April 18, 1967 R. M. CONKLIN ETAL 3,314,678

MECHANISM FOR SETTING BOWLING PINS AT SELECTED POSITIONS

Filed July 9, 1963 9 Sheets-Sheet 1

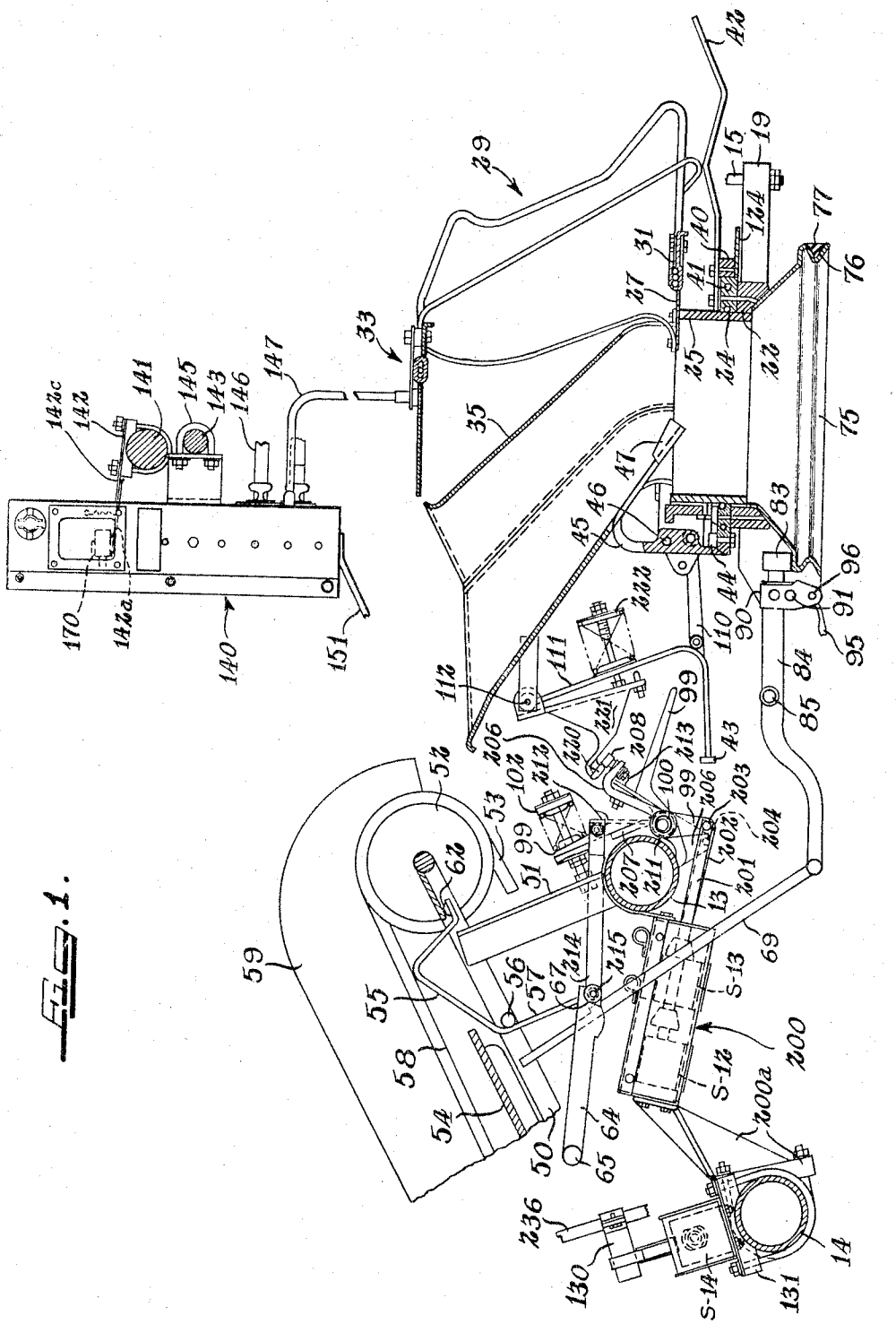


Fig. 1.

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FIG. 2.

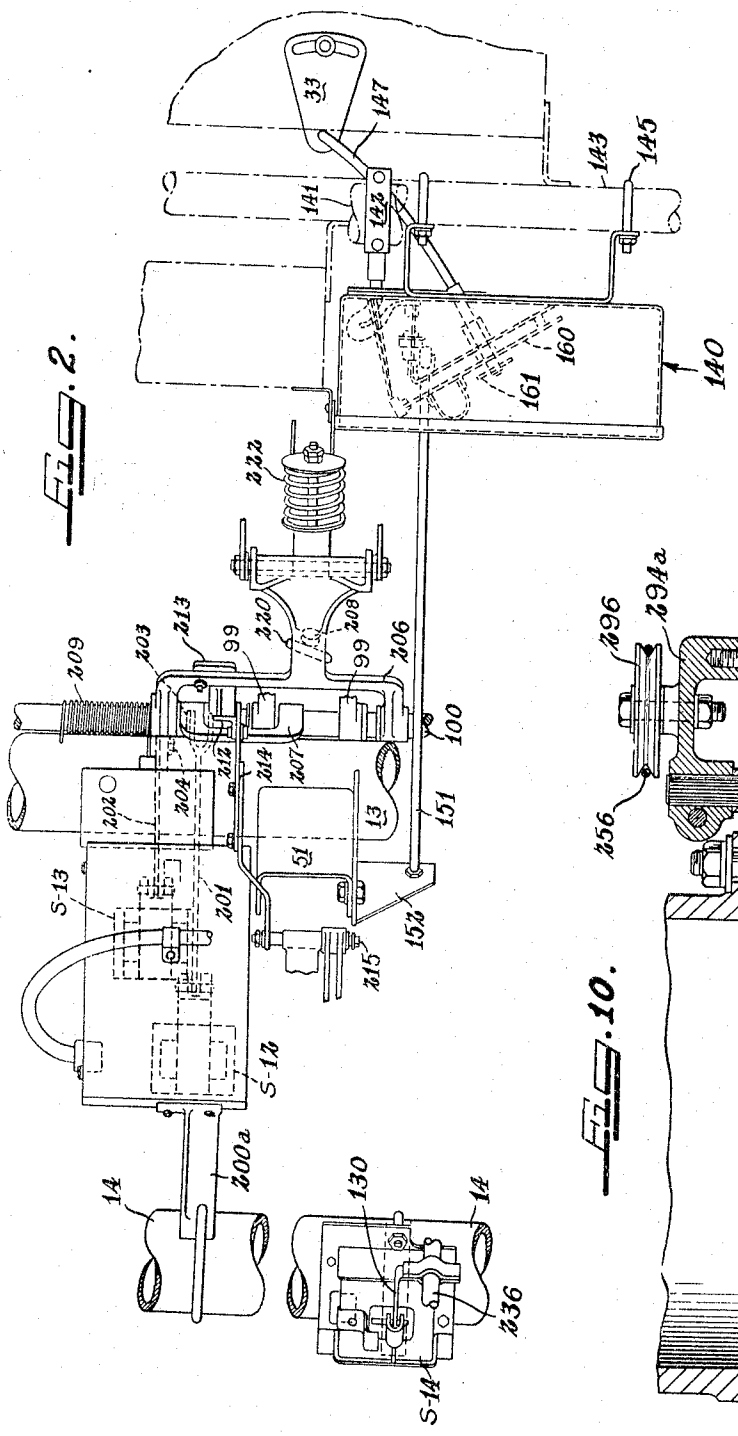
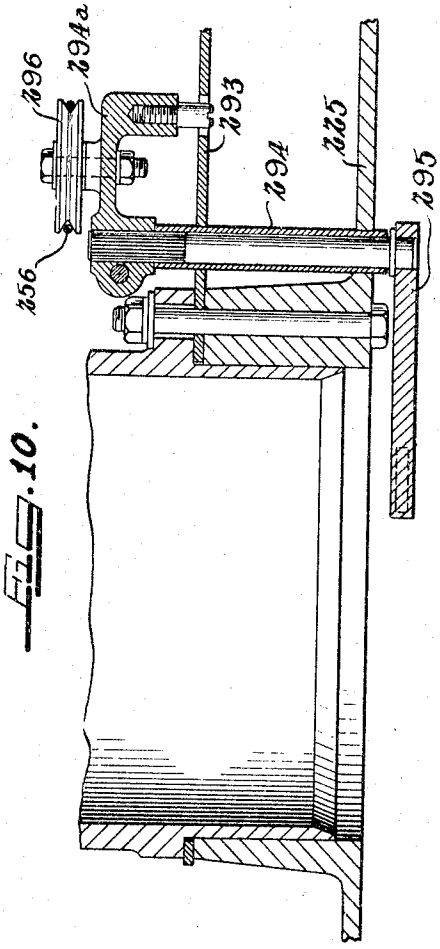


FIG. 10.

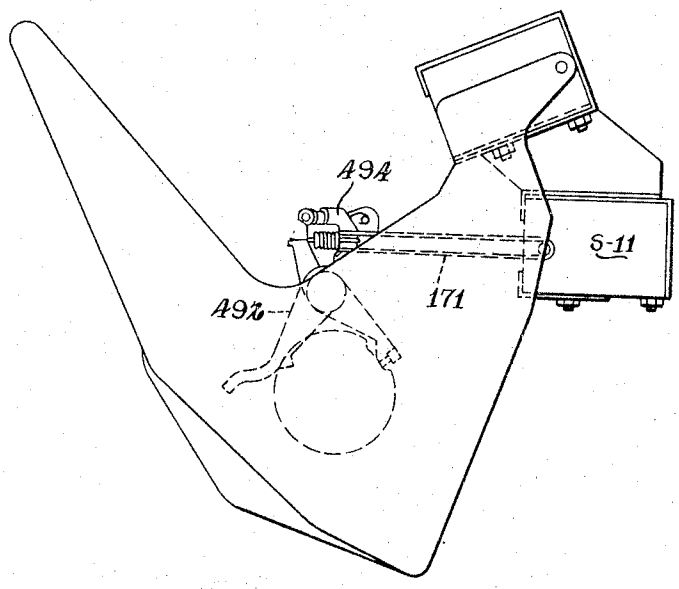


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Fig. 5.



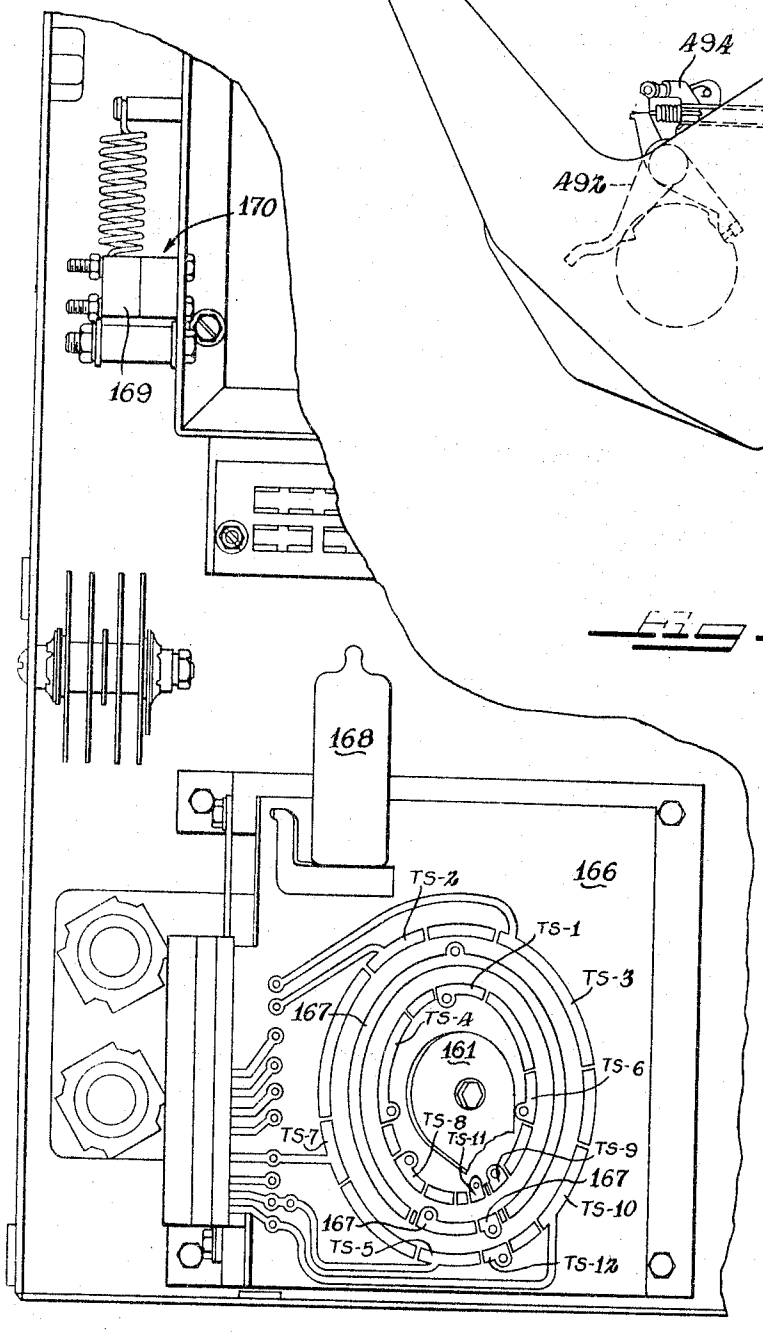
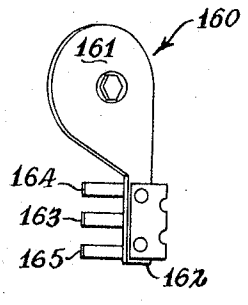


Fig. 3.

