Dec. 27, 1955 T. E. CROSS 2,728,575

BOWLING PIN SETTER

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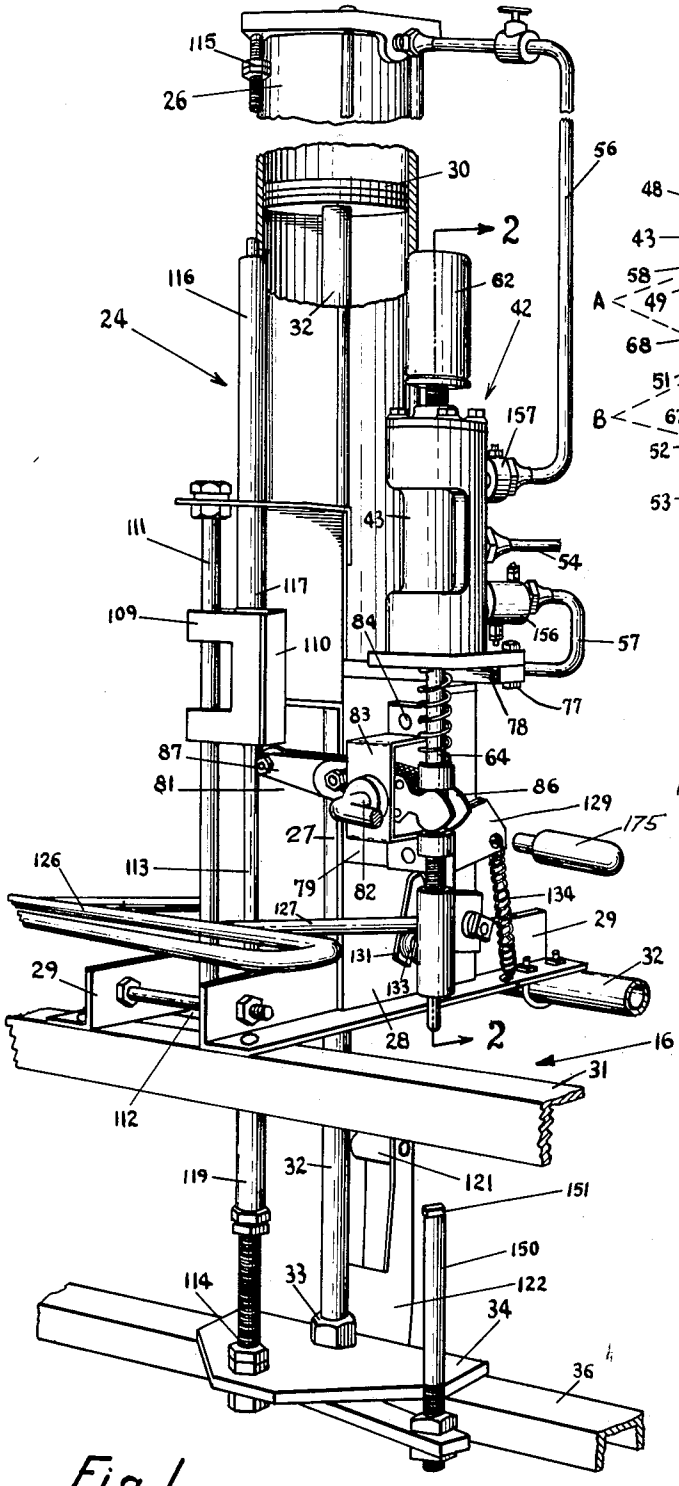


