

May 21, 1963

F. D. PLANT

3,090,619

MECHANICAL PIN SETTER

Filed June 9, 1961

6 Sheets-Sheet 1

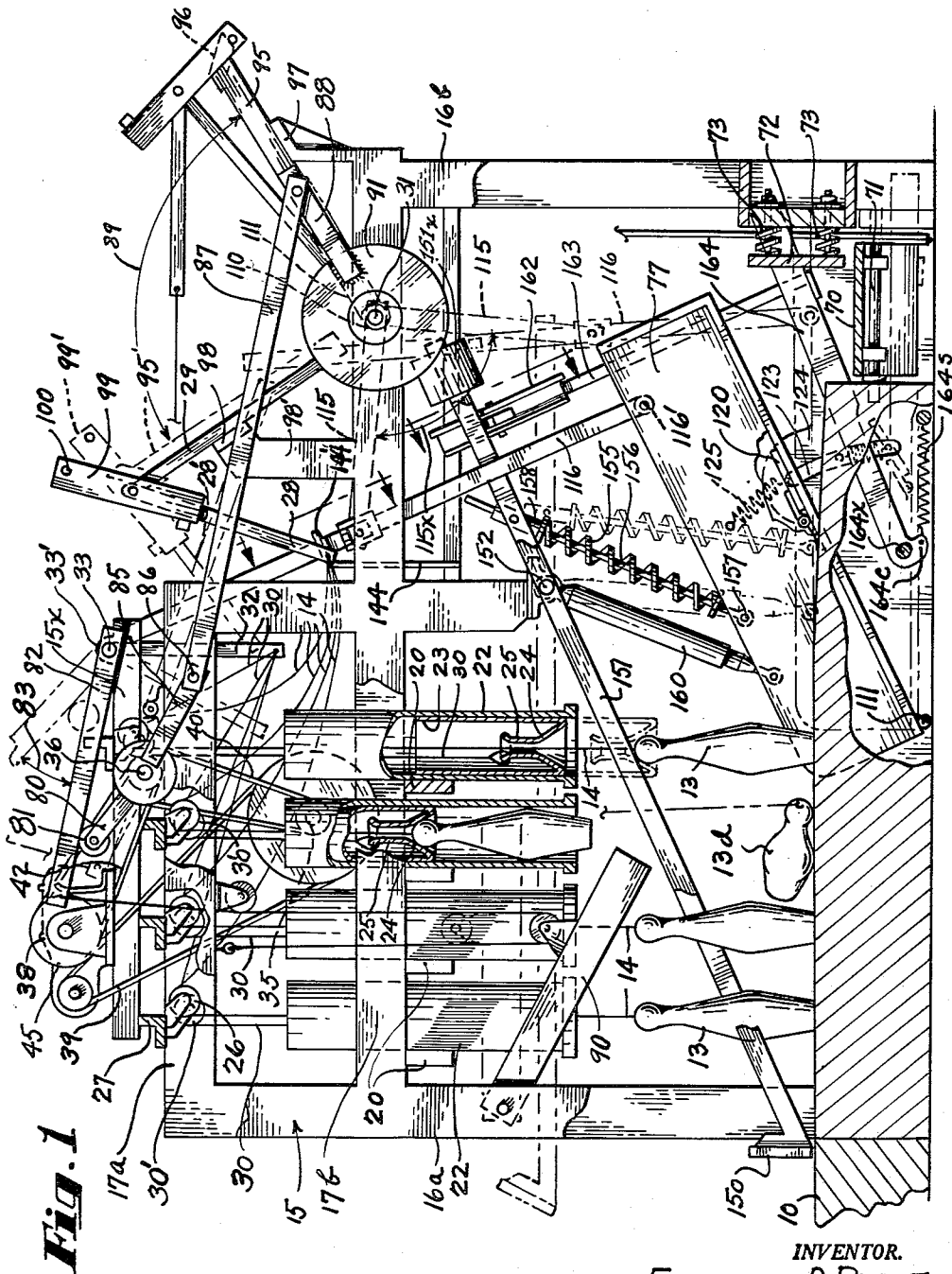


Fig. 1

INVENTOR.

