

Dec. 26, 1961

R. L. BARROWS
MECHANISM FOR RAISING AND LOWERING PINSETTER
BOARD IN A BOWLING PINSETTING MACHINE

3,014,720

Filed Jan. 15, 1958

5 Sheets-Sheet 1

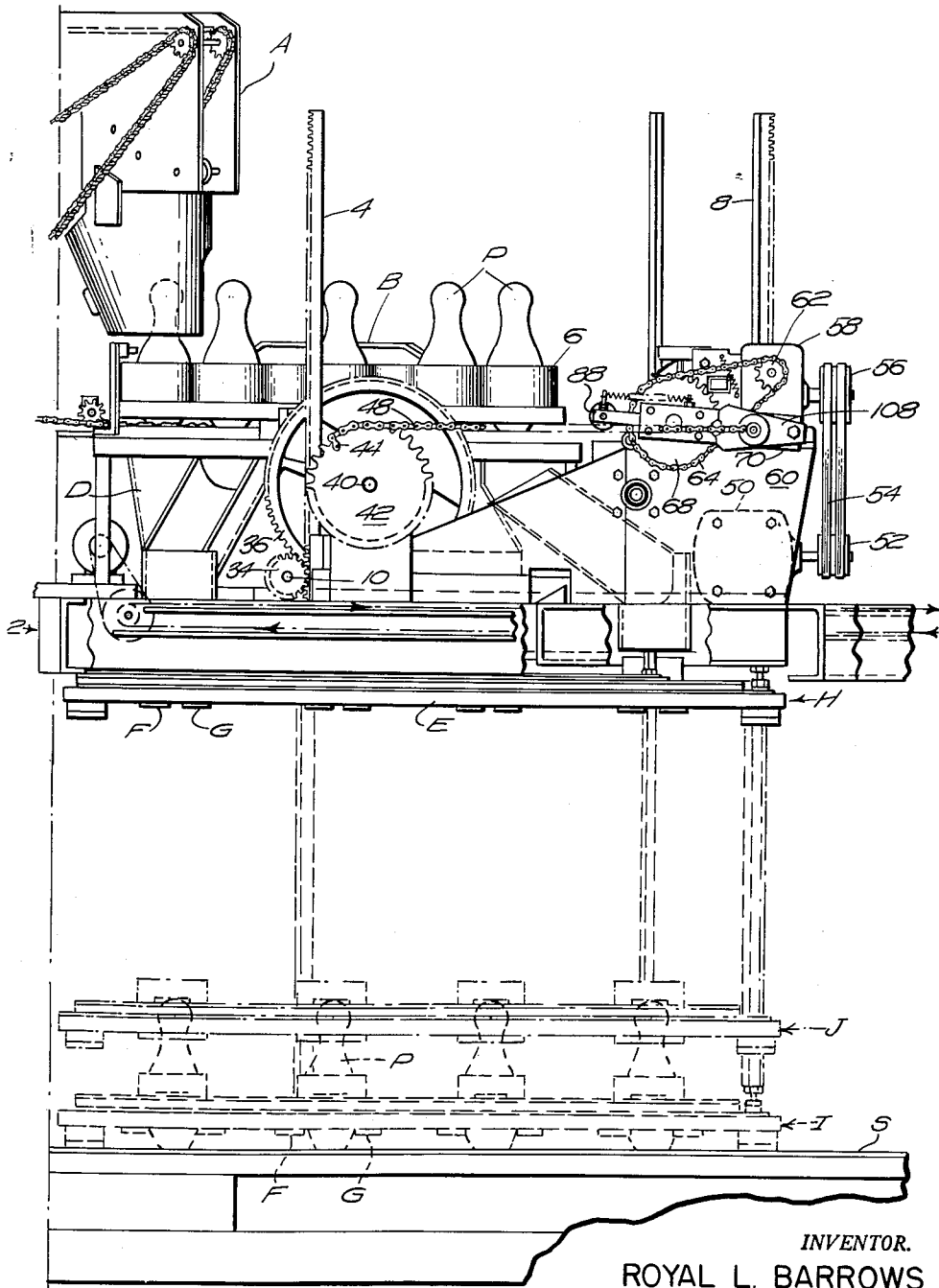


FIG. 1

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5 Sheets-Sheet 2

