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Eade et al.

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[54] CENTRIFUGAL SPRING TYPE PROJECTILE THROWING DEVICE

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[52] **U.S. Cl.**.....**124/7,** 124/34, 124/36, 124/50, 124/30 R, 273/26 D, 124/32, 235/151
[51] **Int. Cl.**.....**F41b 3/02,** F41b 7/00
[58] **Field of Search**.....124/6, 7, 8, 9, 36, 34, 41, 124/50, 32; 273/26 D

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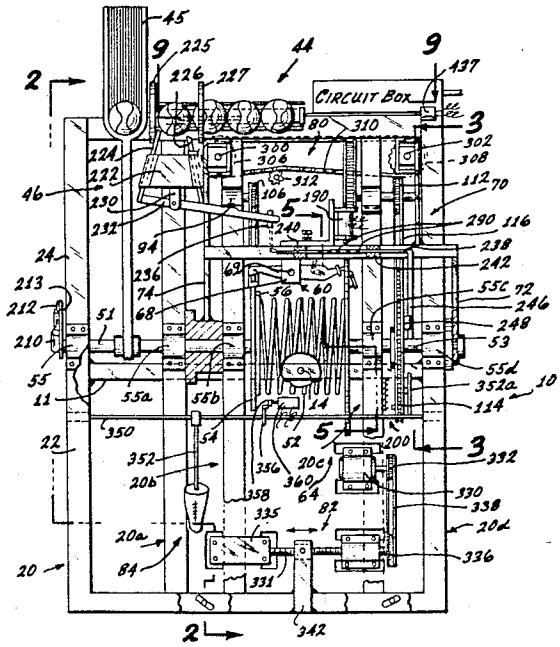
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[57] **ABSTRACT**

A projectile throwing machine exemplified herein as a baseball pitching machine. A throwing arm is driven by a torsion spring which is wound up by a motor and which is automatically triggered for releasing the throwing arm. The trigger is automatically released by actuating levers which are remotely controllable to control the amount of power, that is, torsion in the spring at the time of release to thereby control the speed of pitch. The balls are fed automatically. The machine is adjustable in elevation and azimuth to control the height and lateral position of the pitch and all adjustments are remotely controllable from a console and subject to programming. The machine after being started will repeatedly cycle automatically under remote control. Means are provided to indicate to a batter when a pitch is about to be made and also there are indicator means to indicate the position of the pitched ball relative to the plate.

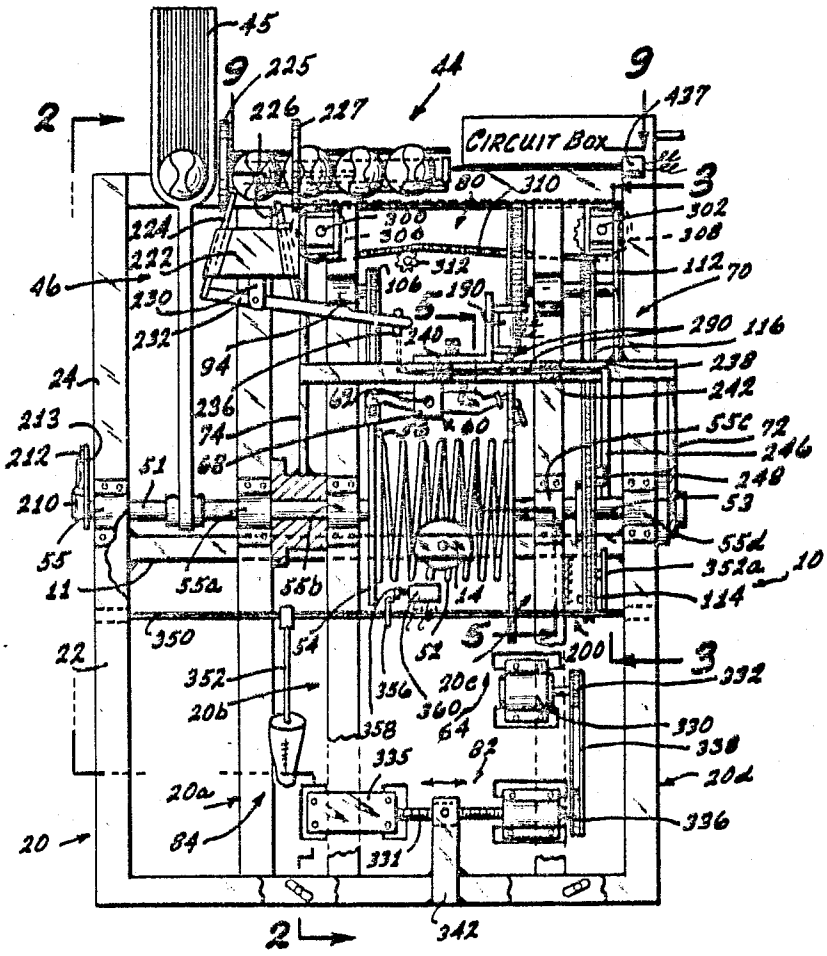
17 Claims, 17 Drawing Figures



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7 Sheets-Sheet 1

Fig. 1



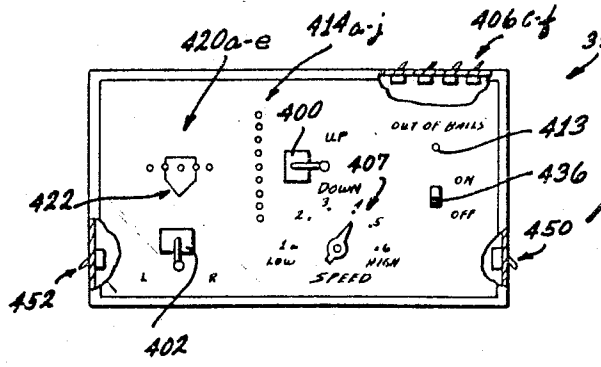
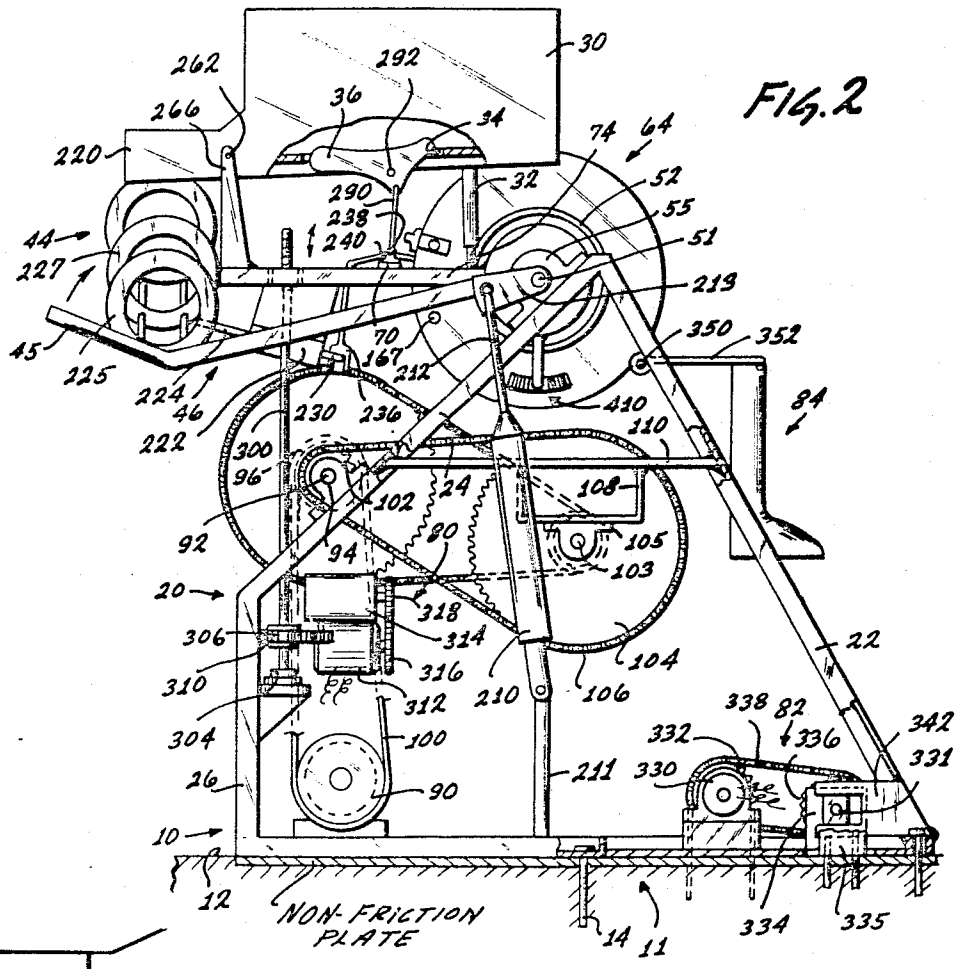


