Nov. 13, 1945. R. E. RUNDELL 2,388,707

BOWLING PIN SETTER

Filed March 10, 1939 7 Sheets-Sheet 1

FIG. 1

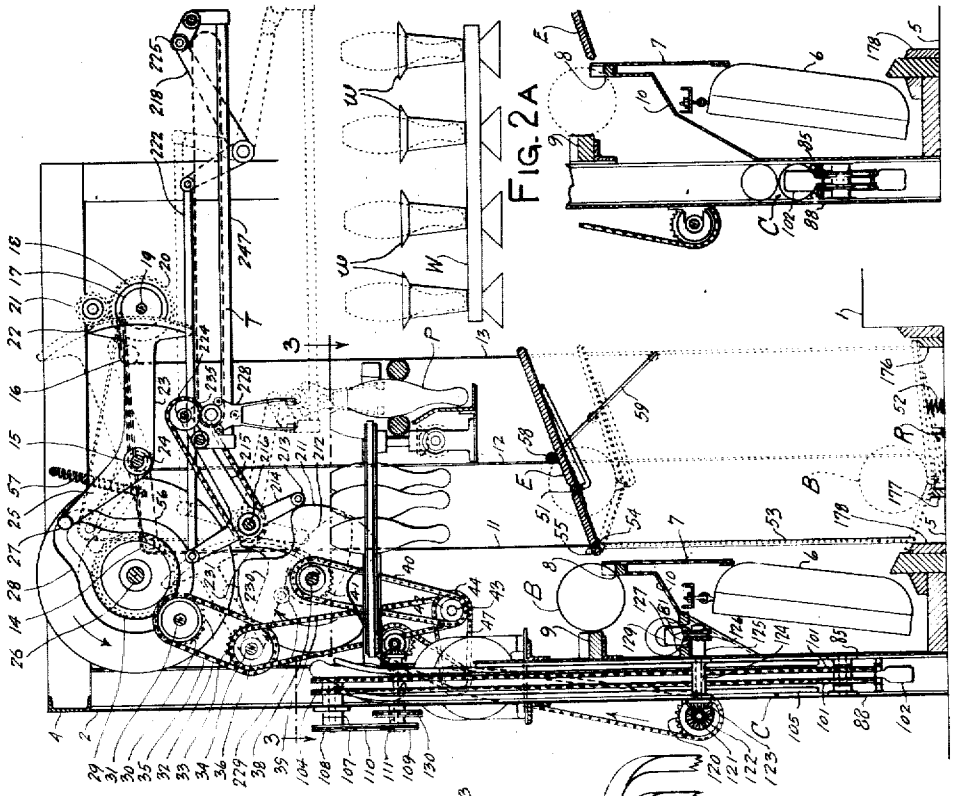
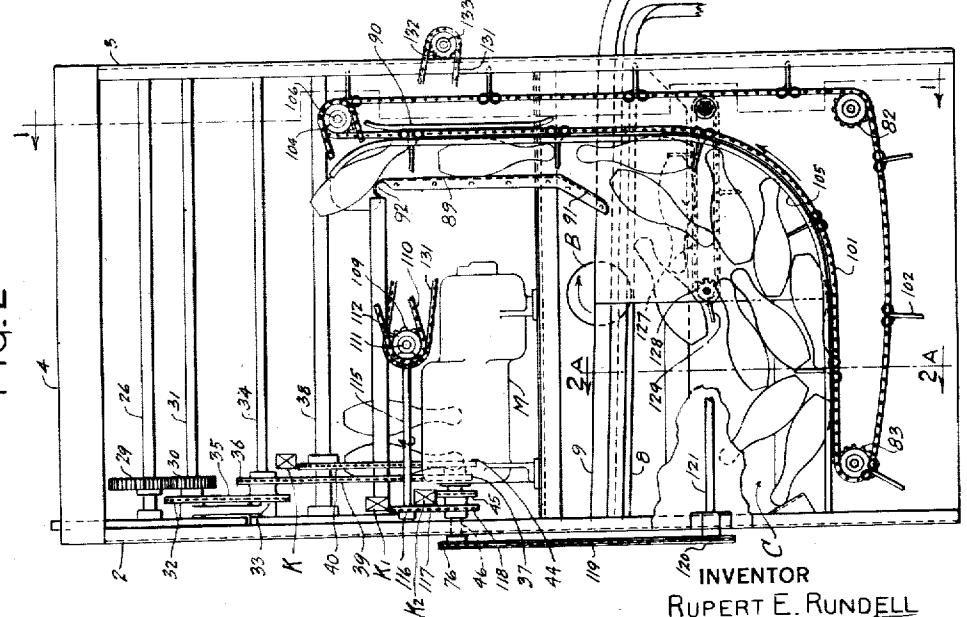


FIG. 2A

FIG. 2



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Nov. 13, 1945. R. E. RUNDELL 2,388,707

BOWLING PIN SETTER

Filed March 10, 1939 7 Sheets-Sheet 2

FIG. 3

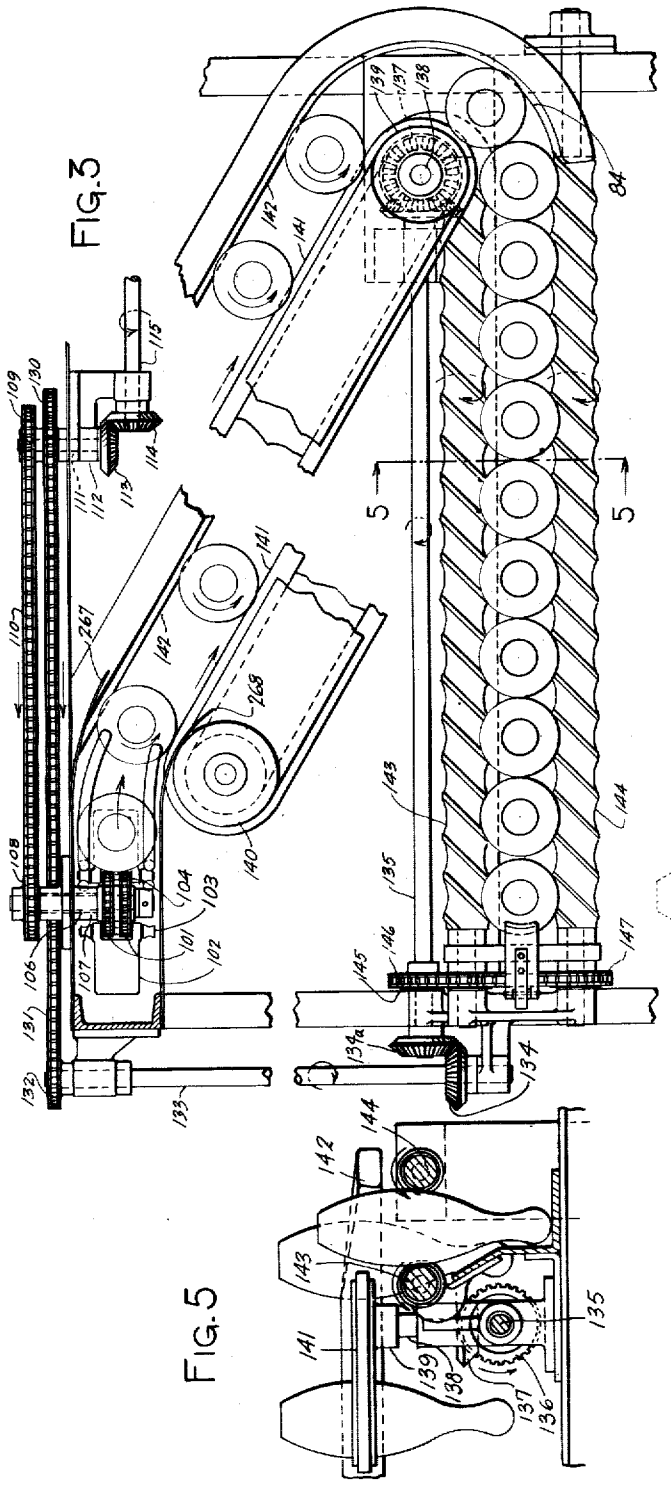
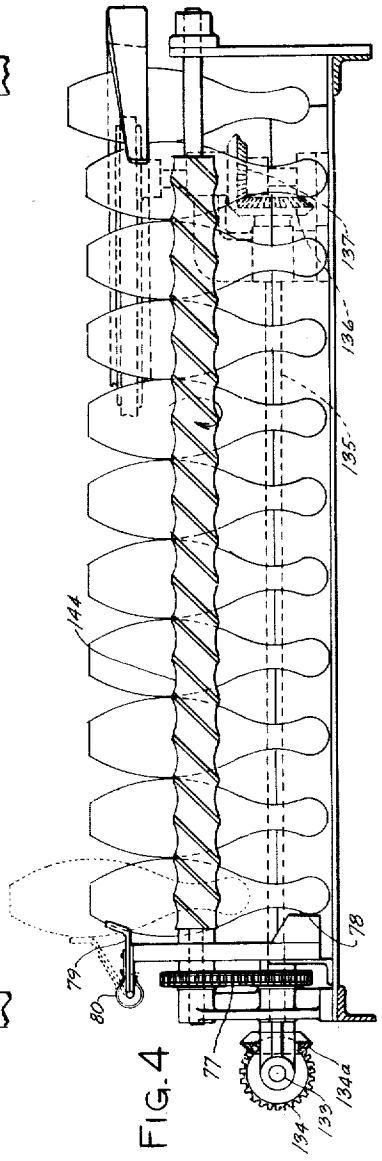


FIG. 5

FIG. 4



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Nov. 13, 1945. R. E. RUNDELL 2,388,707

BOWLING PIN SETTER

Filed March 10, 1939 7 Sheets-Sheet 3

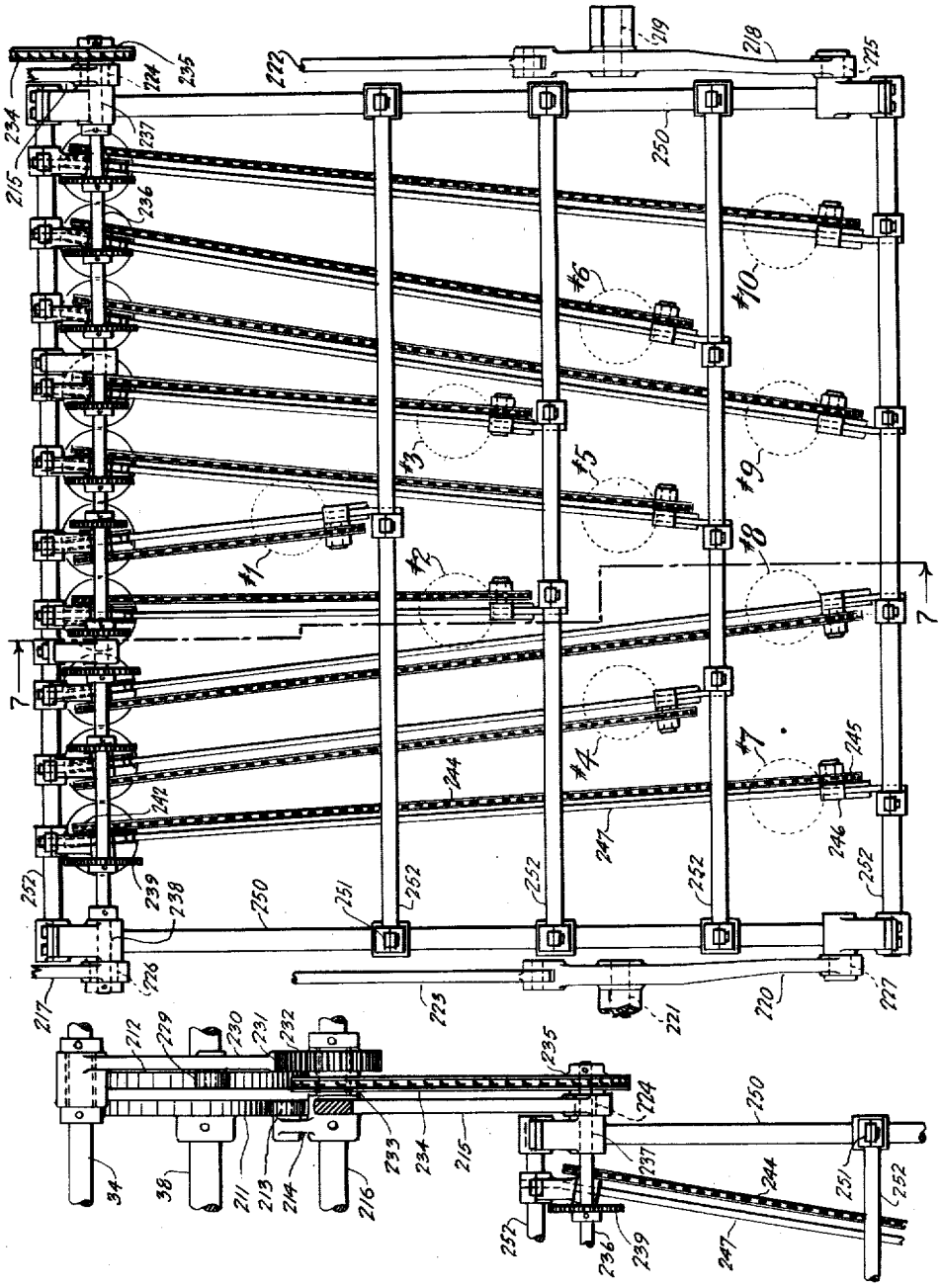


FIG. 6

FIG. 6A

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Nov. 13, 1945. R. E. RUNDELL 2,388,707