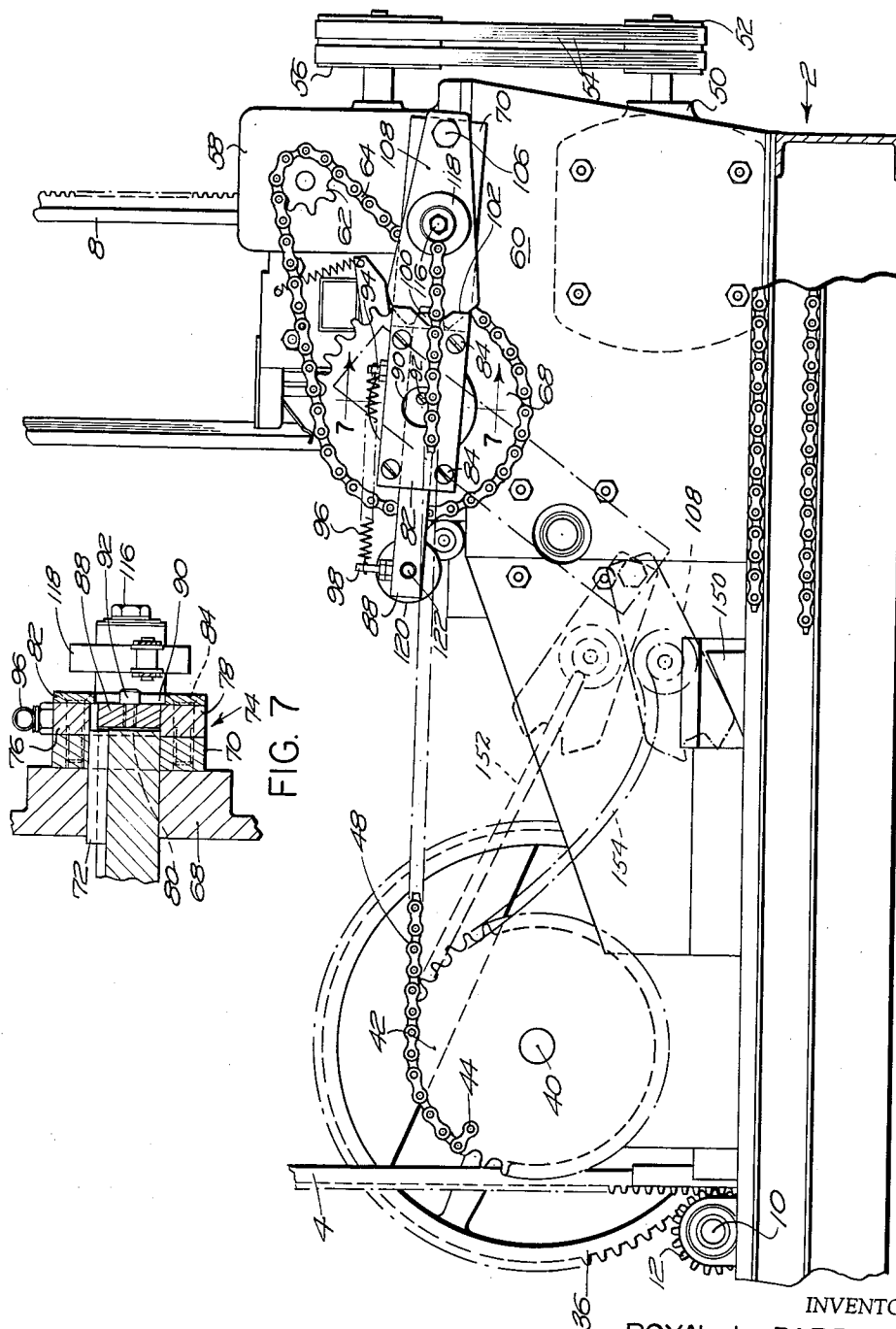


FIG. 2

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5 Sheets-Sheet 3

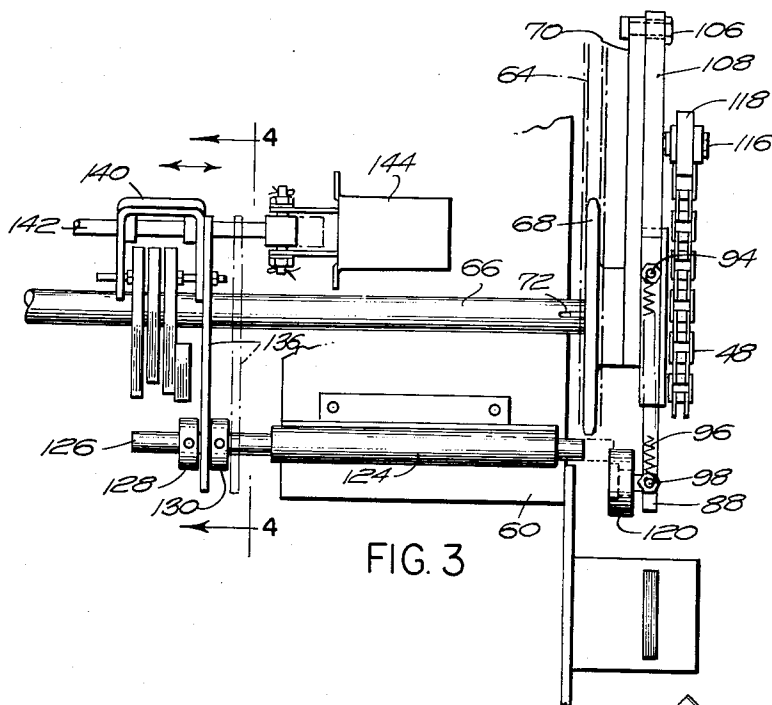


FIG. 3

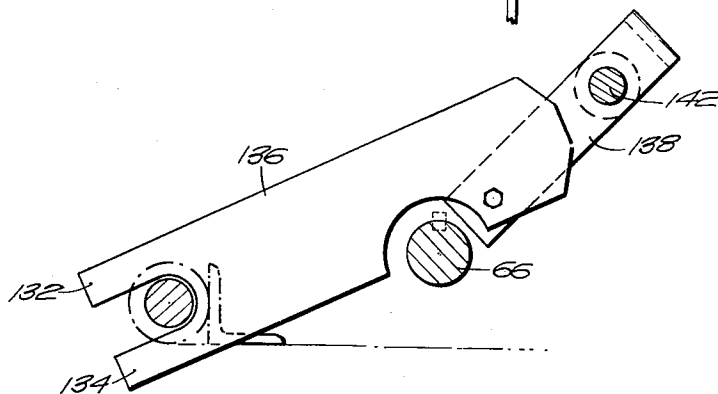


FIG. 4

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5 Sheets-Sheet 4

