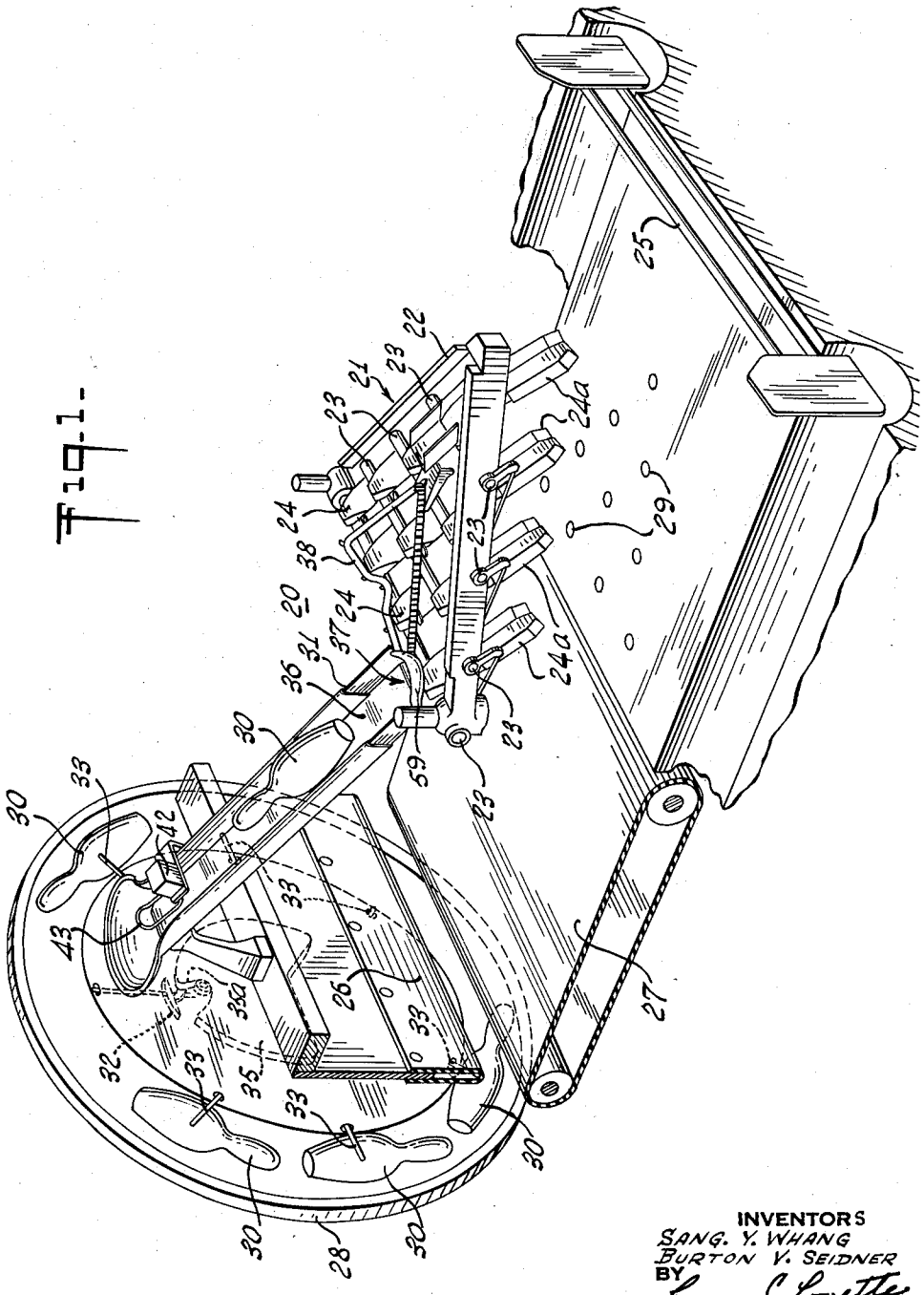
June 18, 1963 SANG Y. WHANG ETAL 3,094,327

SPARE PRACTICE PLAY FOR AN AUTOMATIC PINSPOTTER

Filed May 6, 1960 6 Sheets-Sheet 1

FIG-1-



INVENTORS
SANG. Y. WHANG
BURTON V. SEIDNER
BY
Eugene S. Lovette
ATTORNEY

June 18, 1963 SANG Y. WHANG ETAL 3,094,327

SPARE PRACTICE PLAY FOR AN AUTOMATIC PINSPOTTER

Filed May 6, 1960 6 Sheets-Sheet 2

FIG. 2.

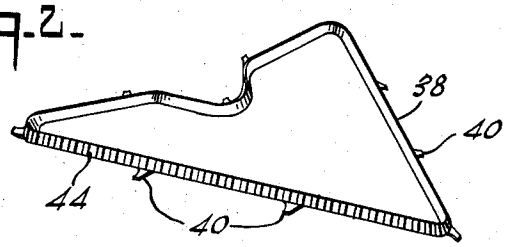


FIG. 3.

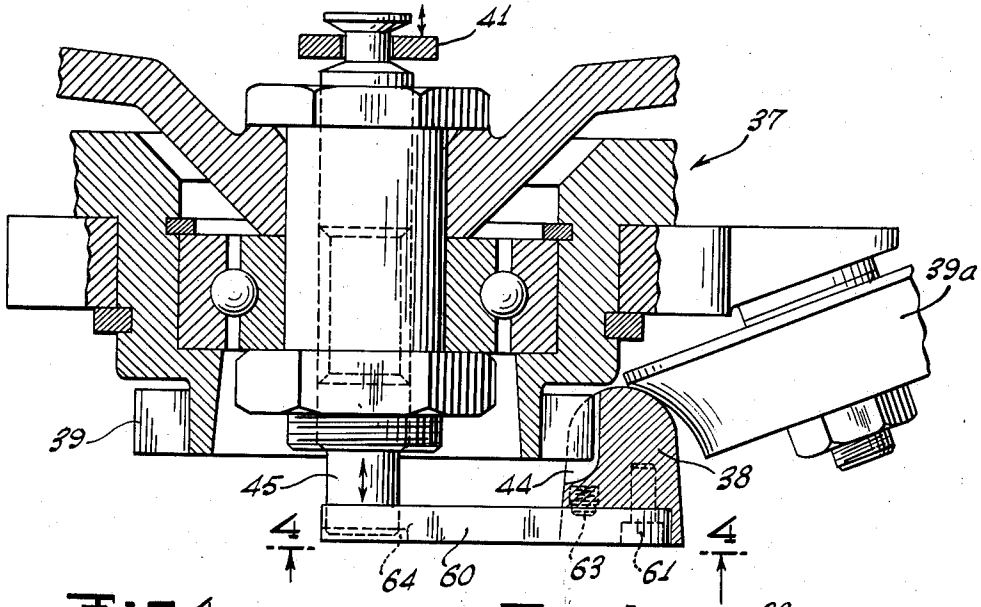


FIG. 4.

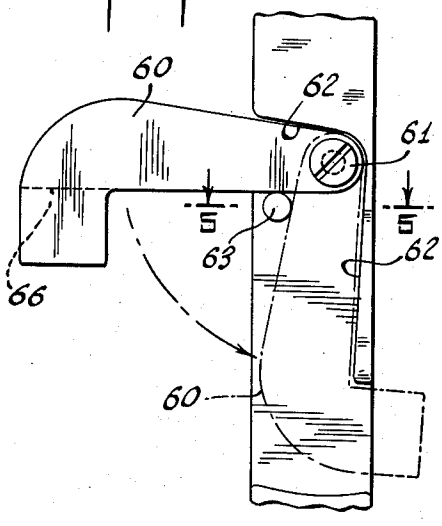


FIG. 6.

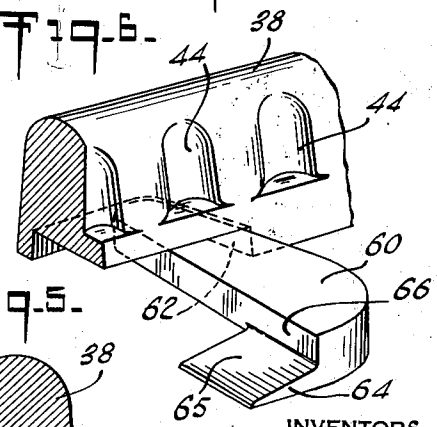
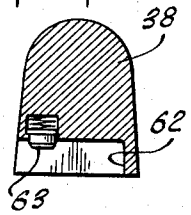


FIG. 5.



INVENTORS
SANG Y. WHANG
BURTON Y. SEIDNER
BY Eugene S. Lovelle
ATTORNEY

SPARE PRACTICE PLAY FOR AN AUTOMATIC PINSPOTTER

Filed May 6, 1960 6 Sheets-Sheet 3

Fig. 7.

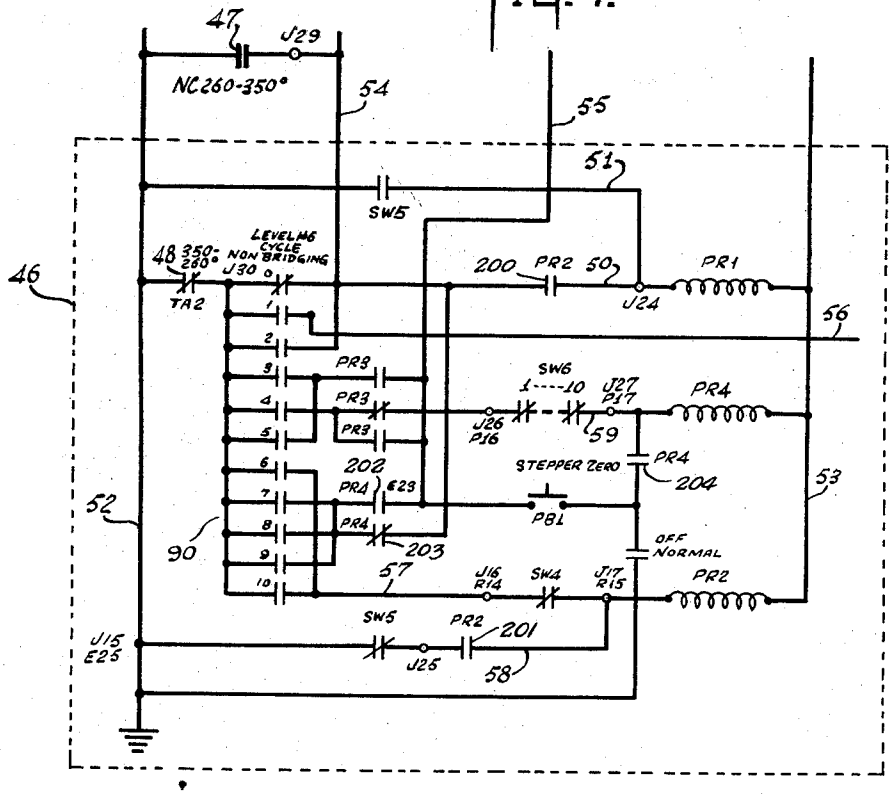
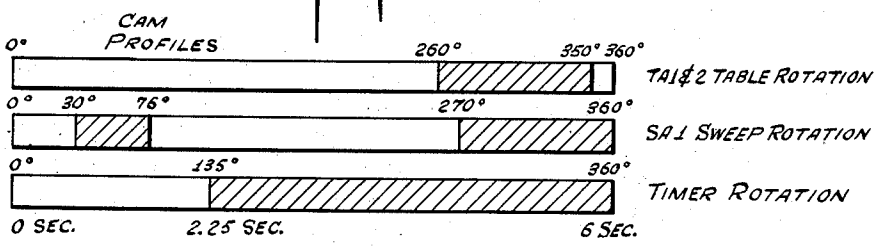


Fig. 8.



INVENTORS
SANG Y. WHANG
BURTON V. SEIDNER
BY
Eugene S. Lovette
ATTORNEY

June 18, 1963 SANG Y. WHANG ETAL 3,094,327

SPARE PRACTICE PLAY FOR AN AUTOMATIC PINSPOTTER

Filed May 6, 1960 6 Sheets-Sheet 4

Fig. 9.