Fig. 4.



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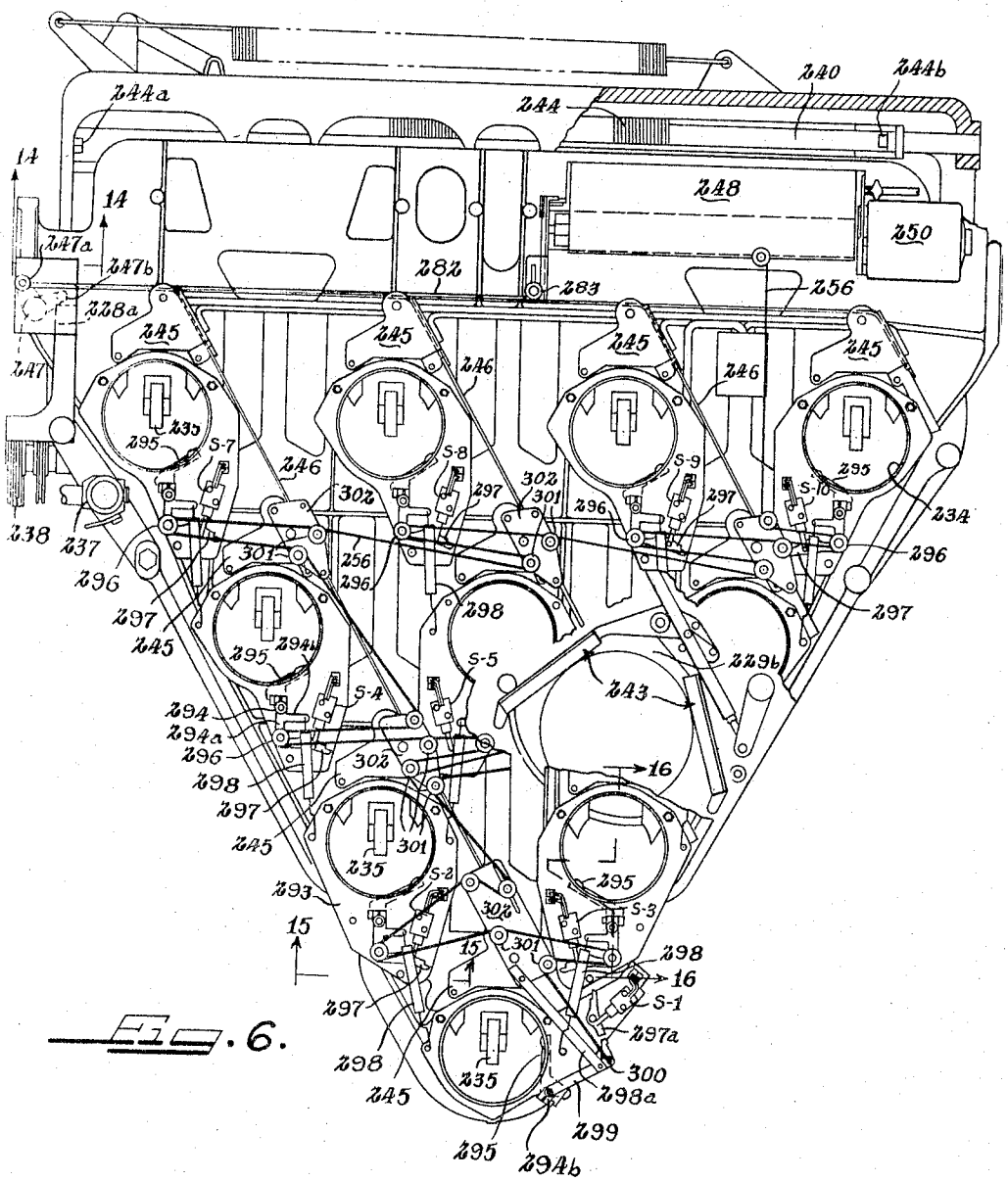
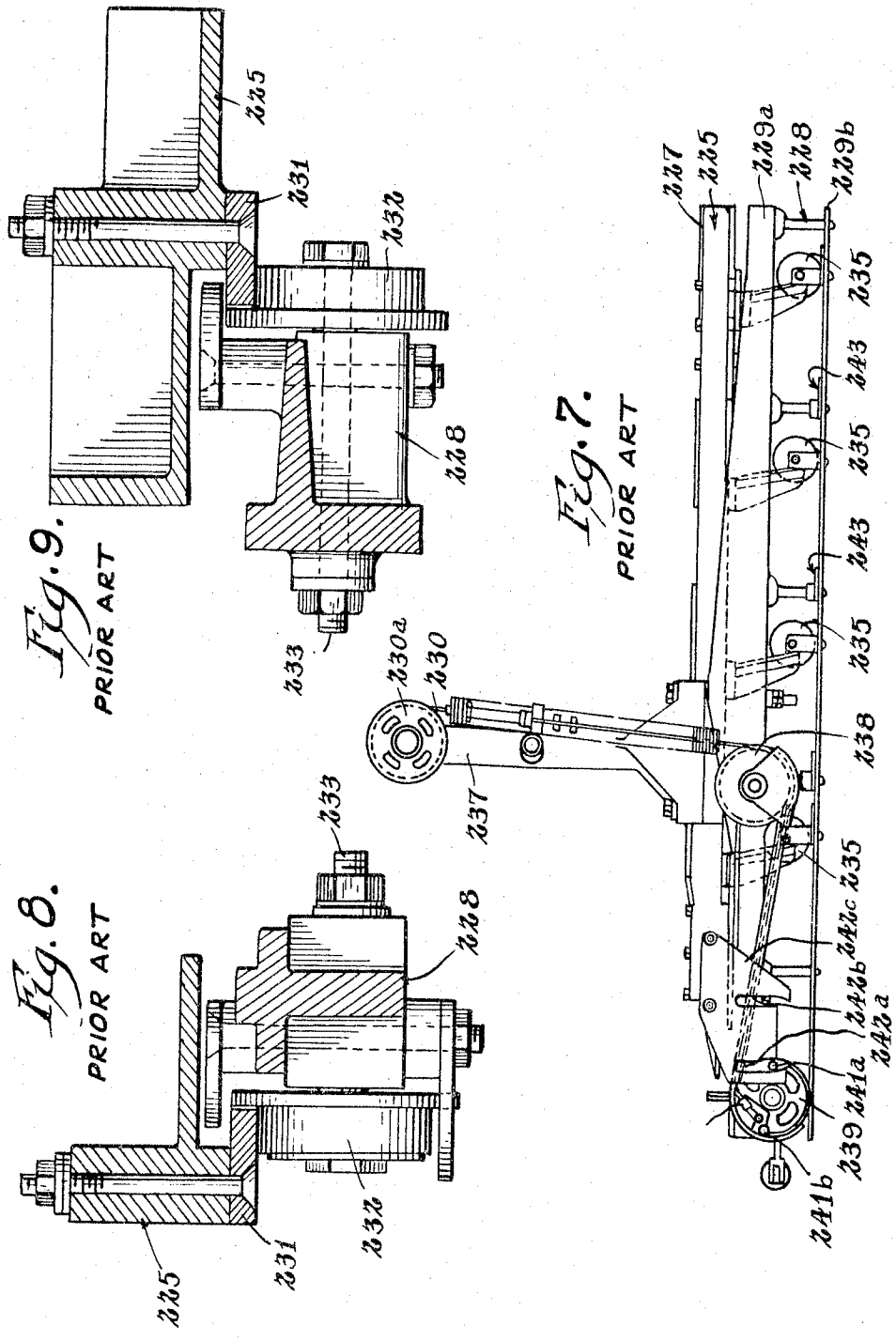


Fig. 6.

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FIG. 11.

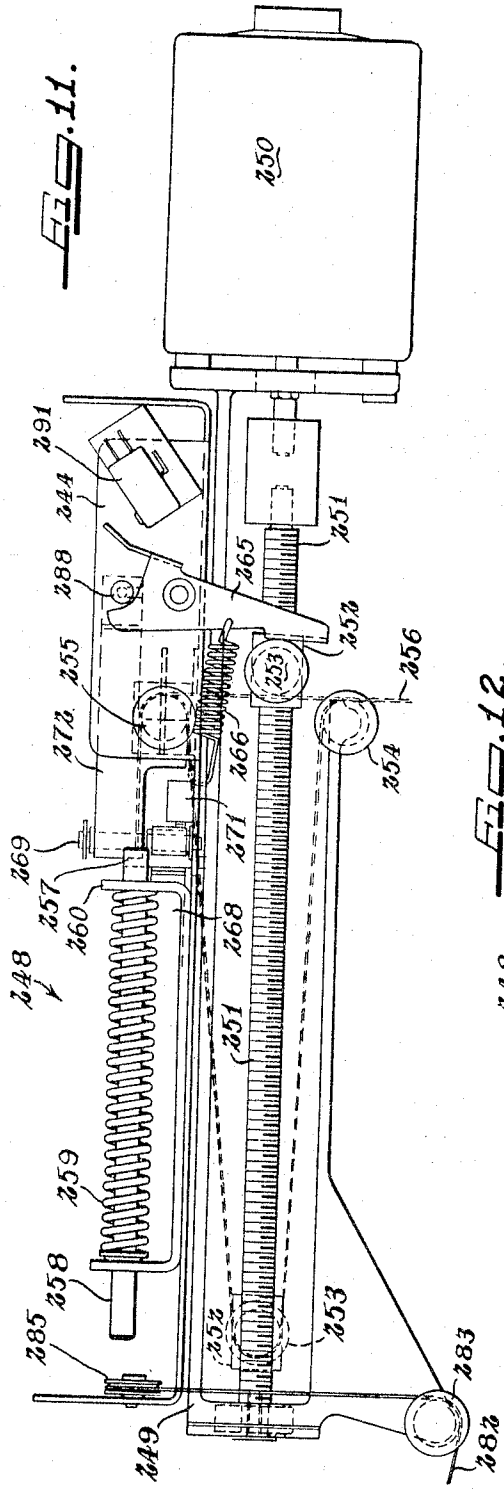


FIG. 12.