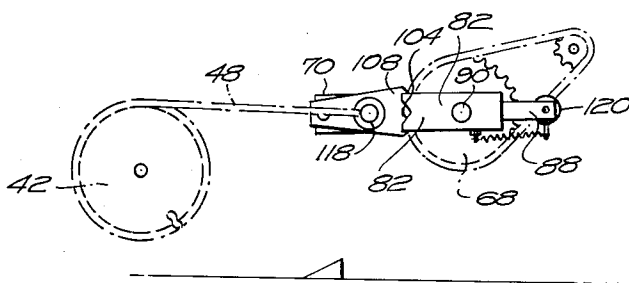


FIG. 5

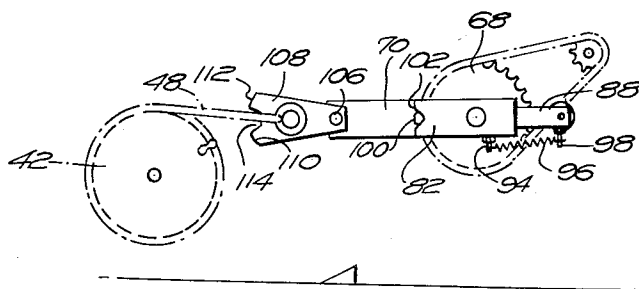


FIG. 6

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5 Sheets-Sheet 5

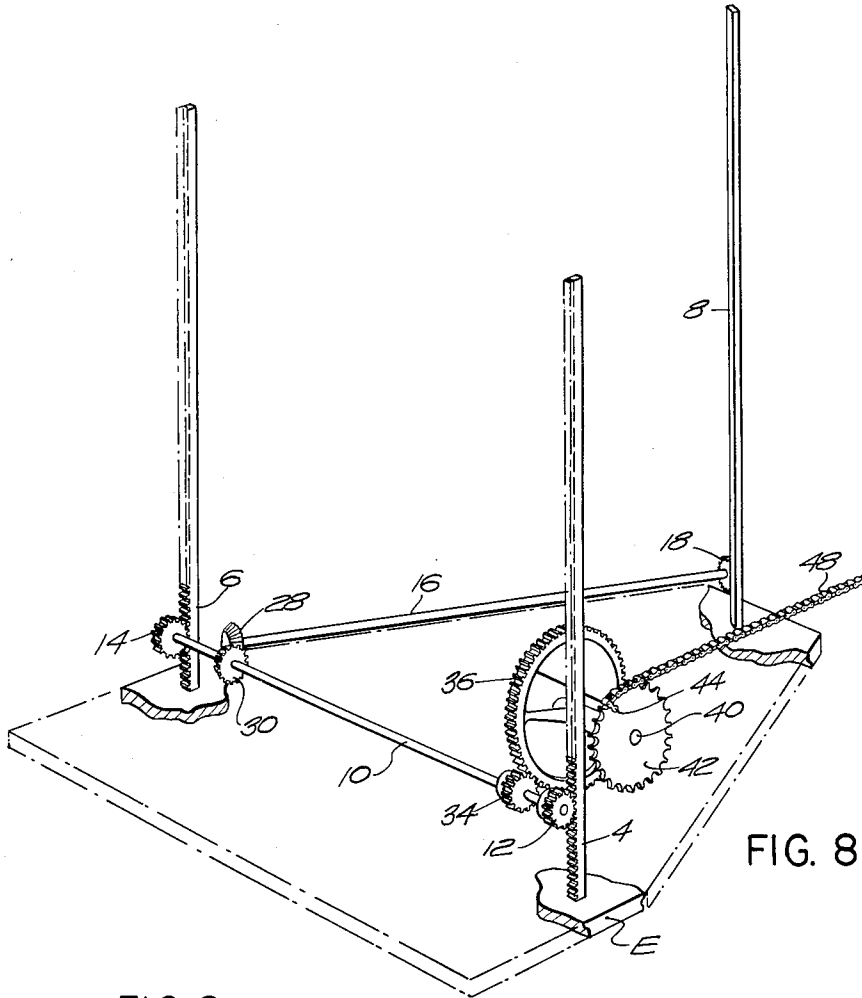
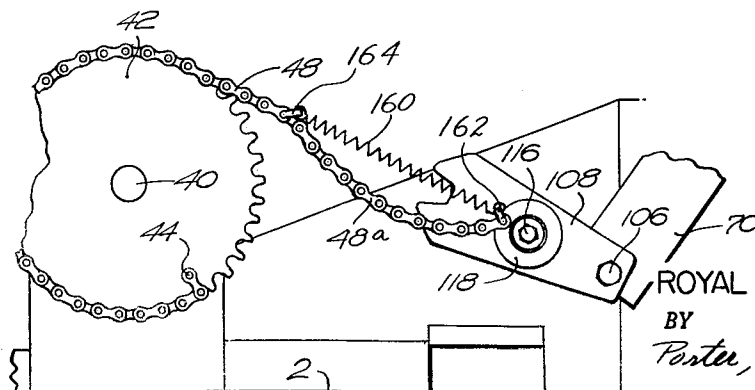