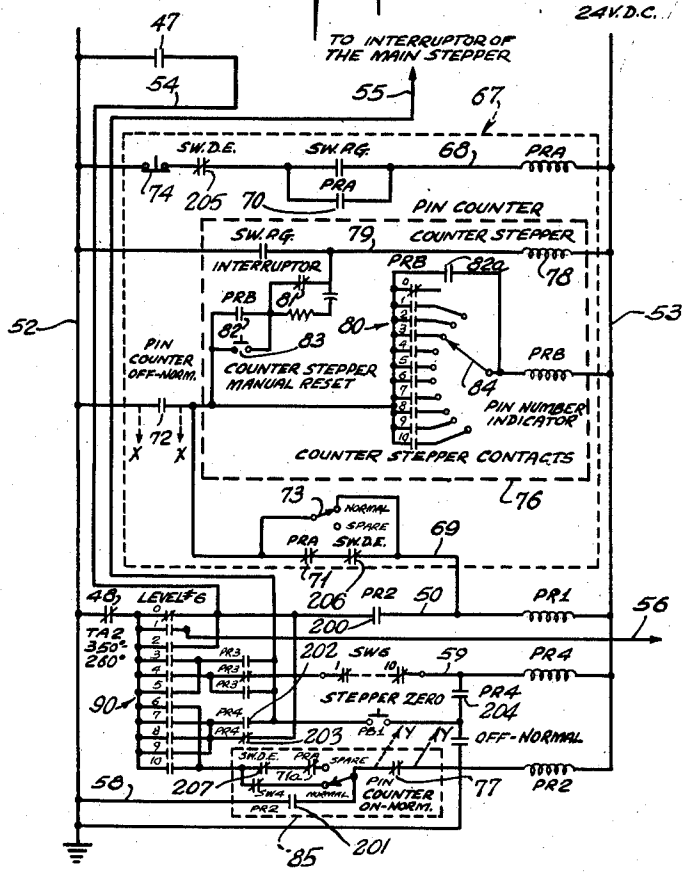


Fig. 10.

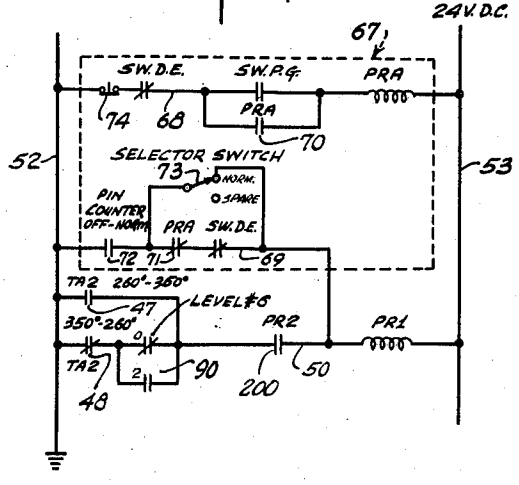
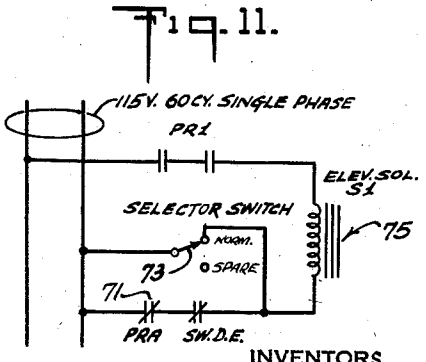


Fig. 11.



INVENTORS
SANG Y. WHANG
BURTON V. SEIDNER
BY Eugene S. Lovette
ATTORNEY

June 18, 1963 SANG Y. WHANG ETAL 3,094,327

SPARE PRACTICE PLAY FOR AN AUTOMATIC PINSPOTTER

Filed May 6, 1960 6 Sheets-Sheet 5

Fig. 12.

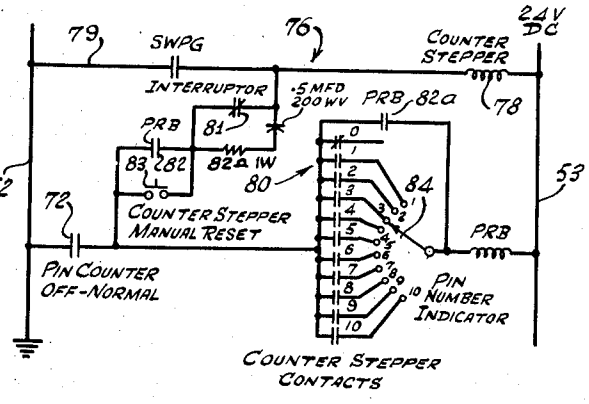


Fig. 13.

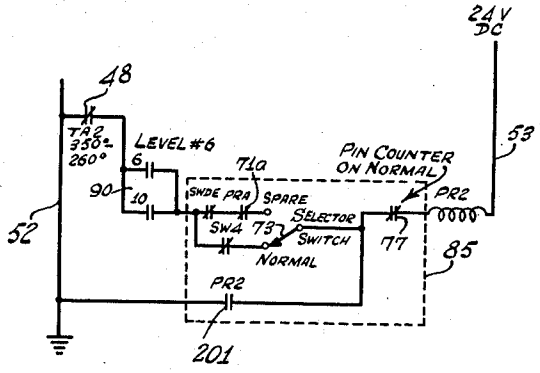


Fig. 14.

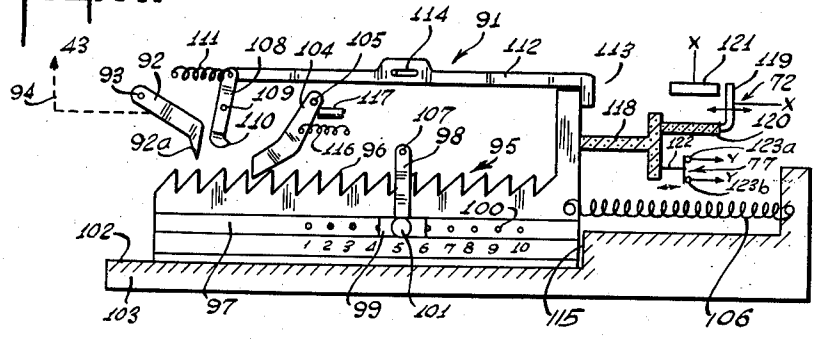
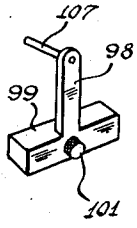


Fig. 15.



INVENTORS
SANG Y. WHANG
BURTON V. SEIDNER
BY
Eugene S. Lovette
ATTORNEY

June 18, 1963 SANG Y. WHANG ETAL 3,094,327

SPARE PRACTICE PLAY FOR AN AUTOMATIC PINSPOTTER

Filed May 6, 1960 6 Sheets-Sheet 6

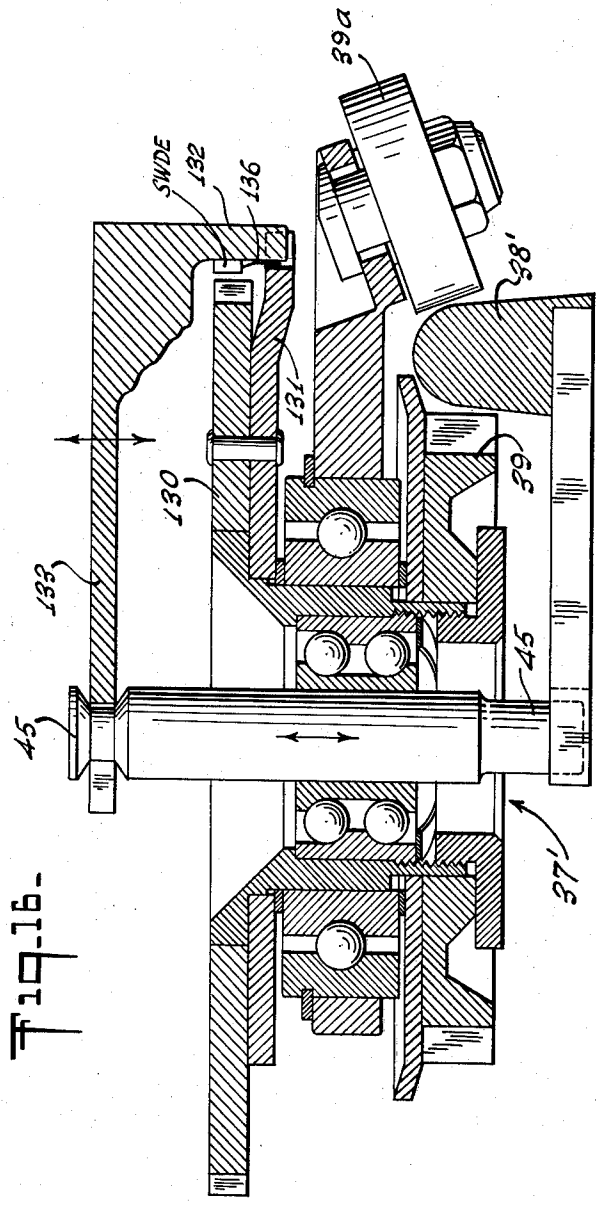


Fig. 16.

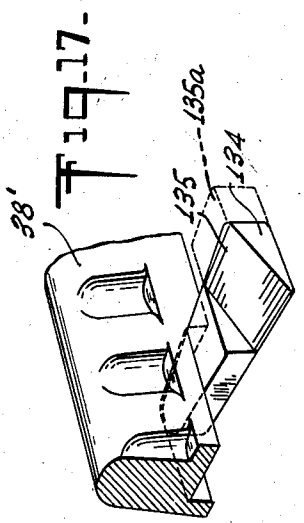


Fig. 17.

INVENTORS
SANG Y. WHANG
BURTON V. SEIDNER
BY
Eugene S. Lovette
ATTORNEY

United States Patent Office 3,094,327
Patented June 18, 1963

3,094,327

SPARE PRACTICE PLAY FOR AN AUTOMATIC PINSPOTTER

Sang Y. Whang, 12 Hinsdale St., Brooklyn, N.Y., and Burton V. Seidner, 9 Pinetree Lane, Great River, N.Y.

Filed May 6, 1960, Ser. No. 27,328
26 Claims. (Cl. 273—43)

This invention relates to automatic pinspotter apparatus designed to spot ten tenpins on a bowling alley floor so that a bowler may play the customary tenpin bowling game.

The well known automatic pinspotter currently in use is made by American Machine & Foundry Company. This apparatus is adapted to spot automatically ten tenpins on a bowling alley floor against which a bowler plays his game. Automatic operation of the pinspotter also contemplates removal of "dead wood" after the first ball is thrown, at which time the pinspotter is holding the spare wood missed by the first ball. The apparatus automatically respots the spare pins for second ball throw. This machine also involves other phases of automatic operation, such as spotting a new set of tenpins after a strike throw.

With the growing popularity of bowling as a game, more persons are finding it desirable to practice against one or combinations of two or more tenpins constituting spare "woods" and, in particular, those spare combinaitons of spares that prove to be difficult to the individual bowler. For such spare pratcice, each bowler may wish to practice against different combinations of spare wood. At present, spare practice can be achieved by having a pin boy setting up the spare wood. Hence, it would be desirous if the foregoing apparatus, in addition to its normal cycle of operation, is also capable of spotting one or more combinations of spare standing pins against which a person can practice. Consequently, the instant invention contemplates certain modifications to the current automatic pinspotter apparatus, such that, in addition to its normal operation, it will also be capable of spotting any combination of one to ten tenpins so that a bowler may practice against any desired combination of spare standing wood. The invention is designed so that the machine will continue to provide such desired combination of spare tenpins until the machine is actuated to provide a different combination of spare tenpins or, if desired, the machine returns to normal operation of spotting ten tenpins on the floor for the bowling game.

As a further advantage of the instant invention, the modifications contemplated herein for allowing a machine to provide spare play practice involves certain structural and electrical changes to the pinspotter which may be readily incorporated into the standard American Machine & Foundry automatic pinspotter currently in use as well as those to be made in the future. In addition, the invention is of such character that it will permit the bowling alley operator or player by means of switches to actuate operaton of the machine incorporating the invention so that it can easily convert from normal play operation to spare play operation or vice versa.

It is, therefore, the principal object of the instant invention to provide means for modifying the standard AMF automatic pinspotter wherein said apparatus will provide whenever desired normal bowling play operation or spare practice operation wherein the latter contemplates spotting of any desired combination of one to ten tenpins and whereby conversion from one operation to the other is readily achieved by a simple modification to adjustable track means and actuation of a switch.

