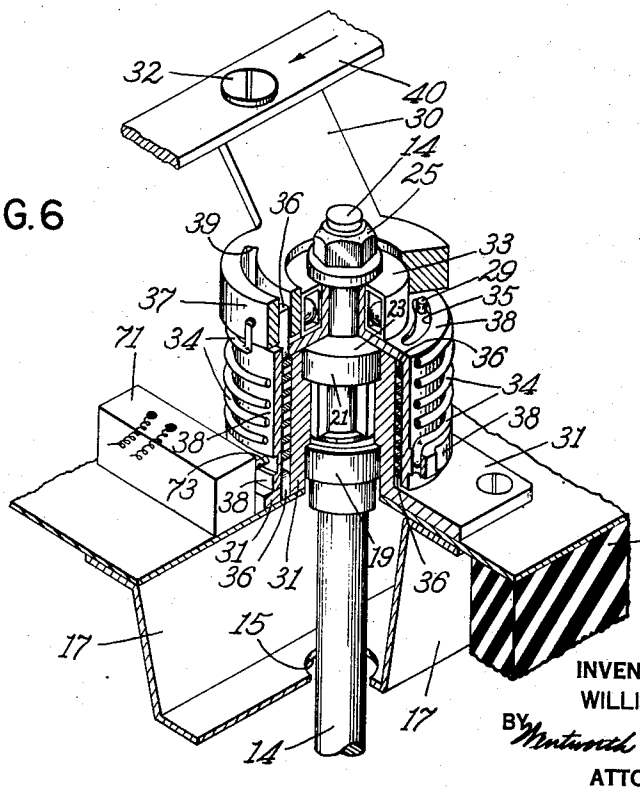


FIG. 6



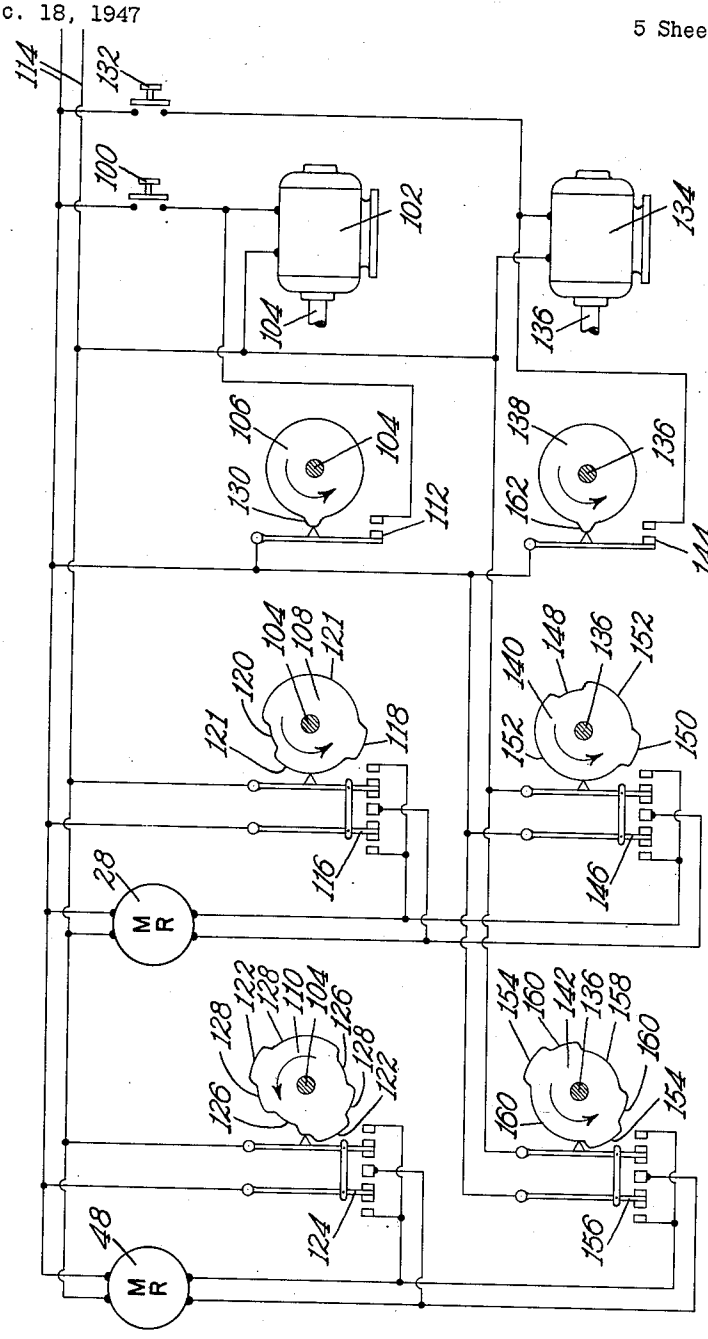
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BOWLING PIN SETTING MECHANISM

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FIG. 7



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Patented Mar. 16, 1954

2,672,340

UNITED STATES PATENT OFFICE

2,672,340

BOWLING PIN SETTING MECHANISM

Willis L. Wells, St. Louis, Mo., assignor, by mesne assignments, to American Machine and Foundry Company, New York, N. Y., a corporation of New Jersey

Application December 18, 1947, Serial No. 792,365

9 Claims. (Cl. 273—42)

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This invention relates to bowling pin setting machines and more particularly to improvements in mechanism for setting and resetting pins upon the playing bed of an alley.

