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AUTOMATIC BALL THROWING MACHINE

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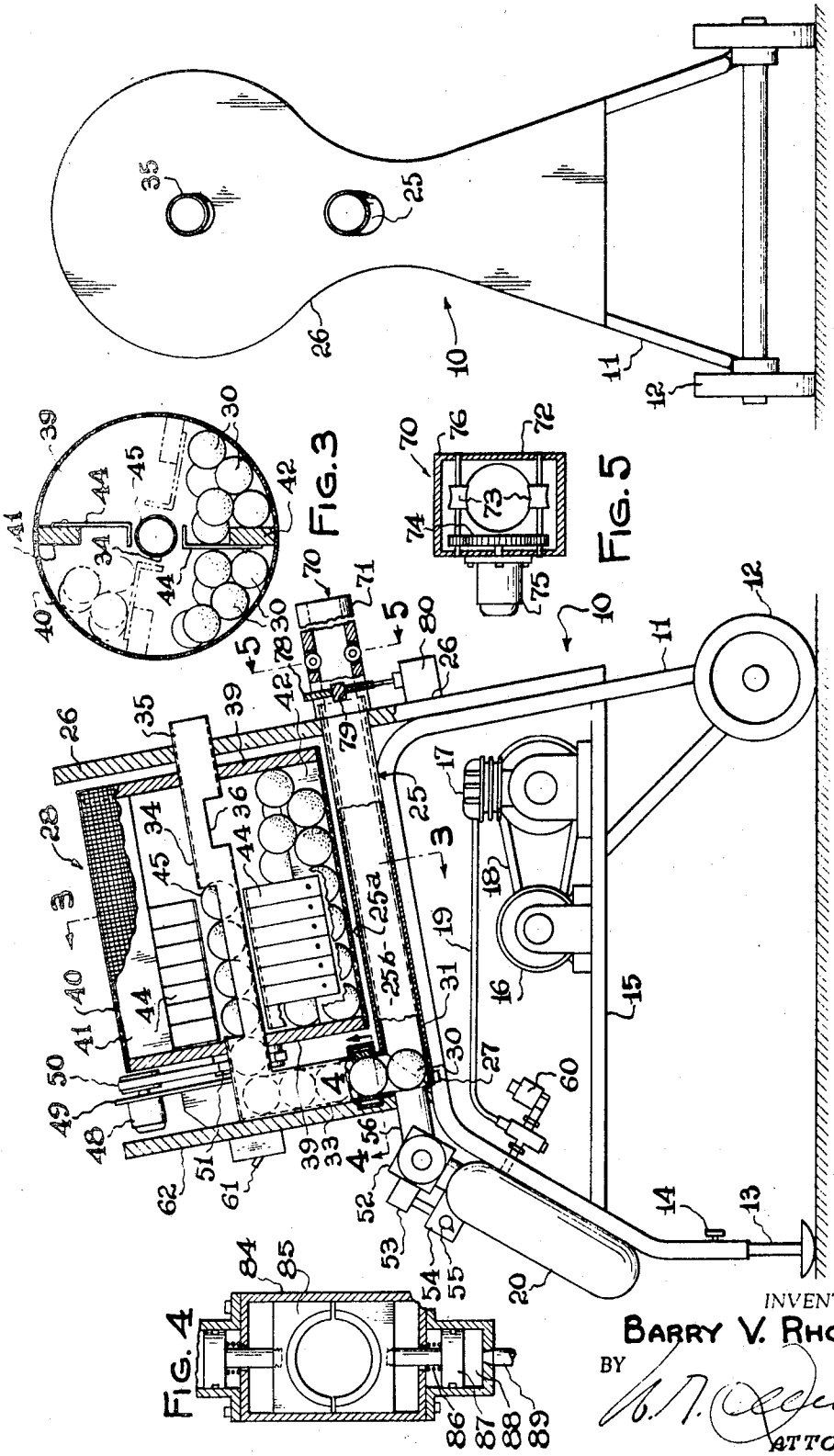


