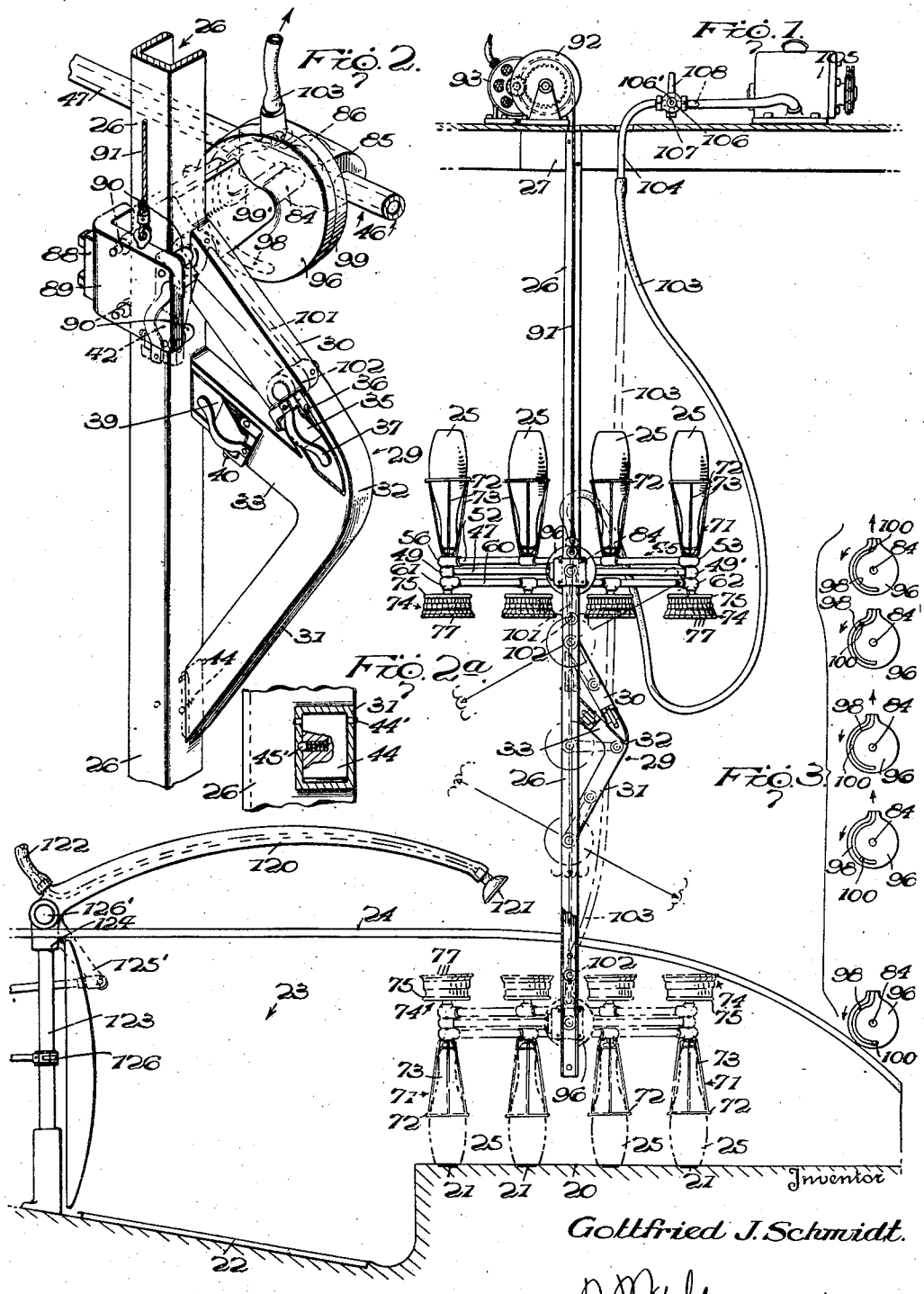
July 23, 1940. G. J. SCHMIDT 2,208,605

BOWLING PIN SETTING APPARATUS

Filed Sept: 17, 1936 7 Sheets-Sheet 1



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July 23, 1940. G. J. SCHMIDT 2,208,605

BOWLING PIN SETTING APPARATUS

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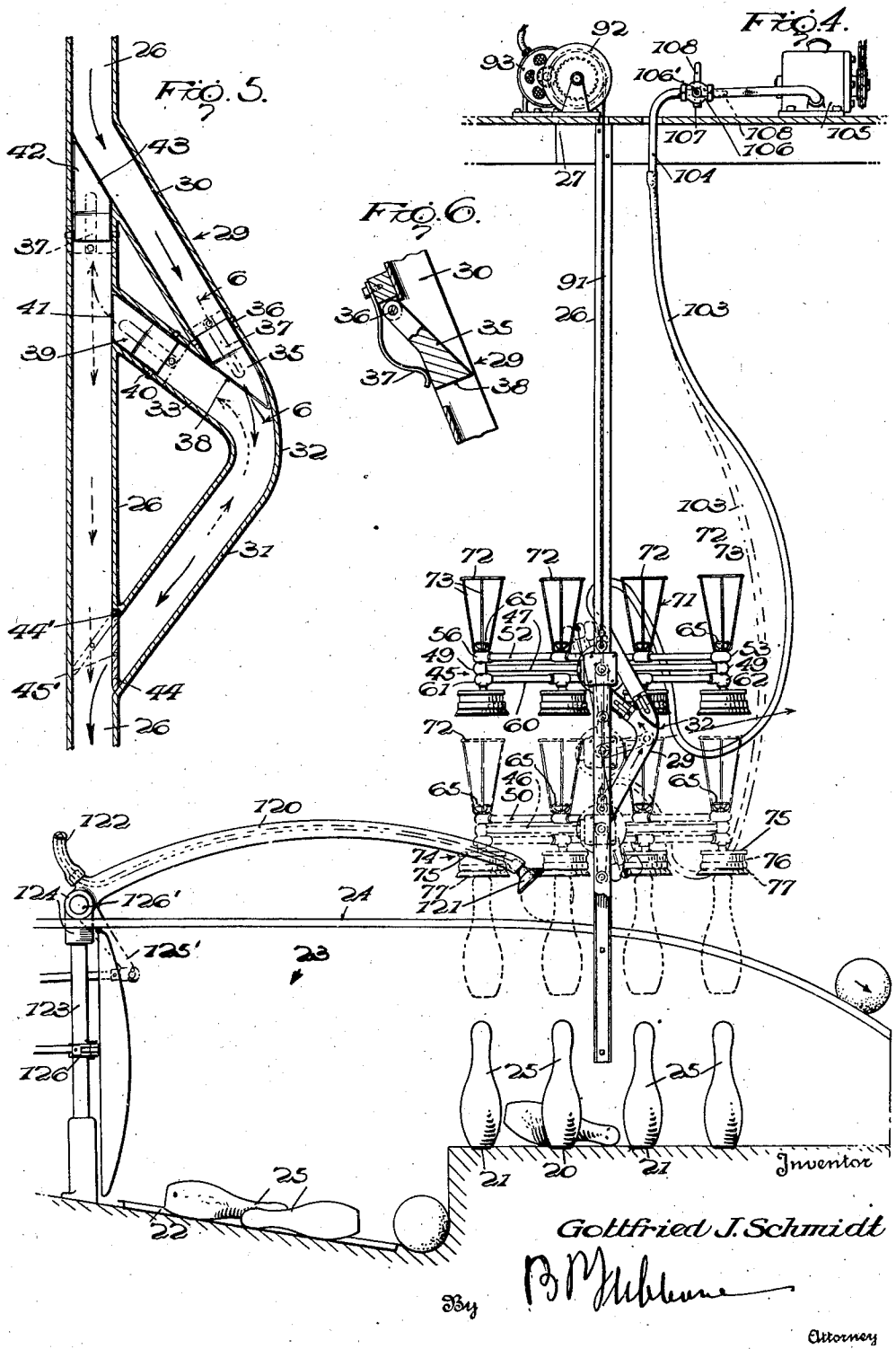