In the game of bowling, it often happens that after a ball is thrown, pins are either knocked off-spot or "walk" off the spots upon which they were originally positioned on an alley prior to the rolling of the ball.

Since the rules of the American Bowling Congress state that pins should occupy the position to which they move or are moved as the result of the throwing of a ball, a problem is present in the case of an automatic bowling pin spotting machine of insuring that any standing pin or pins are properly located in substantially the same on or off-spot position each occupied before the next ball of a particular frame is rolled.

The problem of positioning pins correctly in on or off-spot arrangement is solved by the mechanism constituting my invention. This is because I have provided means which grip and securely hold bowling pins regardless of whether or not they occupy on-spot position on the playing bed of a bowling alley. Therefore, after a first ball of a frame has been rolled, if any pins remain standing, such pins are gripped by my improved spotting and respotting mechanism, lifted clear of the bowling alley in order that deadwood may be swept therefrom and returned to proper on or off-spot position pending rolling of the next ball of the frame. The range of operation of the pin gripping units which form an important part of the invention is such that each unit is operative over a greater one than has heretofore been possible.

My invention is also designed for simplified operation in spotting and respotting pins on the playing bed of an alley. The desired simplification is effected by utilizing the same mechanism for both setting and resetting pins. That is, the spotting and respotting table is provided with pin holding elements, which when the table is moved into a pin receiving position adjacent a pin magazine, are operated to grip ten triangularly positioned pins in the pin magazine. The table is then moved clear of the magazine effecting a withdrawal of ten gripped pins therefrom after which it is moved into pin delivering position adjacent the bed of the alley where the pins are released from the holders and remain in spotted position, triangularly arranged on the bed of the alley when the table is moved upwardly to its inoperative position above the alley. Following the throwing of the first ball of a frame, if any

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pins remain standing, the table is moved downwardly, the pin holders are operated to grip on or off-spot pins, whereupon the table moves upwardly and dwells above the alley bed. The alley is then cleared of deadwood or fallen pins. The table then returns to pin respotting position adjacent the alley. Pins to be respotted are released by the pin holding elements and returned to their on or off-spot positions on the alley. The table then returns to inoperative position above the alley.

Bowling pins may vary somewhat in height because during the life of the pin, in order to extend the life, it is necessary to dress worn pins. The dressing operation may require the removal of a portion of the pin at the base which means that a pin dressed in this manner may not be as tall as other pins in play. In order to insure that pins to be spotted on the alley are lifted and respotted thereon and properly held at all times, the improved spotting-respotting table forming this invention is provided with a pin handle clamping surface located above the plane of operation of the gripping elements. This clamping surface preferably is a relatively thick resilient flexible material, such for instance as sponge rubber or fibrous material which after being compressed returns to its normal thickness when released from compression. In this manner the combined operation of the clamping surface and the gripping elements insures the proper handling of pins being spotted and respotted.

It is an object of my invention to provide an improved spotting-respotting device having sets of pin gripping elements which are operative to grip and remove pins from a magazine for spotting, and also for respotting in on or off-spot positions on the playing bed of a bowling alley.

It is a further object of my invention to provide a spotting-respotting table having triangularly arranged sets of gripping arms, each of which sets of arms is effective to firmly hold a bowling pin, which table is operative to move with pins held in the gripping arms from a source of supply for spotting pins on the playing bed of a bowling alley and also to respot pins on the playing bed.

My invention also consists in the provision of a novel spotting and respotting table having a resilient pin clamping surface which in conjunction with triangularly arranged pin gripping units maintains bowling pins in proper triangular arrangement for spotting on the playing bed of a bowling alley.

My invention also consists in the provision of an improved pin respotting mechanism including triangularly arranged sets of individually operated gripping elements which are actuated to grip the necks of bowling pins and spot or respot them on the bed of a bowling alley.

My invention also consists in the provision of a novel pin spotting and respotting table mounted for movement to and from a pin magazine and the playing bed of a bowling alley, which table can be employed for the dual purpose of setting and resetting bowling pins on the playing bed of the alley.

With these and other objects not specifically mentioned in view, the invention consists in certain combinations and constructions which will be hereinafter fully described, and then set forth in the claims hereunto appended.

