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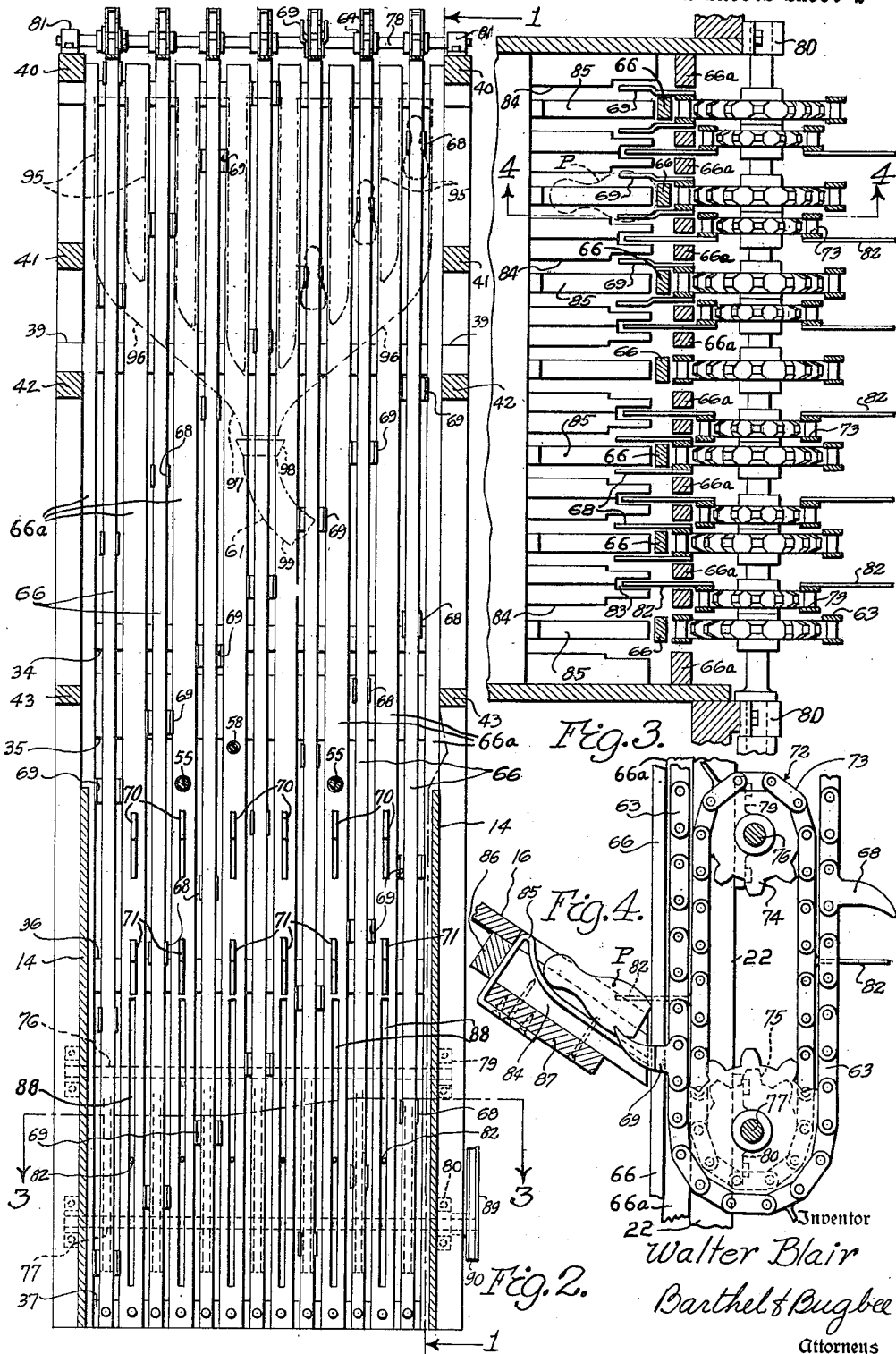
W. BLAIR

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BOWLING PIN ELEVATOR

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2 Sheets-Sheet 2



1

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BOWLING PIN ELEVATOR

Walter Blair, Detroit, Mich.