Fig. 1

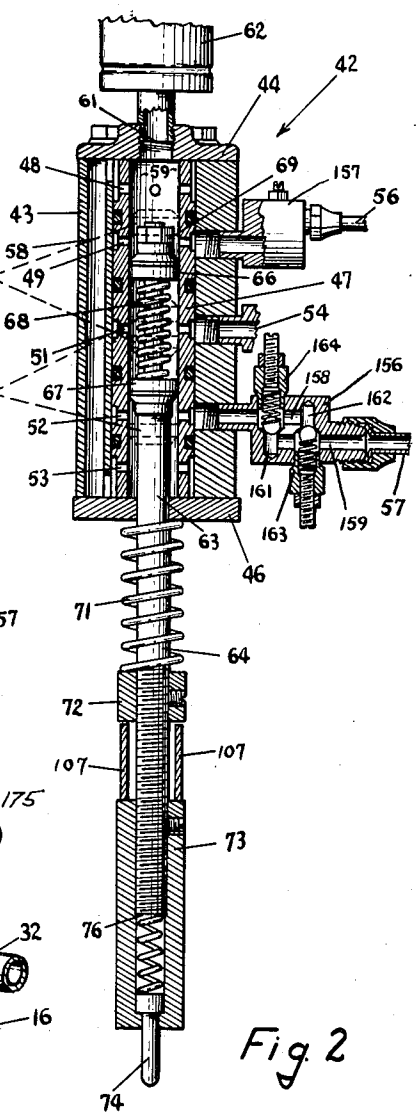


Fig. 2

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Fig. 3

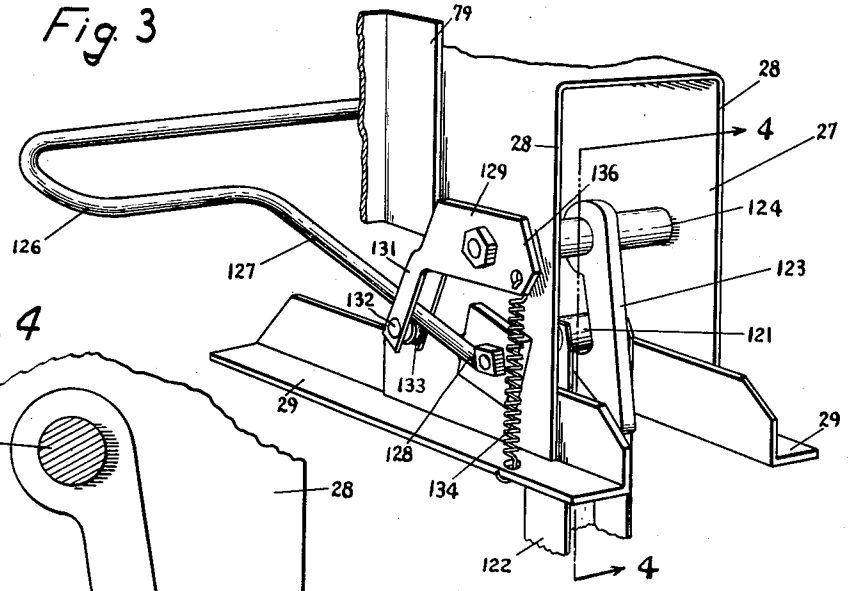
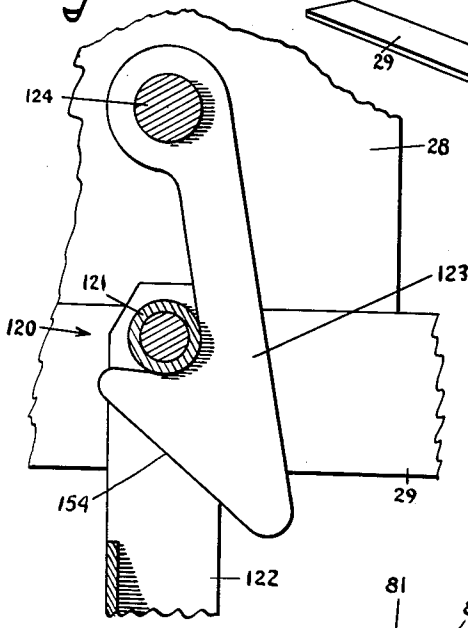


Fig. 4



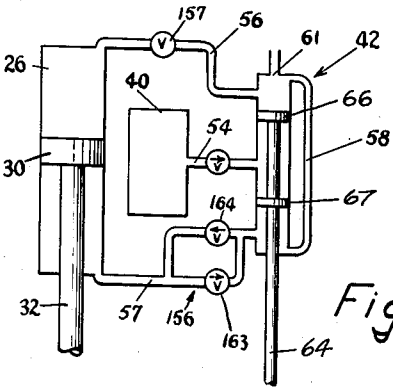
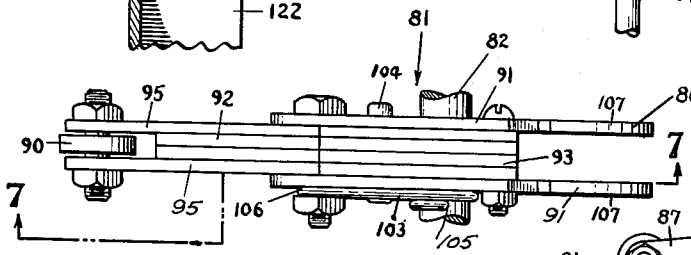