In the accompanying drawings which illustrate a preferred embodiment of the invention and form a part of this specification, and in which like characters of reference indicate the same or like parts:

Figure 1 is a perspective view of my improved bowling pin spotting and respotting table disclosing the pin gripping mechanism in operative arrangement;

Figure 2 is a top plan view of the spotting-respotting table shown in Figure 1, with parts broken away to illustrate inoperative positions of the pin gripping arms beneath the table;

Figure 3 is a side elevation of the improved spotting and respotting table taken on line 3—3 of Figure 2 disclosing the operative relationship between the table, the pin magazine and the bed of the bowling alley upon which pins are spotted and respotted;

Figure 4 shows the table lifting and turning mechanism;

Figure 5 shows the gripping arms in their respective inoperative and operative positions;

Figure 6 is a sectional isometric view of a single torque spring clutch used in operating and controlling the operation of each gripper arm; and

Figure 7 is a wiring diagram showing a suitable control circuit.

Referring to the drawings which illustrate a preferred embodiment of the invention, reference character **18** indicates generally my improved bowling pin spotting and/or respotting device which can be used for spotting and respotting pins as desired. Device **18** is particularly useful in an automatic bowling pin setting machine of the type shown and described in my co-pending application, Serial No. 16,725, filed March 24, 1948, for Bowling Pin Setting Machine. When employed in the machine referred to, device **18** performs the dual function of spotting and respotting pins on the playing bed of a bowling alley **22**. While I have referred to a particular type of bowling pin setting machine, in which my improved spotting and/or respotting mechanism is readily adaptable for use, it is to be understood that it can be used in connection with any type of automatic machine, especially a machine utilizing the same unit for spotting and respotting pins in on or off-spot positions.

The term "table" as used hereinafter designates device **18** and the several spotting and respotting units operatively supported thereon.

As shown in Figures 1 and 3, on the underside of the table **18**, there are provided ten sets of pin gripping arms **10**, each attached to a shaft **14** projecting downwardly from the top portion of table **18** through an opening **15** in a cross-frame member **17** located above each of the sets of arms **10**. Secured to the underside of table **18** is a pin head clamping member **16**. Although member **16** can be formed as a single unit, in the preferred form illustrated in Figure 1, member **16** is made up of four substantially rectangular parts each securely fastened by any suitable means to the underside of table **18** between cross members **17**. Member **16** is preferably made of a resilient or readily compressible material which after being compressed readily returns to its original thickness when released from compression. For this reason it is preferred to use sponge rubber, felt, compressible fabric or other suitable material.

The several sets of arms **10** are mounted on the underside of table **18** in generally triangular arrangement corresponding to the customary spotted positions of bowling pins on the playing bed of a bowling alley. As illustrated somewhat diagrammatically in Figure 5, each gripper set includes four opposed pin holding or gripping arms **10** secured to vertically suspended shafts **14**. The arms are so mounted and arranged that they form the general arrangement of a rectangle within which is located a bowling pin **12**. The four arms are so mounted that two opposed arms **10** mounted on diagonally opposite shafts **14** cooperate as a pair and grip opposite sides of the handle of a pin. As illustrated in Figure 5, the arms **10** of each set of arms normally occupy full line positions disclosed in Figure 5. If pins are on-spot when the arms are moved to operative or gripping position, they assume the positions shown in Figure 5 in dotted lines.

The length and positions of the several arms **10** forming each gripper set are such that a greater area of the playing deck of the alley can be covered by the arms forming the ten triangularly positioned sets of arms **10**. This is desirable because during the play of the game, especially after the first ball of a frame is rolled, it oftens happens that a standing pin walks, or is knocked or otherwise displaced off-spot. Occasionally it happens that such a pin occupies a position relatively remote from its usual spotted position. This condition gives rise to a serious problem in automatically lifting and respotting such pin. By providing four elongated arms **10** of suitable length, as shown in Figure 5, and ten such sets of arms **10**, it is possible to cover a greater area of the actual playing deck of the alley than has heretofore been possible and accurately grip, lift and respot on or off-spot pins thereon.

Arms **10** preferably are covered with a resilient covering, such as rubber, which provides a resilient yet firm grip and assists in the holding and accurate repositioning of pins to be respotted. This covering also lessens danger of damage and moving of the pins.

Referring to Figure 1, which shows arms **10** gripping a pin, it will be seen that the four gripper arms **10** of each unit are so mounted on shafts **14** that opposite arms are in the same horizontal plane. This means that the remaining pair of arms **10** are in a parallel plane either above or below the plane of the above mentioned opposite or opposed arms.