Fig. 1A

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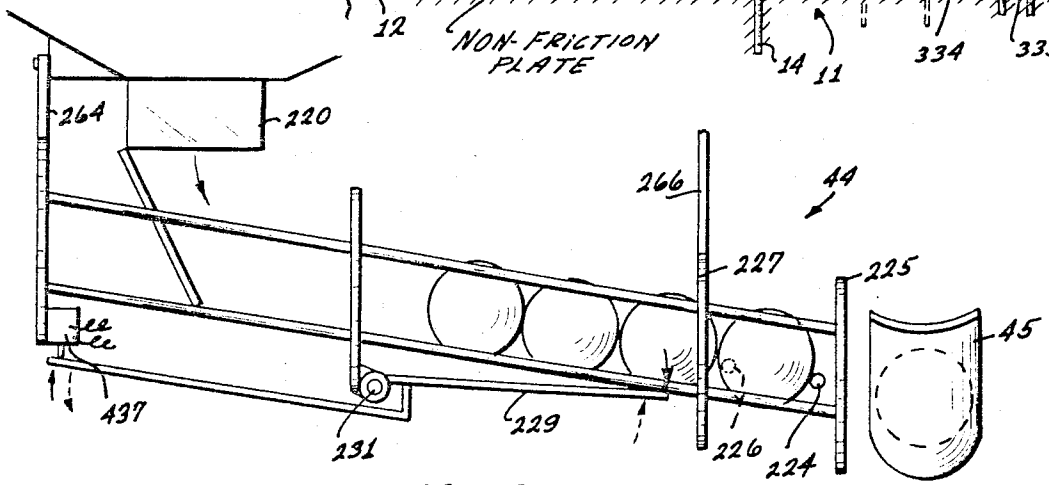


FIG. 9

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Fig. 3

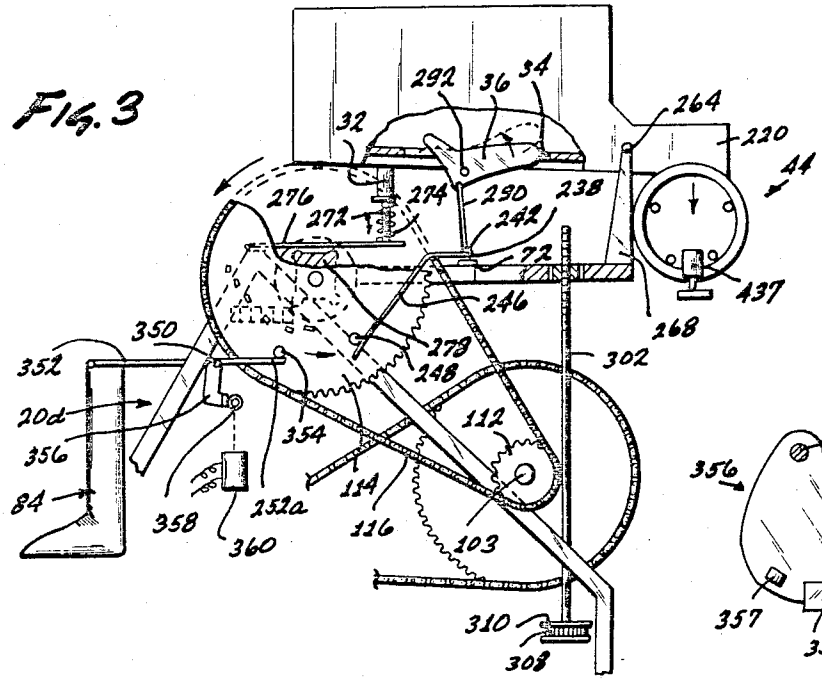
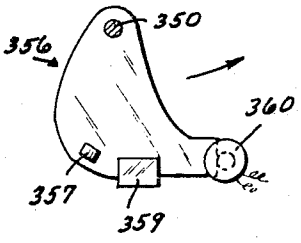


Fig. 3A



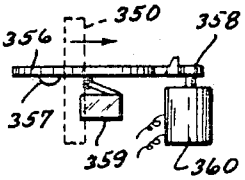
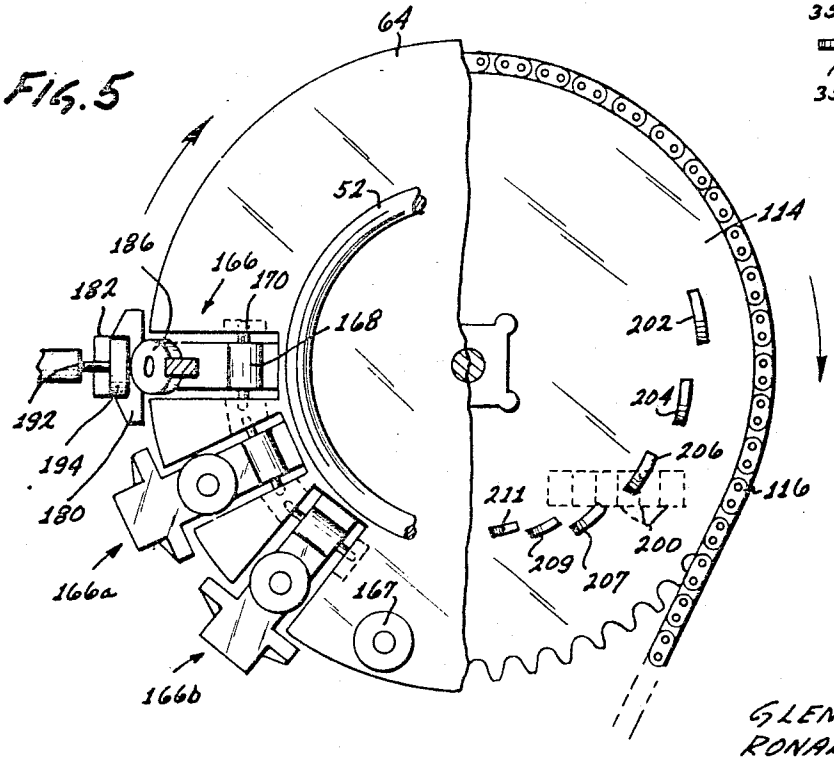