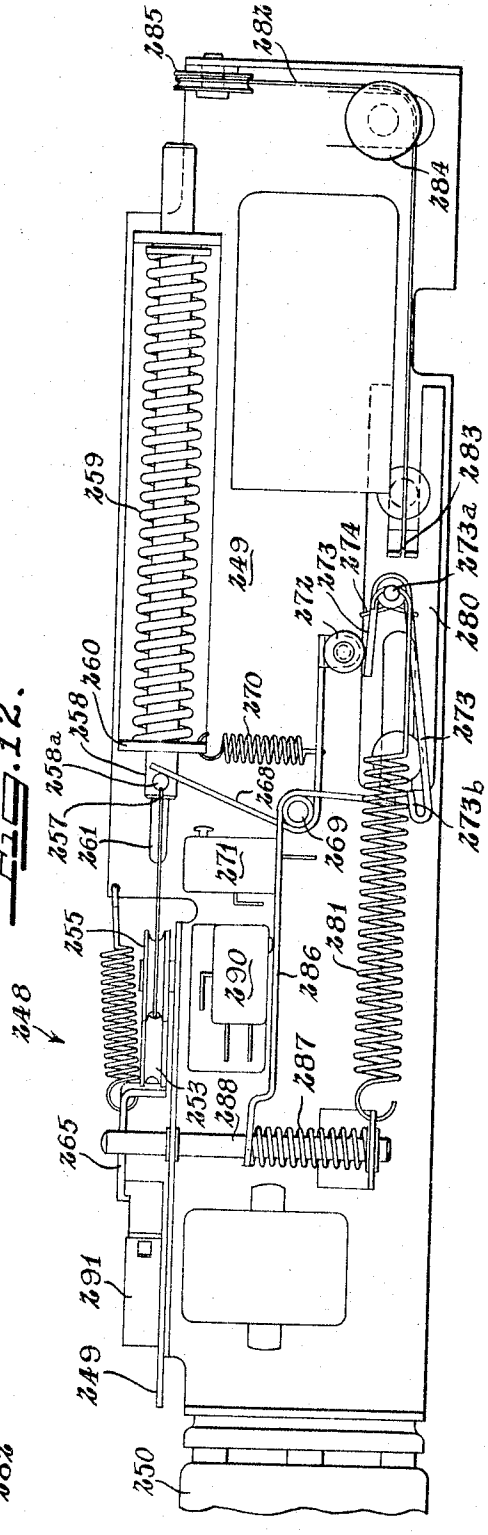


Fig. 13.

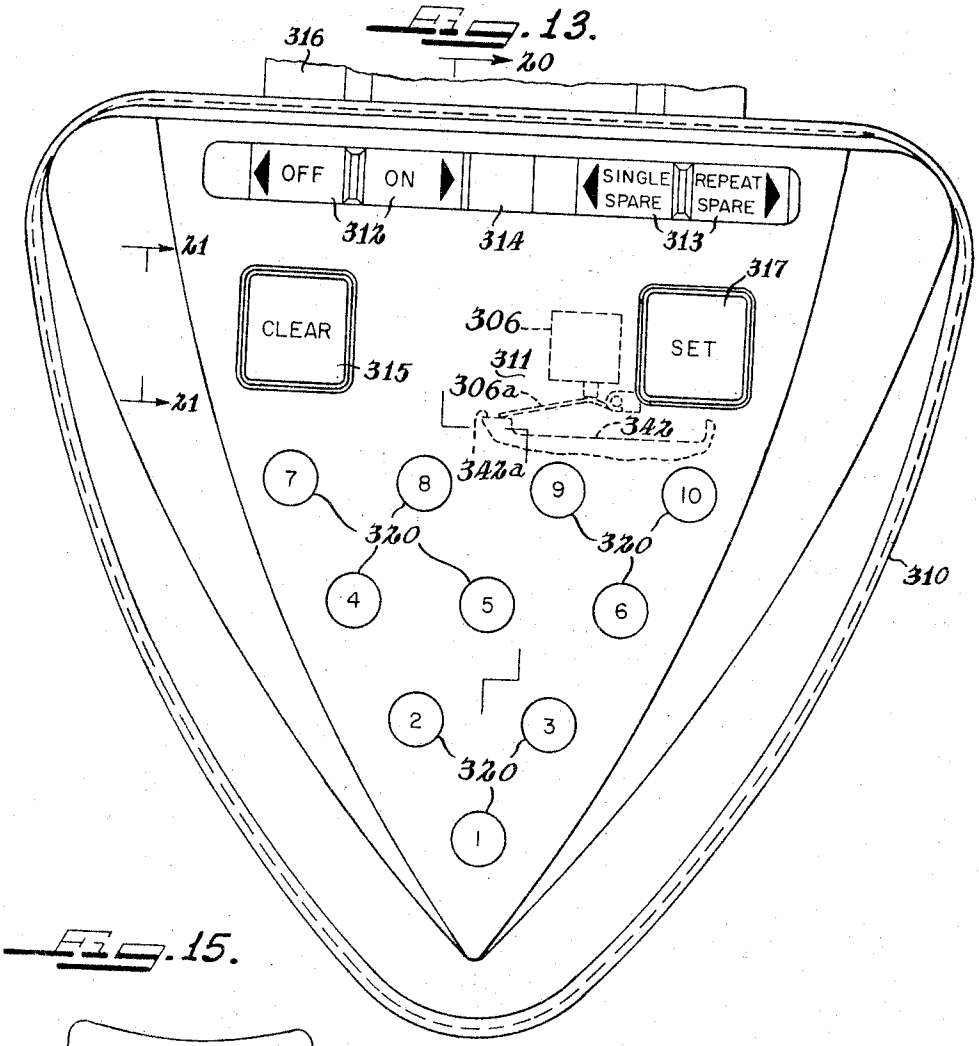
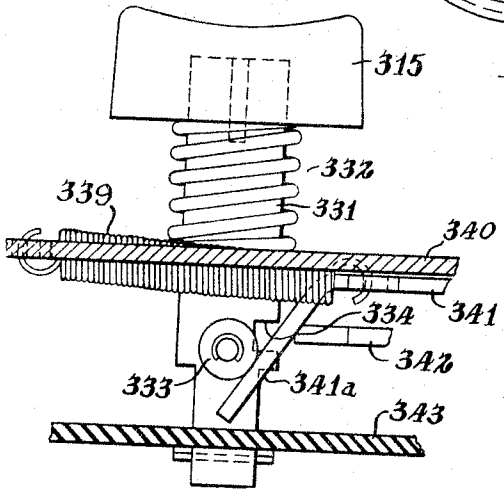

316
20
OFF
ON
SINGLE SPARE
REPEAT SPARE
312
314
313
21
CLEAR
315
317
306
SET
311
306a
342
342a
7
8
9
10
320
320
4
5
6
310
2
3
320
1

Fig. 15.


315
20
332
339
331
340
341
334
342
333
341a
343

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MECHANISM FOR SETTING BOWLING PINS AT SELECTED POSITIONS

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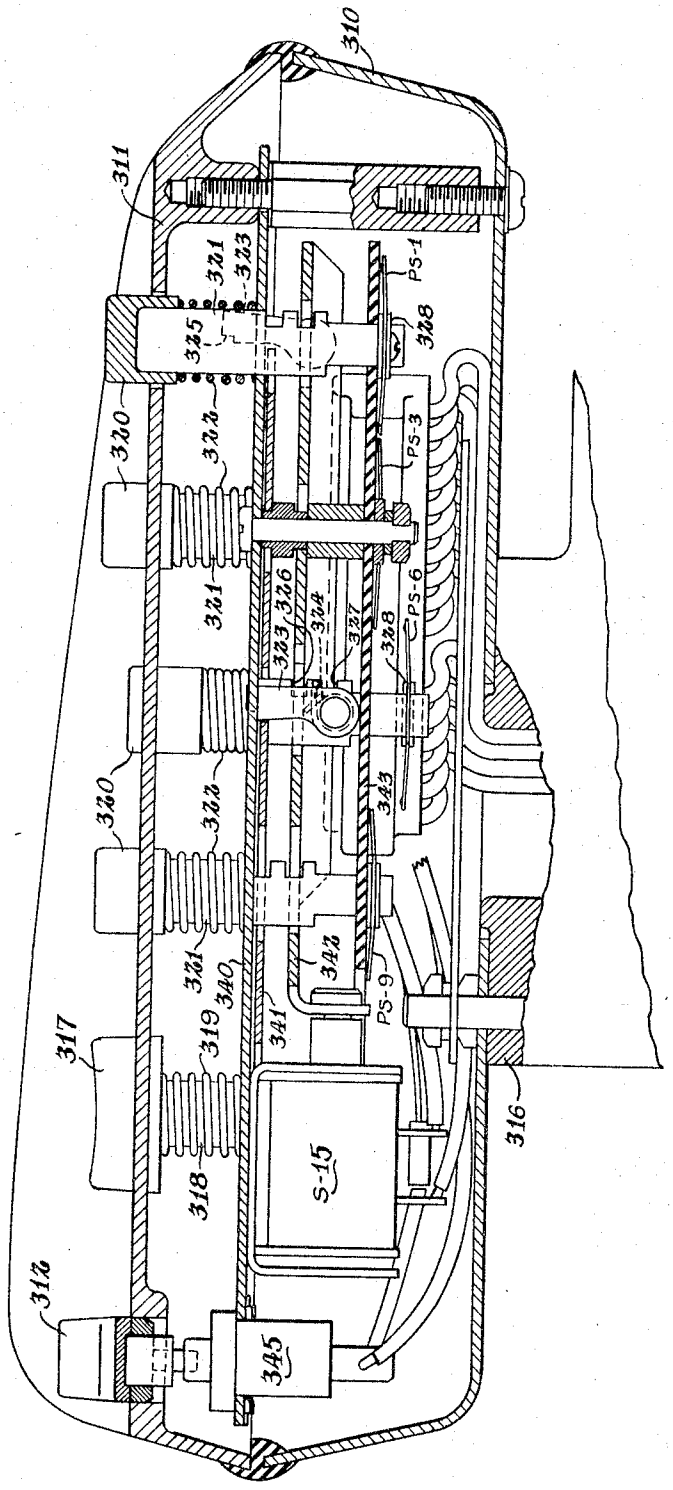


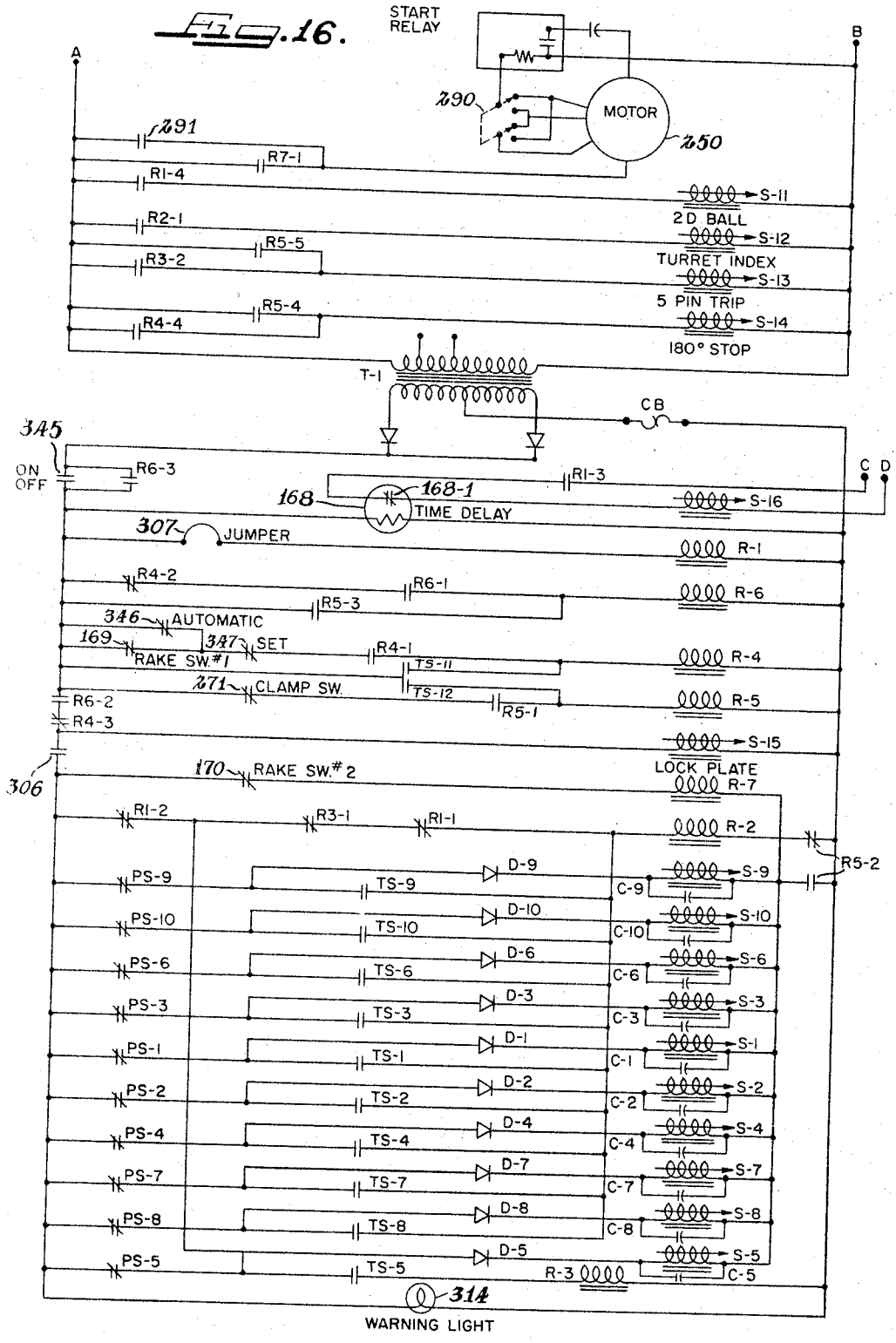
FIG. 14.

