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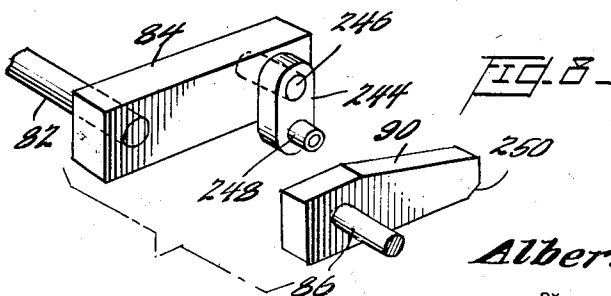
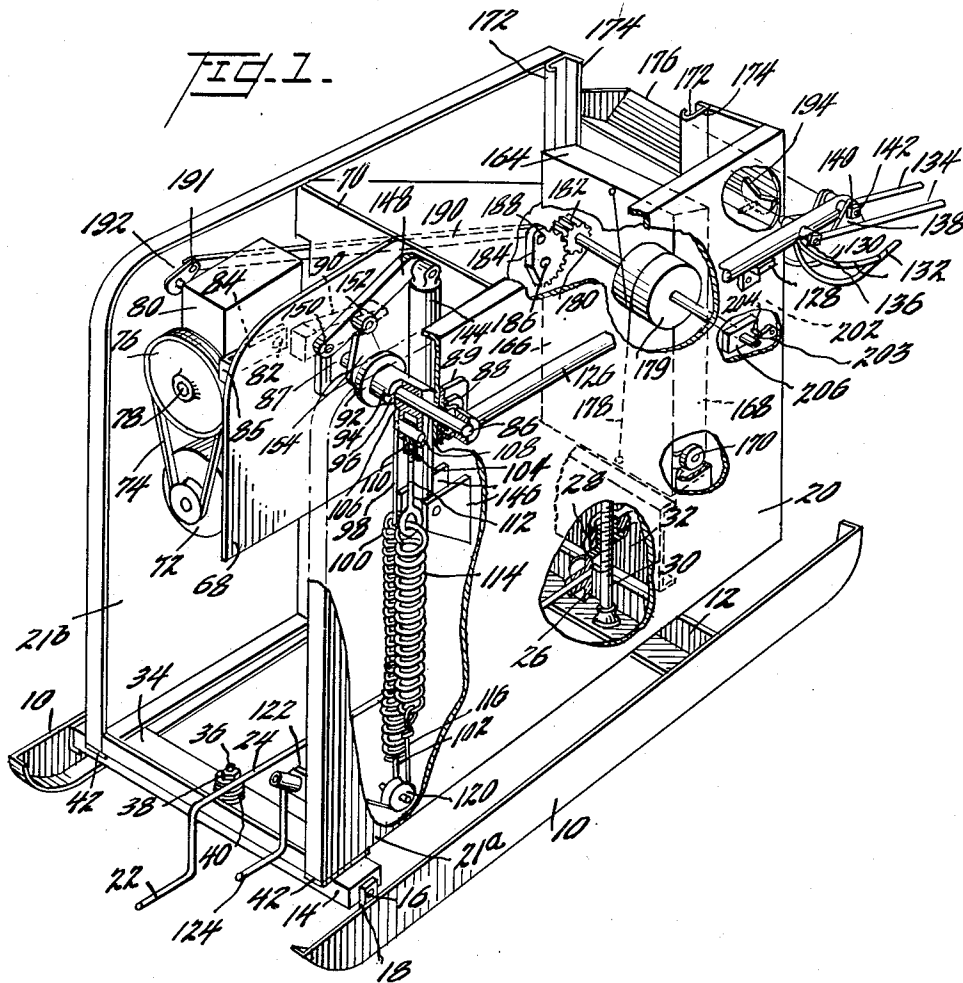
A. L. EMILIAN

2,690,169

BASEBALL THROWING MACHINE

Filed March 23, 1951

5 Sheets-Sheet 1



Sept. 28, 1954

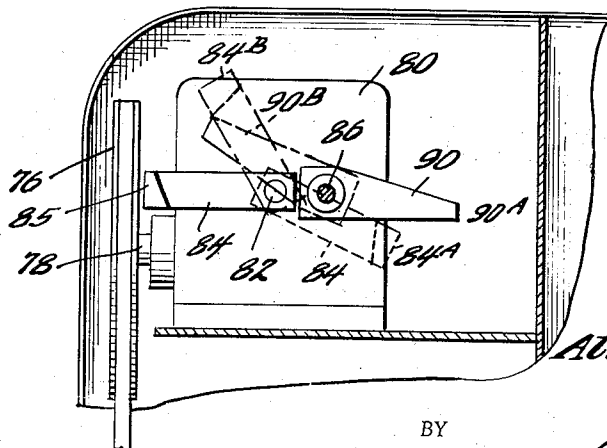
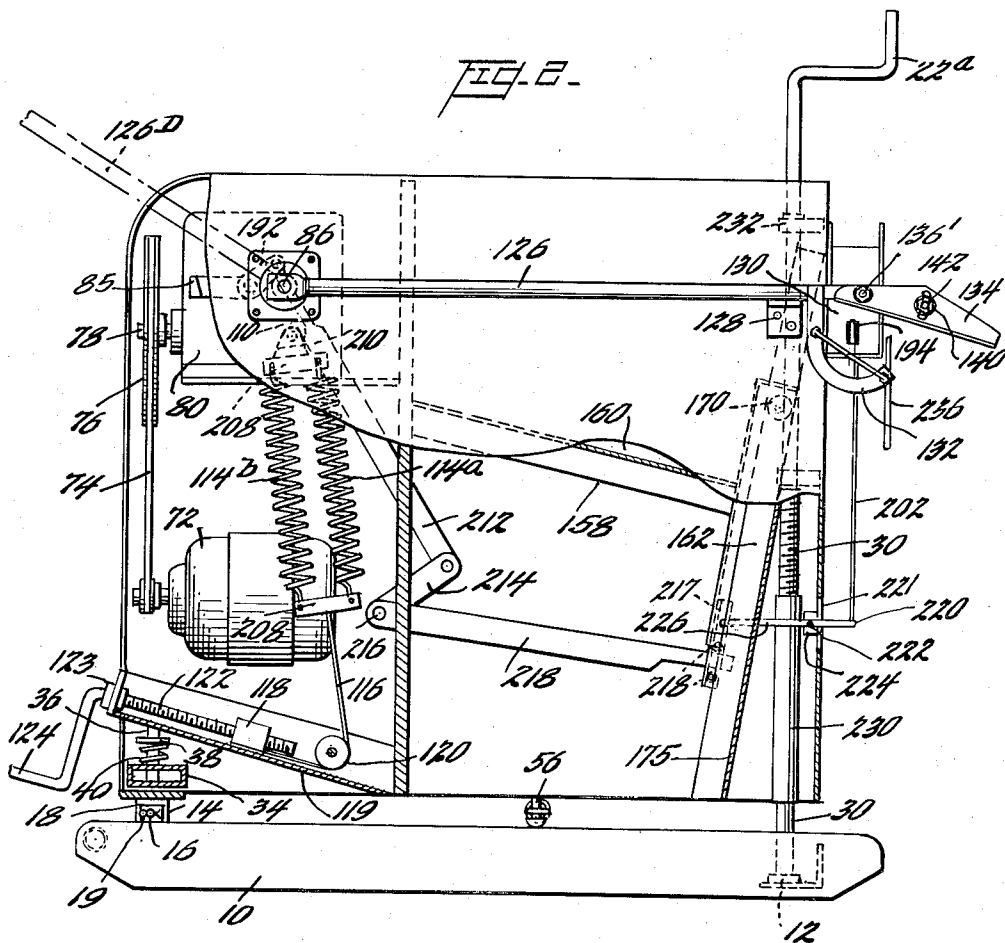
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BASEBALL THROWING MACHINE