FIG. 1

FIG. 2

FIG. 3

FIG. 4

FIG. 5

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AUTOMATIC BALL THROWING MACHINE

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ABSTRACT OF THE DISCLOSURE

A pneumatically-driven automatically-recycling ball throwing machine having means for feeding a single ball into the breech of the barrel immediately following a launching cycle and including means for delaying a repeat launching cycle until a selected air pressure has been re-established. The ball seating means maintains a predetermined leading group of balls captive in a tubular column free of the weight of a variable number of balls in a trailing group of balls, the latter being replenished periodically from an agitated reserve supply of balls. The barrel includes a liner for use in launching smaller diameter balls as well as readily variable means at the muzzle end for imparting different selected degrees and types of spin to the ball during launching.

This invention relates to ball throwing machines and more particularly to an improved machine of this type capable of launching balls in rapid succession from a large reserve supply thereof without attention of any kind and in a safe and foolproof manner.

This application embodies certain improvements and advantages over a related construction disclosed in my copending application for United States Letters Patent Ser. No. 497,763, filed Oct. 19, 1965, since matured into Patent No. 3,400,703 and entitled Automatic Ball Throwing Machine for Use by Sportsmen. The earlier construction functions in a most satisfactory manner but has a limited reserve ball capacity. All balls are normally stored in aligned feeding relation to the breech of the launching barrel. In consequence, the pressure acting on the foremost balls depends upon the total number of balls present in the ball feeding hopper. The automatic, smooth-action and proper reloading of the machine immediately following launching of a ball is dependent to a considerable degree on the free movement of the leading ball followed by the forward movement of all other balls aligned for flow to the breech chamber. This objective is facilitated by use of air pressure serving to launch a ball, and, additionally, to cause agitation if not slight momentary rearward movement of the balls enroute to the breech chamber. Such agitation and rearward movement is variably affected by the number of balls involved and this is particularly true if the number is either very small or excessive. Highly satisfactory results are achieved with a uniform predetermined back pressure best obtained in a given arrangement of the ball feeding means by the presence of the same number of balls. This optimum number is so small as to require the attention of someone to replenish the balls frequently and preferably as the balls are launched.

To avoid these and related disadvantages of prior ball launching machines, there is provided by the present invention an improved fully automatic machine having large if not generally unlimited storage capacity for reserve balls and arranged to maintain ball feeding means of the most efficient and effective capacity fully charged at all times while isolating the operation of this feeding means from interference by any ball in the storage chamber irrespectively of the number of reserve balls there present. Another feature is the provision of means for replenishing

the reserve ball supply at any time without risk of interfering with the operation of any aspect of the machine and without risk of affecting the smooth and certain flow of balls into the launching breech.

An additional feature is the provision of powered means for spinning the ball in any desired plane as an incident to launching the ball and including means for changing the plane of spin of successively launched balls.

Accordingly, it is a primary object of the invention to provide an improved ball launching machine featuring unique means for recharging the machine immediately and as an incident to the launching of each ball whereby the machine is reconditioned for the next operating cycle.

Another object of the invention is the provision of an automatically recycling ball launching machine having storage means for large number of reserve balls together with means for maintaining a predetermined number of these balls isolated and in readiness for sequential flow into the breech of a launching barrel.

Another object of the invention is the provision of an automatic ball launching machine having a rotating ball hopper for a large supply of reserve balls and featuring means for repeatedly attempting to charge balls into a fixed-capacity, gravity-actuated feeding means opening directly and in an unobstructed manner into a continuously open, recharging inlet in the breech of the launching barrel.

These and other more specific objects will appear upon reading the following specification and claims and upon considering in connection therewith the attached drawing to which they relate.

Referring now to the drawing in which a preferred embodiment of the invention is illustrated.