Fig. 3B

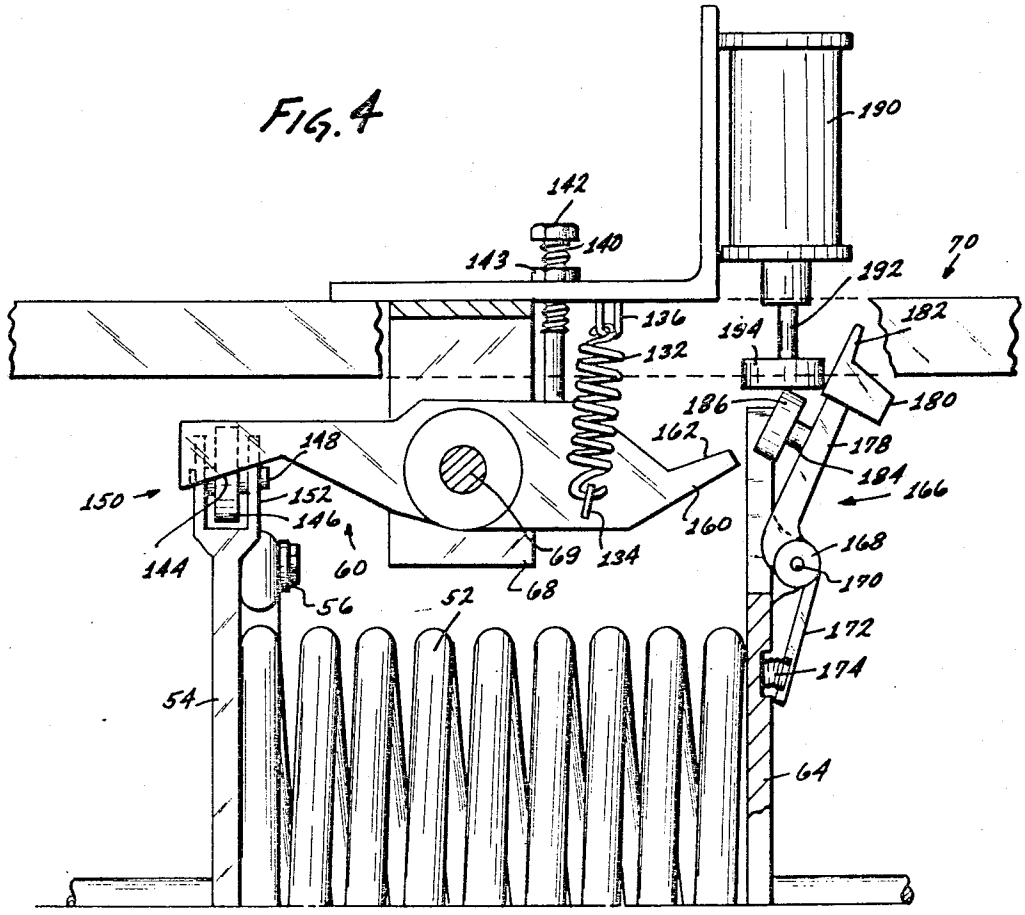
Fig. 5



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FIG. 4



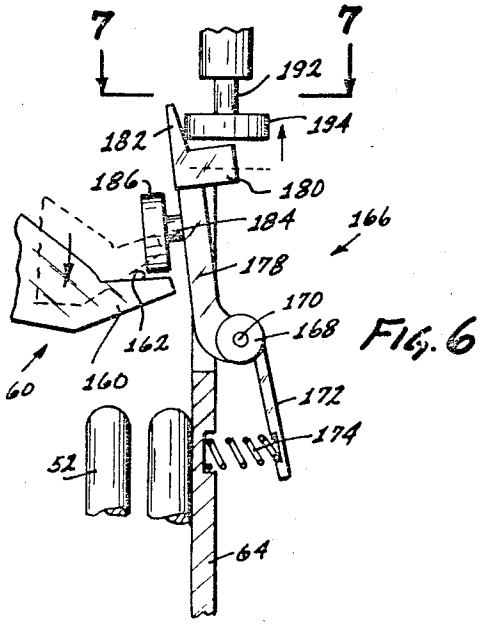


FIG. 6

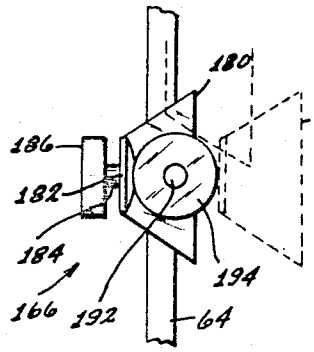
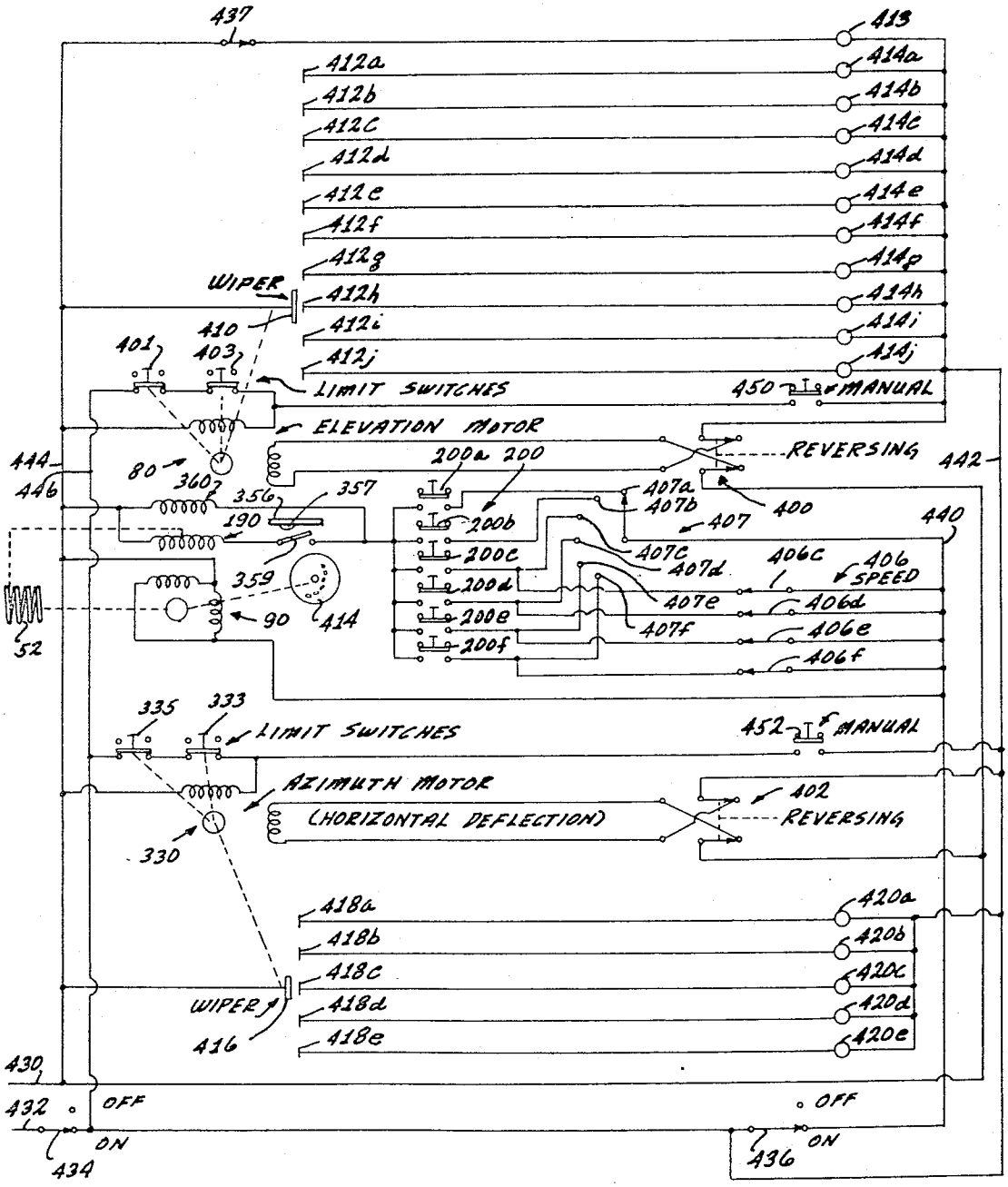


FIG. 7

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FIG. 8



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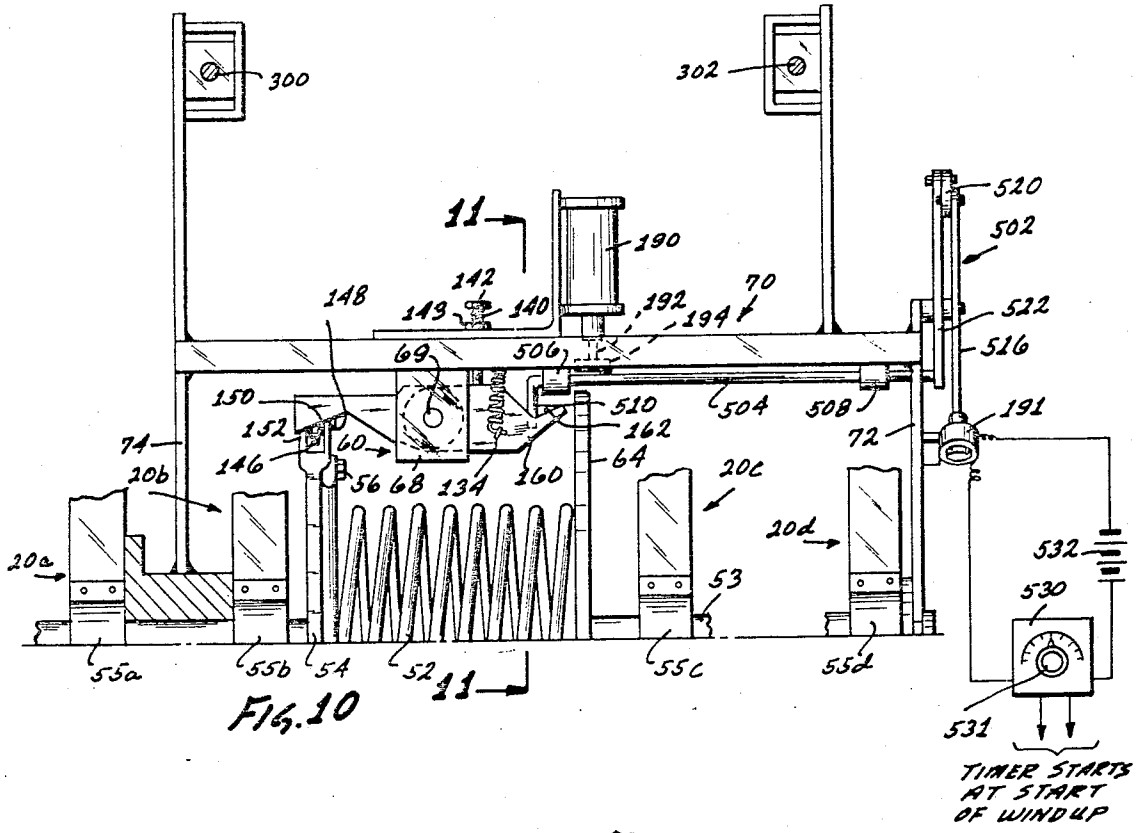