BOWLING PIN SETTER

Filed March 10, 1939 7 Sheets-Sheet 4

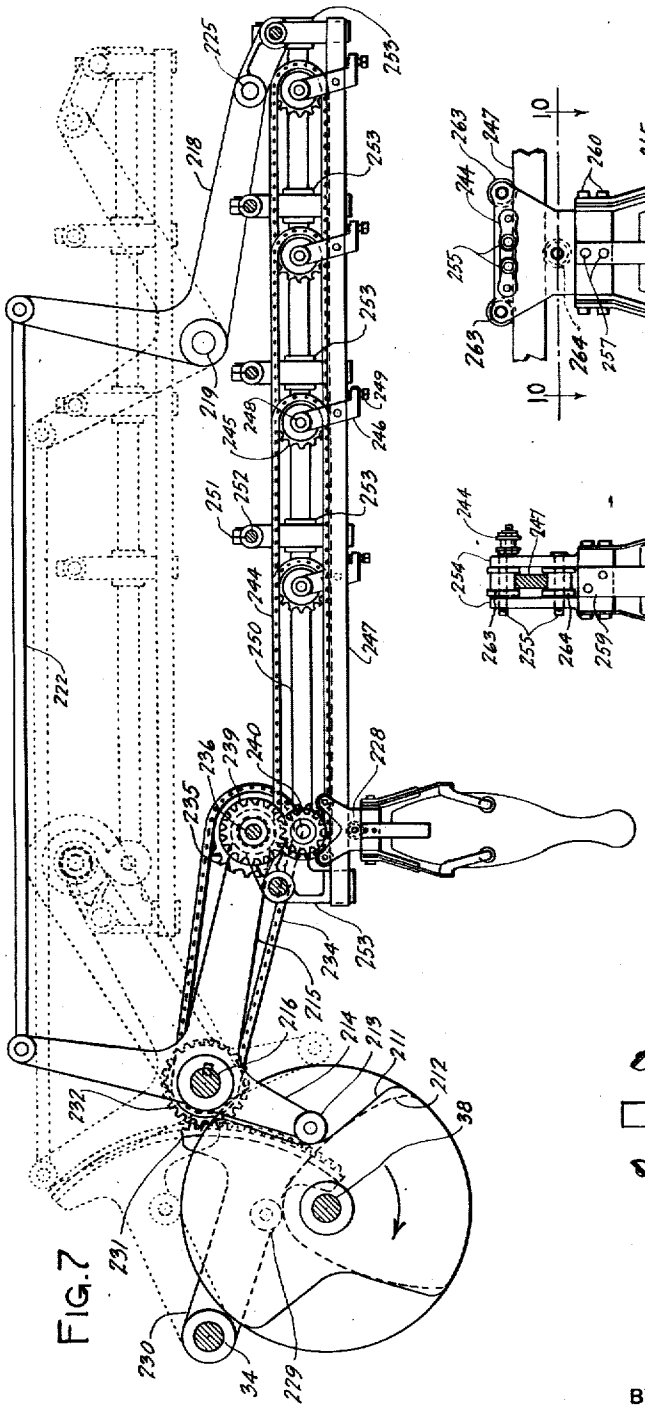


FIG. 7

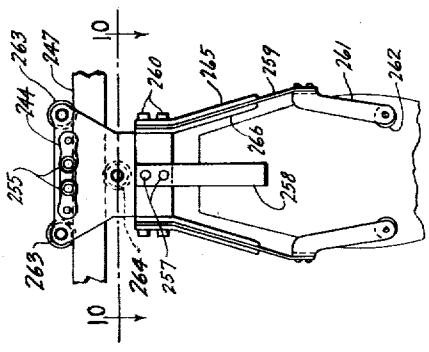


FIG. 8

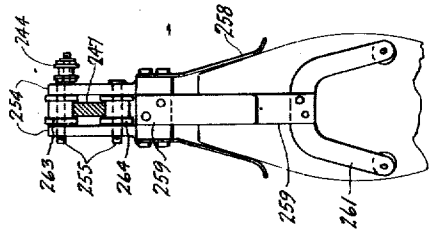


FIG. 9

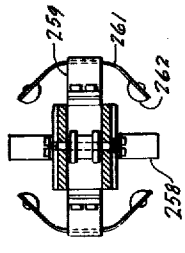


FIG. 10

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Nov. 13, 1945. R. E. RUNDELL 2,388,707

BOWLING PIN SETTER

Filed March 10, 1939 7 Sheets-Sheet 5

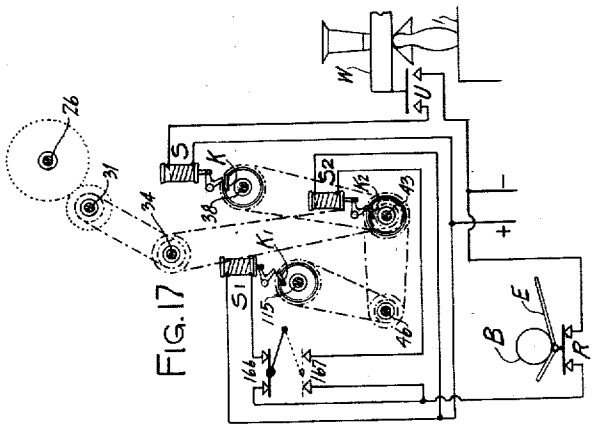


FIG. 17

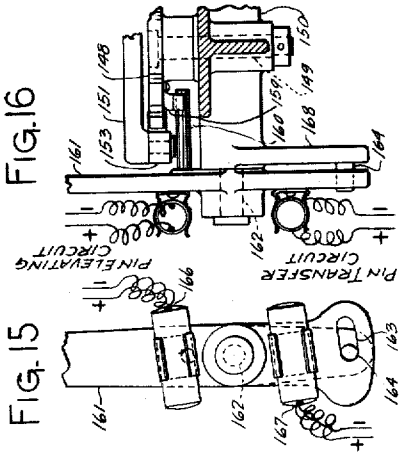


FIG. 16

FIG. 15

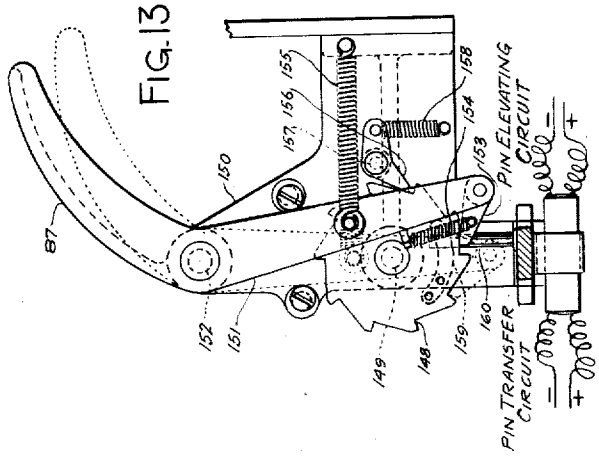


FIG. 13

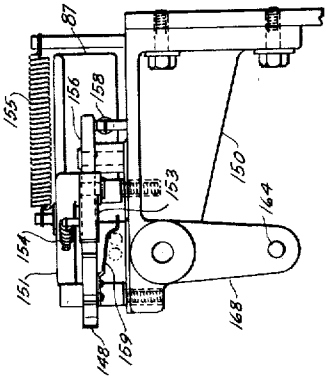


FIG. 14

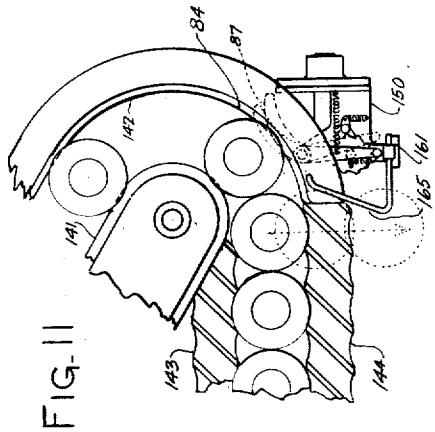


FIG. 11

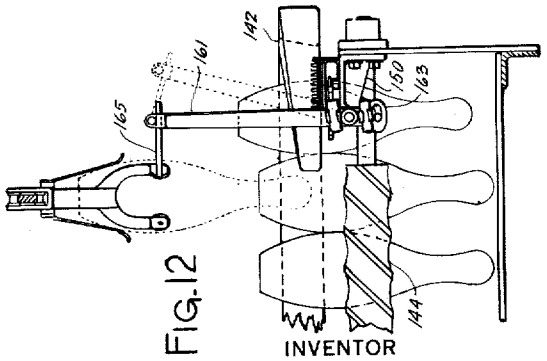


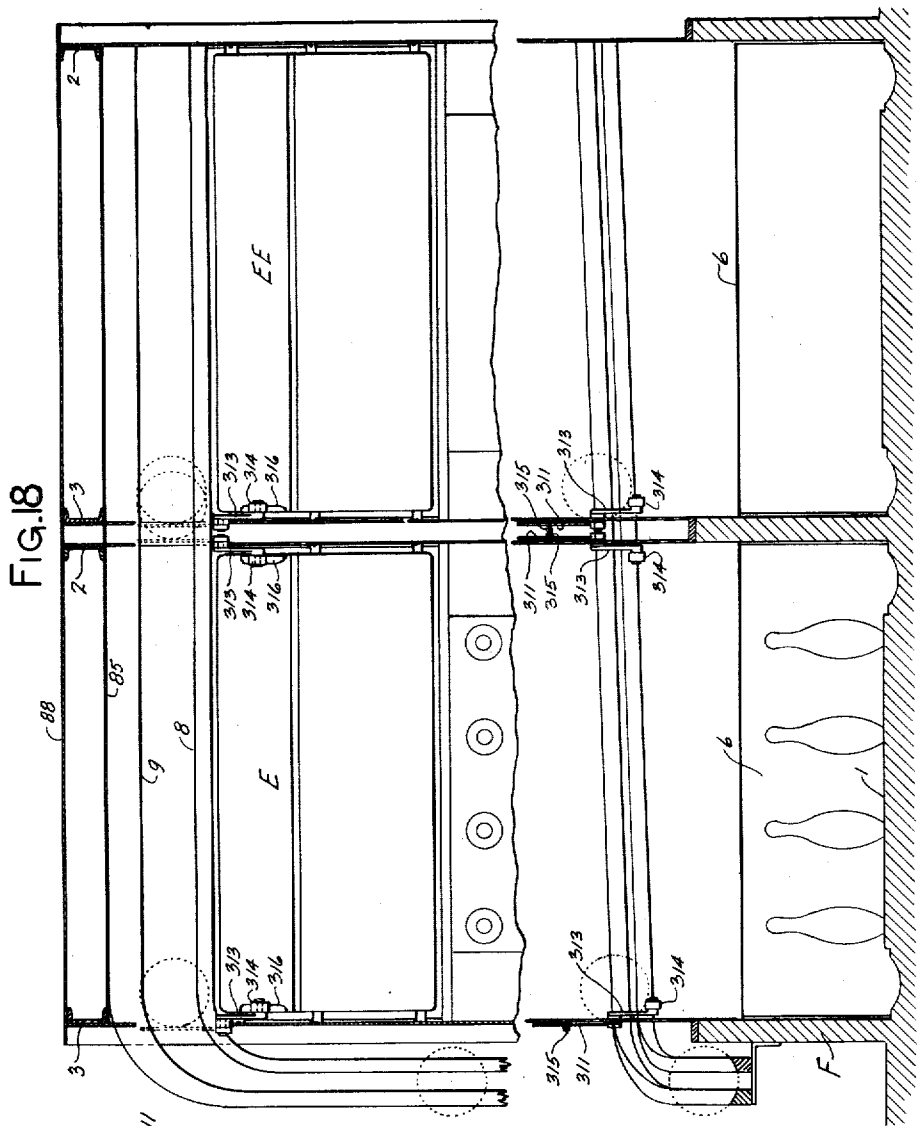
FIG. 12

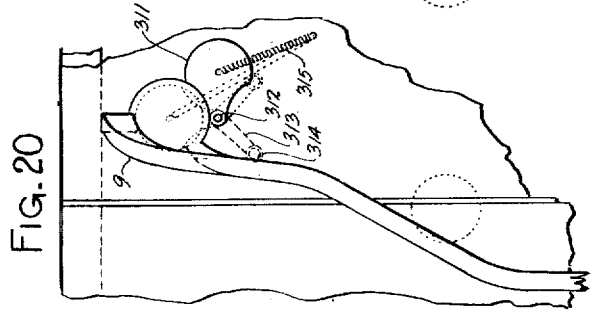
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Nov. 13, 1945. R. E. RUNDELL 2,388,707

BOWLING PIN SETTER

Filed March 10, 1939 7 Sheets-Sheet 6



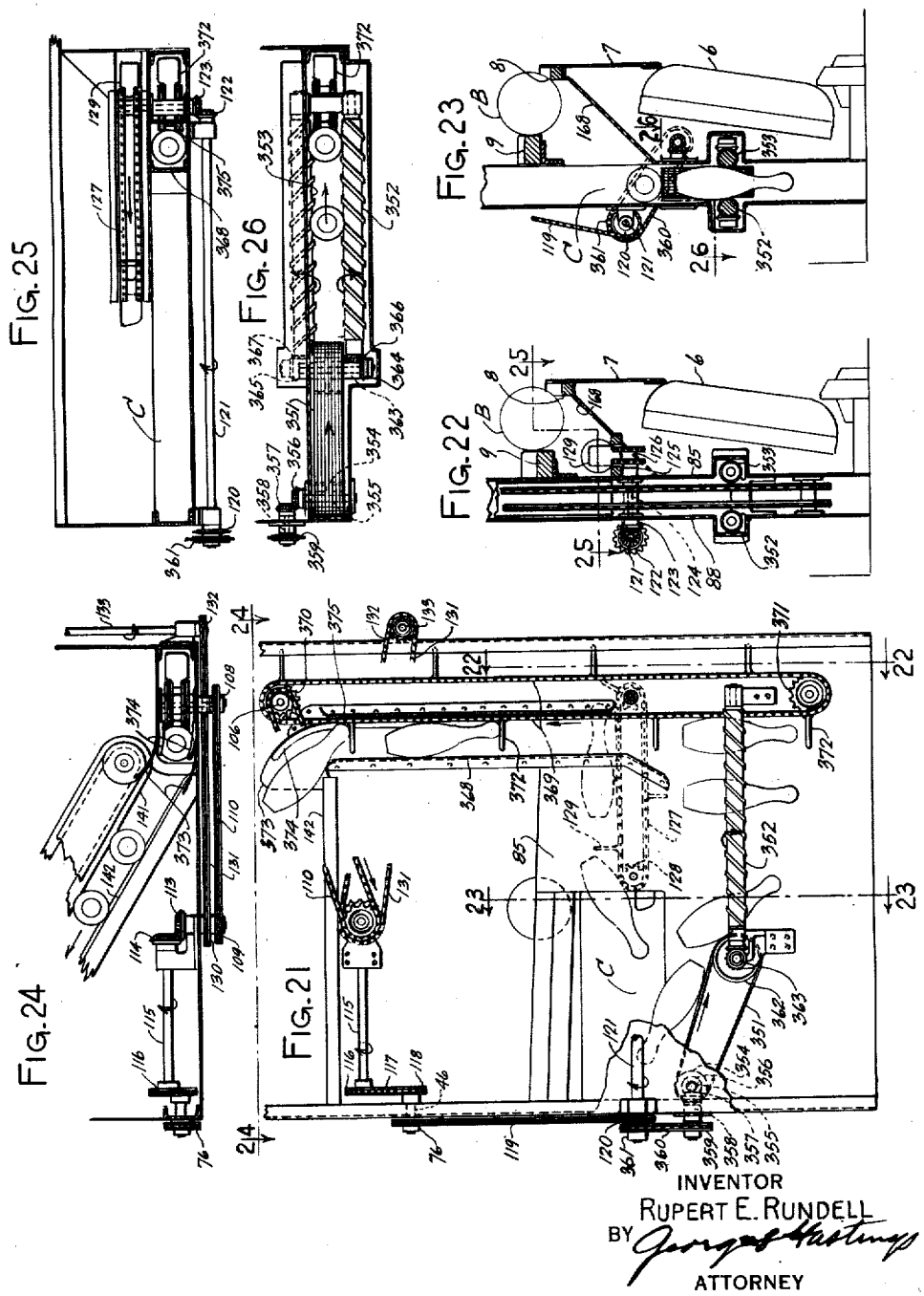


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Nov. 13, 1945. R. E. RUNDELL 2,388,707

BOWLING PIN SETTER

Filed March 10, 1939 7 Sheets-Sheet 7



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Patented Nov. 13, 1945 2,388,707

UNITED STATES PATENT OFFICE

2,388,707

BOWLING PIN SETTER

Rupert E. Rundell, Rockville Centre, N. Y., assignor to American Machine and Foundry Company, a corporation of New Jersey

Application March 10, 1939, Serial No. 260,901

75 Claims. (Cl. 273—43)

This invention relates to an automatic machine for setting pins upon an alley in any desired arrangement, and is chiefly concerned with the handling of pins from the time they are removed from an alley either by a thrown ball or by suitable sweep mechanism, until they are transferred to a pin setter for resetting upon an alley in playing position.

The invention, therefore, consists in the provision of improved mechanism for transporting pins and balls from the pit of a bowling alley and the return of a set of pins to the alley in proper playing position thereon and routing a ball back to the player.