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8 Claims. (Cl. 273—43)

This invention relates to bowling pin setting machines, and, in particular, to pin orienting and elevating apparatus for such machines.

Heretofore, bowling pin elevators have been provided for conveying the bowling pins from the pit of the bowling alley to a distributor which in turn allocates the elevated pins either directly to a pin-setter or to a pin tray which so delivers them. Such prior pin elevators and distributors, however, have been either exceptionally complicated in construction and operation or, if not unusually complicated, were inadequate to their task. Certain of these distributors, for example, have contained multiple pin-receiving tubes with cam-operated gates so arranged as to permit only one pin at a time to drop downward, thereby preventing pins from piling up in the pin-setter or pin tray, as the case may be. In spite of the preventive mechanisms, in prior pin distributors it has been found that occasionally one pin would be deposited on top of another in the pin tray or pin distributor, whereas upon other occasions, there would be no pin at all in one of the spaces which should be occupied by a pin.

One object of the present invention is to provide a bowling pin orienting and elevating apparatus which will insure that the pins are engaged and lifted upward from the pit of the alley, with each pin in its proper position of being grasped by the neck with its butt downward and conveyed in this position upward to the upper part of the machine.

Another object is to provide a bowling pin orienting and elevating apparatus wherein the pins will always be picked up by their necks from the pit of the alley and, if the butt of a pin is presented to the elevator, the latter by self-contained mechanism, will automatically invert the pin and present it properly.

Another object is to provide a bowling pin orienting and elevating apparatus of the foregoing character, wherein the pin pickup fingers on the elevator are arranged in rows which are oblique to the path of travel of the elevator, so that the pins will arrive one by one at the top of the machine and will accordingly be dropped one by one into the receiving chutes through which they are carried downward to the remaining portions of the machine.

In the drawings:

Figure 1 is a side elevation, partly in section, of a bowling pin orienting and elevating apparatus, according to one form of the invention;

Figure 2 is an approximately vertical section through the machine of Figure 1, taken along the zigzag line 2—2 in Figure 1;

Figure 3 is an approximately horizontal section taken along the line 3—3 in Figure 2 showing details of the pin pickup fingers and

Figure 4 is an enlarged fragmentary side elevation of the lower portion of Figure 1, showing the action of the pin tumbling fingers in inverting a pin which has been presented butt downward.

Referring to the drawings in detail, Figure 1 shows diagrammatically a bowling alley, generally designated 10, equipped with an automatic pin setting machine, generally designated 11 and for the most part shown only diagrammatically in order to simplify the showing. Forming a part of the machine 11 is the bowling pin orienting and elevating apparatus 12 of the present invention. The remainder of the machine falls outside the scope of the present invention, and it is understood that

2

the pin elevator of the present invention may be employed with many different types of conventional pin-setting machines. One machine with which the present elevator 12 may be employed is disclosed and claimed in my co-pending application Serial No. 81,087 filed March 12, 1949 for Automatic Bowling Pin Setting Machine.

The bowling alley 10 is of any conventional type with the usual bed 13 upon the rearward end of which the bowling pins P are spotted, the alley bed 13 being supported by side members 14 and cross members 15 extending therebetween. A pit bottom or floor 16 is inclined downwardly from the rearward end 17 of the alley 10 into the pit 18. The latter forms the pin-receiving space behind the bed 13, and receives the fallen pins or "dead wood" which are either knocked or swept off the alley 10 by a pin sweeping mechanism not shown herein but shown in my above-mentioned co-pending application Serial No. 81,087. Omitted from the present drawings are the ball retrieving mechanism and the back-stop or backboard for preventing the balls or pins from hitting and possibly damaging the pin-elevating mechanism.

The pin setting machine 11 is purposely shown in a fragmentary form since the units not forming a part of the present invention may be found in prior patents or in my co-pending application previously referred to. It is therefore sufficient for the purposes of the present invention to state that the pin-setting machine 11 includes a framework 19 having upright members 20, 21 and 22 and cross members 23 to 39 inclusive. The frame 19 is also provided with longitudinal members 40 to 43 inclusive.