FIGURE 1 is a side elevational view partly in section of an illustrative embodiment of the invention machine;

FIGURE 2 is a front elevational view without the ball spinning accessory;

FIGURE 3 is a sectional view taken along line 3—3 on FIGURE 1; and

FIGURE 4 is a sectional view taken along line 4—4 on FIGURE 1;

FIGURE 5 is a sectional view taken along line 5—5 on FIGURE 1.

Referring more particularly to FIGURES 1 and 2, there is shown a preferred embodiment of a ball launching machine designated generally **10** having a tubular main frame **11** supported at one end by a carriage **12** and having its other end **13** bearing against the ground. Desirably, support member **13** is securable to the main frame in any adjusted position, as by clamping screw **14**, and permits the user to adjust the launching barrel, to be described presently, in any of a variety of angles relative to the horizontal. The main frame includes a platform **15** supporting a motor **16** driving an air compressor **17** by a belt **18**. The compressor delivers compressed air through a flexible duct **19** to air reservoir **20** preferably located to discharge air as directly as possible into the breech of the launching barrel.

The ball launching facility includes a tubular barrel assembly **25** rigidly secured to frame **11** with its axis inclined at a suitable angle to the horizontal, such as that indicated in FIGURE 1. The open muzzle end of the barrel projects through a front panel **26** suitably secured to the main frame and having its upper end projecting upwardly to conceal the forward end of ball storage means indicated generally at **28** to be described more fully presently.

Launching barrel assembly **25**, as herein shown, comprises an outer digid tube **25***a* securely anchored in any suitable manner to main frame **11** and having an internal diameter suitable for use in launching a ball such as a baseball. A rather loose fit is desirable for best results

when launching balls like baseballs and softballs. Removably mounted within outer barrel 25*a* is an inner barrel 25*b* having an internal diameter suitable for use in launching a smaller diameter ball, such as a tennis ball. This inner barrel must be firmly anchored in assembled position to avoid possibility of being ejected by the pressurized air used in launching the balls, a suitable means for this purpose being a cap screw 27 carried by outer barrel 25*a* and mating with threads at the inner lower end of barrel 25*b*. It will be understood that the inner end of barrel 25*b* is cut off at an angle of 45 degrees with open bevel end in registry with the lower end of the ball feeder tube 33. The latter tube has an internal diameter freely passing the largest ball to be launched and its lower end opens freely into and is secured to the breech end of barrel 25*a* in an air-tight manner, as by brazing or welding. The fact that feeder tube 33 is over-size with respect to balls launched with liner 25*b* in place does not interfere in any way with the smooth operation of the machine. The lower or breech end 31 of barrel assembly 25 underlies ball feeder tube 33 here shown as opening vertically through the upper side of breech 31. The length of feeding tube 33 is of importance and selected to hold a predetermined number of balls with the balls resting directly upon one another and upon a ball in launching position in breech 31, and with the topmost ball out of contact with the closed upper end of the tube as by a minor portion of the ball diameter. The importance of these features will become apparent in connection with the description of the operation cycle. Desirably, inner barrel 25*b* includes resilient seat means about its exterior cooperating with the interior surface of barrel 25*a* to prevent air leakage between these barrels during a ball launching cycle.

When the machine is being used to pitch baseballs or an object such as a flare or a military grenade at high velocity, it is desirable to equip feeder tube 33 with a combined air seal and ball holder and having the features best shown in FIGURE 4. The opposite sides of tube 33 are equipped with a housing 84 opening into the interior of the tube and slidably supporting a pair of C-shaped clamps 85 of nylon or other suitable material. The semicircular facing ends support resilient pads 86 contoured to grip a ball or the like resting against a ball in firing position in the barrel breech and to form an airtight seal therewith when closed against the ball. The clamps are normally urged to retracted position by springs 86 surrounding a connection with pistons 87, the latter operating in chambers 88 connected through conduits 89 to air reservoir 20. Accordingly, as the air pressure increases after a ball-throwing operation, clamps 85 close against a ball therebetween to seal off virtually all air flow upwardly through tube 33 and hold the ball until the tank pressure falls to a low value whereupon springs 86 open the clamp and release the ball into the barrel breech for the next firing cycle.