It is a further object of the invention to provide a novel pit elevator for balls and pins, and a combined ball-pin separator in order to utilize most efficiently the limited space available in the installation of a pin setting machine on an alley, wherein the pins and balls in the pit are conveyed to a pin magazine and to a position adjacent the player, respectively.

In my machine, after a predetermined number of pins has been set in playing order on the bed of the alley, and the play is started by the throwing of a ball, the ball upon landing in the pit operates control devices and institutes a series of operations for returning pins to the setting device or to storage and for rerouting a ball back to the player.

In most bowling alleys, conservation of space is very important and hence, in order to provide a practical as well as efficient machine, it is imperative that it be readily adaptable for use with existing alleys without changes or reconstruction, and with those under construction without the necessity of utilizing more space than an alley would normally occupy if my machine were not used thereon. According to my invention, therefore, it is a further object to provide novel and improved pin and ball handling mechanism which removes pins and balls from the pit of an alley and returns them to their respective playing positions without requiring additional space for the machine.

According to my invention, the pins after having been swept from the alley fall upon a pit elevator, which is set into operation by an article, such as a ball and/or pin landing thereon, and carries the balls and pins vertically upward to a point where pins and balls are ejected therefrom, whereupon the pins are separated from the ball, and each travels along its respective path to predetermined points for further handling.

A further object of the invention is the provision of improved pin transporting mechanism which may take the form of an endless conveyor or other suitable conveying mechanism located in and extending across a pin receiving chamber positioned at right angles to an alley for elevating pins from the chamber to a storage magazine unit, wherein the conveyor mechanism functions to break up any pin jams or tangles which may result when several pins are deposited into close engagement in the chamber.

It is a further object of the invention to provide a pin receiving chute which may discharge pins either positively or by gravity into a chute, and conveying mechanism for assisting said chute in the performance of its functions.

The invention is further characterized by the provision of mechanism for raising pins vertically either butt end first or head end first, which provides satisfactory results regardless of the end of the pin first issuing from the mechanism. This is due to the fact that the members of the conveyor mechanism of the storage unit are so positioned that the center of gravity of pins fed thereto is located below the points of engagement with this latter mechanism so that the pins will be rectified or will rock about this support and have their head end portions project downwardly.

It is an added object of my invention to provide a novel pin conveying mechanism having means for preventing each flight thereof from carrying more than one pin, and means for maintaining each pin carried in substantial vertical position whether a pin is being supported by its butt or by its head portion.

The invention also consists in the provision of an improved conveying system for elevating pins from a receiving chamber to a storage magazine wherein any jams or tangles of pins awaiting transportation to a pin storage unit are readily broken up by the action of the conveyor mechanism upon the pins to be transported.

It is a further object of this invention to provide a pit elevating platform which is hinged so that it can be broken or humped in the middle, and an ejector which moves relative to the platform at its delivery position for positively discharging balls and pins into the pin and ball handling and distributing mechanisms.

As mentioned previously, an object, such as a ball, dropping into a pit adjacent the end of the alley, operates a control switch to make an electric circuit which leads through the pin storage mechanism to control mechanism operating a device joining the pin and ball elevating mecha-

nism to the main drive of the machine whereupon pins and balls are raised from the pit.

According to my invention, however, the electric circuit cannot be completed unless there is a predetermined number of pins in the pin storage magazine when a ball arrives in the pit upon the platform of the pit elevating mechanism.

When, however, the last of the required number of pins enters the storage magazine, the circuit is completed and the pit elevator mechanism operates to carry fallen pins and a ball located thereon upward to a point where they are discharged therefrom. The pit elevator is then lowered into the pit. Whenever ten pins are removed from the storage magazine for transfer to the pin setter, the movement thereof causes the operation of mechanism for feeding pins from the chamber into which the pins were deposited by the pit elevator whereupon pins are raised and fed by suitable conveying means into the storage to build up the necessary reserve of pins in order that the machine may continue to operate through its predetermined cycle.

It is also an additional object of the invention to provide an electrical control system joining a plurality of pin handling devices, which is controlled by the presence of a ball and/or pins in the pit of an alley, for effecting the elevation of pins and a ball from the alley pit, separating the pins from the ball, conveying the pins to storage, and transferring a predetermined number of pins, usually ten, from the storage to a pin setter whenever in the operation of the machine the necessity of transferring pins to the setter arises.

It is a further object of the invention to provide improved pin lifting mechanism which will effectively lift individual pins from a mass of pins disposed in a chamber and carry them one by one in a single line to a point where they are deposited butt ends up in a member which conveys them to a storage magazine.

In the transfer of pins from the pit to the storage magazine, it is to be observed that there are more than a set of pins between the end of the storage magazine and the end of the conveyor which forms a part of the storage unit for the transfer of pins from the point of discharge of the elevating conveyor to the magazine. It is, therefore, an object of this invention to insure the presence of at least the number of pins required for playing in the storage magazine at all times prior to the movement of the pin transfer to a pin setter, and to provide a counting device for controlling the operation of the pin setting and storage mechanism so that whenever the necessary number of pins has been fed into the storage magazine, the next pin moving thereinto stops the movement of the several conveyor members.

It is a further object of the invention to provide improved pin handling mechanism for raising pins from a heap, rectifying or arranging them so that they rest butt end up and then transporting them in that arrangement to a storage magazine by means of relatively movable conveying members.

It is an additional object of the invention to provide improved pin handling means for transferring a plurality of pins to a point where they are rectified or turned with their butts projecting upwardly, by members which convey them to counting mechanism of a pin storage magazine.

It is a further object of the invention to provide mechanism for feeding pins into a storage magazine and to interrupt the operation of said feeding mechanism whenever a predetermined number of pins has been delivered to said magazine.

It is an additional object of the invention to provide counting mechanism associated with a pin storage magazine, and mechanism for feeding pins to said magazine wherein the counting mechanism determines when a sufficient number of pins has been fed to the magazine and discontinues the operation of the infeed conveyor mechanism.

The invention also consists in the provision of devices for feeding fallen pins and balls from the pit of a bowling alley, separating the pins from the balls, delivering the pins to a storage magazine, and associated controls which prevent the removal of any pin from the pin storage magazine until a predetermined number of pins have been stored therein, and means forming a part of said controls for preventing the introduction of additional pins into the magazine until a set or the number required for playing a frame has been removed from the magazine.

The invention also consists in the provision of means for raising pins and balls from the pit of a bowling alley and delivering balls to a return runway, together with means for regulating the movement of balls out of said machine and along the runway and preventing pins from falling out of said machine adjacent the runway.

It is a further object of the invention to provide means whenever two bowling pin setting machines are arranged side by side for returning balls to the player wherein the ball return runway extends from one machine to the other and projects through openings in the side frames thereof and to furnish means for preventing pins from leaving the machine through the openings and to control the movement of balls along the runway.

It is an additional object of the invention to provide an improved mechanism in the form of a frame carrying a plurality of pin gripping units which operate to lift a number of pins required for playing from a storage magazine and transfer them with differential movements to a pin setter. The pin transfer mechanism is further characterized by the provision of means for raising and lowering the frame to properly position the gripper units for gripping or releasing pins.

The invention further consists in the provision of improved pin gripping units which are provided with yieldable pin gripping members and pin locating elements cooperating therewith.

The invention further consists of improved driving mechanism operated under the control of and in timed relation with the movement of the pit elevator for effecting the transfer of a set of pins from the storage mechanism to a pin setter.

The invention further consists in the provision of control mechanism for setting into operation a device for conveying pins and balls from the pit of a bowling alley to means which elevate pins to a storage magazine.

An added object is to provide a control system set into operation by means of a ball and/or pins arriving on a pit elevator platform, which, whenever a predetermined number of pins are in the storage magazine, causes the platform to rise and transfer pins and balls from the pit to a transportation center whence in a subsequent operation the pins can be transferred to storage.

The invention is further characterized by the provision of mechanism set into operation whenever a ball lands upon the pit elevator platform and operates a control member so that if a predetermined number of pins are located in the pin storage magazine the pit elevator will rise and discharge into a receiving chamber all pins located thereon.

The invention also contemplates the use of a pin transfer device which conveys a plurality of pins, usually ten, from the pin storage to a pin setter and means associated with the transfer mechanism for setting into operation a conveyor system for raising pins from the pin receiving chamber into the storage mechanism.

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

In the accompanying drawings which form a part of this specification, and in which like characters of reference indicate the same or like elements:

Fig. 1 is a sectional side elevation of a preferred embodiment of my invention taken on line 1—1 of Fig. 2, showing mechanism for handling pins and balls in their movement from the pit of a bowling alley to a pin setter, and ball return, respectively;

Fig. 2 is a rear elevational view of Fig. 1, with most of the rear plates broken away to expose the several drives for the various conveyors of the pin elevating mechanisms and the conveyor which raises pins from a receiving chamber to pin storage mechanism;

Fig. 2a is a sectional view taken on line 2a—2a of Fig. 2;

Fig. 3 is a sectional view, taken on line 3—3 of Fig. 1, showing the mechanism which handles the pins as they emerge from the top of the lifting conveyor for transfer by means of the horizontal conveying unit into the pin storage;

Fig. 4 is a front elevation of the pin storage mechanism showing the arrangement of the pins in the storage magazine just prior to the removal of ten pins therefrom, for transfer to the pin setter;

Fig. 5 is a sectional view on line 5—5 of Fig. 3;

Fig. 6 is a plan view of the transfer mechanism which conveys ten pins from the storage magazine to the pin setter;

Fig. 6a is a partial side view of the transfer frame and its operating mechanism;

Fig. 7 is a sectional view taken on line 7—7 of Fig. 6;

Fig. 8 is a side view of a pin gripper unit;

Fig. 9 is a front view of the device shown in Fig. 8;

Fig. 10 is a sectional view of the gripper unit taken on line 10—10 of Fig. 8;

Fig. 11 is a partial detail plan view showing one form of magazine infeed control mechanism which may be employed in the feed of pins to and from the magazine;

Fig. 12 is a front elevation of Fig. 11;

Fig. 13 is a detail plan view drawn to large scale of the counting device shown in Figs. 11 and 12;

Fig. 14 is a partial front view of Fig. 13;

Fig. 15 is a partial front view of the counting control lever shown in Figs. 11 and 12;

Fig. 16 is a partial side elevation of Fig. 13;

Fig. 17 is a wiring diagram showing a circuit for controlling the operation of the several parts of the machine and setting into operation the several pin handling devices;

Fig. 18 is a sectional plan view, showing the installation of a machine, designed for use on a double alley with means for preventing a ball in the runway of the right-hand alley from interfering with the proper handling of the pins and balls on the left-hand alley, and preventing pins from falling through the ball return openings of the machine;

Fig. 19 is a front sectional elevation of Fig. 18;

Fig. 20 is a partial side elevation of Fig. 18, showing one form of runway opening stop member;

Fig. 21 is a rear elevation, parts broken away, showing an alternative device for collecting pins in the pin receiving chamber and elevating them to the pin storage unit;

Fig. 22 is a sectional view taken on line 22—22 of Fig. 21;

Fig. 23 is a sectional view taken on line 23—23 of Fig. 21;

Fig. 24 is a partial plan view taken on line 24—24 of Fig. 21;

Fig. 25 is a sectional plan view taken on line 25—25 of Fig. 22; and

Fig. 26 is a sectional plan view taken on line 26—26 of Fig. 23.

Referring to the drawings in Figs. 1 and 2, there is shown a bowling pin setting machine arranged to set pins on an alley 1. This machine, which may be mounted either on or above an alley in any desired manner, comprises side frames 2 and 3 joined by cross members 4. The conventional bowling alley pit, indicated generally at 5, is located at an end of the alley 1, and at the rear of the pit is suitably positioned a bumper 6, of known type, against which pins and balls may impinge during play. Whenever pins are removed from the alley 1 and projected into the pit 5, either by thrown balls or by pin and ball removing mechanism, which may be similar to that shown and described in my copending application, Serial No. 248,215, for Pin removing and guard mechanism for bowling alleys, filed December 29, 1938, they are subsequently carried to mechanisms which return the ball to the player, and the pins to a point where they can be transferred to a pin setting device.

In the embodiment illustrated in Fig. 1, the pins and balls fall upon a pit platform elevator E, suitably located in the pit 5 below the surface of the alley in order not to interfere with the proper playing of the game. Pit elevator E is adapted to be moved vertically upward, and for that purpose is suspended by cables 11, 12 and 13 which may be secured to the sides of the elevator. These cables are trained over pulleys 14, 15 and 16, and attached to winding drums 17 and 18 mounted upon shaft 19, suitably journalled in the side frames 2 and 3. A gear 20 on shaft 19 meshes with gear 21, which engages with a gear segment 22 forming a part of lever 23 pivoted at 24 in the frame of the machine, and provided with an arm 25, also part of the lever 23, which arm is furnished with a cam follower 27 tracking a cam 28 attached to shaft 26 journalled in the frames of the machine 2 and 3.

The pit elevator E is raised and lowered at the proper time by means of suitable driving mechanism, such for instance as the following: A gear 29 fixed to shaft 26 meshes with a gear 30 secured to shaft 31. A sprocket 32 is mounted on shaft 31 and by means of a chain 35 engages with a sprocket 33 on shaft 34. A second sprocket 36,

secured to shaft 34, is connected to sprocket 37 on shaft 43 by means of chain 38. A second sprocket 44 on shaft 43 is connected by chain 40 to sprocket 41 on shaft 38. A third sprocket 42 on shaft 43 is connected by chain 47 to sprocket 45 on motor shaft 46. In this manner the drive for shaft 26 and 38 is transmitted from the motor shaft through the jack shaft 43 by means of suitable clutches K, K_1 and K_3, hereinafter described more fully. Whenever a ball is thrown it will either roll along the alley or in the gutter and finally drop into the pit along with any pins it may have removed, and come to rest upon platform E, described above. The arrival of an article, such as a ball B and/or one or more pins is responsible for the operation of the pit elevator platform E. Although a pin coming to rest on platform E might set into operation the control mechanism, hereinbelow described, it is more likely that the heavier ball will effect its activation, and hence in the following description the ball will generally be mentioned. A reference to Figs. 1 and 17 will show that one method of controlling the operation of the platform or elevator E is through the use of electrically operated mechanism including a switch adapted to close a circuit which leads through the pin storage to a solenoid S_2 arranged to operate a clutch K_2, connecting the pin elevating mechanism to the main drive. In this mechanism a control member 51 may be movably mounted as by hinging or any other suitable manner, upon the underside of one part of the platform E and provided with a spring 52 normally tending to project member 51 above the surface of the platform and into a position to be engaged by a ball. Member 51 is so arranged with respect to the platform E that it will be engaged by a ball and be operated by the weight thereof to set the elevator into operation. That is, a ball will roll over the platform and depress member 51, thereby closing a switch R to make an electric circuit as shown in Fig. 17, and by means of a clutch, K_2 which may be of the well-known Bliss type, described in my co-pending application above referred to, operated by solenoid 52 transfer the drive from motor shaft 46 through shaft 43 to shaft 26 which effects the raising of elevator platform E. Since it is generally desired to position the hinged plate-like members of the elevator E so that they are held in substantial V-shape for receiving pins and balls from the alley, a plurality of bars 176, 177 and 178 of varying heighth, are positioned in the pit and provide supports for the elevator. The circuit cannot be completed until there is a set minimum or required number of pins in the storage magazine or located upon rods 143, 144. This is due to the fact that the eleventh pin entering the magazine, as shown herein, by means to be described in detail hereinbelow, operates a control to complete another part of the circuit and thereby makes it possible for ball activated bar 51 to set into operation the elevator E, which transports a ball to the return runways 8, 9 and pins to a receiving chamber from which they are directed back to storage.

