

[54] COACTING WHEEL BALL PROJECTING
DEVICE

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[52] U.S. Cl. 124/1, 124/50, 124/41

[51] Int. Cl. F41b 3/04

[58] Field of Search 124/1, 41, 49, 50, 32;
273/26 D; 74/54; 221/68, 133; 214/8.5 H

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Assistant Examiner—William R. Browne

[57] ABSTRACT

A ball throwing machine utilizing two counterrotating wheels positioned so as to grasp between their peripheries, such as a tennis ball, and project it along the mutual tangent line of the counterrotating wheels. A plurality of feed magazines discharging balls one at a time in timed sequence for grasping and projection by the counterrotating wheels. The sequential timed release of balls from the columns of balls in the respective feed magazines is effected by a plurality of escapement mechanisms, one of which is positioned adjacent the exit end of each of the respective feed magazines. The angle and speed at which the ball is projected are adjustable by changing the speed at which the wheels rotate and angle of the entire machine relative to the support on which it rests. The wheels are driven independently of one another, and the escapement mechanisms are driven independently of either wheel. The inner structure of each of the two wheels is made of resilient material which is compressed substantially when a ball is moved therebetween.

4 Claims, 8 Drawing Figures

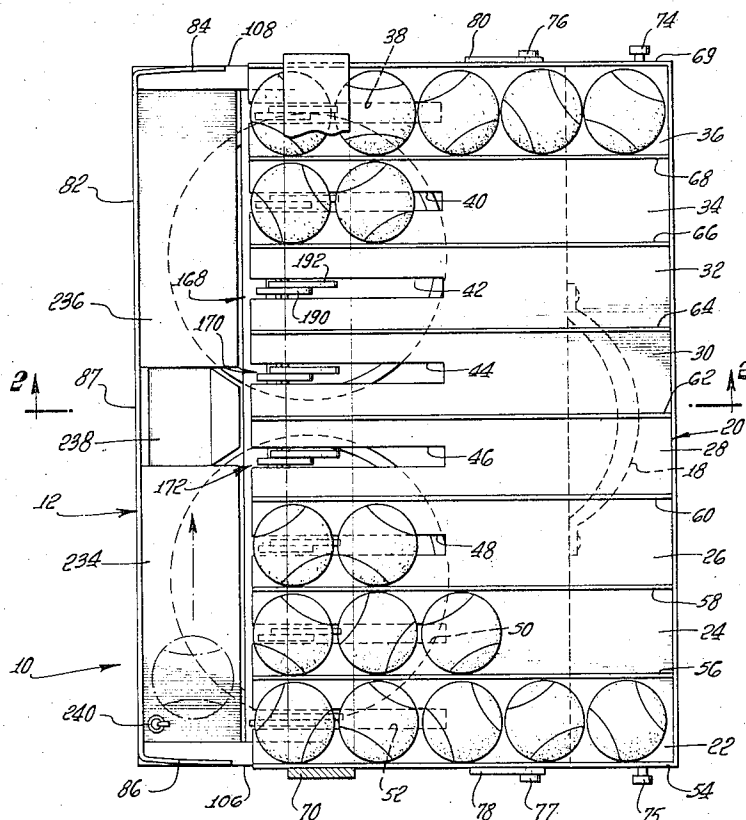


FIG. 1.