The planar arrangement of the opposed pairs of arms **10** allows unobstructed movement of opposite arms **10** toward each other regardless of whether or not there is a standing pin to be gripped thereby. If a pin is standing, further motion of each arm ceases as soon as it engages

the surface of a standing bowling pin. Mechanism for accomplishing this result will be described hereinafter. If no bowling pin is present, the travel of the opposed arms 10 continues until their front edges engage whereupon motion ceases.

The arrangement described permits the four arms 10 of each set to move freely into and out of gripping engagement with the neck of a bowling pin 12 whether it be in on or off-spot position on alley 22. It is obvious that if table 18 is being used for spotting alone, each of the arms 10 will assume the substantially uniformly spaced gripping position shown in dotted lines in Figure 5. If the table 18 is being used for respotting also, on-spot bowling pins 12 being lifted for sweeping of the alley and subsequent respotting will be gripped substantially as shown in Figure 5. If some pins remaining standing are in off-spot positions, arms 10 will move in accordance with the off-spot positions occupied by such pins. The provision of four arms is desirable because it makes possible a very firm gripping engagement and a more rigid holding thereby resulting in greater accuracy in spotting or respotting of pins on an alley.

As mentioned hereinabove, each of the several arms 10 is secured to a torque shaft 14 mounted for rotary movement in table 18. As shown, each arm is secured to the free end of its shaft 14 although, if desired, it could be located along the shaft. The several shafts 14 are mounted for individual and independent movement in order to move arms 10 carried thereby into and out of engagement with bowling pins to be gripped for spotting and/or respotting. Since the several shafts are mounted and operated in the same manner, it is considered that the description of the construction of the mechanism for actuating a single shaft will suffice to cover all of them.

A reference to Figure 6 shows that the upper portion of shaft 14 which projects upwardly through opening 15 in cross frame member 17 is provided with two enlarged parts 19 and 21. Part 19 is rotatably set in a bearing formed in the lower part of base housing 31. Enlarged part 21 which is spaced from part 19 is rotatably seated in a bearing formed at the top of base housing 31. Part 21 (as illustrated in Figure 6) is provided with a suitable seat 23 to which is clamped a flanged portion of casing 38 having a cylindrical skirt extending downwardly over and spaced from base housing 31 in order to allow a spring 36, referred to hereinafter, to be located therebetween. Mounted upon another cylindrical part of casing 38 is a ball bearing 33. A nut 25 threaded on the end of shaft 14 secures the several parts, just described, in driving or turning relationship. Encircling casing 38 is a spring 34. One end of spring 34 is attached to casing 38; the other end is secured to the hub 37 of shaft operating arm 30 which is pivotally attached by screw 32 to operating link 40.

Torsion spring 36, which is mounted between casing 38 and base housing 31, is provided with an upwardly projecting end extending into an elongated arcuate slot 39 formed in hub 37. The other end of spring 36 is located in a vertical groove formed in base housing 31. Mounted on base housing 31 is a pin 29 which extends upwardly into a slot 35 in casing 38.

The thus described torque spring clutch operates as follows: When motor 28 through links 40 and 41 moves all gripper shaft operating arms 30 in the direction of the arrow (indicated in

Figure 6), hubs 37 of arms 30, which are connected through springs 34 to casings 38, move the latter in the same direction for about 60° when the travel or movement of each casing 38 is arrested by pin 29 contacting the end of slot 35 in casing 38. At the same time the upward projecting end of spring 36 has reached one end of slot 39 in hub 37 and further travel of the latter, in the same direction, causes spring 36, which at its lower end is secured to base housing 31, to expand and move into frictional engagement with the inner wall of the cylindrical surface of casing 38, thereby effecting a locking of hub 37 and the therewith connected gripper shaft 14, which is clamped to casing 38 as described hereinabove. The desired locking effect is obtained in the last 30° of a possible 90° movement of gripper shaft operating arms 30. This locking effect, of course, is broken as soon as motor 28, through links 40 and 41, causes arms 30 to move in the opposite direction.

During the operation of table 18 when pins are to be gripped for spotting or for respotting all of the shafts 14 are turned simultaneously to move arms 10 into engagement with the neck portions of pins to be gripped for spotting or respotting as the case may be. The several shaft operating arms 30 are connected to links 40 (Figure 2). Intermediate links 41, pivotally connected to projections 42 formed on five of shaft rocking arms 30 assist in the simultaneous operation of all of the arms 30, of which in the illustrated embodiment there are forty. A link 43 connected to an arm 44 of one of the shaft operating arms 30 is pivotally connected to lever 45 secured to shaft 46 of the gear reduction system of reversing motor 28. From this it follows that when pins are to be gripped and held by arms 10 for respotting, shaft 46 is driven in one direction by reversing motor 28 which effects simultaneous rocking of all of the arms 30 and a concurrent turning of shafts 14 to move arms 10 into gripping relationship with bowling pins to be spotted or respotted. At the conclusion of the respotting operation, reversing motor 28 is operated to turn shaft 46 in the opposite direction, whereupon all of the gripping arms 10 are separated and the pins which were held thereby are left in on-spot or off-spot positions on the bowling alley. A similar gripping operation is effected in the removal of ten pins from magazine M (Figure 3) when table 18 is employed for spotting. In this case, gripper arms 10 are maintained in operative relationship with respect to the handle portions of the ten pins held thereby until table 18 has moved into the position shown in full lines in Figure 3 adjacent alley 22 when current through motor 28 is reversed and the several sets of gripper arms 10 are opened to release the pins in spotted arrangement on the alley.