Filed March 23, 1951

5 Sheets-Sheet 2



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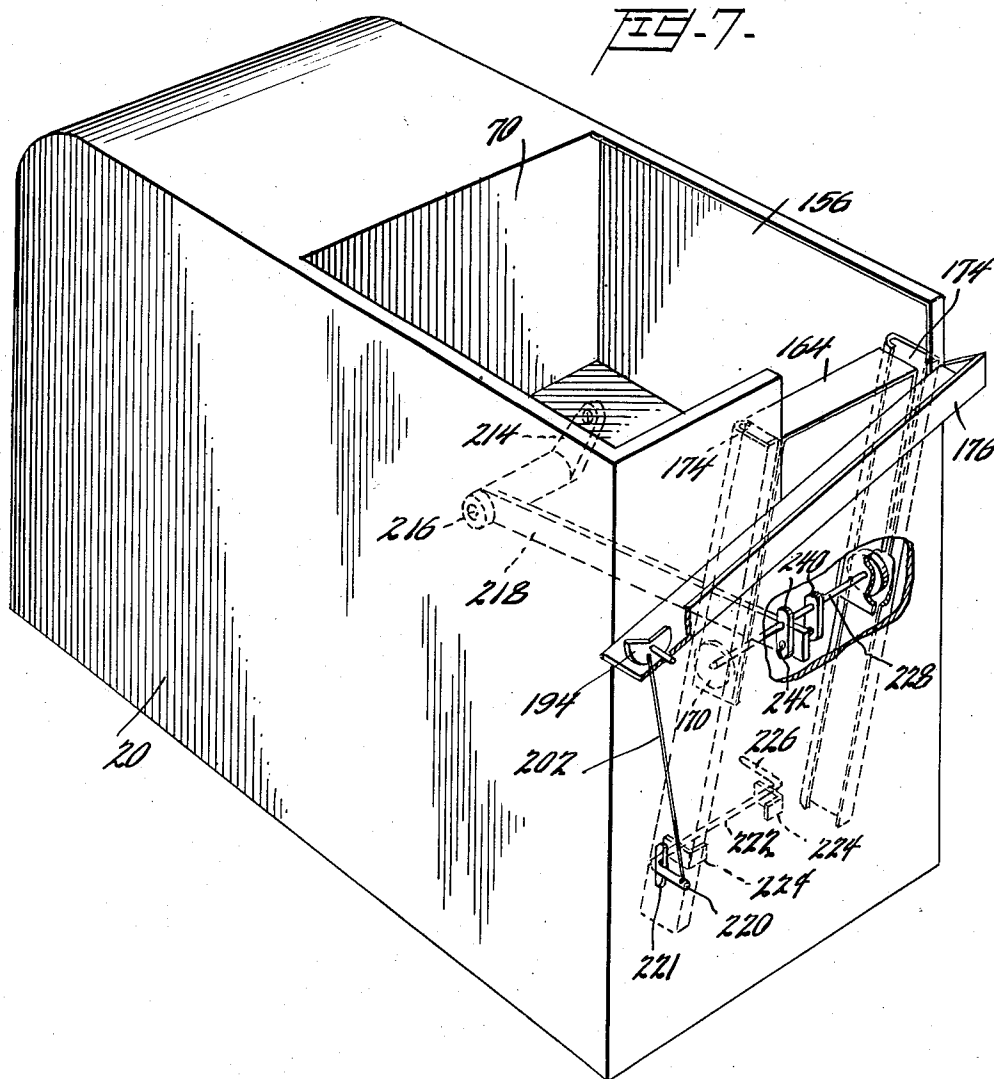
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2,690,169

BASEBALL THROWING MACHINE

Filed March 23, 1951

5 Sheets-Sheet 5



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2,690,169

BASEBALL THROWING MACHINE

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Application March 23, 1951, Serial No. 217,266

18 Claims. (Cl. 124-7)

1

This invention relates to baseball throwers and more particularly to new and useful improvements in the power system for the throwing arm, the individual ball feeding and metering mechanism and in the ball throwing head.

One of the objects of the invention is to provide a simple power system for a ball throwing arm that is more compact, has fewer parts and is more economical to construct and maintain than heretofore known.

Another object of the invention is to provide a power system for the throwing arm that is actuated by a plurality of sources of energy, one of which sources is effective throughout only a predetermined part of the ball throwing stroke of the ball throwing arm.

Another object of the invention is to provide a new and useful system for the individual ball feeding and metering mechanisms.

Another object of the invention is to provide in a ball thrower a ball feeding mechanism that assures a continuous delivery of individual balls to the ball throwing head.

Another object of the invention is to provide in a ball thrower a ball feeding and metering mechanism that is simple in construction and operation.

Another object of the invention is to provide a new and improved ball throwing head for throwing "curved balls."

Another object of the invention is to provide in a ball thrower a new and improved ball throwing head that maintains control of the direction of throw when the thrown balls become wet.