In order to prevent pins from falling from the elevator E during its upward movement beneath the ball return runway rails 8, 9 back into the pit or back of the bumper, there has been provided a vertical guard plate 7 mounted on rail 8 and extending downwardly to a point closely adjacent the bumper 6.

Whenever the switch at the bottom of the pit is closed by the depression of trip bar 51, the circuit which controls the transfer of pins from the storage magazine 143, 144, to the pin setter is completed, whereupon the pin transfer T removes a full set of pins, usually ten, from the magazine, transfers them to the pin setter, shown diagrammatically in Fig. 1, and as the switch 166 in the circuit, which controls the pin elevating mechanism in chamber C, is closed, as shown in Fig. 17, the pit elevator mechanism is temporarily stopped and remains that way until the storage magazine has again been filled with a predetermined number of pins awaiting transfer to the pin setter. In the embodiment shown, the storage magazine will hold ten pins in side by side relation with an eleventh pin located at the entrance to the magazine. If less than the minimum number of pins has been fed to the magazine, the conveyors 101 and 141 will remain active to completely fill the magazine and the transfer T cannot be operated even though a ball has engaged trip bar 51 and closed that part of the circuit running through the elevator E.

The removal of pins from the magazine 143, 144 by transfer T may be utilized as a means for re-instituting the operation of the pin elevating and magazine infeed mechanism to re-fill the magazine. As shown in Figs. 11 to 16, inclusive, the last pin in the magazine, as it is removed therefrom by the transfer T, engages an arm 165 and effects the closure of a switch 166, which operates the pin elevating mechanism to close the circuit and starts the movement of pins upward from chamber C into the storage magazine to replace those just removed. Since it is desirable to remove pins from the magazine without interference of those about to enter therein, arm 165 has been so positioned that a set of pins will be removed clear of the magazine before the magazine infeed conveying mechanism is set into operation, otherwise a jam or improper feeding of pins might result, which would interrupt the normal operation of the machine.

Whenever a ball is present in the pit and the bar 51 is depressed to close the switch R, the circuit made thereby, which controls the pin transfer mechanism, operates to bring the power drive from the motor shaft 46 to shaft 43, and from there, by means of one revolution clutch K_2 of conventional design, to shaft 26 through the connections described above. It will be seen, therefore, that as cam 28 rotates, and as cam follower 27 travels in its designated cam track, cam lever 25 will rock about its pivot 24, whereupon gear segment 22 formed on the other arm of lever 23 will oscillate and set into motion gears 20 and 21 thereby rotating shaft 19 on which drums 17 and 18 are attached. In Fig. 1, the platform E is shown in full lines in its hoisted position and the rotation of the cable drums would, therefore, start the platform on its way down as the drums pay out the cables which suspend the platform.

In order to guide the platform in its vertical movements, and to prevent it from swinging or having any lateral motion on its cables 11, 12 and 13, vertical slots or tracks 53 are provided in each side frame of the machine; or if desired, these slots may be formed in separate members suitably attached to the side frames. Rollers 54 mounted upon each side and adjacent the rear of the platform, travel in slots 53 for the purpose above mentioned. As the platform E approaches its upper limits, prior to the ejection of balls and pins therefrom, rollers 54 engage stops 55 in slots 53 with the result that the rear hinged portion of platform E can no longer move upwardly so that as the drums continue winding up the ca-

bles, the rear cables 11, which pass over pulley 14 mounted on arms 56 pivoted on shaft 24 and held up by springs 57, cause the arms 56 to be swung a distance sufficient to compensate for the extra amount of cable the drums are winding as they bring the front portion of the platform to the proper inclination for the ejection of the pins and ball therefrom. The limits of upward movement of the front portion of the platform E are fixed by the lengths of cables 12 and 13, and the amount of movement of gear segment 22. Obviously, any other suitable travel limiting mechanism could be used.

The combined upward movement of cables 12, 13 after the engagement of rollers 54 with stops 55 causes the front plate of the platform E to be lifted, while the rear plate swings about rollers 54 as a pivot. In this manner the platform plates are moved from the position shown in dotted lines in Fig. 1 to that disclosed in full lines where they lie in substantially the same plane, inclined towards the pin elevating mechanism for ejection of pins and balls thereto either by positively actuated devices or by gravity.

In order to assist in the removal of pins from the platform E, a rake 58, which may take the form of a roller equal in length to the width of the platform, is mounted for movement relative to the platform. Roller 58 is provided with pins in each end which fit loosely in slots 59 formed either in the side frames of the machine or in plates fixed thereto. Through the coaction of roller 58 with slots 59, during the upward movement of the platform E, the roller is translated over the surface of the elevator at a suitable time to assist in the removal of balls and pins from the platform E.

The platform elevator E is raised every time a ball comes to rest thereon and depresses the trip 51 to operate switch S which controls the circuit in the motor M. At the uppermost limit of movement of the elevator E (see Fig. 1) the ball and pins, carried thereby, are discharged. The ball is deposited upon spaced rails 8, 9 extending across the rear and at right angles to the length of the alley and returned thereby to the player. Pins ejected from the elevator E fall in a more or less scrambled arrangement between rails 8, 9 onto plate 10, attached to slotted plate 81 and forming with wall 85 a chute compartment. Part of the pins fall directly into pin receiving chamber C and others which remain in the chute compartment must be propelled to a point adjacent an opening in wall 85 in order to be returned to storage by means of the conveyor in chamber C hereinafter described.

Pin chamber C consists of the frame walls 2 and 3, and two vertical plates or walls 85 and 88 which extend across the rear of the machine and are positioned transversely to the length of an alley. The width of this chamber is slightly greater than the maximum diameter of a bowling pin in order to make the machine adaptable for installation on existing alleys without requiring additional space, and also to assist in the most efficient handling of pins by conveyor 101. It will be seen, therefore, that the opening through which pins are introduced into the chamber C is not continued entirely across the machine because the wall 85 adjacent the vertical portion of conveyor 101, described hereinbelow, and the wall 88, which extends upwardly adjacent the vertical portion of the conveyor 101, limit the lateral movement of pins being raised by the elevator and help to prevent them from falling back into the chamber or into the chute compartment. Any pins remaining in the chute compartment are propelled by a conveyor which may be either continuous or intermittent, to a point adjacent the opening, whence they drop by gravity into the chamber C.

Conveyor 101 is provided, at suitable intervals, with flights 102 which engage and lift individual pins to a higher level whence they are ejected into a conveying system for transfer into the pin storage magazine.

In the embodiment shown in Figs. 1 and 2, the pin elevating conveyor upon which the pins are discharged by the chute compartment, consists of two endless chains 101 to which are attached a plurality of flights 102 by means of pins mounting at each end cam follower 103. Flights 102 serve to separate as well as convey pins from a scrambled heap in the chamber to the storage magazine feed mechanism. Chains 101 are trained around sprockets 104 mounted on shaft 106 suitably journalled in the machine frame, extend downwardly between walls 85 and 88, and pass over two sets of spaced sprockets 82 and 83 mounted in the lower portion of chamber C. As shown in Fig. 2, the active pin engaging portion of conveyor 101 has three, general paths of movement, namely, a horizontal part upon which the pins are dumped extending across a major portion of the chamber, a vertical section terminating at a point of discharge adjacent the storage magazine unit, and a curved portion connecting the horizontal and vertical sections. The conveyor is constrained to operate along these paths because of the provision of guides 105, which may take the form of two spaced rods upon which followers 103 travel, fixed to side frames 3 at their lower ends and suitably attached to the frame of the machine at their upper ends adjacent the vertical limits of the conveyor. Referring to Fig. 2, it will be seen that the conveyor lies in a plane transversely of the pit so that the space needed is only substantially that of the width of the pins, that is, a width slightly greater than the maximum diameter of a pin. In this manner the return run of conveyor 101 does not require any additional space since it extends laterally of the length of the bowling alley or at right angles thereto and it is, therefore, possible to locate the lower or horizontal portion of this conveyor in the limited space back of the bumper.

Suitably supported between the chamber forming plates 85 and 88 and at a distance from the vertical portion of the conveyor 101 slightly greater than the maximum diameter of a pin, is an elongated plate 89 having its lower end 91 flaring downwardly away from the path of travel of the conveyor, and its upper end provided with a curved portion 92 over which pins move as they are discharged from the flights 102 of conveyor 101 into the pin feeding mechanism 141, 142 of the storage unit. In order to eliminate any lateral movement of the flights 102, due to looseness of chains 101, which might allow the pins to drop away from the flights 102 before they are discharged therefrom, there is provided a plate 90 which forms the necessary back support for the flights 102. Plate 90 also prevents pins from slipping down between the chains 101 as they travel upward in engagement with flights 102. The downward flaring portion 91 of plate 89 assists in the proper arrangement of pins on flights 102 so that if more than one pin were being raised toward the channel formed by the

side walls 85 and 88 and plates 89 and 90, they would be directed away from the pin located on a particular flight and redirected downwardly into the chamber for further handling. Guides 105 are formed with curved portions adjacent the point of pin discharge from the conveyor and assist in directing pins from the flights 102 into the pin feeding mechanism of the storage unit. If desired, other separate pin directing members can be used. Each pin entering the feed mechanism is rectified or positioned in the conveyor mechanism, hereinafter described, with butts extending upwardly and head portions projecting downwardly.

In the operation of the conveyor, just described, the pins which lie more or less in a heap on the substantially horizontal portion thereof, are confined between the walls 85 and 88 so that they are constrained to lie with their longitudinal axis approximately in the same plane, due to the fact that the walls are spaced a distance only slightly greater than the maximum diameter of a pin. The pins, therefore, are carried forward upon a progressively increasing inclination by flights 102. When they reach a point in which the pins have a large vertical component, the overlying pins slide back into the chamber over the underlying pins which are closely adjacent the conveyor and which are engaged by flights 102. The vertical component increases because of the continued upward movement of the conveyor, so that all of the underlying pins, except those which are actually adjacent the conveyor and engaged by flights 102, are rejected and deflected downwardly for return to the mass of pins in the chamber C for further handling by successive flights 102. The greatest inclination of the elevating conveyor 101 is such that the pin adjacent thereto will not quite fall back but any other pins will.

In actual practice this arrangement has proved to be a reliable, efficient and positive method of separating pins from even the most tangled masses of pins, especially in those cases where the necks of pins are jammed together and present a serious problem in effecting their release for subsequent transportation to the storage unit. As mentioned previously, the upper portion of the conveyor, which is substantially vertical, carries the pins upwardly through a narrow passageway at the upper end of which the pins are delivered, rectified or turned butt end upward and transferred to a storage magazine.

Twin sprocket 104 (Figs. 1, 2 and 3) is attached to one end of a shaft 106 which runs in a bearing 107. The other end of shaft 106 has a sprocket 108 which is connected to a sprocket 109 by a chain 110. Sprocket 109 is attached to one end of a shaft 111 which runs in a bearing 112. At the other end of shaft 111 is attached a bevel gear 113 which meshes with another bevel gear 114 on one end of a shaft 115. At the other end of shaft 115 is attached a sprocket 116 which is connected by a chain 117 to a sprocket 118 on motor shaft 46. By means of clutch K_1 and solenoid S_1 shaft 115 is maintained in operation until a predetermined number of pins has been fed into the storage magazine 143, 144. Whereupon, by control devices described hereinafter, solenoid S_1 is energized to throw out clutch K_1 and stop the rotation of shaft 115. Clutch K_1 may be of any conventional kind, such for instance as a so-called Bliss type.

Another sprocket 76 on motor shaft 46 is connected by a chain 119 to a sprocket 120 on one end of a shaft 121. At the other end of shaft 121 is a bevel gear 122 which meshes with the bevel gear 123 attached to one end of shaft 124 running in bearing 125. Attached to the other end of shaft 124 are sprockets 126 over which are trained endless chains 127 placed to run horizontally above slotted plate 81 between the sprockets 126 and idler sprockets 128. A plurality of flights 129 are secured at suitable intervals to chains 127 and perform the dual functions of clearing the chute of any pins which may remain therein after their discharge from the pit elevator and prevent these pins from interfering with the progress of a bowling ball along its return runway.

A sprocket 130 attached to shaft 111 (Figs. 1, 2 and 3) is connected by means of a chain 131 to sprocket 132 secured to an end of shaft 133. The other end of shaft 133 has attached thereto a beveled gear 134 adapted to mesh with a beveled gear 134a fast on shaft 135. Also attached to shaft 135 is a bevel gear 136 meshing with a bevel gear 137 secured to shaft 138. A grooved pulley 139 carried by shaft 138 is connected to a free running pulley 140 by means of an endless belt 141. This belt forms the main conveyor member of the pin storage unit in said mechanism and cooperates with a stationary guide rail 142 (Figs. 3, 4 and 5), which is supported parallel to the belt 141 at a distance less than the maximum diameter of a pin and curves around the driving end of the conveyor belt 142 concentric with pulley 139. It will be seen, therefore, that rail 142 forms with conveyor belt 141 a substantially continuous guide from the point where pins are first discharged from the flights 102 of conveyor 101 between spaced guide plates 267, 268 until they enter the storage magazine formed by spaced forwarding members 143, 144. Due to the spacing of relatively movable members 141 and 142 of the pin infeed mechanism and the cooperation of the curved portion 84 of rail 142 with pulley 139 and spaced members 143 and 144, pins are positioned therebetween with their butts extending upwardly fed in a straight line without interference around curved portion 84 and into the storage magazine where they are positioned upon members 143 and 144 in side by side contacting relation pending the removal therefrom of a definite number of pins. Worms 143 and 144 are rotated in the direction indicated by arrows by means of chain 77. This chain is driven by a sprocket 145 on shaft 135 and runs over sprockets 146 and 147 fixed to shafts 143 and 144, respectively.

The "head end" of the first pin of each set fed into the magazine will engage a block 78 providing a stop therefor. A hinged lever 79 operates in a similar manner to interrupt the movement of the "butt end" of the pin. These stops assist the pins in assembling in the magazine in an upright or substantially vertical position. Lever 79 is held down by a light spring 80 which allows it to swing away as the pin adjacent thereto is being lifted out from between the spiral members 143, 144 for transfer to the pin setter, as shown in dotted lines in Fig. 4. While pins are entering the magazine, lever 79 is pushed upward by the pressure of the incoming pins and spring 80 exerts a force to restore it to its substantially horizontal position. In this manner the lever 79 also plays a part in maintaining the vertical position of the pins.

Belt 141 and rail 142, which form the relatively movable elements of the pin storage in said

mechanism, lie in a plane somewhat above that in which the storage magazine members 143 and 144 are located so that as the pins leave the infeed conveyor mechanism and travel through the curved path formed by pulley 139, and rail portion 84, they gradually descend from the higher level of the conveyor mechanism to the lower level of the pin storage, as shown in Fig. 4.

In order to control the operation of the storage mechanism and the pin transfer which conveys the desired number of pins from the storage magazine to the pin setter, I have provided a device which will stop the pin elevating mechanism 101 and prevent it from raising pins from the pin receiving chamber C, when the pin storage magazine contains its allotted number of pins. Mechanism has also been provided for absolutely preventing operation of the transfer T whenever an insufficient number of pins are present in the storage magazine. In this manner it is practically impossible to cause jams of pins in the machine, or to feed an improper number of pins to the setter. The pin elevating conveyor 101, and infeed mechanism 141, 142 are thrown out of operation every time the pin storage magazine formed by members 143, 144 is filled.