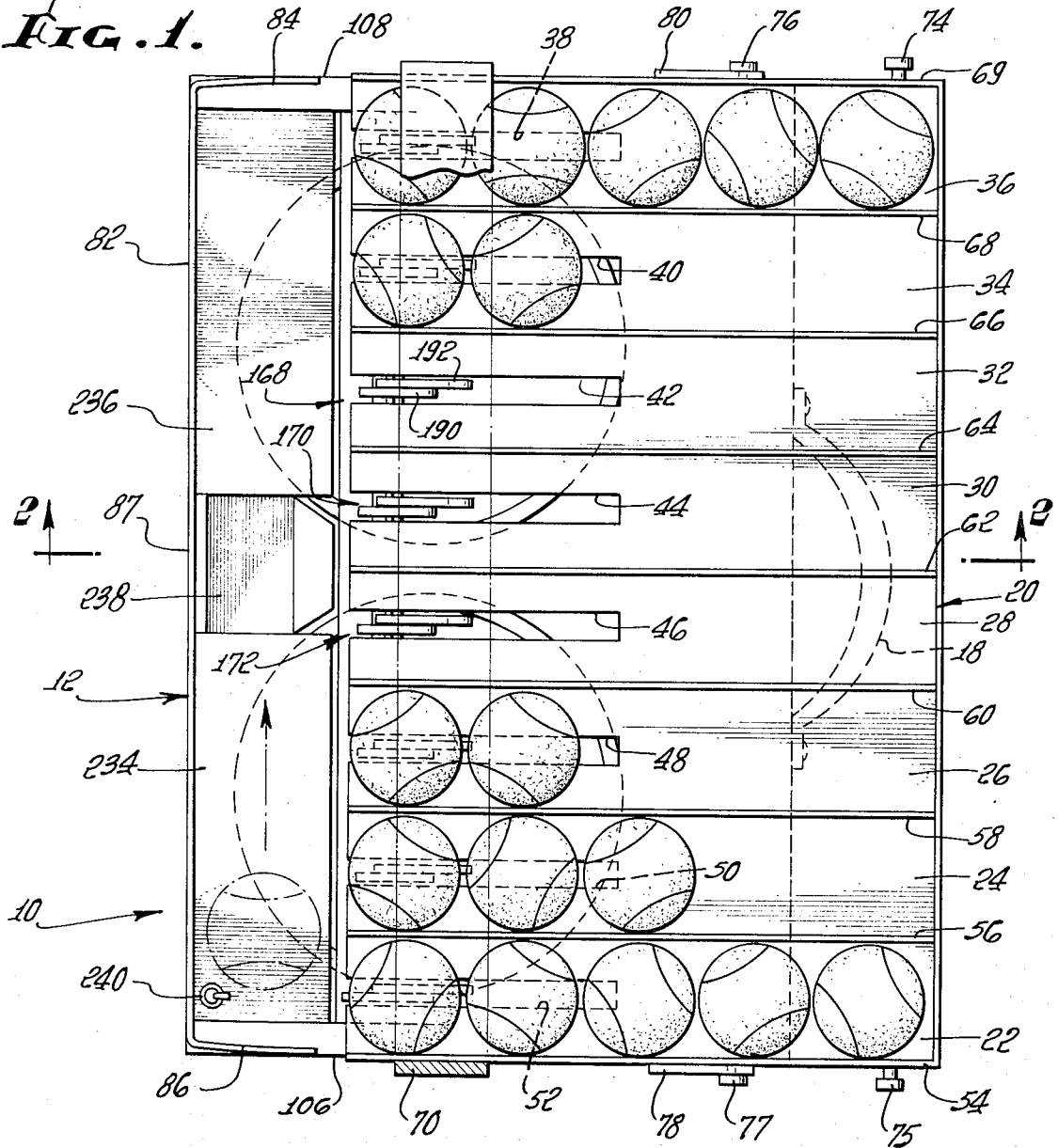


FIG. 6.

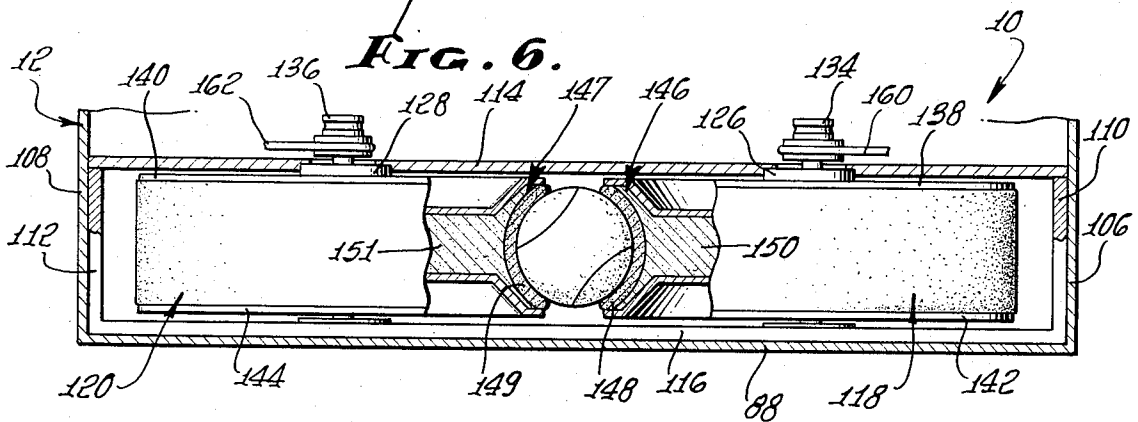


FIG. 2.

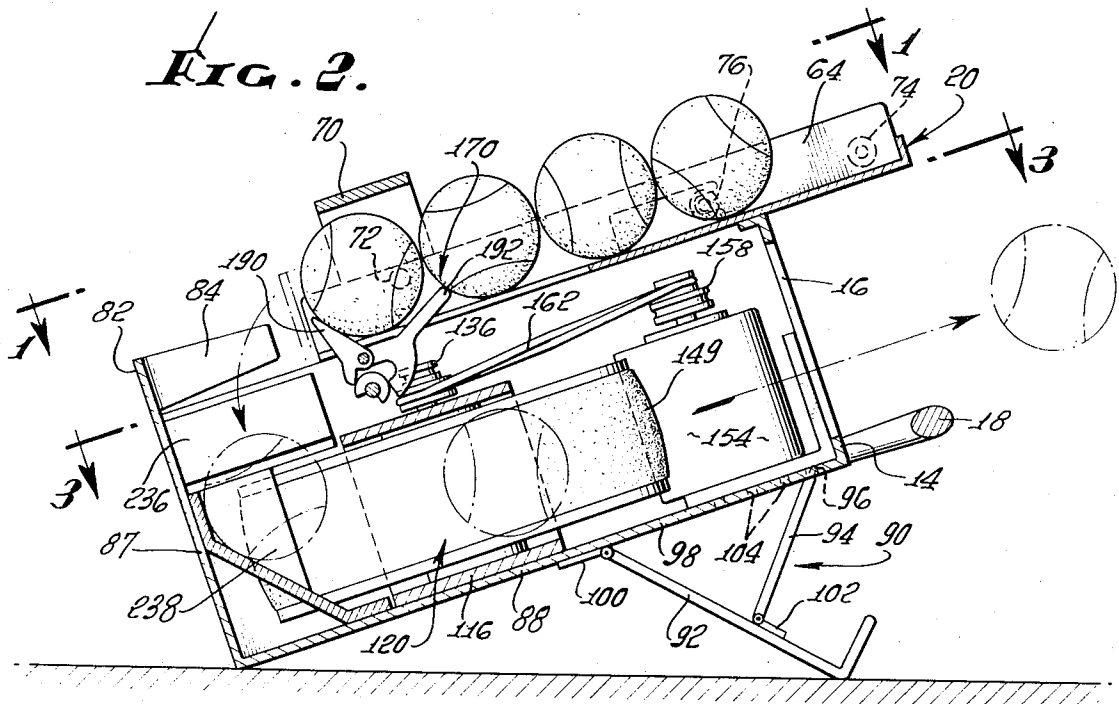


FIG. 7.