FRANKLIN D. PLANT

BY *Robinson & Perry*
ATTORNEYS

May 21, 1963

F. D. PLANT

3,090,619

MECHANICAL PIN SETTER

Filed June 9, 1961

6 Sheets-Sheet 2

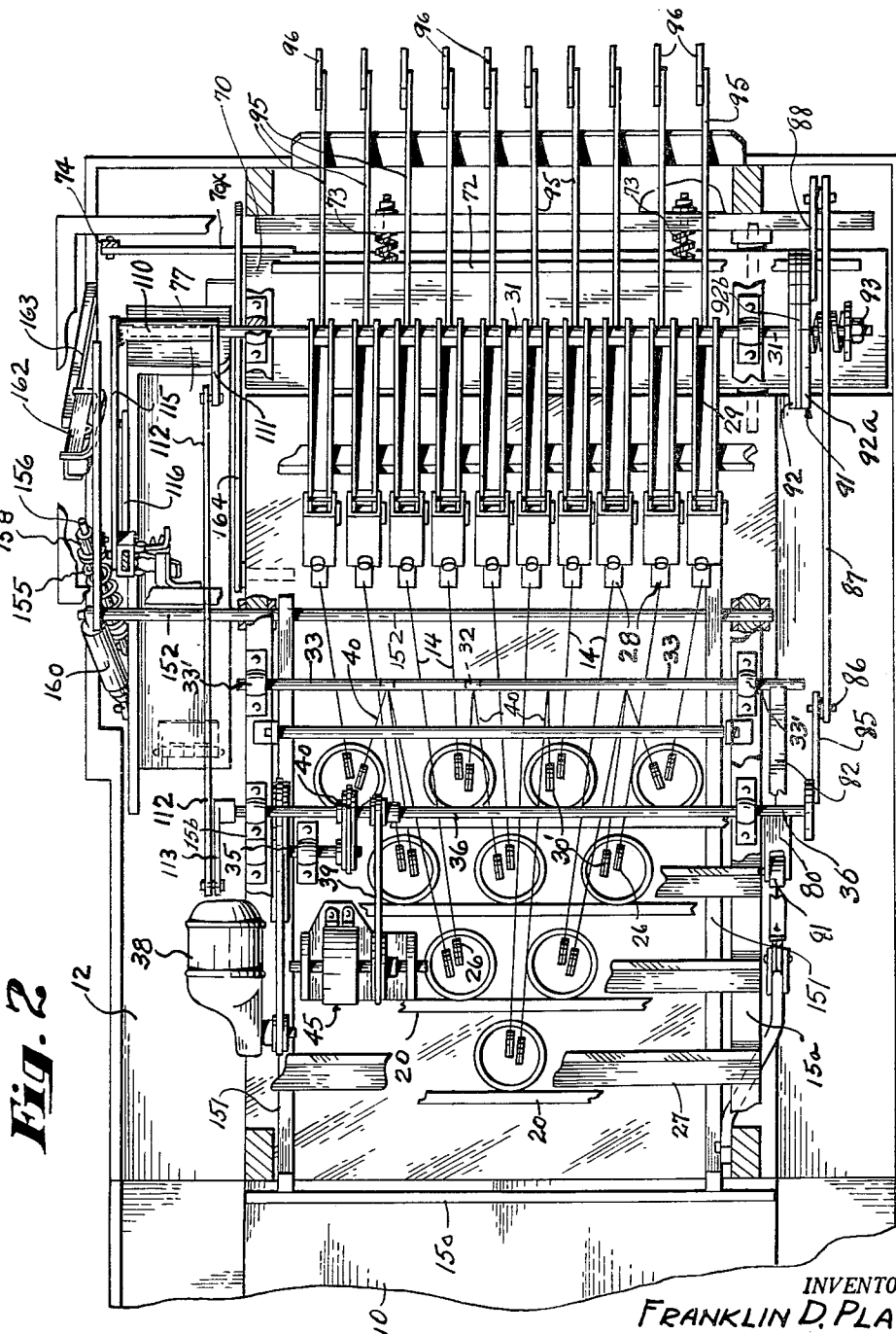


Fig. 2

INVENTOR.
FRANKLIN D. PLANT
BY
Robinson & Berry
ATTORNEYS

May 21, 1963

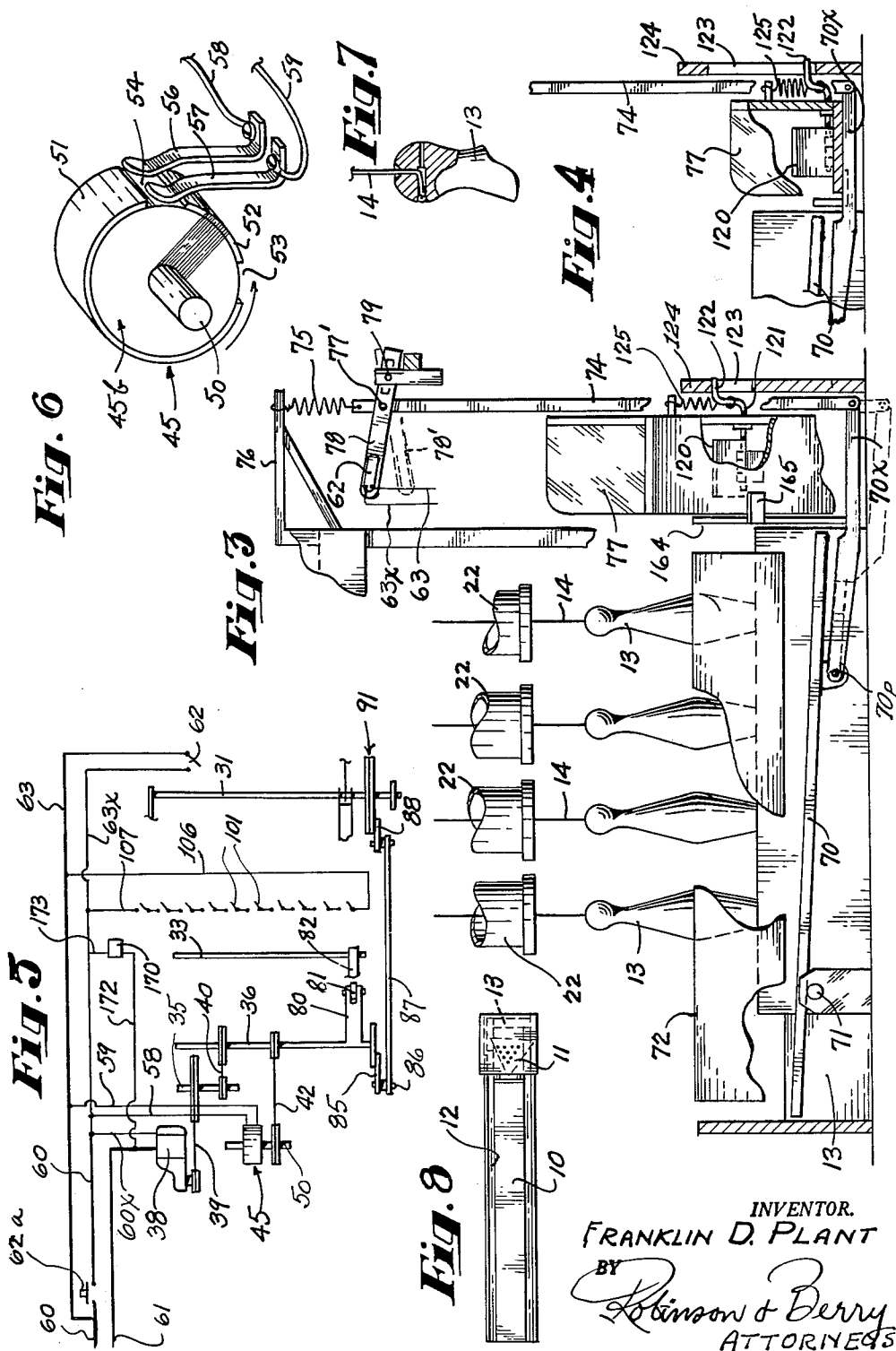
F. D. PLANT

3,090,619

MECHANICAL PIN SETTER

Filed June 9, 1961

6 Sheets-Sheet 3



INVENTOR.
FRANKLIN D. PLANT

BY
Robinson & Berry
ATTORNEYS

May 21, 1963

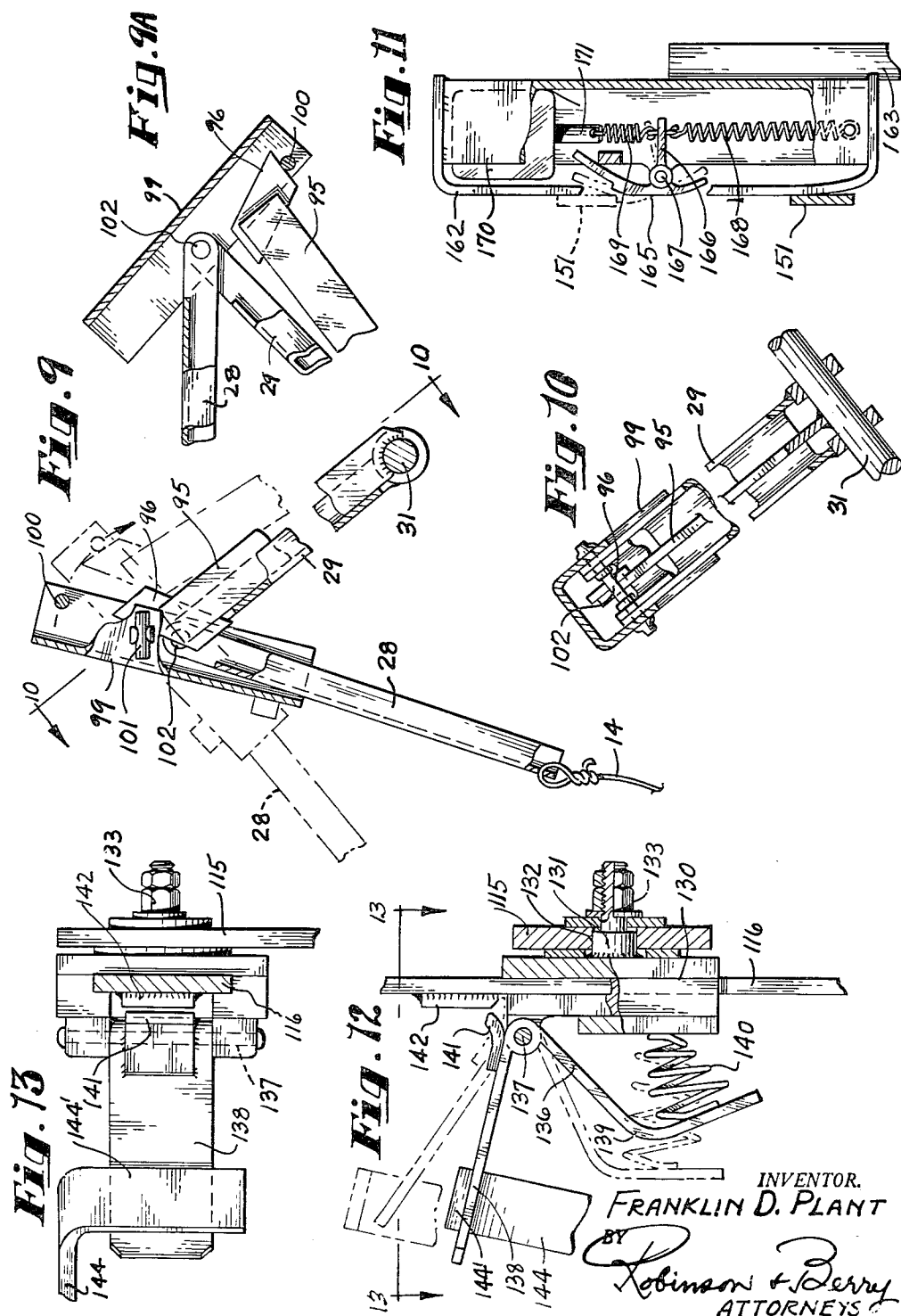
F. D. PLANT

3,090,619

MECHANICAL PIN SETTER

Filed June 9, 1961

6 Sheets-Sheet 4



May 21, 1963

F. D. PLANT
MECHANICAL PIN SETTER

3,090,619

Filed June 9, 1961

6 Sheets-Sheet 5

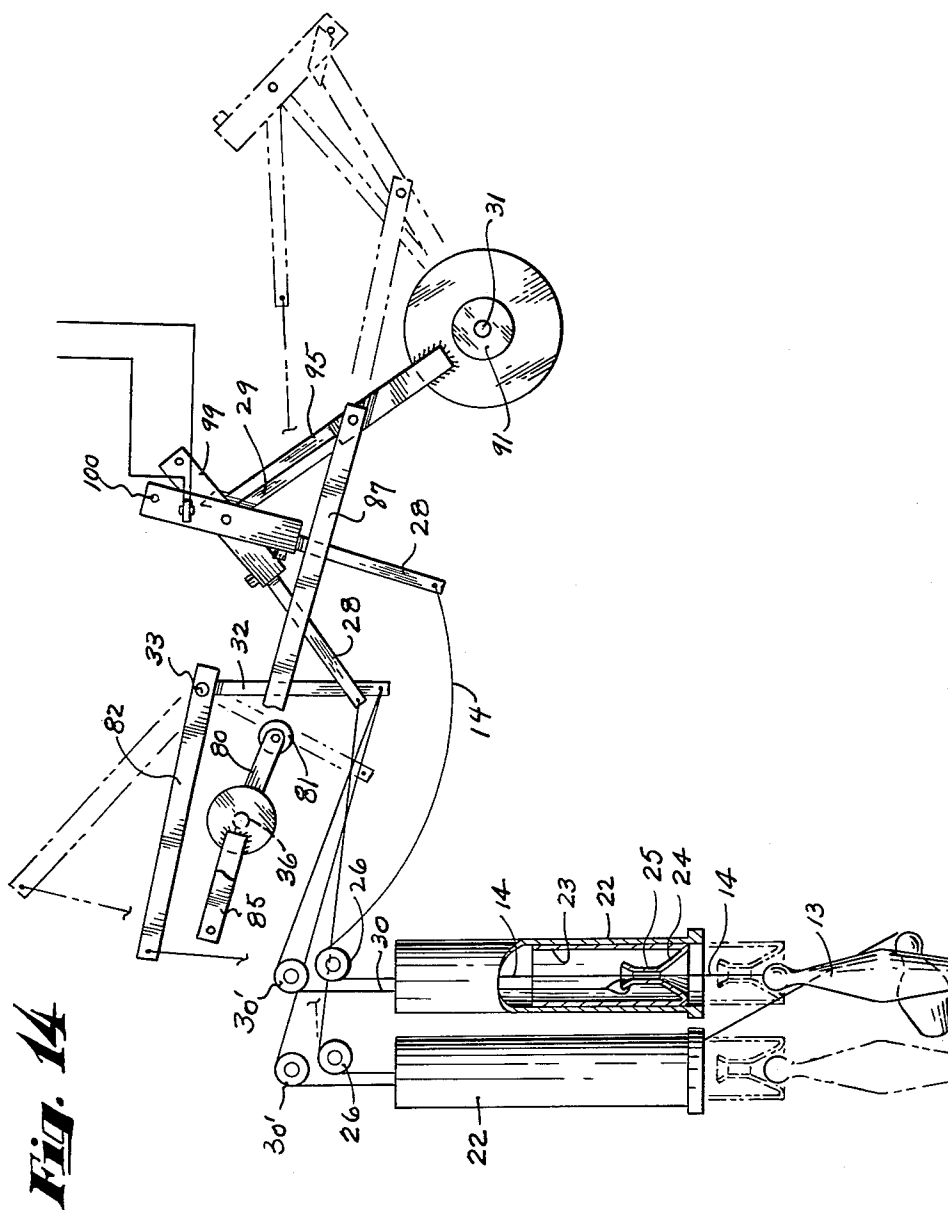


Fig. 14

INVENTOR.
FRANKLIN D. PLANT
BY
Robinson & Derry
ATTORNEYS

May 21, 1963

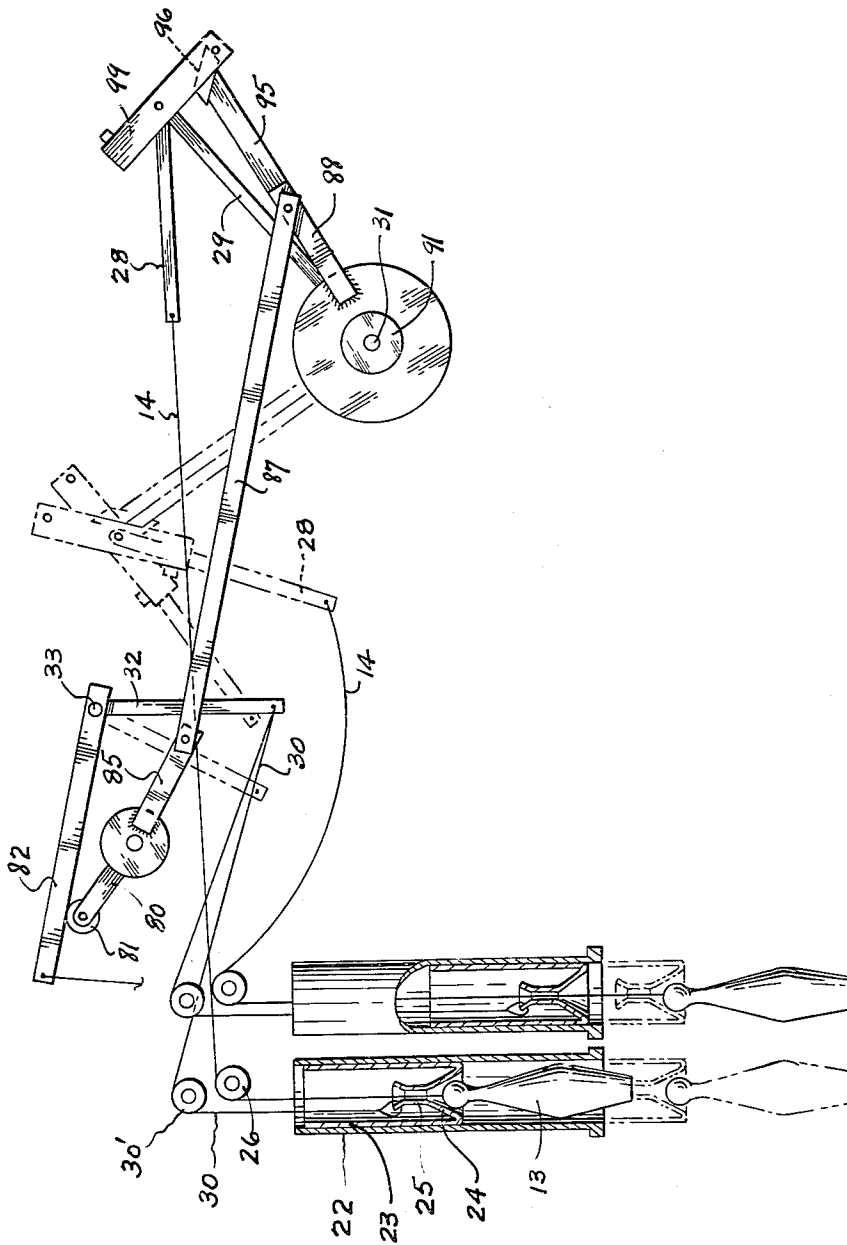
F. D. PLANT
MECHANICAL PIN SETTER

3,090,619

Filed June 9, 1961

6 Sheets-Sheet 6

Fig. 15



INVENTOR.
FRANKLIN D. PLANT
BY *Robinson & Berry*
ATTORNEYS

1

3,090,619

MECHANICAL PIN SETTER

Franklin D. Plant, 11028 SE. 176th St., Renton, Wash.
Filed June 9, 1961, Ser. No. 116,136
8 Claims. (Cl. 273-44)

This invention relates to mechanical pin setters as designed for use in conjunction with the game of bowling as played on bowling alleys.

More particularly, this invention has reference to a mechanism for the resetting of bowling pins as used in alley bowling, but which pins are held captive and are reset or spotted for play by individual resetting cords or cables.

It is the primary object of the present invention to provide a pin setting mechanism including means whereby pins that are downed in play by the bowled balls may be lifted clear of the pin spotting surface of the alley and later resotted or reset thereon preparatory to the beginning of each frame of play.

It is also an object of this invention to provide a pin resetting mechanism that is characterized by the use of a resetting cord for each pin; these cords being attached to the top ends of the pins and serving as the means whereby, when downed, they may be individually mechanically lifted clear of the spotting surface and held in suspension above the level of play until it is desired that they be resotted.

It is also an object of the present invention to provide a mechanism that is automatically operable, first, to lift and hold, in suspension above the spotting area, all pins that may be downed by the first ball delivered in a frame of play, thus to clear the area for play of the second ball, after which all pins downed by the "second ball" may be lifted clear of the surface and automatically and accurately spotted with those previously lifted, for the next frame of play.