A suitable device for performing the above mentioned operation may take the form of that shown in Figs. 11 to 16, inclusive, in which there is shown a member assuming the form of a ten-point star wheel 148 mounted for rotation on a pin 149 fixed in a bracket 150 attaached to the frame of the machine near the point where the pins enter the pin storage magazine (see Figs. 11 and 12).

A lever 151, pivotally mounted on pin 152, in bracket 150, carries at one end thereof a pawl 153, held in contact with the star wheel 148 by spring 154. The other end of lever 151 constitutes a counting finger 87 and is suitably shaped and so located on the machine that it projects into the path of pins as they round the curve 84 prior to entering the magazine.

Every time a pin passes the finger 87, it swings lever 151 an amount sufficient to rotate the star wheel 148 one-tenth of a turn as pawl 153 brings up against a tooth in the star wheel.

A spring 155 urges lever 151 back in position for pawl 153 to engage the next tooth on the star wheel and gives it another one-tenth of a turn as the next pin engages finger 87 of lever 151. A pawl 156, pivoted at 157 and tensioned by a spring 158 keeps any drag of pawl 153 from moving the star wheel backwards, on the return swing of lever 151, so as to prevent entry of pawl 153 in the next space on the star wheel.

The star wheel 148 is so set that when ten pins are in the pin storage and the next pin engages finger 87, it gives the star wheel another one-tenth of a turn. A leaf spring 159, which is attached to the underside of the star wheel, will impinge on a pin 160 of a switch lever 161 and, as the star wheel turns, the spring 159 will cause the switch lever 161 to swing on its pivot 162 until the end of slot 163 bears against a stop pin 164 mounted in an arm 168 of bracket 150.

When the switch lever 161 is in this position, a control rod 165 (Figs. 11 and 12) adjustably attached to the upper end of the switch lever 161, is positioned in the path of one of a set of pins to be transferred from the pin storage and moved to the pin setter, so that in the actual transfer of ten pins by the transfer T to the setter, that pin will engage the control rod 165, press against it, and cause the lever 161 to be swung back to its original position, the leaf spring 159 having passed beyond its engagement with pin 160.

In the counting and control mechanism, just described, electrically operated mechanism is responsible for the several control effects. However, if desired, any other suitable type of mechanism could be used, such for instance as, mechanical devices. In the form shown, I utilize two mercury switches 166 and 167, which are mounted on switch lever 161. Switch 166 controls the circuit of the pin elevating mechanism and switch 167 is responsible for the timely energization of the circuit which operates the pit elevating and pin transfer mechanism T.

Up to the time that the eleventh pin has been brought by conveyor 141 against the detector finger 87 of lever 151, the control circuit of the pin elevating mechanism, which controls the movement of pins from the chamber C to the storage magazine transfer, through mercury switch 166, has been closed, and the circuit for the pit elevating and pin transfer mechanism through mercury switch 167 has been opened, but when lever 151 acted on by the eleventh pin rotates the star wheel 148, it swings the switch lever 161 over sufficiently to reverse the relative circuit control positions of the switches 166 and 167 in order to open the circuit of the pin elevating mechanism and close that of the pit elevating and pin transfer mechanism. The pin elevating and infeed conveyor mechanism 101 and 140, is thus stopped and, if a set of pins are needed in the setter W, the pit transfer mechanism T begins its operations, descends to engage a set of pins in the storage, lifts it out and proceeds to pin setter W, which is provided with a plurality of setter elements W, shown diagrammatically in Fig. 1. This device may be of the type shown and described in co-pending application, Serial No. 204,995 for Pin setting apparatus for bowling alleys, filed April 27, 1938, by Gottfried J. Schmidt. As the pins begin their movement to the pin setter, the one nearest the rod 165 (as shown in dotted lines in Figs. 11 and 12) effects a repositioning of switches 166, 167 and sets the latter to close the circuit through solenoid S_1 for re-instituting the operation of the pin elevating mechanism at the proper time for refilling the pin storage.

The pin transfer mechanism is driven from shaft 38 on which are mounted two cams 211 and 212. Shaft 38 is connected by sprockets, chains and a one-revolution clutch K similar to clutch K_2 controlled by solenoid S to the motor shaft 46. A roller 213 on cam lever 214 rides on cam 211. Cam lever 214 is part of a bell-crank 215, which is secured to a shaft 216. A similar bell-crank 217, (Figs. 6 and 7) without a cam lever, is secured to the opposite end of shaft 216. Another bell crank 218 is pivoted in a bearing 219 on the right side of the machine and a similar bell-crank 220 is pivoted in bearing 221 on the left side frame. The two bell-cranks 214 and 218 are connected by a rod 222 and the two bell-cranks 217 and 220 are connected by a rod 223. From the outer ends 224 and 225 of bell cranks 215 and 217 and from the ends 226 and 227 of bell-cranks 217 and 220, the pin transfer frame T is suspended.

As cam 211 turns with shaft 38, in the direction indicated by arrows in Figs. 1 and 7, the follower 213, on cam lever 214, tracks the surface of cam 211 and causes the bell-crank 215 to swing with shaft 216. As bell-cranks 215 and 217 are connected by rod 222 and, as bell-cranks 217 and

220 are connected by rod 223, all bell-cranks mentioned are swung in unison and as a result the pin transfer frame T will be lowered to the position shown in dotted lines, Fig. 1 and in full lines in Fig. 7. This occurs while the follower 213 travels upon the "low" portion of cam 211, but as the follower 213 starts to travel up the "high" portion of cam 211 the direction of movement of levers 215 and 217 will be reversed and the transfer frame T will be lifted back to its former position.

The transfer frame in the embodiment illustrated has a plurality of movements in transporting a set of pins from the storage to their respective places in the pin setter. When suitable control members have communicated the need of pins the frame is lowered, whereupon the sets of pin transferring members 228 which have been poised above the pins aligned in storage move into engagement with the pins, which are gripped securely, the frame is given a vertical movement, the pins are lifted out of the storage magazine, or from between members 143, 144, and held suspended for translation to the pin setter.

The translation of the pins from a point just above the spiral storage magazine shafts 143 and 144 to a predetermined position above the pin setter is accomplished by cam 212 on shaft 38 with which coacts a cam follower 229 fixed to lever 230, pivotally mounted on shaft 34 and provided with a gear segment 231 at its free end meshing with a gear 232 loosely mounted on shaft 216. A sprocket 233 secured to gear 232 is connected by means of chain 234 to a sprocket 235 on shaft 236 which is journalled in bearings 237 and 238 as well as in bars 224 and 226 (Figs. 6 and 7). Cam follower 229 and its supporting lever are in "dwell" sector while cam 211 is causing the transfer frame to be lowered and then raised with the pins held by the gripper units 228. As the follower 229 starts to climb on cam 212, it imparts a swinging motion to segment lever 230 about its pivot on shaft 34 and causes the gear segment 231 thereof meshing with gear 232 to rotate shaft 236 upon which are mounted in spaced relation ten gears 239, each of which engages with one of ten gears 240 mounted on short shafts 241, each of which shafts is provided with a sprocket 242. A bearing 243 is interposed between each gear and sprocket. Adjustably mounted upon the transfer frame T are a plurality of pivotally mounted plates 246 (see Figs. 6 and 7), each of which is provided with a short shaft 248 on which is mounted an idler sprocket 245. Ten chains 244 connect the ten sprockets 242 with the idler sprocket 245.

Referring to Fig. 6, which shows in dotted lines the relative positions to be occupied by a set of pins, are numbered 1, 2, 3, 4, etc., it will be observed that certain of the gripper units transporting pins from the storage magazine travel relatively short distances, while others move somewhat farther. When the pins are procured from the storage magazine, all gripper units are in substantial alignment, but in the translation of pins they are moved for a given period of time or one revolution of shaft 236 so that they all arrive at their given positions directly over the pin receiving means numbered 1, 2, etc., (Fig. 6). In order to accomplish this distribution of the pins, gears 239 and 240 are provided with varying numbers of teeth so that when shaft 236 is rotated there will be a plurality of differential motions between the several gripper units 228. Those moving to cups 7 to 10, inclusive, will travel more rapidly than those moving to cups 4, 5 and 6, or 1, 2 and 3, as the case may be. All the gripper units arrive at their delivery positions at the same time however.

When the ten gripper carriages with their respective pins are positioned over the pin setter, roller 229 engages a "dwell" section on cam 212 and roller 213 enters a dip portion of cam 211, causing the transfer frame with the ten pins to be lowered and to deposit the pins in the pin setter. Roller 213 then starts to climb on roller 211 and the transfer frame will rise leaving the pins in the pin setter. As the roller 229 engages the dip portion of cam 212, lever 215 swings in the opposite direction and the empty gripper units 228 are returned to their substantially aligned portions at the end of the transfer rail ready to pick up another set of pins.

In the embodiment illustrated, the bars 247 converge somewhat at their outer or pin delivery ends in order to allow for the proper positioning of pins in the pin setter (see Fig. 6). This arrangement and the differential movement of the gripper units 228 eliminate any interference between pins as they are translated to the delivery points, 1 to 10, inclusive.

A reference to Figs. 6 and 7 will show that the frame T may be constructed of longitudinal bars 250, suitably connected as by means of clamp sleeves 251 to cross bars 252. The convergent arrangement of bars 247 may be obtained by mounting them on brackets 253 fixed to cross bars 252 of the frame and so positioned on the cross bars that the outer ends of bars 247 extend generally over the position each pin is to take in the pin setter. Each of the brackets 246 is pivotally mounted on bars 247 and provided with a set screw 249 in order to control the slack in chains 244.

Figures 7, 8, 9 and 10 show the detail construction of a suitable pin transfer unit, designated generally 228. Each unit comprises spaced side plates 254 which are suitably connected as by bolting or welding cross plates 256. If desired, the side or cross plates, which form the supporting head of the pin gripping unit carriages, may be cast or otherwise formed as a single member. Fastened to the side plates 254 by screws 257 are pin locating members 258, which in the illustrated embodiment are made of spring steel and are so arranged with an outwardly flaring free end that if, as the pin gripper unit 228 is moved downwardly towards the row of pins in the storage magazine, any pin is not standing exactly vertical therein it will be shifted to that position by the engagement of the spaced members 258 with opposite sides of the butt end of the pin. Fixed to plates 256 are the gripper fingers, shown in detail in Figs. 8, 9 and 10. These consist of spring members 259 secured to the end plates 256 by means of screws 260. Suitably mounted upon the ends of the spring fingers 259 is a U-shaped member curved more or less to fit its arms 261 about the belly portion of a pin. If desired, fingers 259 and arms 261 can be formed as integral members. Mounted on the ends of each of these arms are pads 262, made of rubber or other suitable friction materials, which assist the gripper unit to firmly hold each pin during its transfer from the storage magazine to the pin setter. It will be seen, therefore, that whenever the pin transfer moves downwardly to acquire a set of pins from the storage magazine, each pin will be properly located in the unit by means of locators 258, and then firmly gripped therein by means of

gripper fingers 259 and the spaced arms 261 carried thereby. In order to give added rigidity to each spring finger 259, it is supported between two substantially non-yieldable members 265 and 266 which are located one on either side of each of the spring fingers 259, and are secured therewith to the end plates 256.

The plates 254 which form upstanding side walls of the carriage portion of each gripper 225, is provided with two spaced rollers 263 which engage the top edge of bars 247 and a lower roller 264 which engages the bottom edge thereof. The carriages are translated to and from pin receiving and pin transferring positions by means of sprocket chains 244, hereabove described, which are connected to one of the plates 254 by means of pins 255 (see Figs. 8 and 9).

In Figs. 18, 19 and 20 there is shown mechanism which is used for preventing balls from leaving the bowling alley along the runway 8, 9 and for making it relatively impossible for pins to be projected out of the machine through the apertures formed in the side frames of the machine for allowing balls to be returned to a player. In the drawings, there are shown two machines arranged side by side, and provided with ball return runway rails 8, 9 which extend from side frame 3 of one machine to and through the adjacent machine and out of an opening in the side frame 2 back to a position adjacent a player, not shown. The device which is instrumental in preventing a ball from leaving the alley until the proper time, consists of a movable member which may be displaced to and from aperture closing position in any suitable manner. In the embodiment shown, this member consists of a plate 311 mounted upon a lever 313 pivoted at 312 on a stud mounted in a side frame of the machine adjacent the aperture through which the ball return runways 8, 9, project either from one machine to another or from one machine back to the player. Lever 313 is provided with a cam follower 314. A spring 315 normally urges the plate 311 away from aperture closing position. Inasmuch as the proper time for the plate 311 to be moved into its operative position is that when pins and balls are being discharged from elevator E, means have been provided in the form of a cam plate 316 mounted upon elevator E and arranged to engage cam follower 314 during the upward movement of the elevator so that as the elevator E approaches pin and ball discharging position, cam follower 314 will be engaged by cam plate 316 carried by the elevator and lever 313 will be rocked on its pivot 312 whereupon plate 311 will move into its operative position and present an effective barrier against loss of pins from the machine and movement of the ball along its runway 8, 9. When elevator E is lowered spring 315 restores the plate 311 to its inoperative position.

Whenever two machines are arranged side by side, as shown in Figs. 18 and 19, it is proper to use two plates 311, one adjacent the aperture formed in each side wall of the adjoining machine. This is done in order to prevent balls and pins discharged from the elevator EE of the right-hand machine (shown in Fig. 18) from interfering with the operation of the left-hand machine. In this manner, when elevator EE rises, cooperation between cam followers 314 and 316 will cause plate 311 to move into aperture closing position and prevent the movement of a ball along runway 8, 9 into the machine and alley, and so also if the left-hand elevator E, as it comes in contact with elevator EE occupies its position, both plates 311 adjacent the center line of the installation of two machines will be inoperative or "aperture closing" position. Due to this arrangement, it is relatively impossible for two balls to strike together and form nicks or low places therein or for pins to jump from one alley to another prior to their distribution in their respective storage units.

In Figs. 21 to 26, inclusive, each show an alternative device for transporting pins, after they have been received in the pin receiving chamber C to the storage unit. As the pins are discharged from the pin elevator E, some may remain in the chute compartment formed by members 168 and 85, while others fall through the opening formed in wall 85 directly into the pin receiving chamber whence they are deposited either on conveyor 351 or upon conveyors 152 and 153. Conveyor 127 shown in Fig. 21 is identical in construction and function with that shown in Fig. 1 and is continuously driven, but could be run intermittently. Pins which land on the conveyor 351 are fed thereby between a pair of revolving, elongated, spiral members 352 and 353 which rotate in opposite directions, as indicated by arrows in Fig. 26. These members are right hand and left hand spirals, respectively. Pins which are supported thereon will be transported head end downwardly in a generally horizontal direction towards a substantially vertical chain conveyor 369 provided with a plurality of spaced flights 372 which carry the pins upward to a point where they are ejected into a storage unit conveyor system identical with that previously described.

Conveyor 351 in the illustrated embodiment consists of an endless belt driven by a drum 354 on a shaft 355. A beveled gear 356 on shaft 355 meshes with a bevel gear 357 on a shaft 358 and a sprocket 359 on shaft 358 which is connected by a chain 360 to a sprocket 361 on shaft 121. Conveyor 351 runs over a drum 362 on a shaft 363 which at its outer ends is provided with beveled gears 364 and 365 meshing with beveled gears 366 and 367, respectively, on the shafts of conveyor members 352 and 353, respectively.