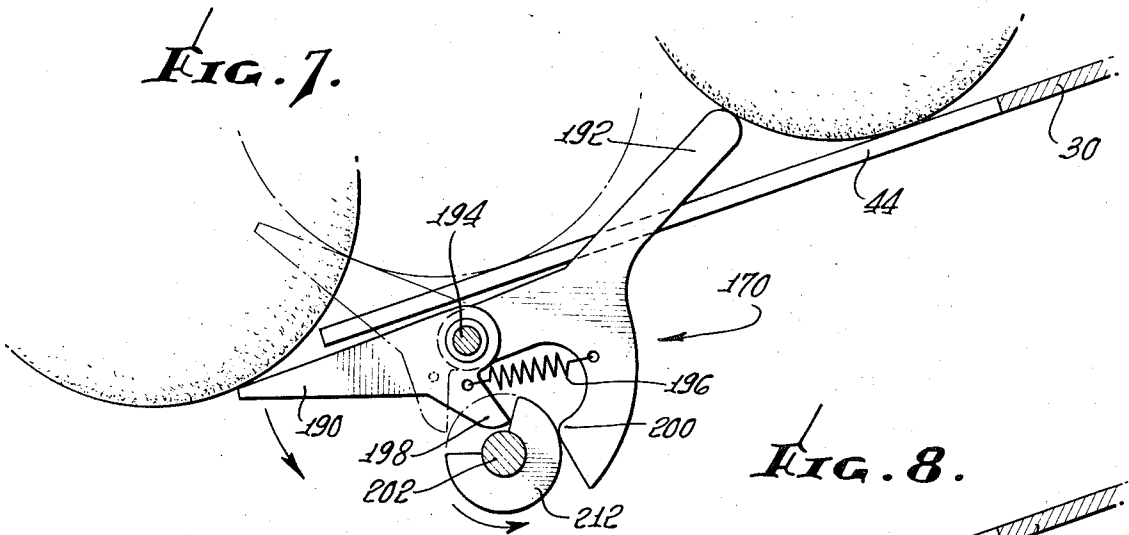


FIG. 8.

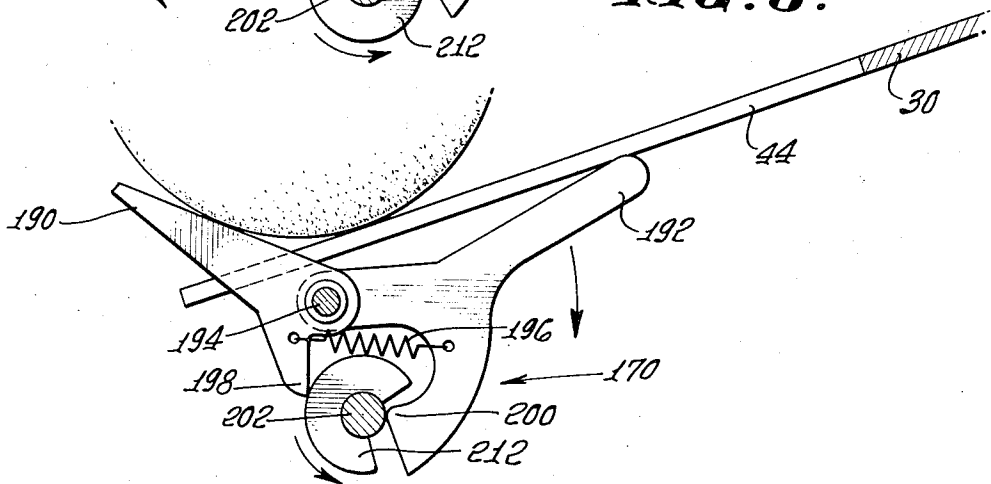


FIG. 3.