Fig. 8



7 Fig. 6

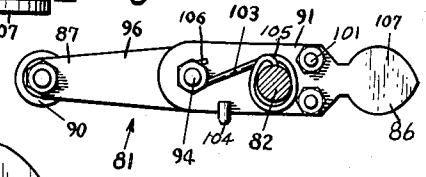


Fig. 5

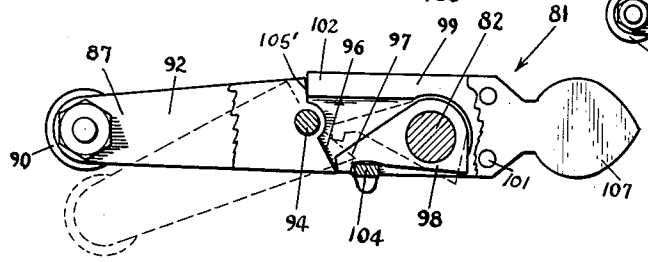


Fig. 7

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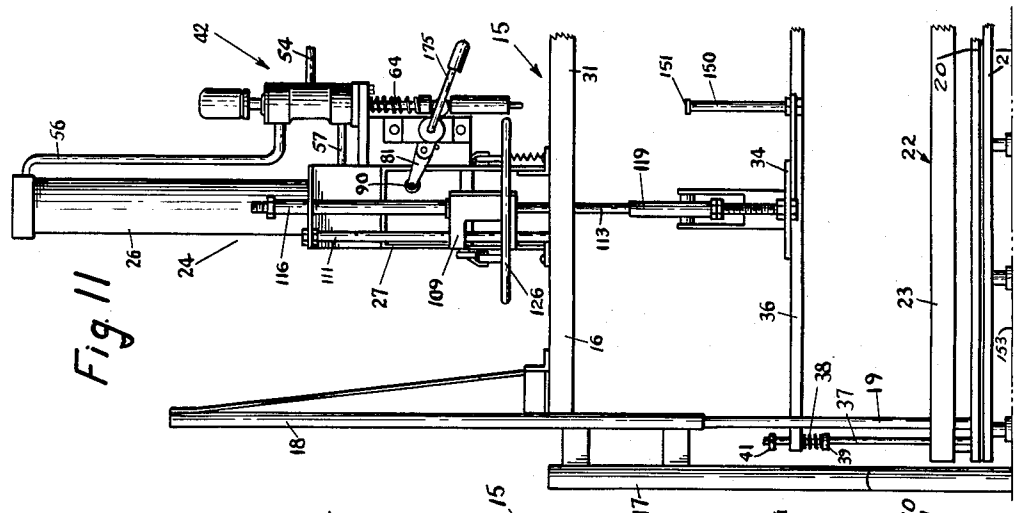


Fig. 11

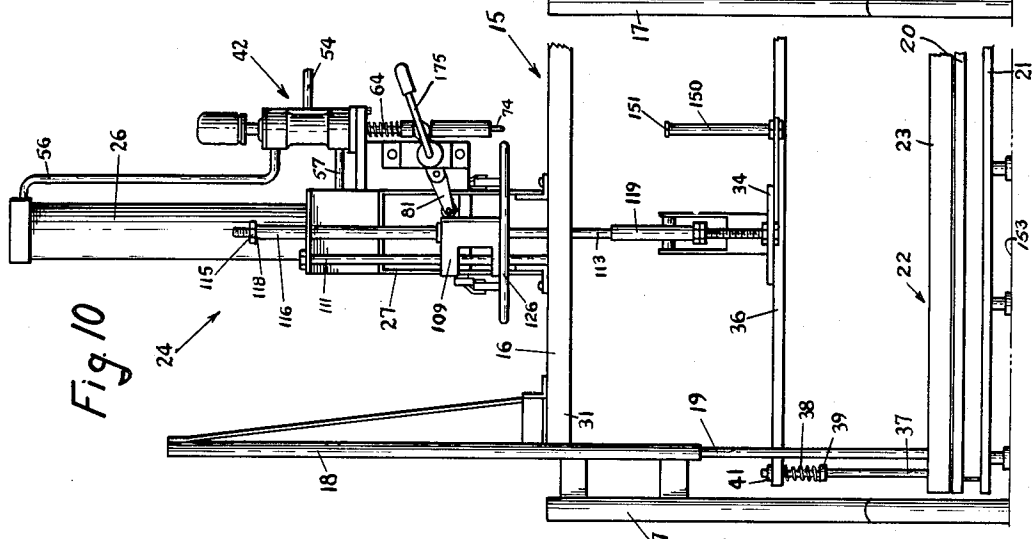


Fig. 10

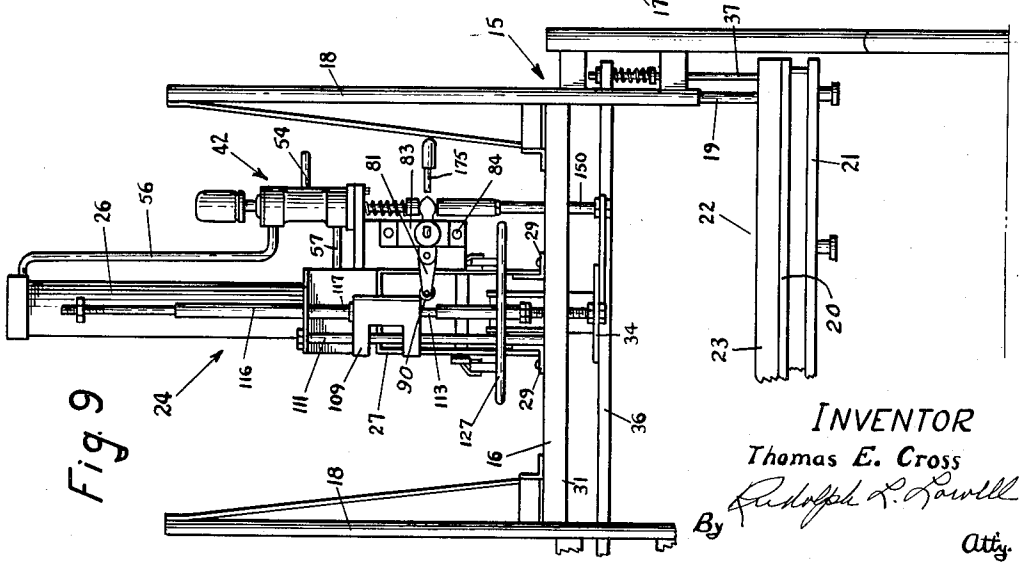


Fig. 9

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2,728,575

BOWLING PIN SETTER

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Application September 29, 1950, Serial No. 187,410