The two spaced chains 369 which comprise the vertical conveyor for lifting pins from the worms 352, 353 are trained about twin sprockets 370 and 371 suitably mounted in the machine, one beneath the worm members 352 and 353 and one pair adjacent the discharge position of the vertical conveyor. The upper sprockets 370 mounted on shaft 106 are driven by means of sprockets 108 through the same chain of sprockets and gears shown in Figs. 1 and 2 and described hereinabove. The flights 372 which raise the pins from between the horizontal forwarding members 352 and 353 for discharge into the pin conveying system of the storage magazine unit are so placed that adequate room is allowed for lifting each pin without any jamming or damage thereto.

As in the construction shown in Fig. 1, a vertical plate 368 (Fig. 21) is located in a plane substantially paralleling the vertical conveyor and at a distance spaced therefrom slightly greater than the maximum diameter of a pin so that each pin is properly positioned and held on a conveyor flight 372. Plate 368 is provided with outwardly flaring portions adjacent its lower end in order to control the introduction of pins into the passageway formed by the conveyor chains, the vertical plate 368 and side walls 85 and 86, and its upper end is curved in order to assist the curved bars 374 positioned at the point of discharge of the

conveyor in transferring pins from the flights 372 through curved guide plates 375 onto conveying members 141 and 142 of the storage magazine pin feeding mechanism. Plates 373 and rods 374 (as shown in Fig. 21) may be mounted upon guide member 375 suitably secured between side walls 85 and 88 by screws or rivets. Guide 375 acts in a manner similar to plate 369 and prevents lateral movement of the flights 372 away from the pins carried thereby in the vertical transfer of pins so that they cannot drop back into the pin receiving chamber.

While in Figs. 21 and 22, I have shown wall 85 extending upwardly adjacent conveyor 127 and forming a part of the vertical pin passageway, it is to be understood that if desired, this wall could be cut away, and all but that portion forming the passageway in which moves the conveyor 127 with its pin propelling flights 129, which could be eliminated. So also the conveyor 351 might be dispensed with and the forwarding members 352 and 353 extended completely across the chamber C. At any rate, these members should be so spaced that pins deposited in the chamber position themselves therebetween so that their head ends rock downwardly about an axis above the center of gravity thereof.

Figure 17 shows a schematic diagram illustrating the means for controlling the movements of the several pin handling devices described above. A ball B is shown resting on the pit elevator platform E, switch R is closed, and since switch 166 is also closed, solenoid S_1 is energized and clutch K_1 on shaft 115 is operative to drive shaft 115 through sprocket 116 and chain 117 (Figs. 1 and 2), thereby continuing the operation of the pin elevating and magazine infeed conveying mechanisms 101 and 141, to feed pins into the magazine 143, 144. When the latter has been filled, the last pin entering will engage arm 87 (Fig. 11) and cause lever 161 to rock from the dotted to full line position (Fig. 12) thereby opening the circuit of solenoid S_1 to throw out clutch K_1 and stop the drive of shaft 115, thus interrupting the operation of the pin elevating and magazine infeed conveyors. Substantially simultaneously with the de-energization of solenoid S_1, switch 167 is closed and through the energization of solenoid S_2, clutch K_2 on shaft 43 is thrown into engagement and the drive from shaft 46 is transmitted through shafts 43, 34 and 31 to shaft 26 and, as hereinabove described, the rotation of shaft 26 causes the elevator E to be raised and lowered. Shaft 43 through clutch K_2 makes one complete revolution and stops so that shaft 26 is also driven through a single revolution for each ball B coming to rest upon pit elevator E.

The solenoid S, which controls the clutch K on shaft 38 will not operate to throw this clutch into engagement until the need for pins is communicated to the solenoid. This communication can be effected in any suitable manner, such for instance as by the use of mechanism somewhat similar to that shown in the Schmidt application, above referred to, and wherein there may be provided a switch U adapted to be closed by a contact mounted upon the pin setter table W, so that unless pins are to be fed to the pin setter W, solenoid S will remain inactive, and one revolution clutch K will not be connected to shaft 38 to rotate it through one revolution and effect the transfer of the number of pins required for playing from the magazine to the pin setter. When, however, a set of pins is to be transferred to the alley, solenoid S will be energized, shaft 38 will be driven, and through cams 211 and 212 on shaft 38, the pin transfer T will remove ten pins from the magazine and transfer them to the setter whereupon they are placed upon the alley in readiness for play. As previously described, the movement of a set of pins by transfer T from the magazine to the setter W causes switch 167 to open the circuit through solenoid S_2 and switch 166 to close the circuit through S_1, whereupon pin elevating conveyor and magazine infeed mechanism 101 and 140, respectively, recommence operating and refill the magazine with pins to take the place of those removed.

The invention above described may be varied in construction within the scope of the claims, for the particular device, selected to illustrate the invention, is but one of many possible concrete embodiments of the same. It is not, therefore, to be restricted to the precise details of the structure shown and described.

What is claimed is:

1. In a pin setting machine for bowling alleys, the combination with an alley and a pit adjacent one end thereof, of an elevator movable vertically into and out of said pit for transporting pins and balls to handling mechanism, said mechanism comprising a ball return, and a pin chamber comprising stationary wall members spaced apart a distance slightly in excess of the width of a pin located at the rear of said pit and extending at right angles across and within the lateral limits of said machine, a pin storage magazine, transfer means for moving pins into said storage magazine, a conveyor extending transversely of said machine located in said chamber for raising pins with their axes substantially vertical to said transfer means, means for assembling a plurality of pins in said magazine, and mechanism for removing a plurality of pins from said magazine for delivery to a pin setter.

2. In a pin setting machine for bowling alleys, the combination with an alley and a pit adjacent one end thereof, of an elevator movable vertically into and out of said pit for transporting pins and balls to handling mechanism, said mechanism comprising a pin chamber located at the rear of said pit and extending at right angles across said machine, said chamber comprising spaced substantially vertical stationary members spaced apart a distance slightly greater than the maximum diameter of a bowling pin, and constructed and arranged to receive pins discharged from said elevator, a ball return adjacent said chamber and projecting through an opening in said machine, a pin storage magazine, transfer means positioned at the top of said chamber and adjacent one end thereof for moving pins into said storage magazine, a conveyor located in said chamber for raising pins vertically between said stationary members to said transfer means, means for maintaining said pins in substantially vertical arrangement and assembling a plurality of pins in said magazine, mechanism for removing a plurality of pins from said magazine for delivery to a pin setter, and a device adjacent the side of said machine for preventing pins from falling through said opening out of the machine during their discharge from said elevator into said chamber, and controlling the movement of balls along said return and out of said machine.

3. In a pin setting machine for bowling alleys,

the combination with an alley and a pit adjacent one end thereof, of a ball return runway extending across said machine at right angles to said alley, spaced vertical walls located at the rear of said pit and forming a pin receiving chamber, a pin and ball elevating member positioned in said pit and movable vertically to discharge pins and balls into said chamber and onto said runway, a conveyor provided with a substantially horizontal pin receiving run and an upwardly curved substantially vertical run extending across said machine wholly within the lateral limits of said chamber, respectively, a pin storage unit, feeding devices for moving pins discharged from said conveyor into said unit, means for controlling the number of pins fed into said unit by said devices, and means for transferring a plurality of pins from said storage mechanism to a pin setter.

4. In a pin setting machine for bowling alleys, the combination with an alley and a pit adjacent one end thereof, of a pin receiving chamber positioned at the rear of said pit, a pin storage magazine, conveyor mechanism for transferring pins from said chamber to said magazine, means for operating said mechanism to feed a predetermined number of pins into said magazine, a transfer for gripping and lifting the number of pins required for playing from said magazine, and means set into operation by pin movement from said magazine for operating said conveyor mechanism to feed additional pins to said magazine.

5. In a pin setting machine for bowling alleys, the combination with an alley and a pit adjacent one end thereof, of a pin handling chamber comprising stationary spaced confining members extending transversely across said machine located at the rear of said pit, means for depositing pins in said chamber, pin storage conveying mechanism, transporting means located within and extending transversely of said chamber for conveying pins from said chamber to said mechanism, means for positioning pins butt ends upward in said mechanism, said means including spaced guides located adjacent the point of discharge of pins from said transporting means.

6. In a pin setting machine for bowling alleys, the combination with an alley and a pit adjacent one end thereof, of a pin handling chamber located at the rear of said pit and wholly within the transverse limits of said alley, and extending across said machine at right angles to the length of said alley, means for depositing pins in said chamber, and conveying means located in said chamber and extending transversely of and wholly within the lateral limits of said machine for elevating pins deposited therein, means mounting said conveyor so that it has a horizontal, a curved and a vertical path of movement, said means also being provided with members coacting with said conveyor for ejecting elevated pins from said conveyor and directing said ejected pins away therefrom.

7. In a pin setting machine for bowling alleys, a pin storage magazine comprising a pair of spaced, elongated, threaded members constructed and arranged to support a plurality of vertically positioned pins in an aligned series, conveyors for transferring pins to said magazine, a device cooperating with said conveyors to limit the number of pins entering said magazine, said device including pin counting mechanism, and control means coacting with said mechanism for terminating the movement of said conveyors when a predetermined number of pins has been fed into said magazine, a device for gripping and transferring pins from said magazine to a pin setter, and means controlled by the movement of pins from said magazine in said device for reinstituting the operation of said conveyors to refill said magazine.

8. In a pin setting machine for bowling alleys, a pin storage magazine comprising a pair of spaced, elongated, threaded members to align a plurality of vertically positioned pins therebetween, conveyors for transferring pins to said magazine, a device cooperating with said conveyor to limit the number of pins entering said magazine, said device including pin counting mechanism, and control means for terminating the movement of said conveyor when a predetermined number of pins has been fed into said magazine, a transfer unit for gripping and lifting said pins from said magazine for transfer to a pin setter, and means controlled by the movement of pins from said magazine for reinstituting the operation of said conveyor to feed additional pins to said magazine, said means including a lever and conveyor control elements mounted on said lever.

9. In a pin setting machine, the combination with a pin storage unit, of a pin magazine arranged to hold the number of pins required for playing, conveying means for transferring substantially vertically positioned pins in a single line to said magazine, mechanism for limiting the number of pins advanced by said conveyor to said magazine, a transfer having devices constructed and arranged for simultaneously holding and removing a plurality of said substantially vertically positioned pins from said magazine, and means for reinstituting the feed of additional pins to said magazine to replace those removed by said transfer, said means being provided with electrical controls which effect the operation of said pin transfer to lift pins from said magazine and set said conveying means into operation.

10. In a bowling pin transfer mechanism, means for arranging a set of pins in side by side position, devices for holding each of said pins, and positively actuated driving mechanism for imparting positive and differential movement to each of said devices to move said devices with pins held therein from said position to substantially triangular formation.

11. In a bowling pin setting machine, the combination with an alley and a pit adjacent one end thereof, of a pin and ball elevator in said pit constructed and arranged for simultaneously lifting all fallen pins from the pit after the throwing of a ball, a pin storage magazine provided with a pin entrance located above said pit, conveyors for feeding a predetermined number of vertically arranged pins through said entrance and into said magazine, means for stopping the operation of said conveyor, a transfer for moving a set of said pins from said magazine, trip mechanism arranged to be actuated by a bowling object, each as a bowling ball deposited on said elevator for instituting the operation of said transfer, elevator and conveyors, and means positioned adjacent said magazine entrance and operated only by pins entering said magazine for maintaining said transfer inoperative to move any pins from said magazine regardless of the operation of said trip, whenever less than the predetermined number of pins is present in said magazine.

12. In a bowling pin setting machine, the combination with a magazine arranged to hold a plu-

rality of pins upright in side by side contacting relation, of a transfer comprising a plurality of traveling pin holding members each constructed and arranged to hold and move with a pin for removing a predetermined number of pins from said magazine, ball actuated means for setting the transfer into operation to gather said pins, and means for incapacitating said transfer whenever less than the minimum number of pins is present in said magazine.

13. In a pin setting machine for bowling alleys, the combination with an alley, a pit adjacent one end of said alley, and a bumper positioned at the rear of said pit, of means for elevating pins and balls from said pit, a pin receiving chamber comprising spaced stationary walls spaced apart a distance greater than the maximum diameter of a bowling pin located behind said bumper, means for feeding pins discharged from said elevating means into said chamber, a conveyor provided with a plurality of pin elevating flights located within said chamber and operable to receive and raise pins therein to a point of discharge, means for restricting the conveyor to raise single pins to said point, a second conveyor located to receive pins raised by said first-named conveyor, means for inverting pins fed into said second-named conveyor and position them substantially vertically, a storage magazine, and means coacting with said feeding conveyor for assembling a limited number of substantially vertically positioned pins in said magazine.

14. In a pin setting machine for bowling alleys, the combination with an alley, a pit adjacent one end of said alley, and a bumper located at the rear of said pit, of a pin receiving chamber behind said bumper, said chamber comprising a pair of spaced walls spaced apart a distance slightly greater than the minimum diameter of a pin, an elevator movable vertically in front of said bumper to and from said pit for raising balls and pins therefrom, guard means preventing pins from falling from said elevator and dropping back of said bumper, a ball return having means associated therewith for guiding pins downwardly back of said bumper and into said chamber, a conveyor located within the limits of said chamber and crosswise with respect to the longitudinal axis of said alley for elevating pins from said chamber, conveying mechanism located at the point of discharge of pins from said elevating conveyor, a storage magazine provided with pin receiving members cooperating with said mechanism for receiving a predetermined number of pins therefrom, and means operative to simultaneously transfer a plurality of pins from said magazine into a setter.

15. In a pin setting machine for bowling alleys, the combination with an alley and a pit adjacent one end of said alley, and a bumper positioned at the rear of said pit, of a pin and ball elevator movable in front of said bumper to and from said pit, a pin receiving chamber positioned at the rear of said bumper, means for guiding pins lifted by said elevator and discharged from said elevator into said chamber, a conveyor in said chamber for raising pins fed thereto to a point of discharge, a pin storage unit including pin rectifying and feeding means positioned to receive pins elevated by said conveyor and arranging said pins with their longitudinal axes substantially vertical, said last named means comprising an abutment spaced from said conveyor and members spaced from said abutment and acting to direct pins over said abutment and into said pin feeding means.

16. In a bowling pin setting machine, an alley, a pit adjacent said alley, a bumper at the rear of said pit, a guard above said bumper, a pin gathering compartment located behind said bumper and extending across said machine approximately the width of said alley and provided with an opening, a pin receiving chamber located at the rear of said bumper and adapted to receive pins through said opening in said pin gathering compartment, means for discharging pins in any order into said gathering compartment, and other means in said compartment for effecting the introduction of pins tending to lodge in the compartment into said pin receiving chamber.

17. In a bowling pin setting machine, the combination with an alley, a pit adjacent said alley, and a bumper located at the rear of said pit, of a pin and ball elevator in said pit, means for raising and lowering said pin elevator to effect the transportation of balls and pins from said pit, a gathering device extending across said alley and provided with a pin discharge opening, a pin receiving chamber, and means for raising said elevator to discharge fallen pins therefrom into said device whereby they fall through said opening into said chamber.

18. In a bowling pin setting machine, the combination with an alley, a pit adjacent said alley, a bumper located at the rear of said pit, a pin and ball elevator in said pit, means for raising and lowering said pin elevator to effect the transportation of balls and pins from said pit, a gathering device extending across said alley and provided with an opening, a pin receiving chamber, means for raising said elevator to discharge fallen pins therefrom into said device whereby they fall from said opening into said chamber, and a conveyor in said device for propelling pins to said opening for positive introduction into said chamber.