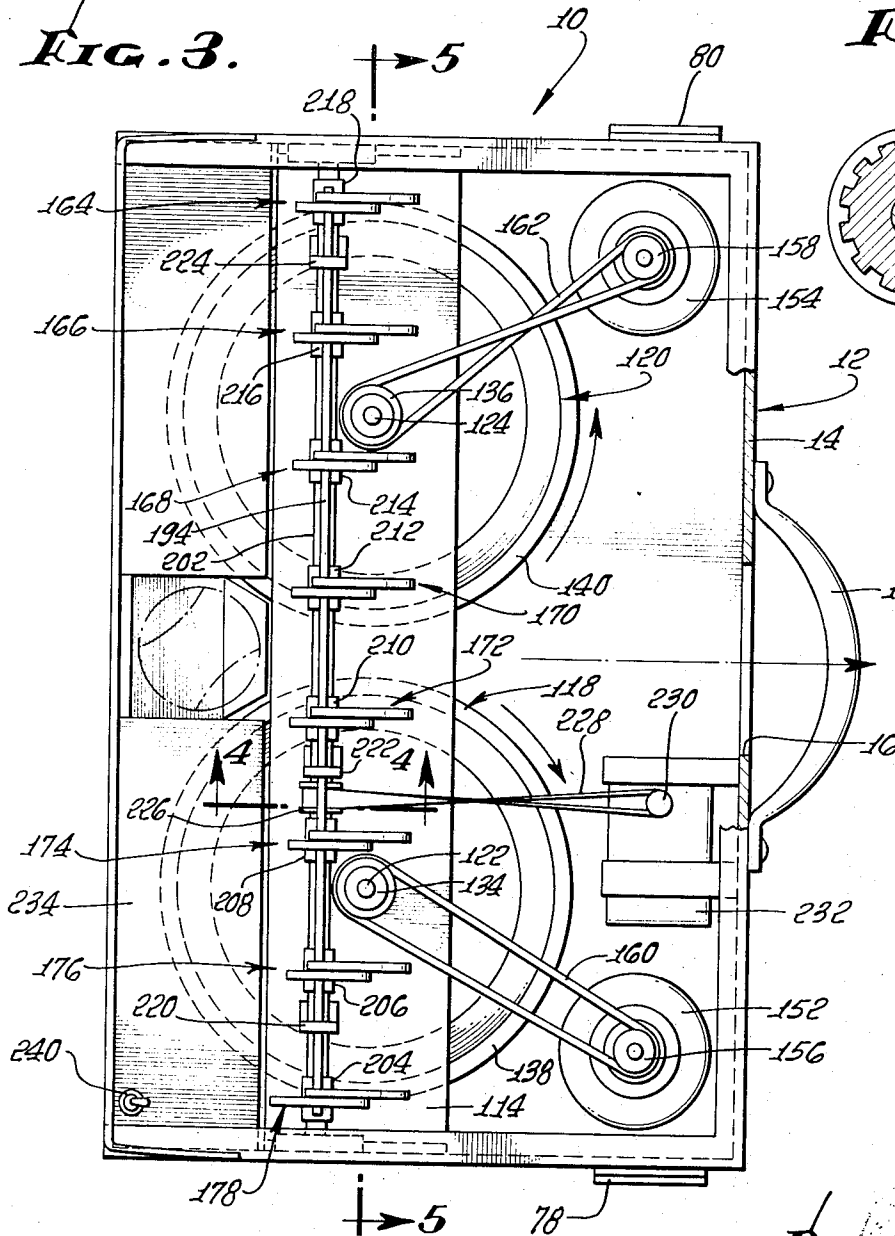


FIG. 4.

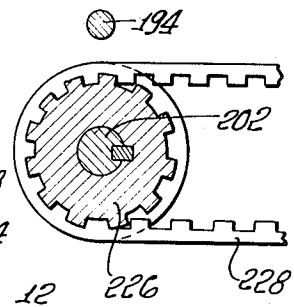
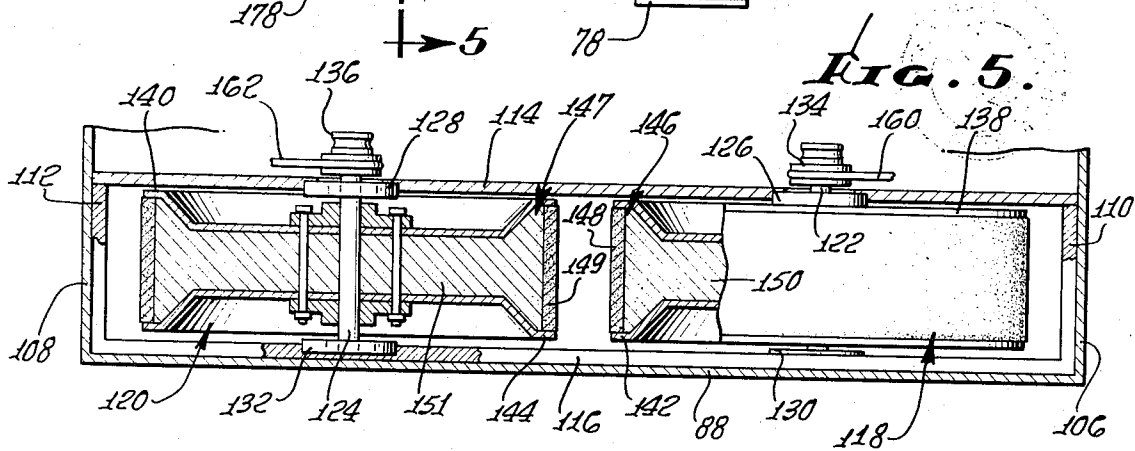


FIG. 5.



COACTING WHEEL BALL PROJECTING DEVICE

Previous devices proposed for automatically projecting balls for the purpose of improving the athletic ability of an individual or team had in general been large, bulky, complicated devices of dubious reliability.

In general, previous devices could not effectively alter their ball trajectory determining characteristics rapidly, simply, and reliably. Previous devices generally utilized large, inefficient ball storage and feed structures. Generally, previous devices had attempted to utilize a single source of power to drive all of the moving mechanisms, which resulted in heavy, expensive, and complicated power transmission devices.

These and other disadvantages of the prior art have been overcome according to the present invention.

The present invention provides a small, lightweight, hand portable ball-throwing machine which automatically projects balls in sequence at timed intervals. In accomplishing this result, an efficient ball storage and ball feed structure is utilized in which a plurality of ball magazines are arranged laterally across one side of a rectangular suitcase-like structure so that the discharge or exit ends of the magazines feed into a short, simple, and efficient ramp structure that delivers balls under the urging of gravity onto the converging side of the peripheries of a pair of counterrotating wheels. The peripheries of the wheels at their closest adjacent point are spaced apart a distance which is somewhat less than the nominal diameter of the ball which is to be projected. The cores of the rotating wheels are composed of resilient, radially compressible material, and the rims of the wheels are defined by relatively rigid flanges. The presence of the ball between the peripheries of the rotating wheels deforms the cores of the peripheries into ball grasping grooves so that the ball is grasped firmly and accelerated to the circumferential speed of the wheels. As the ball approaches the diverging side of the counterrotating wheels, it is released and thrown outwardly along the mutual tangent line of the wheel peripheries.

Each of the ball magazines contains a column of balls. Balls are released from each of the magazines in turn, one ball at a time, by means of an escapement mechanism. There is an escapement device in each ball magazine near its exit end. The escapement devices operate so as to release one of the balls from the column of balls after a predetermined interval of time. The actuation of each escapement device is timed with that of each of the other escapement devices so that one ball is released from each of the feed magazines before a second ball is released from any of the magazines. The feed magazines serve as the ball storage receptacles so that no additional hopper or storage structure is required.

Each of the wheels is directly driven independently of the other by a separate motor. Likewise, the escapement devices are directly driven by a third motor that is independent of the wheel driving motors.