It is a further object of the invention to modify the current operative relationship between the automatic pinspotter distributor and the table track means so that for

spare practice play the distributor will stop at preselected table cups corresponding to those tenpins constituting the combination desired for spare practice play and wherein the distributor by-passes all other table cups.

It is a further object of the invention to modify a portion of the electrical system for regulating operation of the current pinspotter apparatus, whereby such apparatus may be used for normal tenpin play or spare practice play whenever desired, and when operated for the latter, said modified circuit is devised to regulate the pin elevator cam gate energizing circuit so that the elevator delivers a single tenpin when the distributor is stopped at a selected table cup and wherein the elevator gate circuit is temporarily de-actuated to prevent delivery of a tenpin after releasing just one tenpin. Another modification of the electrical system involves the pin counter switch which is actuated when a first tenpin is released to the distributor and counted, and which switch is de-actuated after a preselected number of tenpins constituting the desired set to make up a combination of spare practice pins are counted out. A fourth modification involves the distributor position switch circuit such that the circuit opens when the first tenpin of the aforesaid desired set is counted and which circuit is closed when the distributor head reaches a position along the track corresponding to the first of the selected table cups at which the distributor started distribution of the aforesaid given set of pins.

Further objects and advantages will become apparent from the following description of the invention taken in conjunction with the figures, in which:

FIG. 1 illustrates in perspective elevation and partly cut away an automatic pinspotter currently employed in numerous bowling alleys;

FIG. 2 is a perspective view of the track means employed in the aforesaid apparatus;

FIG. 3 is a fragmentary sectional elevation of the distributor head showing same in operative engagement with the track means and incorporates an embodiment of structural modification to said track in accordance with the improvements claimed herein;

FIG. 4 is a fragmentary plan view showing the adjustable stopper attached to said track in accordance with the invention;

FIG. 5 is a sectional view taken along line 5—5 of FIG. 4;

FIG. 6 is a fragmentary perspective view showing details of the stopper in accordance with the invention;

FIG. 7 is a schematic diagram of the sixth level of the stepper relay circuit currently employed in the aforesaid pinspotter apparatus;

FIG. 8 is a schematic view of cam profiles currently employed in the pinspotter electrical circuit;

FIG. 9 is a schematic illustration of the electrical circuit of the sixth level of the stepper relay circuit pursuant to the improvements claimed herein, and it will be understood that in accordance with the invention the circuit shown in FIG. 9 is used in lieu of the circuit shown in FIG. 7;

FIG. 10 is a schematic of a portion of the electrical circuit shown in FIG. 9;

FIG. 11 is a schematic of an electrical circuit that may be used as an alternative for a portion of the circuit shown in FIG. 10;

FIGS. 12 and 13 are schematics of portions of the electrical circuit shown in FIG. 9;

FIG. 14 illustrates schematically and in elevation a mechanical counter to be used as an alternative for the stepper counter relay illustrated in FIG. 12; and FIG. 15 is a perspective view of the adjustable counter member employed in the mechanical counter of FIG. 14; and

FIGS. 16 and 17 illustrate a further embodiment to the distributor head and track for stopping the distributor at selected cups.

Reference is now made to the figures and, in particular, to FIG. 1 for an understanding of the mode of operation and structre of an automatic bowling pinspotter 20 of the general type currently employed in numerous bowling alleys. It is the purpose of this invention to modify pinspotter 20 in accordance with the improvements claimed herein to achieve the previously described objects. Inasmuch as the structure of pinspotter 20 and its operation are well known to those skilled in the art, the following description and the illustrations thereof will be brief and schematic merely to provide desirable background information for an understanding of the improvements claimed herein.

Pinspotter 20 includes a descendable and ascendable pinsetter table 21 which includes a V-shaped framework 22 supporting four rotatable table shafts 23. Shafts 23 support ten operatively associated spotting and respotting mechanisms 24. Spotting and respotting mechanisms are disposed in a triangular array wherein each mechanism corresponds to the position to be occupied by a correlated tenpin when spotted on the alley pin deck. The ten spots 29 are shown in FIG. 1 on the pin deck portion of the alley floor on which the individual pins are set. Accordingly, the mechanism for pin No. 1 is the apex of the triangular array and at the front of table 21, and the last row of mechanisms are for tenpins 7 through 10, wherein the No. 7 pin is at the left rear looking down upon table 21. Each spotting mechanism includes a spotting cup 24*a* of joined split castings to receive, store and release a tenpin on the alley pin deck. Each spotting mechanism also includes a gripping and releasing cell to pick up a correlated standing pin after a first ball is rolled to permit the removal of deadwood. The respot cells return the individual pins to their respective spots after removal of deadwood for the second ball. The details of the aforesaid cups and cells are well known in the art and do not involve the improvements claimed herein. For further information for this apparatus, reference may be made to "Automatic Pinspotters—Instruction and Service Manual" published in 1953, and "Automatic Pinspotters—Parts List, Rev. (1) 2–55" both published by AMF Pinspotters, Inc. of Shelby, Ohio, a subsidiary of American Machine & Foundry Company.

The table assembly as a whole is supported by a plurality of suitable arms connected to crank means, not shown, and which are responsive to a table motor drive shaft, not shown. The table motor is located in framework above table 21. The assembly is guided by a suitable parallelagram arrangement of connecting rods attached to a rear frame. A table spotting cam, not shown, is keyed to the motor drive shaft, and its cam follower transmits spotting motion through suitable mechanical linkages, gears, cranks, and rods to table shafts 23. When table shafts 23 perform their spotting function, they revolve to swing the spotting cups downward to spot the individual tenpins on the alley deck. Reference may be made to the foregoing AMF publications for the details of the foregoing apparatus.

A descendable and ascendable sweep mechanism 25 is provided at the front of pinspotter 20. Sweep 25 is actuated by the pinspotter electrical system and is adapted to guard pinspotter 20, and in particular table 21, when the latter is in descended position against possible damage by a prematurely rolled ball. During its sweep cycle, sweep 25 removes deadwood from the alley. A ball cushion 26 supported upright in the pit portion of pinspotter 20 serves to stop a bowled ball. When struck by the ball, cushion 26 provides an electrical signal which starts the cycle of pinspotter operation. A conveyor carpet 27 immediately in front of cushion 26 feeds the ball to a ball-lift, not shown, which returns the ball to the bowler. Carpet 27 also works the tenpins swept from the alley to a continuously revolving pin elevator wheel 28 behind cushion 26. Pin elevator 28 carries the tenpins 30 up to a position from which the tenpins 30 are fed, one pin at a time, to an expansible-contractible telescoping distributor 31 on the front side of elevator 28 upon actuation of a solenoid operated elevator cam gate 32. Cam gate 32 is on the rear side of elevator 28. The tenpins 30 guided to elevator 28 are clamped into spaced elevator pockets by correlated spring loaded releasable rods 33. Rods 33 extend through elevator wheel 28 and are provided with individual operatively associated followers 34 riding along a stationary master cam 35 on the back of elevator 28. Cam 35 incorporates the displaceable cam gate 32 which when closed prevents the release of the tenpins to distributor 31. When gate 32 opens, it allows each approaching follower 34 to drop into the cam trough 35*a* which action causes the related clamping rod 33 to release the tenpin held thereby to distributor 31.

Distributor 31 includes a continuously moving telescoping belt 36 which carries the single file of tenpins 30, each butt end forward, to an indexing head 37 at the front or discharge end of the distributor. The rear of the distributor is pivoted so that it can swing from side to side, whereby its index head 37 is able to travel along a precision molded triangular-shaped toothed track 38, provided with gear teeth 44 as shown in FIG. 2. Track 38 is attached to table 21, and is operationally engaged by distributor head gear and backup roller means 39, 39*a*, FIG. 3, whereby the distributor head 37 travels one complete revolution around track 38 to return to its starting position for each phase of tenpin distribution. Track 38 is provided with ten fixed stops 40, and each stop 40 is located adjacent a correlated spot cup 24*a*. Stops 40 are operatively engaged by an index pin 45 of head 37 to halt travel of distributor 31 at each cup position to permit the release of a single tenpin to such cup. As a tenpin is delivered to a spotting cup 24*a*, a trip lever mechanism 41 in distributor head 40 is actuated which clears distributor head 37 for travel to the next spotting cup. Since the ten spotting cups 24*a* are in triangular array, track 38 is triangularly shaped; hence, distributor 31 is designed for telescoping action to allow its head 37 to release pins at the various cups 24*a*. The means for driving the distributor apparatus 31 and the structural details thereof including its head 37 are fully described in the aforesaid AMF manuals. In accordance with the present state of the art, distribution of tenpins always start at the No. 7 spotting cup and continues with the sequence of pins 4—2—1—3—6—10—9—5—8. A counter 42 is mounted on the framework of distributor 31. As the tenpins pass under counter 42, they actuate a counter paddle 43 which works counter 42. Counter 42 provides a signal which allows elevator cam gate 32 to close to prevent more than ten tenpins from dropping out of elevator wheel 28 for each phase of distribution of ten tenpins by the machine.

In addition, pinspotter 20 includes an electrical system which stores the regulating signals for controlling the cycles of phases of operation which the pinspotter is required to undergo. Among its various components, the electrical system includes a stepper relay consisting of six levels of contacts wherein each contact has a zero position and ten steps. The relay contact circuits for the six levels are fully disclosed in the aforesaid Service Manual, pages 3.001–3.002 Rev. (1) 6–56. FIG. 7 herein discloses only the sixth level 46 of the stepper relay contacts because only this portion of the pinspotter electrical circuit involves the invention claimed herein. For convenience, the reference nomenclatures designating the circuit elements in FIG. 7 are the same used in the AMF Manual. This circuit shows the contacts when the machine is in zero position without any regulating signals applied and with a full set of pins in table 21 while distributor 31 is in zero position.

The electrical circuit also includes three cam switches. A pair of these switches TA–1 and TA–2 are on the table cam shaft and are controlled by one cam follower, the other cam switch SA is located on the sweep drive shaft. One revolution of table or sweep motor drive shaft will cause, respectively, one revolution of the table or sweep cam. Switch TA–1 is used in running of table 21 and

is not shown herein. Switch TA–2 is used in the stepper pulsing circuits. FIG. 7 shows a pair of TA–2 contacts; normally open contacts (hereinafter *no*) are shown at **47** and normally closed contacts (hereinafter *nc*) are shown at **48**. The third switch SA is used in operation of the sweep and is not shown herein. The cam profiles for these switches and for a timer motor are shown schematically in FIG. 8.

When pinspotter **20** is ready for the first ball, the stepper relay is at zero, sweep **25** is in its up or zero position, table **21** is at its extreme up or zero position, and the back end of pinspotter **20** is running which includes carpet **27**, distributor **31**, the ball-lift and elevator wheel **28**. Ten tenpins are on spot pattern **29** on the pin deck and ten tenpins are stored, one in each cup **24***a*. Distributor head **37** is at the No. 7 cup position. The bowler rolls the ball which is stopped by cushion **26** and returned to the bowler. Upon striking cushion **26**, a start switch in the electrical system is actuated which starts the cycle of operation. Sweep **25** descends to guard position where it will rest until called upon to sweep the fallen tenpins. Meanwhile, a motor driven time delay, the cam profile thereof is shown schematically in FIG. 8 as "Time Motor," is set in motion when the sweep reaches a predetermined position during descend travel. After a given time delay, table **21** starts its first descent to detect standing tenpins. Ten respot cells indicate to the electrical system whether or not there are standing pins. If there are standing pins, the correlated respot cells mechanically grip and raise such pins to a height sufficient for sweep **25** to clear the alley of deadwood. Thereafter, sweep **25** returns to rest at its forward guard position to prevent damage by a ball prematurely bowled. Meanwhile, table **21** continues its up movement and then starts another revolution, this time to respot the tenpins gripped by its respotting cells. After table **21** has arrived at up position for the second time, sweep **25** will also rise and stop in its up position. Pinspotter **20** is now prepared to receive the second ball. The above-described sequence of the various pinspotter components are activated and controlled by the electrical system and, in particular, by the stepper as it advances from step to step until it reaches step 7.