2 Claims. (Cl. 273—42)

This invention relates generally to bowling pin setting machines and in particular to a pneumatic attachment for a pin setting machine of semi-automatic type.

Pin setting machines of semi-automatic type generally require only the manual loading of the pins within the setter frame, after which the setter frame is power driven in a pin setting operation. These machines, although generally satisfactory, are objectionable in that they are generally bulky and expensive, the relative time required for the descent and elevation of the setter frame is erratic and not readily adjustable, and the setter frame is not properly controlled at a pin setting position to accurately spot the pins, or to steady the pins against any wobbling action on the alley prior to the movement of the frame upwardly from the alley. It is desirable that the time period in which the setter frame rests on the alley be subject to variation so as to accommodate flat or round bottom pins and to steady the pins in positions on the alley corresponding to their relative positions as provided for in the setter frame.

It is an object of this invention, therefore, to provide an improved pin setting machine.

A further object of this invention is to provide an attachment for a pin setting machine for automatically moving the setter frame in a pin setting operation such that the setter frame is maintained in a pin setting position for a pre-determined time interval prior to its being elevated upwardly from the alley.

Yet a further object of this invention is to provide a semi-automatic pin setting machine in which the setter frame is moved downwardly by the action of gravity, retained in a pin-setting position on the alley for a predetermined time interval, and then moved upwardly to a rest or uppermost position by an air operated means which is responsive in operation to the up and down movement of the setter frame.

Still another object of this invention is to provide a pneumatic attachment for operating the setter frame of a pin setting machine which is readily and easily installed on all pin setting machines now commercially available.

Further objects, features, and advantages of this invention will become apparent from the following description when taken in connection with the accompanying drawings in which:

Fig. 1 is a foreshortened perspective view of the pneumatic attachment of this invention for operating the setter frame of a pin setting machine;

Fig. 2 is an enlarged sectional view taken on the line 2—2 in Fig. 1 showing an air valve unit for the attachment shown in Fig. 1;

Fig. 3 is an enlarged detail fragmentary perspective view of a locking mechanism for releasably holding the setter frame in an uppermost or rest position therefor;

Fig. 4 is an enlarged detail sectional view taken on the line 4—4 in Fig. 3;

Fig. 5 is a side elevational view of an actuating member for controlling the operation of the valve unit shown in Fig. 2;

Fig. 6 is an enlarged plan elevational view of the actuating member shown in Fig. 1;

Fig. 7 is a sectional view of the actuating member as seen along the line 7—7 in Fig. 6;

Fig. 8 is a diagrammatic showing of the air system for the pneumatic attachment of this invention;

Fig. 9 is a foreshortened rear elevational view of a pin setting machine embodying the attachment of this invention, and

Figs. 10 and 11 are fragmentary rear elevational views, illustrated similarly to Fig. 9 and show parts in changed positions.

With reference to the drawings there is illustrated in Figs. 9 and 10 a pin setting machine which includes a main frame 15 of a substantially inverted U-shape having a transverse cross frame or base structure 16 connected between the upper ends of a pair of legs or standards 17. Projected upwardly from the base structure 16 are a pair of transversely spaced tubular guides 18 for slidably receiving a pair of slide members 19, the lower ends of which are connected to the upper deck 23 of a pin setter frame designated generally as 22. The setter frame 22 also includes a lower deck 21, connected to the upper deck 23, and an intermediate or floating deck 20, movable between the upper and lower decks 21 and 23, and carrying the usual pin setting shoes (not shown).

The main frame 15 and setter frame 22 are of a well-known construction and form no part of the present invention. Bowling pins (not shown) placed in the upper deck 23 of the setter frame 22, are released for setting the pins on an alley when the deck 20 is moved relative to the decks 21 and 23 in a manner which is well known.

The attachment of this invention, indicated generally as 24 (Figs. 1 and 9) is mounted on the base structure 16 of the main frame 15. The attachment 24 is of pneumatic type and includes an upright double acting air cylinder 26, the lower end of which is supported on a bridge member 27 of an inverted U-shape, with the legs 28 of the bridge member 27 in turn being secured to a pair of transversely spaced longitudinal angle members 29 connected across frame members 31 and 32, which comprise the base structure 16 of the main frame 15.