Referring to Figures 2, 3, and 4, it will be seen that table 18 is of generally triangular formation and is mounted for movement to and from the pin supporting section of a bowling alley 22. Table 18, which is positioned between kickbacks 20, is mounted on arms 64 which support pivots 65 on which the table may swing in moving from magazine M with a set of pins to a spotting position above alley 22. Each arm 64 is provided with an extension 63. A stud 50, carried by each of the extensions 63, is journalled in a suitable bearing of a side frame member 58 secured to the inner wall of its respective alley kickback 20. Thus, the entire table is pivoted and permitted to swing towards and away from the alley bed.

The two extensions 63 of arms 64 are rigidly connected by means of a transverse tubing or shaft 51 which in its center portion carries a motor bracket 49 to which is secured a reversible motor 48, which effects all necessary movement of the table incident to spotting and respotting bowling pins on alley 22. Motor 48 drives a transverse shaft 52 supported by suitable bearings in extensions 63 of arms 64. To each end of shaft 52 is mounted a gear 54 and a sprocket 56. When gears 54 are driven they will cause table 18 to be lifted in a vertical direction away from alley 22 through the meshing of gears 54 on shaft 52 with gear sectors 57 rigidly attached to stationary side brackets 58 on kickbacks 20. Sprockets 56 are tracked by chains 62 enclosed in arms 64. Chains 62 run on driving sprockets 60 on shafts 61 journalled in free ends 59 of arms 64. Gears 66 on shafts 61 mesh with segments 68 fixedly secured to stud shafts 65 mounted on table 18. Pins 67 projecting from table 18 engage openings 69 in each of the segments 68 and act as spacers and also insure their permanent non-turning relationship to table 18. When gears 66 are rotated they cause segments 68 to turn and as a result thereof turn table 18 so that as table 18 is being lifted in the manner described to the pin magazine M, it is also turned by segments 68 to bring it to an upright vertical position and thereby locate it in pin receiving arrangement relative to the ends of the ten triangularized pins projecting from magazine M. These pins, which are located on suitable supports 75 in accurate triangular arrangement, are pressed by resilient pads 16 against back plate 77 of magazine M and while so held, reversing motor 28 is operated to cause shafts 14 to turn whereupon the sets of gripper arms 10 on table 18 firmly grip and hold the ten pins in magazine M. Motor 48 is then reversed which causes arms 64 to swing table 18 clear of magazine M carrying ten triangularly arranged pins which are held in the tens sets of gripper arms 10. Due to the coaction of sprockets 56, chains 62, sprockets 60 and segments 68, table 18 is swung into a horizontal position relative to the bed of alley 22 so that when arms 64 are located in the position shown in full lines in Figure 3, the ten pins carried by the grippers 10 are delivered and spotted in triangular playing arrangement on the playing bed of alley 22.

Mounted within each side frame member 55 are counterbalancing springs 70 having one end secured to a pin 72 and the other end attached to an arm 74 fixed to a shaft 50. Springs 70 assist in the even and balanced movement of the table 18 to and from magazine M and alley 22. The side frame members 55 are secured to kickbacks 20 by angles 79, bolts 76, blocks 78 and bolts 80.

In a two ball per frame game, for example, table 18 performs the function of respotting pins after the first ball of a frame is thrown except in the case of a strike. If a strike is made, or all pins are knocked down by the first ball of a frame, all fallen pins on the alley or in the gutters are swept into the pit by any suitable means (not shown), table 18 is moved by motor 48 through a suitable control, described hereinafter, to the dotted line position indicated in Figure 3 adjacent magazine M where it receives a new set of pins for delivery to alley 22 (as shown in full lines in Figure 3), after which it moves to spotting position relative to alley 22. The pins are released by gripper arms 10 and table 18 moves

to its dwell position above the alley. Since the mechanism for assembling a set of pins in magazine M forms no specific part of this invention and is shown and described in my above mentioned copending application, Serial No. 16,725, a further showing and description herein is deemed unnecessary.