Other objects of the invention will be apparent from the description of the invention as hereinafter set forth in detail and from the drawings made a part hereof in which:

Figure 1 is an isometric view, partly broken away, as seen from the rear and from above the top of a machine representing one embodiment of the invention, in which the balls to be thrown are raised from a storage hopper to a delivery chute by means of a frame or "slide" operated by a drum and cable and in which the throwing arm of the machine is shown at the end of a cycle of operation, that is, the throwing arm is in its position at the end of a throwing stroke or the beginning of a cocking stroke;

Figure 2 is a longitudinal cross-section view of a modification of the invention shown in Figure 1, in which the balls to be thrown are raised from the storage hopper to a delivery chute by means of a slide operated by a bellcrank lever system;

Figure 3 is a horizontal cross-section of the

2

embodiment of the invention shown in Figure 2;

Figure 4 is a front elevation of the machine shown in Figure 2, partially broken away;

Figure 5 is a cross-section view taken on line 5-5 of Figure 3;

Figure 6 is a cross-section view taken on line 6-6 of Figure 3;

Figure 7 is an isometric view of a modification of the invention in which the balls to be thrown are raised from the hopper to a delivery chute by a slide operated by a system of lever arms and links; and

Figure 8 is an isometric view of a modification of the power drive system of the throwing arm shaft.

Similar reference characters are applied to similar elements throughout the drawings.

Briefly described, the machine of this invention consists of a main body that forms supports for the various mechanical elements that furnish power to the throwing arm, which is mounted on and outside the main body, a hopper for the storage of balls, and mechanisms for delivering and metering individual balls to the head of the throwing arm. The main body is mounted on a base with provisions for angularly adjusting the position of the main body with reference to the base, both in a vertical plane or elevation and in a horizontal plane or azimuth.

The source of power for the throwing arm system consists of a motor and a gear box. The rotational motion of the gear box output shaft is converted into an oscillating or reciprocating rotational motion by offsetting a driven shaft axially from the driving shaft and connecting the two shafts together by two drive arms, one on each respective shaft. These drive arms are in contact during only part of the revolution of the driving shaft. The oscillating shaft is spring loaded by a light spring and a heavy spring which return the shaft to its initial position under the force of these two springs when the two arms are not in contact. The throwing arm is keyed to this oscillating shaft and is under the force of the heavy spring during only a portion of its oscillating movement in both directions. This power system for the throwing arm is essentially the same in all drawings. For convenience and clarity in this description and in the claims appended hereto, the motion of the second or driven shaft from its initial position in one direction to a second position, where its engagement with the driving shaft is terminated and the second shaft is free to rotate in the opposite direction, is defined as the cocking stroke and the motion of the driven shaft from this

second position back to its initial position is defined as the throwing stroke. The terms cocking stroke and throwing stroke apply also to the movement of the throwing arm keyed to the driven shaft and to the throwing head at the free end of the throwing arm.

In Figure 2, the heavy spring is shown as two springs connected in parallel by yokes. This arrangement is preferred in some cases when the effect of the inertia of a single heavy spring is desired to be reduced.

In Figures 1, 2, 3, 5 and 6, the driven shaft is shown connected to the driving shaft by a lug on an arm keyed to the driving shaft contacting an arm on the driven shaft. In Figure 8, the driving arm is shown as contacting the driven arm by a hardened roller mounted on a crank arm or link that is pivoted on the driving arm. This latter construction has the advantage of greater accuracy of the point of release by the elimination of wear at the necessarily sharp edges on the driving arm lug and the driven arm as they separate from each other.

The ball-feeding mechanism consists of a frame or slide, the top surface of which slopes downward and toward the front side of the machine. The surface of the slide facing the hopper, in which the balls are stored, is long enough so that its lower edge is below the level of the hopper and the lower edge of the top surface is level with the upper edge of the hopper when the slide is in its upper position and the upper edge of the top surface of the slide is at the level of the floor of the hopper when the slide is in the lower position.

Balls from the hopper roll onto the top surface of the slide when the top surface is below the level of the balls in the hopper and are lifted to the level of a chute juxtaposed the upper edge of the hopper, into which chute the balls roll to be delivered and metered into the throwing head.

The differences between the disclosed feeding and metering mechanisms reside in the supply of power to the slides. In Figure 1, power is supplied by a reciprocating rod, gears, a rotating drum and a cable; in Figure 2, power is supplied by a bell crank lever; and in Figure 7, power is supplied by levers and links.

The throwing head is unique in that it includes two throwing fingers that are independently angularly adjustable with respect to the axis of the throwing arm, to provide for "curved balls" and the surfaces of the fingers are knurled to give control of the balls when wet.

Referring particularly to Figures 1, 2, 3 and 4, 10, 10 are two strips of metal flanged for stiffness and strength that form with cross beams 12 and 14 the base of the machine. Beam 12 is fixed solidly to strips 10 while beam 14 is free to rotate about its axis on pins 16 mounted in the ends of beam 14. Pins 16 rotate in bearings in lugs 18 fastened to strips 10 and may be fixed in position by conventional cotter pins 19. It is thus apparent that the main body of the machine, shown generally as 20, is tiltable in a vertical plane or elevation. The sidewalls of body 20 are designated as 21a and 21b.

The tilt or elevation of the main body 20 is adjusted by turning handle 22 at one end of rod 24, on the other end of which rod is bevel gear 26. Gear 26 meshes with gear 28 which is internally threaded and is in mesh with the threads on rod 30. Gear 28 rotates in bearings (not shown) mounted in beam 32 which is within and is a part of body 20. The lower end of rod 30 bears

upon beam 12 of the base of the machine. When handle 22 is turned in one direction, the right end of body 20 is elevated and when handle 22 is turned in the other direction, body 20 is lowered, body 20 pivoting about pins 16.

Internal body beam 34 is pivotally connected at its longitudinal center to beam 14 by pin 36 which is solidly fixed to beam 14. The upper end of pin 36 is threaded and carries nut 38 and between nut 38 and beam 34 is positioned spring 40. Slide pads 42 are placed between the lower edges of the side walls 21a and 21b of body 20 and beam 14 to reduce friction therebetween as body 20 pivots in a horizontal plane or in azimuth over base beam 14.

The azimuth position of body 20 with reference to base beam 14 is adjusted by a screw-jack arrangement shown in Figures 3 and 4. Threaded rod 44 meshes with internally threaded lug 46 which is fastened to plate 48. Plate 48 is fastened to and extends upwards from strip 10. At the inner end of rod 44 is enlarged head 50 which bears against the side wall 21b of body 20. By turning handle 52 of rod 44 in one direction, body 20 is forced to pivot about pin 36 and is turned in azimuth in reference to the base of the machine. When rod 44 is turned in the other direction, body 20 is forced to follow head 50 by spring 54 which is fastened under tension at one end on lug 56 on body 20 and fastened at the other end by lug 58 on strip 10. It is thus apparent that rod 44 and spring 54 control the azimuth of body 20 as rod 30 slides on beam 12 and rod 30 controls the elevation of body 20 as sidewall 21b slides on enlarged head 50. Plate 48 extends high enough above strip 10 to provide contact between side wall 21b and head 50 for desired elevations of body 20 above the horizontal.