Communicating laterally through the upper end of tube 33 is a third tube 34 here shown as overlying and parallel to barrel 25, the forward end 35 of this tube being open to receive additional balls to be launched. Owing to the downward and rearward inclination of tube 34, the balls fed into open end 35 gravitate rearwardly and discharge into storage cage 28 through an outlet 36 in the bottom of tube 34. This opening is sufficiently large for the balls to fall freely and with certainty into cage 28. If there is any tendency for the ball to roll past the opening then a barrier may be placed across the rearward end of opening 36, but in practice this is seldom found necessary.

The ball storage cage 28, as here shown, comprises a pair of end discs 39, 39 formed with openings journaled upon the exterior of the tube 34 and held in spaced-apart relation thereon by an outer cylindrical covering of wire mesh 40. Additional support for the mesh and for end members 39 is provided by a pair of radially disposed baffle members 41, 42 arranged as best shown in FIGURE 3 along the opposite sides of the drum and interiorly of mesh 40. These baffles serve to carry the balls upwardly as the drum rotates about tube 34. The lower rear ends of baffles 41 and 42 are provided with a plurality of independent L-shaped strip spring members 44 having their shorter legs spaced closely beside the exterior of ball feeding tube 34. Accordingly, a considerable number of the balls are held captive between one of the baffles and springs 44 as storage drum 28 rotates clockwise, as shown in FIGURE 3, thereby carrying the captive balls upwardly into position to roll lengthwise of these springs and into the elongated ball inlet opening 45 formed along the upper half of tube 34. The dotted line showing of these baffles in FIGURE 3 merely shows the baffles rotated to a position where the balls are ready to roll across opening 45 in tube 34. Desirably, opening 45 is sufficiently long to accommodate several balls. Once opening 45 is full of balls the remaining balls simply pass over the top of the balls in the tube and onto the far side of the storage drum.

Drum 28 is driven in any suitable manner, as by a motor 48 mounted on a bracket 49 secured to the upper side of tube 34. A belt 50 interconnects a pulley of this motor and a pulley 51 secured to the rear end of drum 28.

The launcher is driven by compressed air contained in reservoir 20 as pressurized air is released abruptly and suddenly axially into the breech end of barrel 25 by a fast-action pressure differential flow control valve 52. The details of valve 52 are not shown since such valves are well known to persons skilled in the valve art and readily available in the marketplace. Normally closed valve 52 is controlled by a solenoid 53 when energized by a normally open pressure-responsive switch 54 here shown as mounted on the side and in communication with the interior of reservoir 20. This switch has an adjustable control knob 55 operable to close switch when the pressure within the reservoir reaches any selected desired value for which knob 55 is set. Solenoid 53 thereupon opens valve 52 fully and abruptly allowing the full pressure of the air from the reservoir to flow through duct 56 axially into breech 31 of barrel 25. As this is occurring, the high pressure air within the breech is communicated to the balls in feed tube 33 causing these to be momentarily lifted upwardly against the closed end of tube 33 and to be agitated but without causing them to flow backwardly into tube 34. The balls in tube 34 are also usually rolled backward against a crosspiece in tube 34 between openings 36 and 45. As the air pressure within the reservoir decays, switch 54 opens de-energizing solenoid 53 and permitting valve 52 to close substantially instantly. While this is occurring the balls in tube 34 roll to the left as viewed in FIGURE 1 and the balls in tube 33 drop toward breech 31. However, the inner end 58 of member 59 engages the side of the lowest ball just enough to delay the fall for a brief instant. This delay assures that the air pressure will be sufficiently low not to displace the lowest ball along the barrel as otherwise two balls could enter the breech. The inner end 58 of adjustable delay device 59 may be a light spring or the like effective to provide an effective delay without causing hang-up of the balls in tube 33 and failure of the lowest ball to feed into breech 31. As a new ball enters the breech, room is left in tube 34 for the deposit of an additional ball at the upper rear end of inlet opening 45.