Fig. 10

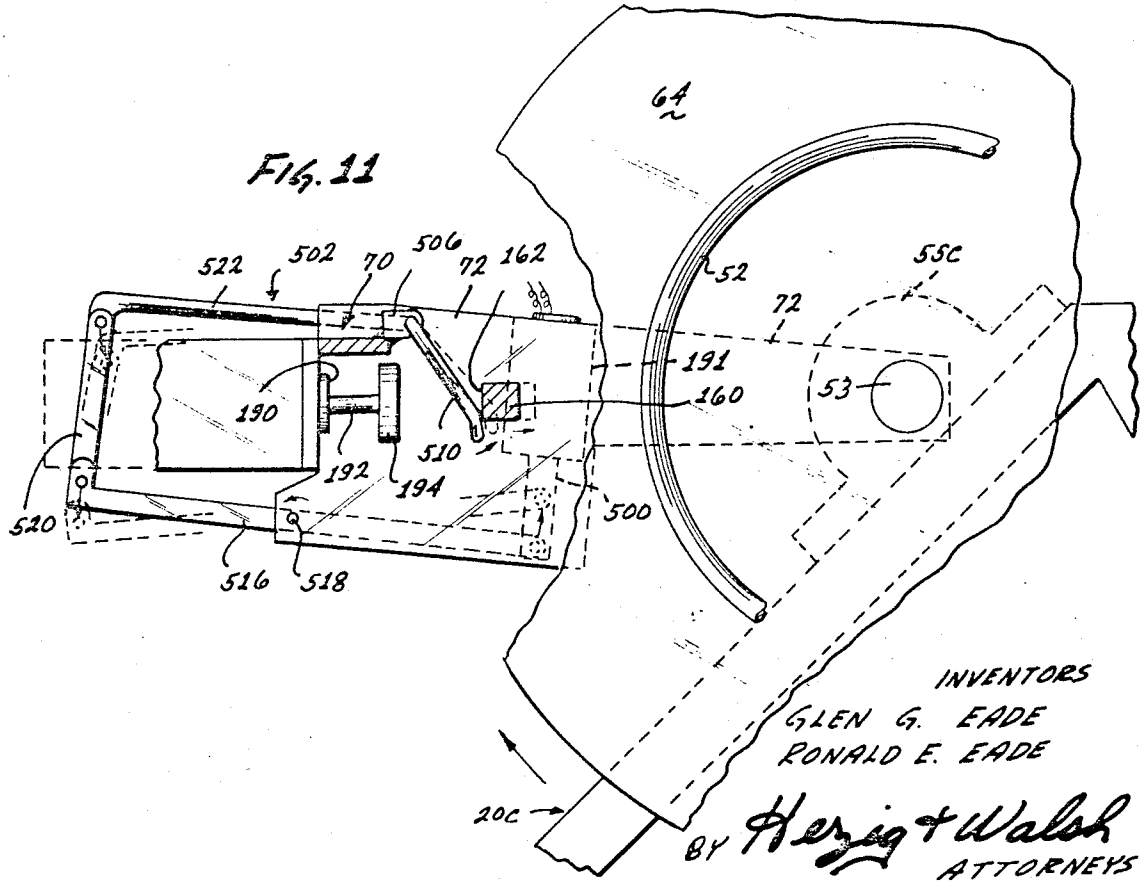


Fig. 11

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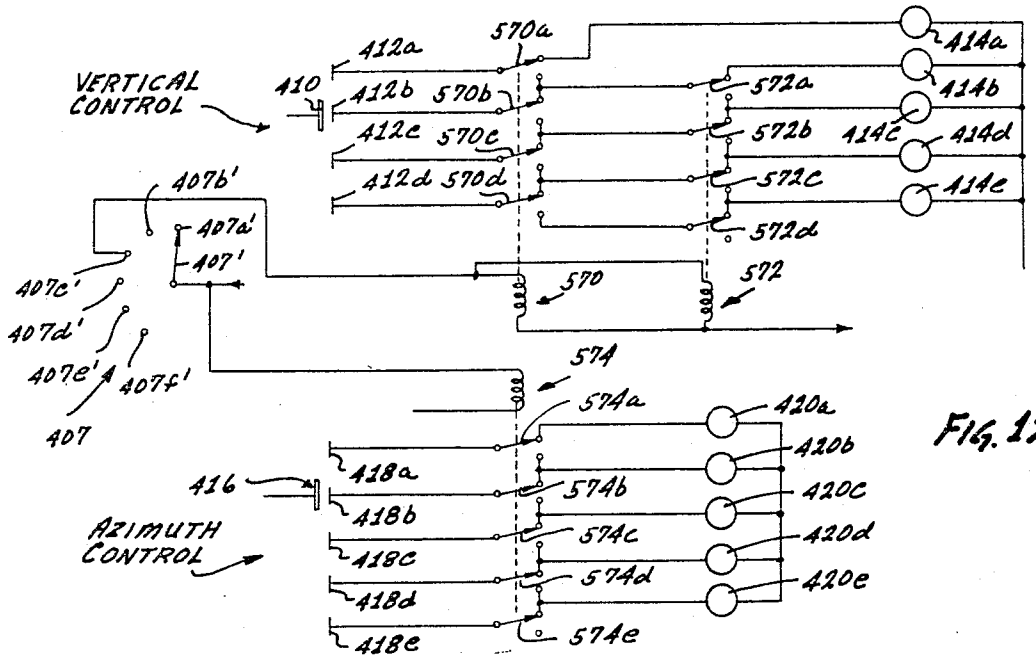


Fig. 12

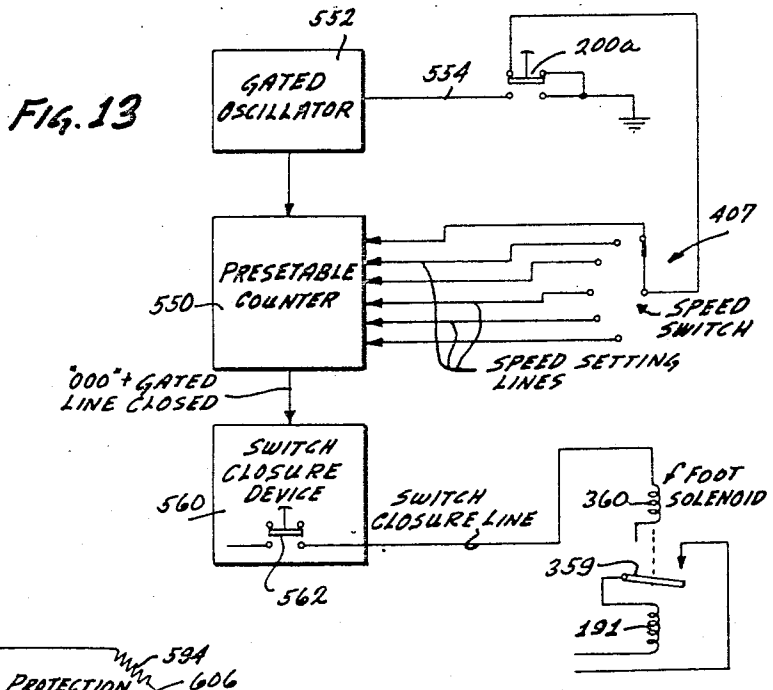


Fig. 13

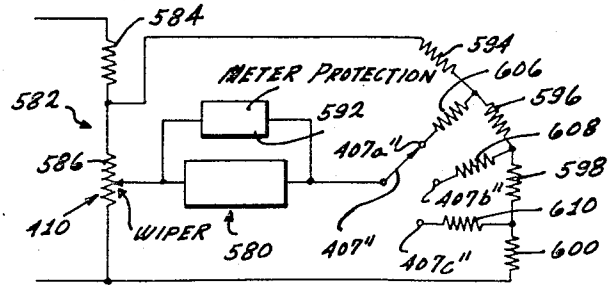


Fig. 14

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CENTRIFUGAL SPRING TYPE PROJECTILE THROWING DEVICE

SUMMARY OF THE INVENTION

The invention relates to a projectile throwing machine. It is exemplified herein in a preferred embodiment described in detail which is a baseball pitching machine.

The machine possesses a number of unique characteristics which adapt it admirably for the service intended by it. Machines of this type are, of course, desirable for use in training baseball batters whether amateur or professional, but are also highly useful as entertainment devices. While the exemplary embodiment of the invention is a baseball pitching machine the principals of the invention could be employed in throwing other types of projectiles.

The machine embodies a throwing arm which is driven by a torsion spring which in turn is wound up by a motor. The torsion spring is released automatically to cause the arm to throw by means of a trigger actuated by a remotely controlled actuating or release lever so organized that the power or torsion at which the release occurs can readily be controlled remotely so as to control the speed of the pitch.

The machine additionally embodies a signalling means in the form of an artificial or simulated leg that automatically moves downwardly to simulate the action of a pitcher just before executing the pitch.

One of the most distinctive features of the invention is the automatic means for predetermining the power at which the torsion spring releases for causing the throwing arm to throw. It is a characteristic of the machine that the throwing arm is driven by a driving motor to make complete revolutions. That is, after the throw it continues rotating in the same direction, bodily rotating the entire torsion spring until a member engages the trigger. The spring is then wound up, that is, torsioned from the opposite end until at a predetermined torsioning of the spring one of a group of actuating or release levers carried on a rotating disc that is attached to the end of the spring actuates the trigger. These release levers are alike, and are equally angularly spaced on the disc at the end of the spring. These actuating levers are of a very unique construction whereby to serve their intended purpose. They comprise levers each carrying a roller and they are pivotally mounted so that they can swing about an axis that is normal to the axis of the torsion spring, that is, in a plane through the axis of the torsion spring. As the spring is wound these actuating levers are moved past an end part of the trigger. At the position of the trigger there is a solenoid having a stem with a roller on the end of it positioned so that normally, as the actuating levers pass the position of the end of the trigger they engage the roller on the stem of the solenoid and are thus positioned so that the rollers on the actuating levers will not engage and trip the trigger. The solenoid is controlled by a series of cam operated switches that are operated by cam dwells on a sprocket wheel that rotates with the shaft at the driving end of the torsion spring, these cam dwells being spaced angularly similarly to the actuating levers. Thus, a circuit can be established remotely by way of manual switches through any one of the cam operated switch contacts to predetermine the angular position at which the solenoid will be operated so that the actuating lever at that particular position will be allowed to release the trigger rather than passing by it. At this particular angular position, when the solenoid is energized, it retracts the roller on its stem so that at that particular angular position the actuating lever will not be engaged and kept inactive by the roller on the solenoid stem, but on the other hand the actuating lever will be rotated about its pivot axis in the opposite direction by a biasing spring so that its roller comes into a position to engage and release the trigger, and furthermore a projection on the actuating lever will now come into a position on the other side of the roller on the stem of the solenoid upon de-energization of the solenoid so that the actuating lever is held in a position where it can release the trigger as will be described in detail hereinafter.