In the drawings there is illustrated:

FIG. 1, a plan view of the ball throwing machine of this invention;

FIG. 2, a cross-sectional elevation taken along view line 2—2 of FIG. 1;

FIG. 3, a plan view partially in cross section taken along view line 3—3 of FIG. 2;

FIG. 4, a cross-sectional view taken along view line 4—4 of FIG. 3;

FIG. 5, a cross-sectional view taken along view line 5—5 of FIG. 3;

FIG. 6, a cross-sectional view similar to FIG. 5, showing a tennis ball in grasped position between the peripheries of ball projecting wheels;

FIG. 7, an enlarged view of the escapement mechanism portion of FIG. 2 showing the escapement mechanism in the ball discharge configuration; and

FIG. 8, a view similar to FIG. 7 showing the escapement mechanism in the ball movement configuration.

Referring particularly to the drawings, there is illustrated a frame 10, which includes a generally rectangular housing 12. Rectangular housing 12 is provided with a first end wall 14. The approximate midportion of first end wall 14 is removed to provide a ball projection port 16. The entire ball throwing machine is adapted to be transported by means of handle 18. Rectangular housing 12 is provided with a first side wall 20. First side wall 20 is detachably mounted in a position that extends generally perpendicular to first end wall 14. First side wall 20 is designed to cooperate with certain fixed structures (as more fully described hereinafter) on rectangular housing 12 to permit first side wall 20 to be mounted in either a transportation and storage configuration or alternatively in a ball projecting configuration.

First side wall 20 is a generally rectangular planar structure on which are defined a plurality of ball magazines. The first through the eighth ball magazines are identified by reference numerals 22 through 36, respectively, see FIG. 1. Each of the ball magazines is provided with a slot adjacent its exit end. The first through the eighth slots are identified respectively with reference numerals 38 through 52, see FIG. 1. The ball magazines 22 through 36, respectively, are defined by the outwardly disposed surface of first side wall 20 in cooperation with partitions mounted on and extending across first side wall 20. The nine partitions utilized in defining the ball magazines are identified by the reference numerals 54 through 69, respectively, see FIG. 1.

The balls are guided adjacent the exit end of the respective ball magazines so as to insure their proper release from the magazines by bar 70, FIGS. 1 and 2. Bar 70 is mounted on pivots 72 so that it may be pivoted between the locations shown in solid lines in FIGS. 1 and 2 and the location shown in phantom lines in FIG. 2.

First side wall 20 is provided with storage position locator pins 74 and 75 that project laterally outwardly from oppositely disposed edges of first side wall 20. Operative position locator pins 76 and 77 are spaced on the oppositely disposed edges of first side wall 20 from storage position locator pins 74 and 76. The respective locator pins 74 through 77 are adapted to engage with first and second magazine mounting brackets 78 and 80 respectively. When first side wall 20 is in its transportation and storage configuration, storage position locator pins 74 and 75 are engaged with second and first magazine mounting brackets 80 and 78, respectively. When first side wall 20 is in the ball projecting configuration, operative position locator pins 76 and 77 are engaged with second and first magazine mounting brackets 80 and 78, respectively.

Ball retainer lip 82, FIGS. 1 and 2, projects outwardly in generally a common plane with fourth end wall 87 so as to prevent balls falling off the machine as they emerge from the exit end of the ball magazines. The respective lateral ends of ball retainer lip 82 are bent through an angle of approximately 90 degrees so as to extend above and generally in a common plane with the second and third end walls 106 and 108, respectively. These extensions of ball retainer lip 82 are identified as end wall retainer legs 84 and 86, respectively. End wall retainer legs 84 and 86 are spaced outwardly from the adjacent edges of the respective third and second end walls 108 and 106 so as to define slots between the retainer legs and the edges of the end walls. The slots that are so defined receive the adjacent portions of first side wall 20 for the purpose of retaining first side wall 20 in proper relationship to rectangular housing 12, when first side wall 20 is in the transportation and storage configuration.

Second side wall 88 serves to mount an angular adjustment structure indicated generally at 90. Angular adjustment structure 90 includes a support leg 92 that is pivotally mounted to second side wall 88 by means of support hinge 100. Brace arm 94 is pivotally mounted to support leg 92 by means of brace hinge 102. A perforated plate 98 is mounted in generally contacting coplanar relationship with second side wall 88 and includes a plurality of holes 104. Brace arm 94 terminates at its unhinged end in locator pin 96. Locator pin 96 is of such dimensions as to be received and secured in the holes 104 of perforated plate 98. By moving locator pin 96 from one of holes 104 to another, the angle between second side wall 88 and the underlying support structure is varied or adjusted to a desired value.

Stiffener plates 110 and 112 are mounted to the inwardly disposed surfaces of second and third end walls 106 and 108, respectively. First mounting plate 114 is mounted on rectangular housing 12 adjacent first side wall 20. Second mounting plate 116 is mounted on the inwardly disposed surface of second side wall 88. Stiffener plates 110 and 112 extend between the respective ends of first and second mounting plates 114 and 116 so as to space these mounting plates apart a predetermined distance.

First and second wheels 118 and 120, respectively, are mounted between first and second mounting plates 114 and 116. First and second wheels 118 and 120 are mounted for counterrotation in a generally common plane in the directions indicated by the arcuate arrows in FIG. 3.

First and second wheels 118 and 120 are spaced apart a distance which is slightly less than the diameter of the balls which are to be projected from the machine. When there are no balls in position between the peripheries of first and second wheels 118 and 120, the peripheries have the configuration illustrated in FIG. 5. When a ball is grasped between the peripheries of first wheel 118 and second wheel 120, the peripheries of the wheels compress radially to define a ball-grasping groove, shown, for example, in FIG. 6.