The conditions existing for the start of the second ball finds table **21** and sweep **25** at zero or up positions and the stepper relay at step 7. Distributor head **37** is at position No. 7; there are ten tenpins in table cups **24***a* and pin elevator **28**, the ball-lift and carpet **27** are running. In the previously described operation, the pinspotter **20** detected standing tenpins, accordingly, distributor **31** remained at cup position No. 7 during such operation. The tenpins previously swept off the alley are stored in the pin elevator pockets ready for delivery to distributor **31**. The rolled ball is stopped by cushion **26** which closes the starting switch and starts operation of the machine. Stepper moves through its steps to step **10** whereas, sweep **25** drops to guard position, and the ball is being returned to the bowler. When sweep **25** reaches predetermined position of travel, the motor driven time delay is set into motion which delays sweep **25** before it completes its cycle of operation, sweep **25** then performs its sweeping operation and returns to its forward guard position. When stepper reaches step **10**, table **21** receives its spotting signal. Spotting cups **24***a* swing downwardly to set a complete set of tenpins on the pin deck. As table **21** approaches the end of its revolution, sweep **25** rises to its up position and table **21** will stop at zero. In the meantime, all tenpins carried into pin elevator wheel **28** are elevated to distributor **31** and singly distributed to the individual spotting cups **24***a* for use for the next frame of bowling play.

The foregoing operation is controlled by the electrical system which also includes four power relays and solenoids. The first is a relay PR–1. Relay coil PR–1 is energized through the contacts of table cam switch TA–2, a stepper relay contact and through normally open contacts **200** of relay PR–2 and alternately through switch SW5, see circuit lines **50** and **51** of FIG. 7. Bus lines **52** and **53** in FIG. 7 provide a 24 voltage D.C. supply to the circuit. Line **54** connects to bus line **52** through contacts **47** of TA–2. Line **55** connects to the interrupter of the main stepper and line **56** connects to the counter circuit. When conditions are right, the contacts of relay PR–1 energize a solenoid for operating pin elevator cam gate **32** which opens gate **32** to allow tenpins to fall from elevator wheel **28** into distributor **31**. The second relay PR–2 is energized through contacts **48** of switch TA–2, stepper relay contacts and switch contacts SW–4 *nc*, see line **57**, to provide a table spotting signal. Relay coil PR–2 is held closed through circuit **58** involving switch contacts SW–5 *nc* and PR–2 *no* contacts **201**, see line **58** . The coil of the third relay PR–3 is not shown in FIG. 7, however, some of its normally opened and closed contacts are included in this circuit. This relay involves foul cycle operation. The fourth relay coil PR–4 is energized through switch contacts TA–2, the stepper relay contacts and a series circuit of ten switch contacts SW–6 in line **59**. Power relay PR–4 involves strike cycle operation. FIG. 7 illustrates normally open contacts **202**, **204** and normally closed contacts **203** of relay PR–4.

The circuit employs a distributor position switch SW–4. Switch SW–4 may be a pressure sensitive switch and is operatively responsive to check the position of the distributor to permit spotting of tenpins. A pin counter switch SW–5 is located on the bridge of distributor **31** and is operatively associated with paddle **43**, FIG. 1. Switch SW–5 has normally opened and normally closed contacts in lines **51**, **58**, respectively. This switch is actuated when the first tenpin drops into distributor **31**, passes paddle **43** to close line **51** and opens its contacts in line **58**. Switch SW–5 remains in this actuated status for nine additional tenpins passing paddle **43** after which, the switch is de-actuated and line **51** opens and the contacts in line **58** close. Consequently, after switch SW–5 counts ten tenpins, it cuts off the pin feed to permit at some subsequent time table **21** to spot the delivered tenpins to the alley pin deck. The pin switch SW–6 consists of ten switches, one per respotting cell, to perform strike detection and pin indication.

As seen hereinbefore, table operation for setting the tenpins on the pin deck is triggered when stepper relay arrives at step **10**. When stepper contacts **10** are closed, power relay PR–2 is energized through contacts **48**, TA–2 *nc* (table **21** has not yet moved, hence contacts **48** are still closed), closed contacts **10** and SW–4 *nc* contacts in line **57**. SW–4 *nc* is closed because distributor **31** is at the spotting cup No. 7. Relay PR–2 energizes table **21** for spotting operation. Relay coil PR–2 is held closed through line **58** which inclues SW–5 *nc* and PR–2 *no* contacts **201**, the latter contacts are now closed because relay PR–2 is energized. The table commences its spotting operation by setting a set of pins on the alley. When table **21** arrives at 260° of its spotting operation, contacts **47**, TA–2 *no* close and stepper advances to step 0. This energizes relay coil PR–1 through contacts **47** and line **50**; the contacts **200**, PR–2 *no* in line **50** are now closed because relay PR–2 is energized. This action opens gate **32** to activate pin feed. When the first tenpin is delivered, contacts SW–5 *no* in line **51** close and will remain closed until a tenth pin is delivered, at which time these contacts open. Thus, power relay PR–1 remains energized for the feed of the remaining nine tenpins through line **51**. Operation of SW–5 switch by the first tenpin opens its normally closed contacts in line **58** to de-energize power coil PR–2.

If at the time table **21** reaches 350° of its spotting operation and the first tenpin has not yet been delivered to distributor **31** and if contacts SW–5 in line **51** are still open, power relay PR–1 is then energized through contacts **48** of TA–2 *nc*, stepper contacts 0 and the normally opened contacts **200** of PR–2 of line **50**; the latter

are closed because the first pin has not yet been delivered. This circuit remains closed through stepper advancing to step contacts 2 which is across step 0. When pins are finally delivered, the relay is energized through line 51. With respect to TA–2 contacts 47, 48, it will be understood that contacts 47 are normally open except during table operation from 260° to 350° wherein these contacts close. Contacts 48 are normally closed except during operation from 260° to 350°. A complete explanation of the foregoing operation is included in the aforesaid AMF Service Manual and is well known to persons skilled in the art.

With respect to strike operation, the ball when rolled hits cushion 26 and actuates the cycle switch. Sweep 25 drops to protect the machine; table 21 descends, and when it finds no standing pins it will proceed to spotting operation, sweep 25 clears the alley, table 21 descends again and resets new pins. As table 21 starts up, it is filled with pins as described hereinbefore. For first foul ball, the cycle of operation is actuated when the ball hits cushion 26, sweep 25 drops to protect the machine and then clears the alley of deadwood and standing pins. Table 21 descends and sets a new set of pins and the machine indicates a second ball as on a spare. For second foul ball, the machine operates as a second ball of a spare.

As noted hereinbefore, pinspotter 20 sets ten tenpins at a time. The purpose of the invention claimed herein is to modify the described pinspotter so that it automatically sets any number of pins, 1 to 10, in quantity and in any predetermined combination of positions on the alley deck. Four modifications are required to effect this object. The first modification involves a structural revision to distributor track 38 whereby distributor head 37 is caused to stop only at preselected spotting cups 24*a*. Inu accordance with the prior art, ten fixed stoppers 40, one for each spotting cup, are casted on the outer side of track 38, see FIG. 2. Stoppers 40 halt the moving distributor head 37 at individual cups 24*a* to permit the discharge of a tenpin into each cup. As the tenpins leave distributor head 37, it passes over a pivotal trip lever 59 which is mechanically linked to lever means 41. This action momentarily depresses trip lever 59 which lifts means 41 and the attached head pin 45 which otherwise engages the stopper. Upward movement of pin 45 releases distributor head 37 for travel to the next stopper. A return spring, not shown, causes trip lever 59 to return to its initial position, whereby pin 45 lowers to abut against the next stopper.

In accordance with the improvements claimed herein, track 38 is provided with ten stoppers 60, each pivotally supported by a hinge pin 61 from the underside of track 38. Stoppers 60 are suitably spaced along track 38 so as to be operatively associated with individual ones of the ten spotting cups 24*a*. Each stopper 60 may be pivoted from one to another of two positions and clamped in such position by an abutment wall 62 and a depressible spring latch pin 63, as depicted in FIGS. 3 to 6. Wall 62 is suitably shaped in the casting of the track underside. Stoppers 60 may be repositioned manually by depressing its latch pin 63 into the track structure. By reason of the foregoing arrangement, the moving distributor head 37 will bypass all the withdrawn stoppers 60 locked in "in" position and will be halted by all protruding stoppers 60 locked in "out" position. A tenpin will drop into the individual spotting cups 24*a* operatively associated with all such protruding stoppers 60.

Accordingly, if a regulation tenpin game is contemplated, all ten stoppers 60 are locked in "out" position as depicted in solid outline in FIG. 4. However, when a player desires spare practice, all stoppers 60 are withdrawn and locked in "in" position as depicted in dotted outline in FIG. 6, except those stoppers selected for loading the desired spare tenpins. This disclosure illustrates manual adjustments of pivotal stoppers 60. It will be understood that such adjustments may be controlled by ten electrical solenoids so that positional adjustments may be made from a remote distance. For such such an arrangement, spring latch pins 63 may not be necessary.

In addition to the foregoing structural changes, each stopper 60 is provided with a ramp 64. Ramp 64 may be an integral part of stopper 60 and is located to engage index pin 45 whenever head 37 is stopped by an outwardly projecting stopper 60. Ramp 64 has an upwardly inclined surface 65. The purpose of ramp 64 will be seen hereinafter. However, it will be understood that every time a stopper halts index head 37, pin 45 rides up ramp face 65 to lift trip lever means 41 a small distance. Head 37 is halted because pin 45 is stopped by a wall 66 formed on stopper 60.

The remaining three modifications in accordance with the improvements claimed herein involve changes to the sixth level of the pinspotter electrical circuit and, in particular, require the use of the circuit illustrated in FIG. 9 in lieu of the sixth level stepper circuit shown in FIG. 7. Since the new circuit of FIG. 9 retains the use of the same sixth level stepper contacts, these contacts are identified by reference No. 90 in FIGS. 7 and 9. Portions of the sixth level contacts are also seen in FIGS. 10 and 13. Each of the modifications will be described separately. The first modification involves a change in the power relay circuit PR–1 so that (1) the elevator cam gate 32 opens whenever distributor head 37 is stopped and a tenpin is called for, and (2) the elevator cam gate 32 closes after sending out just one tenpin. As noted hereinbefore, when power relay PR–1 is energized, it actuates an elevator cam solenoid to open gate 32 whereby ten tenpins are released to distributor 31. Relay PR–1 is energized when table 21 reaches its 260° position in its respotting operation after setting a set of ten tenpins on the floor. Relay PR–1 is de-energized after ten tenpins pass through pin counter 42. In accordance with the modification, power relay PR–1 is energized when table 21 reaches its 260° position after setting a desired set of tenpins on the alley pin deck, but this relay is now de-energized after just one tenpin passes pin counter 42. The relay will be energized again when distributor head 37 is stopped at the next outwardly protruding stopper 60 and again de-energized just after another single tenpin passes through pin counter 42. This sequence of operation will be repeated for each outwardly protruding stopped 60 along track 38, except after the desired set of tenpins are distributed and head 37 returns to the first stopper where the foregoing distribution was initiated, power relay PR–1 is not energized and will not be energized until after the set of desired pins are set on the alley floor.

The portion of the circuit in FIG. 9 effecting the foregoing modification is contained in the dotted outline 67. For convenience, FIG. 10 shows only that portion of the circuit encompassing the foregoing modification. Circuit 67 includes a distributor head switch SWDE provided with contacts 205, 206 in lines 68 and 69 respectively, which contacts are normally closed when distributor head 37 is stopped by the stopper 60. Switch SWDE may be mounted on the side of the distributor head casting and is actuated whenever index pin 45 rides up ramp surface 65. For example, when distributor head 37 is stopped by a stopper 60, ramp 64 as noted hereinbefore will push index pin 45 slightly up. This small movement will move the trip lever assembly 41 a corresponding amount, which movement by any convenient linkage means will close the *nc* contacts of switch SWDE. However, it will be understood that after a tenpin passes over the pivotal trip lever 59, switch SWDE opens. This action will also lift pin 45 above the stopper to clear head 37 for travel to the next outwardly protruding stopper. Consequently, it will be understood that SWDE switch is closed only when index pin 45 is engaged by ramp surface 65, i.e. stopped by a stopper.