Mounted upon a platform 44 extending between the upright frame members 20 and 21 (Figure 1) is a reciprocating motor 45 including a cylinder 46 rising from the platform 44, the lower end of which is supplied with pressure fluid, such as compressed air, through a supply pipe 47. Reciprocable vertically in the cylinder 46 is a piston 48, to the lower end of which is secured the pin-setter proper, generally designated 49, this being shown only diagrammatically. Such a pin-setter ordinarily contains pin-gripping devices of various types which grasp the pins by their heads or necks so as to lift them upward in order to sweep the alley of fallen pins or deadwood. The pin-setter 49 is provided with one or more guide arms 50 which slidably engage one or more vertical guide rods 51 so as to guide the pin-setter 49 as it is raised and lowered by the pressure fluid motor 45.

In order to supply the pin-setter 49 with pins disposed in their usual triangular relationship, a pin tray unit 52 is also ordinarily provided. This unit is also shown only diagrammatically, a complete unit being shown in my afore-mentioned co-pending application. The pin tray 52 for the purposes of the present invention may be said to consist of a roughly triangular block 53 having pin sockets or pockets 54 arranged in the usual triangular formation. The block 53 is provided with supporting rails 55 which reciprocate to and fro on spaced rollers 56 and 57 mounted respectively on the cross members 27 and 28. The tray 52 is reciprocated from its rearward position shown in Figure 1 to a forward position beneath the pin-setter 49 by a piston rod 58 secured to the rearward end of the block 53 and reciprocated by a pneumatic cylinder and piston (not shown). The tray 52 receives the pins from the pin delivery unit, generally designated 60, to which the pins are allocated by a rotary distributor 61. The latter in turn receives the pins from a pin-receiving unit 62 to which the pins are supplied by the pin elevator 12.

Pin elevator construction

The pin elevator 12 consists of a plurality of endless conveyor chains 63 which at their opposite ends are trained over upper and lower sprockets 64 and 65 respectively and guided in the middle of their rearward courses by pulleys 64a mounted on mounts 65a bolted to the cross member 35. The forward courses of the conveyor chains 63 are guided by upwardly and forwardly inclined guide members 66 and 66a in the form of

3

laterally-spaced elongated bars (Figures 2 and 3) in forward and rearward rows respectively. The guide members 66 and 66a are secured to the frame cross members 32, 34, 36, 37, and 39. Bolted or otherwise secured to the frame cross member 31 are the forward ends of laterally-spaced inclined pin ejector cams 67 extending downwardly and rearwardly therefrom into the paths of travel of the heads of the bowling pins P as they are carried upward by the conveyor chains 63 (Figure 1). There are multiple endless chains 63 employed in the machine, seven being a convenient number for efficient operation (Figures 2 and 3).

Each of the endless elevator chains 63 is provided with twin-fingered multiple bowling pin neck graspers having pick-up fingers 68 arranged in narrowly spaced pairs with said fingers spaced apart wider than the pin neck diameter but narrower than the pin head diameter, and interspersed alternately between twin-armed multiple pin inverters having pin-inverting fingers 69 which are arranged in broadly-spaced pairs. The pin pickup fingers 68 and 69 of each pair project forwardly on opposite sides of their respective guide members 66 and 66a and are thus guided thereby (Figures 2 and 3). The fingers 69 are spaced far enough apart to completely clear the head and neck of a bowling pin P, but are spaced slightly closer together than the butt diameter of the bowling pins P, as shown by the dotted pin P and the adjacent fingers 69 near the upper portion of Figure 3. The action of these pin-inverting fingers 69 and pickup fingers 68 is more fully set forth below in connection with the operation of the elevator.

Co-operating with the pairs of fingers 68 and 69 and arranged to push off any pins which may be picked up horizontally on the pairs of fingers 68 and 69 and carried upward transversely of the alley, are pin ejector cams 70 and 71 placed immediately adjacent but outside the paths of travel of the fingers of each pair of fingers 68 or 69. These are roughly triangular in shape (Figure 1) and are positioned between the chains 63 so as to eject any pins carried horizontally upward, as stated above. The pin pickup fingers 68 and the pin-inverting fingers 69 are arranged in sets, the pair of fingers of each set being disposed in "echelon," namely in rows which are inclined obliquely to the path of travel of the chains 63 (Figure 2). This oblique or echelon arrangement of the fingers 68 insures that only one pin at a time will arrive at the top of the machine and that two or more pins will never arrive there simultaneously.