The cylinder 26 is operatively associated with a vertically movable piston or working member 30, provided with a connecting rod 32 the lower end of which is secured at 33 with a plate member 34 mounted intermediate the ends of a transverse crossbar 36. Slidably extended through the opposite ends of the crossbar 36 (Figs. 9 and 10) are upright hanger rods 37 the lower ends of which are secured to the floating deck 20 of the setter frame 22. Coil springs 38 are mounted on the rods 37 between the lower side of the crossbar 36 and holding nuts 39, while nuts 41 on the rods 37 are engageable with the top side of the crossbar 36, to provide what might be termed a yieldable lost motion connection between the rods 37 and the crossbar 36.

The admission of air under pressure to and the exhaust of air from the cylinder 26 are controlled by a valve unit designated generally as 42 (Figs. 1 and 2) which comprises a substantially cylindrical casing 43 closed at its upper end by a cap member 44 and at its lower end by a base member 46. Inserted within the casing 43 is a removable bearing sleeve 47 which is held in assembled position within the casing 43 by the cap member 44 and the base member 46. The bearing sleeve 47 is formed with a series of longitudinally spaced perforations 48, 49, 51, 52, and 53 which are angularly spaced in rows about the

sleeve 47. The perforations 51 are in communication with or open to an air supply line 54 which is connected to a suitable source of air under pressure such as an air tank 40, illustrated in Fig. 8.

The perforations 49 (Fig. 2) are connected with a feeder line 56 which is in fluid registration with the upper end of the cylinder 26, and the perforations 52 are connected to a feeder line 57 which is in fluid communication with the lower end of the cylinder 26. The perforations 48 and 53, at opposite ends of the bearing sleeve 47 are open to a common air passage 58 extended longitudinally of the casing 43, and with the perforations 48, through the upper end 59 of the sleeve 47 being open to the atmosphere through an air exhaust or outlet 61 formed in the cap 44 and provided with a muffler 62.

Mounted for reciprocal movement within the sleeve 47 is a piston structure 63 having a piston rod 64 extended outwardly from the base member 46. Mounted about the piston rod 64 and within the sleeve 47 are a pair of piston members or leathers 66 and 67, which are spaced longitudinally of the piston rod 64 a distance corresponding to the distance between adjacent rows of perforations 49, 51 and 52. This spacing of the piston members 66 and 67 is accomplished by the adjustable movement of the piston member 66 relative to the piston member 67. The piston member 66 is movable axially of the piston rod and a spring 68, mounted about the piston rod 64 between the pistons 66 and 67, spreads the pistons into contact engagement with the bearing sleeve 47.

The projected end portion of the piston rod 64 carries in order from the base member 46 of the casing 43 a coil spring 71, a collar member 72 and a collar extension 73 which is spaced from the collar 72 for a purpose to appear later. The extension 73 carries a spring pressed pin 74 biased outwardly of the extension 73.

As best appears in Fig. 1 the valve unit 42 is arranged in a parallel relation with the upright cylinder 26 so that the piston rod 64 is vertically movable relative to the casing 43. The base member 46 is secured as by bolts 77, to the top side 78 of a bracket member 79 secured to one leg 28 of the bridge member 27.

Operation of the piston rod 64 to control the admission and exhaust of air relative to the cylinder 26 is accomplished by means including an actuating member 81 (Fig. 1) which has a shaft 82 extended transversely of the main frame 15. The shaft 82 is rigidly supported on the bracket 79 and a U-strap 83 secured as by bolts 84 to the bracket 79. One end 86 of the actuating member 81 is engageable with the piston rod 64 while its other end 87 extends toward the cylinder 26 so as to terminate substantially opposite the piston rod 32.

The actuating member 81 (Figs. 5, 6 and 7) is of a laminated construction and includes a pair of side plates 91 for supporting what might be termed a knuckle assembly consisting of knuckle units 92 and 93. The knuckle unit 92 is pivotally supported for up and down movement on a pivot pin 94 carried between the plates 91 and has the inner end thereof formed with a cam surface 96 which is engageable with follower portions 97 formed on members 98 mounted on the shaft 82. The knuckle unit 92 includes two side members 95 which project outwardly from the main body portion of the knuckle unit 92 and carry therebetween a shaft or pin for supporting a roller 90 therebetween.

Partially extended about the follower members 98 are stop members 99 of a substantially L-shape which are mounted on bolts 101 carried between the side plates 91 such that their long legs 102 extend longitudinally of the actuating member 81 at positions above the shaft 82 and with these legs 102 being of a length to engage the knuckle unit 92 at 105' when the knuckle units 92 and 93 are in longitudinal alignment. Stated otherwise, the legs 102 function as stop members to limit the pivotal movement of the knuckle unit 92 to a position in longitudinal alignment with the knuckle unit 93, it being understood

that the knuckle unit 93 is comprised of the follower members 98, and the stop members 99. In a longitudinally aligned position of the knuckle units 92 and 93 the follower members 98 are held by a stop member 104 in positions for engaging the cam surfaces 96. The stop member 104 is connected between the side plates 91 and extends transversely of the actuating member 81.