After a set of pins has been placed on the alley in spotted triangular arrangement by means of a suitable control, described hereinafter, table 18 is raised above the alley clear of the pins to a height such that it does not in any manner obstruct the play of the game. If all pins are knocked down by the first ball of a frame and deadwood remains upon the alley, it is then necessary to lift any standing pins whether in on or off-spot position on the alley so that the deadwood can be swept from the alley and gutters by any suitable means (not shown) after which table 18 is lowered to the position indicated in full lines in Figure 3 or to respotting position. When pins have returned to respotted on or off-spot positions, motor 28 is reversed thereby causing shafts 14 to swing arms 10 out of gripping relation with the handle portions of pins held thereby. Motor 48 is then energized to return table 18 to its intermediate or dwell position above the alley pending delivery of the next ball of the same frame. After the second ball is rolled, all deadwood or fallen pins are swept from the alley prior to the delivery of a new set of pins thereto, as in the case of a strike.

In the operation of the mechanism, after the first ball is thrown, push button 100 is pressed. This causes the starting of a cam control motor 102 which carries on its shaft 104 a cut-out cam 106, a gripper arm control cam 108 and a table control cam 110. Cam 106 is employed for the purpose of supplying current from a power line 114 through a contact 112 to motor 102 after the latter has been started by push button 100. Cam 108 is employed to control the running time as well as the direction of turning of the gripper arm actuating motor 28 through a switch 116 which, depending on the contact of the high spot 118 or the low spot 120 of the cam with the switch, causes motor 28 to run either clockwise or counterclockwise, thus effecting a closing or an opening of the gripper arms 10 for gripping or releasing pins. Cam 108 is also provided with an intermediate track 121 which keeps switch 116 in a neutral position, during which time gripped arms 10 remain locked in either open or closed position. Cam 110 serves the purpose of controlling the running time, as well as the direction of rotation of table motor 48, which effects an ascending as well as a descending movement of table 18. The high spots 122 on cam 110 upon engagement with switch 124 effect an upward movement of table 18, while the low spots 126 cause table 18 to descend. The intermediate track 128 of cam 110 keeps switch 124 in a neutral position which effects a dwelling of table 18 in an intermediate position above alley 22. After the completion of the first ball cycle, bump 130 on cam 106 breaks contact 112, causing a stopping of cam control motor 102, and readying the machine for the second ball cycle.

After the second ball is thrown, a second cycle push button 132 is pressed. This causes the starting of a cam control motor 134 which carries on its shaft 136 a cut-out cam 138, a gripper arm control cam 140 and a table control cam 142. Cam 138 is provided for the purpose of supplying current from the power line 114 through a con-

tact 144 to motor 134 after the latter has been started by push button 132. Cam 140 is provided for controlling the running time as well as the direction of rotation of the reversible gripper arm actuating motor 28 during the second ball cycle through a switch 146. The latter upon contacting the low spot 148 of cam 140 effects a closing of gripper arms 10 when removing pins from magazine M, and the high spot 150 effects the opening of the grippers when spotting a new set of pins on the alley. The intermediate track 152 of cam 140 keeps switch 146 in a neutral position which effects the locking of the gripper arms in either closed or open position. Cam 142 is used for the purpose of controlling the running time as well as the direction of the table control motor 48 which effects the upward as well as downward movement of table 18. The high spots 154 on cam 142 upon engagement with switch 156 effect an upward movement of table 18; the low spot 158 effects a downward movement of the same from the magazine M to alley bed 22 during pin delivery in the second ball cycle. The intermediate tracks 160 effect a dwell of table 18 in its intermediate position, during the second ball cycle. A bump 162 on cam 138 is provided to stop motor 134 at the end of the second ball cycle.

In case a player rolls a strike he then presses the second ball cycle button 132 which, as described heretofore, would effect a setting of a new set of pins on the alley.

Occasionally it is desirable for a player to know which pins remain standing after the first ball of a frame has been rolled. In order to inform him which pins remain standing under such conditions, each of two diagonally opposed shafts 14, of each set of four shafts 14 which comprise a spotting-respotting unit, is provided with a normally closed switch 71 connected in a suitable parallel circuit. Three parallel circuits, each including its own lamp 90, are shown in Fig. 2. When the two opposed arms 10 carried by the shafts 14 provided with switches 71 move to pin engaging position and do not engage a pin, both switches 71 are opened. As a result, the parallel circuit for this unit is broken and its lamp 90 is extinguished, thus indicating that this particular pin has been knocked down or has fallen. The operation of all of the other sets of four arms is the same so that the player has an exact picture of which pins have been knocked down or have fallen because when any pins are standing, the lights corresponding to their positions remain lighted. There are ten lamps 90 arranged in triangular formation in order to designate the presence or absence of pins occupying corresponding positions on the alley bed.