In order to further agitate the pins P in case they come to rest crosswise of the pit 18 at the lower end of the bottom 16, the elevator 12 is additionally provided with pin agitators, generally designated 72 (Figures 1, 3 and 4). The pin agitators 72 consist of short endless chains 73 trained around upper and lower sprockets 74 and 75 respectively (Figure 4), these in turn being mounted on shafts 76 and 77 respectively. The shaft 77 also carries the lower sprockets 65, whereas the upper sprockets 64 are carried on a cross shaft 78. The shafts 76, 77 and 78 are suitably journaled in bearings 79, 80 and 81 respectively (Figure 2). Mounted at intervals along the agitator chains 73 are agitator rods 82 which pass through slots 83 in the lower end of the pit bottom 16.

The pit bottom 16 is also provided with laterally spaced recesses or slots 84 which are located immediately adjacent the fingers 68 and 69 of the elevator chains 63. These are wider than the heads of the bowling pins P but narrower than the butts thereof. Disposed in each recess or slot 84 is a bowling pin guide 85 roughly resembling a numeral 7 (Figure 4), these being fastened to cross members 86 and 87 respectively beneath the pit bottom 16 at its lower end. The guide bars 66 are provided with vertical elongated slots 88 for the passage of the agitator rods 82 (Figure 2) and the bars 66 themselves are spaced apart from one another a sufficient distance for the passage of the pairs of fingers 68 and 69. The chains 63 and 73 are driven by a belt or other endless driving member 89 (Figures 1 and 2) encircling a pulley or wheel 90 on the shaft 77 and likewise passing around a pulley 91 on the armature shaft 92 of a driving motor 93. The latter is mounted upon a shelf 94 bolted to the frame uprights 22.

The pin receiving unit 62 consists of a conduit assembly arranged roughly in the shape of a seven branched candlestick and having individual vertical pipes 95 whose upper

4

ends are cut away at their sides, as at 95a. The pipes 95 extend downward to downwardly inclined headers 96 which converge toward a common spout 97. The latter opens into the upper flared end 98 of the distributor pipe 99 forming a part of the rotary pin distributor 61. The pipe 99 at its lower end is mounted on the outer end of an arm 100, the inner end of which is mounted upon a shaft 101 coaxial with the spout 97 and journaled in an upper platform 102. The shaft 101 on its lower end carries a sprocket 103 encircled by a sprocket chain 104 which is moved step-by-step by mechanism, such as that shown in my co-pending application, Serial No. 81,087 previously referred to. The lower end 105 of the pipe 99 passes through an aperture in the arm 100 and moves successively over the upper ends of pin delivery pipes 106 arranged in a circular path around the upper platform 102. The delivery pipes 106 are bent in such a manner that their lower ends are arranged in the usual triangular pattern which the pins P occupy when properly arranged upon the alley, the lower ends of the pipes 106 being mounted in apertures arranged in this triangular pattern upon the lower platform 107. The lower platform 107 is supported by the frame cross members 25 and 26 and the longitudinal members 43, and the lower ends of the delivery pipes 106 open immediately over the pin pockets 54 in the pin tray 52.

Operation

The operation of a complete machine and electrical circuit controlling the machine has been described in my above-mentioned co-pending application Serial No. 81,087 filed March 12, 1949. The description of the present unit will therefore be confined, so far as possible, to its use in this machine or in a conventional machine in connection with which it may be used. Let it be assumed that a complete set of pins P has been placed upon the bed 13 of the alley 10 in the usual locations of approximately triangular form. Let it also be assumed either that the bowler has bowled one or more balls so as to knock some of the pins rearwardly off the alley bed 13 into the pit 18, or that the pin-sweeping machine (not shown) has swept the fallen pins into the pit 18. Meanwhile, the motor 93 has been operating so as to move the pin operating or conveying chains 63 and the tumbling chains 73 in their respective orbital paths.

As the pins fall into the pit 18, they slide down the inclined bottom 16 to the lower edge thereof adjacent the lower end of the pin elevator 12. The pins will naturally fall and come to rest in different positions. Some will come to rest in the recesses 84 with their heads downward, as shown by the dotted lines in Figure 1, while others will lie with their butts downward, as shown in Figures 3 and 4. Still others will lie crosswise of the alley, and some may even land crosswise just in time to be picked up by the fingers 68 and 69. If the pins fall head foremost in the desired position shown in Figure 1, the closely spaced pairs of fingers 68 will reach in under the head of the pin P and grasp it by the neck immediately below the head, carrying it upward as shown by the successive views in Figures 1 and 2. When the pin, thus elevated, arrives at the top of its travel, its head encounters one of the inclined ejector cams 67, which pushes the pin off the fingers 68 so that it enters the cutaway portion 95a of the pipe 95 and drops downward through the pipe 95 into the common header 96 and thence through one of the delivery pipes 106 into one of the pockets 54 of the pin tray 52.

Since the pin pickup fingers 68 are staggered in their positions on their respective chains 63, so that each row thereof is in an inclined line (Figure 2), only one pair of pickup fingers 68 arrives at the top of the machine at any given time, hence only one pin at a time can be dropped into any of the pipes 95. Consequently, the danger of one pin dropping upon another is completely eliminated and the necessity for providing mechanism for preventing such an occurrence is likewise obviated. Even if the ideal conditions occurred wherein pins fell head downward in each of the recesses or pockets 84 over the entire width of the machine, the pins P would still be picked up in succession, as shown by the dotted lines at the top of Figure 2 and pushed off their respective pickup fingers 68 in succession as they successively encounter the cams 67.

If, as is ordinarily the case, some of the pins come to rest but downward (Figure 4), these must be inverted

into the head down position shown in Figure 1 in order to be properly picked up, and in order to avoid their being dropped head down into the pipes 95. The pickup fingers 68 are only wide enough to grasp the narrowest portions of the pins, namely the necks thereof, and neither the head nor the butt of the pin will pass between these fingers. The pin-inverting fingers 69, however, are spaced much farther apart (Figure 3), but, although they will permit the necks and heads of the pins to pass between them, they are too close together to pass the butts of the pins. Accordingly, they engage the butts of the pins on opposite sides as shown in the upper portion of Figure 3 and in Figure 4. As the chain 63 continues to move upward, it carries with it the pin-inverting fingers 69 and these raise the butt of the pin P (Figure 4) while the head thereof slides downward along the guide 85 until it reaches the bottom thereof, whereupon the pin P is toppled over with its butt uppermost and resting against the upper end of the guide 85. The next pair of pin pickup fingers 68 which comes along will therefore grasp the now inverted pin immediately beneath its neck and convey it upward, as shown in Figure 1, until the fixed cam 67 pushes it off the fingers 68 into the cutaway portion 95a of the pipe 95, as before.

Other pins, however, will come to rest transversely of the alley at the lower edge of the pit bottom. The pin agitating rods 82 now come into play to tumble these pins and rearrange them lengthwise of the alley pit. The pins are engaged by the rods 82 as these are moved in orbital paths by the endless chains 73 (Figures 1 and 3), and any pin of which a portion projects into the gap 83 traversed by any of these rods 82 is either pushed to one side or is bodily tumbled until it finally comes to rest lengthwise of the pit 18.

If, finally, one of the pins P comes to rest crosswise of the alley pit immediately above a pair of approaching fingers 68 or 69 before it can be acted upon by one of the tumbling rods 82, the pin may possibly be carried upward while it is resting crosswise on these fingers. It cannot move for upward, however, before it encounters one of the pin ejector cams 70 or 71 which are placed immediately adjacent but outside the path of travel of the fingers of each pair of fingers 68 or 69 where they will not interfere with the lifting of a pin in its desired position but where they will intercept a pin lying crosswise and projecting laterally beyond each pair of the fingers 68 or 69. The pin, upon engaging the cam 71 or 70, is immediately pushed off the fingers 68 or 69 and drops back into the pit 18 and falls to the lower edge of the pit bottom 16, as before. In this manner, all of the pins P eventually become positioned with their heads and necks downward and their butts upward, as shown in Figure 1, and in this position they are easily picked up by the pin pickup fingers 68 and carried upward, as shown in Figure 1.

As each pin is carried upward and is ejected from the pin elevator 12 by its respective fixed cam 67, it drops downward into its respective pipe 95 and is transferred by the pin distributor pipe 99 and one of the pin delivery pipes 106 to one of the pockets 54 of the pin tray 52. The pin distributor pipe 99 is rotated step-by-step as each pin descends so that each pocket of the pin tray 52 is filled. A further refinement, omitted from Figure 1, but shown in my above-mentioned co-pending application Serial No. 81,087 provides a movable gate at the bottom end of each pin delivery pipe 106, this gate being opened and closed by the control mechanism and control circuit. The circuit is so arranged that the distributor 99 can make two revolutions step-by-step, one revolution to fill each of the ten pockets 54 of the pin tray 52 and the other revolution to fill each of the delivery pipes 106, these pins being held in the pipes by the closing of the gates at their lower ends. When the distributor pipe 99 completes its second revolution, it actuates a limit switch which causes it to halt automatically and likewise causes the motor 93 to halt temporarily. This prevents two pins from being deposited one on top of the other. The disclosure of these refinements is unnecessary for the purposes of the present invention and hence is omitted for the sake of simplicity of showing.

The action of the pin-spotting unit 49 in moving upward or downward either to pick up the standing pins on the alley 10 or to pick up a complete set of pins from the tray 52 when it is advanced to its forward position, is likewise beyond the scope of the present invention, and

a complete description thereof will be found in my above-mentioned co-pending application, Serial No. 81,087. The pin tumbling rods 82 and chains 73 as well as the pin guides 85 and recesses 84 are claimed in this same co-pending application.

In the present application, the pin pickup fingers 68 have been shown and described (Figure 2) as arranged in echelon or in rows oblique to the direction of travel of their respective elevator chains 63, this being for the purpose of insuring that only one pin will arrive at one of the pin ejector cams 67 at a given instant. The purpose of this arrangement is to prevent more than one pin from dropping down through the pipes 95 into the spout 97 at a given time, thereby preventing the possibility of two pins attempting to enter the same delivery pipe 106 or pocket 54 in the pin tray 52. It will be obvious, however, that the same purpose is accomplished by staggering the pin pickup fingers 68 in any manner so long as two pairs of fingers never lie at the same horizontal level. Thus, this staggering of the fingers 68 will likewise prevent more than one pin from arriving at the top of the machine at the ejector cams 67 at any given moment.

The same purpose is accomplished by placing all of the fingers 68 of each group side by side in horizontal rows and placing the inlet openings 95a and pin ejector cams 67 in inclined or staggered positions crosswise of the machine so that each pin would again be ejected at a different time even though a row of pins might be carried upward on the same level. The essential purpose accomplished by all of these arrangements is to insure that only one pin is ejected by an ejector cam 67 at a given time and, from the foregoing remarks, it is obvious that this can be accomplished in the several ways stated above without departing from the spirit or scope of the invention.

What I claim is:

1. An apparatus for orienting and elevating bowling pins from a bowling alley pit to a bowling pin receiver disposed above said pit, said apparatus comprising a frame, an endless bowling pin elevating conveyor mounted in an approximately upright position on said frame and extending between said pit and said pin receiver, a multiplicity of laterally-spaced endless rows of twin-fingered pin neck graspers mounted on said conveyor, the graspers in each row being disposed at intervals spaced apart from one another in the path of travel of said conveyor, each grasper having neck-engaging fingers spaced apart from one another a distance wider than the pin neck diameter but narrower than the pin head diameter, twin-fingered pin inverters disposed in each of said rows of pin neck graspers and interspersed therebetween on said conveyor, each pin inverter having pin butt engaging fingers spaced apart from one another a distance wider than the pin head diameter but narrower than the pin butt diameter, and a multiplicity of pin rests arranged side by side adjacent said conveyor in the paths of travel of said pin neck graspers and having cutaway portions therein for the passage of said pin neck grasper fingers.

2. An apparatus for orienting and elevating bowling pins from a bowling alley pit to a bowling pin receiver disposed above said pit, said apparatus comprising a frame, an endless bowling pin elevating conveyor mounted in an approximately upright position on said frame and extending between said pit and said pin receiver, a multiplicity of laterally-spaced endless rows of twin-fingered pin neck graspers mounted on said conveyor, the graspers in each row being disposed at intervals spaced apart from one another in the path of travel of said conveyor, each grasper having pin neck engaging fingers spaced apart from one another a distance wider than the pin neck diameter but narrower than the pin head diameter, twin-fingered pin inverters disposed in each of said rows of pin neck graspers and interspersed therebetween on said conveyor, each pin inverter having pin butt engaging fingers spaced apart from one another a distance wider than the pin head diameter but narrower than the pin butt diameter, a multiplicity of pin rests arranged side by side adjacent said conveyor in the paths of travel of said pin neck graspers and having cutaway portions therein for the passage of said pin neck grasper fingers, and a rearwardly inclined pit bottom disposed in said pit and sloping downward from the rearward end of said bowling alley to said pin rests.

3. An apparatus for orienting and elevating bowling

pins from a bowling alley pit to a bowling pin receiver disposed above said pit, said apparatus comprising a frame, an endless bowling pin elevating conveyor mounted in an approximately upright position on said frame and extending between said pit and said pin receiver, a multiplicity of laterally-spaced endless rows of twin-fingered pin neck graspers mounted on said conveyor, the graspers in each row being disposed at intervals spaced apart from one another in the path of travel of said conveyor, each grasper having pin neck engaging fingers spaced apart from one another a distance wider than the pin neck diameter but narrower than the pin head diameter, twin-fingered pin inverters disposed in each of said rows of pin neck graspers and interspersed therebetween on said conveyor, each pin inverter having pin butt engaging fingers spaced apart from one another a distance wider than the pin head diameter but narrower than the pin butt diameter, and a multiplicity of pin rests arranged side by side adjacent said conveyor in the paths of travel of said pin neck graspers and having cutaway portions therein for the passage of said pin neck grasper fingers, said pin rests being aligned with and inclined downwardly and rearwardly toward the paths of travel of their respective pin inverters.

4. An apparatus for orienting and elevating bowling pins from a bowling alley pit to a bowling pin receiver disposed above said pit, said apparatus comprising a frame, an endless bowling pin elevating conveyor mounted in an approximately upright position on said frame and extending between said pit and said pin receiver, a multiplicity of laterally-spaced endless rows of twin-fingered pin neck graspers mounted on said conveyor, the graspers in each row being disposed at intervals spaced apart from one another in the path of travel of said conveyor, each grasper having pin neck engaging fingers spaced apart from one another a distance wider than the pin neck diameter but narrower than the pin head diameter, twin-fingered pin inverters disposed in each of said rows of pin neck graspers and interspersed therebetween on said conveyor, each pin inverter having pin butt engaging fingers spaced apart from one another a distance wider than the pin head diameter but narrower than the pin butt diameter, and a multiplicity of pin rests arranged side by side adjacent said conveyor in the paths of travel of said pin neck graspers and having cutaway portions therein for the passage of said pin neck grasper fingers, said pin rests being aligned with and inclined downwardly and rearwardly toward the paths of travel of their respective pin inverters, each pin rest having an elongated pin-receiving recess therein with an inclined pin guide in the bottom thereof, said pin guides being also inclined downwardly and rearwardly toward the paths of travel of their respective pin inverters.

5. An apparatus for orienting and elevating bowling pins from a bowling alley pit to a bowling pin receiver disposed above said pit, said apparatus comprising a frame, an endless bowling pin elevating conveyor mounted in an approximately upright position on said frame and extending between said pit and said pin receiver, a multiplicity of laterally-spaced endless rows of twin-fingered pin neck graspers mounted on said conveyor, the graspers in each row being disposed at intervals spaced apart from one another in the path of travel of said conveyor, each grasper having pin neck engaging fingers spaced apart from one another a distance wider than the pin neck diameter but narrower than the pin head diameter, twin-fingered pin inverters disposed in each of said rows of pin neck graspers and interspersed therebetween on said conveyor, each pin inverter having pin butt engaging fingers spaced apart from one another a distance wider than the pin head diameter but narrower than the pin butt diameter, and a multiplicity of pin rests arranged side by side adjacent the paths of travel of their respective pin inverters in the paths of travel of said pin neck graspers and having cutaway portions therein for the passage of said pin neck grasper fingers, said pin rests being aligned with and inclined downwardly and rearwardly toward the paths of travel of their respective pin inverters, each pin rest having an elongated pin-receiving recess therein with an inclined pin guide in the bottom thereof, said pin guides being also inclined downwardly and rearwardly toward the paths of travel of their respective pin inverters and each guide having an upper forward end portion raised above the level of its lower rearward end portion.

6. An apparatus for orienting and elevating bowling pins from a bowling alley pit to a bowling pin receiver disposed above said pit, said apparatus comprising a frame, an endless bowling pin elevating conveyor mounted in an approximately upright position on said frame and extending between said pit and said pin receiver, a multiplicity of laterally-spaced endless rows of twin-fingered pin neck graspers mounted on said conveyor, the graspers in each row being disposed at intervals spaced apart from one another in the path of travel of said conveyor, each grasper having pin neck engaging fingers spaced apart from one another a distance wider than the pin neck diameter but narrower than the pin head diameter, a multiplicity of pin rests arranged side by side adjacent said conveyor in the paths of travel of said pin neck graspers and having cutaway portions therein for the passage of said pin neck grasper fingers, and stationary pin ejector members secured to and projecting forwardly from the lower portion of said frame between said endless rows of pin neck graspers, said ejector members being disposed adjacent but outside the paths of travel of their respective pin neck graspers.

7. An apparatus for orienting and elevating bowling pins from a bowling alley pit to a bowling pin receiver disposed above said pit, said apparatus comprising a frame, an endless bowling pin elevating conveyor mounted in an approximately upright position on said frame and extending between said pit and said pin receiver, a multiplicity of laterally-spaced endless rows of twin-fingered pin neck graspers mounted on said conveyor, the graspers in each row being disposed at intervals spaced apart from one another in the path of travel of said conveyor, each grasper having pin neck engaging fingers spaced apart from one another a distance wider than the pin neck diameter but narrower than the pin head diameter, a multiplicity of pin rests arranged side by side in laterally-spaced relationship adjacent said conveyor, said pin rests being disposed in the paths of travel of said pin neck graspers and having cutaway portions therein for the passage of said pin neck grasper fingers, an upwardly-traveling pin agitator carrier mounted on said frame near said pin rests, and a plurality of upwardly-movable pin agitators disposed on said carrier between said endless rows of pin neck graspers and having pin agitating members projecting forwardly into the spaces between said pin rests.

8. An apparatus for orienting and elevating bowling pins from a bowling alley pit to a bowling pin receiver disposed above said pit, said apparatus comprising a frame, an endless bowling pin elevating conveyor mounted in an approximately upright position on said frame and extending between said pit and said pin receiver, a multiplicity of laterally-spaced endless rows of twin-fingered pin neck graspers mounted on said conveyor, the graspers in each row being disposed at intervals spaced apart from one another in the path of travel of said conveyor, each grasper having pin neck engaging fingers spaced apart from one another a distance wider than the pin neck diameter but narrower than the pin head diameter, a multiplicity of pin rests arranged side by side in laterally-spaced relationship adjacent said conveyor, said pin rests being disposed in the paths of travel of said pin neck graspers and having cutaway portions therein for the passage of said pin neck grasper fingers, an upwardly-traveling pin agitator carrier mounted on said frame near said pin rests, and a plurality of upwardly-movable pin agitators disposed on said carrier between said endless rows of pin neck graspers and having pin agitating members projecting forwardly into the spaces between said pin rests, said pin agitator carrier including a pair of vertically-spaced wheels disposed in substantially the same plane and rotatable upon substantially parallel axes of rotation, and an endless flexible member encircling said spaced wheels in an orbital path, said pin agitating members being secured to said endless flexible member and disposed substantially in the plane of said wheels.

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