Since the reserve supply of balls in cage 28 is constantly being rotated, new balls are always being presented to opening 45. As soon as a new ball is deposited to replace one gravitating into the upper end of feed tube 33, the remaining balls in cage 28 simply flow over the top of and have momentary contact with the balls exposed through opening 45. As will be appreciated from the showing in FIGURE 3, the shorter legs of the L-shaped spring 44 perform an important function in this connection since these legs are spaced close to the balls in tube 34 and prevent other balls in the cage from coming into contact therewith except when one of the baffles 41 or 42 is rotating between the 9:30 and 10:30 o'clock position. When moving through this small arc, the balls pres-

ent on the baffle to the left of tube **34** can roll along the fingers and across the top of balls already present in opening **45**. However, at all higher positions of the baffles, springs **44**, and particularly their shorter legs, shield the balls in tube **34** from contact with the remaining supply of balls.

The launching device preferably includes a fail-safe pressure release valve **60** for dumping reservoir **20** as soon as motor **16** is de-energized or upon a power failure. Motor **60** is preferably controlled by master switch **61** mounted in any convenient position as on the back cover **62** for ball storage cage **28**. The latter is preferably enclosed by a suitable cover member, not shown, having its opposite ends supported on members **26** and **62**, respectively.

Machine **10** preferably includes automatic power driven means for imparting spin to the balls as an incident to being launched, the means provided for this purpose comprising a unitary subassembly designated **70** having a telescopic fit over the muzzle end of barrel assembly **25**. This accessory has a barrel **71** the internal diameter of which corresponds with that of the launching barrel with which it is to be used. Mounted upon the exterior of barrel **71** is a housing **72** supporting shafts each keyed to a resilient roller **73** projecting through diametrically opposed openings in tube **71** with their surfaces contoured and positioned to contact the surface of a ball as it is being projected through the barrel. Each of the shafts carrying a roller **73** is provided with a smaller gear in mesh with the teeth of a drive gear **74** secured to the shaft of a high-speed reversible motor **75**. This motor must have sufficient speed to impart a desired rate of spin to the ball as it passes between the oppositely-rotating rollers **73**. The various operating components of spinning device **70** are carried in a suitable housing **76** encircling and secured to the exterior of tube **71**.

In order to vary the spin plane of the ball, tube **71** preferably includes means for rotating accessory **70** about the barrel axis comprising a worm gear ring **78** secured to its exterior and meshing with a worm **79** driven by a slow speed motor **80** mounted on front panel **26** of the machine. It will be understood that this motor includes a suitable remote control which may be activated when and for as long a period as desired to rotate device **70** bodily about the outer end of barrel **25**. In this manner the plane of spin may be varied infinitely and in any desired degree from the spin plane of the previously launched ball. If motor **80** is reversible, as is desirable, the time required to change to a new adjustment is reduced to a minimum.

It will be understood from the foregoing that the described ball launching machine operates fully automatically to launch balls sequentially in short intervals at any desired velocity and direction. The direction is controlled by adjusting the rear support members **13, 14**, and additionally by operation of the ball spinning accessory **70** mounted on the muzzle end of barrel **25**. This accessory functions to spin the ball in either direction about its own center and in a plane determined by the position of spinning rollers **73** as adjusted by motor **80**.

Compressor **17** quickly restores the air supply in reservoir **20** so that within a matter of a few seconds after one ball has been ejected the supply pressure is restored to close switch **54** and initiate a new firing cycle. Likewise, the continuous rotation of ball cage **28** assures a continuous and even charge of balls awaiting delivery into the barrel breech. The number of balls maintained in the feeding tube remains constant thereby assuring uniform and certain agitation of the balls awaiting launching as well as the free gravity of these balls into launching position immediately following a preceding launching cycle.