As illustrated in Fig. 6, each switch 71 is provided with an operating button 73 adapted to project into a groove formed in the casing 38 with which the switch is associated. The grooves in casings 38 are of such length that so long as a pin remains standing, at least one switch button 73 of one of the two switches 71 will not be depressed to open the corresponding branch of the parallel circuit. If there is no pin standing at any one spotting position, the arms 10 of the two sets of arms at that position will move into engagement with each other, in which case the operation of casings 38 will be such as to open both switches 71 thereby breaking the parallel circuit including such switches to show the absence of a pin. By means of this structure, if for any reason a pin is so far off-spot that one arm 10 of the pair of arms provided with switches cannot engage it, regardless of the fact that the other arm 10 of this pair of arms and both arms of the other pair of arms 10 engage and grip such pin, only one switch 71 of the two switches provided can be operated. In the circuit shown in Fig. 2, the circuit through lamp 90 remains closed and it is evident that the pin remains standing. A suitable visible signal or annunciator, not shown, having the ten lamps 90 arranged in a conventional triangular pin spotting arrangement, can be employed. This device can be of the general type shown in Patterson and Rundell Patent 2,338,733.

The invention above described may be varied in construction within the scope of the claims because the particular embodiment, selected to illustrate the invention, is but one of several possible concrete forms of the same. The invention is not, therefore, to be restricted to the precise details of the structure shown and described.

What I claim is:

1. A device for use in a bowling pin spotting machine for spotting and respotting bowling pins on the playing bed of a bowling alley, comprising a pin magazine, supports mounting said magazine in fixed position in said machine, a frame, means mounting said frame for swinging movement to and from said pin magazine and said playing bed of said alley, a plurality of pin grippers carried by said frame, means mounting said grippers in substantially triangular pin spotting arrangement on said frame, operating mechanism including means for moving said frame to locate said grippers in pin receiving position adjacent said magazine, means for actuating said grippers to grip the handle ends of pins in said magazine, said operating mechanism including means for moving said frame away from said magazine to remove pins held by said grippers out of said magazine and substantially simultaneously turning said frame to dispose said gripped pins in position for delivery to said alley bed, and means operative after pins have been spotted or respotted on said alley bed for moving said frame upwardly to a dwell position above said alley bed; control means for performing a first cycle of sequential operations of said moving and actuating means to move said frame into pin receiving position adjacent said magazine, to operate said grippers to grip pins in said magazine while said frame is positioned adjacent thereto, to move said frame away from said magazine and withdraw pins held by said grippers therefrom and to substantially simultaneously turn said frame and locate pins held by said grippers in position for placement on said alley bed, and to operate said grippers to release pins held in said grippers in spotted playing arrangement on said alley bed, and then to move said frame to a dwell position above said alley bed, and control means for performing a second cycle of sequential operations of said frame moving means and said actuating means to move said frame from said dwell position into a pin gripping position above said alley bed and to operate said grippers to grip standing pins, to move said frame and lift said standing pins held by said grippers above said alley for removal of fallen pins from said alley and to again move said frame downwardly to respot said lifted pins and operate said gripper operating means to release said pins in respotted position and return said frame to said dwell position above said alley.

2. A bowling pin spotting device comprising a frame, a plurality of sets of grippers mounted on the underside of said frame, means mounting said frame for swinging movement between a pin magazine adapted to hold a set of bowling pins in triangular arrangement and the playing bed of an alley, means for locating said frame with said sets of grippers in position to grip said pins in said magazine, means for operating said grippers to grip said pins, means for moving said frame with a set of pins held by said grippers away from said magazine to withdraw said pins therefrom, means for swinging said frame through substantially ninety degrees and positioning the frame with the bases of said pins adjacent said playing bed of said alley for placement thereon, and means for operating said grippers to release said pins in playing position on said alley.

3. In a bowling pin spotting device, a frame adapted to be moved to and from a bowling alley for spotting and respotting bowling pins in playing arrangement thereon, a plurality of sets of pin grippers mounted on the underside of said frame, each of said sets including a plurality of pairs of opposed individually movable gripping arms, means mounting said pairs of arms in spaced parallel planes, whereby the arms of one pair of arms engage opposite sides of the handle end of a bowling pin and the arms of another pair engage opposite sides of the handle end of said bowling pin at portions substantially at ninety degrees from the portions of said pin engaged by said first-named pair of arms, yieldable operating mechanism for moving each arm to pin engaging position, whereby said arm may rest substantially without movement against a pin held against movement, support arms mounting said frame, a pin magazine, means in said magazine for supporting a plurality of pins in substantially horizontal planes and positioned to be engaged by said grippers, means for moving said support arms to move said frame between said pin magazine and said alley, means cooperating with said last-named means for turning said frame to position said grippers in pin receiving position adjacent said magazine, or in pin releasing position adjacent said alley, and means for operating said grippers to grip said pins to be removed from said magazine and to be placed on said alley.