It is seen, therefore, that with the shaft 82 maintained in a fixed position the knuckle unit 92 is pivotally movable about the shaft 94 relative to the knuckle unit 93. The unit 92 is yieldably biased to its position in longitudinal alignment with the unit 93 by a torsion spring 103 secured at one end 105 to the shaft 82 and having its other end 106 positioned about the pivot 94, so that the breaking or hinging movement of the knuckle unit 92 relative to the knuckle unit 93 takes place against the pressure of the torsion spring 103.

As best appears in Fig. 6 the side plates 91 project outwardly from the knuckle unit 93. These projected portions 107 constitute the end 86 of the actuating member 81 and are arranged in a straddling relation relative with the piston rod 64, of the valve unit 42 at a position between the collar member 72 and the collar extension 73. Thus on pivotal movement of the actuating member 81 about the shaft 82, in a manner to appear later, the piston rod 64 is vertically moved by the engagement of the projections 107 with the collar member 72 or the collar extension 73.

This pivotal movement of the actuating member 81 is accomplished by the provision of means including an operating or cam block 109 (Fig. 1) which is slidably supported for vertical up and down movement on a rod member 111 projected upwardly from a mounting plate 112 connected between the angle members 29. Slidably extended through the cam block 109 is an upright rod 113 the lower end of which is connected at 114 to the mounting plate 34 carried on the crossbar 36. Loosely positioned about the rod 113 and above the cam block 109 is a tubular stop member 116 the lower end 117 of which rests directly on the cam block 109. The upper end of the rod 113 carries an adjustable nut assembly 115 which is engageable with the upper end 118 of the tubular stop 116 for a purpose to appear later. A second tubular stop 119 is positioned about the rod 113 for engaging the underside of the cam block 109. It is seen, therefore, that as the setter frame 22, and in turn the rod 113 are vertically moved, that the rod 113 is capable of movement relative to the cam block 109, which in turn is movable relative to both the rods 113 and 111.

The setter frame 22 is normally releasably held in an uppermost or rest position by a latching mechanism 120 which includes a catch member 121 (Figs. 1, 3 and 4) carried on a bracket 122 projected upwardly from the crossbar 36 at a position adjacent to the piston rod 32. A hook or latch member 123, which is engageable with the catch member 121, is rigidly mounted on a rock shaft 124 extended longitudinally of the main frame 15 and supported between the legs 28 of the bridge member 27. A manually operated handle 126 of a U-shape has arm sections 127 arranged in a straddling relation with the bridge member 27 and pivotally supported at their free ends 128 on the bridge member legs 28. Rock arms 129 mounted on opposite ends of the rock shaft 124 are positioned to the outside of the legs 28 and have one of their ends terminating in a pair of spaced strap members 131 which carry a pin 132 for rotatably supporting a roller 133. Coil springs 134 are connected between the other ends 136 of the rock arms 129 and the angle member supports 29.

It is seen, therefore, that on downward movement of the handle 126, as viewed in Figs. 1 and 3, the rollers 133 are engaged by the arm sections 127 whereby to rotate the rock shaft 124 in a counterclockwise direction, against the action of the springs 134 to release the hook 123 from the catch member 121. When thus released

the setter frame 22 is free to move downwardly by the action of gravity toward a pin setting position therefor.

In the operation of the pin setting machine of this invention assume the setter frame 22 to be in its uppermost or rest position, shown in Fig. 9, as maintained by the latch mechanism 120. For this position of the setter frame the knuckle units 92 and 93 of the actuating member 81 are in longitudinal alignment, and the actuating member 81 is in a substantially horizontal position extended transversely of the machine. With the actuating member 81 in such position, the cam block 109 rests on the roller 90 at the end 87 of the actuating member, and the piston rod 64 of the valve unit 42 is in its neutral position, indicated in full lines in Fig. 2, at which no air is supplied under pressure to the cylinder 26. This neutral position of the piston rod 64 is defined by the engagement of an upright push rod 150 mounted on the crossbar 36 and arranged so that its upper end 151 is engageable with the spring pressed pin 74 at the lower end of the piston rod 64.