The invention embraces a modified form of means for controlling the speed of pitch wherein the wind-up or torsioning of the drive spring is controlled in response to a timing function. A timer set for a predetermined interval causes the machine to wind up for that interval and then to release at the end of the interval. Thus it becomes possible to adjust the machine to pitch at an infinite number of speeds. Also it is desirable to control the actuations of the pitching arm in relation to the signalling leg so that it is assured that a predetermined time is allowed for the signal leg to move after which the cycle begins which brings about the actuation of the throwing arm.

In the light of the foregoing, the primary object of the invention is to provide a projectile throwing machine, more particular a baseball pitching machine having all of the characteristics referred to in the foregoing and which is particularly adapted to be remotely controlled

Another object is to provide a baseball pitching machine as in the foregoing embodying a throwing arm which is driven by a torsion spring which is wound up from one end and which is provided with release triggers which are angularly spaced and which rotate, and which are controllable to predetermine the power or torsion at which the spring is released. A corollary object is to realize the capability of quickly and remotely controlling or adjusting pitch speed.

Another object is to realize the capability that the machine can be stopped at any point in its cycle and allowed to operate safely in reverse.

Further objects and additional advantages of the invention will become apparent from the following detailed description and annexed drawings, wherein:

FIG. 1 is a top view of a preferred form of the invention;

FIG. 1A is a plan view of a console utilized in operating the machine remotely;

FIG. 2 is a side view taken along line 2—2 of FIG. 1;

FIG. 3 is a side view taken along line 3—3 of FIG. 1, which view is partly diagrammatic;

FIG. 3A is a detail view of the solenoid actuator and switch associated with the signalling leg or foot.

FIG. 3B is another view of the parts of FIG. 3A;

FIG. 4 is an enlarged view of the upper half of the torsion spring and the triggering mechanism;

FIG. 5 is a sectional view partly broken away taken along the line 5—5 of FIG. 1;

FIG. 6 is a detail view of one of the actuating levers that controls the release of the trigger;

FIG. 7 is a view taken along the line 7—7 of FIG. 6;

FIG. 8 is a circuit diagram of the controls of the machine;

FIG. 9 is a detail view of the "out of balls" control.

FIG. 10 is an enlarged view of a modified form of the invention;

FIG. 11 is a sectional view taken along line 11—11 of FIG. 10;

FIG. 12 is a wiring diagram of a signal light arrangement for indicating actual position of pitched balls over the plate;

FIG. 13 is a block diagram of a modified arrangement for controlling pitch speed or a time function;

FIG. 14 is a circuit diagram of another arrangement for indicating position of pitched balls.

To facilitate a full understanding of the invention it will be described under the following general headings:

1. General Organization of the Machine.
2. Torsion Spring; Drive Therefor; and Triggering Means.
3. Ball Feeding and Agitating Mechanism.
4. Adjustment of the Machine in Elevation.
5. Adjustment of the Machine in Azimuth.
6. Pitch Signalling Means.
7. Electrical Control Circuitry of Machine.
8. Summary of Operation.
9. **Alternative Modifications.**

GENERAL ORGANIZATION OF THE MACHINE

The general organization of the machine will be understood from the top or plan view, FIG. 1, and the side diagrammatic views, FIGS. 2 and 3.

The machine comprises a frame having a rectangular base as may be seen at 10 in FIG. 2 that rests on a low friction flat surface base 11 which rests on a surface such as concrete surface as designated at 12. (See FIG. 2.) The entire machine can swivel, that is, it can be turned in azimuth as will be described more in detail presently. It is rotatable about a pin 14 that extends into the base 11.

FIG. 1 is a view of the top of the machine, the front of it being at the bottom of this Figure. FIG. 2 is a view of the right side of the machine and FIG. 3 is a diagrammatic view of the left hand side. From FIG. 2 it will be observed that the machine has side frames as designated at 20 comprising angular members as shown at 22 and 24 and rear upright members as shown at 26. The various operating parts of the machine are supported by these side frame members. These various frame members are designated at 20, 20*a*, 20*b*, 20*c*, and 20*d* in FIG. 1.

Numeral 30 designates a box like hopper at the top of the machine for feeding the balls to the throwing arm. The hopper 30 has a pivotal mounting as will be described and mechanism is provided to reciprocate or agitate it up and down to insure delivery of the balls, this being by way of a stem 32. The hopper has an opening 34 in the bottom and there are provided a series of horizontally disposed agitating members 36 that can be agitated in this opening by way of a member 238 as will be described more in detail hereinafter.

The balls are delivered from the hopper 30 by way of a ball chute 44 to cradle 45 of the throwing arm 46. The throwing arm as seen in FIG. 2 rotates to the right, that is, clockwise, to throw a ball. It is mounted to rotate with shaft 51. Around this axis is the torsion spring 52 which drives the arm and which is wound up, that is, torsioned by means of a driving motor as will be referred to presently.

Spring 52 is wound up from the right end looking at FIG. 1 while the left end of it is held and the left end then being released after application of a predetermined amount of torsion as will be described. The shaft 53 is driven by motorized means as will be described which drives a disc 64 attached to the right end of spring 52 and the spring drives a bar 54 which is clamped to the left end of the torsion spring by means as shown at 56. The bar 54 engages an end of the trigger 60 which prevents rotation of the left end of the spring; continued rotated of the shaft 53 winds up the spring.

The trigger 60 has a configuration as shown in FIG. 4 and it is pivotally attached to a bracket 68 by way of pivot pin 69. The right end of trigger 60 forms a cam surface 162 that cooperates with trigger actuators or actuating levers that are carried by the disc 64 and which operate to release the trigger and the throwing arm at predetermined degrees of torsion as described more in detail presently.

The torsion spring 52, shaft 51 and throwing arm 46 are a part of a frame which can be rotated angularly in elevation about the axis of shafts 51 and 53 to adjust the machine in elevation, that is, to vary the height above the ground at which a ball is pitched. This frame includes a transverse member 70 which is rotatable in elevation relative to the shafts 51 and 53 having an arm 72 which journalled on the shaft 53 and another frame member 74 which is journalled on the shaft 51. Motorized elevating means are provided as will be described hereinafter for angularly moving the frame 70. It will be seen that the bracket 68 is attached to the frame 70 so that when it is rotated angularly it moves the trigger 60 and consequently it rotates the spring 52 and the arm 46 to a different angular starting position. Motorized means are provided for adjusting the elevation, that is, the angle of tilt of the frame 70 as will be described hereinafter.

The motorized means for adjusting the machine in elevation are designated generally at 80 (FIG. 2) and the means for adjusting the machine in azimuth is designated generally at 82. Numeral 84 designates a signalling means in the form of an artificial leg or boot which is automatically moved upwardly and then dropped just before the ball is projected or thrown by the machine to simulate the movements of a pitcher before executing a pitch.

The various components or features of the machine will now be described individually in greater detail beginning with the driving torsion spring itself and the manner in which it is wound up and released.

TORSION SPRING; DRIVE THEREFOR; AND TRIGGERING MEANS

As previously pointed out the spring 52 is wound up, that is, torsioned by driving the disc 64 to wind up the right end of the spring. The disc 64 is wound up by means of a driving means as follows. Supported on the base 10 of the machine is an electric drive motor 90. Numeral 92 designates a transverse shaft journalled in pedestal bearings one of which is shown at 94 which are supported on the frame members like the member 24 as may be seen in FIG. 2. On this shaft is a belt pulley 96 and this pulley is driven from the motor 90 through a drive belt 100. On the shaft 92 is also a small sprocket wheel 102 and it drives a large sprocket wheel 104 by way of the sprocket chain 106.

The sprocket wheel 104 is mounted in a shaft 103 and journalled in pedestal bearing as shown at 105 supported from frame members as shown at 108 and 110.

On the shaft 103 is a further sprocket wheel 112 as may be seen in FIG. 3. Numeral 114 designates what may be called the main sprocket which controls the wind up of torsion spring 52 which is on the shaft 53. The sprocket wheel 114 is driven from the sprocket wheel 112 by way of sprocket chain 116. Shafts 51 and 53 and spring 52 are axially aligned the shafts being journalled in pedestal bearings 55, 55*a*, 55*b*, 55*c*, and 55*d* supported on frame members 20, 20*a*, 20*b*, 20*c* and 20*d* respectively.

In operation, when the machine starts and the sprocket wheel 114 is driven it bodily rotates the torsion spring 52 until the bar 54 clamped to the other end of the spring comes into engagement with the trigger 60. Continued rotation of the sprocket wheel 114 then winds up the spring 52 until a triggering release lever on the disc 64 engages the trigger to release the bar 54 allowing the spring to unwind and cause the arm 46 to throw. There are several trigger release levers at different angular positions and the one that causes the trigger to release can be selected by way of a remote selector switch as will be described. Next will be described the triggering levers and the actuation of the trigger, this mechanism being shown in greater detail in FIGS. 4, 5, 6 and 7.