FIG. 8

FIG. 9



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MECHANISM FOR RAISING AND LOWERING PINSETTER BOARD IN A BOWLING PINSETTING MACHINE

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Filed Jan. 15, 1958, Ser. No. 709,020

8 Claims. (Cl. 273—42)

This invention relates to bowling pinsetting machines and more particularly to improved mechanism for raising and lowering a pinsetter board.

In machines adapted for duck pins or ten pins, provision must be made for retrieving standing pins from the alley before the sweeper mechanism is operated to remove "dead wood" and for replacing the pins on the alley in their original standing positions after the sweeper has completed its cycle of operation. Although it has been proposed to have one mechanism for setting a new set of pins and a separate mechanism for retrieving and respotting pins, cost and space requirements make it desirable, if not necessary, that the same pinsetting mechanism be capable of selecting and executing both operations. However, to do this it is necessary to provide means for variably controlling the degree of descent of the pinsetter board. Where a new set of pins is desired, the board must move down to the alley floor. On the other hand, when it is desired to retrieve and respot pins, the board must be stopped above the alley floor at approximately the level of the necks of the pins. Accordingly, the mechanism for raising and lowering the pinsetter board must be capable of selectively stopping descent of the board in either (1) the pin retrieving position, or (2) the pinsetting position, depending upon which operation is called for by the bowler.

Because of the weight of the pinsetter board and also because the drive mechanism is driven usually from a constant speed prime mover, considerable difficulty has been incurred in developing a drive mechanism which not only is capable of both cycles of operation, but which is also capable of bringing the board to a smooth stop, particularly in the intermediate pin retrieving and respotting position, with little noise and with a minimum of jarring and strain applied to the machine.

Accordingly, the primary object of this invention is to provide an improved mechanism for raising a pinsetter board to loading position and for selectively lowering the same pinsetter board either to a lower pinsetting position or to an intermediate pin retrieving and respotting position in a smooth and effective manner and without the difficulty attendant to mechanism for the same purpose heretofore devised and utilized.

Other objects and many of the attendant advantages of the present invention are readily apparent from the following detailed specification when considered together with the accompanying drawings, wherein:

FIG. 1 is a view in side elevation of a portion of a bowling pinsetting machine embodying the present invention;

FIG. 2 is an enlargement of a portion of FIG. 1;

FIG. 3 is a plan view of a portion of the structure of FIG. 2;

FIG. 4 is a vertical section taken on line 4—4 of FIG. 3;

FIG. 5 is a simplified side elevation illustrating the relative positions of certain elements of the mechanism for raising and lowering the pinsetter board when the board is in pin-retrieving position;

FIG. 6 is a simplified view showing the relative posi-

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tions of the elements of FIG. 5 when the pinsetter board is in position to spot a new set of pins;

FIG. 7 is a sectional view taken along line 7—7 of FIG. 2; and

FIG. 8 is a simplified perspective view showing how the pinsetter board is supported for reciprocal vertical movement; and

FIG. 9 is a side view in elevation showing an alternative means for preventing obstruction of the auxiliary crank arm.