Yet another object of the present invention resides in the use of pin setting sleeves that are movable within fixed, vertical guides, mounted above and corresponding to each of the pins and into which sleeves the downed pins corresponding thereto may be lifted through the mediacy of their resetting cords and held out of play and whereby they will be steadied as subsequently lowered to insure their accurate spotting on the pin spotting surface.

Still another object of the invention is to provide the present mechanism with a stop board for balls that might be accidentally or inadvertently bowled during a pin setting operation.

It is a further object of this invention to provide means whereby the pin setting operation may be manually controlled from the player's end of the alley or automatically initiated by delivered balls.

Still further objects of the present invention reside in the various details of construction of its parts; in their combination and in the mode of operation and control of the mechanism, as will hereinafter be fully described.

In accomplishing the above mentioned and other objects and advantages of the present invention, I have provided the improved detail of construction, the preferred forms of which are illustrated in the accompanying drawings, wherein:

FIG. 1 is a right side elevation of a pin setting mechanism embodying the improvements of the present invention therein, showing certain of its parts in cross-section or with some portions thereof broken away, for explanatory purposes.

FIG. 2 is a top view of the pin setting mechanism of FIG. 1 with the various parts thereof as positioned during a pin setting operation.

2

FIG. 3 is a rear end view of the bowling alley of FIGS. 1 and 2 with parts broken away for explanatory purposes.

FIG. 4 is a fragmental, rear and elevational view of parts of the ball return mechanism located at the pin pit end of the alley as positioned at the start of play.

FIG. 5 is a schematic showing of the electrical wiring and various devices for controlling operations of the pin setting mechanism.

FIG. 6 is a perspective view of the circuit and cycle controlling commutator of the electrical system.

FIG. 7 is a sectional detail of the upper end portion of one of bowling pins, showing one mode of connection of a pin resetting cord or cable thereto.

FIG. 8 is a plan view of a bowling alley, shown at greatly reduced scale, for explanatory purpose only.

FIGS. 9 and 9a are elevational views, partly in section, of one of the pin resetting levers and parts directly associated therewith showing them, respectively, at the start and at the end of a pin lifting swing.

FIG. 10 is a sectional detail, taken on line 10-10 in FIG. 9.

FIG. 11 is a side view, partly in section, of the ball stop board retaining latch mechanism.