On a release of the latching mechanism 120 the setter frame 22 moves downwardly, by the action of gravity, to its pin setting position shown in Fig. 10, resting against the floor of the alley indicated at 153. During this downward movement, the setter frame 22 merely hangs suspended from the crossbar 36 on the rods 37 so that the coil springs 38 are without any pressure. Further, by virtue of the slidable support of the cam block 109 on the rods 111 and 113, the block 109 continues to rest on the roller 90 of the actuating member 81 until the stop nut 115 engages the upper end 118 of the tubular stop member 116. This engagement takes place concurrently with the resting of the setter frame 22 on the alley floor 153 so that the cam block 109 is moved downwardly to in turn provide for the pivotal movement of the actuating member 81 in a counterclockwise direction, as viewed in Figs. 9 and 10, to move the piston rod 64 upwardly. This upward movement of the piston rod 64 moves the piston members 66 and 67 from their full line positions in Fig. 2 to their dotted line positions indicated at A in Fig. 2 to provide for the admission of air under pressure from the ports 51 and into the ports 49 and through the air line 56 to the upper end of the cylinder 26. Admission of this air to the upper end of the cylinder 26 moves the piston rod 32, cross member 36 and floating deck 20 downwardly relative to the setter frame 22 until the cam block 109 is moved downwardly out of engagement with the roller 90 of the actuating member 81. During this final downward movement of the piston rod 32, the springs 38 remain extended until the floating deck 20 rests against the lower deck 21 of the setter frame 22, at which time the pins are released to upright positions on the alley floor 153. With the floating deck 20 resting on the lower deck 21, the continued downward movement of the piston rod 32 compresses the springs 38. During this time interval of compressing the springs 38 it is seen that the setter frame 22 is maintained on the alley floor 153 so as to steady the pins against wobbling movement, after they have been placed on the alley floor.

On movement of the actuating member 81 out of engagement with the cam block 109, as illustrated in Fig. 11, the coil spring 71, which was compressed during pivotal movement of the actuating member 81, acts against the collar 72 and the base 46 on the valve casing 43 to move the piston rod 64 downwardly to a position such that the piston members 66 and 67 are in their dotted line positions indicated at B in Fig. 2, so that air under pressure is cut off from the top of cylinder 26 and is admitted to the bottom of the cylinder 26.

On the admission of air under pressure to the lower end of the cylinder 26 the piston rod 32 is moved upwardly to release the springs 38 and to engage the crossbar 36 with the adjusting nuts 41 on the hanger rods 37, whereby to elevate the setter frame 22 away from the alley floor 153. During this upward movement of the setter frame, the tubular stop 119 engages and moves the cam block 109 to a position above the roller 90 on the actuating member 81 concurrently with the moving of the catch member 121 against the cam surface 154 on the hook 123, to a position for engagement with the hook. As the uppermost or rest position of the setter frame is reached, the stop rod 150 engages the spring pressed pin 74 and moves the piston rod 64 upwardly to a position providing for the location of the piston members 66 and 67 in their full line positions shown in Fig. 2. With the shutoff of air under pressure to the lower end of the cylinder 26 the setter frame settles downwardly until the catch member 121 drops within the hook 123. Concurrently with this settling action the cam block 109 drops to a rest position on the roller 90.

It is seen, therefore, that on actuation of the handle 126, the setter frame 22 moves downwardly to the alley floor 153 by the action of gravity, is then maintained on the alley floor during the time interval required for moving the piston rod 32 downwardly against the action of the springs 38 until the cam block 109 is out of engagement with the roller 90, and is then moved upwardly by the connecting rod 32 for automatic locking in its upper or rest position by the latching mechanism 120.

The time required for this cycle of operation of the setter frame 22, as well as the rate of descent, the rate of elevation and the time interval in which the frame rests on the alley floor 153 are readily varied by the provision of means including a two-way valve unit 156 (Figs. 2 and 8) connected in the line 57 for supplying air to the lower end of the cylinder 26, and an adjustable valve 157 connected in the line 56 for admitting air to the upper end of the cylinder 26. The valve 156 includes a pair of longitudinal air passages 158 and 159 and a pair of transverse air passages 161 and 162 open at opposite ends to the longitudinal passages 158 and 159. A one-way ball valve unit 163 controls the flow of air in one direction through the longitudinal passages 158 and 159, and a second one-way ball valve unit 164 controls the passage of air through the longitudinal passages 158 and 159 in a reverse direction. Thus, and with reference to Fig. 2, when air under pressure is supplied to the lower end of the cylinder 26 the valve unit 163 is opened and the valve unit 164 is closed. On the exhaust of air from the lower end of the cylinder 26, the valve unit 163 is closed and the valve 164 is opened. Thus by adjusting the pressure of the springs acting on the ball valves 163 and 164 the rate of upward movement of the setter frame 22 can be accelerated or decreased, and its downward rate of movement, by the action of gravity, can be retarded in accordance with the air pressure built up under the piston 30. This retarding action in the drop of the setter frame 22 by the action of gravity can also be complemented by a manipulation of the valve 157 to increase or decrease the effect of suction pressure acting on the top side of the piston 30.

This control action is best understood from a consideration of Fig. 8 in which it is seen that on the downward movement of the piston 30 the valves 157 and 164 may be manipulated to open the cylinder 26, both above and below the piston 30, to the atmosphere through the exhaust outlet 61, or to pressures either above or below an atmospheric pressure by a relative manipulation of the valves 157 and 164. It is to be further noted that the time period in which the setter frame 22 rests on the alley floor 153 can be varied not only by the extent to which the valve 157 permits air under pressure to be supplied to the upper end of the cylinder 26, but by varying the effective length of the cam surface 110 on the cam block 109, and the tension or pressure in the springs 38 mounted about the hanger rods 37.