Referring again particularly to Figure 1, 68 is an internal longitudinal partition that is rigidly fixed to transverse partition 70, which in turn is rigidly fixed to the side walls of body 20. These partitions and the bottom of body 20 form the foundation for mounting, by conventional beams and braces, the power unit. The power unit consists of motor 72 which drives, by belt 74 and pulley 76, the input shaft 78 of gear box 80.

Gear box 80 is of the conventional type of reduction gear, with input shaft 78 and output or drive shaft 82. On one end of shaft 82 is keyed drive arm 84, at the outer end of which arm is lug 85.

Referring particularly to Figure 3, offset axially from shaft 82 is a second or driven shaft 86 which is supported near the inner end by bearing 87 which is mounted on partition 68. The outer end of shaft 86 is mounted in bearing 88, fixed in a reinforcing pad 89 in the side wall 21a of body 20.

On the inner end of shaft 86 is keyed the arm 90 that forms a cam surface for contact with lug 85 on arm 84. As arm 84 rotates counterclockwise or to the left to position 84A, lug 85 contacts the under side of arm 90 at position 90A (Figure 6) and turns arm 90 to the left until it reaches position 90B, when lug 85 clears the outer end of and releases arm 90. Arm 90 is then free to rotate clockwise or to the right. When arm 90 is spring loaded to the right and is prevented from rotating beyond a horizontal position, arm 90 will oscillate or have rotational reciprocating motion to the left and to the right between the limiting positions 90A and 90B (Figure 6), under the drive of arm 84 and under the force of the loading springs, respectively.

5

Keyed to shaft 86 is pulley 92 which has an elongated hub 94 on one side thereof. A sector of hub 94 is cut away to form jaw 96. Wound around the periphery of pulley 92 is a flexible cable 98. One end of cable 98 is fixed to pulley 92 and the other end of cable 98 is connected to one end of spring 100. The other end of spring 100 is anchored at 102 to the floor of body 20. Shaft 86 is thereby spring loaded to rotate clockwise throughout both the cocking stroke and the throwing stroke and assures that the throwing arm returns to the said initial or loading position at the end of the throwing stroke.

Juxtaposed the elongated portion 94 of pulley 92 is yoke 104 which is mounted on but is free to rotate on shaft 86. At one side of yoke 104 is a protruding jaw 106 which is engaged by jaw 96 when pulley 92 has been rotated a determined amount by shaft 86. Journalled in yoke 104 is pin 108 on which pin is journalled plug 110 to which rod 112 is attached. The lower end of rod 112 engages one end of the strong, heavy, main-power or throwing spring 114. The other end of spring 114 is connected by cable 116 to an internally threaded nut 118 over pulley 120 (see Figure 2). Nut 118 slides in grooves in beam 119, which prevents nut 118 from rotating about its axis. Threaded rod 122, mounted in bearings 123 in the rear of body 20, engages nut 118. By turning handle 124 or rod 122, the tension of spring 114 may be adjusted.

Keyed to shaft 86 and on the outside of body 20 is throwing arm 126, which is shown in its extreme right or initial position, resting on lug 128 that is fastened to the side wall of body 20. Arm 126 is kept in this position under the tension of spring 100 only, jaws 96 and 106 not being engaged until lug 85 has engaged arm 90 and has rotated arm 126 to the left to a predetermined angle. When arm 90 is released from contact with lug 85, arm 126 is urged to the right under tension of springs 100 and 114, until jaws 96 and 106 disengage. Arm 126 is then under tension of spring 100 only which is a weaker spring than spring 114.

At the free end of arm 126 is positioned the throwing head shown generally at 130. The lower part of head 130 consists of a basket-like frame of metal strips 132 spaced apart less than the diameter of the baseballs to be thrown. Strips 132 are fastened to arm 126. The upper part of head 130 consists of throwing fingers 134. Fingers 134 are pivotally mounted on pin 136 set in arm 126 and are held in adjusted angular relation with arm 126 by arcuate grooved lugs 138 fastened on the upper sides of fingers 134 and engaging nuts 140 on pin 142, which is set in arm 126. (See also Figure 2.) Fingers 134 are thus clamped in position by nuts 140, screwed on a threaded pin 142 that passes through and is solid with the end of arm 126. Fingers 134 are adjustable independently of each other.

The latter part of the clockwise rotation of arm 136 is cushioned by a conventional dash pot 144 mounted on frames 146 fixed to the interior of body 20. The operating arm 148 of dash pot 144 is pivoted on pin 150 supported by partition 68. A roller-follower 152 on arm 148 contacts cam 154, which is keyed to shaft 86, as arm 126 approaches stop lug 128.

The baseballs to be thrown are deposited in a hopper or bin, shown generally at 156. The front and sides of hopper 156 are conventional vertical partitions secured to body 20, such as 70. The bottom of the hopper slopes downwardly towards

6

the front of the machine and towards one lateral side of the hopper so that when the hopper is nearly empty the last few balls will be at the side of the hopper near the slide 162, which does not extend fully across the width of body 20. The lower and upper side edges of the bottom of the hopper are shown at 158 and 160, respectively, Figure 2.

At the front wall of the hopper is a sliding frame or slide shown generally at 162. Slide 162 consists of a top surface 164 that slopes downwardly towards the front of the machine, and a solid surface 166 that is long enough so that in its upper position the bottom edge of the surface 166 is below the level of the bottom of the hopper. The two side surfaces 168 of slide 162 support rollers 170 that move in guide grooves 172 in channel beams 174 that are secured to the front frames and bottom frames of body 20. The back and the bottom of slide 162 are open. The slide may be mounted for movement in a vertical direction, such as is shown in Figure 1, in which case the lower edge of top surface 164 follows the front wall of body 20, to prevent balls from falling behind slide 162 when it is lowered or raised. If the slide 162 is mounted at an angle to the vertical, as shown in Figure 2, a light partition 175 is positioned at the same angle to the vertical as slide 162 with the upper edge of partition 175 level with the upper position of the lower or front edge of top surface 164.

The upper portion of the front wall of body 20 is cut away vertically a distance substantially equal to the diameter of the baseballs, to permit the balls to roll from surface 164 into chute 176. The portion of chute 176 opposite the cut away portion of the hopper is in the form of an open trough with its end closed. Battens 177 (Figure 4) form a cover for the remaining portion of the chute. Chute 176 slopes downward toward head 130 when head 130 is in its extreme right or initial position.

Surface 164 is long enough to bring up several balls on each cycle of movement. If the chute 176 is full because the balls brought up by the slide on previous cycles have not been thrown, the excess balls merely fall back in the hopper or are carried back down into the hopper on the surface 164.