July 23, 1940. G. J. SCHMIDT 2,208,605

BOWLING PIN SETTING APPARATUS

Filed Sept. 17, 1936 7 Sheets-Sheet 3

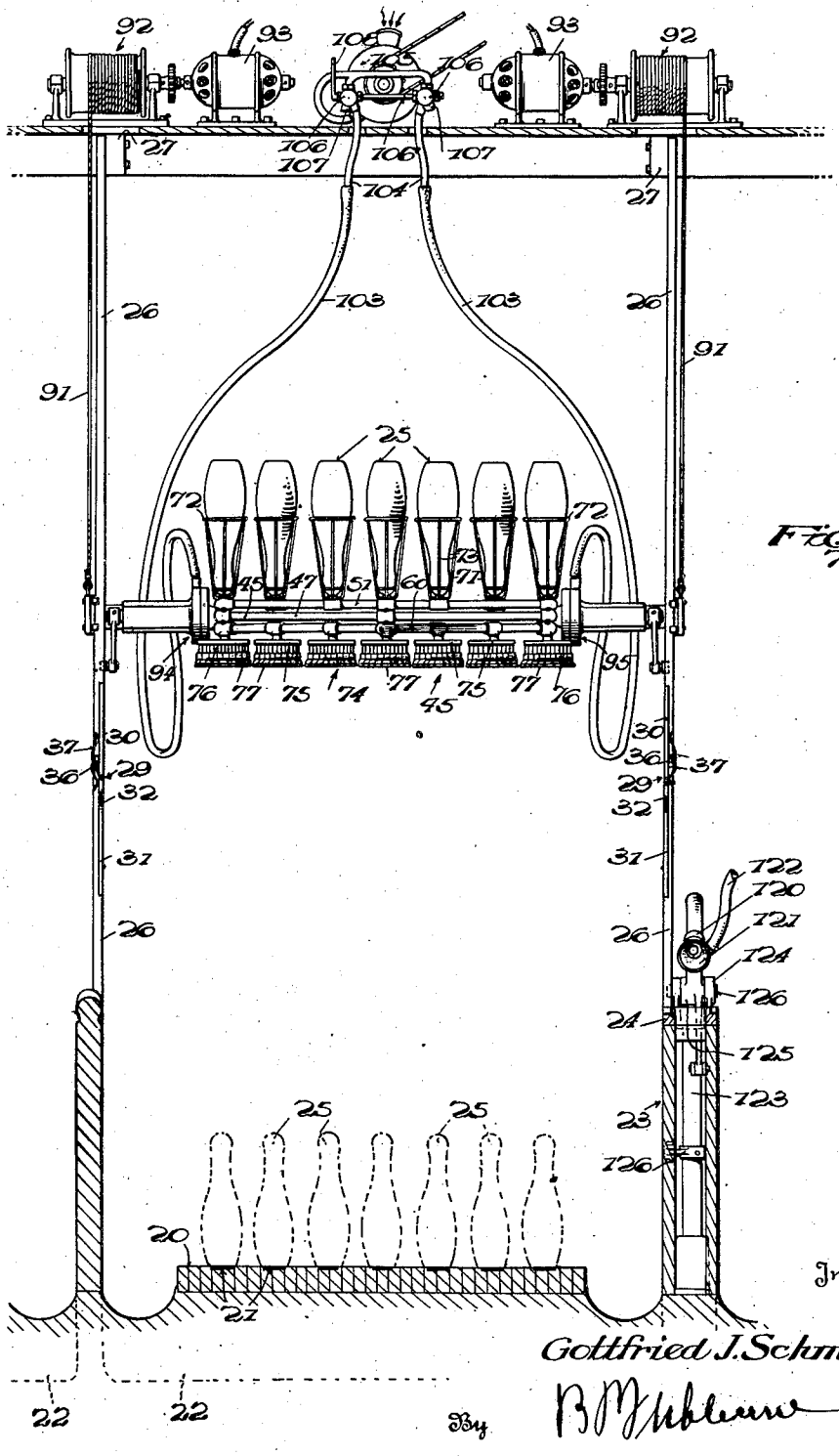

FIG. 7.

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BOWLING PIN SETTING APPARATUS

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FIG. 8.

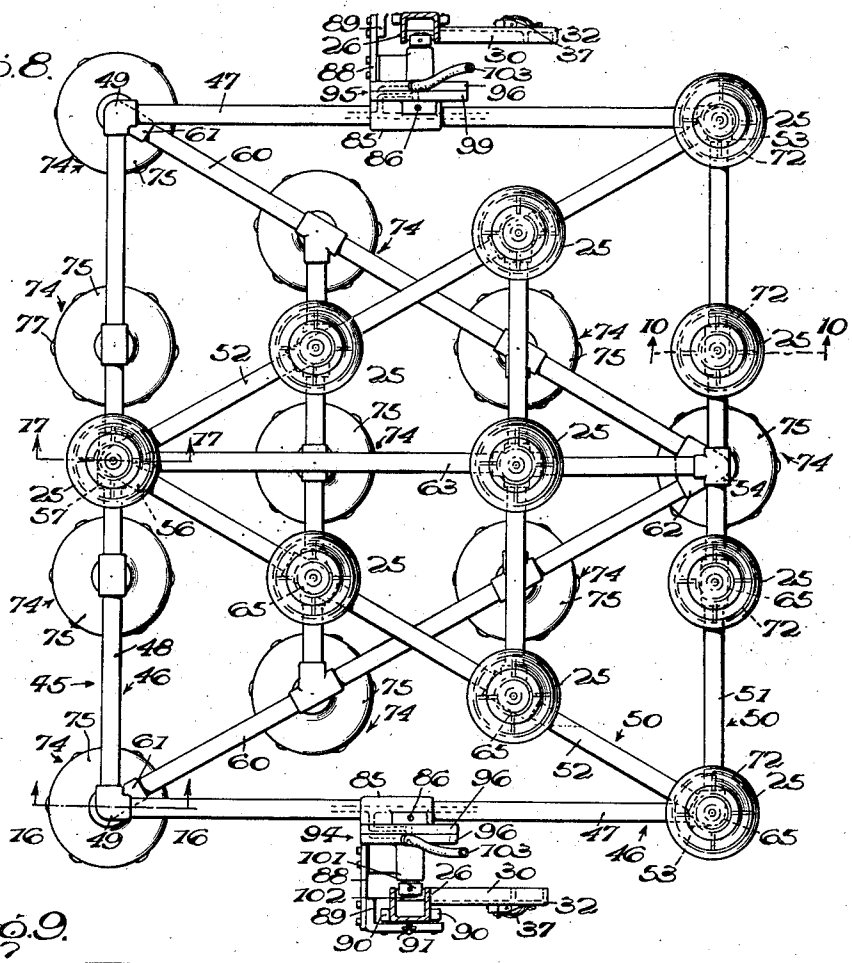
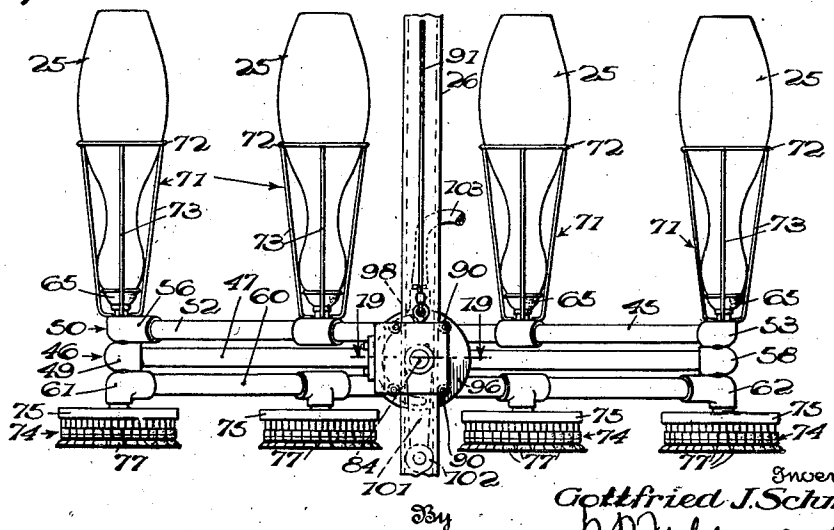


FIG. 9.



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BOWLING PIN SETTING APPARATUS

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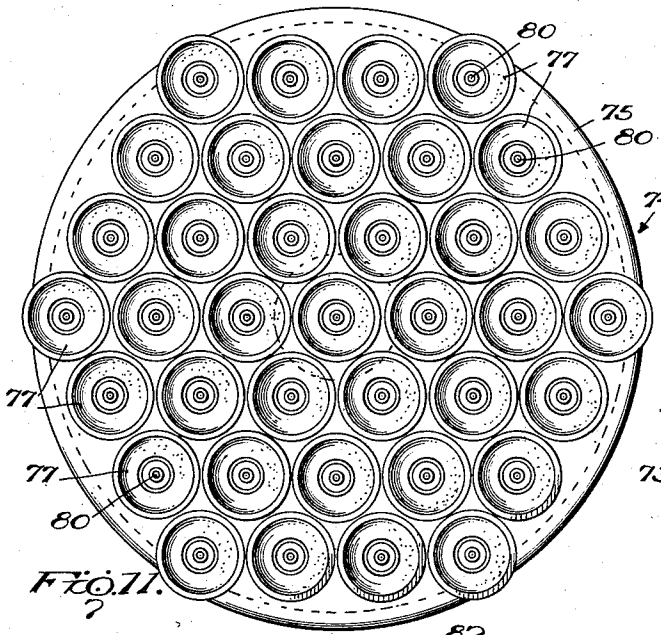

FIG. 11.

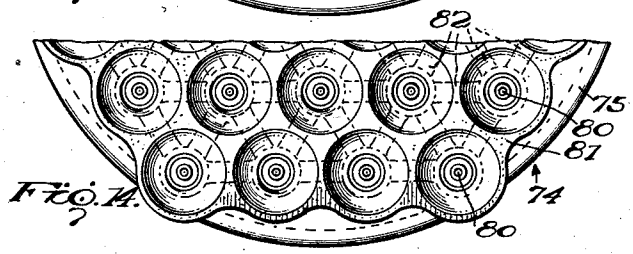

FIG. 14.

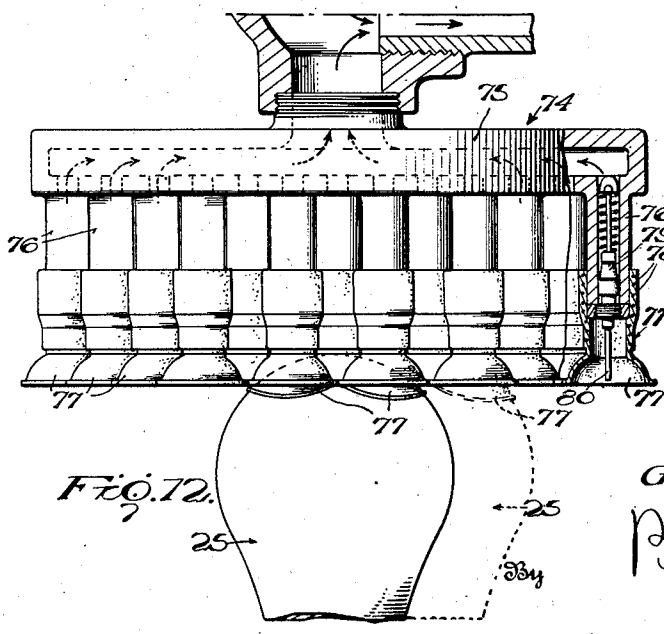

FIG. 12.