First wheel 118 is mounted for rotation on first mounting shaft 122, and second wheel 120 is mounted for rotation on second mounting shaft 124. First and second mounting shafts 122 and 124, respectively, are mounted to first and second mounting plates 114 and 116 so that the mounting shafts extend generally paral-

lel to one another. First mounting shaft 122 is mounted to first mounting plate 114 by means of proximal bearing 126, and second mounting shaft 124 is similarly mounted to plate 114 by means of proximal bearing 128. First mounting shaft 122 is mounted to second mounting plate 116 by means of distal bearing 130, and second mounting shaft 124 is similarly mounted to second mounting plate 116 by means of distal bearing 132. First wheel 118 is rigidly mounted to and rotates with first mounting shaft 122; likewise, second wheel 120 rotates with second mounting shaft 124. Stepped driven pulley 134 is mounted to the proximal end of first mounting shaft 122 and stepped driven pulley 136 is mounted to the proximal end of second mounting shaft 124.

First wheel 118 is composed of a proximal flange 138, a distal flange 142, and a core 146 disposed between the proximal and distal flanges. The second wheel 120 is likewise composed of a proximal flange 140, a distal flange 144, and a core 147 disposed between the proximal and distal flanges. The respective proximal flanges 138 and 140 are of such radial dimensions that at their closest adjacent positions the distance between the respective proximal flanges is less than the diameter of the ball that is intended to be received between the wheels. Likewise, the distal flanges extend radially for such distances that at their closest adjacent points they are spaced apart a distance which is less than the diameter of the ball which is intended to be received between the peripheries of the respective first and second wheels. The respective proximal and distal flanges are generally rigid so that they are not radially compressible to any significant degree.

The core 146 of first wheel 118 is composed at its outermost periphery of ball contacting band 148. Extending radially inwardly from the inner surface of ball contacting band 148 is radially compressible band support 150. Likewise, core 147 of second wheel 120 is composed of a ball contacting band 149 at its outer periphery which is supported on its radially inwardly disposed surface by means of radially compressible band support 151.

Ball contacting bands 148 and 149, respectively, are composed of flexible, shock and abrasion resistant substances that exhibit a high coefficient of friction in contact with the surface of the balls that are to be projected by the machine. The necessary radial deflection that is required for the ball to be grasped by and passed between the moving peripheries of the wheels is provided by the radially compressible band supports 150 and 151. In general, the radially compressible band supports 150 and 151 are composed of resilient sponge-like materials that have a large pore cellular structure so as to admit a considerable amount of radial compression without permanent deformation. The wheels are mounted on hubs that receive the mounting shafts.

First and second motors 152 and 154, respectively, are mounted interiorly of rectangular housing 12. First motor 152 is provided with a stepped driver pulley 156, and a second motor 154 is likewise provided with a stepped driver pulley 158. Stepped driver pulley 156 is connected in direct driving relationship with stepped driven pulley 134 by means of flexible belt 160. Stepped driver pulley 158 is likewise connected directly to stepped driven pulley 136 by means of flexible belt 162. Flexible belt 162 is crossed so as to permit the

counterrotation of second wheel 120 with respect to first wheel 118.

First motor 152 is entirely independent of second motor 154 and drives first wheel 118 directly. Likewise, second motor 154 is completely independent of first motor 152 and is the direct drive for second wheel 120. First and second motors 152 and 154 do not drive any mechanism other than the respective first and second wheels 118 and 120. The rate at which first and second wheels 118 and 120 are driven may be adjusted by moving belts 160 and 162 to various locations on stepped driver pulleys 156 and 158 and stepped driven pulleys 134 and 136. In general, the selection of pulleys should be such that first and second wheels 118 and 120 rotate at the same peripheral speed.

When first side wall 20 is positioned in its operative ball projecting configuration, the respective exit ends of the ball magazines 22 through 36 are operatively positioned adjacent a plurality of escapement devices 164 through 178, respectively, see FIGS. 1 and 3 in particular. The escapement devices regulate the release of balls from the magazines.

Each of the escapement devices is substantially identical to the others and consists of a feed-arm 190 and a stop-arm 192, FIGS. 2, 7, and 8 in particular. A portion of each of the feed-arm 190 and stop-arm 192 projects through the slot at the exit end of the individual ball magazine so that balls in the magazine contact a portion of the feed-arm 190 and stop-arm 192. The frame 10 is positioned so that gravity forces balls against the feed-arm 190 and stop-arm 192. The stop-arm 192 functions to hold the column of balls in a given feed magazine out of contact with feed-arm 190. Feed-arm 190 serves to release the single ball that is in contact with it so that, that single ball will be discharged from the exit end of the respective ball magazine at a predetermined time. Since they are substantially identical, all of the feed-arms and stop-arms have been given the same reference numerals.

Both feed-arm 190 and stop-arm 192 are pivotally mounted on an escapement support shaft 194. Feed-arm 190 and stop-arm 192 pivot about a common point. Cam shaft 202 is rotatably mounted for rotation about an axis that is substantially parallel with the axis of escapement support shaft 194. Cam shaft 202 is provided with eight cams, identified by reference numerals 204 through 218, respectively, see particularly FIG. 3. Each of the escapement devices 164 through 178 is actuated responsive to the movement of one of the cams 204 through 218. The eight cams on cam shaft 202 are angularly displaced from one another by one-eighth of a full revolution, or approximately 45 degrees, so that they operate to actuate the respective escapement devices one at a time at regularly spaced time intervals.

The escapement device 170 is illustrated in enlarged detail, particularly in FIGS. 2, 7, and 8. The description of escapement device 170 applies equally as well to each of the other escapement devices.

With particular reference to FIGS. 7 and 8, feed-arm 190 is provided with a feed-arm cam follower portion 198, and stop-arm 192 is provided with a stop-arm cam follower portion 200. These cam follower portions of the respective arms are biased into contact with the surface of cam 212 by means of biasing spring 196. Biasing spring 196 is mounted to and extends between the respective arms 190 and 192 at a location between the

common pivot point of the respective arms and cam 212.