FIG. 12 is a sectional detail of the releasable latch mechanism employed in the raising and releasing of the ball return chute.

FIG. 13 is a horizontal section, taken on line 13-13 in FIG. 12.

FIGS. 14 and 15 are schematic showings of sequential operations of pin resetting parts during a resetting cycle of operations.

Referring more in detail to the drawings:
The present bowling alley, as shown in FIG. 8 in plan view and at reduced scale, comprises the alley floor structure 10, which may have the usual dimensions of bowling alleys and which also may have the usual structural formation in that it comprises the usual pin spotting area, as defined by the dash line enclosure 11; a ball return gutter 12 that extends along one side of the alley and a pin pit area 13 across the pin end of the alley and which pit in this instance, contains a sloping ball return trough equipped with means, as later described, for delivery of each played ball into a ball return chute that delivers the ball into the gutter 12 for its return therein to the player's end of the alley and with which trough and chute certain play controls are associated, as presently described.

It is to be understood more particularly by reference to FIGS. 1 and 2, that ten bowling pins of the usual kind, each of which is here designated by numeral 13, are employed in playing the game. These pins are spotted for play in the area 11 in the usual formation. However, in the present instance, as differentiated from ordinary play, each pin 13 as previously explained is held captive by its pin spotting or resetting cord or cable 14, which cord is anchored at one end within the top end portion of the neck of the pin, as shown in FIG. 7, and extends directly upward therefrom and over a suitable guiding pulley wheel thence rearwardly and is attached at that end to an individual pin resetting lever mechanism, as will presently be fully explained.

The pin resetting mechanism of this invention as shown in FIG. 1, is mounted by a rigid main frame structure, fabricated from angle bars or the like, and which is herein designated in its entirety in FIG. 1 by reference numeral 15. This main frame structure is erected over and across the pin spotting area 11 and pin pit area 13. It comprises opposite, longitudinally extending, vertical side frames 15a and 15b, best shown in FIG. 1, each of which side frames comprises vertical front and rear end supporting legs, 16a-16b, joined lengthwise of the alley, across their

upper end portions by upper and lower horizontal connecting rails 17a and 17b. The opposite side frames 15a and 15b are rigidly joined across the alley by various horizontal cross-members, as will presently be disclosed.