19. In a bowling pin setting machine, the combination with a pin elevator movable to and from a pit for raising pins and balls to a distribution point, of a gathering device for said pins, said device having an opening, a chamber into which said pins are discharged from said gathering device, a conveyor located in said chamber and arranged with its path of travel transverse to the longitudinal axis of said machine, said conveyor having a substantially horizontal pin receiving portion extending across said chamber and a vertical portion, means for operating said conveyor to raise pins from said chamber to a point of discharge, and means set into operation by the arrival of a ball on said elevator for instituting the movement of said elevator and conveyor.

20. A pin setting mechanism for use in a bowling pin setting machine for a bowling alley having a pit comprising a chamber provided with spaced walls extending transversely of said machine at the rear of said pit, a transverse conveyor movably mounted in said chamber and provided with a plurality of flights along its length, a feed chute for inducting pins into said chamber and onto a portion of said conveyor, a pit elevator for simultaneously transferring all fallen pins from said pit into said chute, and means set into operation by the arrival of a ball on said elevator for operating said elevator to raise all of said fallen pins for substantially simultaneous discharge into said chute and to effect the movement of said conveyor.

21. In a bowling pin setting machine, the com-

bination with a storage magazine for pins, of a pin receiving chamber, a pin receiving chute located above said chamber, said chamber being provided with an opening through which pins are discharged into said chamber, and a conveyor movable in said chute for positively moving all pins tending to lodge out of said chute and towards said opening for discharge into said chamber.

22. In a bowling pin setting machine, the combination with a storage magazine for pins, of a pin receiving chamber, a chute located above said chamber, said chamber being provided with an opening through which pins are discharged from said chute into said chamber, an elevator for raising pins and balls from the pit of a bowling alley for projection into said chute, a conveyor operable in said chute for moving pins towards said opening for positive introduction into said chamber, and a ball return runway associated with said chute upon which said balls are delivered by said elevator.

23. In a bowling pin setting machine, the combination with a storage magazine for pins, of a pit, a pin receiving chamber located at the rear of said pit, a chute located above said chamber, said chamber being provided with an opening through which pins are discharged into said chamber, an elevator for raising pins and balls from said pit, a device for separating pins from the ball as the pins are discharged into said chute, whereby said pins may move through said opening into said chamber, and means for positively ejecting any pins remaining in said chute to said opening for delivery into said chamber.

24. A pin setting machine for bowling alleys, a pin receiving chamber comprising pin confining walls extending transversely across the rear portion of said machine, spaced apart a distance slightly greater than the maximum diameter of a bowling pin, one of said walls being provided with an opening, a transfer chute arranged to feed pins through said opening into said chamber, said transfer chute having associated therewith spaced rails forming a ball return runway, and a conveyor in said chamber for elevating pins to a point of discharge, said conveyor being constructed and arranged to extend transversely of said machine and have a portion thereof located beneath said opening for receiving pins falling between said rails.

25. A pin setting machine for bowling alleys, comprising a pin receiving chamber extending transversely across said machine at the rear thereof having a width slightly greater than the maximum diameter of a pin and provided with an opening, a transfer chute arranged to feed pins through said opening into said chamber, and a transversely positioned conveyor located in said chamber provided with a horizontal pin receiving portion located beneath said opening for elevating said pins to a point of discharge.

26. In a pin setting machine for bowling alleys, a pin receiving chamber comprising spaced wall members extending transversely across the rear of said machine, and positioned apart a distance slightly in excess of the maximum diameter of a pin, one of said members having an opening in one side, a transfer chute arranged to feed pins through said opening into said chamber, a conveyor provided with a plurality of flights located in said chamber and traveling transversely therein beneath said opening for elevating pins to a point of discharge, and means cooperating with said chamber for effecting the separation of pins deposited therein for transfer by said conveyor.

27. A pin setting machine for bowling alleys, comprising a conveyor mounted at right angles to the length of an alley, said conveyor being provided with a generally horizontal portion extending substantially across the rear and wholly within the transverse limits of said machine and an integral vertical section rising therefrom, pin engaging members carried by said conveyor, and means for preventing said members from lifting more than a single pin.

28. A pin setting machine for bowling alleys, comprising a conveyor mounted at right angles to the length of an alley, and at the rear thereof, said conveyor including a generally horizontal portion extending transversely across and wholly within the transverse limits of said machine and a vertical pin lifting section, pin lifting flights fixed to said conveyor, means for delivering a plurality of pins onto said horizontal portion of said conveyor, and means for preventing more than a single pin from being elevated by each flight.

29. A pin setting machine for bowling alleys, comprising a conveyor mounted at right angles to the length of an alley and at the rear thereof, said conveyor including a generally horizontal portion upon which one or more pins are deposited, and a vertical pin lifting section, pin lifting elements mounted on said conveyor at regular intervals, means for preventing said elements from raising more than one pin at a time, said means including an elongated plate paralleling the vertical section of said conveyor and located a distance therefrom slightly greater than the maximum diameter of a bowling pin, said plate being provided adjacent its lower end with a pin rejecting portion flaring downwardly and away from said conveyor.

30. In a pin setting machine for bowling alleys, the combination with a pin receiving chamber, of a conveyor located in said chamber and provided with a generally horizontal transverse portion extending at right angles to the longitudinal axis of said alley within the lateral limits of said chamber, said conveyor being provided with a curved portion becoming vertical at the point of discharge of said conveyor, means for depositing a plurality of pins in a heap on said conveyor, a plurality of pin engaging members mounted on said conveyor, said conveyor being so constructed and arranged that overlying pins of the heap are tumbled back by gravity into the chamber while underlying pins are elevated by said members.

31. A pin setting machine for bowling alleys, comprising a pin receiving chamber extending at right angles across the end of an alley, said chamber including a pair of walls spaced apart a distance slightly greater than the greatest diameter of a pin, a pin elevating conveyor mechanism mounted in and extending transversely across said chamber, means for projecting a plurality of pins upon said conveyor, and means for mounting said conveyor so that individual pins will be separated from a mass and advanced by said conveyor to a point of discharge.

32. In a pin setting machine for bowling alleys, the combination with an alley, a pit adjacent said alley, and a bumper located at the rear of said pit, of a pin receiving chamber positioned behind said bumper, said chamber comprising spaced walls extending transversely across said machine, and spaced apart a distance slightly in excess of the maximum diameter of a bowling pin, one of

said walls having an opening in one wall thereof, a pin transfer chute positioned above and rearwardly of said bumper and having one part thereof connecting with said opening and so arranged that some of the pins fed into the chute may fall by gravity into said chamber, means for elevating fallen pins and a ball from said pit for discharge of said pins to said chute and chamber, a return ball runway for separating pins from the ball, positively actuated means located in said chute for propelling pins tending to lodge therein to a point where they fall by gravity through said opening into said chamber, and means for elevating said pins in said chamber to a storage magazine.

33. A pin setting machine for a bowling alley having a bumper, comprising a pin receiving chamber for pins located back of said bumper and at right angles to and extending substantially across the end of an alley, said chamber being formed of walls spaced, substantially vertical and positioned apart a distance slightly greater than the maximum diameter of a bowling pin having an opening through one of said walls through which pins are projected into said chamber, a pin receiving chute positioned above said chamber and having a part thereof in communication with said opening, means for feeding pins over and downwardly back of said bumper into said chute whereby some of said pins fall by gravity into said chamber, means operative in said chute for positively propelling pins which have not fallen through said opening from said chute to a point where they drop into said chamber, a conveyor positioned in said chamber upon which said pins drop in a heap, said conveyor being provided with a plurality of flights and generally horizontal, curved and vertical traveling portions, and so constructed and arranged for coaction with said spaced walls that pins will be biased by gravity downwardly into the chamber until each flight has positioned thereon only a single pin arranged with its longitudinal axis extending substantially upright in the direction of travel of the conveyor.

34. A pin setting machine for bowling alleys, comprising a pin receiving chamber for pins located at right angles to and extending substantially across the end of an alley, said chamber having an opening through which pins are projected into said chamber, a pin receiving chute positioned above said chamber and having a part thereof in communication with said opening, means for feeding pins to said chute whereby some of said pins fall by gravity into said chamber, means operative in said chute for positively propelling pins which have not fallen through said opening to a point where they drop into said chamber, a conveyor positioned in said chamber upon which said pins drop as a mass, said conveyor being provided with a plurality of flights traveling along generally horizontal, curved and vertical portions, said conveyor being so constructed and arranged that pins are biased by gravity downwardly into the chamber until each flight has positioned thereon only a single pin arranged with its longitudinal axis extending substantially upright in the direction of travel of the conveyor, and means for maintaining each pin in a substantially vertical position during its upward movement to a point of discharge.

35. In a pin elevating mechanism for an automatic bowling alley pin setter, a pin storage magazine, conveying mechanism for elevating pins from a receiving point to said magazine, including a pair of spaced worms, means for rotating said worms in a single direction, means for feeding pins to said worms for translation therealong in upright position, a pin setter, a pin transfer for removing a plurality of pins from said magazine, said transfer including a plurality of positively actuated pin gripping and holding units, and positively actuated mechanism for moving said transfer and substantially simultaneously displacing said units on said transfer to deliver pins from said magazine to said setter.

36. In a pin setting machine for bowling alleys, comprising a pin receiving chamber extending at right angles across the end of an alley, said chamber including a pair of walls spaced apart a distance slightly greater than a maximum diameter of a pin, a pin storage device, mechanism for transferring pins from said chamber to said device, said device comprising a pair of elongated spaced threaded members, means for rotating said members in opposite directions to translate pins therealong in substantially upright position, and a conveyor located at substantially right angles with respect to said members for lifting pins substantially vertically positioned on said conveyor one by one from said chamber to said storage.

37. In a pin setting machine for bowling alleys, the combination with a transfer device, of a pin storage for supplying substantially vertically arranged pins to said device, means for delivering pins to said storage, a pin receiving chamber, means for depositing pins in said chamber, and pin transporting mechanism for moving pins from said chamber to said pin delivering means, comprising a pair of transverse spaced elongated pin forwarding members constructed and operative to position said pins in said substantially vertical arrangement, means for directing pins onto said members, means cooperating with said members for raising pins delivered thereto by said members to said delivering means, said pin directing means including a conveyor positioned above said members, and a chute for feeding pins onto said conveyor for delivery onto said members.

38. In a pin setting machine for bowling alleys, the combination with a transfer device, of a storage mechanism, means for feeding pins to said storage mechanism, a pin receiving chamber extending transversely across said machine, means for depositing pins in said chamber, conveyor mechanism for feeding pins from said chamber to said storage mechanism, said conveyor mechanism including a pair of spaced, elongated, rotating, threaded members, means for directing pins to said threaded members, means cooperating with said members for lifting individual pins to said storage, means for operating said transfer device to move a predetermined number of pins from said storage, and means set into operation during the movement of said pins from said storage for instituting the operation of said conveyor mechanism and said storage feed mechanism.

39. In a bowling pin setting machine, the combination with a storage magazine, and means for removing a predetermined number of pins from said magazine for transfer to a pin setter, of a bowling alley, a pit located adjacent one end of said alley, a pin receiving chamber located at the rear of said pit, a pit elevator movable to and from said pit for transferring balls and pins from said pit to said chamber, a conveyor located in said chamber and extending transversely

therein within the lateral limits of said conveyor for elevating pins from said chamber to said storage, said conveyor including spaced, rotating, elongated pin feeding members supporting said pins in upright position therebetween, a vertical conveyor having a series of pin engaging flights cooperating therewith, and means set into operation by the arrival of a ball on said pit elevator whenever a predetermined number of pins is present in said magazine for setting into operation said pit elevator and said conveyor.

40. In a pin setting machine for bowling alleys, the combination with a bowling alley, and a pit adjacent an end of said alley, of a pit elevator vertically movable in said pit, a pin receiving chamber located at the rear of said pit, a transfer chute located above and arranged to deposit pins into said chamber, means for discharging pins from said elevator into said chute, a pin storage mechanism, a conveyor in said chamber for raising pins to said mechanism, means for transferring a plurality of pins from said storage to a pin setter, and means set into operation by the arrival of a ball on said elevator whenever a predetermined number of pins is present in said mechanism for raising said elevator and for operating said conveyor to feed pins to said storage mechanism, and an auxiliary conveyor located in said chute for inducting said pins into said chamber.

41. In a bowling pin setting machine for a bowling alley, the combination with a storage magazine for holding the number of pins required for playing, of a rigid frame, a plurality of spaced carriages movably mounted on said frame, pin grippers carried by each of said carriages, and means for lowering and raising said frame and said carriages to cause said grippers to procure pins from said magazine, and positively actuated means for imparting differential movement to said carriages to deliver pins from said magazine into predetermined pin playing formation for delivery to the alley.

42. In a bowling pin setting machine, the combination with a bowling alley, a pit, and a bumper located at the rear of said pit, of means for raising said fallen pins and balls from said pit and discharging said pins and balls rearwardly over said bumper, means for separating a ball from said pins during said discharge from said last-named means and re-transporting said pins, said last-named means including a storage magazine, and mechanism for forwarding said pins to said storage magazine, a pin transfer for transferring the number of pins required for playing from said storage magazine to a pin setter, and means set into operation by the movement of said pins from said magazine for energizing said pin mechanism for feeding additional pins to said magazine.

43. In a bowling pin setter for a bowling alley, the combination with a pin transfer, of means for receiving a plurality of pins, an elevator in said means for raising said pins, a pin storage magazine, conveying devices positioned to transfer pins from said elevating conveyor, a storage magazine, adapted to receive said pins, counting mechanism for limiting the number of pins introduced in said magazine, means for interrupting the feed of pins to said magazine when a predetermined number has been positioned therein, a transfer device for gripping and moving the number of pins required for playing from said magazine and delivering them from the magazine into predetermined formation over the alley, means set into operation by the movement of pins from said magazine in said transfer for refilling said magazine, and means operated by the arrival of a ball in said pit whenever a predetermined number of pins is located in said magazine for effecting the delivery of a ball and pins from said pit.

44. In a pin setter for bowling alleys, the combination with a magazine for holding the number of pins required for playing and a plurality of pin setter elements, of a frame mounted above said magazine, a plurality of relatively movable pin holding devices mounted upon said frame, mechanism for lowering and raising said frame to cause said devices to engage and remove pins from said magazine, positively actuated mechanism for moving said devices to deliver pins held thereby from a position adjacent said magazine to a point above said pin setters, and means for lowering said frame to locate said pins held by said devices in said elements.

45. In a pin setter for bowling alleys, the combination with a magazine for holding the number of pins required for playing and a plurality of pin setter elements, of a frame mounted above said magazine, a plurality of relatively movable pin holding devices mounted upon said frame, mechanism for lowering and raising said frame to engage and lift pins from said magazine, means for translating said pins from said storage magazine to a point above said pin setter elements, means for lowering said frame to locate said pins in said elements, and means for preventing operation of said frame until a predetermined number of pins is positioned in said magazine.

46. In a pin setter for bowling alleys, the combination with a pin magazine, of a pin transfer device for transferring a plurality of pins from said magazine to said setter, said device including a frame, a plurality of differentially movable individual pin carriers mounted on said frame, means for lowering and raising said frame to remove pins from said magazine, and positively actuated mechanism for moving said carriers from a pin receiving position adjacent said magazine for transferring said pins to a point of delivery adjacent said setter.

47. In a pin setter for bowling alleys, the combination with a magazine for holding pins, said magazine being arranged to store at least the number of pins required for playing, of pin transfer mechanism positioned above said storage, said mechanism comprising a frame, a plurality of pin gripping elements carried by said frame, rails mounted on said frame supporting said elements for movement from a pin receiving position adjacent said magazine to a pin delivery station, means for lowering said frame to position said elements for gripping said pins in said magazine, means for raising and moving said frame to remove said pins from said magazine, and positively actuated means for imparting differential movements to said elements to cause the same to deliver pins to said station in predetermined formation over the alley.