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Fig. 16.



United States Patent Office

3,314,678

Patented Apr. 18, 1967

3,314,678

MECHANISM FOR SETTING BOWLING PINS AT SELECTED POSITIONS

Robert M. Conklin, Muskegon, Albert M. Rockwood, North Muskegon, Robert Torresen and Anthony J. Gretzky, Muskegon, and Milton E. Brown, deceased, late of Grand Haven, by Burvelle E. Brown, administrator, Grand Haven, Mich., assignors to Brunswick Corporation, a corporation of Delaware

Filed July 9, 1963, Ser. No. 293,909

11 Claims. (Cl. 273—43)

This invention relates to bowling pin handling apparatus, and particularly to a pin handling mechanism for use in an automatic pinsetter to enable the selective setting of less than the normal complement of ten pins for practice bowling, for example.

It it a general object of the invention to provide a new and improved pin handling apparatus of the type described.

Another object is to provide a new and improved pin handling apparatus of the type described, including an indexable pin receiving turret for delivering pins to a pin setting deck structure, conveyor means having a discharge end disposed to deliver pins successively to pin receiving pockets in the turret, means for operating the conveyor and the turret in timed relationship to fill the turret pockets, and selectively operable means for controlling the turret and the conveyor means to fill only preselected pockets in the turret less than the total number of turret pockets.

A more specific object is to provide a new and improved apparatus of the type described, including manually selectively operable control switch means corresponding respectively to pin receiving pockets in the turret, for controlling operation of the conveyor means and turret to preselectively prevent delivery of pins to preselected turret pockets.

Still another object is to provide a new and useful apparatus of the type described which is capable of functioning during normal two-ball bowling in setting the normal complement of ten pins but which is also usable for setting preselected combinations of pins for practice bowling purposes, e.g. for one-ball bowling against preselected "spare" combination, wherein the pinsetter can be signalled to automatically reset the same pin combination after each ball or alternatively can be signalled to set a new combination of pins as selected after each ball.

Yet another object is to provide a bowling pin handling apparatus which includes a pin conveyor and delivery means for feeding pins to an indexable pin receiver including a plurality of pin receptacles arranged to move successively past a pin receiving station in such a manner that pins are delivered only to preselected pin receptacles and the indexable receiver is otherwise maintained empty, and in which apparatus there is also included deck means disposed to receive the pins from the preselected receptacles and deliver the pins so received to a bowling alley, especially while maintaining the deck structure otherwise normally full of pins so that the deck structure normally contains a full complement of ten pins to enable more rapid and efficient change in pin selection.

In preferred aspects of this invention, features which may be employed in accordance herewith are motor actuated cable operated single clamp means for preventing setting of non-selected pins by the deck structure, a turret control system including a wiper adapted to track on a plurality of concentric circular arrays of contacts for completion of electrical contact at or during appropriate intervals coordinated with the rotation of the turret to effect control of delivery of pins to the turret, a console device removed from the location of the pinsetter for remote actuation of control means at the pinsetter, an accessible means such as a jumper arrangement on the pinsetter in a disconnect plug of the control console adapted to prevent pin jams if the console is unplugged while the turret is receiving pins, a particular cable control assembly which includes a motor adapted to drive a threaded shaft to cause a nut member to thread longitudinally on the shaft and tighten a cable for holding clamps in the pin deck in a preselected position to permit or prohibit setting of pins from the pin positions as desired wherein the movement of the nut along the shaft and the movement of the pin deck structure during the pin setting operation are effective to automatically hold the proper clamps in proper positions and are also effective to reset the cable control mechanism responsive to conditions at the pin deck for use during a subsequent pin setting cycle.

Other objects and advantages will become readily apparent from the following detailed description taken in connection with the accompanying drawings, in which:

FIGURE 1 is a vertical sectional view illustrating an embodiment of the turret control of the present invention with portions of the turret and conveyor actuating mechanisms to which the control is applied;

FIGURE 2 is a top view of the turret control mechanism shown in FIGURE 1;

FIGURE 3 is a plan view of turret switch contacts with a turret wiper removed showing arrangement of contacts and also illustrating placement of rake switches;

FIGURE 4 is a perspective view of the turret wiper mountable in the assembly of contacts of FIGURE 3 to form the turret switch;

FIGURE 5 is a fragmentary elevational view of a pinsetter control mechanism including a solenoid means in the circuit of the present control;

FIGURE 6 is a plan view of the pinsetter deck structure with parts broken away and removed to more clearly illustrate the construction;

FIGURE 7 is a side elevational view of the pinsetter deck structure of FIGURE 6, with parts removed to more clearly illustrate the construction;

FIGURE 8 is an enlarged, fragmentary vertical section taken generally along the line **14—14** of FIGURE 6;

FIGURE 9 is an enlarged fragmentary vertical section taken generally along the line **15—15** of FIGURE 6 with the clamping assembly removed for clarity;

FIGURE 10 is a vertical section of the clamp at the #3 pin position taken along line **16—16** in FIGURE 6;

FIGURE 11 is a plan view of a drive and control for the clamping mechanism on the deck structure shown in FIGURE 6;

FIGURE 12 is a rear elevation of the clamping mechanism of FIGURE 11;

FIGURE 13 is a plan view of a console panel embodied in the control of the present invention;

FIGURE 14 is a vertical section through the control panel taken generally along line **20—20** in FIGURE 13;

FIGURE 15 is an enlarged side view of the set button as shown in FIGURE 14 but with parts removed to illustrate construction; and

FIGURE 16 is a wiring diagram illustrating the control circuit of the present control.

While an illustrative embodiment of the invention is shown in the drawings and will be described in detail herein, the invention is susceptible of embodiment in many different forms and it should be understood that the present disclosure is to be considered as an exemplification of the principles of the present invention and is not intended to limit the invention to the embodiment illustrated. The scope of the invention will be pointed out in the appended claims.

The present invention is best understood with the disclosure of A. P. Rogers, U.S. 3,219,345, issued Nov. 23,

1965, and especially the portion of the disclosure relating to Rogers FIGS. 1 through 7, as background. That disclosure is incorporated herein by reference. Rogers discloses a pin handling mechanism for use in an automatic pinsetter and including a turret structure and a conveyor structure arranged to deliver pins one at a time to the turret structure. The conveyor is adapted to receive pins from a pin gathering mechanism for collecting pins in the pit at the end of a bowling alley, elevating the pins to the level of the receiving end of the conveyor and depositing the pins on the conveyor for travel serially with the butts of the pins leading. The turret structure is adapted to deliver as many as a full complement of ten pins to a pinsetting structure for setting the pins initially in playing position on the alley, lifting standing pins after a first ball is rolled in order to permit removal of dead wood, and resetting such pins in playing position for the second ball. A complete automatic pinsetter is not described and illustrated herein, but rather reference should be made to such known pinsetter as that described and illustrated by Huck et al. in U.S. 2,949,300, patented Aug. 16, 1960 as a pinsetter in which the apparatus herein described can conveniently be used.

According to the present invention, a control is imposed on the mechanism described by Rogers with reference to Rogers FIGS. 1 through 7 and 13 through 15 for the purpose of preselectively designating only one or more pin positions, less than ten, at which it is desired that pins be set. Such a control enables the setting of a selected pin, or a group of selected pins, rather than the entire complement of ten pins, for example, for the purpose of enabling a bowler to practice shots at selected pins. To assist in correlating with that system and imposing the control thereon, the reference numbers used in this application are identical with those used by Rogers, and FIGURES 1 through 16 of this application are the same as FIGS. 8–10, 10*a*, and 11–22 seriatim of Rogers. Thus, for any elements illustrated and referenced in the present drawings and not particularly described herein, those in the art can readily refer to the Rogers patent for the more complete description.

Referring now to FIGURE 1, a pin gate and turret control solenoid assembly is provided as generally shown at **200** mounted by bracket **200***a* to frame member **14**. The solenoid assembly has two solenoids **S–12** and **S–13** secured therein, each of which may be a 230 volt A.C. solenoid. Solenoid **S–12** is provided for causing the pin receiving turret to index any or all of the nine outer pin receiving pockets past the pin receiving station while at the same time preventing delivery of pins from the cross conveyor to the selected pocket or pockets which are not to receive pins. Thus, solenoid **S–12**, when energized, indexes the turret in the same manner as a pin dropping on the turret indexing lever **99** would index the turret. Solenoid **S–13** is provided for causing the turret to index the chute **35** past the #5 pin receiving station while preventing delivery of a pin from the cross conveyor when the #5 pin has not been selected. Additionally, solenoid **S–13** trips the turret-spider latch to drop pins from the turret to the deck when the #5 pin has not been selected.

Solenoid **S–12** slidably operates link **201** which is pivotally connected to lever **99** as at **203**. Thus, lever **99** is pivotable by link **201** about its mounting on the frame, as at **100**. As described by Rogers, clockwise movement of the trip member **99** in this fashion is effective through the latch release link **95** (FIGURE 1) to pivot the latch **90** in a clockwise direction, releasing the stop roller **83** and the stop lever **84** to free the turret for indexing rotation. It will be understood that the solenoid mechanism thus described produces the indexing function normally provided by the dropping of a pin from the cross conveyor onto the trip member **99**. The latter is returned to its normal position illustrated in FIGURE 1 by the spring mechanism **102**.

Solenoid **S–13**, slidably operates link **202** which is pivotally connected to lever **206** as shown at **204**. Lever **206** is spring urged in a counter-clockwise direction from the position shown by torsion spring **209** and carries cam roller **208** at its other end. The function of cam roller **208** is to ride an inclined cam surface **220** on a member **221** pivoted on the turret assembly, upon rotation of the turret to bring cam **220** into contact with roller **208**. The upward urging of cam **220** and member **221** causes lever **111** to pivot about its mounting at **112** to the left as viewed in FIGURE 1, lever **111** and member **221** being yieldably connected by spring **222**. Pivoting of lever **111** causes pivoting of trip member **47** in a clockwise direction as viewed in FIGURE 1 to simulate pivotal movement normally given to this member upon passage of a pin from the cross conveyor **11** to the chute **35**. This action frees the spider for indexing movement relative to the turret so that the pins which are delivered to the turret may be suitably dropped to the deck structure therebelow even though no pin is received by the chute **35**. Indexing of the spider in the manner described immediately above initiates a series of operations described by Rogers, which results in subsequently indexing the turrent relative to the spider to reposition the spider arms in supporting positions and to index the #9 pocket of the turret to the pin receiving station beneath the end of the cross conveyor **11**.