Extended transversely of the alley, above the pin spotting surface 11 and fixed at their opposite ends to the horizontal members 17b in the forward end portion of the main frame structure, is a succession of four cross-bars 20, spaced as shown in FIG. 1. These cross-bars rigidly support ten guiding tubes 22 of equal dimensions vertically therefrom, all at the same horizontal level and in the usual pin spotting relationship, as shown in plan view in FIG. 2. Each guide tube 22 is vertically axially aligned with the corresponding pin spotting point in the spotting area 11, and each tube is open at its upper and lower ends. Within each guide tube 22, a tubular sleeve 23 is slidably contained for free and easy up and down movement. Each of these sleeves 23 has an upwardly tapered conical closure member 24 fixed within its lower end portion, as has been shown in FIG. 1 at the right hand end of the group of guides 22 and each of these conical closure members 24 terminates at its upwardly directed and smaller end in a coaxial tubular neck portion 25.

The individual resetting cords 14 for the bowling pins 13 extend directly upwardly from the top ends of the necks of the corresponding pins, through the corresponding and axially aligned tubular necks 25 of the sleeve closure members 24 and thence continue upwardly from the guide tubes, passing forwardly over pulley wheels 26 mounted by a succession of angle bars 27 that are fixed to and which extended horizontally across the top of the frame structure 15. From these pulley wheels 26, the cords 14 extend rearwardly and are connected individually at their rear ends to the lower ends of ten pin lifting and resetting pull links 28, as will be best understood by reference to FIGS. 1, 2 and 9. The links 28 are disposed at the same level in rearwardly inclined positions and in even lateral spacing and are individually pivotally attached at their upper ends to and extend downwardly and slightly forwardly from the upper ends of a like number of rearwardly and downwardly inclined lever arms 29 shown in FIGS. 1 and 9, that are pivoted at their lower ends for oscillation, on a cross-shaft 31 that is extended between and is mounted by the opposite longitudinal side members 17b of the frame structure 15, as best shown in FIGS. 1 and 2.

It is further to be observed in FIG. 1 that individual sleeve lifting cables 30 are attached to the upper end portions of the necks of the closure members 24 of the ten sleeves 23 and pass upwardly therefrom and over pulley wheels 30', which also are fixed for their support to the cross-bars 27, thence they extend rearwardly and are connected at their rear ends to the lower ends of the corresponding lever arms 32 that are rigidly fixed at their upper ends to a horizontal cross-shaft 33. This shaft is rotatably mounted at its opposite ends in bearings 33'—33' fixed on top member 15x of the opposite side frames. It is to be understood that all lever arms 32 are moved equally and in unison with the rotative oscillating movements of cross-shaft 33 as presently explained, thus to lift or lower all sleeves 23 in unison in their guides through the mediacy of their supporting cables 30.

It will be further understood, by reference to FIG. 1 that when the bowling pins 13 and all parts of the mechanism are in their normal setting, as at the beginning of a frame of play, all sleeves 23 are then lifted into and are supported within the lower end portions of their respective guide tubes 22, as is the sleeve in the guide tube at the right hand end of the group of guide tubes 22 shown in FIG. 1, and all standing pins 13 will bear the relationship to their setting or spotting guides and sleeves as do the pins 13 shown standing in FIG. 3. Furthermore, all sleeve suspending cables or cords 30 will then be drawn taut in their connections with the lever arms 32 as extended downwardly from the cross-shaft 33 while all

the pin setting cords 14, as attached to the pins and to the lower ends of the forwardly and downwardly directed lever arms 28 are sufficiently slack as to permit any pin that is struck by a ball in play to fall onto the surface 11, as has been illustrated by the downed pin 13d in FIG. 1. In so falling to the surface, the resetting cord 14 of that pin will draw the corresponding link 28 to an inclined position corresponding to the dash line position 28' in FIG. 1, for a purpose presently explained.

The principal parts of the controlling or operating mechanism of the present mechanism are shown schematically in FIG. 5 to comprise the previously mentioned cross-shafts 31 and 33, a jack shaft 35 and a cam shaft 36; all these shafts being in parallel relationship and mounted by and transversely of the top of the frame structure 15 for rotation. Power is supplied to the jack shaft by an electric motor 38 through a belt driving connection 39. The jack shaft 35 has a chain belt driving connection designated at 40 with cam shaft 36 which, in turn, has a chain belt driving connection 42 with the mounting shaft of a control commutator 45. The belt connection 42 provides one rotation of the commutator 45 for two rotations of the cam shaft 36.

The commutator 45, as shown in FIG. 6, comprises a cylindrical, non-conductive body 45b concentrically mounted on a supporting shaft 50. This body is fitted with segmental electrical conductors 51 and 52 with ends spaced as at 53 and 54 in FIG. 6. Brushes 56 and 57 are mounted with ends in rubbing contact with the commutator to alternately engage the plates as the commutator rotates. The brushes are joined, respectively, by wires 58 and 59 with certain current supply lines to control flow of current to the motor 38 as presently explained.

It has been shown in FIG. 5 that power is supplied to the mechanism through power supply lines 60 and 61. Line 61 leads directly to one side of motor 38 and the other side of the motor is connected to power line 60 by a circuit wire 60x. Interposed in the line 60 portion of this circuit connection is a push button switch 62a for a purpose presently explained.

Located at the rear end of the alley is a mercury switch 62 which has one pole connected by a circuit line 63 with the power line 60 ahead of the push button switch 62a and has its other pole connected by a circuit wire 63x with power line 60. Switch 62 is controlled in connection with operation of means now to be described and whereby a delivered ball received in the pin pit trough, will initiate the pin setting cycle. This cycle comprises a first and a second operation under control of commutator 45. At the start of the cycle the two brushes 56 and 57 are not engaged with either plate 51 or 52 and no current is flowing through these brushes. They are then as shown in FIG. 6.

Disposed across the rear end of the alley, in the pin pit 13 and in position to receive the played bowling balls, is a ball receiving trough which is shown in FIGS. 1 and 3 to comprise a bottom board 70, supported at a slight incline toward the gutter 12, and a back board 72 that is supported by spring cushioning means as at 73 in FIG. 1. Mounted below and extending beyond the lower end of board 70 is a lever arm 70x. This is pivotally attached at its inner end to a fixed pivot 70p and at its other end to the lower end of a vertical link 74 that is suspended by a spring coil 75 from a fixed support 76. The ball discharge chute 77, presently to be more fully described rests at its ball receiving end on lever 70x, as in FIG. 4. This means of suspension provides that when a ball is received on the trough board 70 it will roll thereon to its lower end and thence into the discharge chute 77 that is contained in the rear end portion of the gutter 12, as has been shown in FIG. 1.

Link 74 is pivotally connected near its top end as at 77', with the intermediate portion of a short, horizontally directed lever 78 that has a sliding pivotal support 79 at one end and is free at its other end. Therefore

5

when a ball is received in the trough 77 which rests on lever arm 70x, it will act to tilt this lever arm downwardly and this will act through rod 74 and will cause the free end of lever 78 to be swung downwardly as indicated by its dash line showing 78' in FIG. 3.