Selective Trigger Release Actuating Levers

FIG. 4 is an enlarged view of the upper half of the torsion spring 52 and the triggering mechanism. It will be observed that the bracket 68 to which the trigger 60 is pivoted is supported from the frame member 70. The trigger is biased in a counterclockwise direction by a biasing spring 132, one end of which is hooked on to a lug 134 on the trigger and the other end of which is hooked on to a bracket 136 on the frame member 70. This spring pulls the trigger counterclockwise against the end of a threaded stem 140 which forms a stop, the stem having a head 142 for adjusting and a lock nut 143. On one end of the trigger it has a slanting cam surface as shown at 144 which cooperates with a roller 146 mounted on a pivot shaft 148 which is journalled between legs or bifurcations 150 and 152 at the end of the arm 54.

At the other end of the trigger it has an extending toe 160 having a slanting cam surface 162 that the trigger release mechanism cooperates with. Carried by the disc 64 are three trigger release levers which are equally angularly spaced. One of these is shown in FIG. 4 designated at 166. It is in the form of a lever having an intermediate part 168 pivoted on a shaft

170. The shaft 170 is in a position that is normal to the axis of the shaft 53 so that the actuating lever 166 can rotate in a plane containing the axis of shaft 53. The lever 166 has an arm 172 and between the end of this arm and the disc 64 is a biasing spring 174 which normally urges the lever 166 in a counterclockwise direction looking at FIG. 4. This lever 166 has another arm 178 at the end of which is a shoe 180 having an extending cam finger 182. Also extending inwardly on the inside of the arm 178 is stem 184 having on it a roller 186 that can cooperate with the cam surface 162 on the toe 160 of the trigger.

Cooperating with the trigger release lever 166 is a solenoid as designated at 190 having a stem 192 at the end of which is a roller 194. The solenoid 190 is mounted on a part of the frame member 70 as shown.

The solenoid 190 is controlled by a series or group of switches designated at 200 in FIGS. 1 and 5 which are automatically actuated by a series of cam rises or dwells 202, 204, 206, 207, 209 and 211 on the inside of the sprocket wheel 114 as may be seen in FIG. 5, these cam dwells being spaced apart angularly corresponding to the spacing of the trigger actuater levers 166, 166*a* and 166*b* and further similar levers not shown. These trigger actuating levers are all alike so that the others need not be described in detail. Each actuator lever determines a pitch speed and a fourth pitch speed is determined by cam roller 167 equally angularly spaced on disc 64 and which can actuate the trigger as will be described. The pitch speed is selectable by rotary speed switch 407 which selects one of the cam actuated switches to be energized. Manual switches 406*c*, *d*, *e* and *f* provide a safety device. Preferably these switches are concealed in the console 390. When any one of these switches is closed the machine will nevertheless pitch at that speed even though switch 407 is set for a higher speed. These switches are to prevent amateurs from pitching at dangerous speeds. See FIG. 8.

The figures illustrate the operation of the triggering mechanism. When the solenoid 190 is not energized and the stem 192 and roller 194 are extended as shown in FIG. 4, as the disc 64 rotates while the spring 52 is being wound up, the shoes 180 and extending fingers or projections 182 will simply engage with the roller 194 and will ride past it as shown in FIG. 4 with the actuating lever 166 in a rotated position as shown wherein the roller 186 cannot cooperate with the finger 160 on the trigger 60.

On the other hand if a circuit is energized through a particular one of the switches 200 that is actuated by cam dwells 202–211 then the trigger can be actuated. For example, if the switch in the group 200 that is actuated by the cam dwell 204 has been selected remotely by a remote circuit selector, (speed switch 407) then the switch will energize the solenoid 190 momentarily when the trigger actuating lever 166 corresponding to that angular position comes by the position of roller 194. The solenoid 190 being momentarily energized at this time the roller 194 will be retracted allowing the biasing spring 174 to rotate the actuating lever 166 in a counterclockwise direction, looking at FIGS. 4 and 6 rotating it into a position as shown in FIG. 6 wherein the roller 186 is in a position to engage with and ride over the extending finger 160 of the trigger 60 rotating the trigger in a clockwise direction against the force of spring 132 and causing the other end of the trigger and cam surface 144 to roll out of the way of the roller 146 thus releasing the arm 54 permitting the spring 52 to unwind and cause the arm 46 to throw. FIG. 7 illustrates the position of the parts under these circumstances and as will be seen, as the roller 194 is retracted the finger 182 of shoe 180 rotates inwardly past it bringing roller 186 into a position to engage finger 160 of trigger 60 and upon de-energization of solenoid 190, the roller 194 is again extended so it comes into a position on the other side of the finger 182 as shown in FIGS. 6 and 7 so that the trigger actuating lever 166 is held in its rotated position as it rotates past the finger 160 effecting the triggering of the mechanism.

When bar 54 is released, the arm is rotated clockwise (FIG. 2) to throw a ball. The arcuate movement is dampened by hydraulic cylinder dashpot 210 pivoted to upright 211 and having stem 212 pivoted to segment 213 at the inner end of arm 46. After movement of arm 46 is thus restrained it continues in the same direction back to starting position.

BALL FEEDING AND AGITATING MECHANISM

FIG. 1 shows the throwing arm 46 with a ball that has been fed into the cradle 45 in a position to be thrown. Each time the arm 46 moves to throw a ball it continues rotation in the same direction under the influence of the drive motor until the bar 54 comes back into engagement with trigger 60 which, of course, is now back in the position of FIG. 4. A ball is fed into the cradle 45 and the remaining balls are prevented from advancing. Balls are fed from the hopper 30 as previously described. As may be seen in FIGS. 1 and 2 there is a chute or trough formed of wire loops as designated generally at 44 and that extends from an opening in the bottom side of an extending part 220 of the hopper 30 down into a position adjacent the cradle 45 as may be seen in FIG. 1. The balls roll down this trough or chute. Numeral 222 in FIG. 1 designates a bracket for two reciprocatable stems one of which is designated at 224 and the other at 226 which control feeding of balls. See FIG. 9. The member 222 has an extending bracket 230 to which is pivoted actuating lever 232 to which is attached the inner end of both of the stems 224 and 226 as shown. The end of lever 232 is coupled to an arm 236 on the end of cross shaft 238 mounted in bearings 240 and 242 on the frame member 70. The shaft has a radially extending part 246 which forms a cam follower that cooperates with an extending projection 248 on the sprocket wheel 114 so that every time the sprocket wheel 114 makes a revolution the projection 248 engages the member 246 rotating the shaft 238 and in turn swinging the lever 232. When the lever 232 swings in a counterclockwise direction looking at FIG. 1 the stem 224 retracts allowing a ball to pass from the trough or chute 44 into the cradle 45, the other stem 226 being extended to prevent the next ball from advancing and holding it in position. As may be seen, therefore, each cycle of the machine involves one complete revolution of the shaft 51 and an actuation of the mechanism just described to feed the next ball into the cradle 45 of the throwing arm 46. The balls pass through openings in members 225 and 227, FIG. 9. The balls engage lever 229 pivoted at 231 and when the supply of balls is exhausted lever 229 moves to open switch 437. See FIG. 8.

In order to insure feeding of balls to the throwing arm, the hopper 30 is automatically tilted about its mounting pivot and an agitator is provided for agitating the balls to prevent them from clogging. The hopper 30 is mounted on pivots as shown at 262 and 264 at the upper ends of uprights 266 and 268 upstanding from the frame 70 which is movable angularly about the axis of shafts 51 and 53. A stem 32 includes a smaller telescoping stem 272 having a coil spring 274 around it which extends upwardly from a hinged lever 276. This lever is positioned adjacent a four lobed cam 278 which is part of the sprocket wheel 114 and which rotates therewith. The cam 278 engages the lever 276 to move the stem 274 upwardly thereby tilting the hopper 30 about the pivot axis 262–264 to agitate the balls therein.

The ball agitating member 36 that moves through the opening 34 in the bottom of the hopper 30 is one of a series of similar members positioned horizontally along the bottom of the hopper and movable to agitate the balls by way of a stem 290 which can move arcuately with respect to a pivot 292. At the other end of the stem 290 is a cam follower part 246 which is engageable by projection 248 upon the sprocket wheel 114 so that once during each revolution the stem 290 is swung so as to move the agitating members 36 as shown in FIG. 3 to agitate the balls.

ADJUSTMENT OF MACHINE IN ELEVATION

Frame **70** previously referred to is arcuately movable about the axis of the shafts **51** and **53**. When it is so adjusted it adjusts the spring **52** and arm **46** angularly as well as the trigger so that the height of the pitch is adjusted. Frame **70** is adjustable by way of vertical lead screws **300** and **302** as may be seen in FIGS. **2** and **3** which have threaded engagement as may be seen with the frame members of frame **70**. The lower ends of these lead screws are suitably journalled in bearings such as the one shown at **304** in FIG. **2**. On the ends of these lead screws are sprocket wheels as shown at **306** and **308** and passing over these sprocket wheels is a drive chain as shown at **310** in FIG. **1**. Engaging with this drive chain is a small sprocket wheel **312** as shown in FIG. **1** and FIG. **2** which is on a shaft leading from a gear box **314**. The motor **80** drives gear **316** which in turn drives gear **318** which is on a shaft for the gear box **314**. See FIG. **2**. The motor **80** is remotely controllable and adjustable from a console as will be described hereinafter.