A second switch SWPG is a pin gate switch with contacts in line **68**, which contacts are adapted to close when counter paddle **43** is moved up by a tenpin and adapted to open when paddle **43** returns down after said tenpin passes the paddle. Switch SWPG may be located on the distributor bridge where the present SW–5 switch is now mounted. Line **68** also includes a power relay PRA with normally opened contacts **70** across the contacts of switch SWPG and with normally closed contacts **71** in line **69**. Relay PRA is activated when the pin gate switch SWPG is closed. Contacts **70** hold the coil of relay PRA energized. Relay PRA remains in operation until distributor head switch SWDE is opened by the tenpin which actuated the pin gate switch SWPG. Accordingly, power relay PRA contacts **70** (*no*), **71** (*nc*) are closed and opened, respectively, during the time a tenpin is on distributor **31** past paddle **43** and until such pin trips lever **59**. Relay PRA has another set of contacts **71***a* (*nc*) shown in FIGS. 13 and 9. Line **69** also includes pin counter off-normal contacts **72** of a pin-counter stepper, which contacts are closed after the first tenpin passes counter paddle **43**. Contacts **72** open when all the desired number of pins pass counter paddle **43**. An explanation of the counter stepper and its contacts appear in the description of the next modification. The normally closed contacts of relay PRA and switch SWDE in line **69** are bridged by a selector switch **73**, which switch is set in "normal" position when the customary tenpin game is to be bowled and which is set in "spare" position when selected pins for spare practice are desired. The aforesaid normally closed contacts are operative when selector switch **73** is in "spare" position and shorted out when selector switch **73** is in "normal" position.

As noted hereinbefore, when table **21** is ready to receive tenpins, power relay PR–**1** is energized through contacts **47** and line **50**. As soon as the first pin passes counter paddle **43**, contacts PR–**2** *no* in line **50** open and the pin counter off-normal contacts **72** close. If selector switch **73** is set on "normal," PR–**1** relay coil will remain energized until pin counter off-normal contacts **72** open. If selector switch **73** is set on "spare," PR–**1** relay coil will remain energized when PRA power relay is not energized and SWDE switch is closed, that is to say, while distributor head **37** is stopped by a stopper and before a tenpin lifts counter paddle **43**. The latter action will actuate relay PRA and thus will open contacts **71**. Hence, in "spare" operation, PR–**1** is energized to feed only one pin from the elevator wheel **28** to the distributor **31** for each outwardly projecting stopper **60** because when the single pin so fed passes paddle **43** it opens switch contacts **71** to de-actuate relay PR–**1** which closes cam gate **32**. After the desired number of spare tenpins are distributed, distributor head **37** will reach the stopper from which it started spare distribution. This action will close the SWDE switch contacts in series with the closed PRA contacts **71** in line **69**. However, pin counter off-normal contacts **72** are now open to prevent further energization of power relay PR–**1**. This will halt further distribution of pins from elevator **28**. If, for any reason or by accident, counter paddle **43** is lifted, power relay PRA will become energized and will stay in operation indefinitely. A PRA manual breaker **74** is provided in line **68** to break the circuit in such a situation. If PRA contacts **71** and the normally closed SWDE contacts in line **69** are placed in series with the elevator cam gate solenoid **75** and bridged by selector switch **73** as shown in FIG. 11 instead of being placed in the PR–**1** circuit as shown in FIG. 10, operation of cam gate **32** will be identical to that described hereinbefore for FIG. 10.

The second modification involves a change of operation of the pin counter switch SW–**5**. In FIG. 7 operation, switch SW–**5** operates after the first tenpin actuates pin counter **42**, whereby its normally closed contacts in line **58** open and its normally open contacts in line **51** close. Switch SW–**5** returns to normal status after ten tenpins are counted. The pin counter switch is now arranged whereby it is actuated when the first pin of the desired set actuates counter paddle **43** and is de-actuated after tenpins of preselected number, one to ten, are counted. The modification involves the portion of circuit **76** within dashed lines in FIG. 9. For convenience, only circuit **76** is illustrated in FIG. 12. Circuit **76** introduces a different kind of pin counter, whereby a set of normally open contacts **72** and normally closed contacts **77** (FIG. 13) are closed and opened, respectively, when a first tenpin passes counter paddle **43** and de-actuated when said preselected number of tenpins have passed counter paddle **43**. Contacts **72** in FIG. 12 are the same set of contacts **72** illustrated in FIG. 10 and this is evident from an examination of FIG. 9. Contacts **77** are shown in FIG. 9 and again in the modification circuit illustrated in FIG. 13. Circuit **76** includes a counter stepper relay **78** which is the same kind of stepper currently used in pinspotter **20**. Stepper coil **78** is energized to step its wiper from one step to the next each time switch contacts SWPG in line **79** open after being closed and this occurs each time a tenpin actuates paddle counter **43**. Only one level of stepper contacts **80** are needed and the wiper thereof may be a bridging or non-bridging type. Counter stepper **78** also has operatively associated interrupter contacts **81** and operatively associated pin counter off-normal and pin counter on-normal contacts **72**, **77**, respectively. The interrupter contacts **81** are used to reset counter stepper **78** and **80** to its zero position when the contacts **82** of a power relay PRB are closed or when a manual reset switch **83** is closed. Pin counter off-normal contacts **72** are closed when the stepper wiper is not in its zero position. Pin counter on-normal contacts **77** are closed when the stepper wiper is in its zero position. A pin number indicator **84** is a manual setting ten position switch, and the setting of this switch determines the total number of tenpins desired to be spotted on the alley floor. A power relay PRB is connected to switch **84** and is energized when the counter stepper wiper reaches the contact corresponding to the switch setting of pin number indicator **84**. Relay PRB is de-energized when counter stepper resets to its zero position and pin counter off-normal contacts **72** return to normal open. Manual resetting switch **83** when pressed will reset the counter stepper **78** and **80** to zero position.

Operation of circuit **76** is as follows. At the start, the stepper wiper is at step 0 of contacts **80**. Switch **84** is set to the quantity of tenpins desired and is shown set at position 3 assuming for this example the player wishes to practice against three "spare" tenpins, such as pins 1, 3 and 10. Accordingly, machine **20** will operate to deliver three tenpins individually as determined by the fact that the correlated stoppers **60** for the pin positions 1, 3 and 10 are set in outwardly projecting position whereas all other stoppers on track **38** are withdrawn so that only the proper spotting cups **24***a* each receive one of the three pins. When the first pin passes counter paddle **43**, counter stepper wiper steps from step 0 to step 1 since its coil **78** is energized through line **79**. This closes pin counter off-normal contacts **72** and opens pin counter on-normal contacts **77**, see FIG. 13. With the delivery of the second pin, stepper wiper moves from step 1 to step 2. The stepper will step one step at a time upon each pin actuating counter paddle **43**. Accordingly, when the third pin passes paddle **43**, stepper wiper closes contact **3** at which time power relay PRB is energized through switch arm **84**, the closed contacts **3** of stepper contacts **80** and closed contacts **72**. Power relay PRB is held in operation through its normally opened contacts **82***a* (now closed) and contacts **72**. Contacts **82***a* bridge stepper contacts **80**. When relay PRB is energized, counter stepper **78** and **80** is reset to its zero position through contacts **72**, the normally opened contacts **82**, which are now closed, and the interrupter contacts **81** to coil **78** of the counter stepper in line **79**. The normally closed interrupter contacts

81 are operated by the stepper relay to open momentarily to cause the stepper wiper to advance from one step to the next. Hence, when its wiper reaches contacts 3, stepper relay 78 is pulsed through closed contacts 81, 82 to advance the stepper wiper to contacts 4. When the wiper advances to contacts 4, interrupter contacts return to normally closed position to initiate stepping to contacts 5. In this fashion, the stepper very quickly advances to step 10 and then to the next step. Since the stepper relay is the rotary type, the step following step 10 is zero position, at which time stepper wiper arm engages step contacts 0.

When the counter stepper reaches zero position, pin counter off-normal contacts 72 open to de-energize relay PRB and which also stops further stepping. Concurrently, switch contacts 77 close. It will be understood that pin counter off-normal contacts 72 essentially perform the functions of the normally open switch contacts SW–5 in line 51 of the prior art circuit, FIG. 7, and on-normal contacts 77 essentially perform the functions of the normally closed contacts of switch SW–5 in line 58 of the prior art circuit depicted in FIG. 7.

The last modification to the electrical circuit involves a change in the circuit of the distributor position switch SW–4 such that the circuit opens when the first tenpin goes under counter paddle 43 and closes when distributor head 37 reaches the position where it started distribution of a given set of tenpins. As noted hereinbefore, distributor position switch SW–4 is a pressure switch which is closed when distributor head 37 is held at its starting position corresponding to pin position No. 7. Switch SW–4 is in the circuit of relay PR–2 which triggers table spotting operation when stepper relay reaches step 10 and the distributor is at pin position 7 and a desired set of tenpins are already in the table assembly and ready for release to the alley floor. With respect to "spare" operation in accordance with the practice of the invention claimed herein, it will be understood that distribution of one or more tenpins to cups 24*a* will not necessarily start at pin position 7. In the example of practicing against spare pins 1, 3 and 10, the cups 24*a* are filled in the sequence of 1, 3 and 10 and thus distribution will start at the stopper 60 corresponding to pin position 1. Consequently, this modification is designed to change the SW–4 circuit so that the spot-solenoid control power relay PR–2 will be energized to effect this new mode of operation. The circuit 85 involving the change is shown in dotted outline in FIG. 13 and appears in the circuit of FIG. 9 at the bottom thereof. Circuit 85 includes a selector switch 73 which may be ganged with selector switch 73 in circuit 67. When the selector switch 73 in circuit 85 is in "normal" position, it connects step 10 contacts of the sixth level stepper relay circuit with normally closed contacts SW–4 and pin counter on-normal contacts 77 to power relay coil PR–2, whereby the coil is energized when distributor head 37 is held at No. 7 pin position along track 38.

When selector switch 73 in circuit 85 is set in "spare" position, relay coil PR–2 will be energized when distributor head 37 reaches the position at which it initiated the distribution of a preselected number of pins numbering from one to ten, in number. In the foregoing "spare" practice, for example pins 1—3—10, the starting position corresponds to pin 1. Pin counter on-normal contacts 77 will hold the circuit of power relay PR–2 open until after the last pin of the given set of pins passes counter paddle 43. After pin counter on-normal contacts 77 close and before the last pin of a given set that is being distributed in a table cup 24*a* reaches the index arm trip lever 59 to open SWDE contacts, the normally closed contacts 71*a* (FIG. 13) of power relay PRA are open thereby maintaining the circuit for PR–2 open. When contacts 71*a* close, the SWDE contacts 207 in series therewith are already open, therefore, until SWDE contacts in series therewith are closed again by the stopper from which distribution is started, power relay PR–2 will not be actuated.

Reference is now made to FIG. 9 for operation of the modified sixth level circuit of the stepper relay. In the first place, it will be understood that the invention does not require any change to the distributor per se or its mode of operation. Consequently, distributor 31 will travel along track 38 along the same pin position sequence as it does in the current machine, regardless whether the circuit is set for "normal" or "spare" operation. When set for "normal" operation, the FIG. 9 circuit operation is substantially the same for the FIG. 7 circuit. For example, when the stepper advances to step 10, relay PR–2 is energized through contacts 48, stepper contacts 10, switch 73, the switch arms thereof are in "normal" position, and thus through closed contacts SW–4, and contacts 77. This starts table spotting operation. Relay coil PR–2 is held closed through line 58. When table 21 reaches 260° spotting position, the stepper advances to step zero and contacts 47 now close to energize gate relay PR–1 through line 50. The open contacts 200 of PR–2 in line 50 at this time are closed. This starts pin feed. PR–1 is held closed through line 69, the bridging circuit of switch 73 and the closed contacts 72 which close because stepper counter 78 advanced from zero step to complete pin feed.