As has been stated, solenoids **S–12** and **S–13** each additionally act to block pin gate **55** and hold the pin gate in closed position to prohibit passage of pins from cross conveyor **11** to the turret mechanism. Accordingly, sleeve member **211** is pivotally mounted on frame member **100** and carries arms **212** and **213** projecting therefrom. Energization of solenoid **S–12** has been described as causing clockwise pivoting of trip member **99**. Upon clockwise pivoting, an arm **207** on trip member **99** engages arm **212** upon which a pin gate lock link **214** is mounted. Pin gate lock link **214** is connected pivotally to the pin gate arm **57** as shown at **215** for locking the pin gate **55** in its closed position shown in FIGURE 1 regardless of release by latch member **64**.

For locking of the pin gate by solenoid **S–13**, arm **213** is engageable by an abutment lever **206** which is moved in clockwise direction by the action of solenoid **S–13** as already explained. Lever **206** acts by engagement with arm **213** through sleeve **211**, arm **212**, pin gate lock link **214** and pivotal connection **215** to hold pin gate **55** in raised or closed position regardless of the operation of latch member **64**.

Because of the normal timing of pin gate **55** with usual operation of the illustrated embodiment, the pin intended for chute **36** is normally conveyed past the pin gate **55** before chute **36** is completely indexed to receive the pin. For this reason, solenoid **S–13** is energized, in a manner to be more fully descirbed hereinbelow, just prior to indexing of the chute to the pin receiving station beneath the end of cross conveyor **11**. In this manner, the pin intended for chute **36** is timely stopped on the cross conveyor when no pin is needed in the **45** pin position. Thus, with **S–13** energized as the turret rotates to position chute **36** beneath the end of cross conveyor **11**, cam **220** contacts roller **208** and rides upwardly on the roller in such manner that upon proper positioning of chute **36** lever **111** is urged to a raised position pivoting trip member **47** in a clockwise position and triggering the same mechanisms as are triggered by dropping a pin through chute **35** for dropping pins delivered to the turret to the deck structure below the turret even though chute **35** receives no pin.

Also shown in FIGURE 1 is solenoid **S–14** which may be termed a 180° stop solenoid, a control superimposed on normal pinsetter operation for purposes of providing one of two alternative modes of operation utilizing the control of the present invention. As will appear, the solenoid may be utilized selectively to provide, instead of automatic operation whereby selected pins are re-

peatedly positioned on the alley, a mode of operation whereby the pattern of selected pins may be frequently changed. Specifically, as will appear, the solenoid is provided to stop the pinsetter, after each ball is rolled, at 180° in its cycle, that is, with the rake mechanism down adjacent the alley in its most rearward position having just swept pins, to remind the bowler that a pin selection should be made and the pinsetter set in operation.

As indicated above, the present apparatus is intended for use with and as part of automatic pinsetters such as that described by Huck et al. in U.S. 2,949,300. As illustrated in FIGURE 1, solenoid S–14 is mounted to a suitable frame member **14** by means of a mounting bracket as indicated generally at **131**. The operating or motor arm of solenoid S–14 is secured by bracket **130** to a connecting link **236**. The connecting link **236** corresponds to the connecting link **236** of Huck et al., cited above, which acts to control a clutch assembly and the upper deck position to effect the 180° stop. The stopping action and the mechanisms particularly effecting the 180° stop are fully described by the Huck et al. patent and reference is made to that patent for fuller explanation thereof.

Mounted above the turret is a control box **140** for solenoids S–12 and S–13. Control box **140** is mounted on a supporting bar **151** secured to frame member **51** by means of support bracket **152**. The box is also supported by means of brackets **145** on frame member **143**. A flexible drive shaft **147** is suitably connected at **33** to the turret for rotation therewith, preferably at about the axis of rotation of the turret. Flexible drive shaft **147** extends into control box **140** and drives wiper **160** counter-clockwise about circular arrays of switch contacts, TS–1 through TS–12, as better illustrated in FIGURE 3. Wiper **160** has been shown removed from the switch contacts for clarity and is illustrated in FIGURE 4 but its association with the arrays of contacts will be apparent.

Wiper **160** (FIGURE 4) includes a flat driven member **161** having an arm **162** carrying inter-connected electrical wipers or contact members **163**, **164** and **165**. The three wipers are adapted to wipe the three concentrically circular arrays of contacts on the printed circuit board **166**. Wiper **163** is the common wiper which slides over circular contact **167** while wipers **164** and **165** slide over the inner and outer circular arrays of contacts in the order of their positions upon the board **166** to in effect close switches TS–1 through TS–12. The complete circuitry will be apparent with respect to the wiring diagram of FIGURE 16 discussed hereinbelow.

A time delay **168** and first and second rake switches **169** and **170** are also mounted within the control box as shown in FIGURE 3. The function of the time delay will be described below. Rake switch **169** is a normally open switch and rake switch **170** is a normally closed switch. Switches **169** and **170** each include a pivotally mounted switch operating arm **142***a* spring biased in a counter-clockwise direction to hold switches **169** and **170** in their normal positions. Switch actuator **142***c*, mounted by bracket **142** to rake shaft **141** for movement therewith, is adapted to pivot operating arm **142***a* against the biasing of its spring to actuate switches **169** and **170** respectively to closed and open positions (as shown in FIGURE 1) upon counter-clockwise rotation of rake shaft **141** for the purpose of returning the rake to its normal retracted position. Clockwise rotation of rake shaft **141** to sweep the alley results in release of operating arm **142***a* permitting return of switches **169** and **170** to normal positions. The rake switches are used for control purposes which will be more apparent hereinbelow.

Referring to FIGURE 5, in order to hold a pinsetter of the type illustrated in the previously mentioned Huck et al. Patent 2,949,300 at all times during selective pin bowling in a mode of operation corresponding to that normally following the second ball in conventional bowling, the pinsetter may be provided with a solenoid S–11

connected as by a link **171** to an extension **494** of a latch **492**, corresponding respectively to the extension **494** and the latch **492** in the patent mentioned, to move the latch in a clockwise direction from the position illustrated in FIGURE 5 to a position providing second ball operation in the manner set forth in the patent. This assures that during selective pin bowling, after each ball is rolled the selective pin setup is again repeated without the need for the pinsetter to go through cycling normally providing for the rolling of two balls if these are necessary to knock down the pins. As will appear, the solenoid S–11 is connected in the circuit of FIGURE 16.

Turning now to FIGURES 6–9 of the drawings, there is illustrated an automatic pinsetter deck structure of the general type disclosed in U.S. Patent No. 2,949,300 to Huck et al., and reference may be had thereto for additional discussion of the pinsetter construction and operation. The deck structure is substantially horizontally disposed over the end of a bowling alley adjacent its pit for receiving pins from the turret and setting the pins on the bowling alley in preparation for bowling. In normal bowling operation of the deck structure for conventional bowling, after a first ball has been rolled, the deck structure picks up the pins which remain standing to permit removal of dead wood and then resets the last mentioned standing pins for continued bowling and normally after each frame the pinsetter sets new pins on the bowling alley for play of the following frame.

Generally, the deck structure is vertically movable toward and away from the surface of the bowling alley over which it is installed. The pinsetter deck structure includes an upper deck **225** having a generally triangularly shaped upper deck plate **227**, and a lower deck structure **228** including a generally triangularly shaped intermediate deck frame or plate **229***a* and a lower triangular deck plate **229***b*. As illustrated in FIGURES 8 and 9, upper deck **225** is supported on lower deck **228** for movement longitudinally of the bowling alley by tracks **231** on the upper deck riding on rollers **232** journaled on shafts **233** mounted on the lower deck. Upper deck plate **227** has suitable openings **234** for receiving bowling pins from the turret. Pins delivered to openings **234** are received on suitable rollers **235** mounted on lower deck **228** when upper deck **225** is disposed longitudinally forwardly on lower deck **228** in a pin receiving position. By moving upper deck **225** longitudinally rearwardly on lower deck **228** to a pin setting position (not shown), the upper deck plate openings **30** are generally aligned with and overlie pin passing openings in the lower deck plates **229***a* and **229***b* and pins in upper deck openings **234** move off of lower deck rollers **235** and drop through the lower deck openings.

Mechanism for moving upper deck **225** across lower deck **228** is fully described in the aforementioned Huck patent, and will be briefly described herein in the form of a cable mechanism. Movement of the upper deck **225** forwardly on lower deck **228**, from the pin setting position (not shown) to the pin receiving position illustrated in FIGURES 6 and 7 is accomplished by drawing a cable **230** over a pulley **230***a* journaled on the upper end of a support **237** which is mounted on lower deck **228**. Cable **230** also passes around a pulley **238** journaled on lower deck **228**, and passes around and is attached to a pulley **239** secured to the end of a shaft **240** for rotating pulley **239**. Shaft **240** extends across the rear of lower deck **228** and is journaled at opposite ends on the lower deck. Secured to pulley wheel **239** are a pair of generally diametrically opposed outwardly extending cam pins **241***a* and **241***b* which are movable in cam slots **242***a* and **242***b*, respectively, in cam plates **242***c* secured to and depending from both sides of upper deck **225**, for moving the upper deck forwardly and rearwardly on lower deck **228**. During movement of the upper deck to the pin receiving position shown in FIGURES 6 and 7, pulley wheel **239** is rotated clockwise as seen

in FIGURE 7, winding a spiral torsion spring 244 which is telescoped on shaft 240 and has one end 244*a* anchored on lower deck 228 and an opposite end 244*b* attached to a spring anchor secured on shaft 240. When cable 230 is released spring 244 partially unwinds, rotating pulley wheel 239 counter-clockwise and cam pin 241*a* upwardly in slot 242*a* rapidly moving the upper deck 225 rearwardly on lower deck 228, whereupon cam pin 241*b* is engaged in cam slot 242*b* continuing rapid rearward movement of the upper deck. Actuation of cable 230 is controlled in a suitable manner responsive to a pinsetter operating mechanism as is fully discussed in the previously mentioned Huck patent.

Mechanism is provided for lifting and resetting standing pins on the alley for removal of dead wood after the first ball of each frame during normal bowling. In the illustrated embodiment upper deck 225 is provided on its underside with circular resilient pads or discs (not shown) suitably secured to the underside of upper deck plate 227 and positioned to engage pins standing on the alley when the deck assembly is lowered and in pin detecting position, whether the pins are standing exactly on spot or within a predetermined area surrounding the spot. Engagement of the pads with the tops of standing pins holds the pins securely in position to be gripped at the neck thereof by scissor pick-up mechanisms 243, one associated with each opening in the lower deck and mounted on lower deck plate 229*b* for securely gripping a pin standing within the opening. Suitable scissor pick-up mechanism is more fully discussed in both the aforementioned Huck patent and in Sanford Patent No. 2,817,528.

Also for normal bowling, means for detecting and indicating pins standing on the alley may be provided by apparatus including switch assemblies 245 mounted on upper deck plate 227, and one associated with each opening 234 therein. Each switch assembly is operated in repsonse to a switch actuator detecting the presence of a standing pin on the bowling alley surface to operate a suitable indicator visible to the players, such as a light illuminated in response to operation of the respective switch assembly 245, as is more fully described in copending patent application of Conklin and Torresen, for a "Pin Detecting and Indicating Apparatus," S.N. 126,974, filed July 26, 1961, and now Patent No. 3,118,671.