Cam 212 rotates in the direction indicated by the arrows in FIGS. 7 and 8. As cam 212 reaches the position illustrated in FIG. 7, the feed-arm 190 moves from the position shown in phantom lines to that shown in solid lines, responsive to the movement of feed-arm cam follower portion 198 into the radially depressed portion of cam 212. The portions of feed-arm 190 and stop-arm 192 that project through slot 44 into ball magazine 30 are spaced apart a distance sufficient to receive a ball therebetween, as illustrated in phantom lines in FIG. 7. The single ball that is disposed between the respective arms is prevented from exiting ball magazine 30 by the presence of feed-arm 190. The remainder of the balls in the column of balls contained within ball magazine 30 are prevented from entering the spaced between the respective arms by the presence of the outermost tip of stop-arm 192, see particularly FIGS. 2 and 7.

The rotation of cam 212 to the location where its radially depressed portion registers with feed-arm cam follower portion 198 permits the ball between the respective arms to be released from the exit end of ball magazine 30.

As the cam 212 continues to rotate between the positions shown in FIGS. 7 and 8, there are no balls located in the space between the respective arms.

As the cam 212 rotates to the position shown in FIG. 8, where the radially depressed portion of cam 212 registers with the stop-arm cam follower portion 200, biasing spring 196 serves to draw the stop-arm 192 out of contact with the ball that is at the base of the column of balls in ball magazine 30. This permits the lowest ball of the column of balls in ball magazine 30 to move into position against feed-arm 190. The stop-arm cam follower portion 200 follows the contour of cam 212 as the cam continues to rotate. As the radially depressed portion of cam 212 moves past the stop-arm cam follower portion 200, the stop-arm 192 is again moved into the position, shown in FIG. 7, where it blocks the movement of any of the column of balls in ball magazine 30.

Cam shaft 200 and escapement support shaft 194 are mounted to the outwardly disposed side of first mounting plate 114 by means of mounting brackets 220, 222, and 224, respectively. Cam shaft 202 is provided with a driven toothed pulley 226 that is mounted coaxially and rigidly therewith, see particularly FIG. 4. Driven toothed pulley 226 is operatively engaged with timing belt 228. Timing belt 228 is driven by driver toothed pulley 230. Driver toothed pulley 230 is driven by third motor 232. Third motor 232 is independent of first and second motors 152 and 154, respectively. Third motor 232 drives driver toothed pulley 230 at a very low rate, for example, four or five revolutions per minute. By contrast stepped driver pulleys 156 and 158 are driven by first and second motors 152 and 154, respectively, at speeds of several hundred to several thousand revolutions per minute.

When the escapement devices operate so as to release balls from any of the exit ends of ball magazines 22, 24, 26, or 28, the balls are urged by gravity onto first ramp 234. First ramp 234 extends laterally across the exit ends of ball magazines 22 through 28. First ramp 234 slopes downwardly toward chute 238 so that gravity will urge a ball on its surface toward chute 238. Likewise, balls that are discharged from the exit ends

of ball magazines 30, 32, 34, and 36 will fall under the urging of gravity onto the sloping surface of second ramp 236. Second ramp 236 also slopes downwardly toward chute 238. Chute 238 is arranged to deliver balls under the urging of gravity onto the converging side of the moving peripheries of first and second wheels 118 and 120, respectively. A ball is illustrated in phantom in FIG. 1 on ramp 234 and will move by gravity in the direction indicated by the arrow in that figure into chute 238. A ball is indicated in phantom lines in FIGS. 2 and 3 as it enters chute 238, having traveled down chute 236, as indicated by the arrow in FIG. 2.

Electrical switch 240 is a three way switch having a first position where the first, second, and third motors, 152, 154, and 232, respectively, are all in the unenergized configuration. The second position of the three way switch 240 is where first and second motors 152 and 154, respectively, are energized, and third motor 232 is not energized. The third position of three way switch 240 is one whereat all of first, second, and third motors 152, 154 and 232 are energized.

In operation the first side wall 20 is positioned in the transportation and storage configuration with its lower outer edges under end wall retainer legs 84, 86, and storage locator pins 75 and 74 are engaged with first and second magazine mounting bracket 78 and 80, respectively. The intended user of the machine transports it manually in this configuration, by means of handle 18, to the desired location of use.

The intended user of the machine places it on a suitable supporting surface at the intended site of use and adjusts the angle at which the balls will be projected from the machine by lowering support leg 92 and selecting which of the holes 104 is to receive locator pin 96.

First side wall 20 is removed from its transportation and storage configuration and flexible belts 160 and 162 are positioned on the desired steps of the stepped driven and driver pulleys 134, 136, 156, and 158, respectively. Preferably, belts 160 and 162 are so adjusted that the peripheries of first and second wheels 118 and 120, respectively, move at the same rate of speed.

First side wall 20 is placed in the operative configuration wherein operative position locator pins 76 and 77 are engaged with second and first magazine mounting brackets 80 and 78, respectively. Each of the magazines 22 through 36 is filled with a column of balls, and bar 70 is positioned over the balls that are in contact with the escapement devices, as indicated in FIG. 1.

Three way switch 240 is moved to the position whereat first, second, and third motors 152, 154, and 232, respectively, are energized. The rotation of cam shaft 202, through the cooperative action between the escapement devices and the cams on cam shaft 202, will discharge one ball from magazine 22. One-eighth of a revolution of the cam shaft later, a second ball will be discharged from ball magazine 24. In another one-eighth of a revolution of the cam shaft 202, a third ball will be discharged from magazine 26 and so on for each one-eighth revolution until one ball has been discharged from each of the ball magazines. As balls are being discharged from the respective ball magazines, the escapement mechanisms operate so that periodically the stop-arms 192 pivot downwardly responsive to the cooperation between stop-arm cam follower por-

tion 200 and the radially depressed portion of the respective operatively associated cam. The withdrawal of the stop-arms 192 permits the lowest of the balls in the column of balls in the respective ball magazine to move into position against feed-arms 190. Stop-arms 192 then return to the position in which they serve to hold the remainder of the balls in the magazine out of contact with feed-arm 190. The machine will continue to project balls at a predetermined rate dependent upon the speed of rotation of cam shaft 202 until all of the magazines have been emptied.