The present invention is an improvement over the mechanism for raising and lowering a pinsetter described and illustrated in the copending application Ser. No. 625,739, for Automatic Bowling Pinsetting Machine filed by me and Howard M. Dowd on December 3, 1956. Accordingly, only so much of the machine disclosed in said copending application Ser. No. 625,739 is illustrated in the drawings and referred to hereinafter as is necessary to fully and accurately point out the construction, operation, purpose and advantages of the present invention.

Referring now to FIG. 1 there is illustrated a portion of the machine of said copending application as it appears when provided with the present invention. Briefly, the illustrated portion of the machine comprises the discharge end of a pin conveyor A, a rotary pin distributor B comprising ten cylindrical cups C arranged in a circular array, ten inclined chutes D for directing pins discharged from cups C to a pinsetter board E, and means modified in accordance with the present invention and hereinafter described and identified for controllably raising and lowering the pinsetter board.

As described and illustrated in said copending application, means (not shown) are provided for indexing the distributor B so as to place each cup in turn beneath the discharge end of the pin conveyor. Means (not shown) are provided for holding pins P in the cups and for discharging the pins in the cups into the chutes D when the distributor is full. Means (also not shown) are provided for holding the pins in chutes D and for discharging them for gravity delivery to the pinsetter board when the pinsetter board is in its elevated at rest position illustrated at H and a new set of pins is called for by the bowler. The pinsetter board comprises ten cup-like members open at the bottom, each formed in two halves, F and G. The two halves F and G are shaped to snugly receive and support the body of a pin when the pinsetter board is in elevated position and/or is moving downward to set up a new set of pins as at I and to grasp and support a pin at its neck when the pinsetter board is retrieving or respotting pins on the alley floor as at J. The cup halves F and G are movable toward and away from each other in the plane of the pinsetter board, moving away from each other to set a new set of pins or to respot pins and toward each other when retrieving standing pins or when the pinsetter board is raised back to its normal at rest position ready to receive a new set of pins. Interlocking and co-operating controlling mechanism (not shown) is provided to enable the bowler to selectively cause the pinsetter board to move down to spot a new set of pins or to retrieve and respot standing pins. Also not shown is a sweeper mechanism which automatically sweeps the alley of all pins before the pinsetter board moves down with a new set of pins or after standing pins have been retrieved but before they have been resotted. Referring now to FIGS. 1, 2, and 8, the distributor B is disposed above a horizontal platform 2 located above the alley floors. Extending through platform 2 are three gear racks 4, 6, and 8 which are attached at their bottom ends to pinsetter board E. A shaft 10 rotatably supported on platform 2 is provided with gears 12 and 14 which mesh with racks 4 and 6. A second shaft 16 also rotatably sup-

ported on platform 2 is provided with a gear 18 which meshes with rack 8. Shaft 16 is driven by a bevel gear 28 which in turn is driven by a bevel gear 30 affixed to shaft 10. Also carried by shaft 10 is a pinion gear 34 which meshes with a large bull gear 36 affixed to one end of a third shaft 40 also rotatably secured to platform 2. Affixed to the other end of shaft 40 is a sprocket 42. Secured at 44 to the periphery of sprocket 42 is a chain 48.

It is believed to be apparent that when chain 48 is pulled horizontally to the right as seen in FIGS. 1 and 2, it will cause sprocket 42 to rotate clockwise. Clockwise rotation of sprocket 42 will cause gears 12 and 14 to rotate in the opposite direction, thereby acting on the racks 4, 6, and 8, to move the pinsetter board upward. On the other hand, when the tension on chain 48 is relieved, the weight of board E will cause the board to move downward, thereby causing gears 12 and 14 to rotate clockwise. When gears 12 and 14 rotate clockwise, they cause sprocket 42 to rotate in the opposite direction, and as the latter rotates the chain will be wound up on it. By controlling the length of travel of the chain it is possible to stop the pinsetter board in positions H, I, or J, as desired.

To the extent already described the apparatus of FIGS. 1, 2 and 8 is described and illustrated in said copending applicator Ser. No. 625,739.

The present invention is concerned with improved means hereinafter described for causing the chain to more effectively raise and lower the pinsetter board and locate the board in positions H, I, and J.

Mounted on platform 2 is an electric motor 50 whose output shaft is provided with a pulley 52 which drives a pair of belts 54. Belts 54 drive a pulley 56 affixed to the input shaft of a speed reduction unit 58 supported on a small platform 60 carried by platform 2. The output shaft of reduction unit 58 is provided with a small sprocket 62 which drives an endless chain 64. Rotatably supported by platform 60 and extending parallel to the central axis of sprocket 62 is a shaft 66 (FIGS. 3 and 4) which is provided adjacent its outer end with a large sprocket 68 which carries and is driven by chain 64.

Secured to the outer end of shaft 66 is a radially extending crank arm 70. Both sprocket 68 and crank arm 70 are locked against rotation relative to shaft 66 by a key 72.

Mounted in face to face relation with crank arm 70 is a spacer plate 74 of U-shaped cross section comprising two parallel relatively thick portions 76 and 78 connected to each other by a relatively thin portion 80. The latter is mounted on and keyed to shaft 66 so as to rotate therewith. Mounted on the outside of portions 76 and 78 is a face plate 82. The latter is secured by four screw bolts 84 which pass through holes in portions 76 and 78 and are received in tapped openings in crank arm 70. Face plate 82 cooperates with portions 76, 78 and 80 of spacer plate 74 to define a rectangular channel in which is slidably positioned a locking bar 88. Face plate 82 is provided with a circular opening 90. Attached to locking bar 88 and extending in opening 90 is a screw bolt 92. The opening 90 is several times larger than the head of bolt 92 so as to permit the locking bar to be moved back and forth a predetermined distance in the rectangular channel. Engagement of bolt 92 with the sides of opening 90 determines the distance through which the locking bar can be reciprocated. Attached to the top of spacer plate 74 is a stud 94 to which is attached one end of a tension spring 96. The other end of the spring is attached to a stud 98 carried by the end of locking bar 88 furthest from the free end of crank arm 70. Spring 96 urges the locking bar toward the free end of the crank arm. The end 100 of locking bar 88 nearest the free end of the crank arm is tapered. When the locking bar is nearest the free end of the crank arm the tapered end 100 is substantially flush with the end 102 of face plate 82 which extends beyond the corresponding ends of portions

76 and 78 of spacer plate 74. The end 102 of face plate 82 is notched as at 104 to render visible the tapered end 100 of the locking bar.

Pivoted to the free end of crank arm 70 by means of a bolt 106 is an auxiliary crank arm 108 having a thickness slightly less than the spacing between crank arm 70 and plate 82. The free end of auxiliary crank arm 108 is beveled so as to provide converging cam surfaces 110 and 112 (see FIG. 6). The free end of crank arm 108 is provided with a notch 114 at its center. The sides of the notch converge slightly in the direction of pivot bolt 106 so as to snugly receive the tapered end 100 of locking bar 88. The length of auxiliary crank arm 108 is such that when its free end faces shaft 66 and its notch 114 is in line with locking bar 88 (FIG. 6), its cam surfaces 110 and 112 will be positioned between crank arm 70 and plate 82 just short of engagement with the ends of portions 76 and 78 of spacer plate 74. In this position the auxiliary arm 108 can be locked by locking bar 88 against rotation relative to primary crank arm 70.

Attached to auxiliary crank arm 108 between its free and pivoted ends is a short stub shaft 116 on which is rotatably secured an annular disk 118. Pivotal secured to the periphery of disk 118 is the opposite end of chain 48. Disk 118 resides in the same vertical plane as sprocket 42 so that the chain is not subject to twisting but only to tensioning.

When the auxiliary crank arm is locked by bar 88, the end of the chain 48 attached to disk 118 will move in a fixed circular orbit as crank arm 70 rotates with shaft 66. Since the chain is always under tension due to the weight of the pinsetter board, it tends to stay in a straight line between sprocket 42 and disk 118 even when the auxiliary crank arm is not locked. If the auxiliary crank arm is not locked, chain 48 will cause it to pivot relative to primary crank arm 70 when the latter rotates.

When motor 50 is operating it drives crank arm 70 counterclockwise as viewed in FIG. 1. Assuming that the auxiliary crank arm 108 is unlocked, when the primary crank arm is stopped with its free end in approximately 3 o'clock position, the auxiliary arm will be disposed as shown in FIG. 1. When the motor is started, arm 70 will rotate counterclockwise and as it moves from 3 o'clock to 9 o'clock position, auxiliary arm 108 will be pivoted by chain 48 clockwise relative to arm 70. When arm 70 reaches 9 o'clock position, arm 108 will be in the position shown in FIG. 6.

In FIGS. 5 and 6, the primary crank arm 70 is shown in the 9 o'clock position. It is believed to be apparent from a comparison of the two figures that when the auxiliary crank arm 108 is unlocked (FIG. 6), more of the chain 48 is wound up on sprocket 42 than is possible when the auxiliary crank arm is locked (FIG. 5). However, regardless of whether the auxiliary crank arm is locked or unlocked, the same amount of chain is wound upon sprocket 42 when the crank arm 70 is in approximately the three o'clock position. Thus by having the crank arm 70 come to rest only in the three o'clock position, the pinsetter board will always come to rest in position H (FIG. 1). When the primary crank arm with the auxiliary arm locked thereto is in the 9 o'clock position, the pinsetter board will be in position J (FIG. 1). Similarly, when the primary crank arm with the auxiliary crank arm unlocked is in the 9 o'clock position, the pinsetter board will be in position I (FIG. 1).

It is to be understood that the normal at rest position of the primary crank arm is the position shown in FIG. 1 and that means (not shown) are provided for starting motor 50 and for stopping it when the crank arm 70 has made one revolution and is back in the three o'clock position. Means (described hereinafter) are provided for selectively unlocking the auxiliary arm soon after the primary crank arm begins to move from its at rest posi-

tion. As the primary crank arm 70 approaches the three o'clock position at the ends of its single revolution the auxiliary crank arm pivots back toward the tapered end 100 of the locking bar. When the cam face 112 contacts the tapered end 100 the locking bar 88 is cammed back against the pull of spring 96 far enough to let the notch 114 of the auxiliary crank arm move in line with the tapered end 100, whereupon spring 96 quickly pulls the locking bar forward to lock the auxiliary arm in the position shown in FIG. 1.

The means for retracting the locking bar 88 to free the auxiliary crank arm comprises a roller 120 supported on a stub shaft 122 attached to the locking bar adjacent stud 98. Attached to platform 60 in front of shaft 66 is a sleeve 124 in which is slidably positioned a rod 126. One end of rod 126 is provided with two fixed disks 128 and 130 spaced slightly from each other to receive the forked fingers 132 and 134 formed at the end of a plate 136. The two fingers 132 and 134 are spaced from each other just enough to accommodate rod 126. The opposite end of plate 136 is secured to one leg 138 of a U-shaped yoke 140. A rod 142 extends through and is secured to the legs of the yoke 140. The other end of the rod 142 is secured to the spring-biased armature of a solenoid 144. Yoke 140 and solenoid 144 form part of the machine disclosed in the aforementioned copending application Ser. No. 625,739, and, as disclosed in said copending application, perform functions other than the functions hereinafter described. Accordingly, it is to be understood, as an alternate mode of construction, that plate 136 may be secured directly to the armature of solenoid 144 and that solenoid 144 may be a separate element employed in addition to the solenoid disclosed in said copending application.

The normal at rest position of the plate 136 when the solenoid is deenergized is the position shown in dotted lines in FIG. 3, in which position the rod 126 will be in the path of roller 120. When the solenoid is energized, the rod 126 will be retracted by plate 136 out of the path of roller 120, as shown in solid lines in FIG. 3. Assuming that rod 126 is not retracted, when crank arm 70 begins to rotate from 3 to 9 o'clock position, roller 120 will engage rod 126 and will be forced radially outward by the rod just enough to retract locking bar 88 from the notch 114 in the auxiliary arm, releasing the latter for rotation relative to arm 70. As soon as roller 120 passes by rod 126, spring 96 will automatically return the locking bar to locking position. In practice the rod 126 is so located as to intercept roller 120 shortly after crank arm 70 begins to rotate from its at rest position, and holds the locking bar retracted until after notch 114 has moved out of alignment therewith. While not shown it is to be understood that the electrical circuits for the solenoid and the motor 50 are so interconnected that the solenoid is energized at the same time as the motor but not every time that the motor is energized. The solenoid is not energized when it is desired to set a new set of pins since the latter can be accomplished only when the auxiliary crank arm is released. The motor on the other hand is energized not only when it is desired to deliver a new set of pins, but also when it is desired to retrieve standing pins.

In practice it has been disclosed that trouble may develop if a pin or ball or other object is still on the alley floor when the pinsetter board E is lowered to deliver a new set of pins. The object on the alley floor may prevent the board from descending fully to the setting position I, in which case slack will be produced in chain 48. If the slack is great enough and persists as the crank arm 70 moves from 9 to 6 o'clock position, the free end of auxiliary crank arm 108 will hang vertical and in this position will engage the top of platform 2 and prevent the crank arm 70 from returning to 3 o'clock position. The least that can happen is that arm 70 will stop, belts 54 will slip on pulleys 56, the motor 50 will

continue running and the bowler will have to wait until the jam is cleared. More often, however, pivot bolt 106 is sheared or the gear reducer 58 is damaged.

To prevent such damage, a wedge-shaped block 150 is affixed to platform 2 in a position such that it will be substantially in line with crank arm 70 when the latter is in approximately 7 o'clock position. Crank arm 108 will clear block 150 so long as chain 48 remains taut, as shown at 152 in FIG. 2. However, when chain 48 becomes slack as shown at 154, crank arm 108 will strike block 150 and will be restrained by the latter while crank arm 70 continues to move forward to 6 o'clock position, at which point arm 108 will fall off of block 150 too late to jam arm 70.

FIG. 9 illustrates an alternative means for preventing jamming of the auxiliary crank arm 108. The alternative means comprises a tension spring 160 attached at one end to annular disk 118 by a looped pin 162 which also secures the last link of chain 48 to the disk. The other end of spring 160 is secured to chain 48 at a convenient position by means of a second looped link pin 164. During normal operation of the pinsetter board chain 48 remains taut as shown at 152 in FIG. 2 and so long as the chain is taut spring 160 is stretched to a length equal to that portion 48a of chain 48 that runs between pins 162 and 164. However, if during a setting operation the pinsetter board is prevented from dropping to the level I (FIG. 1), because of a pin, ball or other object on the alley floor, whereby a slack would be produced in chain 48, as shown at 154 in FIG. 2, spring 160 will contract and thereby exert a pull on crank arm 108, causing the latter to pivot clockwise relative to crank arm 70 to the position shown in FIG. 9, in which position the crank arm 108 will clear platform 2. The chain, of course, will festoon or dangle below the spring as shown in FIG. 9 until crank arm 70 has moved far enough to take up the slack.

It is contemplated that the particular shapes of certain elements such as those making up the crank arm assembly and the manner in which these elements are secured to one another may be varied without departing from the principle of the present invention.

Obviously many other modifications and variations of the present invention are also possible in the light of the above teachings. Therefore, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts specifically described or illustrated, and that within the scope of the appended claims it may be practised otherwise than as specifically described or illustrated.

I claim:

1. In combination, a pinsetter board, a sprocket, means rotatably supporting said sprocket, means operatively connected to said sprocket for lowering said board as said sprocket turns in one direction and raising said board as said sprocket turns in the opposite direction, a shaft, a motor means operated by said motor for unidirectionally turning said shaft, a first crank arm connected to said shaft, said first crank arm having a free end, a second auxiliary crank arm pivoted at one end thereof to the free end of said first arm, said second crank arm also having a free end, a chain having one end connected to said second crank arm at a point longitudinally spaced from its point of pivotal connection with said first crank arm and an opposite end connected to the periphery of said sprocket, whereby as said first crank arm is rotated by said shaft said sprocket turns first in said one direction to lower said board and then in the opposite direction to raise said board again, and means on said first crank arm for releasably locking said second arm against pivotal movement relative to said first arm with the free end of said second arm positioned between said shaft and the free end of said first arm, whereby to shorten the distance through which said pinsetter board will descend during movement of said sprocket in said one direction.

2. The combination of claim 1, further including means for releasing said locking means during rotation of said first crank arm.

3. The combination of claim 1, wherein the free end of said second crank arm is provided with a notch and further wherein said locking means comprises a tongue slidably carried by said first crank arm and movable into said notch to prevent movement of said second arm relative to said first arm.

4. The combination of claim 3, further including a spring normally urging said tongue into locking position.

5. The combination of claim 3, further including a roller carried by said tongue, and tongue unlocking means movable transversely of said crank arm into the path of movement of said roller for engaging said roller to cam said tongue to unlocking position.

6. The combination of claim 5, further including selectively operated means for moving said tongue-unlocking means toward and away from roller engaging position.

7. In combination, a carriage, means mounting said carriage for reciprocal vertical movement, a sprocket, means rotatably supporting said sprocket, means operatively connected to said sprocket for lowering said carriage as said sprocket turns in one direction and raising said carriage as said sprocket turns in the opposite direction, a shaft, a motor, means operated by said motor for unidirectionally turning said shaft, a first crank arm connected to said shaft, said first crank arm having a free end, a second auxiliary crank arm pivoted at one end to the free end thereof of said first arm, a chain connected at one end to said second crank arm at a point longitudinally spaced from its point of pivotal connection with said first crank arm and connected at the opposite end to the periphery of said sprocket, whereby as said first crank arm is rotated by said shaft said sprocket turns first in one direction to lower said carriage and then in the opposite direction to raise said carriage, and means carried by said first crank arm for releasably lock-

ing said second arm against pivotal movement relative to said first arm with the free end of said second arm positioned between said shaft and the free end of said first arm, whereby to shorten the distance through which said carriage will descend during movement of said sprocket in said one direction.

8. In a bowling pinsetting machine having a vertically reciprocal pinsetter board, means for lowering and raising said pinsetter board, said means including a crank arm assembly comprising a first crank arm having first and second opposite ends with the first end mounted directly on a rotatable shaft, a second auxiliary crank arm having first and second opposite ends, means pivotally securing the first end of said second auxiliary crank arm to the second end of said first crank arm, means carried by the first crank arm for releasably locking together said first and second crank arms, with the second end of said second crank arm positioned between the first and second ends of said first crank arm, and chain means connected to said second crank arm at a point longitudinally spaced from its point of pivotal connection with said first crank arm for raising and lowering said pinsetter board as said first crank arm is rotated by said shaft.

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