In association with switch assemblies 245, four cables indicated by reference numeral 246 extend diagonally across the top of upper deck 225 and each cable operates one or more of switch assemblies 245 to reset the latter. The cables 246 are guided by pulleys mounted for rotation about vertical axes, and each cable has an end suitably secured to a fitting pivotally attached as by bolt to one arm 247*a* of a bell crank 247. The bell crank is suitably journaled by a nut and bolt assembly on a housing 227*a* on upper deck plate 227 for pivotal movement about a vertical axis. During movement of the deck assembly from pin detecting position as shown in FIGURE 12 to pin setting position (not shown) upper deck 225 moves longitudinally of the bowling alley and rearwardly across lower deck 228. A second arm 247*b* of the bell crank engages an abutment 228*a* on the lower deck assembly 228 and the bell crank moves clockwise as viewed in FIGURE 12. Such clockwise movement of the bell crank permits limited movement of the cables 246 with respect to upper deck 225 due to springs provided for this purpose as described by Torresen et al. in copending patent application for a "Pin Detecting and Indicating Apparatus," S.N. 133,476, filed Aug. 23, 1961, and now Patent No. 3,094,326. The spring retain cables 246 taut. When the deck assembly again moves from pin setting to pin detecting position, the springs also maintain cables 246 tight and bell crank 247 is rotated counter-clockwise through engagement with abutment 228*a* to prevent any slack developing in the cables 246.

The deck structure as illustrated in FIGURES 6–9 is provided with means for clamping nonselected pins with the deck structure during the pin setting operation where it is desired to bowl only at selected pins. Reference is also made to FIGURE 10. Each pin position is provided with a clamp assembly adjacent openings 234 and adapted to pivot a clamp 295 into the opening to hold a bowling pin against being deposited upon the alley during the pin setting phase. The clamps can be activated or de-activated in accordance with a preselected plan.

Each clamp assembly includes a clamp lever 294 (294*b* in the case of the clamp assembly at the #1 position) pivotally mounted through a mounting plate 293 and the upper deck 225. A clamp 295 is secured to the lower end of each clamp lever and is carried thereby just below the upper deck 225 for pivoting with the clamp lever. In positions #2 through #10, a cable pulley 296 is rotatably mounted on arm 294*a* of clamp lever 294. The lever arm of clamp lever 294*b* is indicated at 299 but carries no pulley. Solenoids S–1 through S–10, which are spring return solenoids, are mounted on the mounting plates 293 at the respective pin positions, i.e., S–1 at #1 pin position, S–2 at #2 pin position, etc. Solenoids S–2 through S–10 have their plungers pivotally connected to latch levers 297 and solenoid S–1 has its motor arm pivotally connected to a latch lever 297*a*. Clamp levers 294 are each urged by a tension spring 298 or a compression spring 298*a* (#1 position) acting upon clamp lever arms 294*b* or 299 to bias clamps 295 away from pin clamping position, i.e., away from or out of openings 234. Latch levers 297 engage clamp levers 294 to stop movement of clamps 295 into openings 234, i.e., into pin engaging position.

Cable 256 extends from a cable drive mechanism indicated generally at 248 operatively through a plurality of rotatably mounted cable pulleys, including the aforementioned cable pulleys 296, and its other end is anchored on lever 299 at 300. The additional pulleys other than pulleys 296 are indicated in FIGURE 6 and may be referred to herein as pulleys 301, each of which is mounted for rotation on one of the pulley mounting plates 302. The pulley mounting plates 302 are secured in raised position above the upper deck.

In operation, preselection of a pin position for setting only selected pins, by means to be fully described hereinbelow, results in preventing completion of an electrical circuit to the solenoid controlling the clamp lever latch at the positions selected. During the pin setting phase when the pins are being deposited on the bowling alley, an electrical circuit to only the solenoids at the nonselected positions will be completed just prior to relative movement of the upper and lower decks for depositing the pins on the bowling alley. Thus, the solenoids at the nonselected positions, being energized will pivot the latch levers 297 out of engagement with clamp levers 294 to enable the clamp levers to be pivoted clockwise against the urging of tension springs 298. At the selected positions, latch levers 297 will prevent such clockwise pivoting of the clamp levers. In the case of pin position #1, where the pin position is not selected, solenoid S–1 will be energized and will pivot latch lever 297*a* in a counter-clockwise direction to permit counter-clockwise movement of lever arm 299 which is otherwise blocked from appreciable counter-clockwise movement by latch lever 297*a*. Pivoting of lever 299 is against the urging of compression spring 298*a*. If pin position #1 is a selected position, solenoid S–1 will not be energized and the lever arm will be blocked.

Also prior to shifting of the upper and lower decks for setting of the pins, cable 256 is pulled by cable drive 248 in a manner to be discussed below. It will be noted that cable 256 operatively engages pulleys 296 from one side of clamp lever arms 294*a* in such manner as to urge the clamp lever arms against the latch levers when the solenoids are de-activated. In those pin positions where the solenoid is activated and the latch lever is pivoted

out of engagement with the clamp lever arm, the pulling of cable **256** will, through pulleys **296**, pivot the lever arm **294** so as to carry the clamp **295** into engagement with a bowling pin in the opening **234**. Such engagement of a pin with the clamp would prevent the bowling pin from passing through opening **234** and from being set on the bowling alley. However, where the solenoid is not energized, due to selection of the pin position, the clamp will not be pivoted to engage the pin and the pin will be permitted to freely pass through the normal pin setting operation to the bowling alley.

In the case of pin position #1, the end of cable **256** is secured to lever **299** and upon pulling cable **256** lever **299** is moved or urged against latch lever **297***a* where pin position #1 is a selected position and solenoid S–1 is not energized, or will cause pivoting of arm **299** and the clamp **295** into engagement with the pin to prevent setting of the pin where pin position #1 is a nonselected position and the solenoid S–1 is accordingly energized. Referring to FIG. 16 there are shown capacitors C–1 through C–10, one capacitor across the coils of each of the solenoids S–1 thru S–10. These capacitors are used to compensate for the voltage drop caused by the current drain of each of the solenoids.

After the selected pins have been set on the alley, cable **256** is released by the cable drive mechanism **248** and all clamps are returned by tension springs **298** or compression spring **298***a* to their non-pin engaging positions as shown in FIG. 6. The latch levers also return to their illustrated positions.

In preselected bowling during setting of the pins from the pin deck, the clamps holding the pins in the non-selected positions are maintained effective by means of a motor driven cable arrangement indicated in FIGURE 6 generally at **248**. Referring to FIGURES 11 and 12, there is provided a frame **249** which is supported on the upper deck **225** and upon which is mounted a plurality of associated elements for controlling cable **256** which extends in association with the deck clamp pulleys **296** as described hereinabove. Accordingly, motor **250** is provided and drives a screw rod **251** rotatably mounted on the frame. Motor **250** is a reversible motor which may be controlled by on-off switch **291** and through reversing switch **290**.

The apparatus illustrated in FIGURES 11 and 12 can best be described with reference to its operation. Accordingly, motor **250** is eneregized by means of second rake switch **170** as will be more apparent hereinbelow. Motor **250** rotates screw rod **251** to cause nuts **252**, threaded on screw rod **251**, to be driven away from the motor, toward an extended position shown in dotted lines. Nut **252** carries a pulley **253**. Clamp cable **256** extends through pulleys **254**, **253** and **255** and is anchored at **257** on rod **258** which is biased to the left by spring **259** grounded against frame member **260**. As nut **252** progresses away from motor **250**, cable **256** is tightened to hold clamps **295** in their selected positions on the upper deck structure. The resulting tension on cable **256** is also applied at **257** to rod **258** to urge rod **258** against the biasing of spring **259**. Rod **258** carries a guide pin **258***a* which guides in slots **261** in frame **249** defining a limit of lengthwise movement of rod **258**. As rod **258** is pulled by cable **256**, lever **268** which is biased by spring **270** against guide pin **258***a* is permitted to contact and open normally closed clamp switch **271**. Opening clamp switch **271** results in de-energizing and stopping motor **250**.

As lever **268** pivots about point **269** under the urging of spring **270**, roller **272** which is carried by lever **268** is withdrawn from engagement with lever **273**. Lever **273** is pivotally mounted at **273***a* and is biased by torsion spring **274** in a clockwise direction. Cable **282** extends from slide member **280** through a system of pulleys **283**, **284**, **285** to crank member **247** (FIGURE 6) and slide member **280** is in effect controlled by crank member **247** through cable **282**. Crank member **247**, which is a part of the pin detection assembly as described above and as more particularly described in the above mentioned Patent No. 3,094,326, pivots and the resulting slack in cable **282** is taken up by sliding of slide member **280** under the biasing of tension spring **281** to permit hook end **273***b* of lever **273** to slide past an engaging position with lever **286**.

The crank member **247** is caused to return to its original position by the upper deck moving forward after deck motion normally used for setting pins.

Upon pivoting of crank member **247** back to its original position, cable **282** pulls slide member **280** back to the position shown in FIGURE 12 against the tension of spring **281**. End **273***b* engages lever **286** and pivots lever **286**, mounted pivotally at **269**, in a counter-clockwise direction. As lever **286** pivots it disengages switches **290**, a pair of switches, one behind the other adapted to reverse the direction of the motor **250**. Pivoting of lever **286** also compresses spring **287** and because lever **286** is in engagement with pin **288**,, pivoting of the lever moves pin **288** away from its blocking position with respect to lever **265**. Because nut **252** has progressed away from lever **265** on screw **251**, lever **265** is now free to pivot in a clockwise direction under the urging of spring **266**. Lever **265** thus engages and closes switch **291** to energize motor **250**. Motor **250** rotates screw rod **251** in the opposite direction and nut member **252** is returned to its original position. During return of nut member **252** to its original position, it is apparent that the tension on cable **256** is lessened and rod **258** is permitted to return to its initial position under the urging of spring **259**, thereby urging lever **268** from engagement with switch **271** to close switch **271**. Roller **272** re-engages lever **273** and pivots end **273***b* out of engagement with lever **286** and lever **286** is urged by spring **287** toward its original position but is stopped from returning to its original position by engagement of pin **288** with lever **265**. Upon return of nut member **252** to its original position, lever **265** is pivoted against the urging of spring **266** out of engagement with switch **291** to de-energize motor **250** and out of engagement with pin **288** to permit pin **288** to return to its original position thereby permitting lever **286** to re-engage switch **290**. De-energization of motor **250** by switch **291** is accomplished regardless of the closed position of the second rake switch as will be apparent from discussion of the wiring diagram in FIGURE 16 hereinbelow. Thus, the apparatus is reset for use during the next cycle.

The control panel or console is illustrated in FIGURES 13 through 15. Reference is also made to the wiring diagram of FIGURE 16. Turning now to those figures, the console includes a housing **310** mounted on suitable framework as indicated at **316**. Housing **310** includes a top panel member **311** which has a decorative upper surface. As viewed from the upper surface (FIGURE 13), the console includes "on-off" button **312** for operating on-off slide switch **345**, a "single spare-repeat spare" button **313** for operating the "automatic" slide switch **346**, and a warning light **314**. The "on-off" switch is the master switch for energizing the circuitry of the present control system. The automatic switch is turned to the "on" or "repeat spare" position for the purpose of repeating the same combination of pins set by the pinsetter with each machine cycle for practice bowling purposes. The warning light or indicator indicates to the bowler when the keyboard is locked and buttons cannot be depressed for purposes of selecting a new combination of pins to be played.

"Set" button **317** operates "set" switch **347** (FIGURE 16) when the automatic switch is in the "off" or electrically closed position. The "set" switch is depressed by the bowler to clamp the pins and start or initiate loading of the turret. "Clear" button **315** is provided

to clear the keyboard in a manner to be described hereinbelow.

The keyboard portion of the console includes ten keys or buttons **320**, differing from each other only by numerical designations of **1** to **10** on their upper faces. Keys or buttons **320** are carried on plungers **321** and are normally urged to an upward position or raised position by means of coil springs **322** anchored on a plate member **340** and biasing buttons **320** upwardly. Each plunger **321** carries a latch member **323** pivotally mounted on the plunger and normally urged by spring **322** toward a latch or hold position. Latch members **323** are each provided with a recess **325**. With buttons **320** in the raised position, latch members **323** are retained to the right as viewed in FIGURE 14, against the urging of spring **324** by means of plate member **340**. When the button **320** is depressed, notch **325** becomes aligned with plate **340** and latch member **323** is urged to the left with notch **325** engaging the plate to hold the button and plunger in depressed position.