For "spare" operation, selected stoppers 60 are individually positioned "in" or "out" positions in accordance with the pins to be played against. Distributor head 37 is moved to the first "out" stopper in accordance with the sequence of travel for distributor 31, if the first "out" stopper is not for the No. 7 pin. Switch 84 is set accordingly. Assume the machine is set for spares 1, 3 and 10, as noted hereinbefore. Consequently, switch 84 is set at the No. 3 contacts of counter contacts 80. Switches 73 are set to "spare" position. Relay coil PR–2 is energized when the stepper relay (contacts 90) reaches the tenth step through closed contacts SWDE and PRA in the lower one of selector switches 73 (circuit 85). Relay PR–2 is held in operation by line 58. When table 21 reaches 260° position of its spotting operation, the stepper relay (contacts 90) advances to step zero; contacts 47 close to energize gate control relay PR–1 through line 50 to release the first pin of the set of three to distributor 31. When this tenpin hits counter paddle 43, contacts 71 in line 69 open and counter stepper 78 is triggered through line 79 to advance its wiper to step "one." This action also opens contacts 77 to break the circuit for relay PR–2 which opens its contacts in line 50 with the result that no more pins are fed to distributor 31. This action also closes contacts 72. As the aforesaid first pin leaves distributor 31, it drops lever 59 to release switch SWDE and to clear distributor 31 to advance to the next stopper 60 where distributor 31 halts at pin position No. 3. Contacts 71 return to normally closed when SWDE is rleased. This action now closes switch contacts SWDE in series with closed contacts 71 in line 69 to trigger relay PR–1 for the release of the second tenpin. PR–1 remains energized for a short period of time, that is, until this second tenpin hits counter paddle 43 at which time contacts 71 open to prevent the release of further pins from elevator 28. When counter paddle 43 is hit, counter stepper 78 is triggered to advance to its second step. As the second pin drops into pin position No. 3, it clears distributor head 37 to advance distributor 31 to pin position spot No. 10. When distributor head 37 arrives at this stopper, line 69 is again closed momentarily to trigger relay PR–1 for the feed of one more pin to distributor 31; relay PR–1 is again de-energized as soon as the third pin hits paddle 43. This action also advances counter stepper 78 to No. 3 position, which matches the position of switch 84. Interrupter 81 now quickly advances stepper 78 and 80 to its zero or start position. As the third pin drops into its cup, it releases distributor head 37 to permit distributor 31 to return to its initial or start

position of the foregoing distribution of a set of three tenpins which is the pin position No. 1. Since distributor **31** has to make a lengthy travel, counter stepper **78** and **80** will have reached zero position before distributor head **37** reaches its start position. When stepper returns to zero position, pin counter contacts **72** return to normal open which prevents further energization of power relay PR–1.

From the foregoing, it will be understood that there are basically five steps to perform to a pinspotter incorporating the aforesaid modifications before a "spare" practice game may be played. First, stoppers **60** on distributor track **38** must be set individually in outwardly position to correspond to the tenpin positions desired for spare practice. All other stoppers **60** along track **38** must be withdrawn. Second, pin number indicator **84** is set to its numbered terminal corresponding to the total number of pins to be played. Third, selector switches **73** are set to "spare" position. If normal play is required, it is preferable to set switches **73** to "normal" position. Switches **73** may be left on "spare" position for normal tenpin play, however, distribution of tenpins will take a longer time. Fourth, distributor head **37** is positioned to start distribution of the set of spare pins at the first "out" stopper **60** along track **38** in accordance with the normal sequence of distributor travel along said track. Fifth, pinspotter **20** is operated to sweep the alley deck of any wood on the floor if the standing pins already on the floor do not represent the combination required for "spare" play. The first set of pins spotted by machine **20** may not be the combination required or desired simply because a set of pins may have already been distributed into the pin cups before the foregoing described operation for "spare" play is put into effect. If this is the case, machine **20** should again be operated to sweep the floor. After machine **20** sets the desired set of spare tenpins on the alley floor, it is ready for the first ball throw. If the first ball knocks all pins down, the machine will operate as if a strike ball was thrown and in accordance with its current operation, machine **20** will spot a new set of spare tenpins of the aforesaid desired combination on the alley floor. On the other hand, should the bowler fail to knock down all the tenpins constituting the spare combination, machine **20** will carry out first ball cycle operation whereby it picks up the standing pins, sweeps away the deadwood and respots the standing pins for second ball throw. After second ball throw, machine **20** undergoes second ball cycle operation to spot a new set of spare tenpins of the aforesaid combination on the alley floor. Consequently, except for the spotting of a desired combination of one to ten tenpins for spare practice, the machine otherwise undergoes the same operations it currently follows, such as first ball cycle, second ball cycle or strike cycle, etc. These operations are fully disclosed in the aforesaid AMF references.

FIG. 14 illustrates the embodiment of a mechanical counter **91** which may be used in lieu of the relay counter stepper **78** and **80** for the purpose of controlling the operation of off-normal contacts **72** and on-normal contacts **77**. If mechanical counter **91** of FIG. 14 is used, the entire circuit **76**, FIG. 12, may be withdrawn from the circuit of FIG. 9. Counter **91** has a pivotal counter driver **92** adapted to swing clockwise about a fixed pivot **93** each time counter paddle **43** is actuated upwardly by a tenpin passing same. Driver **92** returns counter-clockwise to the illustrated position when paddle **43** drops to its down position. To obtain synchronous movement of driver **92** and paddle **43**, the latter is mechanically linked to the former as depicted by dash line **94**.

A movable toothed rack **95** is provided with a plurality of equally spaced teeth **96**. Each tooth **96** is adapted to be engaged individually by the lower hooked end **92***a* of driver **92**, whereby each time driver **92** swings clockwise, rack **95** is advanced the distance of one tooth pitch to the left. This also clears driver **92** to return counter-clockwise to hook into the next tooth **96** of the plurality. Rack **95** is also provided with a horizontal keyway **97**. An indicator member **98** has a base **99** adapted to register slidably in keyway **97** for positioning member **98** along the keyway. There are at least ten threaded holes **100** along keyway **97** wherein each hole **100** corresponds to a correlated tooth **96**. Member **98** has a thumb screw **101** which is adapted to engage threadedly any one of the holes **100** to secure member **98** in fixed position with respect to a selected one of the rack teeth **96**. Rack **95** is slidably supported for movement to the left and right in a track **102** of a base **103**. A pivotal return pawl **104** is supported to swing about a fixed axis **105** against a return tension spring **106**. Counterclockwise swing of pawl **104** is limited by a stop **107**. Pawl **104** has a lower end adapted to engage the upright rear wall of the individual teeth **96** to prevent return travel of rack **95** to the right under the force of a return tension spring **106**. Indicator member **98** also has a horizontal extension **107** projecting over teeth **96**. Upon stepped travel of rack **95** to the left, extension **107** ultimately will engage pawl **104** and raise same clockwise to clear teeth **96**. This action will clear rack **95** for return travel to the right. A catcher pawl **108** is pivoted about a fixed axis **109** to form a two-arm member, the lower end of which **110** is hooked to engage and hold pawl **104** when the latter is kicked up by extension **107**. The upper end of pawl **108** is spring biased by a tension spring **111**. Spring **111** pulls the upper end of pawl **108** to the left to urge same counter-clockwise around its pivot, which action will hold pawl **104** in upper hooked position when the latter is engaged by pawl **108**. A guide arm **112** has one end pivotally connected to the upper end of pawl **108**. The opposite end of guide arm **112** is hooked at **113** about a convenient extension of rack **95**, whereby movement of rack **95** to the right pulls arm **112** therewith to the right. Movement of arm **112** to the left and right is limited by a slot and pin combination at **114**.

When rack **95** is in the position shown in FIG. 14, it corresponds to "zero" position, i.e. the "zero" position for counter stepper **78** and **80** of circuit **76**. In this position, rack **95** is stopped against stop wall **115** of base **103**. Slider member **98** is fastened along keyway **97** at a numbered tooth which corresponds to the total quantity of tenpins to be counted out by the off-normal and on-normal pin counters **72, 77** and is shown in the figure set at No. 5 position. Hence, the "spare" operation will count out five pins to be set on the alley floor. In operation, when the first tenpin passes paddle counter **43**, counter driver **92** is driven clockwise so that its lower end **92***a* engages a tooth **96** to advance rack **95** the equivalent of one pitch whereupon driver **92** returns to its initial down position with return movement of paddle counter **43**. This same action is repeated for the next four tenpins. It will be understood that rack **95** is driven by member **92** the equivalent of one tooth pitch by each tenpin. The last pin of the group advances slider member **98** to a position where kicker extension **107** engages pawl **104** to lift same upwardly clockwise which clears rack **95** for return movement to the right. When pawl **104** swings up, it is hooked and held by catcher **108** as rack **95** quickly completes return movement to zero position under the force of spring **106**. Return movement of rack **95** pulls arm **112** to the right which motion is limited by pin-slot **114**. When rack **95** returns to zero position, it will impart sufficient clockwise turning to arm **108** to release pawl **104** and the latter returns counter-clockwise under the pull of spring **116**. Rack **95** is provided with an insulator switch extension **118** which supports on-normal pin counter switch **77** and off-normal pin counter switch **72**. It is seen from FIG. 14 that for "zero" position, switch **77** is closed and for all other positions this switch is open. Switch **72** includes a conductor member **119** connected to one lead wire "X" and supported by an insulator **120**, whereby conductor **119** slidably engages a conductive terminal **121** for all positions of rack **95** other than "zero"

position with the result that switch **72** is open for "zero" position and otherwise closed. Terminal **121** is connected to the other lead wire "X." When mechanical counter **91** is used, the switch contacts **72, 77** in FIG. 9 are removed and lead wires X—X and Y—Y of FIG. 9 connect to the similar designated wires of FIG. 14. Switch **77** has a switch arm **122** and make and break contacts **123***a*, *b* each connected to a lead wire "Y." Mechanical counter **91** may be located in any convenient place in the structure of pinspotter **20**.

The stopper embodiment shown in FIGS. 3 through 6 contemplates adjustable stoppers **60** attached to the underside of track **38** to accommodate operating AMF pinspotters for spare practice play. In the recent models of the AMF pinspotter, track **38** no longer employs stops **40** (see FIG. 2). Therefore, the distributor index head **37** no longer includes an index pin **45** for stopping distributor **31** at each table cup position along the track. For the purpose of using the 1959 model of the AMF pinspotter for spare practice play, it is still required that distributor **31** stop only at the selected table cups where a spare practice pin is called for and by-passing the other table cups. In the 1959 pinspotter model, see FIG. 16, index head **37'** has gear and roller means **39**, **39***a* operatively engaging track **38'** in the same manner as described hereinbefore. However, gear means **39'** is an integral part of a drive gear assembly **130** to turn therewith. Drive gear assembly **130** has a stop arm extension **131** turning therewith. The table cups in the 1959 model are arranged with respect to track **38'** so that gear assembly stop arm **131** engages a movable trip arm assembly **132** on head **37'** once for each revolution of gear turning. Consequently, it is understood that for normal tenpin operation of the 1959 pinspotter model, every time drive gear assembly **130** makes one revolution, its stop arm **131** abuts against trip arm assembly **132** to halt distributor **31** at a correlated table cup. Trip arm assembly **132** is mechanically linked to pivotal trip lever **59**. Each time a tenpin drops into a table cup from the stopped distributor **31**, the tenpin actuates lever **59** as in the prior disclosed embodiment. This action raises the mechanically linked trip arm assembly **132** to clear gear stop arm **131** for turning one full revolution of gear drive assembly **130**, whereby distributor **31** proceeds to the next table cup along track **38'** and is stopped thereat.

In order to regulate the 1959 pinspotter model to stop only at selected cups, index pin **45** is returned to distributor head **37'** as shown in FIG. 16. Index pin **45** is now mechanically linked by member **133** to trip arm assembly **132** so that upward movement of index pin **45** raises trip arm assembly **132** to clear the drive gear stop arm **131** to permit distributor **31** to by-pass the particular table cup. Index pin **45** is tripped by a tripper **134**, see FIG. 17. Ten trippers **134** are mounted along the underside of track **38'** to swing "in" and "out" and each are adapted to be held in one or the other of such positions in the same manner as depicted in FIGS. 3 to 6. However, in this embodiment, each tripper **134** has an inclined cam surface **135** without any rear stop wall. Each tripper is positioned with respect to a correlated table cup so that when a tripper **134** is in "out" position, index pin **45** rides upwardly along inclined surface **135** to raise member **133** which raises trip arm assembly **132** just before the turning gear stop arm **131** would be engaged by the trip arm assembly **132**. This action clears stop arm **131** to continue its turning without being stopped. When pin **45** passes over the rear edge of tripper surface **135**, both pin **45** and trip arm assembly **132** drop to their lower positions. Consequently, distributor **31** is not halted at any table cup whenever its correlated tripper is in "out" position, whereby the distributor by-passes to proceed to the next table cup. The foregoing action contemplates selecting a suitable length for the inclined tripper surface **135** whereby, pin **45** drops from the rear edge of surface **135** only after stop arm **131** will have rotated past trip arm assembly **132** so that the latter does not engage stop arm **131** to halt same. If desired, a horizontal platform **135***a* may be provided to extend integrally from the rear of tripper **134**. Platform **135***a* will hold pin **45** and trip arm assembly **132** in up position until after stop arm **131** rides past trip arm assembly **132** to assure that arm **131** will have traveled completely beyond assembly **132** by the time the latter is permitted to drop. When a tripper **134** is withdrawn to avoid actuating index pin **45**, normal operation takes place wherein distributor **31** halts at the selected table cup. In effecting the above operation, it will be understood that each tripper **134** is properly located along track **38'** so that the index pin **45** is actuated by the "out" tripper before stop arm **131** would normally engage trip arm assembly **132**. In accordance with the invention, trip arm assembly **132** is actuated either by pin **45** acted upon by an "out" tripper **134** or by lever **59** acted upon by a distributed tenpin.