Although repeated reference is made herein to launching balls of various types, it is to be understood that other similar objects can be launched with equal facility, such as grenades, flares, and the like, and that the term "ball" is used in the claims as exemplary of all such objects when launched by the invention machine.

While the particular automatic ball throwing machine herein shown and disclosed in detail is fully capable of attaining the objects and providing the advantages hereinbefore stated, it is to be understood that it is merely illustrative of the presently preferred embodiments of the invention and that no limitations are intended to the details of construction or design herein shown other than as defined in the appended claims.

I claim:

1. In combination, a power-operated tennis ball launching machine operable to throw a ball in a desired trajectory, said machine having a main body supporting an open-ended barrel inclined upwardly relative to the horizon, means for maintaining a reserve supply of tennis balls, means for feeding a single ball at a time into the breech end of said barrel and including means for maintaining a predetermined number of balls aligned in a leading group for successive gravity flow into the barrel breech and free of the weight of any other balls, means for maintaining a plurality of balls separated from the main reserve supply of balls and aligned in a trailing group in readiness to replace the leading ball in said leading group automatically as a ball is launched from said barrel, means for adding a ball from said reserve supply to said trailing group from time to time to maintain a plurality of balls waiting therein for gravity flow into said leading group as the leading ball thereof gravitates into launching position in the barrel breech, said means for maintaining balls aligned in leading and trailing groups comprising tubular means of generally L-shape and positioned generally above the plane of said barrel with the lower discharge end of one leg opening laterally into the breech end of said barrel, the other leg of said tubular means being inclined upwardly toward the open inlet end thereof and having first and second openings through the side wall thereof sized to pass balls freely therethrough, said first opening being relatively close to the inlet for said tubular means and facing downwardly to deliver additional balls by gravity to the reserve supply thereof, said second opening facing upwardly and being remote from said inlet and operating to receive balls from said reserve supply and deliver balls by gravity flow to the breech end of said barrel, and said means for maintaining a reserve supply being rotatably supported between the opposite ends of the uppermost leg of said tubular means and said means for adding a ball from said reserve supply to said second group including means for circulating balls in said reserve supply means in a path intersecting said second opening to feed balls into said tubular means and maintain the same full up to said second opening.

2. The combination defined in claim **1** characterized in that said leading group of balls rest against one another with a loose fit in said one leg which is closed at its upper end and with the weight of all bearing against a ball in launching position in said barrel and cooperating to hold the ball in launching position in axial alignment with said barrel before and as launching is initiated.

3. The combination defined in claim **1** characterized in that said means for maintaining a reserve supply includes means for moving the same in a continuous attempt to add a ball from said reserve supply to said trailing group of balls.

4. The combination as defined in claim **1** including means for normally maintaining all other balls in said reserve supply out of contact with balls previously selected for feeding into launching position.

5. The combination defined in claim **1** including means for moving balls of said reserve supply coming in contact with a selected ball out of contact therewith so as to leave selected balls free for flow toward launching position without interference from balls in said reserve supply.

6. The combination defined in claim 1 including means for safe-guarding non-selected reserve supply balls against interfering with the gravity flow of selected balls toward launching position in said barrel.

7. The combination defined in claim 6 wherein said means for maintaining a reserve supply rotates about the axis of said other uppermost leg.

8. The combination defined in claim 1 characterized in that said ball circulating means includes resilient means rotating with said ball storage means and having a free edge positioned to rotate close to the exterior of said second opening and effective to brush away balls of said reserve supply from a ball positioned in said tubular means as to avoid interfering with the free gravity movement of balls enroute to the launching barrel.

9. The combination defined in claim 8 characterized in the provision of pneumatic means for suddenly and momentarily releasing pressurized air into the breech end of said barrel to project a ball positioned in said breech from said barrel at a desired velocity, and control means for delaying the next ball launching cycle momentarily while the next ball is gravitating into launching position in said breech.

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