In the machine illustrated in Figure 1, slide 162 is moved by a flexible cable 178 that is attached at the bottom edge and at the upper edge of slide 162 and wound about drum 179. Drum 179 is mounted on shaft 180 on bearings (not shown) fixed to body 20. Shaft 180 receives its angular reciprocating motion by gear 182 keyed to shaft 180, which gear meshes with sector gear 184 that pivots about its center on pin 186, which pin is supported on body 20. Gear 184 is connected by off-center pin 188 to rod 190, which rod is connected by pin 191 to arm 192 continuously driven by output shaft 82 of gear box 80. Thus a reciprocating motion of rod 190 is transformed into a reciprocating rotational motion of drum 178.

At the lower end of chute 176 is positioned a gate to meter or permit but one ball at a time to enter head 130 for each cycle of arm 126. The gate consists of a sector of a plate 194 (see Figure 4) pivoted on pin 196. Plate 194 is spring loaded, as by spring 198 attached thereto and to body 20 at 200, such that a ball rests in the cut-out sector of the plate until one side of plate 194 is drawn down by cable 202. Cable 202 is also connected to arm 203 (see Figure 1), which is

pivoted on body 20. Arm 203 receives its motion by lug 204 on plate 206 that is keyed to shaft 180. Lug 204 on plate 206 is so positioned relative to the position of pin 191 on arm 192 on shaft 82 that lug 204 engages arm 203 after arm 90 has become disengaged from lug 85 and arm 126 has rotated to and has stopped at its extreme right position and before lug 85 again engages arm 90 on the next rotational cycle of lug 85. This positional relation between lug 204 and pin 191 assures that head 130 on throwing arm 126 will be opposite the open end of chute 176 when the gate is tripped by cable 202.

In operation baseballs are placed in hopper 156 and in chute 176 and gate 198 is tripped to permit a ball to roll into basket 130, arm 126 being at its initial position under the force of spring 100.

The machine is turned in the direction that the ball is to be thrown and the tension of spring 114 is adjusted by turning handle 124 according to the velocity at which the ball is desired to be thrown.

Throwing fingers 134 are adjusted relative to each other according to whether a "straight ball" or a "curved ball" is desired to be thrown. If a "straight ball" is desired, the two fingers 134 are adjusted level with each other. If a "curved ball" is desired, one finger is adjusted to a position above the other to give a back-spin or a side-spin to the thrown ball.

Throwing fingers 134 are also adjusted in their axial relation to throwing arm 126 as a control of the elevation of the throw of the ball. It is obvious that the greater the angle of elevation of the fingers above the axis of arm 126, the higher will be the throw. However, fingers 134 are not adjusted angularly above the axis of throwing arm 126, although they may be adjusted to approach the axis of arm 126.

Motor 70 is started, which drives input shaft 78 of gear box 80, which causes output shaft 82 to rotate.

When lug 85 on arm 84 contacts arm 90 on shaft 86, shaft 86 is rotated to the left against the tension of spring 100. When jaw 96 on pulley elongated part 94 engages jaw 106 on yoke 104, motor 72 continues to rotate shaft 86 against the tension of both spring 100 and spring 114. During this part of the cycle, cam 154 is out of contact with roller 152 on arm 148 and the plunger in dash pot 144 moves in its unrestricted direction. Throwing arm 126, carrying a ball in basket 130, is likewise rotating to the left.

When lug 85 slips off the end of arm 90, which is at the end of the cocking stroke (position 50B, Figure 6), throwing arm 126 rotates to the right under the force of springs 114 and 130 until jaws 96 and 106 separate, when throwing arm 126 continues to rotate to the right under tension of spring 100 until arm 126 reaches stop lug 128, thus completing the throwing stroke. During the latter part of the rotation of arm 126 to the right, cam 154 contacts roller 152 on arm 148 of dash pot 144 and arm 126 is brought to a slow angular velocity as it reaches and stops on lug 128. The rotative positions of the faces of jaws 96 and 106 are such that they disengage when throwing arm 126 has passed its vertical position on the throwing stroke.

In the meantime, shaft 82 has rotated arm 192, which has produced a cycle of linear movement of rod 190. This movement is transformed to a cycle of reciprocating rotational movement of shaft 180 through gears 182 and 184, whereby slide 162 has been moved down and up to carry balls from hopper 156 to chute 176. Also gate 194

has been tripped to meter or allow another ball to roll into basket 130, after basket 130 has stopped opposite the lower end of chute 176.

During the operation of the machine through a series of thrown balls, the balls may be thrown to the right or left of the initial position in relation to a batter of the balls by turning crank 52. Adjustments for windage may also be made by turning crank 52. If it is desired to throw the balls higher or lower relative to the initial position of the batter, the body 20 may be angularly elevated or depressed by turning handle 22.

Referring particularly to Figures 2, 3, and 4, there is shown therein modifications of the invention shown in Figure 1.

The throwing arm spring power system is the same in all figures, except that in Figure 2 heavy power spring 114 is a double or parallel spring, consisting of springs 114a and 114b, connected together at their ends by yokes 208. The upper yoke is connected by lug 210 to plug 118. The lower yoke 208 is connected to cable 118.

Reciprocating linear motion of slide 162 is obtained by arm 192, turned by gear box shaft 82. Arm 192 is pinned to rod 212 which is pinned to one leg 214 of a bell crank lever journaled on body 20 at 216. The other leg 216 of the bell crank lever extends through a slot in a frame 217 that is secured to face 166 of slide 162 at its bottom edge. Rollers 219 are journaled in frame 217 to reduce the friction of leg 218 as it slides through the frame 217, as leg 218 is angularly rotated above the pivot journal 216 of the bell crank lever.

The gate plate 194 receives its ball metering or tripping motion from shaft 222, which is mounted in bearings 224 fastened to the inside face of the front side of the machine. End 226 of shaft 222 is bent at right angles to extend inwardly the body 20 and to engage rollers 219 as the rollers move up and down with slide 162. End 220 of shaft 222 is bent at right angles and protrudes through the front side of the machine through slot 221. The outer end of end 220 of shaft 222 is connected by cable 202 to gate plate 194.

On the down phase of the movement cycle of slide 162, shaft-end 226 of shaft 222 is moved downward, which merely slackens cable 202. Gate plate 194 is not moved thereby as it is spring loaded by spring 200. However, upon the upward movement of slide 162, shaft 222 is rotated in the opposite direction and cable 202 is pulled down and trips gate plate 194 which meters or permits a single ball to roll into throwing head 130.

In Figures 2, 3, and 4, the angular elevation of body 20 relative to the base of the machine is accomplished by turning rod 30, as hereinbefore described, except that rod 30 is turned directly by handle 22a without beveled gears. Handle 22a is the extension of rod 30, the threaded portion thereof meshing with internally threaded tube 230 fastened to main body 20. The upper end of rod 30 is supported by bearings 232.