It will also be preferable to mount the distributor head switch SWDE on the trip arm assembly casting **132** so that each time gear stop arm **131** engages trip arm assembly **132** to halt distributor **31** at a selected cup, a SWDE switch operator **136** is actuated to close its three switch contacts. SWDE switch operator **136** depends from switch SWDE and when operator **136** is engaged by stop arm **131**, it is actuated to close its switch contacts. On the other hand, when trip arm assembly **132** is lifted by a tripper, the turning stop arm **131** passes under switch operator **136** without actuating same. Consequently, it will be understood that when distributor **31** is permitted to by-pass a correlated table cup, switch SWDE is not actuated whereby its three switch contacts remain open.

The electrical circuit modifications shown in FIG. 9 are also applicable to the 1959 pinspotter model, since electrically the old and new pinspotters are substantially the same. For comparing the disclosures of the track and distributor head for the old and new models of the AMF models, reference is made to the aforesaid AMF Instruction and Service Manual pages 5.023 Rev. (3) 9–56; 5.024 Rev. (3) 9–'56, et seq. for the embodiment contemplated in FIG. 3; and page 5.023 Rev. (4) 1–'59; 5.024 Rev. (4) 1–'59, et seq. for the embodiment contemplated in FIG. 16. Similarly, reference to pages 3.001; 3.002 Rev. (1) 6–' 56, et seq.; and 3.001 Rev. (4) 4–'59; 3.002 Rev. (5) 4–'59 et seq. will permit a comparison of their respective electrical circuits.

It is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. In an automatic pinspotter for spotting a given set of one or more tenpins on a bowling alley floor, table means operable over said alley floor and having a predetermined number of spotting cups for receiving said tenpins and spotting same on said floor, each cup being adapted to receive an individual tenpin and to spot same on said floor, a guide track carried by said table and being operatively associated with said cups, distributor means for traveling along said track and adapted to stop adjacent each cup for releasing an individual tenpin thereto, means for feeding said tenpins one at a time to said distributor, circuit means for selectively and momentarily actuating and then de-actuating said tenpin feeding means to release a predetermined number of tenpins of 1 to 9 in quantity as a given set to said distributor, and means operatively associating said track and distributor and causing said distributor to stop at selected ones of said cups for depositing a tenpin therein, said distributor otherwise by-passing all other table cups, whereby a set of pins of said predetermined number and of selected spot position are set on said floor.

2. Apparatus as defined in claim 1 wherein said cir-

cuit means comprises relay means for actuating said feeding means for releasing tenpins to said distributor, and means for actuating said relay means when said distributor is halted at any individual one of said selected table cups for releasing a single tenpin to said distributor and for de-actuating said relay means after the aforesaid single tenpin is released to said distributor, said single tenpin being deposited by said distributor into said individual table cup.

3. Apparatus as defined in claim 1 wherein said means for operatively associating said track and distributor means includes adjustable stoppers along said track, each stopper being operatively associated with an individual one of said table cups, said stoppers being adjustable for one or the other of two positions, the adjustment of any stopper in its first position halting the distributor thereat to permit the release of an individual tenpin to the correlated table cup, the adjustment of any stopper to the other of its positions allowing said disrtibutor to by-pass same.

4. Apparatus as defined in claim 1 wherein said circuit means have a source of voltage for regulating operation of said pinspotter, said distributor means having an index head operatively engaging said guide track, relay means for actuating said feeding means for releasing tenpins to said distributor, a distributor switch having first and second sets of contacts which are closed when said distributor is stopped at selected ones of said table cups, said distributor switch contacts otherwise being open, a counter switch having make and break contacts which are momentarily closed while said counter switch is being actuated by a tenpin passing along said distributor, said means operatively associating said track and distributor including trip lever means on said distributor head responsive to a tenpin actuating same upon the release of such pin by said distributor to a table cup, actuation of said trip lever resulting in operation of said operatively associating means for releasing said distributor from one selected cup position for travel to the next selected table cup position and also for opening said first and second sets of said distributor switch contacts, and second relay means having normally open and normally closed contacts, said second relay means being energized by said source through said first set of distributor switch contacts in series with said counter switch contacts, said normally open second relay contacts bridging said counter switch contacts and being actuated to close when said second relay means is energized to hold such relay means energized until the first set of distributor switch contacts open, said first relay means being energized by said source through said second set of distributor switch contacts in series with said normally closd second relay contacts, and said last-mentioned contacts opening when said second relay means is energized, said first relay means being momentarily energized to effect the release of a single tenpin to said distributor during the interval that said distributor switch contacts are closed and until such released tenpin actuates said counter switch contacts to close same, said first relay means being then de-energized to achieve the feed of such single tenpin to the selected table cup at which said distributor is stopped.

5. In an automatic pinspotter for spotting a given set of one or more tenpins on a bowling alley floor, table means operable over said alley floor and having a predetermined number of spotting cups, each cup being adapted to receive an individual tenpin and to spot same on said floor, a guide track carried by said table and being operatively associated with said cups, distributor means for traveling along said track and adapted to stop adjacent each cup for releasing an individual tenpin thereto, means for feeding a predetermined number of tenpins of at least one in quantity as a given set to said distributor, and means operatively associating said track and distributor and causing said distributor to stop at selected ones of said cups for depositing a tenpin therein, said distributor otherwise by-passing all other table cups, whereby a set of pins of said predetermined number and of selected spot position are set on said floor, an electrical system having a source of voltage for regulating operation of said pinspotter and also having relay means for actuating said feeding means for releasing tenpins to said distributor, said electrical system also including first and second circuits for alternately connecting said relay means to said source, the first of said circuits including make and break contacts which contacts are temporarily closed when said distributor is halted at a first cup position of a group of preselceted table cups constituting the given set of tenpins to be set on said alley floor by said table, said contacts opening upon the delivery of the first tenpin of said given set to said distributor, said means operatively associating said track and distributor permitting said distributor to move from said first cup position to the next cup position of said preselected cups after the delivery of said first tenpin of said given set to said first cup, means actuated through individual steps by individual ones of the tenpins released to said distributor for counting such tenpins and having responsive off-normal contacts, said off-normal contacts being closed upon said counting means being actuated by the first tenpin of said given set, said off-normal contacts returning to open status upon said counting means being actuated by the last tenpin of said given set, said second circuit connecting said relay means to said source through said off-normal contacts, whereby said relay means is adapted to energize said feeding means for releasing tenpins to said distributor through said second circuit for all tenpins of a given set except the first tenpin thereof, and said second circuit being open upon the feed of the last tenpin of said set to said distributor.

6. Apparatus as defined in claim 5 further including a pin counter switch having make and break contacts which are momentarily closed by each tenpin passing along said distributor, said counting means including a counter stepper having a relay connected to said source through said pin counter switch contacts, said counter stepper having a stepping wiper and operatively associated counter stepper contacts including zero position contacts and a series of contacts equal at least in number to the greatest number of tenpins adapted to be spotted on said alley floor by said table, said stepper relay also having operatively associated interrupter contacts, said off-normal contacts being responsive to actuation of said counter stepper relay wherein said off-normal contacts are closed for all stepper wiper contact positions except for its zero position, a pin number indicator switch adapted to make series connection with individual ones of said counter stepper contacts, and second relay means having a relay coil connected to said source through said off-normal contacts and said pin number indicator switch when such switch is positioned at a selected one of said stepper contacts, said pin number switch being connected to a selected one of said wiper contact positions corresponding to the total number of tenpins constituting said given set of tenpins, whereby said second relay means is actuated when said stepper wiper steps to its contact position corresponding to the setting of said number switch, said second relay means having a pair of normally open contacts, the first of said pair of contacts bridging said stepper contacts and being closed when said second relay means is actuated, the second of said pair of contacts being in series with said interrupter contacts to connect said counter stepper relay to said source upon said second relay being actuated, said counter stepper wiper being at zero position contacts prior to counting of tenpins passing along said distributor, the first tenpin of a given set of tenpins being adapted to actuate said pin counter switch contacts for actuating said stepper counter relay for stepping its stepper wiper from zero position contacts to the first position contacts of its series of contacts and also for closing said off-normal contacts, the passage of sub-

sequent tenpins constituting the remainder of said given set of tenpins individually energizing said stepper counter relay for stepping said wiper one step at a time to succeeding contact positions, whereby said stepper wiper advances to the stepper contacts corresponding to the setting of said pin number indicator switch for energizing said second relay means, actuation of said second relay means allowing said stepper wiper contacts to proceed to zero position through connection of said counter stepper relay through said interrupter contacts at which time said off-normal contacts open to prevent tenpins greater in number than that constituting said given set being released to said distributor.

7. Apparatus as defined in claim 5 wherein said counting means comprises a movable rack having a seires of teeth, driving means for engaging individual ones of said teeth one at a time as individual ones of said tenpins pass along said distributor for moving said rack from a first position by individual steps to a second position, means for returning said rack to said first position, stop means normally in register with said rack to prevent the return of same to its first position, said stop means also being adapted for movement to a clearance position for clearing said rack for return to its first position, catcher means for alternately holding said stop means in its clearance position and for releasing said stop means to permit the return of same to its normal position, means operatively responsive to movement of said rack for actuating said catcher means, and indicator means selectively positioned along said rack in operative association with a correlated one of said rack teeth corresponding to the total number of tenpins to be counted and constituting said given set of tenpins, said indicator means making register with stop means to move same to its clearance position after said rack is stepped by said driver means in response to the last tenpin constituting said given set being fed to said distributor, said off-normal contacts being regulated by said rack wherein said contacts are open when said rack is in its first position and said contacts are otherwise closed for all other positions of said rack.

8. In an automatic pinspotter for spotting a given set of one or more tenpins on a bowling alley floor, table means operable over said alley floor and having a predetermined number of spotting cups, each cup being adapted to receive an individual tenpin and to spot same on said floor, a guide track carried by said table and being operatively associated with said cups, distributor means for traveling along said track and adapted to stop adjacent each cup for releasing an individual tenpin thereto, means for feeding a predetermined number of tenpins of at least one in quantity as a given set to said distributor, and means operatively associating said track and distributor and causing said distributor to stop at selected ones of said cups for depositing a tenpin therein, said distributor otherwise by-passing all other table cups, whereby a set of pins of said predetermined number and of selected spot position are set on said floor, an electrical system having a source of voltage, relay means for actauting said feeding means for releasing tenpins to said distributor, a distributor switch having sets of contacts normally closed when said distributor is stopped at selected ones of said table cups constituting said given set of tenpins, said distributor switch contacts otherwise being open, second relay means adapted for connection to said source through one set of said distributor switch contacts, said second relay means having normally closed contacts which open upon actuation of said second relay means, pin counter on-normal contacts, means actuated by the release of tenpins to said distributor for opening said pin counter on-normal contacts in response to the release of the first tenpin of said given set to said distributor, third relay means adapted for connection to said source through said pin counter on-normal contacts in series with another set of distributor switch contacts and said normally closed second relay contacts, said third relay means having normally open contacts which contacts close during actuation of said third relay means for connecting said relay means to said source to effect the release of tenpins to said distributor, whereby the release of the first tenpin opens said pin counter on-normal contacts to prevent further actuation of said first relay through said normally open contacts of said third relay means.