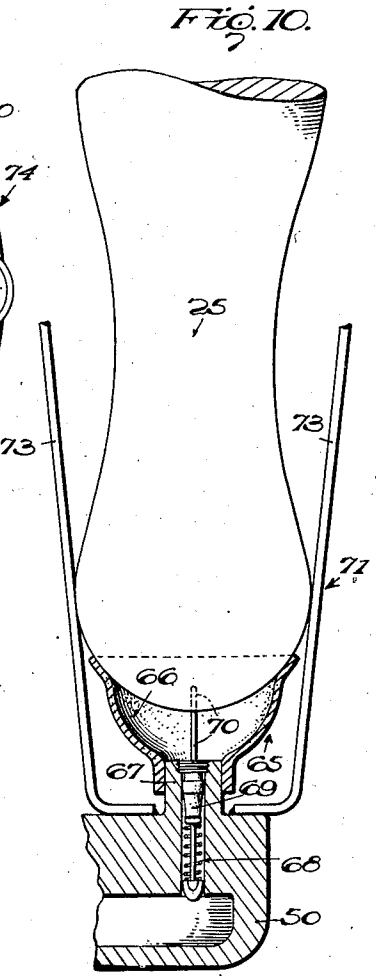

FIG. 10.

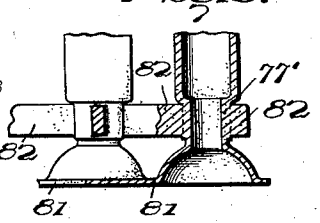

FIG. 13.

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BOWLING PIN SETTING APPARATUS

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FIG. 17.

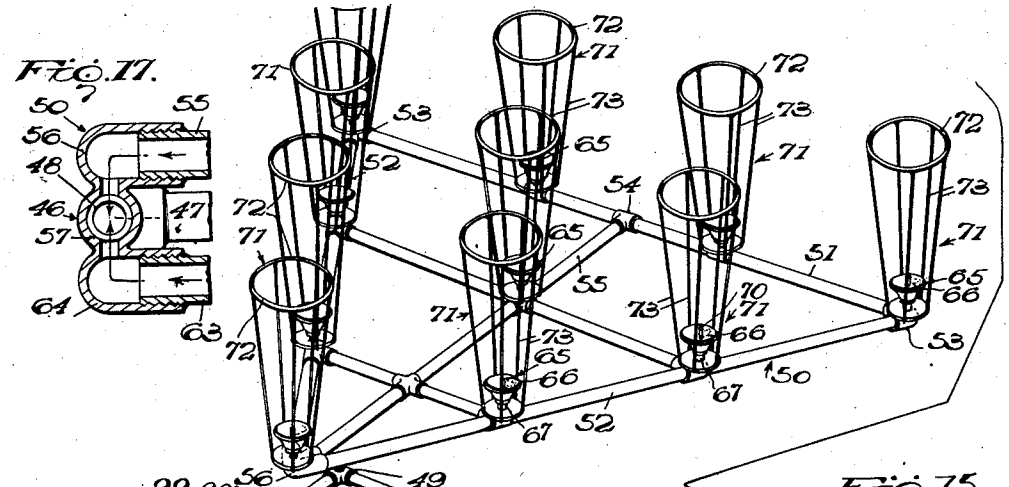
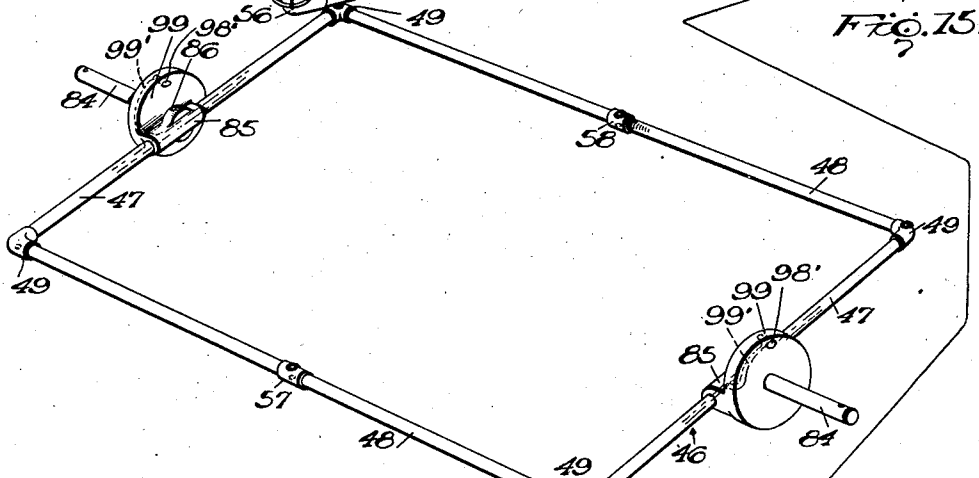


FIG. 15.



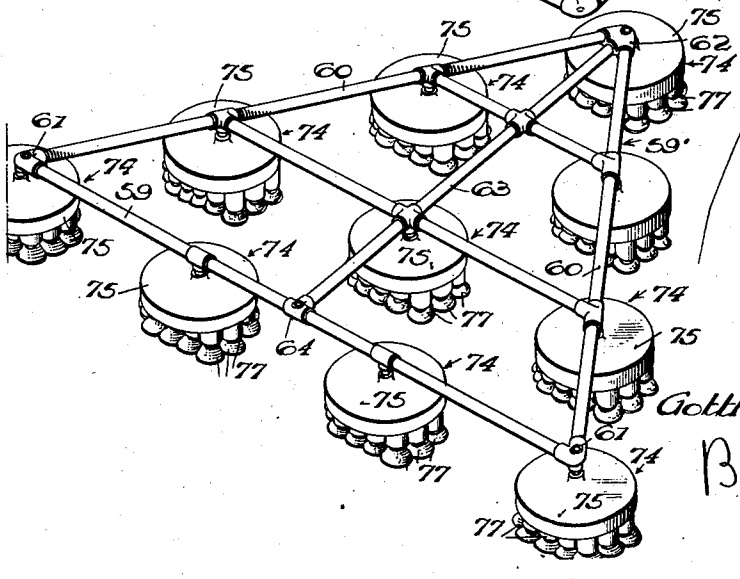
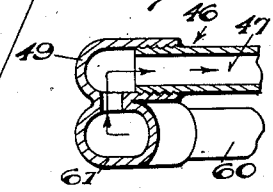


FIG. 16.



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BOWLING PIN SETTING APPARATUS

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FIG. 18.

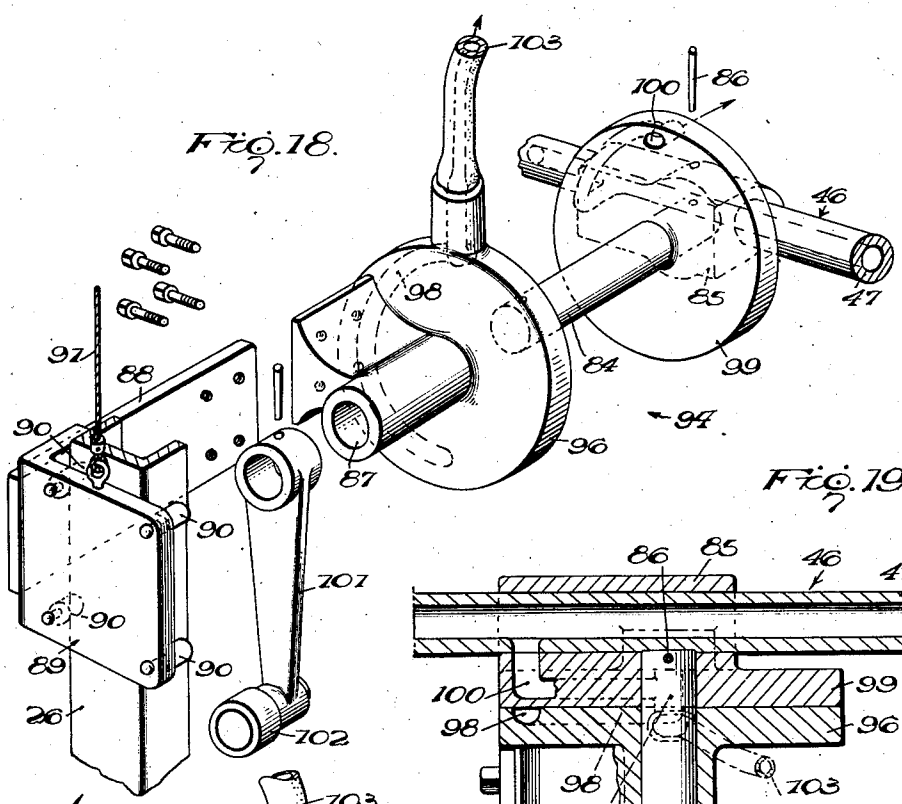
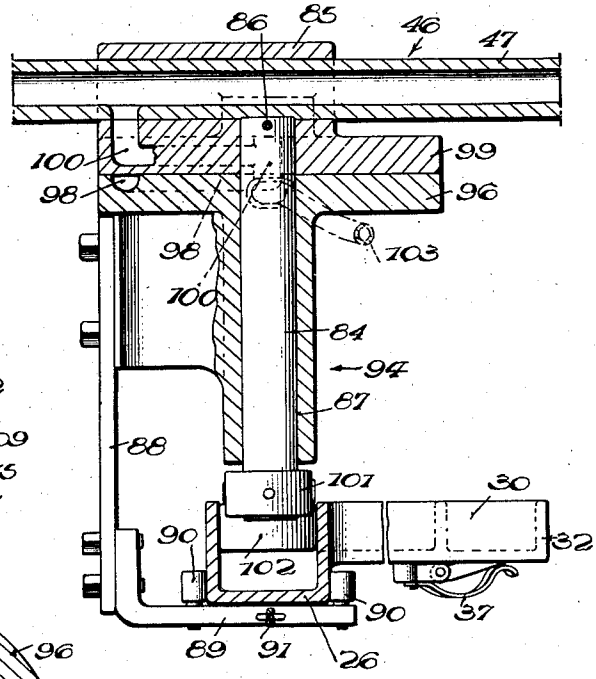


FIG. 19.