Referring particularly to throwing head, shown generally at 130 and 130a, respectively in Figures 2 and 4, the throwing fingers 134 are formed of sheet metal flanged as at 134a. The basket strips 132 are sheet metal braced by rods 132a.

As a ball may be thrown out from head 130 at the instant of first left angular movement of throwing arm 126, which at best operating conditions may be somewhat jerky, guard 236 is

mounted on the front face of body 20. This guard is supported on bracket 238 fastened to body 20 and extends upward to a point above the ends of strips 132.

In the modification of the power system for cyclically moving the slide 162, shown in Figure 7, the leg 218 of the bell crank lever pivoted at 216 is connected to shaft 228 upon which rollers 170 revolve as the rollers travel in channel beams 174. As the free end of leg 218 has arcuate movement about point 216, the end of leg 218 is connected to links 240 near one of their respective ends by pin 242. The other of the respective ends of links 240 pivot about shaft 228.

The tripping of gate plate 194 by shaft 222 and cable 202 is accomplished as heretofore described, except that bent end 226 of shaft 222 engages shaft 228.

In the modification shown in Figure 8, arm 84 keyed to shaft 82 carries near its free end a crank or link 244 which is journaled at one of its ends on pin 246 set in arm 84. At the other end of link 244 is secured pin 248a on which is journaled a hardened roller 248, which rotates with arm 84 in the plane of rotation of arm 90 keyed to shaft 86. When roller 248 engages the lower surface of arm 90 and as shaft 82 continues to rotate counterclockwise, roller 248 approaches and overruns edge 250 of arm 90 and releases arm 90 with a snap-action. It has been found that the release point of arm 90 is more consistently accurate than when plain lug 85 on arm 84 is used and the roller 248 is not subject to wear as much as lug 85, which must be maintained with sharp working edges to assure accuracy.

What I claim is:

1. In a ball throwing machine in combination: a continuously rotating power drive shaft, a second shaft, a throwing arm keyed to said second shaft, a throwing head at the free end of said arm, means connected to said power shaft and to said second shaft for rotating said second shaft intermittently in one direction from an initial position through a cocking stroke to a second position at which second position the said second shaft is free to rotate in the opposite direction through a throwing stroke, means for resiliently opposing the rotation of said second shaft throughout the rotation of said second shaft in the said one direction, means for resiliently opposing the rotating of said second shaft through only the latter portion of the rotation of said second shaft in the said one direction, whereby the said throwing arm is cocked by said drive shaft against a plurality of resilient forces and the said throwing arm is rotated during the throwing stroke thereof by said forces, one of which forces being effective throughout the cocking and the throwing strokes and the other of which forces being effective through only a portion of said strokes, and means for delivering balls singly into said throwing head for each cycle of cocking and throwing strokes and when said head is in the said initial position.

2. In a ball throwing machine in combination: a continuously rotating power drive shaft, a drive arm keyed to said power shaft, a lug on said arm at the free end thereof, a second shaft parallel to and axially offset from said power shaft a distance less than the length of said drive arm, a throwing arm keyed to said second shaft, a throwing head at the free end of said throwing arm, an arm keyed to said second shaft and in the plane of rotation of said lug and of such

length as to be in intermittent contact with said drive arm, whereby said second shaft is cocked in one direction from an initial position through a cocking stroke to a second position whereupon the said second shaft is free to rotate in the opposite direction through a throwing stroke, a plurality of resilient means of different strengths for opposing the force of said drive shaft and for returning said second shaft from said second position to said initial position, the stronger of said resilient means being effective over only a portion of the rotation of said second shaft between the said positions and the weaker of said resilient means being effective throughout the rotations of said second shaft between said positions, and means for delivering balls singly into said throwing head for each cycle of cocking and throwing strokes and when said head is in the said initial position.

3. In a ball throwing machine in combination: a continuously rotating power drive shaft, a drive arm keyed to said power shaft, a link pivotly mounted on said arm at the free end thereof, a roller pivotly mounted on said link, a second shaft parallel to and axially offset from said power shaft a distance less than the length of said drive arm, a throwing arm keyed to said second shaft, a throwing head at the free end of said throwing arm, an arm keyed to said second shaft and in the plane of rotation of said roller and of such length as to be in intermittent contact with said drive arm, whereby said second shaft is cocked in one direction from an initial position through a cocking stroke to a second position whereupon the said second shaft is free to rotate in the opposite direction through a throwing stroke, a plurality of resilient means for opposing the force of said drive shaft and for returning said second shaft from said second position to said initial position, one of said resilient means being effective over only a portion of the rotation of said second shaft between the said positions and the other resilient means being effective to spring load said arm throughout the cocking and the throwing strokes, and means for delivering balls singly into said throwing head for each cycle of cocking and throwing strokes and when said head is in the said initial position.

4. In a ball throwing machine in combination: a continuously rotating power drive shaft, a drive arm keyed to said power shaft, a lug on said arm at the free end thereof, a second shaft parallel to and axially offset from said power shaft a distance less than the length of said drive arm, a throwing arm keyed to said second shaft, a throwing head at the free end of said throwing arm, an arm keyed to said second shaft and in the plane of rotation of said lug and of such length as to be in intermittent contact with said drive arm, whereby said second shaft is cocked in one direction from an initial position through a cocking stroke to a second position whereupon the said second shaft is free to rotate in the opposite direction through a throwing stroke, a plurality of springs for opposing the force of said drive shaft and for returning said second shaft from said second position to said initial position, one of said springs being the heavier and effective over only a latter portion of the rotation of said shaft from the said initial position to said second position and effective over only a corresponding portion of the rotation of said shaft from said second position to said initial position the other said spring being the lighter

and effective throughout said rotation, and means for delivering balls singly into said throwing head for each cycle of cocking and throwing strokes and when said head is in the said initial position.

5. In a ball throwing machine in combination: a continuously rotating power drive shaft, a second shaft, a throwing arm keyed to said second shaft, a throwing head at the free end of said arm, means connected to said power shaft and to said second shaft for rotating said second shaft intermittently in one direction from an initial position through a cocking stroke to a second position at which second position the said second shaft is free to rotate in the opposite direction through a throwing stroke, a light spring for resiliently opposing the rotation of said second shaft throughout the rotation of said second shaft in the said one direction, a heavy spring for resiliently opposing the rotating of said second shaft through only the latter portion of the rotation of said second shaft in the said one direction, whereby the said throwing arm is cocked by said drive shaft against a plurality of resilient forces and the said throwing arm is rotated through corresponding portions of the throwing stroke thereof by said forces, cushioning means for decreasing the velocity of said second shaft as the said second shaft approaches the said initial position from said second position, and means for delivering balls singly into said throwing head for each cycle of cocking and throwing strokes and when said head is in the said initial position.