9. Apparatus as defined in claim 8 further including trip lever means on said distributor, said trip lever means being actuated by each tenpin released by said distributor to a table cup for opening said distributor switch contacts and for releasing said distributor from a stopped position adjacent one of said selected table cups for travel to another one of said selected table cups.

10. Apparatus as defined in claim 9 further including adjustable stoppers along said track and being a part of said means operatively associating said track and distributor, each stopper being operatively associated with an individual one of said table cups, said stoppers being adjustable for one or the other of two positions, the adjustment of any stopper in its first position halting the distributor thereat to permit the release of an individual tenpin to the correlated table cup, the adjustment of a stopper to its other position allowing said distributor to by-pass the correlated table cup.

11. In an automatic pinspotter for spotting a given set of one or more tenpins on a bowling alley floor, table means operable over said alley floor and having a predetermined number of spotting cups, each cup being adapted to receive an individual tenpin and to spot same on said floor, a guide track carried by said table and being operatively associated with said cups, distributor means for traveling along said track and adapted to stop adjacent each cup for releasing an individual tenpin thereto, means for feeding a predetermined number of tenpins of at least one in quantity as a given set to said distributor, and means operatively associating said track and distributor and causing said distributor to stop at selected ones of said cups for depositing a tenpin therein, said distributor otherwise by-passing all other table cups, whereby a set of pins of said predetermined number and of selected spot position are set on said floor, an electrical circuit having a source of voltage, first relay means for actuating said feeding means for releasing tenpins to said distributor, a distributor switch having contacts which are closed when said distributor is stopped at any selected one of said table cups, said distributor switch contacts otherwise being open, normally closed contacts in series with said distributor switch contacts, means for opening said normally closed contacts when an individual tenpin is received by said distributor and for returning said contacts to normally closed status when the aforesaid individual tenpin is released by said distributor to a selected one of said table cups, a second relay having a coil adapted for connection to said source through said series distributor switch contacts and normally closed contacts, a set of pin counter on-normal contacts, means actuated by the release of the first of said tepins of said given set for opening said pin counter on-normal contacts and for returning said on-normal contacts to normally closed status upon counting off the number of tenpins constituting said given set, said pin counter on-normal contacts also being in series with said second relay means to connect same to said source, said second relay having normally open contacts which are closed when said second relay means is energized, said first relay means being connected to said source through said second relay contacts, whereby the positioning of said distributor at any individual one of said selected table cups corresponding to the first tenpin of said given set effects energization of said second relay means to connect said first relay means to said source to permit the release of the aforesaid first tenpin to said distributor and otherwise prevents actuation of said first relay means through said second relay contacts.

12. Apparatus as defined in claim 11 wherein said

electrical system includes first and second circuits for alternately connecting said first relay means to said source, said first circuit including said normal open contacts of said second relay means, said means for opening said normally closed contacts including a third relay, pin counter off-normal contacts, said distributor switch and said relay each having another set of normally closed contacts in series with said pin counter off-normal contacts to define the second circuit for connecting said first relay means to said source, said means for actuating said pin counter on-normal contacts also being adapted to close said pin counter off-normal contacts in response to the release of said first tenpin of said given set to said distributor and for returning said off-normal contacts to open status upon counting off the quantity of tenpins constituting said given set, whereby said first relay means is temporarily energized to release individually all tenpins of said given set to said distributor except for the first tenpin of such set when the contacts constituting said second circuit are simultaneously closed.

13. Apparatus as defined in claim 12 further including selector switches for individually shorting out the series connected normally closed distributor switch and third relay contacts in said second circuit and for connecting said second relay to said source.

14. Apparatus as defined in claim 13 wherein said means for operatively associating said track and distributor comprises a plurality of spaced and adjustable stoppers each operatively associated with an individual one of said table cups for halting said distributor at selected ones of said table cups for constituting the given set of tenpins and for otherwise allowing said distributor to by-pass all other table cups.

15. In an automatic pinspotter for spotting a given set of one or more tenpins on a bowling alley floor wherein said pin spotter includes table means operable over said alley floor and which table means includes a predetermined number of spotting cups whereby each cup is adapted to receive an individual tenpin for spotting same on said floor, said pinspotter also including guide track means carried by said table and being operatively associated with said cups, distributor means for traveling along said track and adapted to stop adjacent each cup for releasing an individual tenpin thereto, and means for feeding a predetermined number of tenpins of at least one in quantity as a given set to said distributor, the combination defining a mechanical counter for counting out the tenpins constituting said given set as such tenpins are released to the distributor comprising, movable rack means having a series of teeth, driving means for engaging said teeth one at a time for moving said rack means from a first position to a second position, individual ones of said teeth being engaged by said driving means as individual ones of said tenpins pass along said distributor whereby said rack means is moved in individual steps from said first position to said second position, means for returning said rack to said first position, stop means normally in register with said rack to prevent the return of same to its first position, said stop means also being adapted for movement to a clearance position for clearing said rack for return to its first position, catcher means for alternately holding said stop means in its clearance position and releasing said stop means to permit the return of same to its normal position, means operatively responsive to movement of said rack for actuating said catcher means, and indicator means selectively positioned along said rack in operative association with a correlated one of said rack teeth corresponding to the total number of tenpins to be counted, said indicator means making register with said stop means to move same to its clearance position after said rack is stepped by said driver means in response to the last tenpin of said given set being fed to said distributor.

16. Apparatus as defined in claim 1 wherein said means for operatively associating said track and distributor means includes adjustable means along said track, each of said means being operatively associated with an individual one of said table cups, said means being adjustable for one or the other of two positions, the adjustment of said means in the first position causing said distributor to halt at the correlated table cup to permit the release of an individual tenpin thereto and the adjustment of such means to the other of its positions allowing said distributor to by-pass the correlated table cup.

17. Apparatus as defined in claim 9 further including adjustable trippers along said track and being a part of said means operatively associating said track and distributor means, each tripper being operatively associated with an individual one of said table cups, said trippers being adjustable for one or the other of two positions, the adjustment of any tripper in its first position causing said distributor to halt at the correleated table cup to permit the release of an individual tenpin thereto, the adjustment of a tripper to the other of its positions allowing said distributor to by-pass the correlated table cup.

18. In means for automatically spotting a given set of tenpins from 1 to 10 in quantity on a bowling alley floor and having table means including ten spotting cups for individually receiving a tenpin and spotting same on said floor, guide track means carried by said table means and being operatively associated with said cups, distributor means for traveling along said track and equipped to stop adjacent each cup for releasing an individual tenpin thereto, and means for feeding said tenpins one at a time to said distributor, the combination comprising, circuit means for actuating and de-actuating said tenpin feeding means to release a predetermined number of tenpins constituting a given set to said distributor means, adjustable stop and pass means for causing said distributor to stop only at selected ones of said cups for depositing a tenpin therein, said distributor otherwise by-passing all other table cups, said selected table cups corresponding in quantity and spot position to said given set of tenpins, said circuit means including counter means for counting each tenpin release to said distributor and for momentarily energizing said circuit means when said distributor means is stopped at a selected one of said cups to effect the release of only one tenpin thereto and for then de-energizing said circuit means to prevent the release of an additional tenpin to said distributor means until said distributor means has completed travel to the next selected cup of said given set and stopped thereat, whereby a given set of tenpins of predetermined number 1 to 10 in quantity and of selected spot positions are set on said floor.

19. Means as defined in claim 18 wherein said circuit means includes an electrical power source, electrical control means for operating said tenpin feeding means, first contact means being normally closed in repsonse to said distributor means being at a selected cup, second normally closed contact means, said second contact means being actuated to open status when a tenpin fed to said distributor means is counted, said second contact means returning to closed status when said counted tenpin is deposited into the selected cup at which said distributor means is stopped, and means for releasing said distributor means for travel from said last-mentioned table cup to the next table cup of said selected cups upon the feed of said counted tenpin from said distributor means to said last-mentioned table cup, said electrical control means being connected to said source through said first and second contact means whereby said circuit means is energized momentarily to feed a singles tenpin to said distributor means and then de-energized until said distributor means travels and stops at the next table cup of said selected cups.

20. Means as defined in claim 19 further including a counter normally open contact means also connected to said electrical control means for coupling same to said source, said counter normally open contact means being actuated to close upon the counting of the first tenpin of a

given set after release of such tenpin to said distributor means, said counter normally open contact means returning to open status after counting of the last tenpin fed to said distributor means and constituting said given set, said electrical control means being coupled to said source through said first and second contact means and said counter normally open contact means to effect the feed of all tenpins constituting said given set to said distributor means except for the first tenpin of said given set.

21. Means as defined in claim 20 further including second electrical control means equipped for connection to said source, third contact means being normally closed in response to said distributor means being at a selected cup, fourth contact means being normally closed except from the time a tenpin fed to said distributor means is counted and until such counted tenpin is fed to the selected table cup at which said distributor means is stopped, said fourth contact means having an open contact status during the aforesaid time interval, a counter normally closed contact means being actuated to open status upon counting of the first tenpin of said given set after release of such tenpin to said distributor means, said counter normally closed contact means returning to closed status after counting of the last tenpin released to said distributor means and constituting said given set, said second control means being coupled to said source through said third and fourth contact means and through said counter normally closed contact means, and normally open fifth contact means actuated closed when said second control means is energized and returning to open status when said second control means is de-energized, said normally open fifth contact means coupling said first control means to said source when said fifth contact means is closed whereby said first control means is energized to effect the release of the first tenpin of said given set to said distributor means.

22. Means as defined in claim 21 further including third electrical control means for controlling said second and fourth contact means and for holding same in closed status when said third electrical control means is de-energized, second counter normally open contact means being actuated temporarily closed from the time that a tenpin released to said distributor means is counted and until said counted tenpin is fed by said distributor means to the selected table cup at which said distributor means is stopped, said third control means being coupled to said source through said second counter normally open contact means, whereby said first electrical control means is momentarily energized to actuate said tenpin feeding means to feed the aforesaid counted tenpin to said distributor means and then said first electrical control means is de-energized upon counting of such tenpin to assure the delivery of only a single tenpin to each selected table cup.

23. Apparatus as defined in claim 22 further including sixth contact means being normally closed in response to said distributor means being at a selected cup, said sixth contact means also being coupled to said third electrical control means for de-energizing same from the time of release of a tenpin by said distributor means to said cup and while said distributor means is traveling along said track means to the next selected cup constituting said given set.

24. Means as defined in claim 18 further including an electrical power source, electrical control means equipped for connection to said source, first contact means being normally closed in response to said distributor means being at a selected cup, second contact means being normally closed except from the time when said counter means is being actuated to count a tenpin fed to said distributor means and until said counted tenpin is released to the selected cup at which said distributor means is stopped, means for releasing said distributor means for travel from said last-mentioned table cup to the next table cup of said selected cups upon the feed of said counted tenpin from said distributor means to said last-mentioned table cup, a counter normally closed contact means being actuated to open status upon counting of the first tenpin of said given set after the feed of such tenpin to said distributor means, said counter normally closed contact means returning to closed status after counting of the last tenpin fed to said distributor means and constituting said given set, said control means being coupled to said source through said first and second contact means and through said counter normally closed contact means, and third contact means being normally open and actuated to closed status when said control means is energized, said third contact means returning to open status when said control means is de-energized, said third contact means being equipped to energize said circuit means to effect the release of the first tenpin of said given set to said distributor means.

25. Means as defined in claim 18 further including an electrical power source, electrical control means equipped to be energized by said source for actuating said tenpin feeding means to effect the feed of tenpins to said distributor means, means for momentarily energizing said control means while said distributor means is stopped at a selected table cup and for de-energizing said control means upon counting the tenpin fed to said distributor means, whereby said tenpin feeding means is momentarily actuated and then de-actuated to assure the delivery of only the single counted tenpin to each selected table cup.

26. Means as defined in claim 25 further including means on said distributor means and responsive to the release of said counted tenpin from said distributor means to said selected table cup for releasing said distributor means for travel to the next selected cup of said given set.

References Cited in the file of this patent

UNITED STATES PATENTS

1,468,212	Redfield	Sept. 18, 1923
2,015,428	Hedenskoog	Sept. 24, 1935
2,692,139	Dumas	Oct. 19, 1954
2,726,086	Patterson et al.	Dec. 6, 1955
2,769,637	Zuercher	Nov. 6, 1956
2,890,886	Dumas	June 16, 1959
2,993,620	Ellison	July 25, 1961
3,000,537	Simon	Sept. 19, 1961