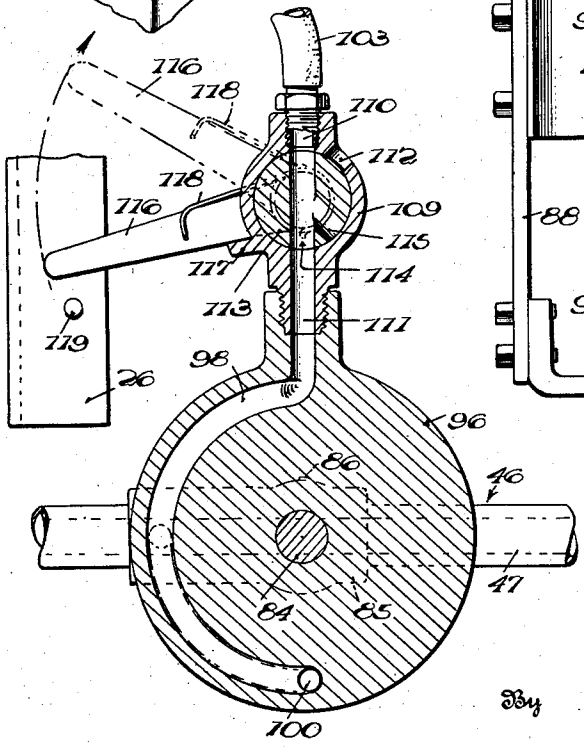


FIG. 20.

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UNITED STATES PATENT OFFICE

2,208,605

BOWLING PIN SETTING APPARATUS

Gottfried J. Schmidt, Pearl River, N. Y., assignor to Bowling Patents Management Corporation, a corporation of New York

Application September 17, 1936, Serial No. 101,332

38 Claims. (Cl. 273—42)

My invention relates to pin setting apparatus for bowling alleys.

As is well known, the proper setting of pins upon the bed of a bowling alley necessitates the accurate spotting of the pins so that they are concentric with the spots. This accurate setting of the pins causes the pins to assume the proper positions, when starting the game. It frequently happens that after one or more balls are thrown, and some of the pins knocked down, that the remaining standing pins have been struck sufficiently so that they are shifted laterally and are not concentric with the spots. In order that the bed may be swept to remove the pins which have been knocked down, it is necessary to remove the standing pins to permit of the sweeping and subsequent returning of the standing pins to the precise positions which they previously occupied, regardless of whether they have been somewhat displaced.

My apparatus is so constructed that the pin setting unit will properly engage with the standing pins, regardless of whether they occupy positions concentric with the spots or have been shifted laterally so that they are off-center with respect to the spots. The apparatus will properly engage and elevate the pins to permit of the sweeping of the knocked down pins and will reset the remaining standing pins in the precise positions they previously occupied, whether concentric or eccentric with respect to the spots.

Attempts have heretofore been made to produce a pin setting apparatus, but these have not proven to be wholly satisfactory. One reason why they have not proven wholly satisfactory is that they cannot properly engage the pins standing to raise them, if such pins are eccentric with respect to the spots on the bowling alley bed and return the pins to the precise positions which they occupied before being raised. A further disadvantage is that these pin setters have mechanical means to engage with the pins, which has resulted in very complicated structures.

In accordance with my invention, the proper handling of the pins, whether concentric or eccentric with respect to the spots, is accomplished by suction means with the result that the organization is greatly simplified.

An important object of the invention is to provide means to accurately set the pins upon the bed of the alley, raise the remaining standing pins after the ball has been thrown, and then accurately reset such raised pins in the true positions which they previously occupied upon the bed.

A further object of the invention is to provide suction means for handling the pins during their several manipulations.

A further object of the invention is to provide apparatus of the above mentioned character, embodying a pin handling unit which is inverted during its operation, to set and reset the pins, thus providing a simplified construction for this purpose.

A further object of the invention is to provide apparatus of the above mentioned character which is of simplified construction and automatic in operation.

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

In the accompanying drawings forming a part of this application and in which like numerals are employed to designate like parts throughout the same.

Figure 1 is a side elevation of a pin setting apparatus embodying my invention, showing the carrier in the raised position,

Figure 2 is a perspective view of the guide or track means, and associated elements,

Figure 2a is a detailed enlarged view of the two way gate, parts in section,

Figure 3 is a diagrammatic view of the valve device, showing its cycle of operation,

Figure 4 is a side elevation, parts broken away, showing the carrier shifted to the lowered position,

Figure 5 is a central vertical longitudinal section through the track or guide means,

Figure 6 is a section taken on line 6—6 of Figure 5,

Figure 7 is a front elevation of the apparatus,

Figure 8 is a plan view of the carrier,

Figure 9 is a side elevation of the same,

Figure 10 is a vertical section taken on line 10—10 of Figure 8,

Figure 11 is a bottom plan view of one of the resetting suction devices,

Figure 12 is a side elevation of the same, parts in section,

Figure 13 is a detailed section through a modified form of suction resetting device,

Figure 14 is a plan view of the same,

Figure 15 is an exploded perspective view of the carrier and associated elements,

Figure 16 is a transverse section taken on line 16—16 of Figure 8,

Figure 17 is a similar view taken on line 17—17 of Figure 8,

Figure 18 is an exploded perspective view of the valve device and associated elements,

Figure 19 is a transverse horizontal section taken on line 19—19 of Figure 9,

Figure 20 is a side elevation, parts in section, of a valve embodied in a modified form of the invention.

In the drawings, wherein for the purpose of illustration is shown a preferred embodiment of my invention, the numeral 20 designates the bed of the alley, Figures 1, 5 and 7, having the usual spots 21. At the forward end of the bed 20 is the usual pit 22. The numeral 23 designates the usual partitions, one of which is provided with the ball return track or runway 24. The numeral 25 designates the bowling pins.

The resetting apparatus for each alley comprises a pair of spaced vertical grooved tracks or guides 26, which are preferably U-shaped in cross-section. The upper ends of the vertical tracks are rigidly connected with a horizontal frame or support 27 and their lower ends are rigidly attached to the partitions 23. Each grooved track 26 is provided with a laterally extending portion 29, including an upper branch 30 and a lower branch 31, connected by an intermediate curved portion 32. The upper and lower branches 30 and 31 are inclined vertically and diverge toward the vertical track 26. Each vertical grooved track 26 is also provided with a third laterally extending grooved branch 33, which leads into the grooved track 26 inwardly of and near the upper end of the branch 30 and leads into the portion 29 adjacent to the curved intermediate portion 32. The upper branch 30 also leads into the outer end of the branch 33, adjacent to the curved portion 32, and a pivoted gate 35 is arranged to control the passage of the roller from the branch 31 into the branch 33. The gate 35 is pivoted at 36 adjacent to its upper end. The gate 35 is forced inwardly by a spring 37. The gate has a stop shoulder 38 at its lower end. It is thus seen that a roller travelling downwardly through the branch 30 will depress the gate 35 and pass the same to enter the lower branch 31, but when this roller travels upwardly through the branch 31, it will engage the stop shoulder 38 and be deflected thereby into the branch 33. A gate 39 is pivoted at 40 and has a stop shoulder 41 and is arranged adjacent to the union of the branch 33 and the track 26. This gate is spring-pressed and is similar to the gate 35 and will serve to permit the roller travelling upwardly through the branch 33 to enter the vertical track 26, but will prevent the roller entering the upper end of the branch 33 when it moves downwardly in the track 26. A second pivoted gate 42 is arranged adjacent to the union of the upper end of the branch 30 with the track 26 and has a top shoulder 43. This gate is spring-pressed and similar to the gate 35. This gate 42 will deflect the roller from the grooved track 26 into the upper end of branch 30 upon the downward movement of the roller. When the roller moves upwardly in the track 26 beneath the gate 42, it will depress the gate and move past it to the upper portion of the track 26. Arranged at the junction of the lower end of the branch 31 and the track 26 is a two way gate 44, pivoted at 44' and having a spring catch 45' to releasably hold the gate in the shifted position.