ADJUSTMENT OF THE MACHINE IN AZIMUTH

As previously explained the entire machine is adjustable angularly and horizontally, that is, in azimuth about the pivot stem **14**.

Referring to FIG. **1** numeral **330** designates a motor which is mounted directly on the base **12** within the base frame **10** of the machine. The shaft of this motor has a sprocket **332**. Numeral **331** is a lead screw journalled in a bearing **334** and having on it a sprocket wheel **336** which is driven from the sprocket wheel **332** by a sprocket chain **338**. Lead screw engages a fitting at the end of a stem **342** attached to the base of the frame **10** so that operation of the lead screw is operable to swing the entire machine about the pivot **14**. The lead screw also operates limit switches as designated at **335** within a suitable housing. The motor bearing and switch unit are mounted directly to the concrete by stems.

PITCH SIGNALLING MECHANISM

As previously explained, numeral **84** identifies an artificial leg or member appearing as a boot which is caused to move downwardly before the ball is pitched to simulate the movements of a live pitcher before pitching. Numeral **350** designates a transverse shaft extending from side to side of the frame **10**. See FIG. **1**.

The shaft **350** has a transverse arm member **352** on the end of which is the artificial leg **84**. The inner end of the arm **352** extends inwardly into a position where it can be engaged by projection **354** on the sprocket wheel **114** for angularly moving the arm **352** and lifting the artificial leg simulating the action of a pitcher. On the shaft **350** is also a cam member **356** that cooperates with roller **358** on the stem of solenoid **360** which is also remotely controlled, whereby to release the leg, to allow it to drop. Solenoid **360** is energized by any one of switches **200**, actuated by cam dwells **202, 204, 206, 207, 209** or **214**. Upon retracting its stem it disengages from behind cam **356** allowing leg **84** to drop.

When the leg drops, abutment **357** on cam **356**, actuates switch **359**, which as described hereinafter allows energization of triggering solenoid **190** after the foot has fallen, during a predetermined readily adjustable time interval. See FIGS. **3A** and **3B**.

ELECTRICAL CONTROL CIRCUITRY OF THE MACHINE

The control circuitry of the machine is shown schematically in FIG. **8** and FIG. **1A** shows the panel **390** of the control console. It will be observed that FIG. **8** shows the azimuth motor, that is, the horizontal deflection motor **330** and the motor **80** for elevation. Also the triggering solenoid **190** is shown as well as the release solenoid **360** for the signalling leg. The torsion spring **52** is also shown as well as the six switches **200** individually identified at **200*a***, **200*b***, **200*c***, **200*d***, **200*e*** and **200*f***, which are actuated by the cam rises as previously described on the sprocket wheel **114** and shown in FIG. **5**. The cam actuation is shown diagrammatically in FIG. **8**. As may be seen in FIG. **8**, the motor **80** is controlled by the reversing switch **400** which may be seen on the panel **390** of the console in FIG. **1A**. The azimuth motor is controlled by a reversing switch **402** which is also shown on the panel in console FIG. **1A**. The speed of the pitch may also be controlled by a group of four manual switches as designated at **406**, the switches being individually identified at **406*c***, **406*d***. **406*e*** and **406*f***. The purpose of these switches has already been described. Primarily the speed is controlled by rotary speed switch **407** having contacts **407** *a* – *f* in series with switches **200** *a* – *f*.

Numeral **410** designates a contact wiper driven from the shaft of motor **80** which cooperates with a series of contacts **412**, *a*, *b*, *c*, *d*, *e*, *f*. *g*, *h*, *i*, and *j* which control circuits through signalling lights as designated at **414*a*** through **414*j***. Thus at the control panel of the console **390** the elevation of the machine can be observed from the signal lights.

Numeral **416** designates a similar wiper driven from the shaft of the motor **330** which cooperates with a series of contacts **418*a***, *b*, *c*, *d*, and *e* that control circuits through signal lights **420*a*** through **420** *e*. These lights are positioned on the control panel **390** across a diagrammatic representation of the home plate as designated at **422** so that the operator can readily observe the horizontal deflection of the pitch from these signal lights. As may be seen in FIG. **8** the power supply from standard **110** volt lines comprises line wires **430** and **432**. The power to the circuitry is controlled by manual switches **434** and **436**. It will be observed that motor **80** may be energized from wires **430** and **442** by way of switch **400** and wires **444** and **446** back to the line. Motor **330** may be energized similarly by way of the switch **402**. Switch **434** controls all circuits. Switch **436** controls the pitch speed circuits. Should motor **80** open one of its limit switches **401** or **403** it can be manually re-energized by manual switch **450** and should motor **330** open one of its limit switches **333** or **335** it can be re-energized by manual switch **452**. Briefly, now referring to the control of the machine from the console, the operator can set the machine for any azimuth, that is, horizontal deflection, and elevation simply by operating the reversing switches **400** and **402** and then observing the signal lights **414** and **420** on the panel of the console to note that the machine has responded. The reversing switches have three positions, including open and closed in either direction of operation.

The operator sets the machine for speed of pitch by setting the speed switch **407** (and/or) closing one of the manual switches **406***c*, *d*, *e*, or *f*. Depending upon which of these switches is closed, a circuit can be energized through one of the switches **200***a*, *b*, *c*, *d*, *e*, or *f* when one of these switches is closed by a cam dwell on the sprocket wheel **114** as described in connection with FIG. **5**. The operator can, of course, observe the speed that is indicated by observing switch **407** (and/or) which of the switches **406***c*, *d*, *e*, or *f* is closed on the panel **390** of the console. As previously described, the closing of one of the switches **406** determines which of the trigger release levers **166** will be effective to actuate the trigger to release the spring **52** and permit it to drive the arm **46**. It will be observed, of course, that switches **406, 407** and **200** control the solenoids **360** and **190** both of which will be energized in the cycle irrespective of which of the other switches **406** is closed, these circuits being in between the wires **440** on one side of the figure and wire **444** on the other side.

SUMMARY OF OPERATION

From the foregoing description of the machine and its component parts and features, those skilled in the art will fully understand and appreciate its operation, particularly in view of the description of the electrical control system FIG. **8**. However, the operation may be briefly summarized as follows. The operator sets a particular horizontal deflection and elevation

setting on the machine by way of the switches **400** and **402**. He sets the machine to operate to deliver a particular speed of pitch by operating rotary speed switch **407** (and/or) **406***c* through *f*. The switch may then be closed to start the machine in operation and it will perform a cycle as described in the foregoing. That is the shaft **51** will be rotated turning spring **52** until bar **54** engages the trigger **60**. The spring **52** is wound up to the point at which trigger **60** is actuated or released to release the bar **54** at which time the arm **46** will move through an arc to throw the ball. The trigger is released by a selected one of the trigger release levers **166**. Just before the pitch is executed as described in the foregoing the signalling leg **84** will be up again and then dropped down again. Prior to the execution of the pitch a ball will be loaded into the cradle **45** of the arm **46** as previously described and during the cycle, hopper **30** will be tilted and the balls agitated by the members **36** as described.

The circuitry is such that if desired the machine will continuously repeat its operating cycle without interruption. At any time however, the operator can, from the console, vary the pitch, as to horizontal deflection, elevation and speed.

It is to be noted that the machine can be stopped if desired at any point in a cycle by shutting off the power. The parts will then move in a reverse direction under the influence of spring **52**. It will be observed that all parts are constructed to permit such reverse movement without damage, particularly the triggering levers **166**.

If desired the machine may be automatically programmed to deliver particular sequences of different pitches, that is, pitches varying in speed, elevation and horizontal position with respect to the plate. To effect such programming the reversing switches **400** and **402** are motorized by reversible motors and a motor driven rotary switch is used to operate the contacts of switches **407** and/or **406***c*, *d*, *e* and *f*. These three motors may be controlled from a programming device so that at the end of each cycle the machine is automatically set for a different predetermined pitch in accordance with a predetermined sequence. The sequence is pre-established on magnetic tape or otherwise in the programmer which controls the aforesaid motors to make the settings between pitches.

ALTERNATIVE MODIFICATIONS

FIGS. **10** and **11** show a modified form of the invention having an additional triggering means which is either manually or automatically operable at any position in the wind up cycle, so that the variation in pitching speed is infinite if desired. This form of the triggering means can be incorporated into the same machine having the triggering means as already described, and then the machine can be triggered either by one system or means, or the other. The alternative triggering means could, of course, be incorporated in a machine by itself.

Preferably the alternative triggering means may be operated in response to a time function that is, a timer that energizes the triggering solenoid after a predetermined interval so that the amount of wind up of the torsion spring is proportional to the time interval and pitch speed varies accordingly. It will be observed that the solenoid **191** in FIGS. **10** and **11** is mounted on the frame member **72**. It is connected to a stem **500** which in turn is able to actuate a linkage **502** linked to a transverse shaft **504** journalled in bearings **506** and **508** carried by the member **70**. On the end of the shaft **504** is a member **510** positioned to be able to come into engagement with the toe **162** of the trigger **60** to trigger or release the throwing arm. The linkage **502** comprises a link **516** pivoted at **518**. The link is pivotally connected by link **520** to another link **522** the end of which is attached to one end of the shaft **504** as shown, the link **520** having pivotal connection to the links **516** and **522**. Thus it may be seen that when the solenoid **191** is energized it acts through the linkage with sufficient force that member **510** can engage the trigger **60** to release. The linkage can also be manually actuated.