48. In a pin setter for bowling alleys, the combination with a magazine for holding bowling pins, means for transporting a plurality of pins from said magazine to said setter, said means comprising a frame, rails of varying lengths forming part of said frame, one end of all of said rails lying in substantially the same vertical plane and with the other end of said rails having a generally convergent relationship, a plurality of pin gripper carriages movably mounted on said

rails, and means for driving said carriages with differential movements to translate pins from said magazine to said setter.

49. In a pin setter for bowling alleys, the combination with a magazine for holding bowling pins, of means for transporting a plurality of pins from said magazine to said pin setter, said means comprising a frame, rails of varying lengths attached to said frame, adjustably mounted brackets supported on said rails, sprockets carried by said brackets, a plurality of drive shafts carried by said frame, sprockets mounted on each of said shafts, chains trained over said sprockets, a plurality of pin grippers, carriages movable on several of said rails mounting said grippers, and driving means for imparting differential movement to each of said carriages to translate pins held by said grippers through different distances for deposition in said pin setter.

50. In a bowling pin setter for use in a bowling alley, the combination with a storage magazine for bowling pins, and a pin setter located above said alley, of mechanism for removing the number of pins required for playing from said magazine for transfer to said setter, said mechanism including a frame, a plurality of pin holding members mounted upon said frame, a supporting device for said frame, means for moving said device to raise and lower said frame to cause said members to grip said pins in said magazine and raise said frame to remove said pins held by said members therefrom, and means for translating said grippers in a substantially horizontal plane to position the pins held therein over said setter, and means for again lowering said frame to locate said pins for deposit in said setter.

51. In a pin setter for bowling alleys, the combination with a magazine for holding a plurality of pins, of a frame, a plurality of pin grippers carried by said frame, means mounting said grippers for differential translatory movements in said frame, means for lowering said frame with a parallel motion to grip said pins, means for raising said frame with a like motion, means for translating said gripping means, and means for lowering said frame to position pins in a pin setter.

52. In a pin setter for bowling alleys, the combination with a magazine for holding the number of pins required for playing, of a plurality of relatively movable pin holding devices, mechanism for imparting differential translatory movement to said devices to cause them to deliver pins held thereby from the magazine simultaneously into predetermined relative playing formation over the alley bed, means for replenishing the supply of pins taken from said magazine, and means set into operation by the movement of pins during their transfer for differential movement from said magazine for instituting the operation of said replenishing means.

53. In a bowling pin setting machine, the combination with a pin storage magazine adapted to hold a plurality of pins positioned vertically therein, of a conveyor for feeding pins to said magazine, means projecting into the path of movement of said pins closely adjacent said magazine for counting the pins entering the magazine, and mechanism controlled by said means for stopping the movement of said conveyor.

54. Pin transfer mechanism for bowling pin setting machines comprising a plurality of bowling pin supporting carriages individually and differentially movable to substantially triangular pin playing position, spaced grippers mounted on said carriages and constructed and arranged to engage curved portions of said pins while said pins are held in said grippers, and means associated with each of said carriages for positioning bowling pins in said grippers.

55. In a bowling pin transfer mechanism for moving a plurality of pins simultaneously from one point to another, the combination with a frame, and a plurality of spaced rails mounted on said frame, of a carriage slidably positioned on each of said rails, means for moving said carriage along said rails, and spaced pin gripping members carried by each of said carriages, said means for moving said carriages being provided with mechanism for positioning said carriages and pins held therein in substantially triangular pin playing formation relative to said frame.

56. In a bowling pin transfer mechanism for moving a plurality of pins simultaneously from one point to another, the combination with a frame, and a plurality of spaced rails mounted on said frame, of a carriage slidably positioned on each of said rails, means for positively moving said carriages along said rails to dispose the same in substantially triangular playing position, spaced pin gripping members carried by each of said carriages, means for moving said frame to locate said members in pin receiving position, and pin positioning members mounted on said carriages and arranged to position pins in said grippers.

57. In a bowling pin transfer mechanism for moving a plurality of pins simultaneously from one point to another, the combination with a frame, having a plurality of supports, of a carriage movably mounted on each of said supports, pin gripping members carried by each of said carriages, means for aligning said carriages at one end of said supports with respect to a plurality of pins arranged in side by side relation, means for moving said frame to cause said members to grip said pins, and means for imparting translatory movement to said carriages to move said pins from single line into substantially triangular formation.

58. In a bowling alley installation, the combination with a plurality of alleys, of a plurality of automatic pin setting machines positioned at the rear end of said alleys, a common ball runway extending transversely of said machines and positioned above each of said alleys, and means for controlling the passage of balls onto and along said runway from one machine to and through another.

59. In a pin setting machine for bowling alleys, a pin storage magazine comprising spaced elongated pin advancing and supporting members constructed and arranged to advance and assemble a predetermined number of bowling pins, means mounting said members above and substantially transverse to said alley, means located adjacent an end of said magazine proximate one of said members for controlling the number of pins fed into said magazine and along said members, and mechanism associated with said last-named means for interrupting the operation of said members whenever said predetermined number of pins has been assembled on said members.

60. In a pin setting machine for bowling alleys, the combination with an alley having a pin supporting bed and a pit located adjacent an end thereof, of a pin receiving station, mechanism for feeding pins from said pit and assembling them vertically at said station, individual pin holding means for holding individual pins for transfer

from said station to said alley bed, and driving means for effecting positive relative movement of said holding means to move said pin holding means longitudinally with respect to said alley bed away from said station and locate said pins in substantially triangular playing arrangement above said alley bed for delivery thereto.

61. In a pin setting machine for bowling alleys, the combination with an alley and a pit located adjacent an end thereof, of a pin storage magazine, conveying mechanism for transferring pins from said pit to said magazine, means for operating said mechanism to feed a predetermined number of pins to said magazine, a transfer device for removing the number of pins required for playing from said magazine, mechanism for operating said transfer device, and means coacting with said transfer device for preventing the feed of additional pins into said magazine until the number of pins required for playing has been moved clear of said magazine by said device.

62. In a pin setting machine for bowling alleys, the combination with an alley and a pit located adjacent an end thereof, of a pin magazine, mechanism for conveying pins from said pit to said magazine, means for interrupting the operation of said conveying mechanism whenever a predetermined number of pins has been fed into said magazine, a pin setter, a transfer for removing the number of pins required from said magazine and delivering them to said setter, and means for preventing the feed of additional pins to said magazine by said mechanism until said pins have been moved away from said magazine by said transfer.

63. In a bowling pin setting machine for a bowling alley provided with a pin supporting bed and a pit adjacent said bed, a pin storage magazine, a movable frame, a plurality of spaced movable pin holders mounted on said frame, a pin setter, means for moving said frame relative to said magazine and setter for positioning pins in said holders, and positively actuated means operated substantially simultaneously with the movement of said frame for effecting relative movement between said holders to move the same and pins held therein to substantially pin playing position for delivery to said setter.

64. In a bowling pin setting machine for use with a bowling alley provided with a pin supporting bed and a pit adjacent said bed, a pin receiving station, conveying mechanism for transferring pins from said pit to said station, a movable frame, a plurality of spaced relatively movable pin holders mounted on said frame, means for positioning said holders at said station to receive a set of pins, means for moving said frame relative to said station, and positively actuated means operated substantially simultaneously with the movement of said frames for effecting positive relative movement of said holders on said frame to dispose said holders and pins positioned therein in substantially triangular position above said bed.

65. In a bowling pin setting machine for a bowling alley provided with a pin supporting bed and a pit at the end of said bed, a main drive shaft, a clutch for said shaft, a pin storage magazine arranged to hold a supply of pins, means made operative by the arrival of a ball in said pit for operating said clutch to drive said shaft and set said machine in motion, a pin transfer constructed and arranged to remove a set of pins from said magazine, mechanism for conveying pins from said pit to said storage magazine, means for operating said conveying mechanism to feed a predetermined number of pins to said magazine, means for incapacitating said conveying mechanism when a predetermined number of pins has been delivered to said magazine, means for operating said transfer when a new set of pins is required on said alley bed to remove said pins from said magazine, means for rehabilitating said conveying mechanism after said pins have been removed from said magazine by said transfer to deliver additional pins to said magazine, and means for maintaining said conveying mechanism in operation and preventing said transfer from removing pins from said magazine until said predetermined number of pins is present in said magazine.

66. In a bowling pin setting machine for a bowling alley having a pin supporting bed and a pit adjacent an end of said bed, a drive shaft, an electric circuit, a pin storage supporting an aligned substantially horizontal row of upright pins, a pit elevator for removing fallen pins lying in said pit, a pin transfer having individual pin holding devices for holding and for removing a set of upright pins and conveying said upright pins from said storage over said bed for delivery thereto, a conveying mechanism coacting with said elevator for delivering pins removed from said pit by said elevator to said storage, and timed interconnected and cooperating devices controlling the operation of said machine, comprising an electric control in said circuit located in said pit actuated by the arrival of a ball therein to cause said shaft to drive said machine, an electric control in said circuit actuated in response to the need for a new set of pins on said bed for operating said transfer to remove a set of pins from said storage, and electric control means in said circuit associated with said storage operative in response to the removal of a set of pins from storage for causing said conveying mechanism to deliver additional pins to said storage.

67. In a bowling pin setting machine for a bowling alley having a pin supporting bed and a pit adjacent an end of said bed, a drive shaft, an electric circuit, a pin storage, a pit elevator for removing fallen pins lying in said pit, a pin transfer for removing a set of pins from said storage for delivery to said bed, a conveying mechanism coacting with said elevator for delivering pins removed from said pit by said elevator to said storage, and timed interconnected and cooperating devices controlling the operation of said machine comprising an electric control in said circuit located in said pit actuated by the arrival of a ball therein to cause said shaft to drive said machine, an electric control in said circuit actuated in response to the need for a new set of pins on said bed for operating said transfer to remove a set of pins from said storage, electric control means in said circuit operative in response to the removal of a set of pins from storage for causing said conveying mechanism to deliver additional pins to said storage, and other means in said circuit for preventing operation of said transfer and continuing the operation of said conveying mechanism until a predetermined number of pins has been fed to said storage.

68. In a bowling pin setting machine for a bowling alley having a pit at one end thereof, a bumper at the rear of the pit, and a pin receiving and distributing chamber at the rear of said bumper, means operative after the throwing of each ball for conveying all fallen pins from said pit to said chamber, a pin distributing conveyor located in said chamber, a pin delivery station, a pin transfer for moving a set of pins from said station for transfer to said alley, and means operative in response to the movement of a set of pins from said

station for operating said distributing conveyor to deliver pins from said chamber to said station.

69. In a bowling pin setting machine for a bowling alley provided with a pin supporting bed, a pit and a bumper at the rear of said pit, a pin receiving and distributing chamber located back of said bumper, a pin receiving and distributing conveyor located in said chamber, means operative after a ball has been thrown for conveying all fallen pins into said chamber, a pin storage magazine, a pin transfer for moving a set of pins from said magazine for delivery to said alley bed, means operative upon the arrival of a ball for setting said machine in operation, means for controlling the operation of said transfer to prevent movement of less than a full set of pins from said magazine when pins are needed on said alley, and means for operating said pin distributing conveyor to feed a predetermined number of pins to said magazine only after a full set of pins has been removed therefrom.

70. In a bowling pin transfer mechanism, means for arranging a set of pins in side by side position, devices for holding each of said pins, and driving mechanism for imparting positive and differential movement to said devices to move said devices with pins held therein from said position to substantially triangular formation.

71. In a bowling pin transfer mechanism for use in a machine for setting pins on a bowling alley having a pit at one end thereof, means for arranging a set of pins in side by side position above said pit, devices for holding each of said pins, and positively actuated driving mechanism for imparting positive movement to said devices to move said devices with pins held therein longitudinally of said alley from said position to substantially triangular formation above said alley.

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

73. In a bowling pin setting machine for a bowling alley provided with a pin supporting bed and a pit adjacent said bed, a pin receiving station, a movable frame mounted above said bed, a plurality of spaced movable pin holders mounted on said frame, a pin setter, means for moving said frame longitudinally of said machine relative to said station and setter for positioning pins in said holders, and positively driven means operative substantially simultaneously with the movement of said frame for effecting relative positive movement between said holders to move the same and pins held therein into substantially pin playing arrangement above said bed for delivery to said setter.

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

75. A bowling alley operating mechanism, comprising a pin conveyor, a pin aligning member constructed and arranged to position pins substantially vertically, means for receiving said substantially vertically positioned pins from said aligning member, a pin hoist including pin gripping devices operative to convey pins from said receiving means to a position above said alley, and means for stopping said conveyor when a predetermined number of vertically positioned pins are in said receiving means.

RUPERT E. RUNDELL.

CERTIFICATE OF CORRECTION.

Patent No. 2,388,707. November 13, 1945.

RUPERT E. RUNDELL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 11, second column, line 64, claim 11, for "each" read --such--; page 12, first column, line 71, claim 15, for "arranging" read --arrange--; page 15, second column, line 19, claim 44, for "setters" read --setter elements--; page 16, first column, line 31, claim 50, before the word "raise" insert --to--; page 17, first column, line 59, claim 64, for "frames" read --frame--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 5th day of March, A. D. 1946.

Leslie Frazer

(Seal) First Assistant Commissioner of Patents.

station for operating said distributing conveyor to deliver pins from said chamber to said station.

69. In a bowling pin setting machine for a bowling alley provided with a pin supporting bed, a pit and a bumper at the rear of said pit, a pin receiving and distributing chamber located back of said bumper, a pin receiving and distributing conveyor located in said chamber, means operative after a ball has been thrown for conveying all fallen pins into said chamber, a pin storage magazine, a pin transfer for moving a set of pins from said magazine for delivery to said alley bed, means operative upon the arrival of a ball for setting said machine in operation, means for controlling the operation of said transfer to prevent movement of less than a full set of pins from said magazine when pins are needed on said alley, and means for operating said pin distributing conveyor to feed a predetermined number of pins to said magazine only after a full set of pins has been removed therefrom.

70. In a bowling pin transfer mechanism, means for arranging a set of pins in side by side position, devices for holding each of said pins, and driving mechanism for imparting positive and differential movement to said devices to move said devices with pins held therein from said position to substantially triangular formation.

71. In a bowling pin transfer mechanism for use in a machine for setting pins on a bowling alley having a pit at one end thereof, means for arranging a set of pins in side by side position above said pit, devices for holding each of said pins, and positively actuated driving mechanism for imparting positive movement to said devices to move said devices with pins held therein longitudinally of said alley from said position to substantially triangular formation above said alley.

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

73. In a bowling pin setting machine for a bowling alley provided with a pin supporting bed and a pit adjacent said bed, a pin receiving station, a movable frame mounted above said bed, a plurality of spaced movable pin holders mounted on said frame, a pin setter, means for moving said frame longitudinally of said machine relative to said station and setter for positioning pins in said holders, and positively driven means operative substantially simultaneously with the movement of said frame for effecting relative positive movement between said holders to move the same and pins held therein into substantially pin playing arrangement above said bed for delivery to said setter.

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

75. A bowling alley operating mechanism, comprising a pin conveyor, a pin aligning member constructed and arranged to position pins substantially vertically, means for receiving said substantially vertically positioned pins from said aligning member, a pin hoist including pin gripping devices operative to convey pins from said receiving means to a position above said alley, and means for stopping said conveyor when a predetermined number of vertically positioned pins are in said receiving means.

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