The apparatus embodies a carrier designated as a whole by the numeral 45. This carrier comprises an intermediate preferably rectangular frame 46, see particularly Figure 15, preferably formed of pipes. The frame 46 comprises sides 47 and ends 48, connected by tubular couplings 49. The numeral 50 designates a triangular setting frame, preferably formed of pipes and including a base 51 and sides 52, which converge, as shown. The base 51 and sides 52 are connected by elbows 53, included in the couplings. A tubular coupling 54 is connected in the base 51 and has connection with a pipe 55, extending toward the converging ends of the sides 52 and connected with a tubular coupling 56, also connected with the converging ends of the sides 52. The tubular coupling 56 is formed integral with a tubular coupling 57 carried by the end 48, as shown. The tubular coupling 54 is formed integral with a tubular coupling 58 carried by the other end 48, these couplings having communication with each other. Arranged upon the opposite side of the frame 46 is a resetting triangular frame 59', preferably formed of pipes including a base 59, connected with converging sides 60 by tubular elbows 61. The elbows 61 are preferably formed integral with the adjacent elbows 49 and communicate therewith. The sides 60 converge in one direction for connection with a tubular coupling 62, also connected with a pipe 63 extending to the base 59 and connected with a tubular coupling 64. The coupling 64 is formed integral with the coupling 57 and the coupling 56, and these tubular couplings are in communication with each other. The coupling 62 is formed integral with the coupling 58 and the coupling 54, and these tubular couplings are in communication with each other. It is thus seen that the bores of the three pipes or tubular frames are in permanent communication.

The setting frame 50 carries suction devices 65, see Figure 10, for engaging with the head ends of the bowling pins. These suction devices are arranged to correspond with the spaced triangular arrangement of the bowling pins, when placed in spotted position upon the bed of the bowling alley, except that the base of the group of suction devices before the carrier in inverted is positioned next to the player, so that the number one suction device will be arranged next to the player when the carrier is inverted, in a manner to be described. Each suction device comprises a flexible suction cup 66, secured to a tubular nipple 67, in communication with the bore of the setting frame 50. The suction cup 66 is preferably formed of rubber and is of a suitable size to fit over the end portion of the head end of the bowling pin 25. The nipple 67 has a passage 68 adapted to establish communication between the bore of the frame 50 and the interior of the suction cup, such communication being controlled by a spring actuated self closing valve 69, having a stem 70, projecting into the suction cup 66, and adapted to be engaged and moved by the head end of the bowling pin, to unseat the valve element of the valve 69. It might be stated at this point that before the head end of the bowling pin passes into the suction cup, that the valve 69 is closed, whereby the suction within the bore of the setting frame is not transmitted to the suction cup, but as soon as the head end of the bowling pin enters the suction cup 66 sufficiently so that the suction cup may have proper holding engagement therewith, the stem 70 is moved inwardly by contact with the head end of the bowling pin and the valve 69 opened, whereby suction is now transmitted to the interior of the

suction cup 66, which will have proper holding action with the head end of the bowling pin. Each suction device is preferably provided with a wire guard or stabilizing device 71, which is rigidly attached to the setting frame adjacent to the sucetion device. This guard is tapered and increases in diameter outwardly and is preferably adapted to suitably engage with the intermediate or body portion of the bowling pin, to hold the same against any perceptible tilting action with respect to the suction cup, when the carrier is being inverted. The guard includes a ring 72 and resilient rods 73. The ring 72 is of a greater diameter than the head end of the pin but of a smaller diameter than the largest diameter of the pin, and the ring will engage the pin inserted therein in an inverted position, at a point above its center of gravity, whereby the pin will automatically assume a vertical position while its head end engages the suction cup.

The resetting frame 59' carries resetting suction devices 74, also adapted to engage with the head end of the pins. These resetting devices are arranged in a spaced triangular group corresponding to the arrangement of the pins, when spotted for playing. The triangular groups of suction devices taper in opposite directions, and the apex of one triangular group is at the base of the other triangular group, at a point equidistantly spaced from the opposite ends of the base. Each suction resetting device 74 comprises a preferably cylindrical shell 75, rigidly attached to the resetting frame, and having its interior in communication with the bore of the resetting frame. The shell 75 is preferably cylindrical and is provided with tubular nipples 76 arranged in rows, as shown, whereby they are also preferably arranged in triangular groups of three's throughout the entire area of the device. A suction cup 77 formed of rubber or the like has a shank 77' which is mounted upon the free end of each tubular nipple 76 and preferably has a coil spring 78 embedded therein, to impart to the shank a suitable stiffness against lateral movement. This spring 78 may also be arranged upon the interior of the shank 77', if desired. A valve device 79 is mounted in each tubular nipple and includes a spring pressed valve body, adapted to be opened by a stem 80, connected with the valve body and arranged within the suction cup 77. It might be stated at this point that before the suction cup is brought into engagement with or proximity to the head end of the pin, that the valve body of the valve device 79 is closed, therefore cutting off communication between the interior of the shell 75 and the interior of the suction cup 77. However, when the head end of the pin is moved into the suction cup 77, it engages and moves the stem 80, unseating the valve body, whereby suction is transmitted from the shell 75 to the suction cup 77. As before stated, the tubular nipples 76 are so arranged that they are also disposed in triangular groups of three over the entire area of the shell 75. The suction cups 77 extend throughout substantially the entire area of the shell 75, and the shell has a diameter considerably larger than the diameter of the head end of the pin. This is an important feature of the invention. If the pin is off-center with respect to the spot on the bed of the bowling alley, when the shell 75 descends in resetting the pins, in a manner to be described, the shell 75 is concentric with respect to the corresponding spot, while the pin is eccentric with respect to the spot. However, since the effective suction area of the resetting suction device is considerably larger than the head end of the pin, it will properly engage with the head end of the pin, if it is in the concentric or eccentric position with respect to the spot. As the resetting suction device engages the head end of the pin, three suction cups will at all times engage therewith, and their valves will be unseated so that the three suction cups will have holding engagement with the head end of the pin. This is true if the pin is concentric with its spot or eccentric with relation thereto for only a slight distance, or for a considerable distance. In Figures 11 and 12 the suction cups 77 are shown as preferably separate and arranged in close relation, while the invention is not restricted to this arrangement. In Figures 13 and 14, the suction cups 77 are shown as connected at their lips with a web or sheet 81 and also at their stems 77' by webs 82. By having three suction cups always engaging the head end of the pin, the pin will be suspended in a truly vertical position, when being moved from and toward the bed of the bowling alley, thus rendering it possible to return the pin to the precise position on the bed that they occupied before being lifted therefrom, regardless of whether the pin was concentric or eccentric with respect to the spot. The invention is not restricted to employing three cups 77 in a group, as any suitable number of cups may be used, when properly arranged in the group.

As more clearly shown in Figures 10 and 11, the suction devices are of such shape and size that they receive the reduced extremity of the head ends of the pins. It is preferred that the suction cup be smaller than the maximum diameter of the head end of the pin, so that it will only engage with the reduced extremity of the head end of the pin. Since this reduced extremity is well within the maximum diameter of the head end, it is protected to a considerable extent against injury, such as dents and scars, due to the falling or movement of the pins when struck, with the result that such reduced extremity ordinarily retains a smooth or unscarred surface, thus assuring an air tight contact between the reduced extremity and the suction device or cup.

The carrier 45 is arranged between the two tracks 26, as clearly shown in Figures 7 and 8. The carrier is rigidly mounted upon horizontal rock shafts 84, Figures 8, 9, 15 and 18, which are attached to the sides 47 of the frame 46. The rock shafts 84 extend into couplings 85, and are clamped therein, as shown at 86. The rock shafts 84 are journalled in bearings 87, which are rigidly bolted to plates 88, rigidly secured to vertically movable carriages 89. These carriages travel upon the outer sides of the tracks 26 and have guide rollers 90. The carriages are raised by cables 91 extending upwardly to be passed about drums 92, rotated by motors 93, or the like. Valve devices 94 and 95 are disposed inwardly of and near the carriages 89. Each valve device comprises an outer stationary disk 96, rigidly secured to the bearing 87 and therefore held against turning movement, and movable vertically with the carriage 89. The disk 96 is provided upon its inner face 97 with a circularly curved elongated groove 98, concentric with the shaft 84, and extending throughout 180°. Coacting with the stationary disk 96 is a companion disk 99, having a central opening through which the shaft 84 passes, and having a port 100 passing through its inner face and in permanent communication with the groove 98. The port 100 has communication with the bore of the frame 46.

Rigidly connected with the outer ends of the rock shafts 84 are cranks 101, carrying rollers 102 at their free ends, and these rollers are adapted to travel within the grooved tracks 26 and their several branches, in a manner to be described.

A suction pipe 103 is connected with each stationary disk 96 and is in permanent communication with the curved groove 98. This suction pipe may be in the form of a flexible hose and is connected at its upper end with a pipe 104, which leads to a source of vacuum or suction, such as a suction pump 105. A two-way valve 106 is connected in each pipe 104, and is adapted to alternately place the hose 103 in communication with the pump 105 or in communication with the atmosphere through a port 107. The valves 106 are connected to move together by a rock shaft 106', and they may be manually turned by a crank 108 or automatically operated. The suction is thus supplied to the frames at their sides, insuring a quick and uniform application.