The solenoid **191** if desired can be actuated directly by a mechanical timer as shown at **530** energized by a battery **532**. The time interval can be manually set on the timer **530** by a knob **531**. The timing interval can be started from any suitable switch on the machine. By way of example the timing interval could be started from any one of the **200** series of switches as shown in FIG. **8**.

FIG. **13** shows another type of timing device for obtaining the timed interval and variation in pitching speed. This timing device might be energized by one of the cam switches such as **200***a*, which is held closed for an interval as long as the maximum setting of switch **407**. Numeral **550** designates a presettable binary count down counter preferably of three bits minimum. The speed switch **407** through its various contacts, when the gate line **554** is open, gates the speed setting lines to set the presettable counter **550** to a like state. The counter is controlled by gated oscillator **552** having a gate line **554** controlled by switch **200***a*. When the gate line is closed the cycle is begun, the oscillator **552** being capable of adjustment of its cycle from 0.05 to 0.3 second. The output of the gated oscillator causes the counter **550** to count down one, each cycle. When the gate line opens the oscillator stop its cycle. While the counter is counting down it cannot be reset by the speed switch. The speed setting lines provide a binary indication of the setting of the rotary speed switch **407**. After the predetermined count down, time switch closure device **560** closes its switch **562** which by way of example, can energize foot solenoid **360** which brings about closure of switch **359** which now energizes the triggering solenoid **191** described in connection with FIG. **10** and **11**.

Having reference to FIG. **1A** of the drawings it will be observed that the signal lights **414** and **420** provide a visual display which is a display of the physical orientation of the machine itself, with respect to elevation and azimuth settings. These lights do not provide an actual display of the relative position of the ball as it passes over the plate because as the speed of pitch changes the position at which the ball passes over the plate will change at the same physical orientations of the machine. It is possible and desirable to provide a display on the console of the actual relative position of the ball as it passes over the plate, this position changing with speed as described. FIG. **12** shows a preferred simplified arrangement for causing the signal lights to indicate the actual position of the ball in passing over the plate.

In FIG. **12** switch blade **407'** is on the same shaft as the switch **407** previously described that adjusts the pitch speed. It cooperates with contacts **407***a'*–**407***f'*. These contacts control three relays as designated at **570**, **572** and **574**. Relay **570** actuates a group of switch blades **570** *a–e*. Each of relays **572** and **574** actuate a similar group of switch blades, the relay **574** having five such blades as shown but the number, of course, being similar to the number of signal lights as shown in FIG. **8**. The wiring of FIG. **12** illustrates the manner of wiring in order to achieve calibration of the machine so that the signal lights **414** and **420** actually provide a display on the console of the position of the ball in passing over the plate. FIG. **12** illustrates the circuitry changes (by way of example) that are brought about by setting of the speed switch to contact **407***c'*. This energizes the relays **570** and **572** thereby moving their switch blades downwardly to their lower contacts. Thus, it will be seen, that whereas previously, the slider **410** would energize the light **414***a*, with relays **570** and **572** energized, at this speed, because of actuation of the relays contact **412***a* now will bring about energization of signal light **414***c* instead of **414***a*. In other words, the change in speed brings about a vertical shift in the signal light that is illuminated. The technique thus illustrated in FIG. **12** is employed to bring about accurate calibration of the machine in that for the actual observed position of the ball in passing over the plate, the correct signal light is caused to light so that it accurately displays the position.

Alternatively instead of relays **570**, **572**, and **574** and their contacts, these contacts might be additional circularly ar-

ranged contacts cooperating with additional wipers on the same shaft as wiper 407'.

The same result is achieved with respect to the horizontal display lights 420. It will be seen that energization of relay 574 shifts its switch contact blades so that there is a shift of one increment with respect to the signal light that is energized. Thus it may be observed that in this manner the machine can be completely and accurately calibrated over its complete range of speed so that there is an accurate display on the display panel 390 of the actual position of the ball in passing over the plate.

FIG. 14 shows a simplified circuit arrangement for providing a display indication of the position of the ball over the plate. Numeral 580 designates an indicating volt meter. Numeral 582 indicates a potentiometer comprising resistor 584 and slide wire resistor 586 with the wiper 410 as previously described operating as a slider cooperating with slide wire resistor 586. Across the volt meter 580 is a Zener diode, for example, 592 for purposes of meter protection. Connected across the slide wire resistor 586 are resistors 594, 596, 598 and 600. Numeral 407'' designates a rotary switch arm on the same shaft as switch 407, 407*a*'', 407*b*'', 407*c*'', etc. Between these terminals and the junctions between the series resistors 594–600 are resistors 606, 608 and 510. As will be noted, as the wiper 410 moves, the volt meter will indicate a position. This reading is varried by changing the position of the rotary switch 407 and must be calibrated on each machine to indicate the actual position of the ball in passing over the plate as it varies depending upon the speed. The calibration is accomplished by varying the appropriate resistance values of 584, 594 through 602*c*, after calibration the indicator will indicate the true position of the ball over the plate at any speed. Thus a system or arrangement as shown in FIG. 14 can be used to indicate the vertical position of the balls, for example, and another similar indicator can be used to provide an indication of the horizontal position. By simple adjustments the volt meters can be made to give an accurate calibrated visual display of the ball position relative to the plate.

From the foregoing those skilled in the art will readily understand the nature and construction of the invention and the manner in which it achieves and realizes all of the objects as set forth in the foregoing as well as the many advantages that are apparent from the detailed description.

The foregoing disclosure is representative of the preferred forms of the invention and is to be interpreted in an illustrative rather than a limiting sense and the invention to be accorded the full scope of the claims appended hereto.

What is claimed is

1. A projectile throwing machine comprising an arm movable through an arc, means comprising a torsion spring for driving said arm, means comprising a motor for torsioning one end of said spring, triggering means for releasing said spring to permit movement of the said arm, and release means cooperable with the triggering means for releasing the triggering means at predetermined angular selected positions of said one end of said spring.

2. A throwing machine as in claim 1 wherein the triggering means is attached to the other end of said torsion spring and the trigger release means is carried by said one end of the torsion spring.

3. A machine as in claim 2 having additional means comprising timing mechanism for releasing the triggering means at a selected increment of time after beginning of the torsioning of the torsion spring.

4. A machine as in claim 1 wherein the triggering means is positioned to hold the end of the arm until the triggering means is released.

5. A machine as in claim 4 wherein the triggering means comprises a member extending along the axial length of the spring.

6. A machine as in claim 4 wherein said trigger release means comprises an actuating lever rotatably carried at said on end of the spring and engageable with the triggering means.

7. A machine as in claim 6 including a movable control member adjacent said on end of said spring positioned with respect to said actuating lever and selectively positionable to engage the lever to restrain the lever from release said triggering means.

8. A machine as in claim 7 wherein said actuating lever comprises a part movable to a position to engage a part of said triggering means for releasing the triggering means, said movable control member being positionable to be engaged by said actuating lever upon rotation of said one end of said spring to a predetermined position to maintain said actuating lever out of engagement with the triggering means.

9. A machine as in claim 8 wherein said actuating lever is pivotally mounted about an axis normal to the axis of the torsion spring and said movable control member has means to engage said actuating lever whereby to hold the actuating lever in a position to release the triggering means as the actuating lever rotates past the triggering means.

10. A machine as in claim 1 wherein said release means comprises timing mechanism for releasing the triggering means at a predetermined selected increment of time after beginning of torsioning of the torsion spring. .

11. A machine as in claim 1 including means for releasing the triggering means at any point in the operating cycle.

12. A machine as in claim 1 including visible display indicating means for visibly indicating the relative position of a pitched ball with respect to a plate.

13. A projectile throwing machine comprising an arm for throwing a projectile, means comprising a torsion spring for driving said arm, said arm being fixedly secured to one end of said torsion spring, means for applying torsion to said spring and means for releasing the torsion for causing said arm to throw and said arm and said torsion spring being rotatably mounted about an axis to allow continuous rotation of the arm and spring in one direction whereby after executing a throw the arm and spring continue to rotate in the said one direction to a starting position.

14. A projectile throwing machine comprising an arm movable through an arc, means comprising a torsion spring for driving said arm, means comprising a motor for torsioning one end of said spring, said arm being connected to the other end of said spring, and means responsive to predetermined angular positions of said one end of the spring for releasing the arm whereby the torsion in the spring drives the arm.

15. A machine as in claim 14 wherein said means responsive to the angular position of said one end of the spring comprises mechanism selectively controllable remotely to predetermine the angular position at which the releasing means is actuated.

16. A machine as in claim 15 wherein said selectively controllable mechanism comprises a solenoid, switch means for controlling the and being solenoid actuatable at a predetermined angular position of the said one end of the spring, said solenoid means being positioned to actuate actuation of the releasing means. .

17. A projectile throwing machine comprising an arm movable through an arc, means comprising a torsion spring for driving said arm, means comprising a motor for torsioning one end of said spring, triggering means for releasing said spring to permit movement of the said arm, release means cooperable with the triggering means for predetermined angular selected positions of said one end of said spring, means comprising a simulated foot automatically actuated to simulate the action of a live pitcher just before a ball is thrown, and mechanism whereby the release means is responsive to a predetermined movement of said simulated foot.

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