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.

In accordance with my invention, the proper handling of the pins, whether concentric or eccentric with respect to the spots, has resulted in very complicated structures. 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.

An important object of the invention is to provide means to accurately set the pins upon the bed of a bowling 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 18—18 of Figure 8, showing the various 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 lanes.

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 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 35 is pivoted at 40 and has a stop shoulder 41 arranged adjacent to the union of the branches 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 union of the lower end of 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, the coupling 49 being connected with the 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 55, connected with converging sides 60 by tubular coupling 61. This coupling is preferably formed integral with the adjacent elbows 49 and communicatetherewith. The sides 60 converge in one direction for connection with a tubular coupling 62, also connected with a pipe 63 extending to the base 55 and connected with a tubular coupling 64. The coupling 58 is formed integral with the coupling 57 and the coupling 64, and these tubular couplings are in communication with each other. The coupling 62 is formed integral with the coupling 58 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 above the pin 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 suction cup 68 and the suction 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 28. 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 66. 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 is within the suction cup 66 sufficiently so that the suction cup may hold engagement therewith, the stem 70 is moved downwardly 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 bowling pin.
suction cup 68, 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 suction device 72. The suction cup 68 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 inverted. The ring 72 resists all 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 devices are adapted to respond 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 equi-distant 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 tubular and is provided with tubular nipples 76 arranged in rows, as shown, whereby they are also preferably arranged in triangular groups of three through-out 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 upon each shell 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, 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 tapered and increases in diameter outwardly and is preferably adapted to suitably engage with the intermediate or body portion of the bowling pin, 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. 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 tops with a web or sheet 81 and also 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 space position 81 from any position 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 43 includes a series of 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 41 of the frame 46. The rock shafts 84 extend into couplings 85, and are clamped thereto, as shown at 86. The rock shafts 84 are journaled in bearings 87, which are rigidly bolted to plates 88, rigidly secured to vertically movable carryages 89. These carryages travel upon the outer sides of the tracks 26 and have guide rollers 90. The carryage 89 is raised by a cable 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 carryages 89. Each valve device comprises an outer stationary disk 95, rigidly secured to the head 94 and, therefore, head against turning movement, and movable vertically with the carryage 89. The disk 95 is provided upon its inner face 97 with a circularly curved elongated groove 98, concentric with the shaft 94, and extending through 180°. Connecting with the stationary disk 95 is a companion disk 96, having a central opening through which the shaft 94 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 all 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 dash line 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 108, and they may be manually turned by a crank 109 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 106 which may be preferably mounted 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 upwardly 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, unless otherwise 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 lowest 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 communication by a spring 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 arm being pivotally supported 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 rollers 102, all within the grooved track 26 and their several branches, a roller shaft 127 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 return runway by the blade 128. The arm 120 may be mechanically swung upwardly by a crank 129, 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 126 and 129.

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, simply by means of 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 85, and thereby supply suction to within the several suction cups 68. 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, when it reaches 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 25, 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 straight portion 22, it is 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 being pivoted 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 56 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 track 26 near and beneath the gate 34. The arm 101 will then turn the carrier in an opposite direction for one-half of a revolution to completely 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 raised to knock 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 the arm 101 is brought into proximity to the head end of the pins, three of the suction cups 77 will engage the head end of the pin and the valve stems 86 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 arm 101 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 the entire head 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 entirely 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 carrier 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 the 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 vapors. 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 115, and valve body 13 is turned thereby placing the groove 89 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 19 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 con-
5 nected therewith, means to lower the support and
invert the same, and means to raise the support
and invert the same.

4. In an 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
10 spotted for playing and carried thereby to en-
gage with the head end of the pins, similarly ar-
ranged suction residing devices carried by the
support and arranged near the opposite side thereof, each resetting device having a diameter
15 larger than the head end of the pin and embody-
ng a suction element constructed and arranged
to embrace and suctionally grasp the rounded head
end of a bowling pin.

5. A bowling pin setting machine for use with
20 the bed of a bowling alley comprising in combi-
nation, a substantially vertical track adjacent
to said bed having a laterally extending branch, a
support to travel longitudinally of the track
25 and including a part to travel longitudinally
of the track and into the branch to invert the
support, means to move the support longitudi-
nally of the track, and pin holding means car-
rying a group of bowling pins holding devices
30 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
35 a bowling alley bed comprising in combination, a
track adjacent said bed having laterally extend-
ing branches, a support movable longitudinally
of the track over said bed, means cooperating
40 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
45 travels upwardly, means to move the support in
opposite directions longitudinally of the track,
and pin holding means carried by the support
40 and operating from the opposite sides of the sup-
port, said pin holding means including bowling
pin holders for a set of bowling pins, said hold-
45 ers having the same arrangement as spotted
pins on the alley bed.

7. In bowling pin setting apparatus, a sub-
stantially vertical track having a laterally extend-
ing branch leading into the track at spaced
50 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 longitudi-
nally of the track, means connected with the sup-
55 port 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
60 end of the first named branch when the part
moves downwardly, a gate arranged at the upper
65 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 sec-
ond named branch to deflect the part into the
70 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 down-
75 wardly in the vertical track and to guide the
part into the branch when it is travelling up-
wardly and into the vertical track when it is
travelling upwardly depending upon the shifted
position which it occupies, a pin holding means
connected with the support and operating from op-
posite sides thereof, and means to move the sup-
port longitudinally of the track.

8. In bowling pin setting apparatus for use
80 with bowling alley beds, a support having a load-
ing position and a setting position, suction means
90 carried by the support for holding engagement
with the bowling pins, said suction means facing
upwardly with the pins upon position for engagement with the bowling pins
holding the bowling pins in a spaced triangu-
lar group corresponding to the spotted arrange-
ment 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 pin end and to invert
the support about an axis transverse to the alley
95 bed so that said base is arranged nearer to the
top 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
100 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 suc-
tion means facing upwardly with the pins upon
the bed in substantial spotted relation.

10. An apparatus for setting pins on a bowling
105 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
110 a set of bowling pins in a spaced group corre-
sponding in number and arrangement to the
spotted arrangement of a set of bowling pins upon
an alley bed, and means to move the support to-
ward and away from said bed to cause the suc-
tion means to set the butt ends of the pins upon
115 the bed in substantial spotted relation and
means coating 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.

11. In bowling pin setting apparatus, a support
120 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
125 a set of bowling pins in a spaced group cor-
sponding to the spotted arrangement of bow-
ing 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 bow-
ing pins upon the bed in substantial spotted rela-
130 tion.

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

16. 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 extended above the support to receive inverted bowling pins, and means to invert the support and move the same toward said bed so that the devices may receive 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 pin 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 receive 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.

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 resetting operative the suction on the pins when engaged by the resetting devices.

23. 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 pins and lift it from the bed and return the same to the bed, 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 pins and lift it from the bed and return the same to the bed.

24. In apparatus for setting and 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 theretofore 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.

25. In apparatus for setting 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 the opposite 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 contiguous to the apex 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 after setting said pins, and means to render the suction cups in both groups ineffective 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 elevator 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.

26. In apparatus for setting bowling pins, a supporting structure arranged near the pit end of the bed of an 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 bowling pins, and means to lower the carriage and invert the same.

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 devices 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 contiguous to the apex 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 after setting said pins, and means to render the suction cups in both groups ineffective 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 elevator 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 head 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
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.

In a 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 relative to the support to cause the suction cups to lift the standing pins from the bed and reset the same thereon.

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 resetting 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 resetting 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.

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 and said pins means in timed relation to 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.

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.

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 pin 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.

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.

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.

GOTTFRIED J. SCHMIDT.