The previously mentioned switch 62 is a mercury switch and is mounted on lever 78, as shown in FIG. 3, in such manner that it closes with the downward swinging movement of the lever 78 as effected by the downward tilting of the lever arm 70x incident to the reception of a bowling ball in the chute 77. Such closing of switch 62 is of short duration but it closes the circuit to motor 38 and starts the pin setting cycle of operations. Starting of the motor 38 also starts rotation of the commutator 45 which then maintains the motor with a current supplying circuit through wires 58 and 59 after the switch 62 has opened. The motor continues to run until the circuit is opened by the commutator when its brushes reach gap 53.

As has been shown in FIG. 5, the cam shaft 36 is equipped at one end with a radially extending lever arm 80 that mounts a roller 81 at its outer end; this arm being so positioned that during each complete rotation of shaft 36, it acts against the under edge of a rocker lever 82 that is fixed to one end of the cross-shaft 33, thus to cause the lever 82 to be lifted and lowered through the arc indicated by the double pointed arrow 83, in FIG. 1 and the cross-shaft 33 to be oscillated accordingly. The cross-shaft 36 is also equipped at the rear end in FIG. 1 with a crank arm 85 that extends in a direction opposite the cam lever arm 80 and is pivotally connected at its outer end, as at 86, with link 87 that extends rearwardly and connects pivotally at its rear end with a lever arm 88 that is mounted on one end of the cross shaft 31. The relationship of these latter mentioned connecting parts is such that with each rotation of shaft 36, the shaft 31 will be oscillated rearwardly and forwardly through the arc designated by the double pointed arrow 89 shown in FIG. 1.

It has been shown in FIG. 1 that a counter weight 90 is suspended from the swinging end of lever arm 82 to yieldably pull this lever arm toward the full line position in which it is shown best in FIG. 2. The lever 88 is connected to shaft 31 through the mediacy of a clutch 91 that comprises a pair of clutch discs 92 and 92a and an interposed friction disk 92b that are held under frictional contact by a coil spring 93. Disk 92 is keyed to shaft 31 while disk 92a is rotatable on the shaft and has the lever arm 88 fixed radially thereto. Slippage of the clutch occurs to protect the mechanism only when something jams the operation.

Mounted on the cross-shaft 31 for oscillation therewith is a succession of ten radially extending lever arms 95; these being laterally spaced along the shaft in the same relationship that the lever arm 28 are applied to the outer ends of lever arms 29, as shown in FIG. 2 and in the same vertical planes therewith. Each of the lever arms 95 is equipped at its outer end with a fixed but angularly inclined latch engaging bar 96 as best shown in FIG. 9. At the start of a frame of play, all lever arms 95 are disposed in a forwardly inclined position, as in the dash line position 95' in FIG. 1, and as its full line position in FIG. 9, in which position, their latch bars 96 are positioned closely adjacent the upper pivotally joined ends of levers 29 and the corresponding links 28.

It is also to be noted in connection with the showing of parts in FIG. 1, that the ten lever arms 29, to the upper ends of which the pull links 28 are pivotally attached, are normally disposed, in a forwardly leaning position, at rest against a horizontal cross-member 98 that is supported from parts 98' on opposite side members of the main frame.

It has also been shown in FIGS. 1 and 9 that a channel-like latch bar 99 is pivotally mounted, medially of its ends, on the upper end of each pull link as an ex-

6

tension thereof, by the same pivot pin 102 that joins the pull link 28 to its actuating lever 29, as shown in FIG. 9.

The latch bars 99 are of channel-like formation and as mounted, face rearwardly and downwardly, and each has a latch pin 100 extending transversely between its opposite sidewalls adjacent its upper end. When the bowling pin setting mechanism is at rest, preparatory to starting a pin setting operation, the parts 28, 29, 95, 96 and 99 are positioned, as shown in full lines in FIG. 9.

In FIG. 9 it is shown that a mercury switch 101 is mounted on the side of the pivoted latch bar 99. Mercury switches 101 are likewise applied to the latch bars 99 of all pull links 28. The disposition of these switches is such that they are normally open but will be closed by the tilting of the bars 99 as to the dash line position in this view. These ten mercury switches, 101, as shown in FIG. 5 are electrically joined in series and the series joined by circuit wires 106 and 107 with circuit lines 63 and 63x. The purpose of this circuit connection will presently be explained.

When a bowled ball is received in the trough that extends across the rear end of the alley and is caused to roll along the bottom board 70 thereof and discharged to the return gutter 12 it is initially received in the discharge chute 77 which has been shown in its "down" position in dash lines in FIG. 1 and in "lifted" position in full lines. Normally this chute is in down position to receive the ball therein directly from the end of trough board 70. When the bowling ball is received in the chute 77, it will be retained against possible forward rolling therein by latch or stop means until the chute is tilted upwardly to its fully lifted, inclined position of FIG. 1. When so lifted, the ball will then be released for discharge from the chute with substantially momentum into the gutter 12 to insure its rolling return to the player. It is shown in FIG. 1 that the chute 77 is hinged at its discharge end, as at 111, for upward tilting. Normally, it is held in its down position by the following described means:

Mounted rotatably on that end of cross-shaft 31 that is opposite that to which lever arm 88 is fixed, is a cylindrical sleeve 110 which has a lever arm 111 extended therefrom. This is pivotally connected at the outer end to a link 112 that extends to and is pivotally joined to a lever arm 113 fixed on that end of the cross-shaft 36 that is opposite the end which carries lever arm 85. The outer end of sleeve 110 has a lever arm 115 fixed thereto which at its outer end is joined to a chute lifting link 116 which is attached to the chute as at 116' in FIG. 1. This linkage, as comprised by parts 113, 112, 111, 110 and 115 operates in synchronism with the linkage 85, 87 and 88 that effects oscillation of cross-shaft 31.

At the start of a frame of play, the radial arm 115 is directed downwardly from sleeve 110 and through its connection with link 116 the chute 77 is normally held in its down position. With that rotation of shaft 36 and the actuation of cross-shaft 31 that causes the rearward swinging of lever arms 95, the sleeve 110 is oscillated to swing lever arm 115 forwardly and upwardly and through the mediacy of link 116, this lifts the chute 77 to its ball discharge position and causes the ball retaining stop latch thereto to act to release the ball for its forward delivery into and along the gutter 12 to the players end of the alley.

The latch device whereby the ball, upon being received in the discharge chute 77 is held against forward discharge until the chute is fully lifted is shown in FIGS. 1, 3 and 4 to comprise a stop plate 120 that is fixed on a shaft 121 that extends into and transversely of the chute 77 through a sidewall thereof. The shaft is hingedly mounted on the bottom of the chute and has its outer end portion formed as a crank arm 122 that extends at its end into an arcuate slot 123 formed in a fixed member 124 at the outside of the chute. This crank arm has connection with a coiled spring 125 mounted on a

sidewall of the chute, see FIG. 4, and which acts to yieldingly hold the plate 120 in the upwardly directed ball stop position shown in the lowered chute in FIG. 1. With the upward tilting of the chute 77 for ball discharge, the end portion of the crank arm 122 is caused to engage the upper end wall of the slot 123 and to thereby actuate the crank to swing the plate 120 to a position flatly against the bottom of the chute and thus release the retained ball for discharge but only after the chute has been fully raised. When the chute 77 is subsequently lowered, the ball stop plate again assumes its raised position where it is held by the tension of spring 125 as attached thereto.