In the operation of a pin setting machine it is often-

times necessary to raise the setter frame **22**, before it has reached the floor of the alley **153**, as in the case where a bowler prematurely delivers a bowling ball, or where all of the pins may not be properly positioned in the setter frame for release by the frame in a set position. For this purpose there is provided on the shaft **82** (Fig. 1) a safety lever **175**. Regardless of what position the setter frame **22** might have, during its downward movement, on depression of the lever **175** to rotate the shaft **82** in a clockwise direction, as viewed in Fig. 1, the knuckle unit **93** of the actuating member **81** is moved downwardly so that the units **92** and **93** are folded or moved relative to each other to provide for the unit **92** being in a position relative to the unit **93** shown in dotted lines in Fig. 7 to provide for a movement of the pistons **66** and **67** in the valve unit **42** to their dotted line positions shown at B in Fig. 2 for admitting air to the lower end of the cylinder **26**. During this clockwise movement of knuckle unit **93**, should the actuating member **81** be in engagement with the cam surface **110** on the cam block **109**, the knuckle unit **92** of the actuating member **81** is moved from its full line position shown in Fig. 7 to its dotted line position shown in the same figure, to provide for the actuation of the valve unit **42** by the actuating member **81** through the safety lever **175**.

On upward movement of the setter frame **22** to its uppermost or rest position, as shown in Fig. 9, the setter frame is releasably locked by the latching mechanism **120** and the actuating member **81** and cam block **109** assume their positions shown in Fig. 9, in all respects the same as when the operation of the setter frame **22** took place by the manually operated handle **126**.

From the above description it is seen that the invention provides a pneumatic attachment for a pin setting machine which is of a simple and compact construction, capable of operating the setter frame **22** through a predetermined cycle and the relative rates of descent and elevation of the setter frame, as well as the time interval during which the setter frame rests on the alley floor **153** in a setting position, may be relatively varied to accommodate any desired pin setting operation. It is further apparent that the attachment is easily and readily installed and applied to existing commercial setter frame and main frame structures, is positive in operation, and since it is automatic in operation, after the pins have been loaded in the setter frame **22**, that a minimum of time is required for the setting operation to in turn provide for faster bowling games. In this respect, complete cycles of operation of the setter frame **22** have been made with the attachment of this invention in an overall time period of about six seconds, while still providing for a two-second delay or hesitation of the setter frame on the alley floor, to properly locate or set the pins.

Although the invention has been described with respect to a preferred embodiment thereof it is to be understood that it is not to be so limited since changes and modifications can be made therein which are within the scope of this invention as defined by the appended claims.

I claim:

1. In a pin setting machine having a main frame and a setter frame vertically movable between upper and lower positions therefor on said main frame, a floating deck mounted on said setter frame for vertical movement between defined upper and lower limits, a pneumatic unit mounted on said main frame and having a vertically movable working member, means yieldably connecting said working member with said floating deck, a valve unit for controlling the admission of air to and the exhaust of air under pressure from said pneumatic unit, an actuating member for said valve unit, a slidable member engageable with said actuating member and mounted on said main frame for vertical movement relative thereto, means for releasably locking said setter frame in the upper position therefor, means for releasing said locking means to provide for the downward movement of said setter frame and said deck by the action of gravity to the lower position for said setter frame, means for moving said slidable member to operate said actuating member when the setter frame reaches the lower position to initially provide for a pneumatically operated downward movement of said working member and said deck to move said deck to the lower limit therefor on said setter frame, pin depositing mechanism operated in response to movement of said deck to the lower limit therefor on said setter frame, with said means for moving said slidable member providing for further downward movement of said working member against the action of said yieldable connecting means so that the deck remains at said lower limit for a predetermined time interval sufficient for the pins to become steady, means for moving said slidable member out of engagement with said actuating member at the termination of said time interval to provide for operation of said pneumatic unit to move said working member upwardly to lift said setter frame to the upper position therefor, and means operatively associated with said working member for operating said actuating member at said upper position of the setter frame to stop the admission of air under pressure to said pneumatic unit.

2. In a pin setting machine having a main frame and a setter frame mounted for movement between lower and upper positions therefor on said main frame, means for releasably holding said setter frame in said upper position, a floating deck movably supported on said setter frame for vertical movement between upper and lower positions therefor on said setter frame, pin depositing mechanism operated in response to movement of said deck to said lower position therefor, means for moving said setter frame including a double acting air cylinder mounted on said main frame, a piston for said cylinder, means yieldably connecting said piston with said floating deck, a valve unit for controlling the admission of air under pressure to and the exhaust of air from said cylinder including a control piston, means for releasing said setter frame for downward movement of the setter frame and the deck on said main frame by the action of gravity, and means for moving said control piston in response to the movement of said setter frame to the lower position therefor to admit air to said cylinder for initially moving said cylinder piston and said floating deck downwardly to the lower position of said deck on said setter frame and for finally moving said piston downwardly against said yieldable connecting means while said floating deck is in said lower position so that said floating deck is retained under pressure in said lower position for a predetermined time interval prior to upward movement thereof.

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