6. In a ball throwing machine in combination: a continuously rotating power drive shaft, a second shaft, a throwing arm keyed to said second shaft, a throwing head at the free end of said arm, means connected to said power shaft and to said second shaft for cocking said second shaft intermittently in one direction from an initial position through a cocking stroke to a second position at which second position the said second shaft is free to rotate in the opposite direction through a throwing stroke, a pulley keyed to said second shaft, said pulley having an axially elongated hub of which a sector portion is cut away to form a jaw on said hub, a relatively weak spring connected to said pulley, a yoke journaled on said second shaft, said yoke being cut away to form a jaw thereon, the said pulley jaw and said yoke jaw being juxtaposed for engagement and rotational engagement with each other, a relative strong spring connected to said yoke, and means for delivering balls singly into said throwing head for each cycle of cocking and throwing strokes and when said head is in the said initial position.

7. In a ball throwing machine in combination: a continuously rotating power drive shaft, a second shaft, a throwing arm keyed to said second shaft, a throwing head at the free end of said arm, means connected to said power shaft and to said second shaft for cocking said second shaft intermittently in one direction from an initial position through a cocking stroke to a second position at which second position the said second shaft is free to rotate in the opposite direction through a throwing stroke, a pulley keyed to said second shaft, said pulley having an axially elongated hub a sector portion of which is cut away to form a jaw on said hub, a first resilient means connected to said pulley, a yoke journaled on said second shaft, said yoke being cut away to form a jaw thereon, the said pulley jaw and

said yoke jaw being juxtaposed for engagement and rotational engagement with each other, a second resilient means stronger than said first resilient means connected to said yoke, means for adjusting the force exerted by said second resilient means, and means for delivering balls singly into said throwing head for each cycle of cocking and throwing strokes and when said head is in the said initial position.

8. In a ball throwing machine in combination: a continuously rotating power drive shaft, a second shaft, a throwing arm keyed to said second shaft, a throwing head at the free end of said arm, means connected to said power shaft and to said second shaft for cocking said second shaft intermittently in one direction from an initial position through a cocking stroke to a second position at which second position the said second shaft is free to rotate in the opposite direction through a throwing stroke, a pulley keyed to said second shaft and having a jaw protruding axially therefrom, a cable wound on said pulley one end of which cable is fixed to said pulley, a first spring one end of which spring is anchored to said machine and the other end of which spring is connected to the other end of said cable, a yoke rotatably mounted on said second shaft and having a jaw protruding therefrom into the plane of rotation of said pulley jaw, a second spring stronger than said first spring connected to said yoke resiliently restraining the movement of said yoke about its axis from a primary position, the said jaw on said yoke in its primary position being angularly displaced from the said pulley jaw when said second shaft is in said initial position, whereby the said jaws are engaged during a latter portion of the cocking stroke of said second shaft and are disengaged during a latter portion of the throwing stroke of said second shaft, and means for delivering balls singly into said throwing head for each cycle of cocking and throwing strokes and when said head is in the said initial position.

9. In a ball throwing machine in combination: a continuously rotating power drive shaft, a second shaft, a throwing arm keyed to said second shaft, a throwing head at the free end of said arm, means connected to said power shaft and to said second shaft for cocking said second shaft intermittently in one direction from an initial position through a cocking stroke to a second position at which second position the said second shaft is free to rotate in the opposite direction through a throwing stroke, a pulley keyed to said second shaft and having a jaw protruding axially therefrom, a cable wound on said pulley one end of which cable is fixed to said pulley, a first spring one end of which spring is anchored to said machine and the other end of which spring is connected to the other end of said cable, a yoke rotatably mounted on said second shaft and having a jaw protruding therefrom into the plane of rotation of said pulley jaw, a second spring stronger than said first spring and connected to said yoke resiliently restraining the movement of said yoke about its axis from a primary position, means for adjusting the tension of said second spring, the said jaw on said yoke in its primary position being angularly displaced from the said pulley jaw when said second shaft is in said initial position, whereby the said jaws are engaged during a latter portion of the cocking stroke of said second shaft and are disengaged during a latter portion of the throwing stroke of said second

shaft, and means for delivering balls singly into said throwing head for each cycle of cocking and throwing strokes and when said head is in the said initial position.

10. In a ball throwing machine in combination: a ball throwing arm including a throwing head at one end thereof, means for cyclically rotating said arm from an initial position to a second position and back to said initial position, a hopper for the storage of balls to be thrown, a chute juxtaposed at one end an upper edge of said hopper and juxtaposed at the other end the said throwing head in said initial position, guide channels in said hopper extending from the said upper edge of said hopper to a position below the floor of said hopper, a slide guided by said channels, the top face of said slide sloping downward and toward said chute and the lower edge of the front face being lower than the floor of said hopper when said slide is in its upper position, means for moving said slide cyclically from said upper position to a lower position where the said top face is level with the floor of said hopper, means for metering the balls in said chute into said head when said head is in said initial position, and means connected to said slide for tripping said metering means.

11. In a ball throwing machine in combination: a ball throwing arm including a throwing head at one end thereof, means including a drive shaft for cyclically rotating said arm from an initial position to a second position and back to said initial position, a hopper for the storage of balls to be thrown, a chute juxtaposed at one end an upper edge of said hopper and juxtaposed at the other end the said throwing head in said initial position, guide channels in said hopper extending from the said upper edge of said hopper to a position below the floor of said hopper, a slide guided by said channels, the top face of said slide sloping downward and toward said chute and the lower edge of the front face being lower than the floor of said hopper when said slide is in its upper position, a second shaft mounted within said machine parallel to the front face of said slide, a drum keyed to said second shaft, a cable connected at one end to a top edge of said slide and at the other end to a bottom edge of said slide, the said cable being wound around the periphery of said drum, a gear on said second shaft, a gear sector in mesh with said gear, the said gear sector being pivoted at its center, a driving lever on said drive shaft, a rod connected at one end thereof to said driving lever and at the other end thereof to said gear sector and off-center thereto, whereby the rotary motion of said drive shaft is transformed into reciprocating motion of said slide means for metering the balls in said chute into said head when said head is in said initial position, and means connected to said slide for tripping said metering means.