When it is desired to project only one ball at a time, for example, where a coach is working individually with a student, the switch 240 is moved to the configuration in which only the first and second electrical motors 152 and 154, respectively, are energized, and the third electrical motor 232 is not energized. In that situation the escapement devices will not operate, and balls may be fed manually to the converging side of first and second wheels 118 and 120 at any desired rate.

The ball projecting machine of this invention is particularly well suited for use with tennis balls; however, baseballs, ping pong balls, and the like may be used if desired. The proportions of the machine are adjusted to accommodate the particular ball that is to be used.

The radial compressibility of the cores 146 and 147 is generally achieved through the use of a resilient, synthetic sponge material in which the pores are relatively large, and the material is fatigue resistant. This spongy material is utilized as the radially compressible band supports 150 and 151. In general, material of this nature does not exhibit good wear resistant characteristics and exhibits generally undesirable characteristics when contacted directly with the ball. The radially compressible band support material is protected by ball contacting bands 148 and 149. These ball contacting bands are generally composed of synthetic elastic material that exhibits a high coefficient of friction and a minimum of wear when contacted directly with the balls. In general, the ball contacting band is composed of a resilient, synthetic elastomer. Foamed, wear-resistant, synthetic plastic materials having a very fine pore structure have been found to be very suitable for use as the ball contacting band material. The ball contacting bands are bonded to the band supports.

The escapement devices may be configured as desired so long as they act to release only one ball at a time from the column of balls in the ball magazine. Various known ball release means, including devices wherein one ball at a time is received in a rotating receptacle at one position and discharged after the receptacle has rotated approximately 180 degrees, and devices wherein the feed-arm and stop-arm are integral and the ball release function is accomplished by rotating or pivoting the integral arms, may be used if desired. If desired, ball release devices may be adjusted to release balls one at a time from a single magazine until it is empty instead of releasing one ball from each magazine in turn.

The side wall may be hinged to the frame instead of being completely removable if desired. If desired, the exit ends of the ball magazines may be fixed in place adjacent the escapement devices and the remainder of the ball magazines may be telescoped or hinged with the exit ends so as to provide access to the interior of

the frame and collapsibility for carrying and storage purposes.

What is claimed is:

1. A lightweight, small, hand portable device for projecting a plurality of balls in sequence at timed intervals comprising:

a frame means for supporting a mechanism for projecting a plurality of balls including a generally rectangular housing;

a pair of wheels rotatably mounted within said generally rectangular housing for counterrotation in substantially a common plane, said pair of wheels having a diverging side and a converging side, the peripheries of each of the individual wheels in said pair of wheels including substantially rigid flanges and a resiliently, radially compressible core means disposed between said flanges and a compressible support band means for forming the inner portion of the wheels so that when one of said balls of said plurality of balls is positioned between said wheels said core means and said band means will be compressed substantially by one of said balls of said plurality of balls and said wheels will accelerate said ball to the speed at which said wheels are rotating and project said ball from the diverging side of said wheels along a mutual tangent line of said wheels;

a ball guide means for guiding balls, said ball guide means being mounted on said frame means on the converging side of said pair of wheels in position to deliver balls under the urging of gravity to said converging side;

a plurality of ball magazine means for holding balls mounted on a first side wall of said generally rectangular housing, each of said ball magazine means being configured to hold a plurality of balls in the form of a single column of balls, each individual one of said plurality of ball magazine means having an exit end, the exit ends of each said individual ball magazine means being positioned to discharge

balls under the urging of gravity onto said ball guide means; and

a plurality of escapement devices positioned adjacent the exit ends of said individual ball magazine means, one of said escapement devices being positioned adjacent the exit end of each of said individual ball magazine means, means for coordinating the operation of said plurality of escapement devices whereby balls are released sequentially at predetermined intervals from said plurality of ball magazine means.

2. A device of claim 1, wherein the escapement devices are actuated to release balls by cams mounted on a driven cam shaft, cams mounted on a cam shaft said cams being spaced at regular angular intervals on said cam shaft, a feed-arm and a stop-arm being biased into contact with each of said cams, the feed-arm and stop-arm associated with one cam projecting into the exit end of one of the individual ball magazine means, the said feed-arm and stop-arm being spaced apart in the said exit end to receive a ball therebetween, whereby actuation of said feed-arm by said cam releases a ball from between the said feed-arm and stop-arm and actuation of the said stop-arm by said cam allows a ball of said plurality of balls in said individual ball magazine means to move into the space between the said feed-arm and stop-arm.

3. A device of claim 1, wherein the first side wall mounting the plurality of ball magazine means is mounted on the frame means and said first side wall is generally planar.

4. A device of claim 1 wherein the ball guide means includes a ball chute mounted on said frame means on the converging side of said pair of wheels positioned to deliver balls under the urging of gravity to said converging side, and a ramp means for guiding balls from the exit ends of the individual ball magazine means to said ball chute under the urging of gravity.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,815,567 Dated June 11, 1974

Inventor(s) Norman R. Serra

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 10, line 14, cancel "cams mounted on a cam shaft"; and line 15, after "said" insert "--driven--".
In Column 10, line 39, insert the following claim:

5. A device of claim 1 wherein each of the wheels is driven independently of the other, the rate at which said wheels are driven being adjustable, and the plurality of escapement devices being driven independently of said wheels.

Signed and sealed this 5th day of november 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents