Jan. 22, 1952 D. D. JACOBUS 2,583,052

BOWLING PIN RESPOTTER

Filed Dec. 17, 1946 4 Sheets-Sheet 1

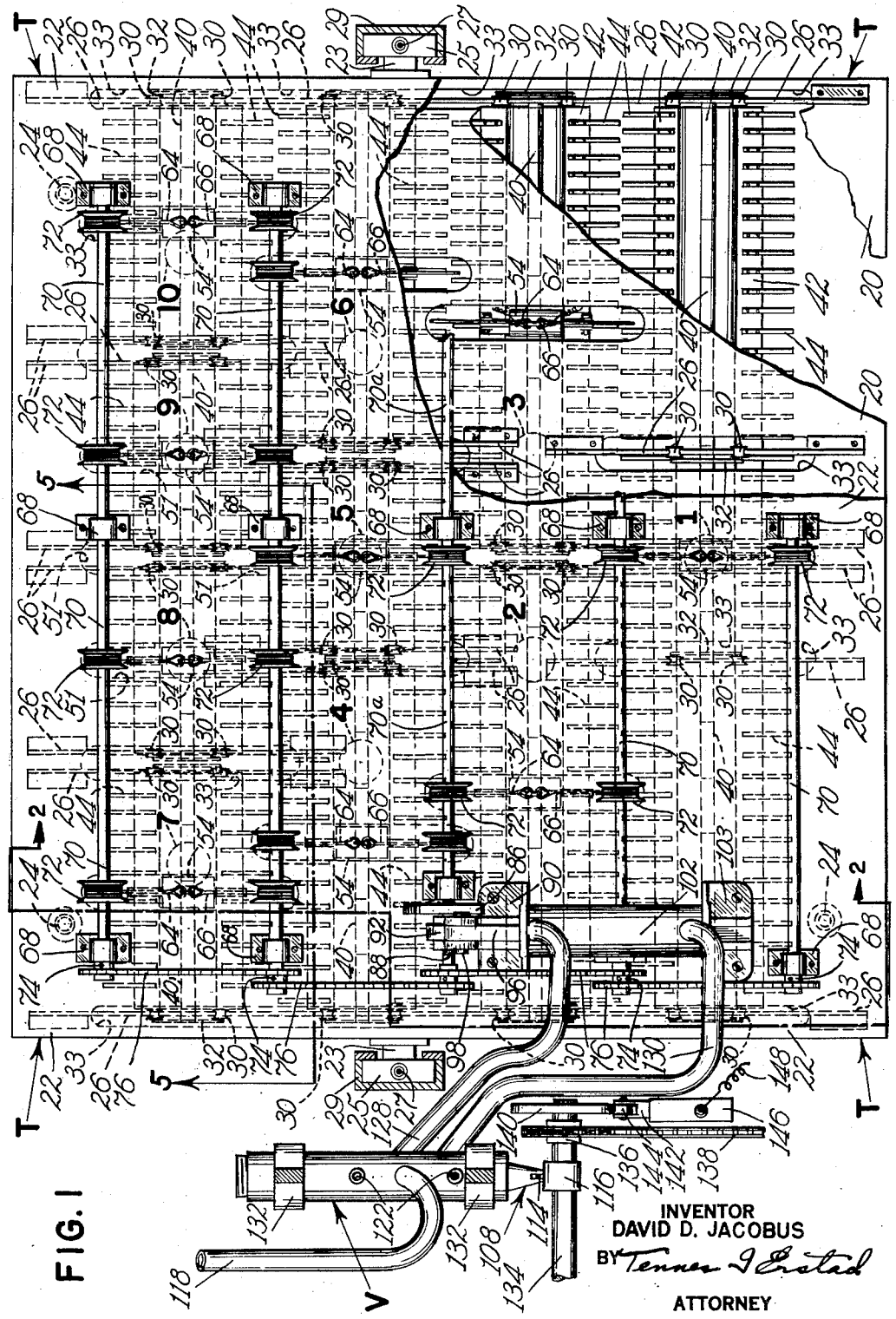


FIG. 1

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BOWLING PIN RESPOTTER

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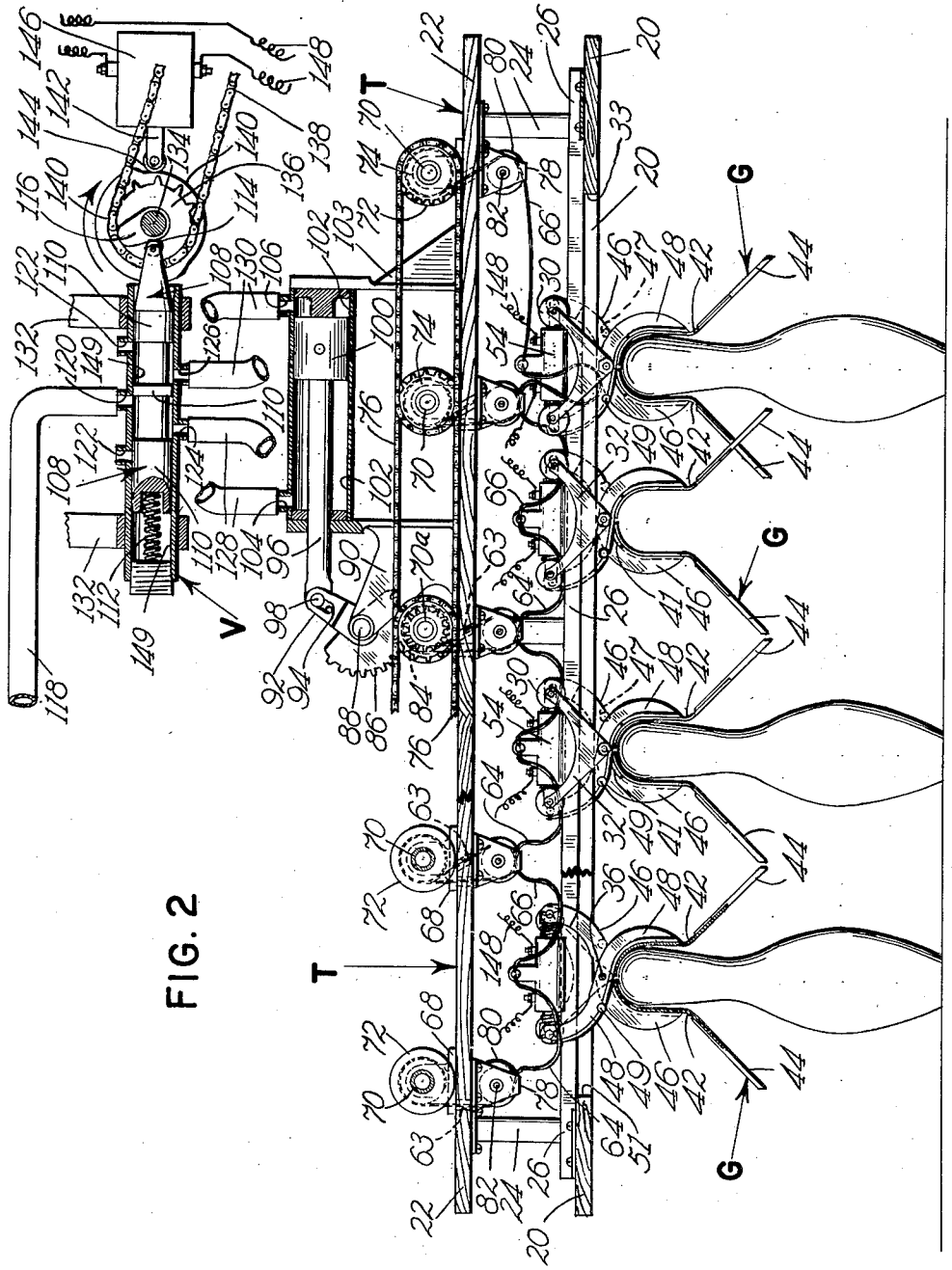


FIG. 2

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BOWLING PIN RESPOTTER

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FIG. 3

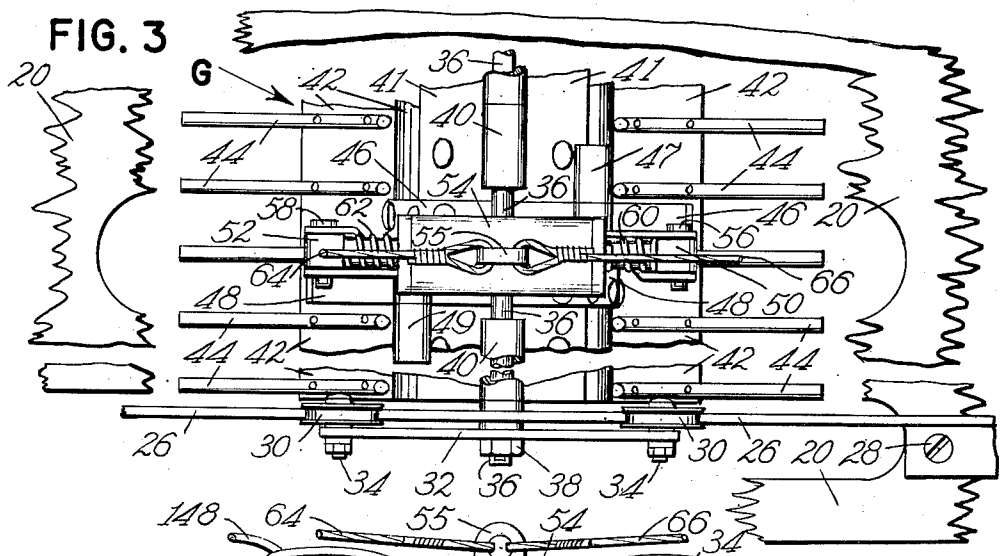
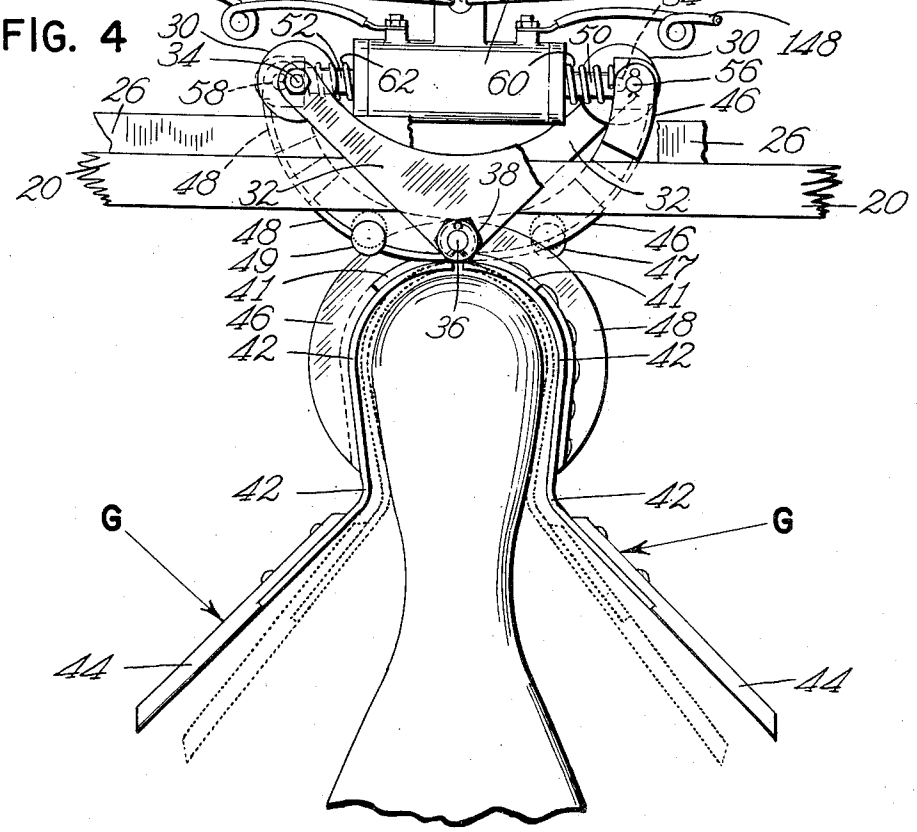


FIG. 4



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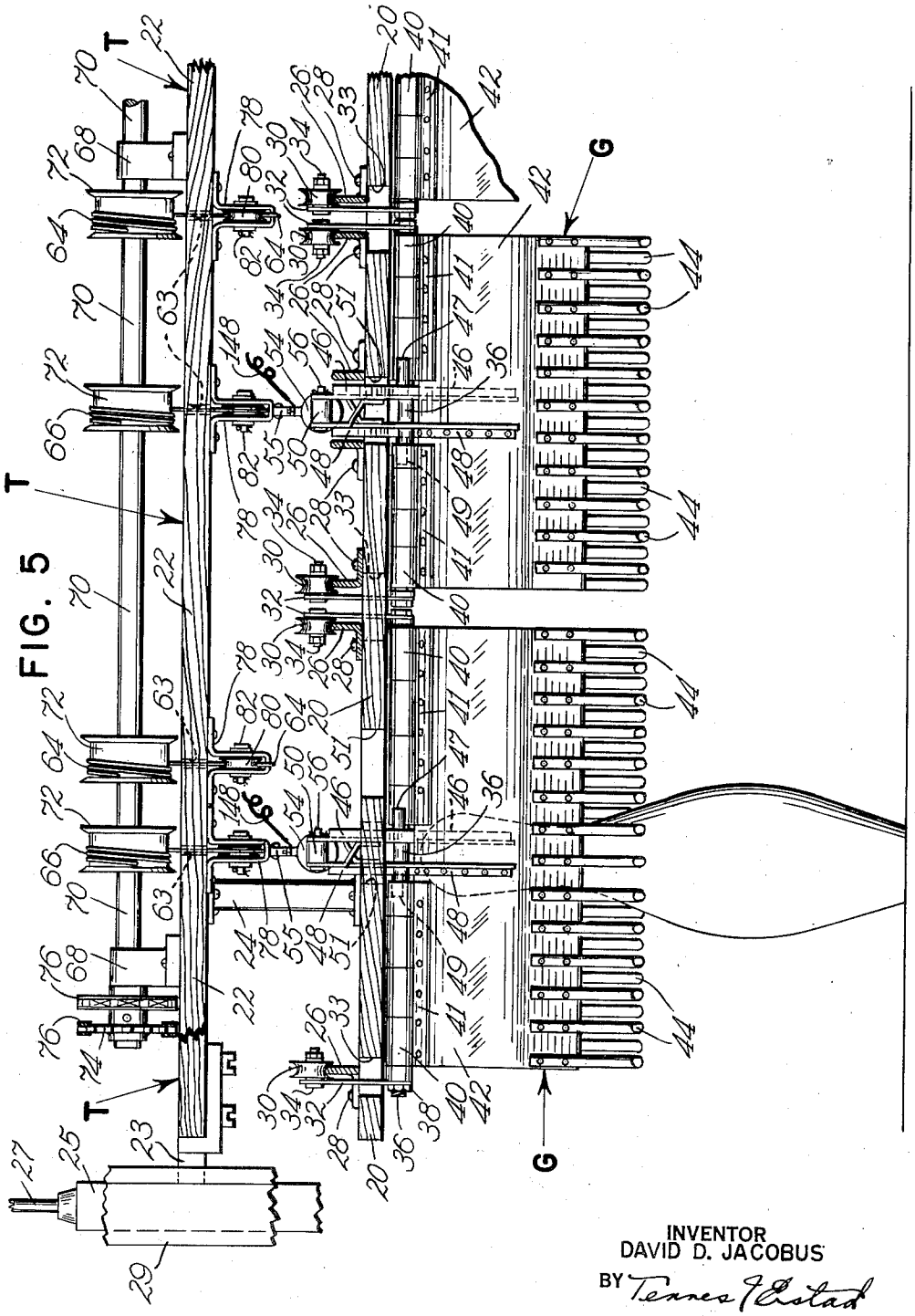


FIG. 5

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Patented Jan. 22, 1952

2,583,052

UNITED STATES PATENT OFFICE

2,583,052

BOWLING PIN RESPOTTER

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Application December 17, 1946, Serial No. 716,850

12 Claims. (Cl. 273—42)

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This invention relates to improvements in automatic pin respotting apparatus for bowling alleys and, more particularly, to improvements in apparatus for engaging, gripping, lifting and replacing spot and off-spot pins in the same position on an alley from which they were lifted by the apparatus.

In the game of bowling, after the first ball has been thrown, some of the pins which remain standing may become displaced with respect to the position on which they were originally spotted. It is an object of my invention to provide a plurality of inverted trough-shaped members which are constructed and arranged to perform a sequence of operations consisting of: first, automatically centering themselves over spot and off-spot pins, then, gripping and lifting the standing pins above the alley so that the fallen pins may be swept from the alley; and lastly, replacing the lifted pins on the alley in the same position they occupied before being lifted from the alley.

Another object of my invention is to increase the range of individual bowling pin respotters to the extent that the entire width of a bowling alley is covered by the respotters, and to provide a respotting device which is not dependent upon the use of either suction or electro-magnets for gripping bowling pins.

Another object is to provide a plurality of pin engaging members which, by a camming action, will guide pin gripping members into gripping position with a standing spot, misaligned or off-spot bowling pin.

Another object is to provide inverted trough-like pin gripping members adapted for free rectilinear movement which will engage with a standing bowling pin and guide each pin gripping mechanism into gripping position over the respective bowling pins with which they engage.

It is also an object of my invention to provide each trough-shaped device with fingers which can interfinger with the fingers of an adjoining trough upon engagement with standing pins that have been moved off their original spotted position to increase the range of the bowling pin grippers and thereby diminish the inoperative areas between adjoining bowling pin grippers.

Another object is to provide pin engaging grippers which will be centered automatically after each pin gripping cycle to provide a maximum coverage of the bowling alley in each pin lifting and replacing cycle.

Another object is to provide a gripper which will have a scissor-like action to grip a bowling pin.

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Other objects and features of the invention will appear as the description of the particular physical embodiment selected to illustrate the invention progresses. In the accompanying drawings which form a part of this specification, like characters of reference have been applied to corresponding parts throughout the several views which make up the drawings.

Fig. 1 is a plan view of the respotter table with parts broken away to illustrate its construction;

Fig. 2 is a sectional side elevation taken on line 2—2 of Fig. 1, showing said table in pin engaging position;

Fig. 3 is a partial detailed plan view of one of the pin gripping troughs;

Fig. 4 is a detailed side elevation of one of the gripping mechanisms; and

Fig. 5 is a partial sectional front elevation of the respotting table, taken on line 5—5 of Fig. 1.

The pin respotting invention consists of a vertically reciprocating respotter table T, having a lower platform or frame 20 and an upper platform or frame 22 (Fig. 2) which are fixedly spaced from each other by means of spacers 24. The respotting table T is moved toward and away from the bed of a bowling alley by means of protruding studs 23, projecting from either side of platform 22, which are connected at their protruding end to a guide shoe 25. Suitable cables 27 are connected to the guide shoes 25 which travel in vertical guide channels 29 when the cables 27 lower and raise the table T in proper time relation with the operation of the bowling pin setting machine.

It is understood that the device I have shown for moving the table platform toward and away from a bowling alley is for purposes of illustration only and that other suitable devices could also be employed for this purpose. If desired, reference may be made to U. S. Patent No. 2,208,605, issued to G. J. Schmidt on July 23, 1940, and U. S. Patent No. 2,388,709, issued to R. E. Rundell on November 13, 1945, which disclose mechanism of the general type to which I refer for performing this function.

A number of parallel running tracks 26, employed for the purpose of supporting and guiding the trough-shaped pin grippers G, are secured to the upper side of the lower frame or platform 20 by means of screws 28. Traveling on each pair of tracks 26 are pairs of rollers 30 which, by means of studs 34, are connected to and support hangers 32 which project below the lower platform or frame 20 through suitable openings 33. The lower end of each hanger 32 has a hole in

which one end of a shaft 36 is mounted. A lock nut 38 is threaded on the ends of each shaft 36 to hold the shafts 36 in position in their respective hanger supports 32. The shafts 36 form the pivot of piano hinges 40 which extend over the entire length of each shaft 36.

Fixedly secured to the flanges 41 of each piano hinge 40 are plates 42 which form an inverted trough-like assembly. When the plates 42 are brought together they engage and grip bowling pins over which the trough-like assembly has been located. The plates 42 are constructed preferably of light metal, such as aluminum or magnesium sheet metal, and have secured at their free horizontal edges a plurality of pin engaging fingers 44 which extend the effective operating range of the pin engaging plates 42. The pin engaging fingers 44 of adjacent troughs are alternately spaced so that they can interfinger, as shown in Fig. 2, to pick up bowling pins which have been moved off-spot with respect to their original spotted position.

The pin engaging troughs G have been constructed and arranged, as shown in Fig. 1, to have a range which covers the entire width of a bowling alley on which pins are spotted. The trough covering the area of the number 1 pin is alleywide. The area of the number 2 and 3 pins is covered by two separate troughs, the combined length of which is also alleywide. The 4, 5 and 6 areas are covered by three separate troughs, the combined length of which is also alleywise. The 7, 8, 9 and 10 pin areas are covered by four separate troughs, the combined length of which is likewise alleywide. It will thus be seen that I have provide a pin respotting device which has alleywide coverage. My invention is also readily adaptable for use with any other number of pins and I have used ten pins as a conventional way of illustrating my invention without any intention of restricting it to any specific number of pins.

Pairs of scissor-like lever arms 46 and 48, also pivoted on shafts 36, are connected at one end to each pair of plates 42, described above, to bring the U-shaped apex of plates 42 into and out of pin gripping position as shown in dotted and full lines in Fig. 4. It will be noted that the U-shaped gripper extends along the entire length of plates 42 and, therefore, can pick up a pin at any point along the entire length of the trough. The opposite end of each pair of arms 46 and 48 is connected to solenoid armature plungers 50 and 52 by means of pins 56 and 58 and the arms 46 and 48 support each double acting solenoid 54.

Rubber covered studs or pins 47 and 49, transversely mounted in each of the scissor-like lever arms 46 and 48, are sufficiently long so that, when the grippers are moved into gripping relationship, the pins 47 and 49 will engage with the under side of frame 20 which acts to lock the hanger or support 32 against further travel on tracks 26. The rubber covering on the studs 47 and 49 allows for any slight variation that may exist in diameters of the bowling pin handles. A pair of springs 60 and 62 is provided for each solenoid to push the plungers 50 and 52 outwardly when the solenoid 54 is not energized.

Suitable openings 33 are formed in the lower frame 20 to permit the hangers 32, supporting shafts 36 of each of the inverted trough members 42, to travel back and forth over each pin spotting area. Suitable openings 51 (Fig. 5) are also formed in the lower frame 20 to permit the actuating arms 46 and 48, for each of the inverted trough-like members 42, to travel freely over each pin spotting area.

A pair of cables 64 and 66 is connected to each of the double acting solenoids 54 to center each of the inverted trough-like members 42 over their respective pin spot areas on a bowling alley after each pin gripping cycle.

Fixed to the upper frame 22 are suitable bearing brackets 68 in which are mounted four shafts 70, as shown in Figs. 1 and 5. The shaft, through which rotary movement is imparted to the other shafts 70, has been designated as 70*a*. Pairs of reels 72 are mounted opposite each other on spaced shafts 70 and 70*a*. Shafts 70 and 70*a* are located over opposite sides of the inverted pin engaging troughs 42.

A pair of cables 64 and 66 is connected at one end to the eye of a lug 55 protruding from each of the solenoids 54 and, after passing through suitable openings 63 formed in the frame 22, is connected at the other end to one of the pairs of reels 72 located on each side of the area over which each of the inverted pin engaging troughs 42 travel. Secured to the under side of the frame 22 are pulley supporting brackets 78. A pulley 80 is freely mounted in each of these brackets 78 on studs 82 which pass through the brackets 78 and the pulley 80, as shown in Fig. 5. Reference, therefore, to Figs. 2 and 5 will show that the cables 64 and 66, in interconnecting the solenoids 54 with reels 72, pass around the pulleys 80.

Each shaft 70 and 70*a* has fixedly mounted on its end a sprocket 74 which is actuated by sprocket chains 76 (see Figs. 1 and 2). Actuating movement is imparted to the sprocket chains 76 by means of a spur gear 84 which is fixedly mounted on the shaft 70*a*, shown in Fig. 2. Coacting with the spur gear 84 is a gear segment 86, fixedly mounted on a shaft 88 which, in turn, is rotatably mounted in suitable bearings formed in lug 90 (Fig. 2). Fixedly connected to the shaft 88 is a lever arm 92 which has a slot 94 formed in its upper end. The lever arm 92 is actuated by piston rod 96 which is connected at one end to the lever arm 92 by means of pin 98 and, at the other end, to the piston 100 which reciprocates in cylinder 102. The cylinder 102 may be secured to the upper frame 22 by suitable brackets 103, one of which has formed thereon the lug 90 mentioned above.

Suitable fluid pressure means, such as air or oil, is employed for operating the piston 100. Inlet and outlet ports 104 and 106 are provided for introducing and releasing fluid from either side of the piston 100.

The flow of fluid through inlet and outlet ports 104 and 106 is controlled by means of a slide valve designated generally by the letter "V". The slide valve, supported in brackets 132, consists of a cylinder 149 and a valve plunger 108 having bands 110. A compression spring 112 causes an outward thrust to be applied against valve plunger 108, causing the roller 114 of the plunger to ride at all times against cam 116. Fluid under pressure, received from a suitable source of supply (not shown), is introduced into the valve V by means of tubing 118 through an inlet port 120. Outlet ports 122 are provided for releasing the fluid which has already actuated the piston 100. Ports 124 and 126 are connected to the ports 104 and 106 respectively by means of tubing 128 and 130.

Cams 116 and 140 and sprocket 136 are fixedly mounted on shaft 134 which is rotated intermittently by sprocket chain 138. When my in-

vention is used with an automatic bowling pin spotting machine, the sprocket chain 138 will be connected to the main drive of the machine to be operated in timed relation therewith. My invention is also adapted to be used by itself for respotting and, in such case, the sprocket chain would be connected to a suitably controlled drive. Cam 140, through roller 144, actuates the plunger 142 of a conventional control switch 146 which opens and closes an electrical circuit and thereby controls the energization of the double acting solenoid 54. The wires 148 are connected to each of the solenoids 54 and cause the same to be energized whenever the switch 146 is closed by the high part of cam 140 engaging with the plunger 142.

The operation of the machine may be briefly described as follows:

After a bowling ball has been thrown and some of the pins knocked down, the pin respotting mechanism shown in this application will be started into operation by suitable control means which causes the frames 20 and 22, carrying the inverted pin engaging troughs, to be lowered toward the bed of a bowling alley. At the beginning of the machine cycle, the supporting frames 20 and 22 are in an elevated position above the alley and the various inverted pin engaging troughs, consisting of plates 42 and their respective projecting fingers 44, will have been centered over their respective pin spotting areas of the bowling alley by cables 64 and 66.

When the pin spotting apparatus is started in operation, the frames 20 and 22, through cables 27, will be lowered over the pin spotting area of a bowling alley. The downward movement of the frames 20 and 22 brings the inverted trough elements, comprising plates 42 and fingers 44, into engagement with the heads of standing bowling pins.

If a standing pin has been moved off its original spotted position, the engagement of the pin with the fingers 44 or plates 42 will cause the entire inverted trough member to travel on tracks 26 in a longitudinal rectilinear direction until the apex of the trough is centered with respect to the top of the standing offspot bowling pin. When one pin travels an unusual distance from its original spotted position, as shown in Fig. 2, the adjoining troughs 42, due to the interfingering of alternately spaced fingers 44, can move relatively close together, thus permitting the apex of each inverted trough 42 to be centered over the top of its respective pin. When the frames 20 and 22 have reached the limit of their downward movement, the U-shaped pin gripping apices of the inverted troughs will be saddled over the standing pins to be gripped.

The sprocket chain 138, which is also operated in timed relation with the lowering of frames 20 and 22, will have rotated the shaft 134 by means of sprocket 136 so that when the frames 20 and 22 have reached their lowermost position of travel, the high portion of the cam 140 will engage with the roller 144 to actuate the plunger 142 and close the switch mechanism 146. As soon as the switch mechanism 146 is closed, all of the solenoids 54 will be energized by electrical current carried through wires 148. Upon actuation of the solenoids, the scissor-like lever arms 46 and 48, connected to each solenoid, will close their respective inverted troughs to bring the U-shaped pin gripping apex of each trough into gripping engagement with their respective bowling pins. When the inverted troughs have been

brought into pin gripping position in the manner described, the rubber covered locking studs 47 and 49 will wedge themselves against the lower frame 20, thereby locking the trough against any further rectilinear movement along tracks 26, as shown in dotted position Fig. 4. When the pins have been gripped, the frames 20 and 22, together with the troughs 42 gripping the standing pins, are elevated away from the bed of a bowling alley.

The fallen pins and the bowling ball are then swept or removed from the bowling alley by suitable means, not shown. If desired, reference may be made to U. S. Patent No. 2 250,503, issued to R. E. Rundell on July 29, 1941, which shows one type of mechanism that can be employed for removing the fallen pins and bowling ball from the bowling alley.

After the alley has been cleared of the items mentioned, the frames 20 and 22 are lowered and the gripped pins will be replaced on the alley in exactly the same position they occupied before being engaged by the pin engaging and gripping troughs 42.

When the frames 20 and 22 reach their lowermost point of travel, the roller 144 will be ready to leave the high part of the cam 140 and begin engagement with the low part of the cam, thus opening the switch 146 which, in turn, will deenergize the solenoids 54. When the solenoids are deenergized, the plungers 50 and 52 move outwardly under the pressure of springs 60 and 62 causing the scissor-like lever arms 46 and 48 to open the inverted troughs and release the gripped bowling pins. As soon as the inverted troughs have been opened in the manner just described, the frames 20 and 22 are elevated again and the pin engaging inverted troughs move out of engagement with the bowling pins which have been replaced on the bowling alley in the exact position they occupied before being gripped.

The contour of cam 116 is such that, when the frames 20 and 22 have been raised to a level where they are above the standing replaced bowling pins, the plunger 108 is actuated to cause fluid pressure to be applied to the opposite end of piston 100. This application of pressure to the piston 100 causes piston plunger 96 to move outwardly, thereby moving the lever arm 92 to which the gear segment 86 is attached. This, in turn, causes the spur gear 84 to be rotated. The rotation of spur gear 84, in turn, through sprocket chains 76 and sprockets 74 causes all of the reels 72 to rotate in unison. The rotation of reels 72 causes the cables 64 and 66 of each solenoid assembly to be tightened and thereby causes the various inverted pin engaging troughs to be centered over the positions where bowling pins are normally spotted on a bowling alley. By the arrangement described, it will be seen that I have provided means which automatically centers all of the troughs from a central control after each cycle.

After this centering operation, the high portion of the cam 116 moves out of engagement with the roller 114, thus allowing the valve plunger 108 to move outwardly under the pressure of spring 112 which reverses the flow of fluid to the opposite side of piston 100. This reversal of pressure on the piston 100 operates, in the manner heretofore described, through gear segment 86, spur gear 84, sprockets 74 and sprocket chains 76 to reverse the rotary movement of the reels 72. The reversal of the rotary

movement of reels 72 causes the cables 64 and 66 to be unwound and sufficient slack made available which enables the inverted pin engaging troughs to move freely back and forth on tracks 26 in the next respotting cycle when the pin engaging troughs are lowered into engagement with the standing bowling pins.

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 embodiments of the same. The invention, therefore, is not to be restricted to the precise details of the structure shown and described.

What is claimed is:

1. In a machine for engaging, lifting and replacing pins on a bowling alley in substantially the same position they occupied before being engaged and lifted, a frame adapted to be moved toward and away from the bed of a bowling alley on which pins are spotted, inverted trough-shaped members having pin engaging surfaces, means movably connecting said members to said frame and confining said troughs for rectilinear movement transverse to the major axis of said trough shaped members to allow said members to center themselves over standing pins by engagement with standing bowling pins, and pin gripper devices formed on said members and operative along the length of the inverted trough-shaped members for gripping pins over which said devices have been centered by said members.

2. A machine for respotting bowling pins on a bowling alley in substantially the same position they occupied before being engaged and lifted, said machine having, a member adapted to be moved toward and away from the area of a bowling alley on which bowling pins are spotted, a plurality of elongated trough-shaped pin engaging members extending transversely over the alley, guide means for causing said trough shaped members to move lengthwise of the alley, pin grippers carried by said pin engaging members, said pin engaging members having surfaces adapted to effect a camming action when engaging with the head of a standing pin to center the pin grippers carried by the pin engaging members over the pins which remain standing on a bowling alley.

3. A device for respotting bowling pins on a bowling alley in substantially the same position they occupied before being engaged and lifted, said device having, pairs of members, wherein each pair is constructed and arranged to have an inverted trough-shaped opening extending across the alley; a guiding support for mounting each pair of members for free rectilinear movement longitudinally of the alley, means for lowering said support and bringing each pair of members into engagement with standing bowling pins to effect movement of said yieldable members by a camming action with the top of the standing bowling pins to thereby center each pair of members with respect to the standing bowling pins engaged, a pin gripping device operative along the length of each pair of members for gripping the pins over which said pairs of members have been centered, and means for actuating said support to cause the gripped pins to be elevated from the bowling alley and then replaced on the bowling alley.

4. A device for respotting bowling pins on a bowling alley in substantially the same position they occupied before being engaged and lifted above the alley comprising, a plurality of longitudinally movable inverted troughs extending across the entire width of a bowling alley over the positions on which bowling pins are spotted, said inverted troughs having relatively movable parts constructed and arranged to engage and grip standing bowling pins, a frame for supporting said troughs for movement toward and away from a bowling alley, guide means on said frame to cause said troughs to move rectilinearly in a plane parallel to the bowling alley and transverse to the axis of the troughs, and solenoid actuated means associated with the relatively movable parts of said inverted troughs for bringing said troughs into and out of pin gripping relationship.

5. In a machine for respotting bowling pins on a bowling alley, a frame, elongated generally trough-shaped members supported by said frame, each of said members including a gripping portion at the apex and extending along the length of the members and plate members diverging from said gripping portion for relative guiding movement of the trough-shaped members with respect to standing bowling pins.

6. In a machine having the elements provided for in claim 5 wherein said plate members terminate in fingers.

7. In a machine having the elements provided for in claim 5 wherein the plate members and the gripping portion thereof are positioned to cover the entire width of the bowling alley where bowling pins are positioned on the alley.

8. A machine for respotting bowling pins on a bowling alley in substantially the same position they occupied before being engaged and lifted above the alley comprising, a support adapted to be moved toward and away from a bowling alley, inverted trough-shaped members for engaging with bowling pins standing on said alley, means for associating said trough-shaped members with said support for free movement thereon and confining said members to rectilinear movement in a direction transverse to the axis of said members to allow said members to be moved by and their apices centered over bowling pins with which they engage, means associated with each of said inverted trough-shaped members for gripping standing bowling pins, engaged along the length of said trough-shaped members, means for locking said trough-shaped members against free movement on said support when in pin gripping position, and a device for raising and lowering said support to first lift and then replace on the bowling alley, bowling pins gripped by said trough-shaped members.

9. A device for removing standing spot and off-spot pins from a bowling alley and then replacing said pins in substantially the same position they occupied before being removed having, a member adapted to move toward and away from the bed of a bowling alley, a plurality of elongated inverted V-shaped troughs extending across the entire width of a bowling alley where bowling pins are spotted, guides constraining said members for free rectilinear movement lengthwise of the bowling alley, means for lowering said inverted troughs into sliding engagement with the heads of bowling pins standing on the alley to center said troughs over pins with which they engage then raising said inverted troughs and gripped pins above the alley and then lowering said inverted troughs to replace the pins on the alley, and gripping means operative along the length of the apex of

each inverted trough for gripping the bowling pin over which each trough has been centered preliminary to each pin raising operation and operable to release gripped pins after they have been replaced on the alley.

10. A device for respoting standing bowling pins on a bowling alley in substantially the same position they occupied before being engaged and lifted above the alley, said device having, inverted elongated trough-like members, a guide support for confining said trough like members to free rectilinear movement in a direction transverse to the longitudinal axis of said members, said trough-like members being shiftable rectilinearly by engagement with the tops of standing bowling pins, pin grippers formed along the length of the apex of each trough-like member, and means for moving said trough-like members into and out of engagement with standing bowling pins to center the grippers formed along the apex of each trough, over standing bowling pins by sliding over the tops of standing bowling pins.

11. A device for removing, and replacing standing bowling pins on a bowling alley in substantially the same position they occupied before being engaged and lifted above the alley, said device having, a table adapted to move toward and away from the bed of a bowling alley, a plurality of elongated pin grippers, guides for constraining said pin grippers for free rectilinear movement on said table in a plane parallel to the bowling alley, flat plates arranged in the form of an inverted trough extending downwardly from each of said grippers for centering said grippers over standing off-spot bowling pins to enable said grippers to grip standing off-spot pins, over which they are centered, means for moving said table toward and away from a bowling alley to cause said grippers to first lift and then replace said gripped

pins on the bowling alley in the same position they occupied before being gripped and lifted from the bowling alley, a recentering device located on said frame for centering said pin grippers and flat plates over the spot positions on a bowling alley on which pins are spotted, and means operative prior to each pin removing and replacing cycle for energizing said recentering device.

12. A device for removing and replacing standing bowling pins on a bowling alley in substantially the same position they occupied before being engaged and lifted, said device having, a member adapted to move toward and away from the bed of a bowling alley, elongated members arranged to form an inverted V in cross section along their width, a guide structure causing said V-shaped members on the under side of said member to freely move rectilinearly in a direction transverse to the major axis of said elongated V-shaped members when engaging with a standing pin, pin holding means connected to and extending along the length of said V-shaped members for removing and replacing standing pins on a bowling alley as said members are moved away and toward a bowling alley, and mechanism for centering said inverted V-shaped members over the positions on a bowling alley where bowling pins are spotted prior to each bowling pin removing and replacing operation.

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The following references are of record in the file of this patent:

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