In Figure 20, I have shown a slightly modified form of the invention, whereby the groove 98 is alternately placed in communication with the source of vacuum, or in communication with the atmosphere. This means comprises a valve which I preferably mount adjacent to each valve disk 96, and rigidly attach thereto. This valve comprises a casing 109, having oppositely arranged vacuum supply ports 110 and 111. The port 111 is in permanent communication with the curved groove 98. The casing also has a vacuum breaking port 112, in permanent communication with the atmosphere. A valve body 113 is mounted to turn within the casing 109 and has a main port 114, to connect ports 110 and 111, and a branch port 115 also adapted to register with the port 111, while the remote end of port 114 will register with port 112. The valve body 113 is turned by means of a lever 116, rigidly connected therewith. The downward movement of this lever is limited by a stationary stop 117 carried by the casing 109. The lever is moved downwardly by a spring 118, so that port 114 will connect ports 110 and 111. The valve body 113 preferably has sufficient frictional engagement within the casing 109 and the spring 118 is of such a strength that it will return the lever 116 to the lowered position, relatively slowly, for a purpose to be described. If desired, additional means may be employed, in the form of a dash pot to retard the downward movement of the lever due to the action of the spring 118. The lever 116, when the carrier approaches its lowermost position, engages a stop 119, which is attached to the adjacent track 26, swinging the outer end of the lever upwardly and turning the valve body 113 so that groove 98 is placed into communication with the atmosphere through the port 112 and at the same time is placed out of communication with the suction pipe 103.

I also provide suction means to return the ball or balls to the return runway. This means is shown as embodying a preferably rigid tubular arm 120, provided at its forward end with a rubber suction cup 121. The tubular arm has connection with a suction hose 122, connected with the source of suction. The numeral 123 designates a vertical shaft, which is capable of turning upon its vertical axis, and this shaft is provided at its upper end with knuckles 124, to receive therebetween the knuckles 125 formed upon the tubular arm 120, the knuckles being pivotally connected by a horizontal pin 126'. The tubular arm 120 may therefore be swung in a vertical plane and may be also swung in a horizontal plane by turning shaft 123 upon its vertical axis.

To return the ball, the tubular arm 120 is swung downwardly to bring the suction cup 121 in engagement with the ball, and the arm is subsequently swung upwardly and then shifted horizontally so that the ball is positioned over the return runway and is discharged into the runway by releasing or breaking the suction. The arm 120 may be mechanically swung upwardly by a crank 125', rigidly connected therewith, and swung horizontally by a crank 126, rigidly secured to the vertical shaft 123. Any suitable means may be employed to move the cranks 125 and 126.

The operation of the apparatus is as follows:

The bed of the bowling alley having been raked and all pins removed therefrom, the carrier is in the uppermost position, and the pins 25 are introduced into the guards 71, with their head ends down. The pins 25 may be fed into the guards 71 by any suitable means, or they may be introduced therein manually. When the carrier is thus in the uppermost position, the interior of the pipe or tubular frame 50 is connected with the source of suction, since port 100 is in permanent communication with the groove 98, and each valve body 106 is now in a position to place pipe 103 in communication with the source of vacuum 105. When the pins 25 are thus introduced into the guards 71 they are free to swing upon the upper rings 72 so that they will automatically assume true vertical positions, and when they descend into the guards 71 their head ends engage the stems 70, opening the valves 69, and thereby supply suction to within the several suction cups 65. The suction cups now securely engage and hold the head ends of the pins. This suction remains supplied to the cups 65 and the carrier is started upon its descending movement by the operation of the motor 93, causing the cables 91 to pay out, the carrier descending by gravity. The movement of the carrier is at a proper speed to enable the same to function correctly and should be relatively slow. As the carrier begins to descend, the setting frame 50 is arranged uppermost and the pins are held with their butt ends uppermost. When the carrier moves downwardly sufficiently, the roller 102 at each side of the carrier enters the inclined branch 30 and the arm or crank 101 is accordingly shifted from its vertical position to an inclined position, which effects a tilting of the carrier upon its horizontal transverse axis as defined by the shafts 84. By the time the roller 102 reaches the curved portion 32 of the portion 29, the carrier has been tilted so that its weight tends to complete the tilting action, and the arm 101 is now arranged above the setting frame 50 instead of below it, and as the carrier continues on its downward movement, the arm 101 continues to approach the vertical, until the roller 102 again enters the track 26 below the branch 31, at which time, the carrier will have been inverted and will be in a true horizontal position. When the roller passes through the branch 30, as explained, it is deflected by the gate 42 into the branch 30 and passes the gate 35 and passes the gate 43 shifting it to a position to cover the adjacent portion of the track 26 and enters the track 26 below the gate 43. The carrier now continues to move downwardly until the butt ends of the pins are placed upon the bed, directly over the spots and are in concentric relation thereto, at which time the motor is stopped and

the carrier is brought to rest. Before the carrier starts to move upwardly, the valves 108 are operated to place the interior of the tubular spotting frame 50 in communication with the atmosphere through the ports 107, and cutting off communication with the source of suction or vacuum whereby the suction within cups 65 is completely broken. The pins being properly spotted and released, the motor is started to raise the carrier so that it will be out of the way when the player throws the first ball. As the carrier moves upwardly, the roller 102 will travel in the track 26 until it engages the gate 43, previously shifted to the left, and the roller will therefore travel through branch 31, curved portion 32 and branch 33, and will pass gate 39 and reenter the vertical track 26 near and beneath the gate 34. The arm 101 will thus turn the carrier in an opposite direction for one-half of a revolution to completely again invert the same, whereby the resetting frame 46 will be in the lowermost position and the setting frame 52 in the uppermost position. The motor is stopped and the carrier brought to rest at this point. With the carrier held at this elevation, the player rolls the first ball, and if some of the pins remain standing, they must be raised, the bed raked to remove the knocked down pins, and the raised pins reset. Assuming that all of the pins have not been knocked down, the motor is again started and the carrier descends to bring the resetting suction devices 74 into proper engagement with the head ends of the pins. When each suction device 74 is brought into proximity to the head end of the pin, three of the suction cups 77 will engage the head end of the pin and the valve stems 80 will contact with the head end of the pin, opening the valves 79, whereby the suction cups 77 are placed in communication with the source of suction, the valves 106 being now in a position to connect the pipe 103 with the source of suction 105 and to cover the ports 107. After this occurs the motor is stopped and the carrier is brought to rest, and the motor is reversed and the carrier raised. When the carrier was lowered, to bring the suction devices 74 into engagement with the head ends of the pins, roller 102 travelled through the vertical track 26 and swung gate 43 to the right, and upon the upward movement of the carrier, last referred to, the roller 102 will not enter branch 31, but travels vertically through track 26 and will stop near and beneath the gate 34, as stated. While the carrier is thus elevated, the bed is raked to remove the knocked down pins. This raking may be done by any suitable means or may be effected manually. After the bed is thus raked, the motor is again started and the carrier is lowered, the roller continuing to travel in the vertical track 26 and passing gate 43 which is now at the right, Figure 5. The downward movement of the carrier continues until the pins have their butt ends set upon the bed. When this occurs the carrier is stopped, valves 106 are manipulated to place the interior of the cups 77 into communication with the atmosphere and to break their communication with the source of suction 105, whereby the vacuum or suction in the cups 77 is completely broken. The carrier then starts to rise and may be stopped when the roller 102 reaches a point near and beneath the gate 42. The pins having been reset, the second ball is rolled. If three balls are to be employed, as is sometimes done in the playing of duckpins, the carried would again move down so that the suction cups 77 would engage the remaining upstanding pins and elevate the same permitting of the raking of the bed, and again reset these pins. The carrier would then move upwardly after resetting the last pins and would continue its upward movement, the roller 102 passing the gate 42, until the carrier reached its uppermost starting position, Figure 1, at which point the pins would again be introduced into the guards 72. If only two balls are employed, when the carrier was elevated after resetting the pins for the first time, the upward movement of the carrier would be continued until the uppermost position were reached, for reloading with the pins. The carrier is now returned to the initial starting position and the cycle of operation would be repeated.

The operation of the motor and the movement of the valves 106 may be manually effected, or any suitable automatic means may be employed to actuate the same, in proper timed order.

In Figure 20, I have shown the automatically operated valve to be substituted for the valve 106. When the carrier approaches its lowermost position, to spot the pins, the lever 116 engages the stop 119, and valve body 113 is turned thereby placing the groove 98 in communication with the atmosphere and disconnecting this groove from the suction pipe 103. The vacuum is therefore completely broken within the several suction cups 65 and will remain broken until the cups have entirely disengaged the head ends of the pins, since the spring 18 slowly returns the lever 116 to the normal position, and the carrier has had sufficient time to be elevated for a considerable distance before the lever is returned to its normal position. In a similar manner the suction is automatically broken after the suction devices 74 have reset the pins, and before the cups 77 disengage the pins and remain unbroken until these cups have moved out of engagement with the head ends of the pins.

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

Having thus described my invention, I claim:

1. In a bowling pin setting apparatus, a support adapted to assume a generally horizontal loading position, suction operated means carried by the support and facing upwardly to engage with the head ends of the inverted bowling pins, and means to invert the support and move it downwardly to set the butt ends of the pins upon the bed in spotted playing arrangement.

2. In a machine for manipulating bowling pins, a support, a group of spaced suction pin setting devices arranged in spaced playing relationship near one side of the support and connected therewith, a group of spaced suction pin resetting devices arranged in spaced playing arrangement near the opposite side of the support and connected therewith, and means to move the support vertically and invert the same.

3. In a machine for manipulating and setting bowling pins on an alley bed, a support, arranged to overlie said bed, suction pin setting devices shaped to fit a rounded surface of the pins to hold a set of bowling pins arranged near one side of the support and said devices being connected therewith, suction pin resetting devices arranged

near the opposite side of the support to hold a set of bowling pins and said devices being connected therewith, means to lower the support and invert the same, and means to raise the support and invert the same.