The holding connection of lever arm 115 with the chute lifting link 116 is effected through a latch mechanism that has been shown in detail in FIGS. 12 and 13 to comprise a sleeve-like housing 130 through which the chute lift link 116 is slidably contained. The sleeve is pivotally fixed to the lever arm 115 by a stud 131 that extends from a side of the sleeve and through a hole 132 in the end of lever arm 115 as shown in FIG. 12, where it is held by a nut 133 that is threaded onto the stud. At the side opposite the stud, the sleeve housing 130 pivotally mounts an angularly bent trip latch 136 on a horizontal pivot pin 137. This latch has an outwardly and upwardly directed arm 138 at its upper end and a downwardly directed arm 139 projecting downwardly from the hinge point, with a coil spring 140 disposed to bear against the arm 139 in such manner as to yieldingly urge the arm 138 upwardly. A latch or catch piece 141 is applied to arm 138 in position to engage against a catch lug 142 on link 116 beyond its sliding connection with the sleeve.

At the start of a chute lifting operation, the latch piece 141 is engaged firmly against lug 142 and therefore the upward swing of lever arm 115 will act through the sleeve and latch to cause upward tilting of the chute. When the chute has reached a fully raised position, the latch arm 138 then engages the outturned end portion 144' of stop bar 144 fixed on the frame and the latch piece 141 is thereby released from catch lug 142 and this allows the chute 77 to move back to its horizontal or lowered position for reception of the second or next ball to be bowled and received therein.

In order that no damage to the pin setting mechanism will be caused by any ball inadvertently bowled while the mechanism is in a cycle of operation, I have provided a ball stop gate or drop board 150 extended across the alley at the front end of the frame structure 15. This board is supported at its opposite ends by counter balanced levers 151-151 that extend along the opposite sides of the main frame and are fixed to a cross-shaft 152 that extends through and is rotatably mounted by the main frame to cause them to swing in unison. Normally the stop board or gate 150 is in its raised dash line position of FIG. 1. With the releasing of the ball discharge chute 77 from its fully raised position, this reduces the compressive force of spring 155 and the lever arms 151-151, under the weight of their counter balancing weights 151x lift the gate to its raised position.

The stop board or gate 150 moves downwardly with retarded action, incident to the lifting of the ball discharge chute 77. The chute is actuated upwardly by the coil spring 155 that is applied about a rod 156 pivoted at its lower end to a sidewall of the chute, at 157 in FIG. 1, its upper end being slidably contained in a sleeve 158 attached pivotally to the lever 151 rearwardly of the pivot shaft 152. This spring is maintained under yieldable compression to normally urge the stop gate to down position. When the chute swings upwardly for ball discharge, the spring 155 is placed under such increased compression that it forces that gate downwardly against the alley surface as in FIG. 1. The delayed action in this operation is obtained by use of a snubber piston 160 pivotally attached at one end to the cross-shaft 152 and

at its other end to a sidewall of the chute. This operates to retard and cushion the drop of the ball lifting chute.

When the gate swinging lever 151 swings up at its weighted end, it moves along a latch housing 162 that is fixed to the upper end of an inclined bar 163 that extends upwardly from the base rail of the side frame 15b of the main frame 15. The swinging travel of the lever 151 along this housing 162 is between the full line and dash line positions of the lever, as indicated in FIG. 11. When it moves upwardly it passes over a pivoted latch bar 165 shown in FIG. 11 to be pivoted between its ends in the housing as at 167. This bar has a rocker arm 166 attached thereto and extended inwardly at a right angle to the latch bar. To this arm coiled springs 168 and 169 are attached under tension, as shown in FIG. 11. Spring 168 pulls the latch to "release" position. Spring 169 acts in the opposite direction under additionally induced tension when produced by a solenoid 170 mounted in the housing 162 and having a sliding core bar 171 to which this spring is attached.

It has been shown in FIG. 5 that the solenoid 170 has circuit connections 172 and 173 with the wires 61 and 60 through which current is supplied to the motor. Thus, whenever switch 62 is closed to energize the motor 38, the solenoid is simultaneously energized and operates through the coil spring 169 to pull the latch bar 165 to its dash line "latching position" of FIG. 11 thus to hold the stop or gate 150 in its down position. When the commutator opens the motor circuit, the motor stops running, the solenoid is de-energized and the latch is then retracted by spring 168 to "release" position. These operations provide that when the gate drops to ball stop position and lever 151 moves up past the latch bar 165 to its dash line position in FIG. 11, it is retained in that position by the latch bar 165 until the motor stops. When the latch is released, the gate is then lifted by reason of the counter weights 151x applied to its lever arm 151.

Assuming that the pin setting mechanism is so constructed and assembled, its operation is as follows: reference being directed to FIGS. 14 and 15 of the drawings.

With all ten bowling pins correctly spotted and all other parts of the mechanism set in starting positions as schematically shown in FIG. 14, the first ball of the frame of play is bowled. Some pins 13 may be bowled over and some may be left standing and the bowling ball, ordinarily, will be delivered into the pin pit trough onto its bottom board 70 on which it will roll into the lowered ball chute 77 and in so doing will rock the lever arm 70x downwardly and thereby cause the mercury switch 62 to close, thus to start the motor 38 and the cycle of pin setting operations; this being effected incident to the rotation of cross-shaft 36 and its simultaneous turning of the commutator 45. With the initial turning of the shaft 36 and the incident turning of the commutator, the motor circuit will then be maintained through the commutator plate 52 and the circuit lines 58 and 59 as joined to power lines 60 and 63, until the first portion of the pin setting cycle is completed. This "first portion" of the operation oscillates shaft 31 in a clockwise direction, through the arc 89 shown in FIG. 14 where it remains until the "second ball" bowled sets the motor in operation.

All bowling pins 13 that are knocked down by the "first ball" bowled operate through their respective resetting cords 14 to swing the resetting links 28 with which they are connected, to positions corresponding to the dotted line position 28' of link 28 in FIGS. 1 and 14. This forward swinging of the lower end portions of these links 28 causes the latch bars 99 at their upper ends to assume positions corresponding to the dash line position 99' of these parts. Then, as the cross-shaft 36 continues to rotate, in its counter-clockwise direction, it operates through its camming lever arm 80 to lift lever 82 and cause it to rotate the cross-shaft 33 to which it is

fixed thus to swing its lever arms 32 forwardly and thus slacken off on all pull cords 30 and thus lower the sleeves 23 in their guides 22 to engage their lower end closures 24 with the top ends of all standing pins, as shown in dash lines in the guide at the right end in FIG. 14, thus to hold the standing pins against being accidentally knocked down during the lifting of the downed pins that immediately follows. After this lifting of downed pins, the sleeves 23 are lifted back to their normal positions in their guides 22. The rotating of shaft 36 also operates through its crank arm 85, link 87; the lever arm 88 and clutch 91 to oscillate the cross-shaft 31 and thus swing its ten lever arms 29 through arc 89 from their position of forward inclination to rearwardly inclined positions. With this rearward swinging of the ten lever arms 29 the latch engaging bars 96 at their outer ends engage the latch pins 100 of the corresponding latch bars 99 of the upwardly tilted links 28 to pull these tilted links and their mounting levers 29 to the rearwardly inclined dash line positions in which they are shown in dash lines in FIG. 14. This rearward swinging of levers 95 tensions the pin resetting cords 14 of downed pins and through them lifts the downed pins upwardly and into their corresponding resetting tubes 22 to positions corresponding to that position in which one of the pins has been shown in FIG. 1. With the swinging of the lever arms 29 against the rear horizontal stop bar 97, the motor circuit, as had been maintained by the commutator plate 52, is opened and the motor stops. During this initial operation, the sloping trough board 70 has delivered the ball into the chute 77 and the chute was lifted by the lever arm 115 and link 116 and has effected the return of the first played ball to the players end of the alley.

When this first phase of the cycle of operations was completed, the parts were in position indicated schematically in FIG. 15, in readiness for the second phase of the operation which is as follows:

With the delivery of the "second ball" some more of the pins 13 may or may not be knocked down and ordinarily the second ball is received in the pin pit trough on the bottom board 70 and into chute 77 and will cause pivoting of lever 70x and lever 78 to again close the switch 62 and thus energize motor 38. With this energization of the motor, the shaft 36 starts to rotate and the motor circuit is then maintained by the commutator through its plate 51. The second phase of operation is of such duration as to cause the oscillation of the lever arms 95 forwardly through arc 89, then rearwardly to its rearward limit and then again forwardly, where the cycle ends. This part of the cycle being of greater duration than the first portion, as will presently be understood.

With the forward swinging of the lever arms 95, from the rearwardly inclined positions, all previously lifted pins will be lowered onto the spotting surface where they remain. Then with the immediate rearward swinging of lever arms 95, the pins downed by the second ball will be lifted thereby into their guide sleeves to be respotted with the final forward swinging of these lever arms. With this the cycle of operation ends, with all pins spotted and all sleeves lifted into their tubular guides to normal position.

In the event that a "strike" is made by the first ball, all pull links 28 will be actuated by their downed pins to individually close their mercury switches 101 and this will close the motor circuit and the cycle will be started in the same manner as by switch 62, and maintained until it is fully completed, thus to reset all pins, and return the commutator to its FIG. 6 position.

If a player should desire at any time to start a cycle of operations without bowling a ball, this may be done by closing the push button switch 62a to energize motor 38.

In order to prevent any possibility of a ball accidental-

ly or otherwise getting into the pin pit trough and being delivered by the bottom board 70 into the gutter 12 below the chute 77, a stop bar 164 is pivotally mounted at one end on a side surface of the alley, as at 164x in FIG. 1, and is thereformed with a short crank arm 164c to which a coil spring 164s is attached under tension. This bar has a laterally turned flange 165 at one side positioned to underlie the chute 77 when it is lowered, thus to move and hold the bar 164 down and out of the path of travel of bowling balls delivered along the bottom board 70. However, with the upswing of this chute 77 the spring 164s causes the bar 164 to swing up to the ball stopping position in which it is shown in full lines in FIG. 1, where it remains until the chute has been returned to its lowered position.

In the event that any accidental placement of a pin or ball should join the operation and cause such slippage of the clutch 92 as to put the mechanism out of sequence or synchronism, this will have no effect in the ball chute lifting linkage 111, 112 and 113, and the clutch is restored to normal setting by the engagement of the lever arms 95 with the bars with which these arms engage at the limits of their arc of swinging travel.

What I claim as new is:

1. In combination with a ten pin bowling alley; a pin setting mechanism comprising a frame structure mounted across said alley over the pin spotting area thereof, a cross-shaft mounted horizontally and for oscillation in said frame structure, means operable for effecting forward and rearward oscillations thereof, a succession of lever arms, corresponding to the number of pins used in play, fixedly mounted on and extending radially from said cross-shaft for simultaneous oscillation thereby between forwardly and rearwardly leaning limits of travel, a second succession of lever arms, paired with the first mentioned lever arms but freely pivoted on said cross-shaft for independent oscillation thereon between forwardly and rearwardly leaning limits of travel, pin resetting pull links corresponding to and pivotally attached at their upper ends to the free ends of the second mentioned succession of lever arms to depend therefrom, each pull link having a latch bar at its top end and a pin resetting cord attached to its lower end and extended therefrom to the upper end of the corresponding bowling pin as spotted on the alley for play; each of said cords being of such length that the knocking down of the pin to which it is attached will cause the pin resetting pull link to which it is attached to be swung to a position at which a latching connection of the latch bar at its upper end with the upper end of the corresponding lever arm of the first mentioned succession of lever arms will be effected when the latter is energized by the cross-shaft for rearward swinging from its forward leaning position, thus to effect the lifting of the downed pin from the spotting area.

2. The combination recited in claim 1 wherein said means for effecting forward and reverse oscillations of said cross-shaft includes powered means operating under control of balls as successively delivered in a frame of play.

3. In combination with a ten pin bowling alley; a pin spotting mechanism comprising a frame structure mounted across the alley over the pin spotting area thereof, a cross-shaft mounted horizontally in said frame structure for limited oscillation, a succession of lever arms, corresponding to the number of pins used in play, fixedly mounted on and extending radially in the same plane, from said cross-shaft, and adapted to be simultaneously oscillated by said cross-shaft between forwardly and rearwardly leaning limits of travel, a second succession of lever arms paired with the first succession of lever arms, freely pivoted on said cross-shaft for oscillation thereon between forwardly and rearwardly leaning limits of travel, pin resetting pull links corresponding to and pivotally attached at their upper ends to and depending

11

from the swinging ends of the lever arms of the second mentioned succession of lever arms, each pull link having a latch bar at its pivoted end, pin resetting cords attached individually to the lower ends of said depending pull links and to upper ends of bowling pins corresponding thereto as positioned on the alley for play; each of said cords being of such length that the knocking down of the pin to which it is attached will cause its resetting pull link to be so actuated as to position the latch bar at its pivoted end for effecting a latching connection with the upper end of the corresponding lever arm of the first mentioned succession of lever arms when energized by the cross-shaft for rearward swinging action, to thereby cause the latched resetting pull link through its pull cord to effect the lifting of the downed bowling pin from the alley surface, and powered means for causing the pin setting oscillating action of said cross-shaft.

4. The combination recited in claim 3 wherein said powered means includes a cross-shaft, an electric motor for rotating said cross-shaft, a crank arm on said last mentioned cross-shaft, a crank arm on the first mentioned cross-shaft and a link connecting said crank arms whereby rotation of the motor driven cross-shaft causes oscillation of the first mentioned cross-shaft to effect the pin resetting sequence of operations.

5. A combination according to claim 4 wherein said electric motor has a controlling electric circuit including a normally open switch, and means operable by each played bowling ball to close said switch momentarily to effect the energization of said electric motor thus to institute a pin setting cycle of operations by said pin spotting mechanism.

6. A pin setting mechanism according to claim 5 in-

12

cluding a commutator that is embodied in the motor circuit and driven by said motor and which is set in motion with the momentary energization of the motor by said switch thus to maintain the motor circuit through a predetermined pin lifting cycle after the switch has opened.

7. The pin setting mechanism of claim 5 wherein said last mentioned means includes a pivoted pin pit trough positioned to receive each played bowling ball for delivery therealong and which trough is operable under weight of a ball delivered therethrough to close said normally open switch to start the electric motor to thereby drive a commutator and thus establish the motor circuit therethrough.

8. A combination according to claim 5 wherein said electric motor, as energized first by the delivery of the first ball effects an initial forward oscillation of said cross-shaft to cause lifting of all pins knocked down by the first ball and as energized by the delivery of the second ball causes a succession of oscillations for the lifting of all additional pins knocked down by the delivery of the second ball in the frame of play and the spotting of all lifted pins in the pin spotting area in readiness for a subsequent game of play.

References Cited in the file of this patent

UNITED STATES PATENTS

1,292,738	Estabrook	Jan. 28, 1919
2,326,554	Nall	Aug. 10, 1943
2,367,400	Janes	Jan. 16, 1945
2,668,648	Carlsen	Feb. 9, 1954

FOREIGN PATENTS

1,043,169	Germany	Nov. 6, 1958
-----------	---------	--------------