Clear button **315** is provided to permit buttons **320** to return to the raised position. Button **315** is secured to the top of the plunger **331** which is spring biased by spring **332**, anchored on plate **340**, to a raised position. Roller **333** is rotatably mounted on and carried by plunger **331**. Hold plate **341** is provided for coacting with roller **333** upon depression of button **315** for clearing the keyboard. Release plate **341** abuts each of the latch members **323** in the hold position of the latch members. Plate **341** is slidable with respect to plate **340** and is spring biased in one direction, e.g., by spring **339**. Depression of button **315** causes roller **333**, in engagement with cam portion **341***a* of plate **341** to urge plate **341** against any of the latch members **333** which are in the hold position and against the biasing of springs **324** of such latch members until notch **325** becomes disengaged from cross member **340**, at which time spring **322** urges button **320** back to its raised position. Upon release of button **313**, spring **339** returns plate **341** to its position providing re-engagement of notches **325** with cross member **340** as before.

Each of the buttons **320** controls one of switches PS–1 through PS–10 in accordance with the number on the upper surface of the button. With buttons **320** raised, PS–1 through PS–10 are all closed by contact with printed circuitry on the lower face of circuit board **343**. The printed circuit on the lower surface of circuit board **343** corresponds to circuitry diagrammed in FIGURE 16. The switch members PS–1 through PS–10 are mounted to plungers **321** and insulated therefrom by electrical insulating means **328**, e.g., a rubber grommet or the like.

Solenoid S–15 is mounted within housing **310** and is actuatable to move lock plate **342** into engagement with lock recesses **326** and **327** on each of plungers **321** to lock buttons **320** in the depressed and raised positions respectively. Solenoid S–15, by means of lock plate **342**, also functions to lock button **315** against depression by sliding lock plate **342** into slot **334** of plunger **331**. The lock plate **342** is moved to the left as illustrated in FIGURES 14 and 15 by solenoid S–15 in order to effect the locking action. The solenoid S–15 which is a 24-volt D.C. solenoid, is energized just before turret loading begins, i.e., at the time the clamp motor is started, and remains energized until after the turret has been loaded and has dropped pins into the deck. Thus, the solenoid S–15 prevents the bowler from intentionally or unintentionally changing the selection during this period of time in order to insure correct delivery of pins to the turret and from the turret to the deck, to accurately replace the pins dropped from the normally filled deck.

Lock plate **342** has an abutment **342***a* engageable with an actuator **306***a* which controls an "anti-tease" switch **306** to close switch **306** only when the lock plate is in locking position and open switch **306** when the keyboard is unlocked. Switch **306** controls the selection circuitry (FIGURE 16) to prevent energization of the selection circuits when the keyboard is not locked. Because partially depressed keys may prevent closure of the lock plate, the arrangement assures that the selection circuitry is not energized until the keyboard is locked following completion of a selection.

Set switch button **317** is secured to the upper end of plunger **318** and is biased upwardly by spring **319** in the same manner as buttons **320** are biased upwardly. Plunger **318** works set switch **347** (FIGURE 16), included within the printed circuit on board **343** upon which contacts of the same construction as provided for PS–1 through PS–10 are adapted to rest while button **317** is in its normal raised position. Thus, switch **347** is a normally closed switch and depressing button **317** opens switch **347** until button **317** is released and the switch contacts re-engage the printed circuit.

The electrical circuitry of the specific embodiment of this invention is diagrammatically illustrated in FIGURE 16. The circuit is supplied by a power source of 230 volts A.C. applied at A and B. A conventional transformer T–1, capable of supplying about 24 volts D.C. in the secondary is included as illustrated. Additionally, a conventional circuit breaker CB is employed in the secondary of T–1.

The electric circuitry will be further discussed hereinbelow with reference to the cyclic operation of the pinsetter. According to normal operation, the machine is ready for bowling of the first of two balls at 0° of a cycle. The first ball is bowled and triggers the machine. The pin deck descends to detect for standing pins and lifts any pins remaining standing. The bottom of the detecting stroke occurs at 90° and at 180° the deck is raised carrying the lifted pins. Also at 0°, the rake starts down, sweeps the dead wood backward and is at its rearmost position at 180°. Thus, at 180° of the cycle, the rake is still down and the pins left by the first ball are lifted. Thereafter, the lifted pins are reset and the rake comes up, the bottom of the re-set stroke occurring at 270°. The deck rises and is in its raised position at 360°.

Assuming that a second ball is to be bowled, the machine over-cycles and stops at 90° instead of stopping at 360° to await the second ball. This over-cycling eliminates the detecting portion of the cycle unnecessary after bowling a second ball thereby cutting down on pin setting time. The deck remains up while over-cycling. The second ball is bowled and triggers the machine. The rake descends and sweeps the alley. The rake is still down at 180° but thereafter rises and a new set of pins is set at 270° by the descending deck and the deck rises at 360° to await the bowling of a new first ball.

Where a strike occurs on bowling the first ball, the absence of pins is detected during the detection stroke and a new set of pins is set at 270° and the machine comes to rest at 360°.

The control system for use in the present invention places the pinsetter in a mode of operation at all times simulating that normally followed after bowling a second ball in the frame. Accordingly, the machine always over-cycles and stops at 90°, the starting point for one-ball spare bowling in accordance herewith. When the ball is then bowled it triggers the machine. In automatic operation for setting the same selective combination of pins in each successive cycle, the cycling continues past 180° and the pins are set as selected at 270° and the deck rises with the machine over-cycling and stopping at 90° to await again the bowling of a ball at the selected pin combination. Where it is desired to change a selection of less than ten pins, this is done before the machine starts from 90°. After 90°, the turret indexes to receive pins for replacement of the pins in the deck to be set during the next cycle and the pattern for

the next cycle set is established. The keyboard remains locked during turret indexing to prohibit making or changing a selection. Thus, if a change in selection is made before bowling, the new selection is set immediately after bowling.

During non-automatic operation, i.e., where it is desired to bowl at different combinations of pins for each successive ball, the new selection of pins is usually made each time the machine is waiting at 90°. However, where no selection is made at 90°, e.g., the operator forgets to select prior to bowling, the 180° stop solenoid S–14 is actuated and stops the machine at 180° with the rake still down prior to setting the pins, at which time a selection may be made, and the selected combination is then set.

In initiating either automatic or non-automatic selective operation in accordance herewith, the turret is first cleared of pins so that pins subsequently may be directed only to preselected pockets in the turret. This, of course, entails one cycling of the automatic pinsetter, ordinarily maintained with a full deck and a filling turret, in order to drop the ten pins from the deck and release ten pins from the turrret to the deck to ready the turret for receiving preselected pins. In operation, assuming ten pins are on the alley and the pinsetter is at 0° of its cycle, referring to FIGURES 13–16, in order to ready the pinsetter for operation in selecting a predetermined combination of pins to be set up on the alley deck, the "on-off" slide switch **345** is moved to the "on" position. Relay R–1 is thereby actuated and contacts R1–1 and R1–2 open while contacts R1–3 and R1–4 close. Opening of contacts R1–1 and R1–2 isolates relay R–2 from the anti-tease switch **306**. Closing of the R1–3 contacts completes the circuit from time delay **168**, a thermal time delay relay with normally closed contacts **168–1**, to a pinsetter re-cycle solenoid S–16, in circuit with source C, D. The re-cycle solenoid corresponds to that provided in the pinsetter as shown at **580** in the Huck et al. patent, for example. A delay of about five seconds is provided to cause the pinsetter to cycle once when switch **345** is first closed, and after such delay, contacts **168–1** open. Closing contacts R1–4 energizes the second ball solenoid S–11 located in the pinsetter, so that the pinsetter is over-cycled to 90° for second ball operation thereby to eliminate parts of the cycling normally provided for the bowling of two balls.

It will be noted that at this time there is no power to the pin selecting circuitry because the R6–2 contacts and switch **306** are open. When the pinsetter is triggered by the re-cycle solenoid, the ten pins on the alley are swept away and ten pins are set on the alley from the pin deck. At the same time the turret proceeds to load fully.

After the turret has dropped the pins to the deck in the usual manner the pinsetter completes its cycle and stops at 90°. As the turret starts to index from the #5 pin position to the #9 pin position with the turret empty, wiper **160** (FIGS. 3 and 4) closes switch TS–11 which makes before switch TS–5 breaks and actuates relay R–4 which closes contacts R4–1 and R4–4 and opens contacts R4–2 and R4–3. Contacts R4–2 open. Contacts R4–3 open to disable contacts R6–2 from energizing the pin selection circuitry. Closing of contacts R4–4 actuates 180° stop solenoid S–14 for subsequent control to stop the pinsetter at 180° of its cycle unless disabled as explained below.

Immediately after TS–11 is closed, switch TS–12 is made by wiper **160** thereby actuating relay R–5 to close contacts R5–1, R5–3, R5–4 and R5–5 while transferring and closing the normally open contact of R5–2, a single pole, double throw switch. Such actuation of R5–2 disconnects relay R–2 from the negative side of the line and connects the deck solenoids S–1 through S–10 and relay R–7 to the negative side of the line. Closing of contacts R5–3 actuates relay R–6, thereby closing contacts R6–1, R6–2 and R6–3. Closing of contact R5–4 provides for holding in the 180° stop solenoid S–14 regardless of control by contacts R4–4. Closing contacts R5–5 energizes the #5 pin trip solenoid S–13 to lock the pin gate. Contacts R6–1 close to enable holding of relay R–6 through contacts R4–2 (now open). Contacts R6–2 close to ready actuation of solenoid S–15 through contacts R4–3 (now open). Closure of contacts R6–3 provides a by-pass around on-off switch **345** to prevent de-energizing the selection circuitry by switch **345** during loading of the turret.

The turret continues to rotate to the #9 pin position and switches TS–11 and TS–12 are broken as the wiper travels around the printed circuit in the control box to close TS–9, bringing the turret to position for awaiting loading. Relay R–4 remains energized by means of contacts R4–1, the "set" switch **347** and the first rake switch **169**, a normally open switch which is held closed while the pinsetter is not cycling, i.e., stopped at 90°. Relay R–5 is still energized through contacts R5–1 and normally closed clamp switch **271**.

The pinsetter, being at 90° of the cycle, is now ready for use by a bowler for bowling at a preselected spare arrangement. The bowler makes his selection on the keyboard by depressing buttons **320** as desired and thereafter either rolls a ball at the ten pins on the lane or actuates the re-cycle solenoid by means of a re-cycle button normally provided at the bowling alley in order to get his preselected spare set up on the alley.

For automatic operation wherein the preselected pattern is repeated after each ball is bowled, the automatic switch **346** is turned to the "on" position to open the switch. As the machine is triggered to set the selected complement of pins, the rake proceeds downward and the first rake switch (closed at 90° of cycle) is opened de-energizing relay R–4. Contacts R4–1 and R4–4 are opened but solenoid S–14 remains energized by means of contacts R5–4. Contacts R4–2 close to keep relay R–6 energized through contacts R6–1 while contacts R4–3 close to actuate lock plate solenoid S–15 which in turn locks the keyboard and closes switch **306** to provide power to the selection circuit. Warning light **314** goes on to indicate to the bowler that the selection circuitry is energized and the keyboard is locked.

The second rake switch (held open at 90° of cycle) closes and R–7 is thereby energized to close contacts R7–1 and start clamp motor **250**.

All of the pin switches which are not depressed permit current to flow through their respective solenoids which disengage latches permitting clamp motor **250** to clamp all pins which have not been selected. Wherever a pin has been selected, the corresponding PS switch is open and no energization of the corresponding solenoid occurs.

When non-selected pins have been clamped, the clamp switch **21** opens permitting relay R–5 to open thereby opening contacts R5–1, R5–3, R5–4 and R5–5 while returning R5–2 to its normally closed pole. This results in de-energization of the 180° stop solenoid S–14 and the #5 pin trip solenoid S–13. The pin gate is thereby unlocked.