4. In apparatus for manipulating bowling pins, a support, hollow suction cups arranged near one side of the support with substantially the same relative positions and spacing as the pins when spotted for playing and carried thereby to engage with the head end of the pins, similarly arranged suction resetting devices carried by the support and arranged near the opposite side thereof, each resetting device having a diameter larger than the head end of the pin and embodying a suction element constructed and arranged to embrace and suctionally grip the rounded head end of a bowling pin.

5. A bowling pin setting machine for use with the bed of a bowling alley comprising in combination, a substantially vertical track adjacent said bed having a laterally extending branch, a support to travel longitudinally of the track above said bed, means connected with the support and including a part to travel longitudinally of the track and into the branch to invert the support, means to move the support longitudinally of the track, and pin holding means carried by the support, said pin holding means including a group of bowling pin holding devices in number, spacing and arrangement similar to that of spotted pins in playing arrangement on the alley bed.

6. A pin setting apparatus for cooperation with a bowling alley bed comprising in combination, a track adjacent said bed having laterally extending branches, a support movable longitudinally of the track over said bed, means cooperating with the support and the track and branches to cause the support to be inverted when it travels downwardly and to be again inverted when it travels upwardly, means to move the support in opposite directions longitudinally of the track, and pin holding means carried by the support and operating from the opposite sides of the support, said pin holding means including bowling pin holders for a set of bowling pins, said holders having the same arrangement as spotted pins on the alley bed.

7. In bowling pin setting apparatus, a substantially vertical track having a laterally extending branch leading into the track at spaced points, a second branch leading into the vertical track between its points of connection with the first named branch and leading into the branch between its ends, a support movable longitudinally of the track, means connected with the support and including a part to engage with the track and its branches to be guided thereby, a gate arranged near the upper end of the first named branch to deflect the part into the upper end of the first named branch when the part moves downwardly, a gate arranged at the upper end of the second named branch to prevent the passage of the part into such branch when the part is travelling adjacent thereto in the vertical track, a gate arranged at the lower end of the second named branch to deflect the part into the second named branch when it is travelling upwardly in the first named branch, a double acting gate arranged adjacent to the lower end of the first named branch and shifted by the part travelling downwardly in the branch and downwardly in the vertical track and to guide the part into the branch when it is travelling upwardly and into the vertical track when it is travelling upwardly depending upon the shifted position which it occupies, a pin holding means carried by the support and operating from opposite sides thereof, and means to move the support longitudinally of the track.

8. In bowling pin setting apparatus for use with bowling alley beds, a support having a loading position and a setting position, suction means carried by the support for holding engagement with the bowling pins, said suction means facing upwardly when the support is in the loading position for engagement with the bowling pins for holding the bowling pins in a spaced triangular group corresponding to the spotted arrangement of bowling pins upon a bed and the base of the triangular group being also then arranged remote from the pin end of the bed, and means to hold the support in the loading position with said base remote from the pit end and to invert the support about an axis transverse to the alley bed so that said base is arranged nearer to the pit end and to set the butt ends of the pins upon the bed in substantial spotted relation.

9. In bowling pin setting apparatus, a support arranged near the pit end of a bowling alley bed, suction means carried by the support for holding engagement with a set of bowling pins, said suction means being constructed and arranged to hold the bowling pins in a spaced group corresponding in number and arrangement to the spotted arrangement of a set of bowling pins upon an alley bed, and means to move the support toward and away from said bed to cause the suction means to set the butt ends of the pins upon the bed in substantial spotted relation and means coacting with said suction means to cut off the suction on the pins and release the same when the butt ends of the pins are on the bed.

10. An apparatus for setting pins on a bowling alley bed comprising in combination, a support arranged near the pit end of said bowling alley bed, suction means carried by the support for holding engagement with a set of bowling pins constructed and arranged to set the butt ends of a set of bowling pins upon the bed in spaced spotted relation upon the movement of the support in one direction, and means to move the support in said direction for effecting the spotting of the pins upon said bed.

11. In bowling pin setting apparatus, a support arranged near the pit end of a bowling alley bed and having a loading position at an elevation above the bed, suction means carried by the support for holding engagement with a set of bowling pins, said suction means serving to hold a set of bowling pins in a spaced group corresponding to the spotted arrangement of bowling pins upon a bed, and means to lower the support from the loading position to cause the suction means to set the butt ends of the bowling pins upon the bed in substantial spotted relation.

12. In apparatus for setting and resetting bowling pins upon a bowling alley, setting suction means arranged near the pit end of the bed and adapted to engage and hold a playing set of bowling pins in a group with the pins in the group spaced and arranged corresponding to the spotted arrangement of bowling pins upon a bed, resetting suction means arranged near the pit end of the bed and adapted to engage and hold a playing set of bowling pins in a group with the pins in the group spaced and arranged corresponding to the spotted arrangement of bowl-

ing pins upon a bed and to also engage and hold any number of pins less than a full playing set, and means to cause the setting suction means to set the butt ends of the set of bowling pins upon the bed in such spotted relation and to release the set pins and to subsequently cause the resetting suction means to engage the remaining standing pins and removes the same from the bed and then reset such remaining pins upon the bed in the positions previously occupied and again release the same.

13. In apparatus for setting and resetting bowling pins upon a bowling alley bed, a support arranged near the pit end of the bed, setting suction devices carried by the support and facing in one direction and arranged in a group with the devices in the group spaced and arranged corresponding to the spotted arrangement of bowling pins upon a bed, resetting suction devices carried by the support and facing in a different direction relative to the setting suction devices and arranged in a group with the devices in the group spaced and arranged corresponding to the spotted arrangement of bowling pins upon a bed, means to move the support in a cycle of operation to cause the suction setting devices to set the pins upon the bed and to move the support in a cycle of operation to cause the resetting suction devices to remove the remaining standing pins from the bed and reset the same, and means to turn the support during its setting cycle of operation to present the setting suction devices in operative relation to the bed and then the resetting suction devices in operative relation to the bed.

14. In apparatus for resetting bowling pins upon a bowling alley, resetting suction devices arranged near the pit end of the bed and disposed in a group with the devices in the group spaced and arranged corresponding to the spotted arrangement of bowling pins upon a bed, said group being arranged in a generally horizontal plane, a valve for controlling the admission of suction to each suction device and having a pin engaging part arranged within such suction device, and means to simultaneously move all of the suction devices toward the alley so that certain of such suction devices will engage with the remaining standing pins and their valves will be actuated thereby while the valves of the suction devices not engaging the standing pins remain unactuated.

15. In apparatus for setting bowling pins upon a bowling alley bed, a support arranged near the pin end of the bed, suction devices carried by the support and facing away from one side of the support and arranged in a group with the devices in the group spaced and arranged corresponding to the spotted arrangement of bowling pins upon a bed, means for supporting the support in a generally horizontal position with the suction devices facing upwardly, and pin guiding devices carried by the support and extending above the suction devices when such suction devices face upwardly, the guiding devices serving to locate and conduct the head end of pins into contact with the suction devices.

16. In apparatus for setting bowling pins upon a bowling alley bed, a support arranged near the pit end of the bed, suction devices carried by the support and facing away from one side of the support and arranged in a group with the devices in the group spaced and arranged corresponding to the spotted arrangement of bowling pins upon a bed, means for supporting the support in a generally horizontal position with the suction devices facing upwardly, bowling pin receiving guards constructed and arranged to surround pins engaged by said suction devices, said guards being carried by the support and corresponding in number and arrangement to the suction devices and extending above the suction devices when the suction devices face upwardly, and means to turn the support to invert the same so that the suction devices face downwardly, said guards being substantially rigidly secured to the support and operated to prevent lateral displacement of the pins during the inverting of the support.

17. An apparatus for setting and resetting bowling pins upon a bowling alley bed on which a set of pins is to be set in spaced playing arrangement, comprising a support arranged near the pit end of the bed, separate triangular groups of bowling pin engaging and holding devices mounted upon the support, the devices in each triangular group being spaced and disposed corresponding to the spotted arrangement of bowling pins upon a bed, the devices in one group having their pin engaging portions facing generally in an opposite direction to the devices in the other group to hold the pins of the respective groups extending in opposite directions from said support and one triangular group having the base of its triangle arranged next to the apex of the other group, and means to turn the support about an axis transverse to the length of the alley bed so that the bases of the triangular groups may be alternately arranged nearest to the pit end of the bed.

18. In apparatus for setting and resetting bowling pins upon a bowling alley bed, a support arranged near the pit end of the bed, a group of spaced bowling pins setting devices mounted upon the support in spotted playing relationship, a group of bowling pin resetting devices mounted upon the support, each resetting device being of greater effective diameter than the diameter of the handle portion of the pin for holding engagement with its pin when the pin is concentric or eccentric with respect to its spot for removing the pin from the bed and returning the pin to the precise position previously occupied upon the bed, and means to turn the support.

19. Apparatus for setting bowling pins upon a bowling alley bed comprising, a support separate from said bed arranged near the pit end of the bed, bowling pin engaging and holding devices formed to receive a portion of the handle end of the pins carried by the support and adapted to receive inverted bowling pins, and means to invert the support and move the same toward said bed so that the devices may place the butt ends of the pins upon the bowling alley bed and means to release said pins when the butt ends thereof are on said bed.

20. In apparatus for setting bowling pins upon a bowling alley bed, a support arranged near the bed, bowling pin engaging and holding devices carried by the support, and means to invert the support and guard means arranged to surround the body portion of the pins and hold the pins against lateral displacement as a result of the inverting of said support.