12. In a ball throwing machine in combination: a ball throwing arm including a throwing head at one end thereof, means including a drive shaft for cyclically rotating said arm from an initial position to a second position and back to said initial position, a hopper for the storage of balls to be thrown, a chute juxtaposed at one end an upper edge of said hopper and juxtaposed at the other end the said throwing head in said initial position, guide channels in said hopper extending from the said upper edge of said hopper to a position below the floor of said hopper, a slide guided by said channels, the top

face of said slide sloping downward and toward said chute and the lower edge of the front face being lower than the floor of said hopper when said slide is in its upper position, a drive arm on said drive shaft, a bell crank lever pivoted within said machine, a rod connected to said drive arm and to one leg of said bell crank lever, the free end of the other leg of said bell crank lever being in movement contact with said slide at the bottom thereof, whereby the rotary motion of said drive shaft is transformed into reciprocating motion of said slide means for metering the balls in said chute into said head when said head is in said initial position, and means connected to said slide for tripping said metering means.

13. In a ball throwing machine in combination: a ball throwing arm including a throwing head at one end thereof, means including a drive shaft for cyclically rotating said arm from an initial position to a second position and back to said initial position, a hopper for the storage of balls to be thrown, a chute juxtaposed at one end an upper edge of said hopper and juxtaposed at the other end the said throwing head in said initial position, guide channels in said hopper extending from the said upper edge of said hopper to a position below the floor of said hopper, a slide guided by said channels, the top face of said slide sloping downward and toward said chute and the lower edge of the front face being lower than the floor of said hopper when said slide is in its upper position, a drive arm on said drive shaft, a bell crank lever pivoted within said machine, a rod connected to said drive arm and to one leg of said bell crank lever, a frame positioned at the lower portion of said slide, a pair of rollers journaled one above the other in said frame, the other leg of said bell crank lever being in contact with both of said rollers, whereby the rotary motion of said drive shaft is transformed into reciprocating motion of said slide means for metering the balls in said chute into said head when said head is in said initial position, and means connected to said slide for tripping said metering means.

14. In a ball throwing machine in combination: a ball throwing arm including a throwing head at one end thereof, means including a drive shaft for cyclically rotating said arm from an initial position to a second position and back to said initial position, a hopper for the storage of balls to be thrown, a chute juxtaposed at one end an upper edge of said hopper and juxtaposed at the other end the said throwing head in said initial position, guide channels in said hopper extending from the said upper edge of said hopper to a position below the floor of said hopper, a slide guided by said channels, the top face of said slide sloping downward and toward said chute and the lower edge of the front face being lower than the floor of said hopper when said slide is in its upper position, a drive arm on said drive shaft, a bell crank lever pivoted within said machine, a rod connected to said drive arm and to one leg of said bell crank lever, a shaft journaled in the sides of said slide and positioned in the lower portion of said slide, and links connecting the end of the other leg of said bell crank lever and said slide shaft, whereby the rotary motion of said drive shaft is transformed into reciprocating motion of said slide means for metering the balls in said chute into said head when said head is in said initial position, and means connected to said slide for tripping said metering means.

15. In a ball throwing machine in combination: a ball throwing arm including a throwing head at one end thereof, means including a drive shaft for cyclically rotating said arm from an initial position to a second position and back to said initial position, a hopper for the storage of balls to be thrown, a chute juxtaposed at one end an upper edge of said hopper and juxtaposed at the other end the said throwing head in said initial position, guide channels in said hopper extending from the said upper edge of said hopper to a position below the floor of said hopper, a slide guided by said channels, the top face of said slide sloping downward and toward said chute and the lower edge of the front face being lower than the floor of said hopper when said slide is in its upper position, a drive arm on said drive shaft, a bell crank lever pivoted within said machine, a rod connected to said drive arm and to one leg of said bell crank lever, a shaft journaled in the side of said slide and positioned in the lower portion of said slide, links connecting the end of the other leg of said bell crank lever and said slide shaft, whereby the rotary motion of said drive shaft is transformed into reciprocating motion of said slide means for metering the balls in said chute into said head when said head is in said initial position, comprising a tripping rod journaled within said machine, one end of said rod being bent to engage said slide shaft as said slide moves in said channels, the other end of said rod being bent and protruding through the wall of said machine on which the said chute is positioned, and a flexible cable connected at one end to said protruding end of said tripping rod and at the other end to said metering means.

16. In a ball throwing machine in combination: a ball throwing arm including a throwing head at one end thereof, means for cyclically rotating said arm through a cocking stroke from an initial position to a second position and back through a throwing stroke to said initial position, means for delivering balls singly into said throwing head for each cycle of cocking and throwing strokes and when said head is in said initial position, the said head consisting of a frame on one side of said throwing arm for supporting the ball to be thrown as said arm moves from said initial position to a vertical position in said cocking stroke and throwing fingers pivoted to and on the other side of said throwing arm to support said ball during the remainder of said cocking stroke and to accelerate the said ball during part of the throwing stroke of said arm, the said throwing fingers being independently adjustable in relative positions to each other in the planes of movement of said fingers.

17. In a ball throwing machine in combination: a ball throwing arm including a throwing head at one end thereof, means for cyclically rotating said arm through a cocking stroke from

an initial position to a second position and back to said initial position through a throwing stroke, and means for delivering balls singly into said throwing head for each cycle of cocking and throwing strokes and when said head is in said initial position, the said head consisting of a frame on one side of said throwing arm for supporting the ball to be thrown as said arm moves from said initial position to a vertical position in said cocking stroke and throwing fingers pivoted to and on the other side of said throwing arm to support said ball during the remainder of said cocking stroke and to accelerate the said ball during part of the throwing stroke of said arm, the said throwing fingers consisting of flanged sheet metal plates, the said plates being pivoted independently to and on opposite sides of said throwing arms, each plate having an arcuate slot cut therein, a threaded pin in the throwing arm opposite said slots, and clamping means for holding said fingers in predetermined angular relations to each other.

18. In a ball throwing machine in combination: a ball throwing arm including a throwing head at one end thereof, means for cyclically rotating said arm through a cocking stroke from an initial position to a second position and back through a throwing stroke to said initial position, and means for delivering balls singly into said throwing head for each cycle of cocking and throwing strokes and when said head is in said initial position, the said head consisting of a frame on one side of said throwing arm for supporting the ball to be thrown as said arm moves from said initial position to a vertical position in said cocking stroke and throwing fingers pivoted to and on the other side of said throwing arm to support said ball during the remainder of said cocking stroke and to accelerate the said ball during part of the throwing stroke of said arm, the said throwing fingers consisting of two flanged sheet metal plates, the said plates being pivoted independently to and on opposite sides of said throwing arm, each plate having an arcuate slot cut therein, and each plate being knurled on the surfaces thereof that are in contact with the ball in the head during the throwing stroke of said throwing arm, a threaded pin in the throwing arm opposite said slots, and clamping means for holding said fingers in predetermined angular relations to each other, and to the axis of said throwing arm.

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