The turret next begins to selectively load in order to replace pins that are being set. As the turret switch is scanned, the wiper **160** passes over and closes TS–9, TS–10, TS–6, TS–3, TS–1, TS–2, TS–4, TS–7 and TS–8 in that order. These segments or contacts are "make before break" contacts. If a button is depressed, the turret stops and awaits a pin in normal pin loading manner. If the button is not depressed, relay R–2 is energized through closed TS and PS switches in series which actuates turret index solenoid S–12 and the turret indexes without receiving a pin. The wiper continues to TS–5, "break before make" between TS–3 and TS–11, and upon reaching the #5 pin position if the #5 button is depressed, the turret stops and waits for a pin. If the #5 button is

not depressed, R–3 is actuated by TS–5 and contacts R3–2 close to energize the #5 pin trip solenoid S–13 and the spider is thereby tripped to set the selected pins on the alley and energization of the pin causes the selected pins to drop from the turret to the deck. Contacts R3–1 are opened.

Next the turret advances from the #5 to the #9 position and TS–11 is closed actuating relay R–4. R4–2 and R4–3 are opened permitting de-energizing relay R–6 and removing power from the lock solenoid S–15 and selecting circuit and de-energizing relay R–7 to unclamp the pins in the deck. TS–12 is then made energizing relay R–5. Contacts R5–1 and R5–3 close, the latter re-energizing relay R–6. Contacts R5–2 switch to connect relay R–7 and the deck solenoids to the negative side of the line. Contacts R5–4 close. Relay R–5 holds in as TS–12 is broken by progression of the wiper because the deck is now unclamped and clamp switch 271 is in closed position.

The above completes a cycle of operation with the automatic switch 346 closed. Upon bowling a ball, the preselected pins will automatically again be set and the cycle will be repeated each time a ball is bowled.

Where the control circuitry is operated with the automatic switch 346 in closed or "off" position, the cycle is exactly the same except that the set switch 347 must be depressed and opened to cause clamping of the pins and starting of turret loading. If the set switch 347 is not depressed before triggering the machine to move from its 90° waiting position, a 180° stop will occur due to solenoid S–14 being energized and the machine will wait at 180° for the bowler to make a selection and press the set button. If the set button is depressed while the machine is waiting at 90° of cycle, before bowling at the setup then on the lane, the selection having been made at that time, no stop is made at 180°. Thus, 180° stop solenoid S–14 is used to stop the pin setting machine after 180° of cycle whenever a selection is not on the keyboard, i.e., where a selection of a different combination of pins is to be made between the bowling of each ball and has not been made. It will be recalled that while the pinsetter is at 180° of cycle the rake is down; in non-automatic operation the stop is made at this time so that the bowler will be reminded to make his selection.

Relay R–6 has two important functions. As described above, this relay is employed to prevent selective loading of the turret when switch 345 is first turned on. Thus, the turret is allowed to load fully the first time so that a full complement of pins can be maintained in the deck. The second purpose of relay R–6 is to prevent loss of memory from the selection circuitry if switch 345 is turned off while the turret is receiving a pin selection to replace pins set from the deck. If switch 345 is turned off, electrical contact still remains by way of contacts R6–3 and the cycle will continue normally until TS–11 is made which opens contacts R4–2 to de-energize relay R–6 causing loss of power to the system through opening of contacts R6–3.

Direct current blocking diodes D–1 through D–10 are provided in the circuitry of FIGURE 16 to prevent current from flowing through the common solenoid line upon closure of any of the TS switches during movement of the wiper for selective loading of the turret.

A jumper 307 is provided in series in the circuitry to relay R–1, the relay which energizes the "spare" setting sequence by actuation through switch 345. The jumper is in an otherwise conventional disconnect plug provided in the bowlers' console for putting the keyboard controls in the circuit. The purpose of the jumper is to prevent pin jams if the cnosole is unplugged while the turret is receiving pins. Accordingly, when the console is unplugged, the jumper is also thereby disconnected and power is lost to relay R–1, causing contacts R1–1 and R1–2 to close energizing relay R–2 (via R6–2, R6–3 and R4–3). The turret then continues indexing without receiving pins until it reaches the #5 pin position, whereupon relay R–3 is closed through R1–2 and TS–5. Contacts R3–1 are thereby opened releasing the turret index and tripping the spider. Then TS–11 is closed which shuts off the system.

We claim:

1. A bowling pin handling apparatus comprising a pin setting deck structure movable toward and away from a pin supporting surface on a bowling alley, means on the deck structure for receiving and holding bowling pins at positions in a predetermined pattern thereon preparatory to release of the pins to drop therebeneath for setup on said pin supporting surface and for releasing the pins, means for operating said receiving and holding means normally to release and drop each of the pins held thereby, selection means for selecting less than all the pins for setup, separate clamp means at each pin position on said deck structure movable to pin holding position for separately holding each pin on the deck structure during pin release by said pin releasing means, a common drive means for moving all of said clamps to pin holding position on activation of the clamps, and means responsive to said selection means for selectively activating the clamps at non-selected pin positions to set only the unheld pins upon release of pins by said releasing means.

2. A bowling pin handling appratus comprising a pin setting deck structure movable toward and away from a pin supporting surface on a bowling alley, means on the deck structure for receiving and holding bowling pins at positions in a predetermined pattern thereon preparatory to release of the pins to drop therebeneath for setup on said pin supporting surface, means for operating said receiving and holding means normally to release and drop each of the pins held thereby, means for selecting less than all pins of a normal pin setup, separately operable clamp means at each pin position on said deck structure, means mounting each clamp for individual movement from a non-pin-engaging position to a pin engaging position for holding each pin independently at its pin position, common drive means for all said clamp means for driving all of said clamp means to pin holding position, and control means for stopping movement of clamps at selected positions during operation of said common drive means and responsive to said selection means.

3. A combination as defined in claim 2, wherein said common drive means includes resilient means and said control means comprises latch means associated respectively with the clamps for blocking clamp operation, and means for selectively operating the latch means responsive to said selection means.

4. A bowling pin handling apparatus comprising a pin deck structure movable toward and away from a pin supporting surface on a bowling alley and having means for receiving and holding bowling pins at predetermined positions thereon preparatory to release of the pins to be dropped therebeneath for setup on said pin supporting surface; pin delivery means for delivering pins to the separate positions in said deck structure; clamp means including a clamp at each pin position capable of holding pins in the deck structure during normal operation of said deck structure for release of pins to the pin supporting surface; selection means for selecting a pattern of bowling pins desired to be deposited on the bowling alley; means responsive to the selection means for controlling the pin delivery means including means for actuating said pin delivery means to deliver pins solely to pin positions of said pattern; a cable engaging all of said clamps and capable of moving said clamps to pin engaging position upon tightening, a motor adapted to drive a threaded shaft, a threaded nut on said threaded shaft secured against rotation therewith, a pulley pivotally mounted on and carried by said nut, said cable engaging said pulley and adapted to be tightened by movement of said nut upon said shaft, and said control means comprises means

responsive to said selection means for latching clamps at selected pin positions against movement to pin engaging position, and means for energizing said motor to cause said nut to move from a starting position along said shaft and tighten said cable to move unlatched clamp means to pin engaging position during release of pins from said deck structure.

5. The apparatus of claim 4 which includes means for reversing said motor and means biasing said cable to return upon reversing said motor.

6. The apparatus of claim 4 which includes means deenergizing said motor responsive to tightening of said cable sufficiently to move said clamps to pin engaging position.

7. The apparatus of claim 6 which includes means for reversing said motor, means for reenergizing said motor to drive said nut in the opposite direction on said shaft responsive to completion of setting of pins by said deck structure, and means deenergizing said motor upon return of said nut to its starting position.

8. A bowling pin handling apparatus comprising a pin setting deck structure movable toward and away from a pin supporting surface on a bowling alley and having means for receiving and holding bowling pins at positions in a predetermined pattern thereon preparatory to release of the pins to be dropped therebeneath for setup on said pin supporting surface, selection means for selecting the predetermined pattern, pin delivery means responsive to said selection means for delivering pins successively to selected positions on said deck structure, clamp means at each pin position on said deck mechanism capable of holding pins in said deck means during operation of the deck mechanism for delivery of pins to the bowling alley, latch means for each clamp means for latching the clamp means in a non-pin-holding position, solenoid means for each latch responsive to said selection means for moving the latch means to latching position at selected pin positions on said deck on deenergization of said solenoid means for holding the clamp means against movement into engagement with a pin at its pin position, means for selectively disabling energization of preselected ones of said solenoid means to latch preselected clamp means, means for normally energizing all non-deenergized solenoids for unlatching the remainder of said clamp means, and means for moving unlatched clamp means to pin engaging position.

9. In a bowling pin handling apparatus having pin distributor means having a plurality of pin receiving pockets, one for each pin position of a bowling pin setup, means for delivering pins to the pin receiving station, a pin setting deck structure movable toward and away from a pin supporting surface on a bowling alley and having means for receiving and holding bowling pins at positions in a predetermined pattern thereon preparatory to release of the pins to be dropped therebeneath for setup on said pin supporting surface, means for operating the deck structure to drop each of the pins held thereby to the pin supporting surface therebelow, the improvement which comprises selectively operable means for controlling said delivering means for selectively delivering pins from said discharge station to only preselected pockets of said distributor means while said distributor means is maintained otherwise normally empty, a clamp at each pin position in said pin deck, means mounting each clamp for individual pivotal movement to a pin holding position to hold a bowling pin against setting on the pin supporting surface, means for individually positioning said clamps to provide clamping of pins only in the deck pin positions corresponding to non-selected pockets, common cable means for securing each clamp in or out of its pin holding position as determined by said selecting means upon tightening of the cable, a threaded shaft, a motor drivingly connected to said shaft for rotating the shaft, a threaded nut member on said shaft for pulling said common cable means upon movement of the nut axially along the shaft in one direction, said nut being held against rotation with said shaft, means for energizing said motor to drive said nut along the shaft in said one direction for carrying and tightening said cable during setting of pins by the pin deck, and means responsive to completion of the pin setting operation by said pin deck for releasing said cable and clamps and reversing said motor to return said nut.

10. A bowling pin handling apparatus comprising distributor means having a plurality of pin receiving pockets, one for each pin position of a normal pin setup, conveyor means having a discharge station for delivering pins to each pocket, means for operating the conveyor means and the distributor means to deliver a pin from the conveyor means to each distributor pocket at the pin receiving station thereby to fill the distributor pockets, selectively operable means for selecting a pin setup of less than the normal complement and for controlling the last recited means to deliver pins to only selected pockets in the distributor, normally full pin deck means having separate pin receiving positions for receiving pins from said pockets, separately operable clamp means for holding a pin at each position in said pin deck and for releasing pins independently from each position to a bowling surface in a pattern correlated with said selected pockets in the distributor, cable means adapted to move each of said clamp means to a pin holding position for clamping a pin at the pin position, means responsive to said selecting means for disabling clamp means at selected pin positions from operation by said cable means, reversible motor means for tightening or loosening said cable means, means for energizing said motor to tighten said cable for operating all on-disabled clamp means, and means responsive to completion of delivery of pins to the bowling surface for reversing said motor to loosen said cable and release said clamp means.

11. A bowling pin handling apparatus comprising a pin setting deck structure movable toward and away from a pin supporting surface on a bowling alley, means on the deck structure for receiving and holding bowling pins at positions in a predetermined pattern thereon preparatory to normal release of the pins to drop therebeneath for setup on said pin supporting surface, means for operating said receiving and holding means to release and normally drop each of the pins held thereby, means for selecting less than all of the pins on the deck structure for setting only the selected pins, a plurality of clamps, one associated with each pin position on the deck structure for holding the pin at that position on the deck structure during normal pin release from the deck structure, spring means normally retracting each of the clamps, a cable operatively associated with each of the clamps for moving the same to clamping position, a latch associated with each clamp for latching the same in retracted position against operation by the cable, and selectively operable means for releasing the latches from non-selected pins responsive to said selecting means.

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ANTON O. OECHSLE, *Primary Examiner.*

DELBERT B. LOWE, *Examiner.*