21. In apparatus for setting and resetting bowling pins upon a bowling alley bed, a single support, setting devices mounted upon the support to engage the bowling pins and set the

same upon the bed in a triangular group in spaced spotted relation, resetting suction devices to engage the standing pins remaining after a ball is thrown and remove the same from the bed and return the same to the bed in the same position previously occupied, and means for imparting successive movements to the support to first cause the setting devices to set pins upon the bowling alley bed and, secondly, to cause said resetting devices to engage and lift standing pins, and means coacting with said devices for releasing the pins when adjacent the alley during the first movement and for rendering operative the suction on the pins when engaged by the resetting devices.

22. In apparatus for resetting bowling pins upon a bowling alley bed, a suction device arranged near the pit end of the alley and having a range of action sufficient to enable it to engage a bowling pin standing upon the bed eccentric or concentric with respect to its spotted position and to lift the standing pin from the bed and return the same to the bed at the same position previously occupied, a bowling pin actuated valve for controlling the suction within the suction device, and means to move the suction device to cause the same to engage the pin and lift it from the bed and replace the same upon the bed.

23. In apparatus for resetting bowling pins upon a bowling alley bed, a group of suction devices arranged near the pit end of the alley, a support on which said suction devices are disposed in spaced relation corresponding generally to the spotted relation of bowling pins upon an alley bed, each suction device having a range of action sufficient to enable it to engage a bowling pin standing upon the bed eccentric or concentric with respect to its spotted position and to lift the standing pin from the bed and return the same to the bed at the same position previously occupied, and means to impart movement to said support to bring said suction devices into contact with standing pins on said bed and to thereafter lift and return said pins, and means to render the suction in said devices effective prior to the lifting movement thereof and ineffective subsequent to the return movement thereof.

24. In apparatus for setting and resetting bowling pins upon a bowling alley bed, a group of suction pin setting devices arranged near the pit end of the alley and adapted to engage bowling pins and set them upon the alley in proper spotted relation, a group of resetting suction devices arranged in spotted playing formation near the pit end of the alley, the resetting group facing generally in an opposite direction from the setting group, each device of the resetting group having a range of action sufficient to enable it to engage a bowling pin standing upon the bed eccentric or concentric with respect to its spotted position and to lift the standing pin from the bed and return the same to the bed at the same position previously occupied, a common support for the groups of suction devices, and means to move the support.

25. In a machine for manipulating bowling pins, a supporting structure arranged near the pit end of the bed of the alley, a carriage mounted upon the supporting structure, a triangular group of suction devices mounted upon the carriage for holding engagement with the head ends of the bowling pins, and means to lower the carriage and invert the same.

26. In apparatus for setting pins on a bowling alley, a means at the pin spotting end of the alley including a suction device having a range of action sufficient to enable it to engage and lift a pin standing on the alley concentric or eccentric with respect to its proper position thereon, mechanism for imparting pin engaging, removing and replacing motions to the device, a means for creating suction in the device during the pin engaging, removing and replacing motions thereof imparted thereto by said mechanism, whereby the device will engage the standing pin, remove it from the alley, and replace said pin upon said alley where it was before.

27. An elevator mounted above the pin spotting end of the alley, a plurality of vacuum controlled pin engaging devices mounted on the elevator in triangular formation, mechanism for repeatedly lowering and raising the elevator and devices, during the cycle of operation of said apparatus, and vacuum producing means connected with all of the devices and operable during said cycle to render any one of said device effective to grip a pin within its range of action left standing on the alley, lift the pin therefrom, lower and replace the pin on said alley, and then release said pin.

28. In apparatus for resetting bowling pins, a supporting structure arranged near the pit end of the bed of an alley, an elevator arranged at the supporting structure, a group of suction cups arranged in spotted playing arrangement upon one side of the elevator and secured thereto and adapted to receive therein the head ends of the bowling pins, means to create and break suction within the suction cups, a second group of suction cups arranged in spotted playing arrangement upon the opposite side of the elevator and secured thereto, the second group extending in an opposite direction to the first group so that the apex of one group is adjacent to the base of the other group, the suction cups in the second group having a range of action greater than the diameter of the head of the pins for holding engagement with the head ends of the standing pins when they are eccentric or concentric with respect to the spots without shifting the pins laterally, means to create and break suction within the second group of cups, means to raise and lower the elevator, a means to hold the elevator substantially horizontal while lowering it and turning the same over for substantially 180° during its downward movement and to turn the elevator over for substantially 180° during its upward movement, the turning movement of the elevator upon its upward movement being in an opposite direction to the turning movement in its downward movement.

29. In an apparatus for setting bowling pins, mechanism for setting pins on a bowling alley bed in spotted relation including a support, suction devices on said support formed to fit the rounded surfaces of a bowling pin and corresponding in number to the number of pins to be set associated with the rear end of the bowling alley bed, means on said support providing converging guide surfaces for registering the handle ends of the pins with said suction devices to cause said devices to hold said pins, and means to impart movement to said devices to transport said pins toward said alley bed.

30. In a bowling pin setting apparatus, a support arranged near the pit end of the bowling alley bed, a set of pin holding devices arranged on said support in a triangular group corresponding to the spotted arrangement of pins on the

alley bed, said devices being constructed and arranged to hold pins free from magnetic pin material by the tapering extremity only of the head ends of the pins beyond the greatest circumference of the handle end of the pins whereby said pins are held by a portion of the pins which is relatively free from wear and means for moving said support back and forth between a position remote from said alley bed to a setting position adjacent said alley bed.

31. In a bowling pin setting apparatus, the combination with open ended pin receiving elements each arranged to receive a bowling pin head end first, said receivers being of generally conical formation with the base of the cone open to receive the upper portion of the pin and to conform substantially to the taper thereof, and means cooperating with said receivers for holding said receivers with the open base of the cone up to receive the pins in inverted position and acting to invert said holders to bring the pins into upright position.

32. In bowling pin setting apparatus, a support arranged near the pit end of a bowling alley, a spaced group of suction cups carried by the support and corresponding to the spotted arrangement of bowling pins upon the bed, the suction cups being adapted to engage with the tapered extremities of the head ends of the standing pins, each suction cup having an effective diameter less than the maximum diameter of the head end of the pin so that it receives only the reduced extremity of the head end which is relatively free from injury, and means to move the support to cause the suction cups to lift the standing pins from the bed and reset the same thereon.

33. In a pin setting apparatus for use with a bowling alley bed, the combination with a pin setter mechanism movable into an operating position adjacent to and overlying the bed to set the pins in upright position on said bed, of a pin resetter mechanism also movable to a position adjacent to and overlying the bed to engage, lift and again set standing pins on said bed, and means for moving one of said mechanisms to a position remote from the bed and its pin setting position adjacent the bed when the other mechanism is in its setting position adjacent said bed, said pin resetter mechanism including pin holding devices having a range of action sufficient to engage off spot pins and reset them in the same off spot position.

34. A pin setter for cooperating with a bowling alley bed comprising in combination a carriage, means mounting said carriage for vertical movement toward and away from said bed, a setter frame, pivot structure supporting said frame on said carriage for rotating about a substantially horizontal axis, a plurality of hollow suction cups constructed to embrace and grip the tapered handle ends of a set of bowling pins, and operating means to rotate the frame on said pivot means in timed relation to said vertical carriage movement to first present said suction cups in an upwardly directed position to receive and grip the pins in inverted position, and then turn the pins to upright position with their butts adjacent the alley bed, and means to release the suction on said cups when the pins are in the last-mentioned position, to complete the setting of the pins, and a set of suction resetting devices facing oppositely to said cups to engage and lift standing pins, each of said devices being so constructed and arranged that its range of action is extended over an area greater than the diameter of the head ends of the pins in order to pick up off spot pins, and operating means including mechanism to lower said carriage while said resetting devices face downwardly to bring the resetting devices into contact with the standing pins and raise the same to lift the pins and again lower the same to return the standing pins to the alley bed, and means to start the suction in said devices when the same are lowered into contact with the standing pins and stop the suction therein when the pins are returned to the alley.

35. A bowling pin setting machine for use with the bed of a bowling alley comprising in combination a guide adjacent said bed, a carriage mounted to travel longitudinally upon said guide toward and away from said bed, a support positioned over said bed and pivotally mounted on the carriage to travel thereon toward and away from the bed and to turn upon its axis, a group of bowling pin holding devices constructed and arranged to hold a set of the pins in substantially playing arrangement, means to move said carriage on said guide toward and away from said bed, and mechanism for turning said support on said axis.

36. In a pin setting machine for bowling alleys, the combination with an alley adapted to support a plurality of pins arranged in playing position and adjacent one end thereof, of a pin setting table provided with a plurality of suction pin spotting elements formed to engage a rounded surface of the bowling pins, mechanism for resetting upon said alley pins which were left standing after the throwing of a ball, and means associated with said elements responsive to the presence or absence of pins standing on said alley for operating said elements to hold said standing pins for resetting.

37. Bowling pin setting apparatus for use with a bowling alley bed comprising in combination a support arranged near the pit end of said bed, suction bowling pin holders carried by said support and constructed and arranged to hold a set of bowling pins by suction, said holders including suction elements formed to grip a rounded surface of said bowling pin and means for moving said support toward and away from said bed.

38. In an apparatus for setting pins upon the bed of an alley, an elevator to be raised and lowered, pin engaging devices carried by said elevator, constructed and arranged to support a set of bowling pins in playing arrangement, means for moving said elevator from pin receiving to pin setting position, and mechanism for holding pins in said devices, comprising fluid operated members, and means for directing fluid to said members to cause them to hold said pins in said devices during the movement of said pins from said receiving position until they are located in said arrangement upon said alley bed.

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