4. A bowling pin spotting and respotting device for spotting and respotting bowling pins on the playing surface of a bowling alley comprising a frame, triangularly arranged pin holding units mounted on said frame, a stationary pin magazine mounted in a plane substantially at right angles with the plane of said bowling alley, pin supports in said magazine adapted to support a predetermined number of pins having their longitudinal axes lying in substantially parallel planes and with said pins positioned to be gripped and removed from said magazine, mechanism for moving said frame through substantially ninety degrees to and from said magazine and said surface of said alley and substantially simultaneously turning said frame to dispose the gripped pins in position for spotting on said surface of said alley including a reversing motor, and means responsive to the movement of said frame into pin receiving position adjacent said magazine for operating said pin holders to grip pins to be spotted, and means responsive to the positioning of said frame adjacent said surface for operating said holders when they are positioned adjacent said surface to release pins to be spotted or respotted on said surface.

5. A bowling pin spotting and respotting device for spotting and respotting bowling pins on the playing bed of a bowling alley comprising a frame, supporting arms mounting said frame for movement to and from said bed of said alley, a plurality of sets of bowling pin gripping arms carried by said frame, a stationary pin magazine supported in a plane substantially at right angles to the plane of said alley, supports in said magazine adapted to support a predetermined number of pins with their longitudinal axes lying in substantially parallel planes and with said pins positioned to be gripped, mechanism for moving said frame through an angular path of substantially ninety degrees to and from said magazine for spotting bowling pins on said bed, said mechanism including a reversing motor, fixed gear segments, and gears meshing with said segments, said mechanism including means driven by said motor controlling the movement of said frame along said angular path relative to said magazine and the bed of said alley and substantially simultaneously turning said frame to dispose said gripped pins in position for spotting on said bed of said alley, means responsive to the movement of said frame into pin receiving position for operating said sets of gripping arms when adjacent said magazine to grip pins to be spotted, and means operative in response to the positioning of said frame adjacent the bed of said bowling alley when said sets of gripping arms are positioned adjacent said alley bed to operate said gripping arms to release pins to be spotted on said bed of said alley, and mechanism for counterbalancing said frame for uniform movement to and from said magazine and the bed of said alley.

6. A bowling pin spotting device comprising a frame, a plurality of sets of grippers mounted on the underside of said frame, a pin magazine, means in said magazine for supporting a plurality of pins in positions to be gripped by said grippers, means mounting said frame for swinging movement between said pin magazine and the playing bed of an alley, mechanism for swinging and simultaneously turning said frame to locate said grippers adjacent said magazine in a plane substantially ninety degrees to the plane of operation of said grippers in spotting and respotting pins on said bed of the alley, means responsive to the movement of said frame into pin receiving position adjacent said magazine for operating said grippers to grip said pins in said magazine, means for moving said frame away from said magazine and positioning said frame in pin spotting position in a plane substantially parallel with the plane of said alley bed, means responsive to the positioning of said frame adjacent said alley bed for operating said grippers to release pins held thereby to spot said pins removed from said magazine on said bed.

7. A bowling pin spotting and respotting device for spotting and respotting bowling pins on the playing bed of an alley comprising a frame, triangularly arranged pin holders mounted on said frame and constructed and arranged to spot pins in on-spot position and also to respot pins in on and off-spot positions on said bed, a stationary substantially vertically positioned pin magazine having means for supporting a plurality of substantially triangularized pins with the handle ends of said pins positioned to be en-

gaged by said holders, and operating mechanism including means for moving said frame to a pin receiving station adjacent said magazine to engage said holders with said handle ends of said pins in said magazine, means for operating said holders to grip said handle ends of said positioned pins, said operating mechanism including means for moving said frame with said pins held by said holders away from said station to remove said pins from said magazine and substantially simultaneously turning said frame to position said frame in a plane substantially parallel with the plane of said bed and adjacent thereto, and means for operating said holders to release pins and spot said pins on said bed.

8. The invention defined in claim 7 wherein said operating mechanism includes means operative in response to the release of said pins from said holders in spotted arrangement on said alley bed for moving said frame to a dwell position above said alley bed, and selective control means for sequentially operating said frame moving and holder operating means to move said frame downwardly to spotting position adjacent said alley bed, to operate said holders to grip on or off-spot standing pins and to then move said frame and said gripped pins upwardly to said dwell position whereby said bed may be cleared of standing pins, and to then move said frame to said spotting position and to operate said holder operating means to release said pins from said holders in respotted position on said alley, and then to move said frame to said dwell position.

9. The invention defined in claim 8 wherein each of said holders comprises a set of individually operated opposed pin gripping arms, a normally closed switch for each of two opposed arms of said set of arms, a parallel circuit connecting said switches, a lamp in said circuit, and means operative in response to the movement of said last-named arms beyond positions where they normally engage a standing on-spot pin for opening said switches thereby breaking said circuit and extinguishing said lamp.

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